



Building Resilience Within Koh Klang Community On Coastal Erosion, Marine And Mangroves Ecosystem

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Abstract

The picturesque coastal community of Koh Klang has long been struggling with the devastating effects of coastal erosion, and the damaging impact on their marine and mangrove ecosystems. This has had a significant impact on the local community, causing economic and daily routine disruptions. Unfortunately, the villagers' lack of knowledge and support from related organizations has further exacerbated these problems. To tackle these issues, we partnered with the Population and Community Development Association (PDA) to empower the Koh Klang community through three key deliverables: maps, infographics, and videos for both adults and children. Our goal was to help build resilience within the community and equip them with the knowledge and tools they need to combat the ongoing environmental issues. Through our workshops, we discovered that the people of Koh Klang urgently need more education about their environmental problems, as well as consistent support from the government and a strong leader to guide them. Our research provides a nuanced understanding of the complex ecosystem issues that Koh Klang is facing, which has broader implications for Krabi and beyond. As part of a group of Chulalongkorn University students, we believe that our findings will contribute to future research on similar topics. Ultimately, our project aims to empower the community to take action and make positive changes for their future.

Glossary

1. **Acidification:** the action or process of making or becoming acidic.
2. **Biodiversity:** the variety of life in the world or in a particular habitat or ecosystem.
3. **Climate change:** a change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.
4. **Ecosystem:** a biological community of interacting organisms and their physical environment.
5. **Erosion:** the process of eroding or being eroded by wind, water, or other natural agents.
6. **Geographic Information System (GIS) :** a computer system for capturing, storing, checking, and displaying data related to positions on Earth's surface. GIS can show many different kinds of data on one map, such as streets, buildings, and vegetation. This enables people to more easily see, analyze, and understand patterns and relationships more.
7. **Mangrove:** any of certain shrubs and trees that belong primarily to the families Rhizophoraceae, Acanthaceae, Lythraceae, Combretaceae, and Arecaceae; that grow in dense thickets or forests along tidal estuaries, in salt marshes, and on muddy coasts; and that characteristically have prop roots—i.e., exposed supporting roots.
8. **Resilience:** the capacity to withstand or to recover quickly from difficulties; toughness

Executive Summary

Climate change has an impact on human well-being, food production, residential, safety, and employment. The impacts that are visible today include coastal erosion caused by extreme weather, sea level rise, and human activities, as well as ecosystem destruction. People who live in small islands and underdeveloped regions have become more vulnerable to climate impacts (*United Nations, n.d.*). An example of the effect on people's residential areas on small islands is the erosion of coastal areas, which destroys buildings nearby. Because of a lack of awareness and understanding about the threats that coastal societies face, construction and living conditions are impacted due to coastal erosion caused by climate change. Since that, giving advice and knowledge about the threats, cause and effect, and instilling resilience about conservation and protection of the ecosystem around that area has emerged as a solution to that problem. When everyone in the community is on the same page, the problems caused by climate change will have less of an impact on their lives because the knowledge has spread, and they know how to blend in with the current situation.

Therefore, in this project we will focus on a small village in Krabi called ‘Koh Klang Village’, which has been facing difficulties and is heavily affected by coastal erosion. Hence, “building resilience among villagers regarding the coastal erosion and mangrove ecosystem, as well as stepping in and educating the youths in schools to be better prepared for the upcoming risks for a generation to come”; are our ultimate goals for this project.

The objectives to reach our goals are

1. Investigate the problems including Coastal erosion and Marine & Mangrove forest ecosystem.
2. Select appropriate contents to be spread.
3. Understand the target group’s media preference.
4. Design the educational materials and evaluation

To begin our hands-on work process, we had to gather information in order to gain a better understanding of the topic we are working on, especially from the eyes of the villagers who are locals to the area, and this was done through interview and observations. Moreover, we observe the territory of the mangrove forest, and our areas of interest; and lastly, design

our educational outputs, which consists of risk maps, infographics, and videos; which will be used and spread within schools, communities, and other online platforms.

Throughout this chapter, we have delved into the results that were gathered and analyzed regarding the issues faced by Koh Klang village. These results were then grouped into 10 relevant findings that provide crucial insights into the challenges faced by the region. By categorizing these results, we were able to identify the key areas that require attention and intervention in order to ensure the sustainability of the ecosystem and the livelihoods of the people in the village with respect to the listed findings below:

Finding 1 highlights the importance of addressing coastal erosion and ecosystem destruction, which are two of the most significant issues facing the area. This finding emphasizes the need for immediate action to prevent further deterioration of the environment and the communities that depend on it.

Finding 2 suggests that cooperation between different communication tools, such as maps, infographics, and videos, can significantly improve the understanding and awareness of the villagers in Koh Klang about the issues they face. This finding underlines the importance of effective communication strategies in educating and engaging local communities in efforts to address environmental challenges.

Finding 3 points out that villagers often overlook natural deterioration in the face of more pressing concerns, such as financial crises. This finding highlights the need to address the economic challenges faced by the communities in Krabi while also raising awareness about the environmental issues that they face.

Finding 4 stresses the critical role of understanding shoreline steepness in building resilience against coastal erosion in Koh Klang. This finding underscores the importance of using data-driven approaches to develop effective strategies for mitigating the impact of coastal erosion.

Finding 5 reveals that the disappearance of animals in Krabi can be attributed to climate change and the lack of government involvement. This finding emphasizes the need for increased government intervention in addressing the effects of climate change on the environment and its inhabitants.

Finding 6 suggests that the decreasing number of bird migrations is affecting the economy and people of Koh Klang village. This finding highlights the interconnectedness of the environment, the economy, and human well-being, and the importance of addressing environmental challenges in a holistic manner.

Finding 7 emphasizes the need to raise awareness of coastal erosion among the population of Koh Klang. This finding stresses the importance of communication and community engagement in addressing environmental issues at the local level.

Finding 8 reveals that there are different claims among villages and governmental sections about the abundance of certain species. This finding emphasizes the need for a collaborative approach to environmental conservation and management, involving all stakeholders in the decision-making process.

Finding 9 demonstrates that misconceptions about the Muta tree can be corrected. This finding highlights the importance of accurate information and education in addressing environmental challenges and fostering sustainable practices.

Finally, **finding 10** emphasizes the importance of an educated population in securing higher awareness of coastal and ecosystem issues in Koh Klang's community. This finding highlights the role of education in promoting environmental awareness and fostering sustainable practices among local communities.

Overall, these 10 findings provide valuable insights into the challenges faced by Krabi and the steps that can be taken to address them. By understanding these challenges and their interconnections, we can develop effective strategies for promoting sustainability and fostering a more resilient and thriving environment and community in Krabi.

Based on our research, we recommend that the government and related organizations increase their involvement in the Koh Klang community to address the long-term damage caused by the ignorance of adults. The government should adjust its curriculum to educate children about these issues, as neighboring schools have seen success in increasing awareness. With proper support, the community can handle the ongoing problems, and it is recommended that houses not be constructed in high-risk areas to prevent damage and displacement. The community is eager for support and input from outsiders to give them hope for a change. Moreover, action plans based on the workshop recommendations include establishing a maintenance team to check and renovate bamboo dams and security facilities, adapting workshop outputs to school curriculums, inviting an organization to educate locals on the ecosystem and benefits of the Muta tree, and encouraging political parties to take action based on workshop findings for upcoming elections. This study produced video/animation, infographics and maps to improve understanding among adults and children in Koh Klang and Klong Prasong districts about coastal erosion, marine ecosystem, and mangrove ecosystem. Furthermore, survey results showed significant improvement in

understanding among adults after exposure to the generated outputs. Children also showed significant improvement in understanding. Ultimately, action must be taken to raise awareness and increase safety in local people to avoid the detrimental effects of coastal erosion and protect ecosystems in the area.

Chapter 1: Introduction

General

Climate change is already beginning to present major environmental, social, and economic challenges for Thailand. Nearly 20% of the Thai population lives in the coastal province; and according to Climadapt (2019), the Thai coastline covers 2,800 kilometers and is subject to fierce erosion. Of these 2800 km, 12% of Thailand's coasts is estimated to be impacted by a 1-meter rise in sea level. To state a more serious fact, nearly 30% of the coast is in critical danger, losing more than 5 meters of coastline per year, and is increasing, therefore making them vulnerable to flooding and coastal erosion. Climate expert, Danny Marks, warned that "Climate change is set to drastically affect the world, and Thailand will likely be one of the most affected countries given its geography, economy, and level of development." (August 11).

Current issues and ongoing problems

This ongoing national problem is broad and scattered, thus to scope down the problem, we are going to focus only on coastal erosion and the marine & mangrove ecosystem in Krabi. Krabi is a province located near the southern coast of Thailand and has been severely impacted by natural disasters such as coastal erosion as well as changes to its coastal ecosystem. All of which are the result of climate change, which has long been regarded as a grave threat to human civilization as it causes coastal erosion and poses a threat to animal life.

Firstly, coastal deterioration is affected by several aspects: extreme weather, coastal erosion, sea level rise, and human activities. All of these contribute to coastal ecosystem risks, as well as the loss of lands and also affecting the communities and people living in the area.

Secondly, marine ecosystems provide critical benefits to human well-being and economic progress in coastal communities. Despite this, they are vulnerable to climate change and human activity, which has resulted in significant changes to Krabi's coastal ecosystem.

Thirdly, mangroves play a significant role in the coastal ecology of Krabi and are essential for the ecosystem of nearby villages. The mangrove area serves as natural infrastructure and protection for the surrounding populated areas by reducing erosion and absorbing storm surges during extreme weather events. Additionally, it serves as a valuable resource for the villages around Krabi. However, due to the reduction in mangrove acreage, Krabi is facing severe problems both geographically and in terms of resources.

Even Though, with the pressing issues that they are currently facing, most people in Krabi are still unaware of how serious the situation is or are not yet adequately prepared for the consequences that will follow. Therefore, our research is approaching to change that misunderstanding and be a part of the organization to spread awareness among people in Krabi.

Goal and Objectives

The goal of this project is to “build resilience in villagers regarding the coastal erosion and mangrove ecosystem within the areas that may have a significant impact on them”; as well as to step in and educate the youths in schools to be better prepared for the upcoming risks for a generation to come.

Our objectives to reach the ultimate goal are

1. Investigate the problems including Coastal erosion and Marine & Mangrove forest ecosystem.
2. Select appropriate contents to be spread.
3. Understand the target group’s media preference.
4. Design the educational materials and evaluation (which are risk maps, infographics, and videos).

After completing the four objectives, we expect to observe changes in the behavior of people who live along the Krabi coastline. Our goal is to educate them about the seriousness of the problem and encourage them to take action to prevent the increasing rates of coastal erosion and restore balance to the marine and mangrove ecosystems in a sustainable and long-lasting way as much as possible.

Our sponsor

The Population and Community Development Association (PDA) aims to help the coastal communities understand the cause and be prepared for the change in the ocean ecosystem. Thus, to achieve the goal, the four objectives are to comprehend the needs of the sponsoring organization, discover the means of subsistence used by local communities and gain an understanding of the fundamental problems, and collect the available data, analyze, and transform data into a coastal ecosystem risk map that is easy to understand for the coastal communities. Together with comprehending the background data, it is necessary to develop and portray the message to all parties concerned. The most suitable recommended design may benefit from this information's more comprehensive context of the Koh Klang Krabi area's natural characteristics. This background chapter is therefore crucial for this specific project.

Preview to next Chapters

Next, in chapter 2 will be a literature review over the topics of geographical information of Karbi, Ban Koh Klang, and Tha Pom Klong Song Nam. Also information about the coastal ecosystem of Krabi, mangrove ecosystem in Krabi, and organization and programing which related to our interested issues.

In chapter 3 will be a description on the methodology in order to achieve goals and objectives. In which to observe and interview the villagers in our selected community which is Koh Klang. Moreover, observing Tha pom klong song nam for further information. Afterwards we will analyze the data and create the instruments to measure our result which are risk pattern map, infographic, and short video clip.

Chapter 4, Results and Analysis, presents the findings of our project related to the topic of interest. This chapter includes an analysis of the results and draws conclusions based on the findings. The topic of interest is selected and presented in a clear and organized manner, with a focus on providing insights and implications for future research or practical applications. Overall, the Results and Analysis chapter is a crucial part of the project that showcases the outcomes of our work and contributes to the overall knowledge in the field.

Lastly, chapter 5, Conclusion and Recommendations, presents the overall conclusion of the project and offers recommendations for future research or practical applications. This chapter summarizes the findings presented in the previous chapter and describes the

implications of these findings. Based on the conclusions drawn, the chapter provides recommendations for further research or suggests practical applications of the project's results. Overall, the Conclusion and Recommendations chapter is a vital part of the project that offers insights and guidance for future work in the field.

Chapter 2: Background

1. Krabi, a southern province of Thailand

Krabi, a coastal province in southern Thailand, boasts some of the most stunning beaches and marine life in the world. The 203.79 kilometers of coastline stretches from the vibrant 'Ao Luek District' to the serene 'Klong Thom District', with plenty of mangrove forests in between. But with great beauty comes great risk - Krabi and its neighboring areas have faced threats of coastal erosion and flooding due to natural occurrences such as storms, extreme sea levels, and powerful waves. It's a battle to protect the precious land and ecosystems, but Krabi's resilient community continues to push forward with innovative solutions. (*Krabi General Information*, n.d.)

1.1 Ban Koh Klang

Ban Koh Klang community, Krabi



Figure 1 : Ban Koh Klang community map

Ban Koh Klang located in Klong Prasong subdistrict, is a small island on the left of the Krabi, which is considered as one of the most popular spots for tourism of Krabi. The current goal of the community in Ban Koh Klang is to create a sustainable tourism base community where tourists can experience different cultures and beliefs.

The island is covered with a majority of mangrove forests and an overall abundance of natural resources.

The rich mangrove forest and different marine species surrounding Ban Koh Klang Island are the reason that fishing and agriculture are the main occupation for the people in this community. The major fishing activities involved catching shrimps and fish, catching the black crab in mangrove forests, and more.

The total area of Koh Klang is estimated to be 16,250 rai which consists of 4 villages Ban Ko Klang, Ban Bang Kanun, Ban Klong Prasong, and Bang Klongkam (*Krabi Koh Klang | Community Based Tourism in Thailand, n.d.*).

1.2 Tha Pom, Klong Song Nam

Tha Pom Klong Song Nam Peat Swamp Forest

It is an institute that teaches about the natural integrity of groundwater and plants that grow in both water and soil. Depending on the sea level, Klong Song Nam has both freshwater and brackish water streams. It becomes freshwater during low tide and a saltwater canal during high tide. The stream is as clear as glass and lush with green grass, making it ideal for canoeing.

Tourists can also walk for about 700 meters along the canal on a natural walk path through the freshwater peat swamp forest and the border of the two forests, admiring the beauty of palm trees and a variety of local vegetables (*ดินแดนพิศวง “ท่าปอมคลองสองน้ำ”*, 2012).

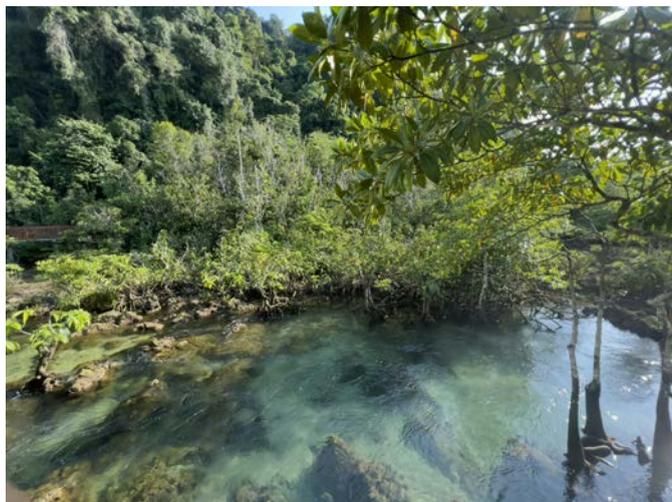


Figure 2 : Tha Pom, Klong Song Nam ecosystem

2. Coastal Ecosystems of Krabi

Coastal ecosystems refer to distinctive environments created by various flora and fauna that can flourish in the transitional zones between the sea and land. These regions are characterized by constantly changing tides and the presence of saltwater, which require specialized adaptations for survival.

2.1 Effect from human activity towards the coastal ecosystem

The impact of human actions on coastal ecosystems can be categorized into 2 groups. (1) Micro scale is something that people do alone or as a small group with limited impact; (2) Macro scale includes much larger scale activity that needs to be decided by organizational level. Both of them are having a negative effect towards the coastal ecosystem in different severity.

- **Micro Scale**

- **Fishery** The main concern is that excessive fishing effort and harmful fishing practices can result in less fish at sea, which can have a negative impact on the lives and livelihoods of coastal ecosystems. Bottom trawling, for example, utilized in shrimp, has a negative impact on coastal water biodiversity, with negative consequences for fishworkers. The use of dynamite and other explosives, as well as poisons such as cyanide, may ruin extensive expanses of coral reefs and result in the indiscriminate destruction of marine life.
- **Recreational Activity** is a chronicle of activities that humans do to refresh their body and mind. Sometimes without any awareness nor concern of the marine ecosystem.

- **Macro Scale**

- **Industrial activities** coastal ecosystems, particularly vulnerable habitats, have been transformed, disrupted, and destroyed as a result of industrial development. Many key industrial centers are located on estuaries or near metropolitan regions and ports. Sometimes they release their wastewater and hazardous chemicals into the sea and so gradually intoxicate the environment around them.
- **Dredging and Dumping:** Dredging mostly generates physical disruption and may result in pollutant redistribution via desorption

from fine sediments. Offshore sand mining for beach replenishment and land reclamation, as well as aggregate extraction for the building industry, disrupts benthic populations temporarily and, in some circumstances, permanently.

- **Beach pollution (marine debris):** Any dangerous chemical that contaminates our coast is considered beach pollution. Litter and waste, including cigarette butts, plastic bottles, and food wrappers, are the most apparent types of beach pollution. They are usually left behind by tourists or even locals. Improperly disposed of household or business trash will eventually reach the coastal area and finally deteriorate the coastal ecosystem.

2.2 Effect from climate change towards communities and ecosystem

- **Make the community more vulnerable to Flood, Tsunami and Storms:**
 - Sea level rising: changing sea levels are harming human activity in coastal locations. Rising sea levels flood low-lying wetlands and dry land, erode shorelines, contribute to coastal flooding, and increase salt water flow into estuaries and surrounding groundwater aquifers.
 - Landslide: A warmer climate can raise the likelihood of both undersea and aerial landslides, raising the possibility of local tsunamis. Permafrost (frozen soil) thawing at high latitudes reduces soil stability, making it more prone to erosion and landslides. As storms grow more common as a result of climate change, heavy rainfall can also cause landslides. Tsunamis can occur when a landslide reaches the water or when water is displaced by a quick underwater landslide.
 - Earthquake: There are several ways that climate change might increase the frequency of earthquakes and hence the risk of tsunamis. For starters, the weight of ice sheets may be preventing fault movement and earthquakes. When the ice melts, the isostatic rebound (land uplift) causes an increase in

earthquakes and fault movement as the crust adjusts to the weight reduction. Thus increase the risk of flood and tsunami.

