

THE EFFECT OF COASTLINE CHANGES TO LOCAL COMMUNITY'S SOCIAL-ECONOMIC

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ABSTRACT:

The coastal area is absolutely essential for the purposes of resident, recreation, tourism, fisheries and agriculture as a source of socio-economic development of local community. Some of the activities will affect the coastline changes. Coastline changes may occur due to two main factors include natural factors and also by the factor of human activities in coastal areas. Sea level rise, erosion and sedimentation are among the factors that can contribute to the changes in the coastline naturally, while the reclamation and development in coastal areas are factors of coastline changes due to human activities. Resident area and all activities in coastal areas will provide economic resources to the residents of coastal areas. However, coastline changes occur in the coastal areas will affect socio-economic for local community. A significant effect can be seen through destruction of infrastructure, loss of land, and destroy of crops. Batu Pahat is an area with significant changes of coastline. The changes of coastline from 1985 to 2013 can be determined by using topographical maps in 1985 and satellite images where the changes images are taken in 2011 and 2013 respectively. To identify the changes of risk areas, Coastal Vulnerability Index (CVI) is used to indicate vulnerability for coastal areas. This change indirectly affects the source of income in their agricultural cash crops such as oil palm and coconut. Their crops destroyed and reduced due to impact of changes in the coastline. Identification of risk coastal areas needs to be done in order for the society and local authorities to be prepared for coastline changes.

1. INTRODUCTION

Malaysia's coastline approximately has 4,800 kilometre (KM) including coastal area at Sabah and Sarawak (Ismail, 2014). Coastal area of Malaysia locates on the geologically stable Sunda Shelf (Ong, 2001). The total lengths of coastline Malaysia are about 73% from total length of Malaysia border. Each states in Malaysia have coastal area zone. The states that have largest coastal area are Sarawak, Sabah and Johor. More than half of Malaysia's coastal areas are mangrove and some of rocky beach (Ismail, 2001).

Federal Department of Town and Country Planning Peninsular Malaysia (JPBD) has guidelines through conservation and development of Environmental Sensitive Areas (ESA) establishes that coastal areas are comprised 5 KM to the land of the coastal shoreline. Preparation of National Physical Plan (NFP) through 8th Malaysia Plan (RMK-8) which has targeted growth target of gross domestic product (KDNK) is high at 7.0%. The economic growth target has been hit spatial planning to ensure the availability of land suitable for development while also protecting Environmental Sensitive Areas (ESA) including coastal ecosystem.

There are multi-functional coastal areas such as recreation, residential, tourism, industry, agriculture, aquaculture and others (JPBD, 2012). Port Dickson is one of interesting place for tourism and recreation at coastal area. National Physical Plan for 2010 has established several corridors in accelerating economic growth in the country's cities from Kangar to Johor Bahru and Kota Bharu to Johor Bahru. Extracted from the NPN mention that, there are important economic zones in the area west coast of peninsular Malaysia, including the main cities, ports, airports and tourist centre. In addition, fishery-based

activities taken into account in their socio-economic help to gradually lower to compete.

The population of has placed emphasis on activity of socio-economic growth in coastal areas. Each of these activities can provide economic resources to the local community at coastal area. It will give impact of socio-economic to community's coastal area if the coastline getting changes. Good planning for the country's economic growth is very important in contributing to the stability of income, particularly rural communities.

Regarding to National Coastal Zone Physical Plan 2012 (NCZPP) reported that, the population of the coastal areas of Peninsular Malaysia was 6.65 million (JPBD, 2012). It represents a total population of 30.6% compared to the total population of peninsular Malaysia in 2009. These numbers show a rapid increase of more than 18 years. It also clearly shows that the placement of the population is concentrated in the coastal areas.

Emphasis on the movement of population migration are increasingly focused on the coastal areas have an impact on economic development itself (JPBD, 2012). Development will be focuses on the coastal areas and it will give impact on the stability of coastal areas. Continued development will affect the stability of the coastline. It will change caused by human factor and natural causes such as climate change, sea level rise, and global warming. The primary causes of coastline changes are by natural process or human activities (Erkki, 2010). It may causes coastal land lost. According to research conducted by Robert A. Morton about coastal land lost, the common causes of coastal land lost as Table 1 below.