- **Fewer bird population and species migration in Koh Klang :** Global warming also influences the routes of many migratory birds and their annual migration rhythm. A lot of migratory birds change their routes, shorten or completely cancel their journey as a result of changing temperatures. Birds such as Great Knot, Nordmann's Greenshank, Chinese Egret, White-bellied Sea Eagle and Mangrove Pitta could still be seen. However species such as Masked Finfoot, Grey herons and Gulls that are migrating from Siberia and Australia to hunt around Ban Koh Klang community for many decades ago, however, because of the changes in weather conditions and detriment in the Coastal area and Mangroves area, none of the migration has been seen for more than 2-3 years now. This surely states the problem that Krabi and its environment are facing (*Department of marine and mangrove ecosystem, 2019*).
- **Effect on Agriculture lands :** Chronically from the effect of climate change that has been stated above, higher risk of salt water flooding from tsunami and the decreasing number of birds to feed on pests suggests declining in crops retrieved each year. Therefore, from the past decades, farmers have gained lower income and food due to the changes in world's temperature (*Department of marine and mangrove ecosystem, 2019*).
- **Vanished Species**
 - **Dolphin :** Climate change is anticipated to be the leading cause of mass extinctions in the twenty-first century, and whales and dolphins will be no exception. The fast warming of the world is causing a loss of habitat for whales and dolphins in the area, as well as increased competition for a limited number of prey species. It has an impact on the time and ranges of their migration, dispersal, and even reproduction (*Department of marine and mangrove ecosystem, 2019*).

- **Oriental small-clawed otter** : Climate change might modify climatic circumstances by causing fluctuations in temperature and precipitation, which would have a knock-on impact on other elements of their ecology, such as changes in food supplies, illnesses, parasites, and other predators. Otters, for instance, may be more sensitive to these changes than others and may be unable to adapt to the new environment. Climate change may also physically shift acceptable habitat to a new site, otters to stay and adapt or either relocate to a more favorable area in terms of temperature, food, and other environmental variables. Moreover, human pollution and development may also contaminate the water quality and food supplies of otters, as well as damage their habitats (*Department of marine and mangrove ecosystem, 2019*).

3. Mangrove Ecosystem in Krabi

The mangrove forests that line Krabi's coastline play an important role in protecting coastal settlements and croplands from storm surges. They also serve as spawning grounds for fish and shellfish, a source of food and firewood for subsistence communities, and contribute to improved water quality by filtering out nutrients flowing from upstream.

3.1 Effect from human activity towards the mangrove ecosystem

Many individuals take the mangrove ecosystem for granted because they are unaware of the significance of maintaining a healthy mangrove ecosystem. Several factors have been identified as contributing to mangrove deterioration, and for both natural and human-caused ones. Human activities such as shrimp farming, black crab farming, and long tail boat usage represent the greatest threat to mangrove forest deterioration; given the predicted decline and destruction of mangrove forest at approximately 1% each year.

3.1.1 The impact of shrimp and black crab farming on mangrove forest.

Mangrove ecosystems should be protected due to their tremendous ecological significance, and they can be utilized to offer a variety of food and medicinal goods to

local communities in a sustainable way (*Hamilton, n.d.*). The value of mangroves to local residents greatly outweighs the cash generated by destroying mangrove areas to build shrimp farms. Farmed shrimp is commonly produced in complicated, fragmented, and hidden supply networks, masking the true human and environmental impacts of production. Aside from causing environmental loss, several goods have been related to forced labor abuses and illegal fishing by vessels that provide feed for shrimp farms. Companies may face reputational, legal, social, and regulatory issues as a result of this lack of traceability and transparency. Shrimp farming takes three to six months to raise market-sized shrimp in tropical regions, where most farmed shrimp is grown, with many farmers cultivating two to three crops per year. Shrimp farms emit a continual stream of organic waste, pesticides, and antibiotics that can harm groundwater or coastal estuaries. Salt from the ponds can potentially contaminate groundwater and agricultural land. This has had long-term consequences, altering the hydrology that serves as the foundation of wetland ecosystems.

3.1.2 The impact of long tail boat usage and other water transportation on mangrove forests.

Wave breaking may cause erosion by wiping away sediments and therefore eroding mangrove banks (*CLOUGH & Gendera, n.d.*). The principle of boat wake erosion occurs when the boat generates wave motion and the energy produced initiates sediment transport. The action of a single wave plus the combined effect of multiple wave trains from boats as they sail through can cause erosion of the shoreline. Initially, local boats were a small effect in mangrove erosion, but with the increasing number of high-speed craft, this issue has become a global concern that can contribute to mangrove erosion. Mangrove erosion also occurred on the way to the Koh Klang district. Long tail boat waves have undercut and toppled the fringing mangrove trees.

3.2 Effect from climate change towards the mangroves ecosystem

3.2.1 The Impact of Climate Change on Mangrove Forests

Mangrove forests have endured several disastrous climatic catastrophes over the past decades. Mangrove peat deposits provide evidence of past local and regional extinction occurrences, typically due to sudden, fast

sea-level changes. Most mangrove plants and related creatures are prone to either being resilient or resistant to most environmental changes since they inhabit a hard border between land and sea. According to the most recent Intergovernmental Panel on Climate Change (IPCC) predictions, mangrove forests will continue to spread poleward. Still, they will shrink in size, structural complexity, and function along drier coastlines, sinking river deltas, and numerous islands. Given the continued rise in sea level, average global temperature, and atmospheric CO₂ concentrations, they will likely endure into the near future (*Department of marine and mangrove ecosystem, 2019*).

3.2.2 Impact of Global Change on Nutrient Dynamics in Mangrove Forests

The production of mangroves depends heavily on the cycling of necessary nutrients. Mangroves are shown to depend on soil nitrification, ammonification, and dissimilatory reduction to ammonium for available nitrogen through a mass balance. In mangroves, fertilizer availability and tree photosynthesis are tightly correlated, and nutrient availability is frequently limited. Different disturbances, such as deforestation, changes in hydrology brought on by impoundments, changes in land use, increasing storm frequency and intensity, rising temperatures, rising atmospheric CO₂ concentrations, and a rise in sea level, can upset this relationship, as a result, reduce forest productivity. Deforestation and hydrological changes are the greatest detrimental factors for soil nutrient-plant relationships and mangrove production. Land use changes may have beneficial and harmful effects on mangroves and increase the frequency and power of storms. Mangroves, nitrogen, and phosphorus microbial transformation rates are initially more affected by rising temperatures and atmospheric CO₂ levels. Sea level rise has various consequences that depend on the local rate of sea level rise, the rate of soil accretion, the rate of subsidence or uplift, and the tidal position. Seaward mangroves will perish if sea levels rise too quickly, but if there is enough room, landward mangroves will grow larger, exhibit accelerated growth, and cycle nutrients more quickly (*Department of marine and mangrove ecosystem, 2019*).

3.2.3 Mangrove forests in a rapidly changing world

The production of mangroves depends heavily on the cycling of necessary nutrients. Mangroves are shown to depend on soil nitrification, ammonification, and dissimilatory reduction to ammonium for availability. Mangrove forests are in danger due to various components of climate change, even though they have great socioeconomic value. The effects of climate change on mangrove forests along the Gulf of Mexico coast. The region is of particular interest as it spans several ecologically significant abiotic gradients that are representative of other mangrove transition zones around the world. The study examines past and projected responses of mangrove forests to a range of global change drivers, including temperature change, precipitation change, accelerated sea level rise, intensification of tropical cyclones, increased atmospheric carbon dioxide, eutrophication, invasive non-native species, and land use change. While the global perspective of each driver is briefly discussed, the review mainly focuses on the impacts of global change on mangrove forests in the United States, Mexico, and Cuba, the three nations that border the Gulf of Mexico. The study provides examples to demonstrate the significance of the interactive impacts of global change, which have the potential to cause significant ecological implications. The study suggests that mangrove death and loss may occur as a result of interactions between global change drivers, while other exchanges may cause mangrove expansion at the expense of other ecosystems. By investigating the impacts of climate change on mangrove forests in the Gulf of Mexico, this review contributes to the understanding of the ecological consequences of global change and highlights the importance of considering the interactive effects of multiple drivers in predicting future outcomes (*Department of marine and mangrove ecosystem, 2019*).

4. Organization and application

4.1 Global Mapper

Global mapper is the application for visualizing, editing, analyzing lidar or cloud data of any format (*Santi, 2023*).

Global mapper is an extensive and varied data format support format. It offers over 300 raster, vector, and elevation data types, Global Mapper supports virtually all types of geospatial data right.

Vector, raster, and elevation data can be exported in virtually every common file format as well as many proprietary types. During export, data can be tiled into smaller or more manageable files, or the export area can be cropped to a defined area or to the extent of the current screen view.

‘Global Mapper®’ is a GIS software that provides a comprehensive array of spatial data processing tools, with access to an unparalleled variety of data formats. It’s intuitive user interface and logical layout help smooth the learning curve and ensure that users will be up-and-running in no time. Organizations of any size quickly see a significant return on investment brought about by efficient data processing, accurate map creation, and optimized spatial data management (*Global Mapper, n.d.*).



Figure 3 : Global Mapper Application

4.2 Surfer

Surfer is a software application developed by Golden Software that is widely used in the field of data analysis and visualization. It is specifically designed for professionals in geophysics, oceanography, hydrology, and other related fields. The app allows users to create high-quality 2D and 3D maps, cross-sections, and contour plots from various types of data, including surface and subsurface data (*Surfer® | 2D & 3D Mapping, Modeling & Analysis Software for Scientists and Engineers*, n.d.).

One of the key features of Surfer is its ability to import a wide variety of data formats, such as XLS, CSV, LAS, and BLN. It also supports several industry-standard file formats such as SEG-Y, ASCII, and DXF. Users can create maps and plots of their data using a variety of visualization techniques such as shaded relief, contour lines, and color gradients. Surfer also has a built-in grid editor that allows users to manipulate their data, and to create custom grids and maps.

In addition to its core features, Surfer has several advanced capabilities that are particularly useful for professionals in the geophysical and oceanographic fields. For example, it can be used to create 3D surface maps of underwater features such as seafloor topography or water column temperature. It also allows users to generate contour maps of magnetic, gravity, or seismic data.

Overall, Surfer is a powerful and versatile software application that is widely used by professionals in the geophysical and oceanographic fields. Its ease of use, flexibility, and advanced features make it a valuable tool for data analysis, visualization, and presentation.



Figure 4 : Surfer Application

4.3 Department of Marine and Coastal Resources

The Department of Marine and Coastal Resources is the government department under the Ministry of Natural Resources and Environment established to conserve and restore natural resources and the environment, including management of sustainable benefits which focus on marine and coastal resources (*เกี่ยวข้องกับเรา*, n.d.).

The term "marine and coastal resources" refers to objects that exist or occur naturally in oceans and coastlines, such as coastal peat, wetlands, canals, lakes, and estuaries. Which have a contact with the sea or are influenced by sea water, such as mangrove forests, beach forests, seashore beaches, islands, sea grasses, coral reefs, marine plants and animals, or man-made things for the benefit of the ecosystem in marine and coastal areas, such as artificial coral reefs, wave reduction reefs, and coastal erosion protection.

Moreover, the department of marine and coastal resources is also the data center, which gives people knowledge and information about marine and coastal resources. The data include the big data, the protected area, the knowledge base, the

information about the budget, Geographic Information System(GIS), Management Information System (MIS), Marine Resource Database System (MRDS), Marine Endangered Species Encounter System (MES), Artificial reef and Buoy information systems(AB), Central database research (RIS), Central database to promote the work of Network participation (CN), and Marine Debris Database (TCC).



Figure 5 : Department of Marine and Coastal Resources

4.4 Kahoot!

Kahoot! is a game-based learning platform which can make it simple to quickly develop, share, and play learning games or trivia quizzes. It can be used to help students learn by making the information engaging in a fun way (*Edwards, 2022*).

Kahoot! provides questions and optional multiple choice answers as its basic feature. Adding rich media such as images and videos enhances the interactivity of the experience.

In the scoring part, users can earn up to 1000 points, depending on how quickly they answer correctly and discrete feedback on their classroom ranking is provided by each individual. For the response, a red screen indicates an incorrect answer, while a green screen indicates a correct response.

To conclude this chapter, it is imperative to define the key terms and concepts presented in this chapter to ensure a thorough understanding of the subject matter and facilitate the comprehension of subsequent chapters. By providing clear definitions, readers will be able to more easily follow the discourse and better grasp the implications of the research findings.



Figure 6 : Kahoot! Application

Chapter 3 : Methodology

1. Goal and Target groups:

The ultimate goal of our project is to build resilience in villagers about the Coastal, Mangroves, and Marine ecosystem. Thus, our main focus is the people who live within the Koh Klang village area, which will be split into two groups. The first group are the adults, as they are currently the main contributors in the Village. Whereas our second target group are the children, which is another very important group that we may not forget about, because they are the future and therefore one day, need to be responsible for the village instead of their parents and their elders.

3. Objectives

3.1 Investigate the problems including coastal erosion and mangrove forest ecosystem.

3.1.1 Interview villagers

Oral approach is being used here as we want to observe their understanding about coastal erosion and marine & mangroves system. Moreover, apart from that, we also want to know problems that they are currently facing and illustrate those knowledge

A. Questions for normal villagers

- a. The means we performed is that we ask the head of the villages about villagers who are available and ready for us to interview and collect our data. Then we went hopping around the island to interview each individual and record some footage. The population pool is about 20 people varied in sex, social roles and occupations.

B. Questions for fishermen

- a. The way we performed is similar to what we did with the villagers. However, the question set is different, as we focus more on marine and mangroves ecosystems. The population pool is about 8 local fishermen difference in age range.

3.1.2 Interview PDA officers

The PDA organization has been working in many communities in and around Krabi quite thoroughly. They know the problems that have been going on through and through. Fortunately they are our sponsor, so we decided to interview them as one of the sources. We believe that people who are working to develop villages will have the other of the information that we need. Thus, we set up a meeting at the Headquarter of PDA and discussed our project with the director of PDA while collecting some useful data, insights and suggestions.

3.1.3 Ask for support information from Department of Marine and Coastal Resources

Corresponding to our objectives, the Department of Marine and Coastal resource will be another highly trusted source for us to obtain data about Krabi's shoreline and also species that are endangered or even vanished. With all these findings, they will be included in our videos and infographic later on to emphasize ongoing issues.

3.1.4 Observe the territory of mangrove forest

A. Tha Pom Klong Song Nam

- a. The reason that we chose to observe the mangrove forest here is because it's one of the most famous tourist attractions in Krabi. Therefore nature will have to adapt herself as the invasion of mankind into the forest. For example, there are lesser benthos and many types of fish. Moreover some tree species adapted the structure of their roots due to the environment.

B. Klong Prasong district

- a. In contrast to Tha Pom Klong Song Nam, Klong Prasong Mangroves forest is nature at its best. The prosperity and balance of the forest are restored. Biodiversity here is much more diverse, as we could study the function of mangroves area firsthand.

C. Comparison

- a. Besides, we chose these two special areas because we want to distinguish the real difference between conserved and attractions types of mangroves forest. Like our hypothesis, the biodiversity and food chain are quite different if a closer observation is performed. With more in depth data, this helps us conclude the

advantages and disadvantages of non-conservation forest.

3.1.5 Map analysis through Global mapper and Surfer

As part of our efforts to raise awareness about potential dangers in the Krabi area, we are creating detailed risk maps. These maps will include information on a range of natural hazards, such as flooding, landslides, and earthquakes, as well as geological risks like sinkholes and rockfall. By providing visual representations of these risks, we hope to empower people in the area with the knowledge they need to make informed decisions about how to prepare for and respond to potential hazards. In addition to displaying potential risks, the maps will also provide practical guidance on how to stay safe in different scenarios, such as by avoiding flood-prone areas or seeking higher ground in the event of an earthquake. Ultimately, our goal is to help protect residents and visitors to the Krabi area, and to foster a culture of safety and preparedness throughout the region.

3.2 Understand the target group's trend of interest.

According to our observations, some groups of villagers are already aware of the occurring problems, however, they do not choose to take action. Therefore, other than raising awareness to those who are unaware of the dangers, one of our goals is to also encourage those who know the issues to see the bigger picture and be more concerned of the issues.

3.2.1 Interview the villagers:

During our time at the village, we visited the villagers and interviewed them on any problems or issues they have faced or are currently facing. Hence the data we collected on the issues includes:

A. Understandings

a. Coastal erosion vs Nature

According to the villagers' understanding, they are aware to an extent that coastal erosion is caused by nature; for instance, the shift in sands and sediments from wave actions throughout time, as well as storms and more.

b. Coastal erosion vs Humans

Another understanding the villagers are mindful of are the causes of erosion that is caused by us humans. For instance, the small waves and tides from boats that sails nearby the village, affecting the mangroves ecosystem, as well as causing coastal erosion over time, resulting in a loss of habitat.

c. Debris

The villagers also talked about the amount of garbage that has been flushed into their living area, which is called a ‘basin’, where a lot of waste and garbage from both its own village, as well as other islands is gathered there.

d. Vanished species

According to the official report from the Department of Marine and Coastal ecosystem of Krabi, there are several species that have started to be noticed by local people. For instance, the dolphin has a lower exposure rate compared to the record of previous year (*Department of Marine and Ecosystem, 2018*). Furthermore, from the interviewing the exposure of local people with sea otters also reduces.

B. Misunderstanding

However, through observations and interviews, we noticed a trend in the villagers of some misunderstandings.

a. Erosion from waves from boat movements:

This is one of the misunderstandings from some groups of villagers where they think boats are a main factor that affects their receding coastline as well as killing the mangrove trees. However, the things that cause erosion and damage to the mangroves are (1) Nature, which is further initiated by human activities;

(2) Trees are planted too close to each other, resulting in some receiving less exposure to sunlight, therefore dying through not receiving enough resources they need.

b. Plant Species:

Plants are another thing that the villagers have a misunderstanding on. For instance, the ‘Muta Tree’, which is misunderstood to be toxic, and poisonous. However, the tree in fact has many benefits. Including being able to cure Pediculosis Pubis, Constipation, Tinea Cruris, leprosy, helps to expel wind in the stomach, and many more.

3.3 Selecting appropriate contents to be spread

3.3.1 Talking to Krabi’s Government organization

3.3.2 Consulting with Professors back at the University

A. Coastal Erosion

a. Professor Anond Snidvongs

After consulting with him about the data obtained, we get the idea that even though coastal erosion was a natural phenomenon, it was tremendously intensified by human actions. There are still other reasons that temporarily affect the loss of coast lands. After thinking them through we simplified his words and resources in order to further connect the problem and solution, and finally express it as clearly as possible.

b. Professor Santi Pailoplee

He explained us actually the most severe coastal erosion happens along the gulf of Thailand and not the Andaman sea which Krabi located at .Using this emerging fact, we could encourage villagers to be more

active as there are still time left to find the proper solution for the ongoing problem and, thus fix it in time.

Another advice from him is that we should change our initial map creator “QGIS” to “Global Mapper and Surfer” as they are more suitable for our work and also with just the limited time we have.

B. Marine Ecosystem

a. Professor Jes Kettratad

He guides us about the idea of actual ecosystem indicators. As for sea otters that have vanished from Tha Pom, he mentions several possible causes such as the amount of sea otters’ food which is fish that may reduce down after time or being hunted from humans.

Also, we have asked about his most concerning issue about both marine and mangrove ecosystems. Then, he said that the most concerning issue of both ecosystems is the pollution. As a result, we will do further analysis and simplifying information about pollution for both marine and mangrove ecosystems to be most beneficial for our target group.

3.4 Design the output and evaluation (which are risk map, infographic, and videos)

3.4.1 Designed products

A. The Risk Pattern Maps are designed to provide valuable insights into the vulnerability of specific areas within Krabi to various risks. These maps are divided into three categories: Natural Hazards maps, Coastal Erosion maps, and a Base Map. The Natural Hazards maps offer critical information about the potential risks associated with earthquakes, floods, and tsunamis. The Coastal Erosion maps provide details about the shoreline, sand bar, and different levels of erosion, including 1m, 5m, and 10m. The Base

Map, on the other hand, focuses on ecosystem-related maps and sea basins. By using these maps, decision-makers can make informed decisions about where to allocate resources and how to plan for future events. Overall, the Risk Pattern Maps provide a comprehensive understanding of the risks present in Krabi and can aid in creating better strategies for mitigating them.

- B. Infographics which are a powerful tool to visually communicate ongoing environmental issues such as coastal erosion, marine ecosystem conservation, and the preservation of mangrove ecosystems. These critical issues require attention due to their significant environmental and economic consequences, and infographics can be used to raise awareness and showcase steps to mitigate their impacts.
- C. Short videos and animations can be an effective way to communicate important environmental issues to both adults and children.
 - a. For adults, serious, long-form videos can be created to highlight the ongoing problems faced by villages in Krabi, emphasizing the issues and encouraging actions to prevent and find solutions.
 - b. For children, engaging and educational animations can be used to raise awareness about environmental issues in a fun and interactive way. Two topics that could be covered in such animations are coastal erosion and the conservation of marine and mangrove ecosystems. By educating children about these issues, we can inspire the next generation to take action and become stewards of the environment.

3.4.2 Evaluation

- A. Using a survey with a measurable number of questions and interviews can help gather feedback and responses from

the target group, while evaluation comments from a PDA can provide valuable insights for improvement.

All in all, after successfully gathering the necessary data, it will be used and grouped under connected subjects for a better understanding and also rating how much all of the risks that can happen. The information will next be analyzed using specific data from reliable sources, such as professors, specialists on the topic, and other data from related organizations. The coastal erosion will use data from the observation picture and official from the Department of Marine and Coastal Resources. One of the final data will be assessed in light of the amount of fish and marine life captured by fishermen throughout time, and finally, the entire information that has been analyzed will be utilized to construct a map that represents the risk of this site under various climate change scenarios and then given to the sponsor for the better development in order to keep the real-time data and to encourage local people in becoming more sustainable. The sponsor will be the one who observes the situation, assessing for the most serious issue, and further proceeds to minimize them in the future.

Chapter 4 : Research and Findings

Preview:

This chapter will present the data collection, analysis results from mixed research methodologies such as interviewing, observation, and survey, along with grouping them into findings based on their related issues or topics, and finally, each result will be elaborated and summarized at the end.

Finding 1: Coastal erosion and ecosystem destruction are the two important issues for Koh Klang

We investigated the problem by interviewing and observing the surrounding area around Koh Klang and discovered several signs or proof of coastal erosion, marine ecosystem, or mangrove ecosystem issues.

For example, a fallen mangrove tree near the coast of the mangrove forest on the way to Koh Klang. We brought this information to a discussion with an expert and discovered that it is not only the result of coastal erosion caused by boats, the only mode of transportation between land and Koh Klang, but also the unsuitable planting of mangrove forest. Unlike in most mangrove forests, which have other species of trees as a barrier before the mangrove tree area, the mangrove tree is placed on the forest's shores.

Furthermore, the distance between each mangrove tree is insufficient for them to grow effectively. As a result, they create a competitive situation among themselves, and the weaker will be the one to fall.

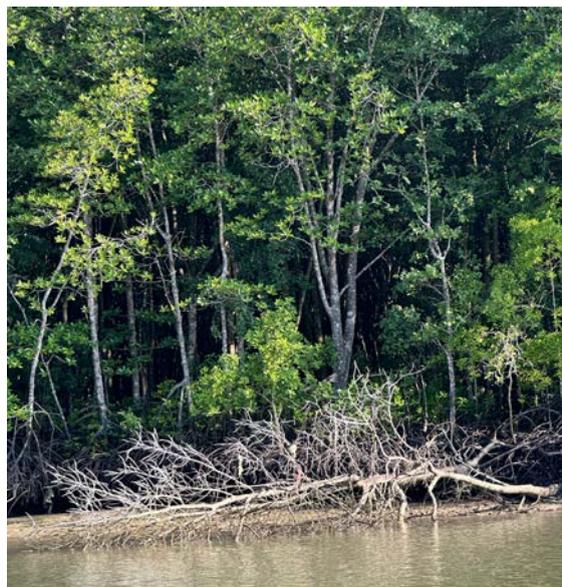


Figure 7 : Mangrove trees fallen down

Another issue that we discovered while interviewing and obtaining statistical data from the Department of Marine and Coastal Resources is the number of migratory birds,

which normally migrate to Koh Klang from late November to February. However, no birds have migrated to Koh Klang in the last three years.

Furthermore, the problem of coastal erosion is severe for the villagers who live near the Koh Klang coast. One of our interviewers was also affected by coastal erosion and lost her home four times before cooperating with an outside organization to plant mangrove trees around the coastal area where her old home used to be as a barrier for the current location.

However, as we discussed with Professor Santi, a geological expert, the severity of coastal erosion on the Amdaman coast, where Krabi is located, is not as severe as on the Gulf of Thailand coast. But nevertheless, when we look up during the interviewing and problem investigation process, coastal erosion appears to be one of the serious problems that the villagers are concerned about because it has a significant impact on their daily lives.

Eventually, we come up with main issues including coastal erosion and ecosystem, which comprises marine ecosystem and mangrove ecosystem. The information following topics has been gathered in a different procedure as indicated below :

- a. Coastal Erosion
 - i. MitrEarth (Professor Santi Phailoblee).
 - ii. Department of Marine and Coastal Resources.
- b. Marine & Mangroves Ecosystem
 - i. Book recommended by Professor Jes : (ความสำเร็จในการปลูกและฟื้นฟูป่าชายเลน) - Development of Mangroves forest restoration.
 - ii. Department of Marine and Coastal Resources.
 - iii. Related websites.

Finding 2 : Cooperation of Map, Infographic, and Video can induce significant change in understanding and awareness of Koh Klang villagers

In response to the current trends of interest among our target groups, we have selected maps, infographics, and video clips as our primary media channels, recognizing their potential to effectively convey our messaging and achieve our marketing objectives. Our rationale for selecting maps as one of our primary media channels is that they offer a larger-scale overview of risk, allowing us to present a more comprehensive perspective to our audience. We have chosen to utilize infographics as a key media channel due to their ease of comprehension, enabling us to convey complex information in a more accessible and digestible format for our target audience. Our decision to prioritize video clips as a media channel is rooted in their ability to captivate and engage our target audience, allowing us to effectively capture their attention and communicate our messaging in a more immersive and impactful way.

In consideration of our target group which includes children, we have developed animations as an additional media tool to further capture their interest and engagement, recognizing the unique appeal of animated content to this specific demographic. Animation can easily engage learners by explaining complex information or processes in a simple and entertaining manner (*Farmer, 2021*).

In a study conducted by Dale back in 1969 the findings to support visual learning were radical (*Dale, E. (1969). Audio-visual methods in teaching. Holt, Rinehart and Winston.*):

- When spoken/heard, recall with a test group of students after 3 hours was 25% and after 3 days was 10-20%.
- When written/read, recall after 3 hours was 72% and after 3 days was 10%.
- But visual information recall was 80% after 3 hours and an amazing 65% after 3 days.

As a result there are huge benefits in including more animated elements in educational materials.

Based on our analysis of the outcomes, we can confidently assert that our outputs have proven to be highly effective, as evidenced by the observed increase in results following our presentation activity.

Finding 3 : Villagers neglected natural deterioration due to a more concerning issue of financial crisis.

From our observation and interview of the people at Koh Klang community, the most concerning issue for them is not about the downfall of the shoreline or the mangroves ecosystem; the most common trend of interest our target group have is leaning toward poverty and getting back into being financially stable as stated by Mr. Sunthorn P., the assistant head of the Klong Prasong sub-district.

During the pandemic Koh Klang community decided to shut down the entire district, blocking all the pathways to enter or exit the district. Due to the lockdown, the locals lost their income which mainly are from fishery, export of rice, and tourism. On the other hand, the result from isolating the whole district from tourism gave an essential period for the restoration of the environment according to the locals and the head of the village that saw species that was assumed to be extinct or bird species that didn't migrate to Koh Klang since 5 years ago but came back during the recent year to hunt for food.

After the pandemic, the Subdistrict Administrative Organization is looking for the solution to deal with the current poverty crisis in the community and the local are looking to get back their incomes from every opportunity available which result in the ignorance of the ongoing problem of coastal erosion and the deterioration of the mangroves ecosystem.

Finding 4 : :Shoreline steepness is critical information for building resilience against coastal erosion in Koh Klang.

Our group discovered that many villagers in Koh Klang lacked awareness about the threat of coastal erosion, and even those who knew about the problem were unsure about its causes and impacts. To address this knowledge gap, we provided the villagers with a map as a useful tool for understanding the factors that can lead to coastal erosion. With twelve different hazard maps available, Professor Dr. Santi Pailoplee suggested the shoreline steepness map to be particularly useful. This map helps identify areas at high risk of coastal erosion, which we observed during our first field trip to have caused significant damage to homes and displaced many families. We also obtained the raw data needed to create the map from Professor Dr. Santi Pailoplee, from the Geology Department, and used it to educate the villagers and increase their understanding of the issue. By using the shoreline steepness map,

we can help the villagers identify the areas at high risk of erosion and increase their awareness and knowledge of this issue.

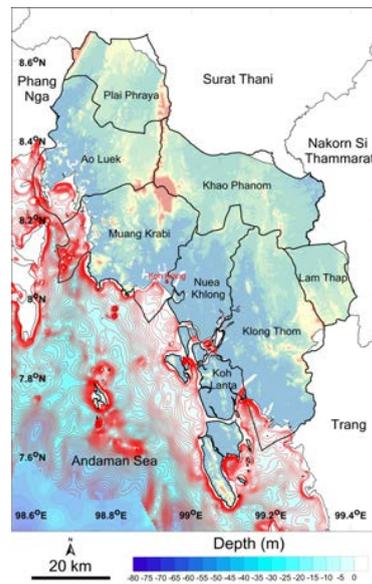


Figure 8 : Shoreline Steepness Map

However, our pre-test on the topic of coastal erosion for adults revealed that only 67.50 percent of the surveyed population understood the issue, and for the students, it was 72.22 percent, indicating a need for further education and awareness-raising efforts. To address this, we utilized the shoreline steepness map to show adults, teachers, and a local politician the areas at high risk of erosion and increase their awareness and knowledge of this issue. After educating them with our map, we found that their understanding had improved, with the post-test score for adults and students rising to 82.50 and 86.11 percent, respectively.

In addition to providing the shoreline steepness map as a tool for educating villagers about coastal erosion, we also held a post-test discussion with the adults who attended our presentation. During the discussion, many audience members, including the local politician, expressed their appreciation for the map and how it increased their understanding of the issue. The school requested a copy of the map to incorporate it into their curriculum, while the local politician requested a copy of the map in the form of a PDF, shapefile, and the sources used to update the map for his party's use. This level of interest and engagement is a promising indication of the potential impact that mapping can have in raising awareness and educating people about critical issues such as coastal erosion.

Finding 5: Disappearance of animals in Krabi happens due to climate change vs. lack of government involvement.

According to ‘Krabi’s Marine and Mangrove Ecosystem Conservatory’, there has been a record of vanished species, such as dolphins, otters, and many bird species, which are due to factors such as climate change, habitat loss, exploitation, and more. However, when

we had the opportunity to talk and interview the villagers of the Koh-Klang village and area, they confirmed the fact that animals such as otters and dolphins are still seen; but agreed to the fact that they are seen less today than they were before. Moreover, villagers also stated that otters have now moved and relocated into peoples' homes. This may be due to the lack of food sources in their previous habitat, resulting in them moving to people's living areas. Hence this suggests the lack of government and related organizations' involvement; resulting in the wrong data and information about such matters. Therefore, governmental sections and related organizations should be more involved and make more frequent visits to keep up the the information within the village and the areas around it.

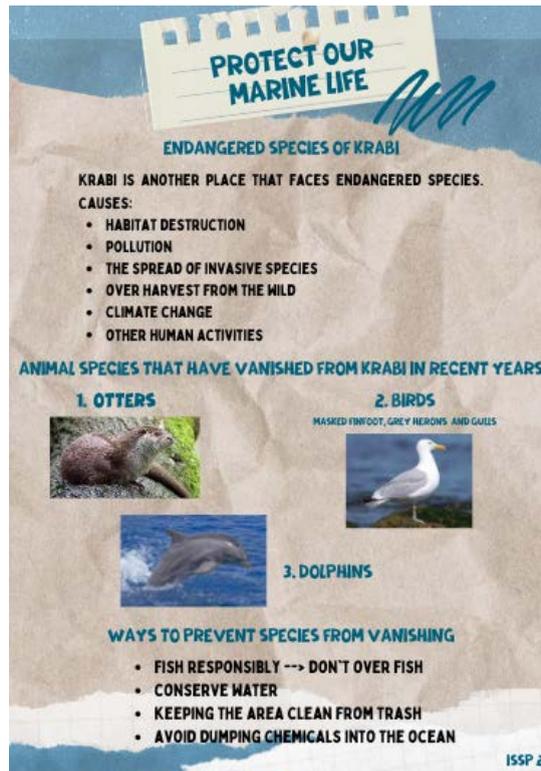


Figure 9 : Infographic on Marine Life Endangerment

Finding 6: Decreasing the number of “Bird migration” is affecting the economy and the people of Koh Klang village.

Bird migration is a seasonal movement of birds, where several species of birds would travel south to find a more suitable place with a better habitat, atmosphere, and food source. Krabi is one of the places where birds from many countries migrate to and is also one of Krabi's main tourist attractions. However, in recent years, there have been reports that numbers of birds migrating within Krabi has decreased. This therefore affects both Krabi's ecosystem, and more importantly, the economy and the people. This happens due to many factors, for instance, warmer climate, which influences birds to change in routes, shorten, or in some cases, completely cancel their journey. Another factor that affects bird migration is

due to lack of food source. According to local fishermen, the number of fishes, which is the main food source for birds, have been decreasing, resulting in less birds migrating into the area, as well as affecting the local fishermen's income.



Figure 10 : Pictures from video clip on mangrove and marine ecosystem; birds migration part

As a result, we made this a primary focus for producing outputs. For instance, in our infographic, we provide a comprehensive explanation of bird migration, including its definition, the reasons why birds migrate, and the various species that used to migrate through Krabi. Additionally, we examine the factors that impact bird migration, and how these changes affect local communities. We aim to create accessible resources that educate people on the intricacies of bird migration, while also highlighting its importance for local ecosystems.

Finding 7: Coastal erosion is a must know and aware issue for Koh Klang

Based on our interviews and observations, we discovered that Koh Klang has been threatened by coastal erosion for several years. Many organizations are attempting to solve this problem by sponsoring or advising on the construction of a bamboo or concrete wall to reduce the intensity of the wave before it reaches the coast. However, there is no long-term solution because most villagers still do not understand the source of coastal erosion.

As a result, our group created outputs that include content about coastal erosion and the source of the problem, such as a map, infographic, and video.

- Coastal Erosion Map

- Loss of lands map from Figure 2a and 2b.

This map provides a visual comparison of the changes in the Krabi shoreline over the course of five years, from 2017 to 2021, by depicting accurately the evolution of the coastline during this period.

- Steepness of shoreline map (1m, 5m and 10m) from Figure 1b, 1c and 1d.

These maps depict the same coastal erosion data, offering a comprehensive view of the extent of erosion at various distances from the shoreline. The first map shows the erosion at a distance of 1 meter, the second map displays the erosion at a distance of 5 meters, and the third map illustrates the erosion at a distance of 10 meters from the shore.

This map provides a visual representation of the potential risk of future coastal erosion based on the steepness of the shoreline. It highlights the areas that are most susceptible to erosion, as the steep slope of these areas make them vulnerable to the erosive forces of gravity and ocean waves. In these areas, even a small change in the ocean's waves and currents can result in significant loss of sand or sediment, making them prone to erosion in the future.

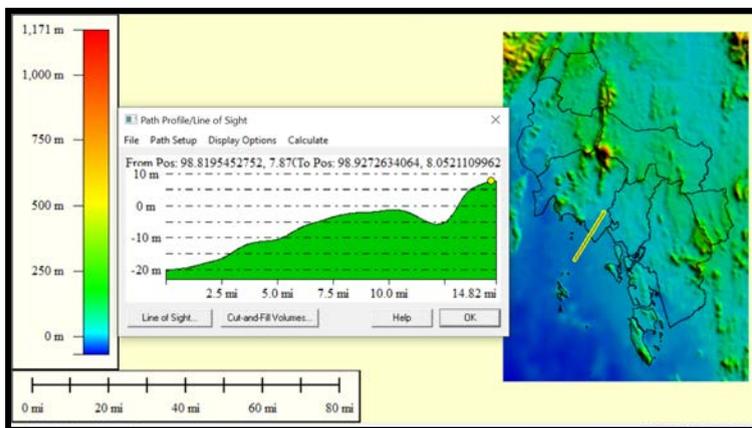


Figure 11 : Steepness of Koh Klang coastal

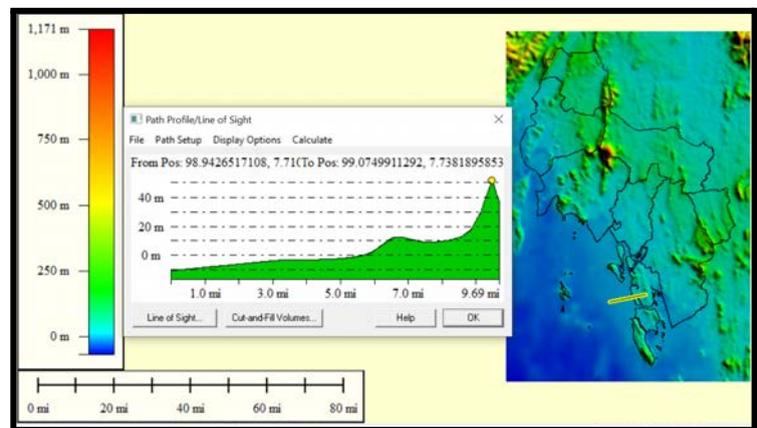


Figure 12 : Steepness of Koh Lanta coastal

- A Coastal Steepness Comparison: Koh Klong vs. Koh Lanta

Figures 11 and 12 provide a comparison of the steepness of the coastlines of Koh Klong and Koh Lanta, with the 0-meter line serving as a reference point for assessing their relative steepness. As shown in the figures, it is evident that the coastline of Koh Klong is steeper than that of Koh Lanta. This finding has significant implications for the risk of coastal erosion and the stability of the coast in the future.

Finding 8 : Different claim among villages and governmental sectors about abundance of some species

During our problem investigation process, we have the opportunity to visit the Department of Marine and Coastal Resources and discuss with the Director. In the interview video, he claims that some species, such as dolphins, have gone extinct in that area. On the other hand, we went to Koh Klang and interviewed the villagers about the same issue, and the results tell a completely different story. Species that were once thought to be endangered can still be found in the Koh Klang area.