Natural Process	
Agent	Examples
Erosion	Waves and Currents
	Storms
	Landslides
Sediment Reduction	Climate Change
	Stream Avulsion
	Source Depletion
Submergence	Land Subsidence
	Sea-level Rise
Wetland Deterioration	Herbivory
	Freezes
	Fires
	Saltwater Intrusion
Human Activities	
Agent	Examples
Transportation	Boat Wakes, Altered Water Circulation
Coastal Construction	Sediment deprivation (bluff retention)
	Coastal Structures (jetties, groins, seawalls)
River Modification	Control and Diversion (dams, levees)
Fluid Extraction	Water, oil, gas, sulfur
Climate Alteration	Global Warming and Ocean Expansion
	Increased frequency and intensity of storms
Excavation	Dredging (canal, pipelines, drainage)
	Mineral Extraction (sand, shell, heavy mins)
Wetland Destruction	Pollution discharge
	Traffic
	Failed Reclamation
	Burning

Table 1. Common Physical and anthropogenic causes of coastal land loss (Source: Morton, 2003)

The impact of coastline changes will seriously affect to the natural environment and socio-economic who lived in coastal zone area. It also will reduce water quality, ground water characteristic, loss of properties, and risk of life, agricultures, and loss of tourism recreation (Doong, 2009).

Continuous shoreline change will affect the socio-economic communities. Sources of income will change from natural sources to other sources such as businesses, and service.

1.1 Problem Background

About 44% of the world's population lives within 150 kilometres from the coastline (Abd Maulud et al., 2015). Eight of the top ten largest cities in the world are located by the coast

which starting from Tokyo, Mumbai, New York, Shanghai, Lagos, Los Angeles, Calcutta, and Buenos Aires (NRC, n.d.). According to United Nation stated that the rate of population growth in coastal areas is accelerating and increasing tourism adds to pressure on the environment (United Nation, 2000). One example of this incredible growth is Casablanca whose population soared from 600 in 1839 to 29,000 in 1900 and to almost 5 million in year 2000 (NRC, n.d.).

In Malaysia, development and population to coastal areas emphasized that on the stability of the region. Requests from stakeholders and balance the interests of land use is a matter to be concern. According to reports from NCZPP said that there are three states with the ratio of employment in coastal zones are high, which is Pulau Pinang (0.3%), Selangor (0.39%) and Johor (0.37%) where the area is important for employment, placement, and business (JPBD, 2012). Batu Pahat and Muar are being built in Johor. NCZPP reported that agricultural activities along the coastal areas of Muar and Batu Pahat involving palm oil (17%) and cash crops (11%), which includes the use of land for coastal areas.

Along with the ongoing development, erosion and accretion remain in force and change the coastline for some coastal areas of the developing zone. In the National Coastal Erosion Study Final Report (Volume 1) conducted by the Economic Planning Unit (EPU) said that the area around the town of Batu Pahat have critical erosion (UPE, 1985). The occurrence of shoreline change caused by the natural, manmade, or both that occurs continuously force on the weaknesses of beach in the area.

Scope of the study focused on the coastal areas of Batu Pahat. Batu Pahat is an area of the most vulnerable to risk of coastal erosion that occurs on an ongoing basis starting from 2007 (Peter, 2005). Indirectly affects agricultural land and the area is also an area prone to flooding (JPBD, 2012). Batu Pahat is one of the districts in Johor, which has a population of 336,509 people (Susmita et al., 2007). Figure 1 below show the research area of Batu Pahat.



Figure 1. Research Area of Batu Pahat

Studies conducted in the field and focus areas expected to be exposed to risks flooded. The impact of coastline changes on socio-economic development of local communities focused on the impact on people's income sources.

The issues on the coastline changes at Batu Pahat starting from getting special attention when article was published on a national newspaper uncovered that Batu Pahat may go into underwater (Peter, 2005).

The shoreline of Batu Pahat has six mukims which is Sungai Kluang, Sungai Punggor, Kampung Bahru, Minyak Beku, Bagan, and Lubok.

Along the process of field survey and interview, Batu Pahat coastle area has very limited to access and most of the coastle areas are covered by mangrove and mudflat.

2. LITERATURE REVIEW

Based on explanation of the issue in topic introduction before, most of population lived in coastal area. The phenomena of sea level rise, coastal erosion may give impact to the social life. The explanation about coastline changes and impact of changes to socio-economy will discuss as sub topic below.

2.1 Coastline Changes

Refer to Encyclopaedia of Coastal Science - Coastline changes (here defined as changes on the high-tide shoreline) can and measured on various coastal sectors over time scales ranging from a few hours or days (related to tidal cycles, weather events, earthquakes or tsunamis) to long-term trends over decades or centuries (Eric, 2005).

Coastlines changes can be categorize into two main factors are as below (Abd Maulud, et al., 2015):

- Natural process
- Human activities

Natural process such as wave, soil erosion and accretion, and so on. Human activities are more on reclamation of land for the purpose of development and so on.

2.1.1 Natural Process

One of the factor of coastline changes is by continues natural process. Figure 2 above show coastal erosion process causes by sediment movement (NRC, n.d).

According to Alex, coastal erosion involves the breaking down and removal of material along a coastline by the movement of wind & water. It leads to the formation of many landforms and, combined with deposition, plays an important role in shaping the coastline (Alex, n.d.). Erosion also is invisible action away land along the shore by currents, waves, wind, and other elements (Peter, 2005).