According to statistical information from the governmental section, some species of animals were said to be endangered, or be at risk of endangerment. However, some villagers have said to still see those animals. For instance, animals like otters or dolphins; where according to the governmental insights, these two species have not been seen for a few years. This therefore suggests a misunderstanding or the lack of update on information, which further suggests that Hence after talking and interviewing the villagers and locals in the area during our second field trip, the villagers moreover mentioned about asking for a hand to send a message to governments and helpful-organizations, to pay more attention, as well as to stay committed and consistent in their words and actions in the refinement of the village and community, as well as the ecosystem of the area.

Therefore the generated outputs such as infographics, we present the species of animals that have vanished from Krabi in recent years to raise awareness and help readers recognize the decrease in the number of species they were once familiar with or have ceased to exist altogether. We have incorporated the cause or actions behind the disappearance of these animal species in the infographic to create a stronger impact and deter individuals from engaging in similar actions that may lead to further harm to the environment and its inhabitants. Recognizing the ways that contribute to the disappearance of species, we have also included preventative measures in the infographic to inform readers about what they can do to help prevent further loss of animal species and encourage their participation in conservation efforts.

Finding 9 : Misconception about Muta trees can be fixed.

Villagers do not fully understand the role of the Muta tree in their daily lives on Koh Klang or in the ecosystem of the mangrove forest nearby. However, when we interviewed one of the villagers who worked as a beekeeper, he mentioned that Muta tree is another type of tree that he used as food for his bees. Different types of honey emit different fragrances, as does Muta honey. This could also be evidence that the Muta tree can still benefit individual villagers in some way. Furthermore, the Muta tree is a common species of tree that grows in mangrove forests; if the villagers cut down all of the Muta trees, the mangrove ecosystem will become unstable in the future.

Therefore, we produce outputs such as infographics that explain how the Muta tree can benefit the individual and how to avoid being injured by the Muta tree.

To raise awareness about the importance of mangrove forests, we have included information in the infographic detailing the unique features and benefits of these ecosystems. This is intended to help people understand and appreciate the value of mangrove forests. We also informed them that mangroves are currently facing threats and dangers to help them understand that some of their actions may unknowingly harm these ecosystems. Finally, we provided information on ways to conserve and protect mangroves, highlighting appropriate actions that can help sustain and promote their growth. This is intended to encourage individuals to take an active role in preserving these valuable ecosystems.

As a result of being exposed to our outputs, we discovered that the children gained a better understanding. Before we started presenting the output to them, we also asked them some questions about the mangrove forest and the Muta tree, but only a small number of

children are familiar with this type of tree, but after our output presentation, they appear to have a better understanding of what it is.

Findings 10: An educated population is key to securing higher awareness of coastal and ecosystem issues in Koh Klang’s community.

Before the workshops, surveys are given out to measure the awareness and understanding of both children and adults in Koh Klang village.

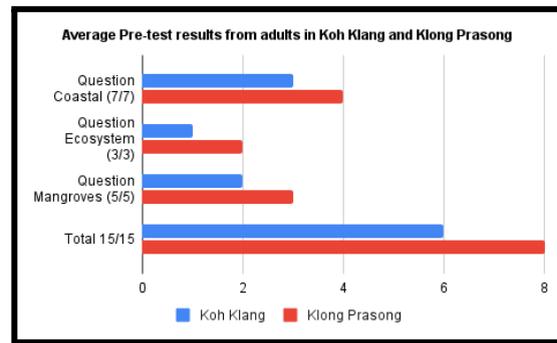
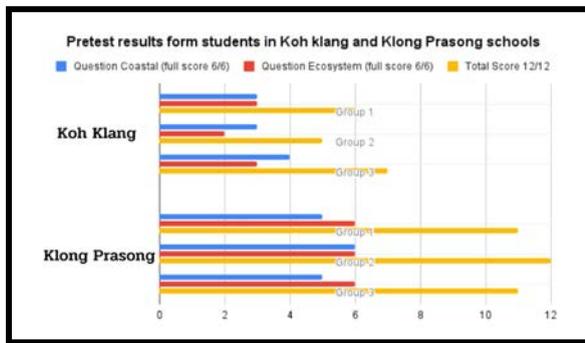


Figure 13. the Pre-test scores between 3 groups of children in Koh Klang vs Klong Prasong schools.

Figure 14. average Pre-test scores of adults in Koh Klang vs Klong Prasong villages.

Children from both schools are split randomly into 3 groups, and each group has 10 people. The result obtained from figure 13 illustrates the fundamental understanding of children in Koh Klang and Klong Prasong schools about coastal ecosystems before the workshop. On the other hand, figure 14 gives us the picture adult’s awareness and understanding from Koh Klang and Klong Prasong villages about the coastal erosion ecosystem.

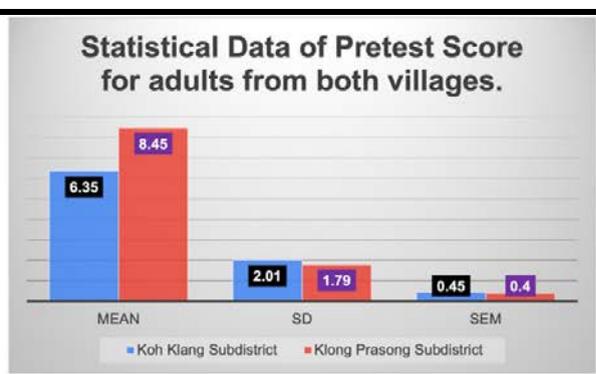
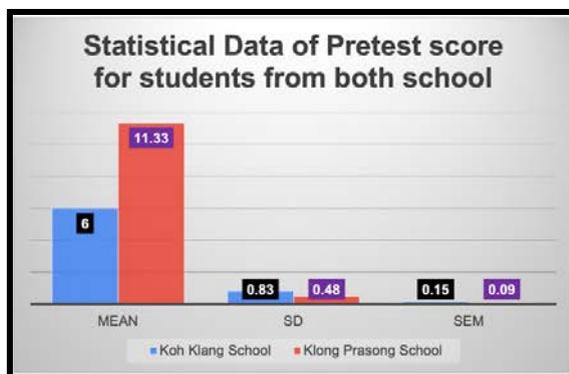


Figure 15. the differences in Mean, Sd, and SEM of Pre-test score between Koh Klang and Klong Prasong school (a), and in (b) pictorial the difference in Mean, Sd, and SEM of Pre-test scores between adults in Koh Klang vs Klong Prasong.

According to figure 15, states that the average's scores of people in Klong Prasong are 5.33 lower for children and 2.10 lower for the adults. This is a surprising result, as the gap of mean scores between the two villages are much different, especially in children because these two villages are only 3 km apart. To dig deeper about the emerging concern, we performed an unpaired T-test to examine whether these two groups are significantly different from one another or to put it into words are there any reasons behind this unfamiliar 2 data sets.

Welch's t test Tabular results		Welch's t test Tabular results	
Table Analyzed	Col: Unpaired t test for Students	F test to compare variances	
Column B	Students from klong Prasong School	F, DFn, Dfd	3.000, 29, 29
vs.	vs.	P value	0.0042
Column A	Students from Koh Klang School	P value summary	**
		Significantly different (P < 0.05)?	Yes
Unpaired t test with Welch's correction		Data analyzed	
P value	<0.0001	Sample size, column A	30
P value summary	****	Sample size, column B	30
Significantly different (P < 0.05)?	Yes		
One- or two-tailed P value?	Two-tailed		
Welch-corrected t, df	t=30.46, df=46.40		
How big is the difference?			
Mean of column A	6.000		
Mean of column B	11.33		
Difference between means (B - A) ± SEM	5.333 ± 0.1751		
95% confidence interval	4.981 to 5.686		
R squared (eta squared)	0.9524		

Figure 16 : calculated unpaired T-test for Students between Koh Klang vs Klong Prasong Schools.

Welch's t test Tabular results		Welch's t test Tabular results	
Table Analyzed	Col: Unpaired t test for Adults	F test to compare variances	
Column B	Adults from Klong Prasong	F, DFn, Dfd	1.256, 19, 19
vs.	vs.	P value	0.6244
Column A	Adults from Koh Klang	P value summary	ns
Unpaired t test with Welch's correction		Significantly different (P < 0.05)?	No
P value	0.0012	Data analyzed	
P value summary	**	Sample size, column A	20
Significantly different (P < 0.05)?	Yes	Sample size, column B	20
One- or two-tailed P value?	Two-tailed		
Welch-corrected t, df	t=3.491, df=37.52		
How big is the difference?			
Mean of column A	6.350		
Mean of column B	8.450		
Difference between means (B - A) ± SEM	2.100 ± 0.6015		
95% confidence interval	0.8817 to 3.318		
R squared (eta squared)	0.2452		

Figure 17 : calculated unpaired T-test for Adults between Koh Klang vs Klong Prasong Villages.

For unpaired T-tests, we tested it with 95% confidence interval, that means to conclude what we have concluded, p-value of both tests have to be less than 0.05. According to figure 3, the p-value is less than 0.0001 which states how serious these data sets are significant to each other. Moreover, from figure 4 p-value is about 0.0012 which is again lower than 0.05. To summarize, both of the p-values are less than 0.05 and as the results of both figure 3 and figure 4 is a solid support for the claim that we are trying to test, which is “are there any significant reasons behind the difference in scores for both Koh Klang and Klong Prasong village?”.

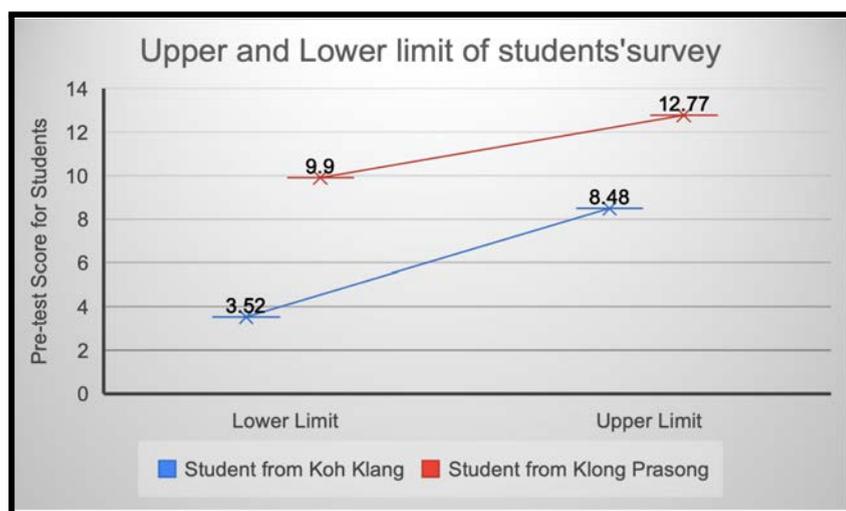


Figure 18 : Upper and lower limit of Pre-test score between students from Koh Klang and Klong Prasong schools.

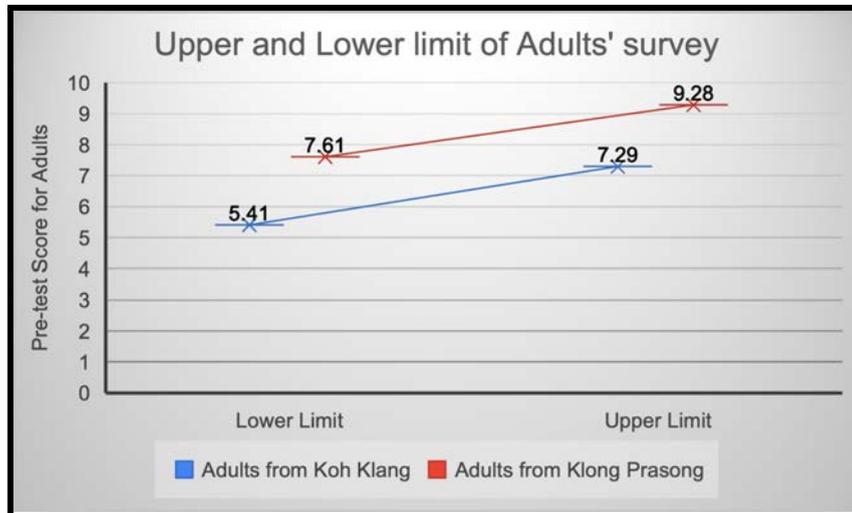


Figure 19 : Upper and lower limit of Pre-test score between adults from Koh Klang and Klong Prasong villages.

Not only p-value is used to conclude the support of this claim, based on figure 20 and 21, we can see the gap between calculated upper and lower limits from both datasets. By observation, we see that there is no overlap between the scores of neither students from 2 different schools nor adults from 2 different villages, this tells us that the scores are particularly significant to each other for both of the datasets. To investigate these gaps in knowledge between people from both villages according to observation, interviews and statistical data. We decided to dig deeper into the core of the problem and look for the origin of this emerging issue.

There are some tremendous findings that we found, the first evidence comes from the teachers from both of the schools and the answer we found is that Klong Prasong school spends more time (6 lessons more) teaching about coastal erosion and ecosystems compared to their counterparts. so this might more or less affect the understanding of people in Koh Klang. Another comment from the director in Koh Klang school says that “Coastal erosion has been taught in our school and students seem to take it seriously, but their parents are not taking the problems seriously enough”. Which is because, on their side of the island, people are facing lesser coastal erosion problems and also other ecosystem issues in general. This states that nothing will change if the everyday environment or in other words primary motivator are the one ignoring it. If this trend still keeps on going when children grow up, they tend to be careless and ignorant like their parents.



Figure 20: Koh Klang island map which contains both Koh Klang and Klong Prasong villages.

As from figure 22, Klong Prasong village is the community connected directly to Andaman sea which is currently facing severe coastal erosion every day; however, in Koh Klang village people aren't having the same severity and thus their decreased seriousness. Which is totally understandable as people tend to be ignored when they aren't experiencing it.

Therefore, our workshops are designed to grab the most attention of people in both villages, especially adults' attention. As we are aware, nothing will change in children's understanding if the everyday environment or in other words their parents are the ones ignoring it. If this trend still keeps on going when children grow up, they tend to be careless and ignorant like their parents. Adults really do need to care more about the ongoing problems because this will undoubtedly increase the awareness of their children according to the positive correlation between adults post-test survey results from both villages which is shown below here.

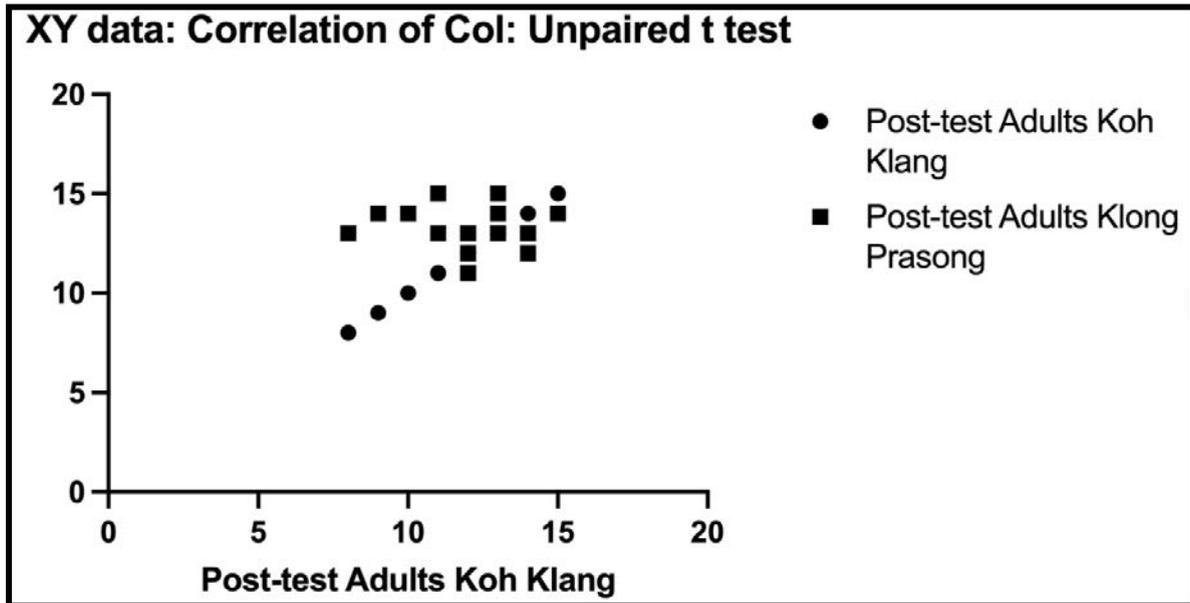


Figure 21: The positive correlation of Post-test score between Adults from Koh Klang and Klong Prasong villages.

To summarize this finding, the pre-test scored retrieved looks eccentric, therefore unpaired T-test is being used to collect p-value and upper/lower limits at 95% confidence interval in order to support the claim that there are significant reasons behind the difference in scores for people in both villages. As predicted, there are literally reasons behind these differences which are 1. Adult’s seriousness due to the less severity of problems and 2. The amount of time students get taught in school is also deviated. Thus, our ultimate goal for the workshops was raising awareness and even building resilience for both adults and children from both villages. Especially adults as they are the leading example and main influencer of the children in the communities. Now we can conclude that an educated population is key to securing higher awareness of coastal and ecosystem issues in Koh Klang’s community. However, our workshop caused only a short-term impact, for the long-lasting and more sustainable impact will be discussed later in the recommendation plan part.

Finding 11: Mangrove forest create healthy relationship with villagers of Koh Klang as a component of their society

To raise awareness about the importance of mangrove forests, we have included information in the infographic detailing the unique features and benefits of these ecosystems. This is intended to help people understand and appreciate the value of mangrove forests. We also informed them that mangroves are currently facing threats and dangers to help them understand that some of their actions may unknowingly harm these ecosystems. Finally, we provided information on ways to conserve and protect mangroves, highlighting appropriate actions that can help sustain and promote their growth. This is intended to encourage individuals to take an active role in preserving these valuable ecosystems.

Finding 12: Resource constraints, time-consuming communication, and the small number of students are some limitations on the direct comparison between two villages.

The Kahoot pre- and post-test were conducted as a team because of the limitation of our tools. There were a total of 3 tablets to share with 30 children, which we further separated them into a group of 10 with 1 tablet per group. From this limitation, the results from both pretest and posttest are shown as a group rather than individual which may not be as effective to use in the analysis. Moreover, children can have less chance to share their opinion when working in a large group, which leads to some of them might not get a chance to share their opinions.

Also, we requested information from the Department of Marine and Coastal Resources, and they took about three weeks to process and return the information. However, the information received did not meet our expectations because we requested at least 20 consecutive years but only received 5 years, which was insufficient to map out the significant difference.

Moreover, due to the limitations on the number of students that can be included in each school, it may be difficult to control the variation in our sample. Since **Ban koh klang** school has a larger student population, they selected fourth-grade students to participate in our activity.

Chapter 5 : Conclusion and Recommendations

Recommendations

1. Governmental sections and related organizations should be more involved and make more frequent visits to keep up with the information within the village and the areas around it.

This recommendation is related to Finding 8 that during our investigation, we spoke with the Director of the Department of Marine and Coastal Resources, who claimed that certain species, such as dolphins, had gone extinct in the area. However, when we interviewed villagers in Koh Klang, we found that some of these species were still present in the area. This suggests a need for updated information and highlights the need for government organizations to stay committed to protecting the ecosystem. Furthermore, the villagers requested assistance in conveying their message to relevant organizations to pay more attention and take action towards conserving the area.

2. Government should seriously consider adjusting their curriculum for children during their elementary school time

This recommendation is related to Finding 10 as, after interviewing villagers in Koh Klang's community, we understand why a portion of adults act this way. Most of the time, they didn't realize how such small things could do long-term damage. Also sometimes the problems are out of their control, judging from our session with villagers and sponsors, government support is critically needed to change the ignorance of adults in the community.

Based on our findings, the government should seriously consider adjusting their curriculum for children during their elementary school time. As currently from the pre-test results we did in Koh Klang school, states that the understanding of children is there however due to the amount of lessons that they had in school they lacked some important knowledge. The first step of the change is easy, as the neighboring Klong Prasong school already spent more time educating kids about these significant problems, resulting in higher awareness in both children and adults in the area.

3. Providing adequate and appropriate support to communities can lead to better problem-solving methods and ignite hope.

Related to finding 11, it's known that some groups of people in the community are already aware about these ongoing problems. With the adequate and appropriate support from related organizations, this community could really have better methods to handle this problem. Our contribution shows them the courage and willpower to ignite hope for this community even though we are not the one who lives there. After the workshop, surprisingly, a representative approached us and asked us about the maps that we created in more detail. He wanted us to send all the designed outputs to him as it will be emphasizing his plan for the new election in Krabi. Moreover, the same trends go by teachers in both schools, they are more than eager to get our outputs. From this finding we see that sometimes the problem is not about the core knowledge of people in the community, sometimes it's because they don't have enough support or you could say the one who gives them hope.

4. Avoid constructing buildings in high-risk erosion areas and steep shorelines to prevent damage and displacement of families living in those areas.

Related to Finding 4, after reviewing the information provided on the shoreline steepness map, we strongly recommended that houses or buildings should not be constructed in areas with a high risk of erosion or where the shoreline is very steep. This recommendation was made in order to prevent damage to buildings and displacement of families living in these areas due to the impact of coastal erosion.

Action Plans based on recommendations

1. Maintenance team, for this aspect, we plan to have a maintenance team to check up on the bamboo dams and other security facilities that need to be renovated and assessed closely.
2. Adapt our outputs (infographics, maps, video clips) to the school's curriculum.
3. Allow a trustworthy organization to send a check-up team to observe and educate on the ecosystem to the locals Muta tree's benefits.
4. Political parties start some serious action as they are using our outputs to further develop their strategy for upcoming elections.

Conclusion

To summarize, this study collected data, investigated problems, and produced three main outputs: video/animation, infographics, and maps. Following the completion of surveys and the generation of those outputs, the next step is to assess the improvement in understanding of the target group, villagers, as a result of exposure to the generated output.

As a result, there has been a significant improvement among adults in Koh Klang, with the initial percentage of survey results in the topics of coastal erosion, marine ecosystem, and mangrove ecosystem being 60%, 55%, and 56% respectively. However, after being exposed to our outputs, the percentages for each topic increased to 74%, 80%, and 87%, respectively. As for Klong Prasong district, the starting awareness and understandings are 75%, 80%, and 78% chronically. After being shown the presentation, the results are collected as 91%, 87%, and 86% according to problems about coastal erosion, marine ecosystem and finally mangrove ecosystem.

For children, the significant improvement is shown as follows. In the pre-test section, the children in ban koh klang school get 56% and ban klong Prasong school get 77%. In the post-test section, ban koh klang school gained 88% and ban klong Prasong school gained 88%. We can conclude that they have significant improvement after learning from our outputs.

Furthermore, this study includes a survey for children in Koh Klang because they are also considered villagers, which is our study's target group. However, the main goal of approaching children is not to get a huge improvement in their understanding, but to build their resilience and awareness of issues that may affect them in the future.

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Appendix A : Interview Question

- 1) Questions for locals (villagers)
 - a) What do you think about living in a village near the coast?
 - b) How did your village change over time in your opinion?

- c) How was your village affected by the tourists, can there be either positive or negative effects?
- d) Are there any organizations or governmental/NGOs visits? and what problems do they solve?
 - i) If yes, how do they solve your problem and is it efficient?
 - ii) If not, are there any specific organizations you need help from?
- e) How did you manage or get rid of waste from your household?
- f) Do you think the coastal area around your village changed or not? If yes, how?
- g) Are there any species including plants and animals that you have seen before but have barely seen now?
- h) Within the past 5 years, are there any plants that never existed in this village but now you are exposed to it a lot?
- i) Are there any problems that you currently face and think that if it isn't solved will have a huge effect in the future?
- j)

2) Questions for fishermen

- a) Have you encountered any difficulty during fishing?
- b) Do you see any changes in the ecosystem in the last 5-10 years, both good and negative, and how does this affect fishing activities?
- c) Within these past 5-10 years, Have you ever encountered the problem of the aspect of amount or quantity of the marine's species population?
- d) Are there any other species that you haven't seen before but it started to be seen, and how did they affect you and the environment?
 - i) size and quantities
 - ii) time consuming
 - iii) species
 - iv) any loss species
 - v) any prevention for catching during each specific question
 - vi) any plants that less spotted
- e) What do you believe is the source of the problem, and how do you plan to address it? (Did the government or any other organization provide adequate support?)
- f) Do you have any more words to express to your neighbor, or anything else you want your neighbor's help with to avert the problem?

Appendix B : Project Timeline

	week 1	week 2	week 3	week 4	week 5	week 6	week 7	week 9
activities								

	1 Jan - 7 Jan	8 Jan - 14 Jan	15 Jan - 21 Jan	22 Jan - 28 Jan	29 Jan - 4 Feb	5 Feb - 11 Feb	12 Feb - 18 Feb	26 Feb - 5 March
Field trip to the real study area								
visualize and identify problems from actual site								
identify possible solution for those problems								
finalize the suggested solution and submit to the sponsors								
working on report and presentation								

Appendix C: Sponsor Description

- Population and Community Development Association (PDA).
- Why do they come to Krabi: PDA decided to settle down at Krabi after the tsunami to educate and improve the lives of people in the community.
- 5 Aspects of Operation

- Decrease birth: Carry out family planning activities that emphasize community participation. (Community-Based Distribution System (CBD) by training and organizing community family planning volunteers in more than 12,000 villages.
 - Decrease death: Organize public health projects to provide knowledge of healthcare campaigns for knowledge and understanding of AIDS through public relations, such as magazines, radio, and television.
 - Decrease poverty: Village Development Partnership (VDP) project is to eliminate poverty with the private sector, which focuses on developing and encouraging villagers to have occupational skills. Set up a village development bank as a source of funds for the community that villagers jointly manage instead of borrowing money informally.
 - Decrease stupidity: They are giving scholarships to create an alternative education system for the underprivileged in rural areas. The goal is to develop the school as a learning center for everyone in the community and be part of developing the countryside.
 - Decrease selfishness: Educating people to have a public mind, know how to share, help, and become volunteers to help society starting from their community. Actions were taken for school children and the general public through organizing activities and clubs.
- STEM Education Camp (Science, Environment, Energy and Innovation Camp): From experience in environmental conservation, it has been conveyed through training and stem camps for educational institutions, organizations, and those interested, which Dr. Thaksin Artchawakom manages.
- Awards: The Population and Community Development Association is a public benefit organization established in 1974. By having Mr. Mechai Viravaidya work on social development, rehabilitation, and improving the quality of life. His works are to be accepted both domestically and internationally. Furthermore, he also received several important awards, such as the Outstanding Environment Project Award 2002 from UNEP for the Sub Tai Village Development Project, one of 27 projects worldwide. And most importantly, in February 2012, the association was honored by The Global Journal as one of the 100 outstanding public benefit organizations, the 39th The Best NGOs in the world.
 - 1. Equator Prize Winner: 2002

- 2. Top 100 NGOS
- 3. Etc.

Appendix D : Survey Question

Rate the answer in the scale of 0 to 5 which each number indicates different intensity of effect.

- 0 indicates that there is no effect on daily life and work live, also not worry at all
- 1 indicates that there is no effect on daily life and work life, but they do worry
- 2 indicates that there is an effect on daily life as their land of residence is eroded a bit, and work life as their income decreases for a bit.

- 3 indicates that there is an effect on daily life as they have lost most of their land of residence, and work life as their income decreases for half.
- 4 indicates that there is an effect on daily life as they lost their residence for 1 time, and work life as they lost their job.
- 5 indicates that there is an effect on daily life as they lost their residence 2 and more times, and work life has lost their job.

Pre-test questions

คำถาม
คุณคิดว่าการกัดเซาะชายฝั่งมีผลกระทบ โดยตรงต่อการดำรงชีวิตมากแค่ไหน
คุณคิดว่าคุณมีความรู้เกี่ยวกับระบบนิเวศหรือความเสี่ยงในพื้นที่มากน้อยแค่ไหน
คุณมีความกังวลเกี่ยวกับการทรุดโทรมลงของชายฝั่งและป่าชายเลน ในบริเวณชุมชนมากน้อยแค่ไหน
คุณคิดว่าการกระทำของมนุษย์มีผลกระทบต่อป่าชายเลนและชายฝั่งมากแค่ไหน
คุณคิดว่าการเปลี่ยนแปลงของสภาพแวดล้อมและสภาพอากาศมีผลกระทบต่อชายฝั่งมากแค่ไหน
คุณคิดว่าการเปลี่ยนแปลงของสิ่งมีชีวิต เช่น การเพิ่ม/ลด, ชนิด มีการเปลี่ยนแปลงมากน้อยแค่ไหน ในช่วง 10 ปีที่ผ่านมา
คุณคิดว่าความรุนแรงจากการกัดเซาะและความเสื่อมโทรมของพื้นที่ชายฝั่งที่จะเกิดขึ้น ในชุมชน ระหว่างช่วงเวลา 10 ปีข้างหน้าจะมีความรุนแรงมากขึ้นแค่ไหน

Post-test questions

คำถาม
หลังจากฟังเนื้อหาทั้งหมด คุณมีความเข้าใจเกี่ยวกับการเกิดขึ้นของการกัดเซาะชายฝั่งขึ้นมากน้อยเพียงใด
หลังจากฟังเนื้อหาทั้งหมด คุณมีความเข้าใจเกี่ยวกับการหายไปของชายฝั่งทะเลเนื่องมาจากความชันของสันทรายขึ้นมากน้อยเพียงใด
หลังจากฟังเนื้อหาทั้งหมด คุณมีความเข้าใจเกี่ยวกับการก่อสร้าง ในบริเวณที่มีความชันของสันทรายแต่ละระดับขึ้นมากน้อยเพียงใด
หลังจากฟังเนื้อหาทั้งหมด คุณมีความเข้าใจเกี่ยวกับปัจจัยที่ก่อให้เกิดการกัดเซาะชายฝั่งขึ้นมากน้อยเพียงใด
หลังจากฟังเนื้อหาทั้งหมด คุณมีความเข้าใจเกี่ยวกับวิธีการป้องกันการกัดเซาะของชายฝั่งขึ้นมากน้อยเพียงใด
หลังจากฟังเนื้อหาทั้งหมด คุณมีความเข้าใจเกี่ยวกับผลกระทบของการเคลื่อนตัวของทรายที่เกิดจากสันทรายขึ้นมากน้อยเพียงใด
หลังจากฟังเนื้อหาทั้งหมด คุณมีความเข้าใจเกี่ยวกับอายุการใช้งานของเขื่อนไม้ไผ่ขึ้นมากน้อยเพียงใด
หลังจากฟังเนื้อหาทั้งหมด คุณมีความเข้าใจเกี่ยวกับประโยชน์ของต้นมูตาขึ้นมากน้อยเพียงใด
หลังจากฟังเนื้อหาทั้งหมด คุณมีความเข้าใจเกี่ยวกับบริเวณที่มีความเสี่ยง โดนกัดเซาะขึ้นมากน้อยเพียงใด
หลังจากฟังเนื้อหาทั้งหมด คุณมีความเข้าใจเกี่ยวกับผลกระทบจากการใช้เรือยนต์ขึ้นมากน้อยเพียงใด
หลังจากฟังเนื้อหาทั้งหมด คุณมีความเข้าใจเกี่ยวกับความเปลี่ยนแปลงไปของปริมาณสัตว์น้ำขึ้นมากน้อยเพียงใด

Appendix E : Maps

Map of Moo 1, Ban Koh Klang:

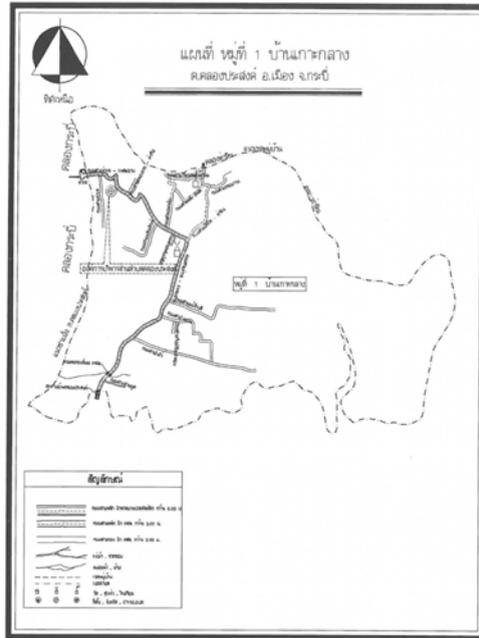


Figure 22 : Map of Moo 1, Ban Koh Klang

Map of Moo 2, Ban Khlong Prasong:

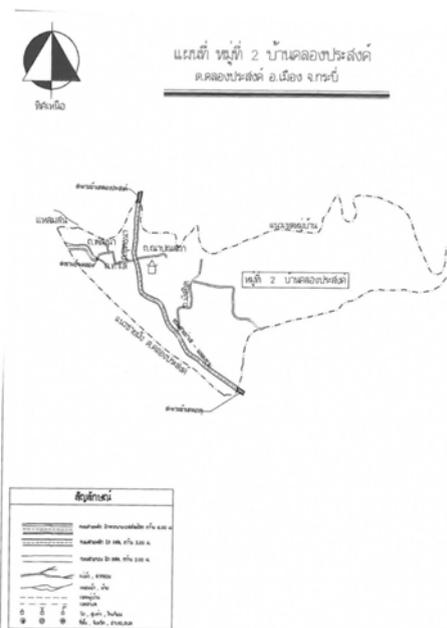


Figure 23 : Map of Moo 2, Ban Khlong Prasong

Map of Moo 3, Ban Khlong Kum:

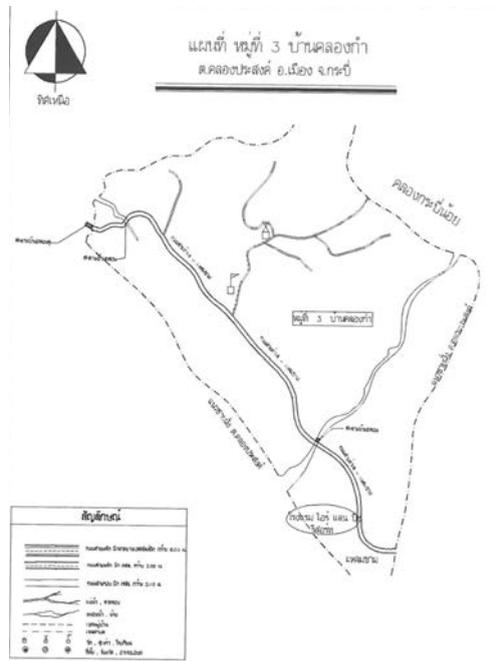


Figure 24 : Map of Moo 3, Ban Khlong Kum

Map of Moo 4, Ban Bang Kanun:



Figure 25 : Map of Moo 4, Ban Bang Kanun

Designed Educational Output Maps:

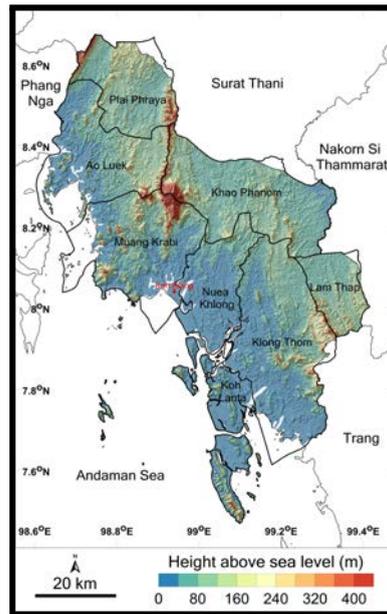


Figure 26 : Base map

From figure 26, we could see the topology of Krabi, including Koh Klang village. This general map is considered as our base map as it helps us import data on to it and show other numerous risk telling maps.

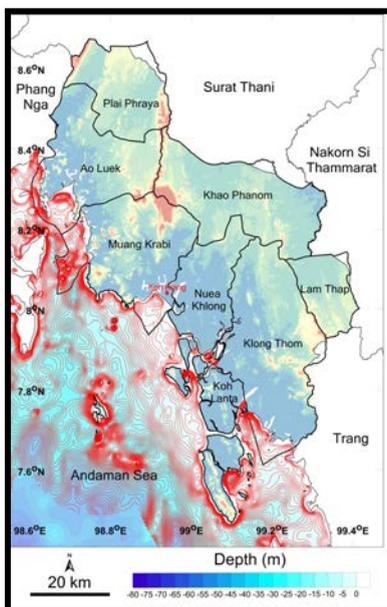


Figure 27

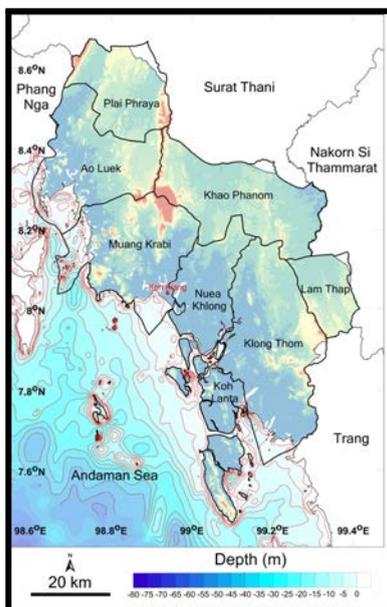


Figure 28

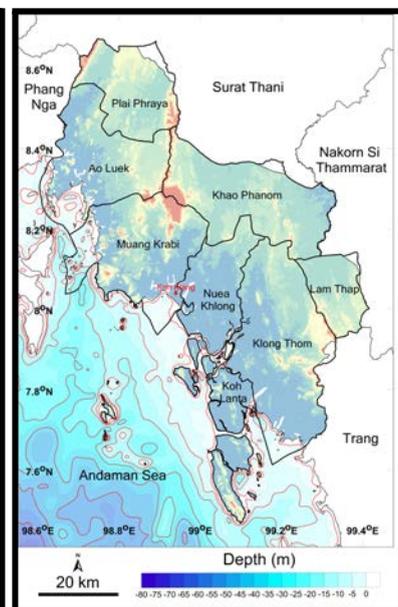


Figure 29

Steepness of shoreline map (1m, 5m and 10m) from Figure 27, 28 and 29.