Climate change is one of causes of coastline changes. Climate change will have many negative effects, including greater frequency of heat waves; increased intensity of storms, floods and droughts; rising sea levels; a more rapid spread of disease; and loss of biodiversity (Susmita et al., 2007).

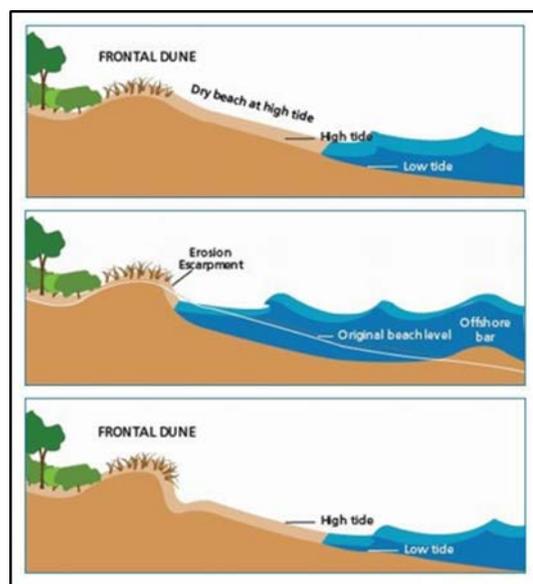


Figure 2. Coastal Erosion Process (Source: NRC, n.d.)

The phenomena of sea level rise, affects the change of coastline through the process of accretion and erosion (Mohamad et al., 2014). Union of Concerned Scientists (UCS) saying that, global warming is the primary cause of current sea level rise (UCS, 2013). The figure of sea level rise is affecting the coastline changes represented as Figure 3 below where it show storm surge and high tides magnify the risks of local sea level rise.

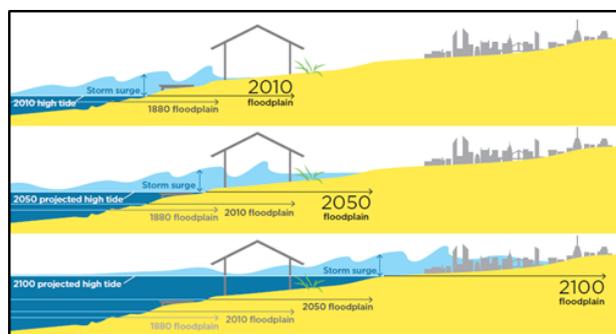


Figure 3. Sea Level Rise (Source: UCS, 2013)

Based on research by National Hydraulic Research Institute of Malaysia (NAHRIM) mention that Peninsular Malaysia will experience sea level rise increase with range of 0.253m to 0.517m by the year 2100 or 2.7mm to 7.00mm / year (NAHRIM, 2010). This phenomenon will effect coastal area and can give negative impact for coastal activates.

2.1.2 Human Activities

Second factor of coastline changes also caused by human factor where some of activities involve in coastal area like development, tourism, recreation are also factor for coastline changes.

Department of Irrigation & Drainage (JPS) saying that, reclamation in coastal area is to handle coastal erosion problem but the process need including reclamation works for the beach re-intervention in five years (JPS, 2010). Some of coastal area on Peninsular Malaysia has been reclamation of land from the sea (Ong, 2001). He says large areas of shallow seas on the west coast of Peninsular Malaysia are convert into dry land. The

most significant areas are Penang, Malacca and Johor Bahru. Ong stated that, area of mangrove have been cleared and reclaimed for agriculture, aquaculture, industries, housing and other uses. Ong also stated, at least half of mangrove area on Peninsular Malaysia has been lost in the past 50 years (Ong, 2001). Coastal mangrove important for fisheries and marine productivity (Gallian, 2005) and also to prevent saline and tidal intrusion (Ong, 2001).

Figure 4 below show coastal area before getting reclamation in 21st January 2003 and Figure 5 show coastal area has been reclamation in 20 April 2015. Both image are retrieve from Google Earth.