These three maps depict the same coastal erosion data, offering a comprehensive view of the extent of erosion at various distances from the shoreline. The first map shows the erosion at a

distance of 1 meter, the second map displays the erosion at a distance of 5 meters, and the third map illustrates the erosion at a distance of 10 meters from the shore.

This map provides a visual representation of the potential risk of future coastal erosion based on the steepness of the shoreline. It highlights the areas that are most susceptible to erosion, as the steep slope of these areas make them vulnerable to the erosive forces of gravity and ocean waves. In these areas, even a small change in the ocean's waves and currents can result in significant loss of sand or sediment, making them prone to erosion in the future.

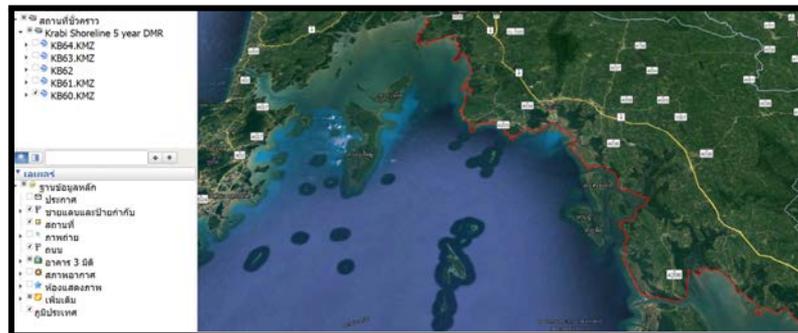


Figure 30 : Shoreline of Krabi (Year 2017)

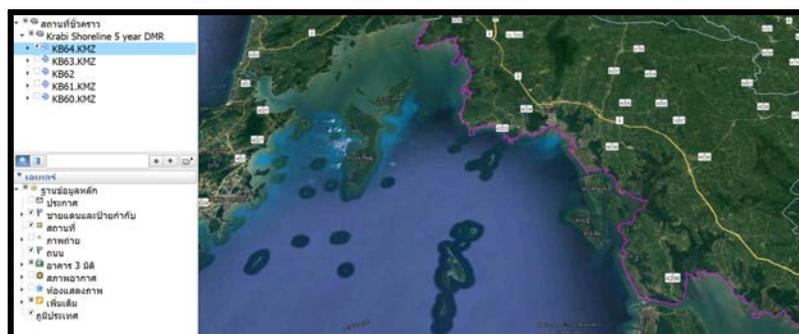


Figure 31 : Shoreline of Krabi (Year 2021)

Loss of lands map from Figure 30 and 31.

This map provides a visual comparison of the changes in the Krabi shoreline over the course of five years, from 2017 to 2021, by accurately depicting the evolution of the coastline during this period.

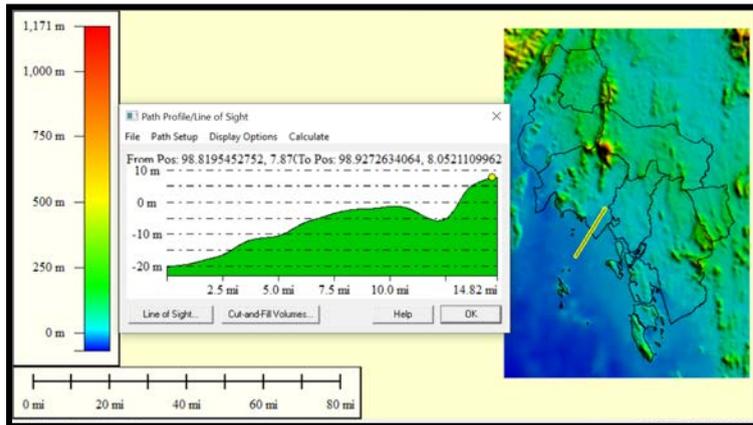


Figure 32 : Steepness of Koh Klang coastal

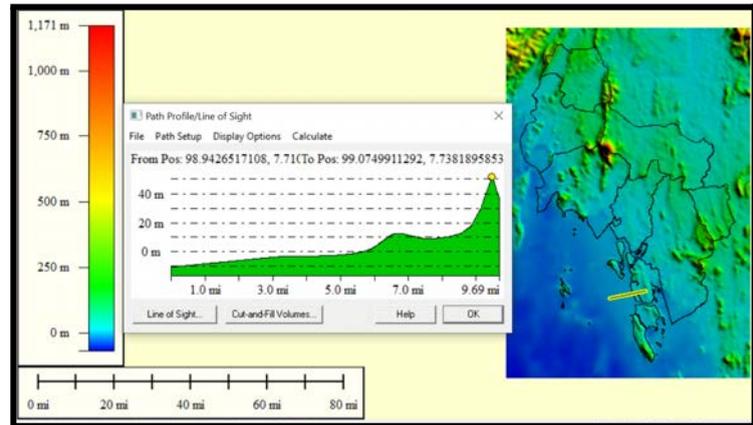


Figure 33 : Steepness of Koh Lanta coastal

The illustrations in Figures 32 and 33 show the comparison of the steepness of the coastlines of Koh Klong and Koh Lanta. The 0-meter line serves as a reference, representing the land and making it easier to assess the relative steepness of the two coastlines. As depicted in the figures, it is clear that the coastline of Koh Klong is steeper than that of Koh Lanta, which could have significant implications for the risk of coastal erosion and the stability of the coast in the future.

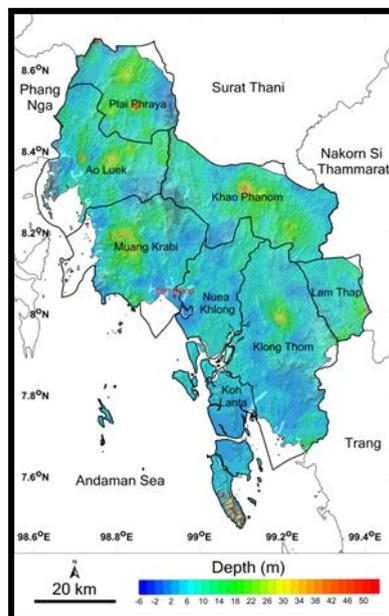


Figure 34 : Groundwater depth map

The figure 34 shows how assessing the depth of groundwater can help determine the vulnerability to subsidence in a given area. Since many communities in Krabi rely on groundwater, the rate of earth shrinking can be faster and more severe in certain regions. Deeper wells indicate a higher capacity for consumption and, as a result, a greater risk of subsidence. Plai Praya, Aow Leuk, and Khao Phanom districts have deeper groundwater wells, which makes them more vulnerable to subsidence. This map is particularly useful for

urban planners and civil engineers who need to take subsidence risks into account when designing and constructing infrastructure in Krabi.

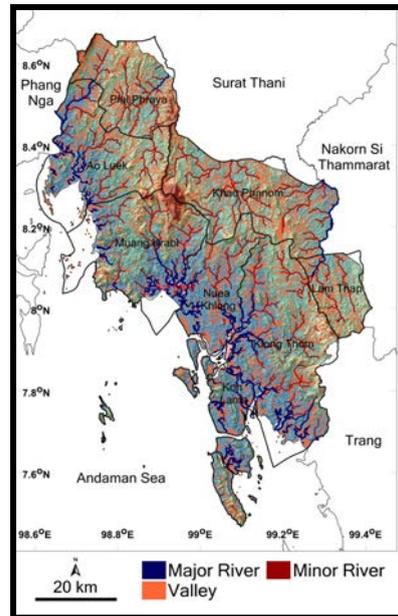


Figure 35 : Major/Minor stream and Valley map

Figure 35 illustrates the convergence of major and minor streams, as well as valleys, can create powerful currents that have the ability to transport sediments away from the surrounding land. When this occurs near a shoreline, it can lead to accelerated erosion rates for those areas.

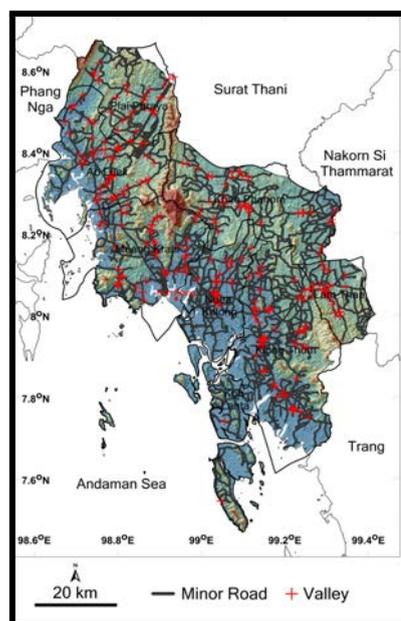


Figure 36

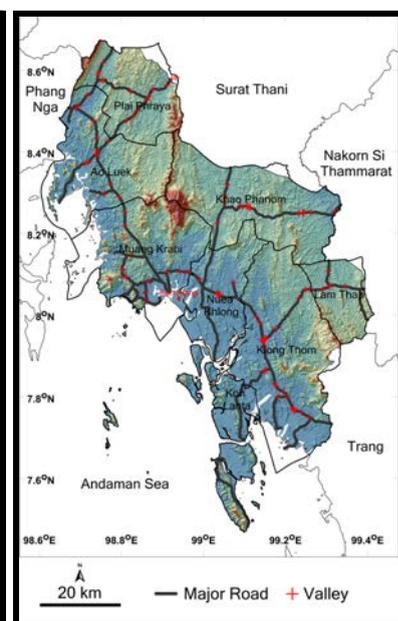


Figure 37

Flood indicating map

The resulting maps about the erosion could be classified into 2 groups. Areas that are prone to Flood judging from the intersection between minor roads and valleys and also the intersection between major roads and valleys from figure 36 and 37 respectively.

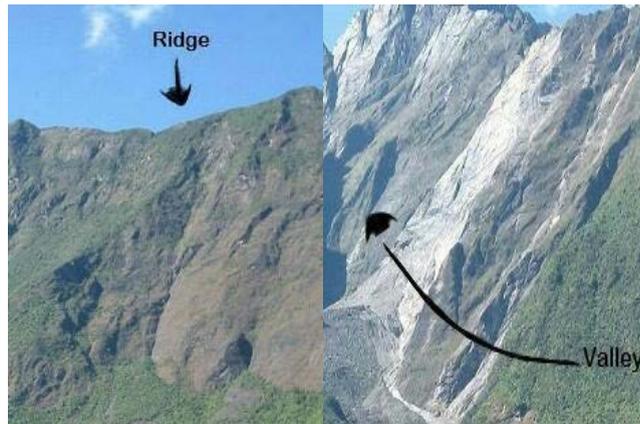


Figure 38 : Illustrates a photograph of the differences between ridge and valley.

The intersection of the minor/major roads and valleys depicted on these two maps indicates that these areas are more susceptible to flooding due to the geography of the region. Valleys are unable to hold water due to their slope and can even accelerate the rate of rainwater flowing into lower water sources, such as streams or rivers, as shown in Figure 38. Moreover, a comparison between valleys of different steepness reveals that steeper valleys are more prone to flooding than flatter ones, since rainwater runs down faster into the river. Therefore, it is recommended to implement an improved water drainage system in areas where roads intersect with valleys. This could include installing more drainage sewers or enhancing the pumping force to decrease the severity of flooding in these areas.

This map is useful for the entire community, especially civil engineers who are planning to construct buildings or houses along the roads. By assessing the risk of flooding in advance, the necessary precautions can be taken to ensure the safety of the construction and the people who will live there.

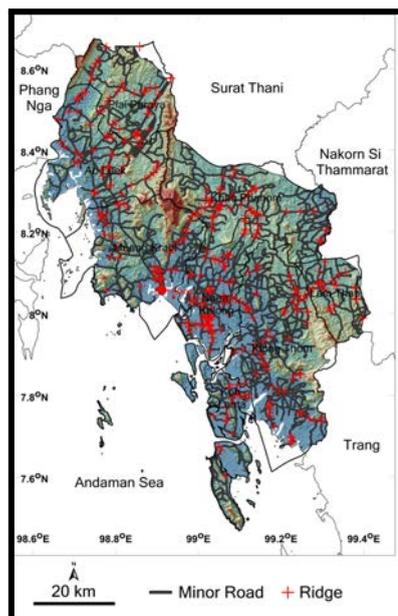


Figure 39

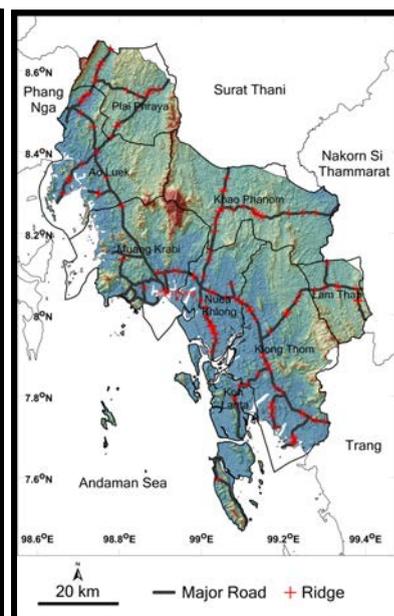


Figure 40

Areas with resistance to flooding can be identified by analyzing the intersection of ridges with minor and major roads, as shown in Figures 39 and 40. The intersection of the minor/major roads and ridges depicted on these two maps indicates that these areas have a lower chance of flooding compared to other regions due to the geography of the area. As water flows from ridges to valleys in contour zones, floodplains with inhabited buildings are more susceptible to damage.

This map is also useful for the entire community, especially civil engineers who are planning to construct buildings or houses along the roads. By examining the geographic terrain in advance, people can be more aware of the potential risk of flooding and make more informed decisions about where to build. This can boost their confidence in constructing buildings or houses in areas with lower chances of getting flooded.

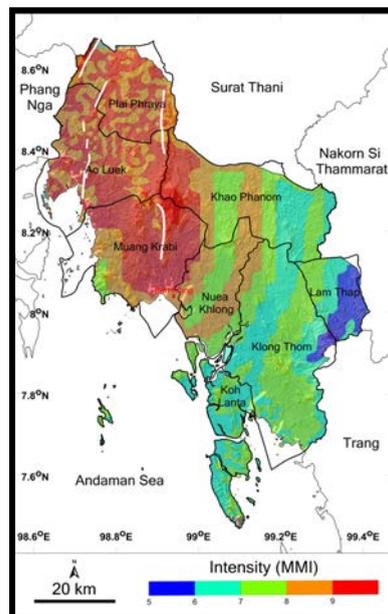


Figure 41 : Earthquake map

CIIM Intensity	People's Reaction	Furnishings	Built Environment	Natural Environment
I	Not felt			Changes in level and clarity of well water are occasionally associated with great earthquakes at distances beyond which the earthquakes felt by people.
II	Felt by a few.	Delicately suspended objects may swing.		
III	Felt by several; vibration like passing of truck.	Hanging objects may swing appreciably.		
IV	Felt by many; sensation like heavy body striking building.	Dishes rattle.	Walls creak; window rattle.	
V	Felt by nearly all; frightens a few.	Pictures swing out of place; small objects move; a few objects fall from shelves within the community.	A few instances of cracked plaster and cracked windows within the community.	Trees and bushes shaken noticeably.
VI	Frightens many; people move unsteadily.	Many objects fall from shelves.	A few instances of fallen plaster, broken windows, and damaged chimneys within the community.	Some fall of tree limbs and tops, isolated rockfalls and landslides, and isolated liquefaction.
VII	Frightens most; some lose balance.	Heavy furniture overturned.	Damage negligible in buildings of good design and construction, but considerable in some poorly built or badly designed structures; weak chimneys broken at roof line, fall of unbraced parapets.	Tree damage, rockfalls, landslides, and liquefaction are more severe and widespread with increasing intensity.
VIII	Many find it difficult to stand.	Very heavy furniture moves conspicuously.	Damage slight in buildings designed to be earthquake resistant, but severe in some poorly built structures. Widespread fall of chimneys and monuments.	
IX	Some forcibly thrown to the ground.		Damage considerable in some buildings designed to be earthquake resistant; buildings shift off foundations if not bolted to them.	
X			Most ordinary masonry structures collapse; damage moderate to severe in many buildings designed to be earthquake resistant.	

Figure 42 : Depicts The Modified Mercalli Intensity (MMI) scale of destruction.

Figure 42 illustrates the vulnerability to earthquakes in the Krabi area using the Modified Mercalli intensity scale (MMI), which measures the intensity of shaking caused by an earthquake as shown in figure 10. This seismic intensity scale was developed by Giuseppe Mercalli.

According to the map, Lum Tub district is the most resistant to earthquakes with a rating of only 5-6 MMI. In contrast, Plaai Praya, Aow Leuk, and Krabi districts are more prone to earthquakes, with a rating of 8-9 MMI.

By assessing the earthquake vulnerability of an area in advance, civil engineers and constructors can make informed decisions about the safety of a particular location for building structures, thereby reducing the risk of damage or collapse during an earthquake.

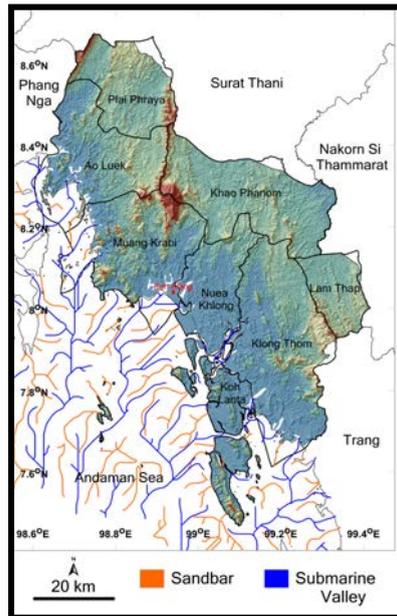


Figure 43 : Navigation map

The map shown in figure 43 displays the sandbars and submarine valleys present in the Andaman Sea along Krabi's shoreline. This map is crucial for navigating boats in the ocean, as sandbars can pose a risk to sailing vessels, causing them to run aground. Similarly, the submarine valleys can lead to submarine landslides, making it hazardous for both the crew and their motor. Therefore, this map is especially useful for fishermen who rely on daily fishing activities, as it can help them minimize the risk of running aground and prevent potential accidents.

Appendix F : Infographics

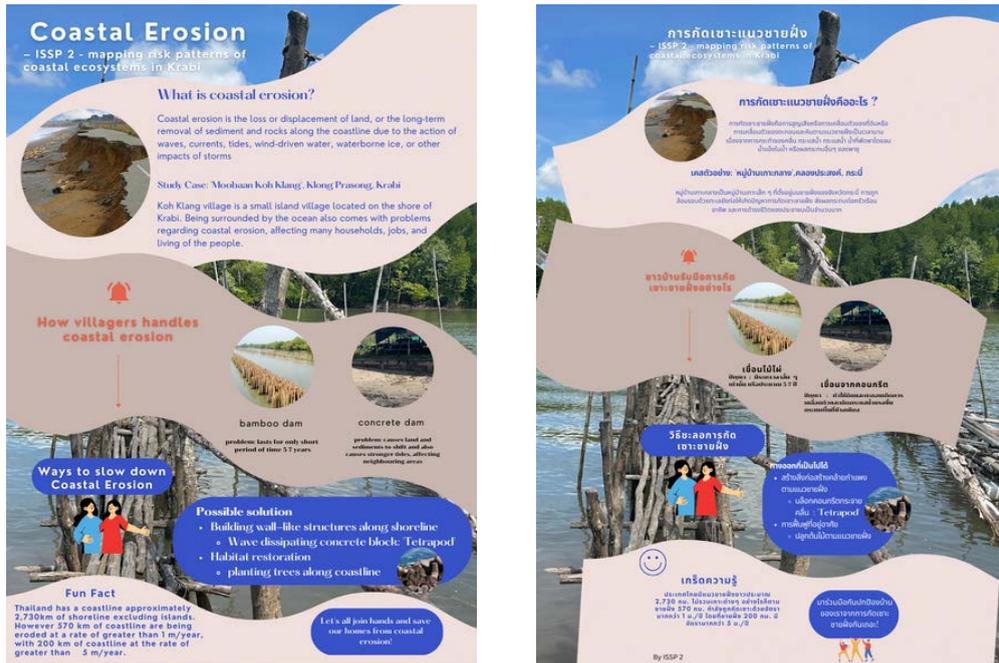


Figure 44 : Infographic on the topic of Coastal Erosion

This figure shows an infographic on the topic of Coastal Erosion. Within includes the causes of coastal erosion, as well as coastal erosion situations in Koh Klang village, which is our target area. Moreover it includes a suggestion or a way to deal with the issue.



Figure 45 : Infographic on the fundamental knowledge on the Muta tree (*Excoecaria Agallocha*)

This figure portrays an infographic on the fundamental knowledge on the Muta tree (*Excoecaria Agallocha*), including its benefits as well as stating how to use different parts of the tree, to be used medically.



Figure 46 : Infographic on the importance of the marine environment

This figure is an infographic called “Protect our Marine Life”, which is about the importance of the marine environment. Moreover this figure also includes the species of animals that are at risk of endangerment within Krabi areas. Lastly, there are also suggestions on how to prevent the animal species from vanishing.

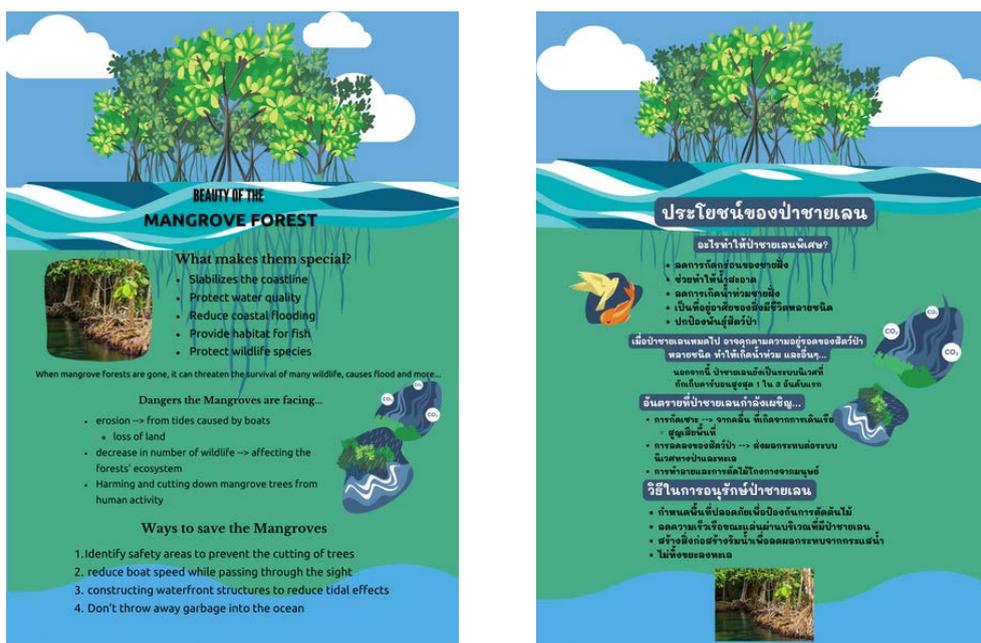


Figure 47 : Infographic on “Beauty of the Mangrove Forest”

Figure 47 is an infographic called the “Beauty of the Mangrove Forest”, which illustrates the qualities that makes the mangrove trees and forests special, including its benefits that they contribute to the environment, as well as for the well-being for both animals and humans. Furthermore, this figure also includes the dangers that the mangrove forests are facing currently; and lastly, there is a suggestion of ways to save the mangroves from the dangers they face.



Figure 48 : infographic on ‘Bird Migration’

This figure is an infographic on ‘Bird Migration’, illustrating the definition, as well as a brief explanation on why birds migrate. Moreover, there is a list of bird species that used to migrate to Krabi, however, in the past years, they no longer do. This figure moreover states the factors that contribute to absence of migrating birds; and lastly, its effects on us humans.

Appendix G : Videos and Animations



Figure 49 : Animation for children 1 named Mangroves Ecosystem Animation

<https://youtu.be/zAWH7ERroi4>



Figure 50 : Animation for children 2 named Coastal Erosion Animation

https://youtu.be/pQm_4NDzd4Q



Figure 51 : Video for adults named Klong Prasong's Risks

https://youtu.be/gus_dZDVWE

Appendix H : Recorded Interview

A. Interview with the Assistant Village Headman, Administrative Department of Khlong Prasong Subdistrict

Interviewer : Please introduce yourself, and also this Island

Interviewee : I am the Assistant Village Headman, Administrative Department, Moo 1, Khlong Prasong Subdistrict. I act on almost everything. In areas in the village, especially Moo 1, is surrounded by water. The only way to travel is by boat. The distance is about 700 meters from the municipality to the villages. There are villages on this island. Moo 1 is Koh Klang, Moo 2 is Klong Prasong, and Moo 3 is Ban Khlok Khram. Each village is different. The highlight in Moo 1 is the mangrove forest, which is quite complete. Because every sector wants to be a selling point for tourists, while Moo 2 is a semi-mangrove forest and sandy beach, which is a relatively complete source of food in Krabi now. Moo 3, closest to Nuea Khlong District, is a wide community area. This area shows the Muslim community to tourists. Every day, at least a hundred tourists come to see Khao Khanap Nam. On this island there will be farming. without irrigation, use rain water, use local wisdom.

Interviewer : Is there a sub-district map here today?

Interviewee : Absolutely, but after the tsunami, a group of our religious leaders or senior citizens wish to create a hand map. includes a collection of islands in the center, how many people are in each direction, and how many bedridden patients there are. Due to the frequent occurrence of disasters, particularly earthquakes in Sumatra, marine communities must exercise caution due to the significant amount of damage. Like when the last tsunami hit If a tsunami strikes again, the hand map will enable people to be carried to the island in time as there are only motorcycles nearby.

Interviewee : The rice fields on our island are the agricultural high point. The cost meant little to the residents of the community. because the production of high-quality rice is supported by numerous industries. If there are any pests like rodents, birds, mussels, or monkeys, the administration will check for them. The salt water dam collapsed last year due to the increased sea level, allowing salt water to infiltrate the rice field. It cannot be repeated in the same location this year. Due to the land's reduction from 700 rai to 500 rai, but already receiving compensation The village was unable to grow much rice. As a result, it was agreed that accreditation from several sectors was required for rice sales in the community.

Interviewee : in regard to resources Mangrove trees and migrating birds are two attractions for tourists, but their arrival has some effects on the local population, such as bird flu. Regarding the coastal environment, there are additional issues like coastal erosion, which is a significant issue for the neighborhood. The Marine Department is involved in this matter as

well. Each home has a title document, however the Department does not compute according to the original area when the water level changes.

Interviewer : Do you think construction along the coast has an effect on erosion?

Interviewee : If you look at the areas where the fish are raised in cages, you will notice that there is no erosion since the cages can withstand the power of the water. building a dam and digging The smallest error will cause the water's direction to shift. The municipality comes each year to create a passage for boats to enter. The scooped soil will be placed in Moo 1 in an inactive fish pond and an inactive shrimp pond that they never used. Digging takes three months. This results in certain soil slips.

It is highly challenging to plant trees in Village No. 2, but the Raks Thai Foundation offered local knowledge to aid, such as a bamboo dam, although it did not endure long.

Interviewee: The community's drug problem is the next issue, which has been exacerbated by some laws, the media, and lax standards. There is treatment in the religious community at the mosque to find a solution together, but it is very challenging in the community. Cannabis and kratom are major issues in the neighborhood. Conflicts over fishing regulations between local and commercial fisheries are another issue.

Interviewee : The second issue that the government cooperates with is trying to tell the villagers what is illegal, which net is right and wrong in moo1 was none illegal, because they cooperated fairly. But there is a problem that there are two ministries that are responsible for making rules. The Marine Department, Ministry of Transport, hooks up the boat about the seine machine and other equipment related to the fishing cage. In order to make shrimp nets, we have to apply for permission from the Department of Fisheries. All permission required which increases the cost. If we ask for everything, but we don't do everything it is extravagant. In fact, before I came to work in the administration, I worked in the public sector before. The work of the public sector is fast and focuses a lot on the community. But when being a governmental sector, it requires a lot of documents, it's delayed, but it's a matter of the law, we must rely on that anyway.

Interviewer : We are curious about fish species raised in cages. Is it a fish that we can usually find in the waters around here or do we bring fish species from other places to raise ?

Interviewee : In the part of fish farming has been promoted by the Department of Fisheries. If we take the fish from there to raise, it will be the fish that they breed themselves, which the

growth rate is slow. The fishermen who worked around here, most of them have brought the breed of fish from other places instead. Since the ones obtained from the Department of Fisheries grow slowly and sometimes still die a lot, for example, bringing at initially hundred and die until only forty left.

Interviewer : What effect does global warming have on oceans you are close with?

Interviewee : There are a lot. Apart from the tsunami, I have lived for 55 years. Since birth, I have never seen a flood, but last year there was a flood in the agricultural area twice. Global warming affects the community a lot. Before farming, we would start sowing seedlings around July and then have to wait 28 days to start pulling those seedlings to transplant them. But now we can't determine if July will be able to do it. Normally, we start doing rice in July. August surely brought rice, December surely harvested, but now that's not the case. It's completely changed. Before January, February, it won't rain anymore. If it's raining, the villagers will take buckets to collect water because it's strange.

Interviewer : I wanted to ask about changes in flora and fauna that used to be plentiful but now changed to lower number

Interviewee : We have rules about ecosystems. It may have changed a bit but remember how to keep it. Last year, the Department of Fisheries released an artificial nest along the coast. According to local wisdom, it can be recognized that where there are nests, they will avoid it and another reason is that we do not have any fishing gear to destroy them. If someone from outside comes in, there will be a discussion about the rules that we will do, for example, the ship's oil drain rules, whether it's a tourist boat, a foreign boat, a yacht, a long-tailed boat. You can see that there is no engine oil flowing in the sea at all because if each person transfers into the sea, it will affect the person raising the fish in the cage first. Because the sea water will remain circulate like that. Then the coastal areas and small aquatic animals would disappear, which the current situation was not. Our ecosystem is quite complete. For example, during COVID, the village was closed for a year. Some people are sick but ask if there is any effect or not. No one goes in and out. We also have rice. Boats we can take out to find fish to eat. In this way, we can live for a year without any trouble. Because this resource can go out to sea for a while, it must be under an agreement made in a nearby area.

Have you ever gone out to see shellfish when the water is dry? It will come up to a thousand rai. You can go and eat it, but don't put it on fire. There was an incident last year where people came to burn and peel the skin and leave it in the water. So came to make an agreement that if you want to keep it, don't burn it. In the village is a lot of resources.

B. Interview with Mr.Somnuk, Retired Fisherman

Interviewer : Can you introduce yourself, please?

Interviewee : My name is Somnuk. I used to work as a fisherman, but I don't go out to sea anymore because I'm over 70 years old.

Interviewer : So now you're working on a crab farm, right?

Interviewee : Yes, I'm using land in the mangrove forest. Technically, it's not legal according to forest conservation laws, but since I don't have any other occupation, I asked to work in this area. The forest officers said it was okay as long as I didn't harm the trees. I've been doing this for three years now since the COVID outbreak. However, there are still problems when it comes to selling crabs and fish due to flooding caused by sea-level rise. If the ponds flood, there's nothing left to sell.

Interviewer : How many years have you been fishing before this?

Interviewee : I've been fishing on and off my entire life. Whenever there wasn't much fish, I worked as a laborer.

Interviewer : Have you faced any problems while fishing? There might not have been any problems before, but have you seen more problems recently?

Interviewee : Yes, the problem of going out to sea and not catching anything has become more frequent due to changing weather patterns. For example, now that the northeast monsoon is blowing, there are fewer fishermen out at sea. But those who are determined to fish will adapt and change their fishing methods. In the past, we just managed to get by; we didn't get rich, but we were content with what we had.

Interviewer : Has the marine ecosystem changed a lot?

Interviewee : If you ask if the marine ecosystem has changed a lot, the answer is yes. The water has become warmer, and the coral reefs are dying. The fish population is decreasing, and many marine animals are in danger of extinction. The sea is no longer the same as it was before.

Interviewer : What types of fish can we catch around here normally?

Interviewee : Well, it depends on the type of equipment used. But generally, there are sandfish and various types of shrimp. You know that fishing for fish and fishing for shrimp are different, right? I'll show you later. This floating shrimp trap is used to anchor the soil so that it does not erode. The locals call it the "three-layer float", which has a part called "distant eyes" and "close eyes". If it is a fish trap, it is a special type and there is also a crab trap.

Interviewer : And now, are there fewer fish than before or almost none left?

Interviewee : There are very few fish left, almost all species. Mostly because the sea around here is depleted. In the past, there used to be more.

Interviewer : What do you think is the cause?

Interviewee : These fish are not large schools of fish, and there are already not many of them. But due to the increase in population, more people are hunting for them. In the past, during low tide, there was less water in the deep water. There is a dock in Klong Prasong village used for fishing in deep water at night.

Interviewer : So, the problem that caused these types of fish to gradually disappear is due to the increasing population?

Interviewee : Yes, the population is increasing, and there are more diverse tools.

Interviewer : Are there any months when it is prohibited to catch certain types of fish?

Interviewee : Yes, there is already an announcement from the Department of Fisheries. It is the idea of the Fisheries Association of Krabi Province. It is a prohibited area, but only for commercial boats and some types of equipment. However, if it is a boat owned by the locals, there is not much of a problem. It is in the conservation area. If commercial equipment comes in, the locals will not have a profession. If a drag net comes in, it is over. There are still illegal activities occurring in the area. It's strange. Well in commercial ships, there will be equipment to detect everything. If they enter a conservation watershed, there will be an immediate signal.

Interviewer : It shows that the local fishermen here also see commercial ships as a problem.

Interviewee : Yes, but it's less of a problem now. In the past, there were many conflicts. Actually, there aren't many commercial ships in Krabi province itself. There are only some anchored ones, not those being towed because people in Krabi prohibit it. But the problems that arise from this come from Phuket and Trang provinces.

Interviewer : So the problem crosses provincial boundaries?

Interviewee : Yes.

Interviewer : And what about boats from Phang Nga province?

Interviewee : Not many. Because Phang Nga is located at the end of the bay. Overall, they call it the mouth of the bay in Phang Nga. Actually, the anchored ships are located on small islands outside. But in the end, the real problem comes from an increasing number of people. The resources are still okay, but if we talk about promoting fisheries, we should have knowledge of proper fishing practices and which government agencies or organizations can support them. We want to support those who can raise fish better than hunting them.

Interviewer : So you want the government or private organizations to support fish farming instead of hunting?

Interviewee : Yes, living like this and eating together with family is enough. The rest can be shared with neighbors, sold, or given to friends. If there are too many, we can just lay them out. If we have a lot of crabs, we can cook them in a curry or boil them, whatever we like. Sometimes we just eat them here for fun”.

Interviewer : “Do you want to say something to the people in the community about preserving the sea and nature because I've heard that there will be a plan to construct a bridge here?

Interviewee : That plan is a trend, but it will have to happen in the future because people here depend on the bridge. If there is a bridge, they are afraid that their traditional way of life will be lost, and they fear that other things may happen. That is true, but the burden on the community here is heavy. Building a house or structure here costs a lot, tens of millions of baht per year. If you build something in Krabi, it costs 100,000 baht, but here it costs 200,000-300,000 baht. Then we have to transport all the building materials. If we conduct research and investigate how much each household in Klong Prasong spends on construction per year, we will see clearly. Those who have cars have nowhere to park because they have to park on the other side. It costs at least 30 baht to hire a motorcycle to rush across the bridge, and don't forget that we have to pay another 30 baht to return. If there is no car, we have to hire a motorcycle to park the car on the other side. A car parking company also has to pay a monthly fee. That is an expense that some people may not think about.

Interviewer : So, to summarize, do you agree with building the bridge?

Interviewee : Yes, I do. But another issue is how to do it. It will take several years, but this has been a trend for many years. Sometimes it's just political rhetoric. For example, some say that the bridge is going to be built and land prices will go up from hundreds of thousands to millions of baht per rai.

Interviewer : If there is a real bridge, more investors will come to build more hotels on the Andaman coast. Will it affect fishing and fishermen?

Interviewee : It may have some impact, but it can still be avoided. Taking fishing boats out to find fish and taking tourists to hotels are different times. So, they can coexist. But some parts need to be protected, as there are conditions in the Klong Prasong sub-district that alcohol, dogs, and drugs are prohibited, regardless of any business.

Interviewer : But I heard that some people secretly bring alcohol in because there is a Thai-Buddhist village.

Interviewee : Yes, that's true. They were given a designated area to stay. Just don't go into the Muslim village area. But anyway, they have been living there since the village was founded. Religious disputes do not exist, and they normally seek each other out. That's the way of living here. We just need to be respectful of each other's beliefs.

Interviewer : Are you afraid if civilization comes in, the way of living and culture will fade and be gone?

Interviewee : When asked if I worry, of course, I do, but we have to adapt. Even though culture is important, if we protect ourselves from alcohol and other prohibitions, we can still survive and flourish. Before, someone asked if they could drink at their homestay in a quiet place. The locals said it was not allowed and that didn't make the guest comfortable so they want to leave. We don't mind them not staying so we go and send them off. If they want to drink, they can visit the market. If they want to get drunk, it's alright as there will be a boat that waits 24 hours. They can take a boat and come back to sleep on the island if they want. That's their right. But if they come here, they must respect the rules here because this rule was established based on religious criteria.

Interviewer : Do you think the problem of coastal erosion has any impact?

Interviewee : Yes.

Interviewer : Then, if you want people to come and support fish and crab farming, will there be enough space for farming if erosion continues?

Interviewee : Currently, if we talk about erosion, we have some hope because we have a seawall. The government can support us here because the Klong Prasong subdistrict has one disadvantage compared to Thara pier, which doesn't have much erosion. But here, the land moves every year due to ship dredging, especially in deep water, and the soil on the surface flows into the sea. But if we have a dam, it would be better than Thara pier where they have to import sand. That's the difference when compared to the local pier. That area is flooded every year, especially when there is high tide.

Interviewer : What causes the sea level to rise?

Interviewee : Well, if there's a storm, the wind currents will change. During the period from May to August, every year there will be storms. Especially during the Monsoon season. But there's one advantage, when the storm comes, there will be more shrimp and fish, making it easier to catch more. However, you have to take a risk with the storm. That's all.

C. Interview with the representative of the farmers.

Interviewer : Normally, farmers in the Koh Klang use rainwater for agriculture?

Interviewee : Yes

Interviewer : I would like to know if the amount of rainwater collected is sufficient for farming each year.