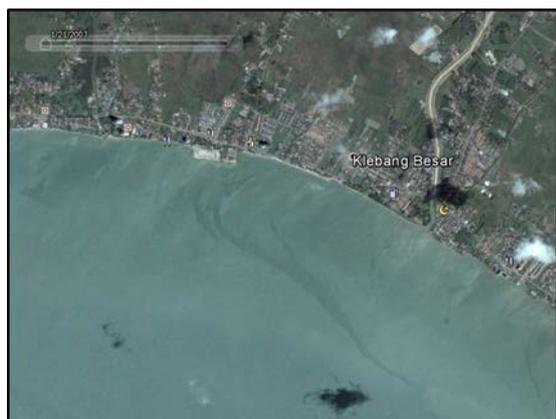


Figure 4. Banda Hilir in January 2003

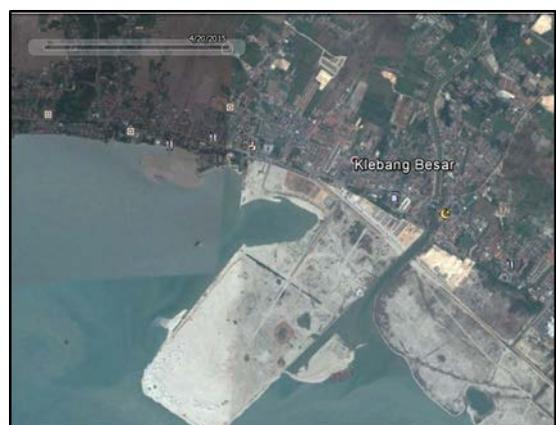


Figure 5. Banda Hilir in April 2015

2.2 Impact of Coastline Changes

Coastline changes may give impact to the environment such as flora and fauna and also will effect to human social life. The impact of coastline changes can be categorize into two part which is the impact to natural environment and the impact to socio-economic.

2.2.1 Impact to Natural Environment

The impact of coastline changes will cause saltwater stagnant in agricultural area and it will destroying coconut plantation and indirectly causes the ownership of the land or private land effected (Abd Maulud, et al., 2015). Besides that, It also will caused coastal flooding and effect to economical and habitability (Gill, 2014). Figure 6 below show the impact of sea level rise on shoreline changes at Sungai Lurus, Batu Pahat that effect the private land (Abd Maulud et al., 2015).

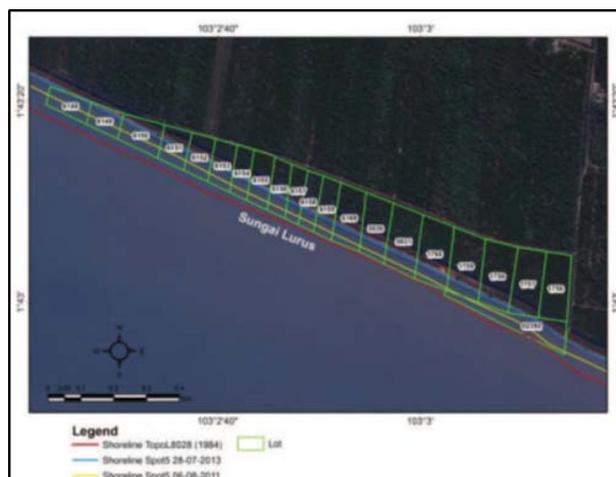


Figure 6. Impact Sea Level Rise on Shoreline Changes That Effect Private Land (Source: Abd Maulud et al., 2015)

Ministry of Science, Technology and The Environment (MOSTI) where submitted report to the United Nations Framework Convention on Climate Change reported biophysical impacts resulting from sea level rise (MOSTI, 2000). Table 2 below show biophysical impacts resulting from sea level rise conducted by MOSTI.

Type of Biophysical Impact	Sea Level Rise Scenario (Year 2100)		
	20 cm (or 0.2 cm/yr)	50cm (or 0.5 cm/yr)	90cm (0.9cm/yr)
Tidal Inundation			
a) Mangrove-fringed mudflats			
a. Bunded	Insignificant as bunds will be raised	Insignificant as bunds will be raised	Perhaps 300m strip may be lost (retreat bund) Perhaps 300m strip may be lost (retreat bund)
b. Unbunded	Insignificant as bunds are likely to be build	Insignificant as bunds are likely to be build and topped up	
b) Sandy shores	Insignificant as existing ground level is higher	Insignificant as existing ground level is higher	Insignificant as existing ground level is higher
c) Increased flooding	Reduced drainage efficiency of tidal control gates	Reduced drainage efficiency of tidal control gates	Tidal gates rendered non-operational and replaced by pumped drainage
Shoreline Erosion			
a) Sandy shoreline retreat	Insignificant	Insignificant	Insignificant
b) Mangrove loss	Vertical accretion rate able to keep pace	Vertical accretion rate able to keep pace	Total mangrove loss
Increased Wave Action	Insignificant	Reduced factor of safety, but taken into account during refurbishment if necessary	Taken into account during refurbishment
Saline Intrusion	Unlikely to be of concern due to shift towards reservoir development		

Table 2. Biophysical Impacts Resulting from Sea Level Rise (Source: MOSTI, 2000)

It is important in the identification of coastline risk areas to be change. Coastal Vulnerability Index (CVI) are used to Identifying areas of coastline that are vulnerable to impacts of

climate change and coastal processes, highlighting potential problem areas (William, 2012). CVI also used to understand the biophysical and socio-economic effects of climate change and assess the costs and benefits of alternative responses in order to improve coastal zone planning and management (Doukakis, 2005). The parameter used for CVI are geomorphology, coastal slope, relative sea level rise rate, shoreline changes rate, mean tidal range, mean wave height (Thieler et al., 2000).

2.2.2 Impact to Socio-economic

Coastline changes will give impact to socio-economy for the local community who lived in coastal area (MOSTI, 2000). If previously they depend on natural sources of income such as marine productivity and farming, now they may be change to other sources of income. Shoreline changes affect the activity of angler. If before they are easy to handle of their catchments, now they are difficult because of the physical changes that increasingly shallow beach makes them difficult to landing.

Through the National Audit Department (Audit), quoting the local newspaper saying that the anglers do not know where else to place their fishing after coastal erosion (Audit, 2009). According to the official site of the Universiti Kebangsaan Malaysia (UKM) said that some house and gardens near the beach, which also has a small garden of palm oil, has hit by a wave of effects of coastal erosion phenomenon (Saiful, 2015). Besides that, the effects of coastline changes also give impact to plantation area (Zaitul et al., 2001). Table 3 below show impact of sea level rise to the socio-economic where recorded by MOSTI.

Type of Impact	Socio-economic Impacts based on the High Rate of Sea Level Rise (0.9cm/yr)
Loss of agricultural production from eroded/inundated lands	RM46 million for Western Johor Agricultural Development Project Area. The West Johor Project area accounts for about 25% of the national drainage areas
Displacement and relocation of flood victims with associated disruption of business/economic activities resulting from increased flooding	Long-term annual flood damage estimated at about RM88 million for Peninsular Malaysia and RM12 million for Sabah/Sarawak based on 1980 price level. If the flood frequency is double, the annual flood damage will increase by 1.67 times.
Loss of fisheries production due to mangrove loss	RM300 million loss based on 20% loss of mangrove resulting in a loss of about 70,000 tonnes of prawn production valued at RM4500/tonne.
Interruption of port operation	May see some improvement due to reduced siltation.

Table 3. The Socio-Economic Impacts Cause By Sea Level Rise (Source: MOSTI, 2000)

3. METHODOLOGY

The methodology is very important to a research. This topic will be discussing the work done for each phase. The methodology divided into four phase. All the phase depends on objectives of research and all the objectives based on research question to be answered. Phase one is identifying the changes of coastline changes. Phase two is to identify the effect of changes to socio-economic. Phase three is to identify the risk area and the effect to the socio-economic. Phase four is produce map of result. Figure 7 below show research work flow that has been used for this study.

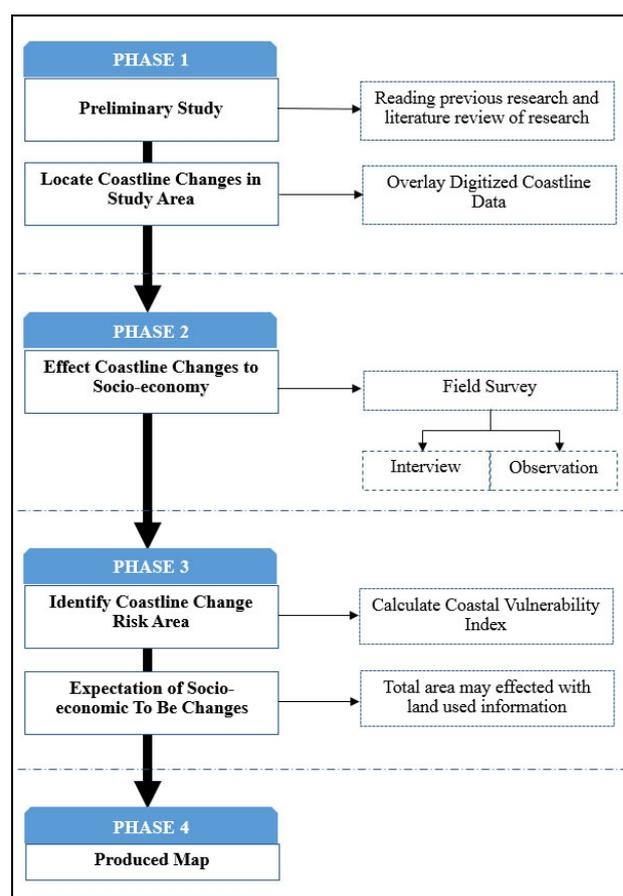


Figure 7. Research Work Flow of Study

3.1 Preliminary Study

The initial study is the first phase of this study. Reading material to obtain an understanding of the study is an initial phase of this study. It includes the understanding, knowledge and background related studies including the studies that have been done before.

Identify issues related to the study of the problem, the causes of coastline changes and its impact on the physical and social impact on the lives of the coastal environment.

3.2 Data Used

The study involved two major data types which are spatial data and also field data. Spatial data involves shoreline data, CVI data, and land use data. Field data are gained by doing interviews with the local community involved in coastline changes in the study area.

3.2.1 Spatial Data

Shoreline Data and CVI data are taken from studies that have been conducted by Sr. Dr. Khairul Nizam from Universiti Kebangsaan Malaysia about the shoreline changes and sea level rise for Batu Pahat area.