Interviewee : Agriculture in Klong Prasong district is different from other areas because it is surrounded by the sea, and we are unable to bring water from other sources. During the dry season, which lasts from February to May, there is no rainfall. As a result, saltwater infiltrates the soil, leading to soil cracking. When the rainy season begins in June, we collect rainwater for agricultural purposes each year, as we only plant crops once a year during the rice growing season, and we rely solely on rainwater.

Interviewer : Are there any issues affecting rice cultivation, such as seawater intrusion?

Interviewee : This is the main issue, and it is difficult to solve because our area is adjacent to the Department of Marine and Coastal Resources. We cannot redirect the saltwater because it would affect the department's operations, and they could take legal action against us.

Interviewer : And how would blocking seawater affect the Department of Marine and Coastal Resources?

Interviewee : If we attempt to block seawater from entering our area, it would invade the Department of Marine and Coastal Resources' jurisdiction. To proceed in the proper way, we would need to seek approval from both the department and the ministry for them to take action on our behalf. However, the process would be too slow to help us farmers and villagers, so we must rely on ourselves. For instance, last year, 80% of the area was flooded due to seawater intrusion. The villagers had to struggle and help themselves since there was

no assistance from any government agencies. This is due to problems of inter-agency conflicts and lack of coordination within the government.

Interviewer : Do you think that global warming has caused sea levels to rise?

Interviewee : The impact of global warming is significant, as it has caused sea levels to rise by almost 50% compared to before.

Interviewer : Are there any years when rice cultivation is impossible and does it have any impact on the community?

Interviewee : We grow rice for our own consumption and sell the surplus. For example, last year, we only harvested 20% of the rice due to seawater intrusion. The remaining 80% was flooded by seawater. The villagers had to struggle more than ever and had to go out to sea to buy rice. Even during a storm, we had to go out to buy rice because we need it for every meal.

Interviewer : Has rice harvesting decreased in the past 5-10 years?

Interviewee : It varies. If there is more rainfall in a year and less seawater intrusion, we can harvest more rice. But if there is more seawater intrusion, we will have less harvest. For example, last year we lost 80% of our rice, but this year we had an 80% increase in harvest. It all depends on the weather. If there is severe seawater intrusion, we may not see any rice fields at all, only a sea of water.

Interviewer : Does the rice variety 'Sam Yod' tolerate saltwater the most, and does it eventually become intolerable to saltwater?

Interviewee : It cannot withstand the saltwater, but currently the Department of Rice is developing rice varieties that can tolerate saltwater intrusion to some extent. However, it will take at least 5 years to develop such a variety.

Interviewer : Do you have satellite images of sea level rise flooding fields?

Interviewee : There are no satellite images of sea water inundating rice fields. Most of the time, the flooding usually occurs during the night time in November. The high tide can reach up to a meter, and houses near the shore are impacted. The flooding requires people to come together to move their belongings. People living near the shore are at high risk of flooding every year.

Interviewer : Do people in the community also beware of flooding?

Interviewee : Yes, everyone is cautious and prepares themselves to deal with the situation around November.

Interviewer : Are there any pests in the rice fields?

Interviewee : Yes, there are definitely pests in the rice fields. Pests like rats, birds, snails, and insects can cause significant damage to the crops, leading to reduced yields and financial losses for farmers. For example, last year, when the water flooded, the snails died along with the sea water, which was good because they eat our rice crops, but there are still enough pests left. If there is rice, birds will come down to eat it.

Interviewer : What are the ways to prevent these pests?

Interviewee : It's difficult to prevent them, but one way to minimize the impact is to encourage everyone to plant rice at the same time, so when it's time to harvest, the pests won't be concentrated in one place, which can help to minimize the damage caused.

Interviewer : Over the past 5-10 years, have pests in the rice fields increased or decreased, and why?

Interviewee : Pests have increased in the past 5-10 years due to various factors such as the expanding food chain cycle. Pests reproduce more, and their numbers increase, leading to greater damage to crops. However, some people have noticed that birds are also part of the food chain but have not been coming to eat the pests. This unbalanced food chain cycle can lead to further pest problems. To address this, Kasetsart University has come to help by increasing bird breeding in the area to help control the pest population.

Interviewer : Do you think building a bridge in a community would pose any problems for farming?

Interviewee : If there is a bridge, it would make farming more predictable and transportation of fertilizer would be easier and faster.

D. Interview with head of stingless bee group (Khun Kran)

Interviewer : We come from Chulalongkorn University to do a project about mapping risk patterns in Krabi. So, this interview will provide useful data for the project's research for our sponsor or other organizations. First, can you introduce yourselves?

Interviewee : Hello, my name is Kran Mardosod. Before covid-19 pandemic I worked as a taxi driver in the town and after the pandemic I came back home to work as a beekeeper.

Interviewer : How long did you do this?

Interviewee : I raised stingless bees for about 6-7 months but started operating as a group on this island for 1 month. It is not easy since it used to take time to collect these bees from the forest and raise them at home, so it takes a long time for this group. Now, it looks like the organization in my mind.

Interviewer : Do you have any problems while doing this?

Interviewee : Yes, there are many problems. As it is a community enterprise, it is only a small group, so some people are busy. On our island, one person does many things, and some are fishermen who are very busy. This is one of our problems, as we are not always prepared.

Interviewer : You mentioned that you catch bees from the forest. Are there no bees near the village?

Interviewee : There are some, but not many, and they are all the same species. I would like to have more species. On this island, there are 6-7 species, but in the village, there is only one species called "konngun."

Interviewer : How did you establish this organization? Did you do it alone or as a team?

Interviewee : First, I did not come with it myself, there is one organization called "Enlife" that offers stingless bees for the community. Then, I think I am jobless, so I consult with them then they let me learn from the expert.

Interviewer : There are many problems in the community so, what is the problem that you concern the most?

Interviewee : There is one problem about the mangrove forest. Mangrove forests in our area do not have any organization working here so the locals use the wood from the forest arbitrarily. Then, the stingless bee which lives in the deep forest will go deeper and deeper. If we let it be like this, the species that I find will become extinct since they can't find the suitable hive.

Interviewer : What do you think about living near the sea, does it have any effect on your life?

Interviewee : Nothing, since we are familiar with it. In the past, after the tsunami there don't have any mangrove forest, but the "Enlife" organization and locals help reforest and make the bamboo dam to slow down the wave

Interviewer : Do you think your organization helps tourism in the community?

Interviewee : Yes, there are some tourists who come here, mostly are the foreign tourists. They are interested in these bees.

Interviewer : Do you have any waste management?

Interviewee : For water waste, we don't have any way to manage so we often throw it back to the sea but the dry waste the "Enlight" organization gives us a high-power and no dust incinerator for use on the island. It helps a lot.

Interviewer : What do you think about the bridge that will link the island with the town?

Interviewee : In my opinion, I think I am good. It makes a good opportunity for people on the island to get more jobs and be more comfortable. But there is also a con, our village will change and it will lose some of our locals' lives. And there are also can bring more trash and the drug through the bridge since it is more easy to transfer to the island.

Interviewer : Are there any new types of plants that you have never seen before?

Interviewee : There are some plants that I never knew before in the mangrove forest since I didn't know it before but saw it when I went to the mangrove forest to catch the stingless bee.

Interviewer : Which type of plant can you see stingless bee hives the most?

Interviewee : The most common are Muta tree, Mangrove palm, *Xylocarpus granatum* and *Acanthus ebracteatus* which the stingless bee can be found.

E. Interview with Mr.Poramut Chuaykarn

Interviewee : Others will see the Koh Klang village as just one Moo, but the village consists of Moo 1(Koh Klang), Moo 2(Klong Prasong), Moo3(Klong Kham), and Moo 4(Bangkanoon). Regarding business, moo1 has brought tourism to the village, building a name for the whole district. However, as time passes, people in Moo2 also want to do

business with outsiders in tourism. But they do not get the same recognition as Moo1 gets. This is why we would prefer you to call us as a whole district rather than ‘Koh-Klang’.

Interviewer : So on this island, there are 3 villages?

Interviewee : Yes, there are three villages on this island, you will definitely get to go to Moo1 and Moo2, but only if you need more information, then you can go to Moo3 as well.

Interviewer : At first we were planning to go to another location in Phang Nga, however, we have decided that we will instead focus on this area.

Interviewee : Alright then, as for today I can tell you all the brief information that you need, and then tomorrow, you can collect any missing information you want.

Interviewer : So we will start off by introducing ourselves, we are from Chulalongkorn University, and we are here with the purpose to collect information and observe the issues and problems villagers here face, especially on the topic of coastal erosion.

Interviewee : Hello I am Mut, I am an Architect, and right now I am currently working as a freelance, and also an owner of a homestay. And sometime after that, a group of people came to me and suggested I become a leader. At first, I did not want to accept the offer because I myself think I am very young and inexperienced, but people here want a new face and a new generation to lead; this, therefore, leads me here.

Interviewer : So our team has received a project from our university and our sponsors to build a risk map for this village, or if Krabi as a whole, on the risks of both risks on natural disasters, or economic risks for instance, in order to make the people in the village be aware of the risks and dangers that are going around them.

Interviewee : So if understand correctly, the first is about resources, and the second is culture; because there is an ongoing plan to build a bridge, which one side of the bridge is afraid of changes and new things that will be brought in; but looking from another perspective, it is something that is essential for a better living and to make life easier. For instance, there have been cases where children are delivered on the way to the hospital on boats.

Interviewer : Before we came here, we made three assumptions : coastal erosion, marine ecosystems, and issues on tourism and the economy. And we plan on creating three outputs which are: infographics, videos, and risk maps.

Interviewee : So what information exactly do you want?

Interviewer : We would like to know about the problems you face, and also want a map of this island.

Interviewee : Yes I can give you that, but at the pier nearby, we have a detailed map. You can take a picture of that map.

Interviewer : Going back to the problems, what is a problem you think is most severe?

Interviewee : Garbage and waste, it is something we as a village have been trying to fix and cure, but it's not something that can be easily fixed. For instance in schools, teachers teach kids on this matter, but as soon as the kids get home, they still see bad behaviors from their parents, which results in a never stopping cycle of improper waste management behaviors. We also do not have a proper waste management system in the village, this is because villagers may not have enough money to afford the bills. If you ask me, paying an amount of 30 baht per month to let the government take over this matter would not be a problem, however, some people may be unhappy. Which results in everyone having to deal with trash on their own. Another example is that some households choose to burn garbage, and the problem with this is that it is against the rules and regulations of the village. This is why it is so hard to deal with since we cannot find a middle ground.

Interviewer : I heard there is a new government team recently, are there any improvements made?

Interviewee : Overall, it's better. But they stated that during the first year, they can't make that many changes, since they have to follow the same plan from the previous government group. Therefore everyone does have more hope in the new government group, but still, they need more time to prove themselves. Therefore, in the meantime, villagers will still have to mostly rely on themselves. But there are some other organizations that have stepped in to help on this matter, such as the 'Ruk Thai' organization that donated good quality incinerators to some groups of villagers. The second topic is the mangrove ecosystem. I would like to take you to 'P Nid', which is someone who will answer your question very well since she has been directly affected by this, as she currently has moved houses five times throughout the decade due to coastal erosion; and by this, she realized that this is something that we need to fix not run away. Therefore, a suggestion is to plant more trees to prevent land loss from both the coastal erosion from waves and to help absorb the water to prevent floods.

Interviewer : What was the main cause of coastal erosion?

Interviewee : The island is separated into two sides, one side that touches the river, and another side that touches the Andaman sea. P Nid's house is directly in contact with the sea, which is why she is affected more, especially during the tsunami. This is why we have two ways to deal with this, which are to plant more trees and build dams, which both require

specific ways to plant and keep the trees alive. Currently, we also take our knowledge from these to further adapt to our lives. For instance, taking the tree's barks and using them for dyes to make tie-dye clothes, being able to find more fishes in some areas, and planting trees themselves as a tourist attraction.

Interviewer : Going back to the topics of garbage and waste, how would garbage affect the village other than it being unclean and unpleasant?

Interviewee : Mostly, it is about the village as a whole being unpleasant, however, it may affect tourism as well. Moreover, our village is surrounded by water, therefore garbage and trash would get flushed up and get stuck in the area, which will definitely be seen by tourists or outsiders who come to visit the island. Moreover, there are many places that we cleaned and cleared out, however after two months, the places again become filled with trash. This is because of two aspects: one is from the locals themselves, and two is from the flushed-up waste from water. Another aspect that causes coastal erosion is boats' waves, which over time cause the land nearby to slowly erode and also cause the trees to slowly fall or die. In the past, when we used paddle boats, there were no problems at all. But boats nowadays rely on motors which have a high speed. And think about how many boats cross our village per day. Before the width of the shoreline was approximately 15 meters, but now it only seems to get wider and wider. That is about it for the mangrove forests. Moving on to the disruption of mangrove forests by humans. This sometimes happens but with the regulations from the government, they would take back the land that doesn't belong. For instance, a hotel nearby used up some of the land that didn't belong to them to build more buildings. So what happened was the government stepped in and took the land back. We do agree with this regulation to an extent. But if this happens to the locals, where they need to use the land for a living and have no other choice, I think there should be a solution to help out.

Interviewer : Are there any other problems your village faces?

Interviewee : Oh yes, another problem would be the resources. We often have outsiders that would come in and steal the resources, such as fish, shrimp, crabs, and more. However, we have no power to stop them. They would come in and take all of the resources without caring about the consequences.

Interviewer : By outsiders, who do you mean?

Interviewee : The people from Krabi, or even Surat. They would come randomly, and we cannot prevent this because we could not even see who, when, or where they are.

Interviewer : Does the government do anything about this?

Interviewee : At the moment no, there are no rules or regulations on this matter yet.

Interviewer : Do you think that the locals all have the same level of awareness of these problems?

Interviewee : No I believe they do not. We have to understand that there are many groups of villagers, and some are more educated than others. But in the village, there are more people who are still used to the old ways, therefore it is hard to change their habits.

Interviewer : We would like to ask more about the construction of the bridge, what's your thought on that?

Interviewee : It's been discussed for about 10 years, some people agree with it and some don't. In the latest meeting, 80% of people want the bridge to be built. Now after the agreement of building the bridge, we now have to ask, what kind of bridge? Since in our village, the roads are very small, therefore it would be inappropriate for big cars to enter.

Interviewer : Are you afraid of what technology and innovation will bring in?

Interviewee : Absolutely, we are scared, but sometimes we do have to grow and get better. And to be honest, the people who want the bridge to be built most are outsiders who purchased lands on the island, so that they will be able to build hotels and attract tourists. But we are afraid that there would be things that clash with our villages' being and beliefs. Personally, I agree with the bridge construction but again we have to be aware of what's coming, and I hope it would not change us too much.

Interviewer : It makes me think of Myanmar, that if Myanmar would have opened their country, would it be better?

Interviewee : Yes I agree, but a friend of mine who lives in another city that has been innovated over the past year, says that he really misses the old ways and the localness and how easy things used to be versus now. And if there is a bridge, the boat people, or people who make a living from boats would be heavily affected too.

Interviewer : That is all we want to ask, thank you so much for providing all this information.

Interview with Mrs Knit Sukdang, member of the Village Health Volunteer team, a head of the natural tie dye cloth group

Interviewer : Can you please introduce yourself?

Interviewee : My name is Knit Sukdang; you can call me Nid. I'm a member of the Village Health volunteer team and also the head of the natural tie-dye cloth group in the community.

Interviewer : What do you think about living in a village near the coast?

Interviewee : Living near the coastal area has been difficult for me. This is already my 5th house because the ocean already devours my other houses due to coastal erosion. Back in the day, I didn't realize the threat of natural disasters like tsunamis, Coastal erosion, and sea level rise, so we were heavily impacted by the Tsunami back in 2004. Luckily, we got supported by รักร้อยไทย foundation, which they help educating us about natural disasters and effective reforestation methods.

Interviewer : How did your village change over time in your opinion?

Interviewee : There are ups and downs in this community. In some areas, we are trying to grow trees, while on the other hand, some people are cutting down trees daily. Currently, we are trying to preserve our island and culture by reforestation and building occupations for the people in the village.

Moreover, because of the civilization of our island, roads are constructed around our community, which makes it easy for us to move around from place to place. However, by creating roads around the island, we must trade with some forest areas. For me, civilization is good, but it does come with a major issue: the rise of the drug crisis in the community.

Interviewer : How is your village affected by the tourists, can there be either positive or negative effects?

Interviewee : I don't see any problem having people visiting us. In fact, I think the tourists can bring us a lot of income, and we also get to meet new friends.

Interviewer : What is the impact of the pandemic towards this island?

Interviewee : We closed all the entrances and exits to the island and had home isolation for a few months. We also had a checkpoint in each village to track people moving around the island. It was an effective method to prevent the spread of the coronavirus to a certain extent. However, the impact of shutting down the island is that we lose all the income.

Interviewer : Are there any organizations or governmental/NGOs visits? And what problems do they solve?

Interviewee : After the Tsunami incident, ฟ้าหลังฝน foundation reaches out with a helping hand to support us against the natural disaster. The foundation helped educate us on different tree species as well as helped us restore our mangrove forest, which was heavily damaged by the Tsunami.

Interviewer : Do you find any problems that will significantly threaten the community if not trying to address them now?

Interviewee : The population of clams and fish is declining. Back then, our island was extremely rich in natural resources. We used to walk out of the house to find many clams lying around our house.

Moreover, life is much more expensive these days. Growing trees to act as a barrier against natural disasters is essential for the island. However, the cost of transportation from our house to hunt for clams increased due to the extra distance from reforesting the mangrove forest.

Interviewer : Are there any species, including plants and animals, that you have seen before but have barely seen now?

Interviewee : I don't see any new species around the island, maybe because this area is salt water. We tried to plant the mangrove trees, but they all died. The only tree species that can survive around here is *Avicenna marina* Vierh because they are durable in the saltwater environment.

Interviewer : Can you talk us through what happened with your previous houses?

Interviewee : I think it is because of the coastal erosion and Tsunami. Many factors cause coastal erosion, including global warming, natural disasters, and human activities. One human activity I can see is throwing trash in the oceans.

Back then, we used to hire a waste management company from the outside, but due to the financial crisis, we could not pay for the service and had to do it ourselves.

Interviewer : Do you see a solution to the garbage problem?

Interviewee : First off, people need to have subconsciousness. Some people never think about others and only care for themselves. That is why they throw the trash out in the ocean because it is the easiest way to eliminate it. For the Health Volunteer team, we have been working on distributing small incinerators around the island.

Interviewer : Are there any organizations or governmental/NGOs helping with the garbage problem?

Interviewee : Not at all. We have yet to receive any help regarding the garbage problem. We would highly appreciate a helping hand from the government or organizations.

Interviewer : Do you know anything about the plan for bridge construction? If so, do you think more problems will come with it?

Interviewee : Yes, I heard about the construction, and I'm sure the situation we are facing now will multiply once the bridge is complete.

Interviewer : What do you think about the bridge construction?

Interviewee : In my opinion, it is a double-edged sword. For me, I don't think it is a good idea. However, the only transportation we have from the island to the city is the long-tail boat which can be challenging for the elderly or injured people. There was a time when someone was injured and needed to be sent to the hospital immediately, but the long-tail boat driver would not leave the pier if at least five people were not on the boat. So you either have to wait for more people to join or pay the ridiculous price the driver charges for an emergency ride. So I think building a bridge can solve this problem.