Shoreline data are taken from topographic maps in 1985 as well as the shoreline of satellite image Spot 5 for 2011 and 2013. The issue of shoreline change starts from 1985 that has been highlighted by the Economic Planning Unit. To identify the changes that occur coastal area, shoreline from topographic maps has been taken in 1985 and this data is only available to use where satellite images in this year are not available yet.

3.3 Questionnaire

To get the latest information related to the issue of coastline changes is by doing interviews with the community that involved in coastline changes. This session was conducted to obtain information on the physical condition of the coastal area before coastline change and the current situation which is after coastline changes. In addition, this session will also be conducted to obtain information on their socio-economic related about their sources of income, whether affected or not.

The questions of the questionnaire are divided into two sections to get an analysis of the data. Part A is to get responded background information such as age, religion, sex, and also the duration of stay in that area. Part B is to obtain socio-economic information. In this section are divided into three parts which are with the latest information and also the previous information before coastline changes. The main focus of this section is to obtain information on their sources of income either primary or secondary income. Part B also contained questions to get others information. Part of the question is to obtain information about the awareness of residents on the issue of coastline changes including their action to be faced with this issue.

3.4 Identification of Coastline Changes

Coastline changes can be identify using differential temporal resolution of satellite image. Topography map and Spot 5 image are used to identify the coastlines that have been changes.

All digitizing process is starting from Pantai Semerah until Sungai Tampok Laut. All three data of coastline has been converted into polygon to know the area of erosion and accretion. The values to know the rate of changes are measured from the longest changes for each changes group in unit meter per year.

Figure 8 below show the coastline changes in years 1984, 2011 and 2013. Overlay of coastline data can identify rate of erosion and accretions where the value are used to calculate CVI rank. The calculation to identify change rate per year are by divided the value of change length with 28 where based on years from 1985 until 2013.

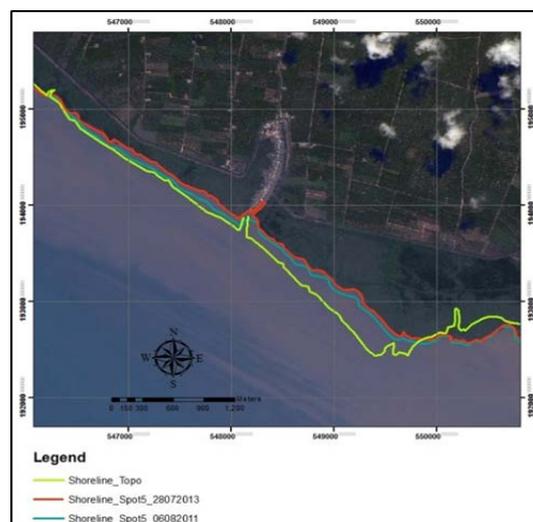


Figure 8. Coastline Changes

3.5 Effect of Coastline Changes to Socio-economic

The study was conducted through observation and in-depth interviews with residents of coastal communities. Fifty respondents are selected randomly but only those who are only coastal area that will be interviewed as a first responder groups. Second group respondents are those who are outside of the coastal areas to differentiate effects on their income. Research in depth interviews aimed at understanding the causes of degradation of their income sources. Interviews with local authorities also conducted to obtain information about administrative management on this issue. Among those interviewed are, Batu Pahat Municipal Council, Department of Irrigation and Drainage Batu Pahat, and also Batu Pahat District Office Department of Agriculture Malaysia, Batu Pahat

3.6 Identify the Coastline Risk Area

Coastal Vulnerability Index (CVI) are using to construct the coastline change risk area where it will show the rank of vulnerability of coastal area in very low, low, moderate, high, and very height. Six parameters for CVI have used which are Geomorphology, Shoreline Erosion, Coastal Slope, Relative Sea Level Rise, Mean Tidal Range, and Mean Significant Wave Height. Table 4 below show the ranking of CVI variable based on values from Hammar-Klose and Thieler.

Variables	Vulnerability Ranks				
	Very Low	Low	Moderate	High	Very High
Geomorphology	Rocky cliff coastal, Fjord	Medium cliffs, Indented coasts	Low cliffs, Glacial drift, Alluvial plains	Cobble Beach, Estuary, Lagoon	Mangrove, Mud flats, barrier & sand beaches, salt marsh, deltas, coral reefs
Shoreline Erosion rate	>2.0	1.0 – 2.0	-1.0 – 1.0	-2.0 - -1.0	< -2.0
Coastal Slope (%)	>1.20	1.20 – 0.90	0.90 – 0.60	0.60 – 0.30	<0.30
Relative Sea Level Rise (mm/yr)	<1.8	1.8 – 2.5	2.5 – 3.0	3.0 – 3.4	>3.4
Mean Wave Hight (m)	<0.55	0.55 – 0.85	0.85 – 1.05	1.05 – 1.25	>1.25
Mean Tide Range (m)	>6.0	4.0 – 6.0	2.0 – 4.0	1.0 – 2.0	<1.0

Table 4. Rank for Vulnerability Index
(Source: Hammar-Klose and Thieler, 2001)

The coastline has been divided into six Management Unit (MU) for the process of identify the rank of CVI itself. Figure 9 below show MU for coastal area of Batu Pahat.



Figure 9. Management Unit (MU)

4. RESULT AND ANALYSIS

Based on the methodology in section 3, this section will show the result and analysis founded in this research.

4.1 Coastline Changes Analysis

Coastline changes from 1985 up to 2013 represent in coastline erosion rate. Table 4 below show the coastline change rate where retrieved from the year 1985, 2011 and 2013 coastline data. Figure 10 below show erosion and accretion map for MU - 1, MU - 2, and MU - 3.

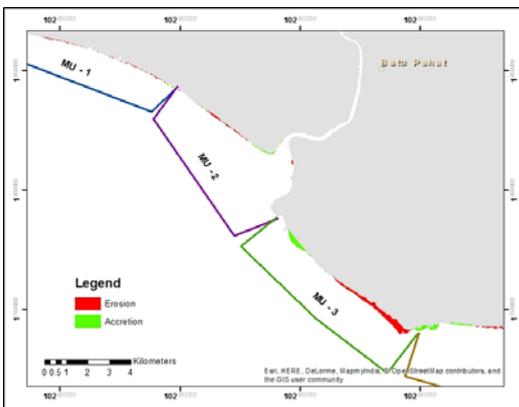


Figure 10. Erosion and Accretion for MU-1, MU-2, and MU-3

Figure 4.2 below show the erosion and accretion for MU - 4, MU - 5, and MU - 6.

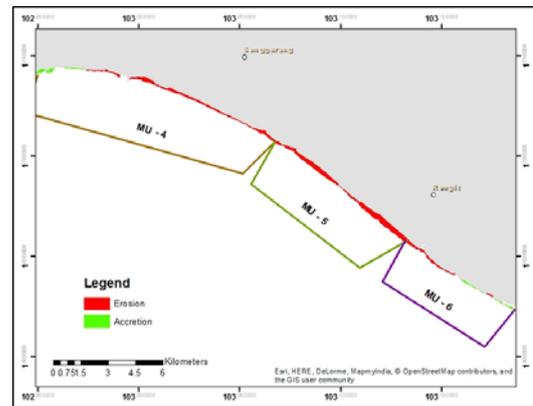


Figure 11. Erosion and Accretion for MU-4, MU-5, and MU-6

Refer to Table 5 show different coastline data represent as erosion and accretions. The result shows all section of MU has a very high range of erosion. Table 6 below show the result of coastline changes where to represent in change rate (m/yr).

MU	Status	Change Rate (m/yr)	Range
1	Erosion	-0.793	High
2	Erosion	-3.005	Very High
3	Erosion	-8.200	Very High
4	Erosion	-9.958	Very High
5	Erosion	-27.412	Very High
6	Erosion	-23.620	Very High

Table 5. Coastline Changes Rate

The results of coastline changes, most of the coastal area in Batu Pahat are erosion. It has affected the residential area because of tide flooding, and it damaging their plantation. The value of negative (-) represented as erosion.

Figure 12 below show the coastal erosion in Kampung Parit Hailam, Senggarang that the closer the building of worship in the village.



Figure 12. Erosion at Kampung Parit Hailam, Senggarang

Figure 12 below show erosion that has damaged the infrastructure of coastal residents in Kampung Sungai Ayam.



Figure 13. Erosion at Kampung Sungai Ayam

4.2 Analysis of Socio-Economic Impact

Result of the interview show about 93% respondents know with the phenomena of coastline changes. 60 % of respondents stated that their income be affected by coastline changes.

They are of those who receive income from agricultural products such as palm and coconut. They stated, the effect is the total output was decrease compared before coastline changes. Most of the respondent stated that, coastline changes not affect their main income but their side income. 30% percent of respondents is retired and depend on crop yields for which they earn their income.

Table 6 below shows result during interview session where include respondent profile and information of their sosio-economy.

Item	Total	Percent (%)
1. Resident Period (year)		
• < 10	5	17
• 11 - 20	5	17
• 21 - 30	6	19
• > 30	14	47
2. Occupation		
• Fisheries	8	27
• Farmer	5	17
• Business	3	10
• Labor	4	13
• Driver	1	3
• Others	9	30
3. Income (RM)		
• Below 499	5	16.6
• 500 - 999	9	30
• 1000-1499	11	36.7
• 1500-1999	2	6.7
• 3000-3499	1	3.3
• 4000-5000	1	3.3
• Above 5000	1	3.3

4. Partime Work		
• Yes	16	53
• No	14	47
5. Known of Coastline Change Phenomena		
• Yes	28	93
• No	2	7
6. Year of Coastline Changes		
• <1990	1	3.3
• 1991-2005	2	6.7
• 2006-2010	12	40
• 2011-2012	8	26.7
• >2013	5	16.7
• No Answer	2	6.6
7. Disrupting sources of income		
• Yes*	18	60
• No	12	40

* Include income from part time jobs.

Table 6. Interview Result from Respondent

Most of the respondents had lived along in the study area. They are peoples who can see the changes taking place in the area with great attention to detail. Only 17% of respondent lived below then 10 years. But all of respondent getting know the phenomena of coastal erosion where they can identify where the exactly land before erosion and current erosion.

Figure 14 and Figure 15 below show the different size of coconut that has not effected and effected to the coastline changes.



Figure 14. Coconut Size Not Effect to Coastline Changes



Figure 15. Coconut Size Effected to Coastline Changes

Figure 16 below show coconut tree are destroy causes by coastline changes.



Figure 16. Coconut Tree That Destroyed the Effect of Changes in the Coastline

Most of the coastal area are covered by mangrove and also palm tree. The productions of the palm tree are decrease half then before. Palm employers saying that they can collect the palm twice in a year but, after the phenomena of coastline changes, they only can collect the palm held on a year. The production of coconut is also effected. The fertility trees are decrease. Community saying that, the price before can get up to RM1 per coconut, but the effect of coastline change become RM0.50 per coconut.

These situations prove that, the coastline change give impact to the production of the tree and also effect the price of production. It affects the source of income who are depending on this source for their life.

The results by the interview to community found that expectations source of income changes are different. At first, the change in source of income affects the fishermen, but after doing surveys and interviews, the effect more to source of plant such as coconut and palm oil. The results of interviews with local authorities in Batu Pahat found that, most of the problems of coastal change are not known by them. However, for every problem complained, the local authorities have taken a precautionary step to make wall to block waves. Batu Pahat Municipal Council stated that a detailed study of this issue for the long term is still run by the national administration.

4.3 Prediction of Risk Area

The predictions of risk area are identify using CVI formula. Table 7 below show data for shoreline change rate. Refer to the table, it shows that each MU has very high rank except MU-1 with high rank.

SR Line	Type	Area	Change Length(m)	Sum	ChangeRate (m/yr)	Range
1	Erosion	23214	-47.0649410	-11.891467	-0.792764453	High
	Accretion	20173	51.0237180			
	Erosion	6587	-35.9834960			
	Erosion	2865	-15.8357100			
	Erosion	2305	-23.9280900			
	Erosion	8627	-44.5773360			
2	Erosion	39711	-62.0061470	-45.082671	-3.0055114	Very High
	Erosion	3277	-28.3370310			
	Accretion	4794	31.7790610			
	Accretion	1121	35.9844210			
	Accretion	1598	32.6738700			
	Accretion	68570	65.4037800			
	Erosion	57592	-78.3073260			
	Erosion	1316	-15.2786800			
3	Erosion	22273	-68.9597370	-123.006411	-8.2004274	Very High
	Erosion	1277	-20.0410290			
	Accretion	221906	250.4023470			
4	Erosion	704679	-317.6270530	-149.367978	-9.9578652	Very High
	Accretion	67531	86.5823590			
	Accretion	160761	289.2766340			
	Erosion	3116425	-411.1824940			
5	Erosion	121586	-114.0444770	-411.182494	-27.41216627	Very High
	Erosion	3116425	-411.1824940			
6	Accretion	69654	84.6792630	-354.301740	-23.620116	Very High
	Accretion	69130	96.6568030			
	Erosion	31923	-124.4553120			
	Erosion	3116425	-411.1824940			

Table 7. Shoreline Change Rate

Table 8 below show data for coastal slope for each six MU. Data for coastal slope are getting from measuring slope using Google Earth. MU-1 and MU-3 represent High rank and MU-4 and MU-2 are in very low rank.

MU	Sub-MU	Slope (%)	Total_EveSlope	Range
6	1	1.47	0.96	Low
	2	0.97		
	3	0.43		
5	1	0.30	0.80	Low
	2	0.57		
	3	1.53		
4	4	1.10	1.38	Very Low
	3	1.30		
	2	1.83		
	1	1.30		
3	2	0.73	0.48	High
	1	0.23		
2	3	1.07	1.27	Very Low
	2	2.20		
	1	0.53		
1	3	0.70	0.56	High
	2	0.33		
	1	0.63		

Table 8. Coastal Slope Rate

Data for Mean Tidal Range is -0.025 meter in rank of very high rank for each MU. Relative sea level rise is 0.291492 cm/year for Kukup station with moderate ranking.

Figure 17 below show CVI map that showing the risk area where the very high rankings are the most risk to get changes.

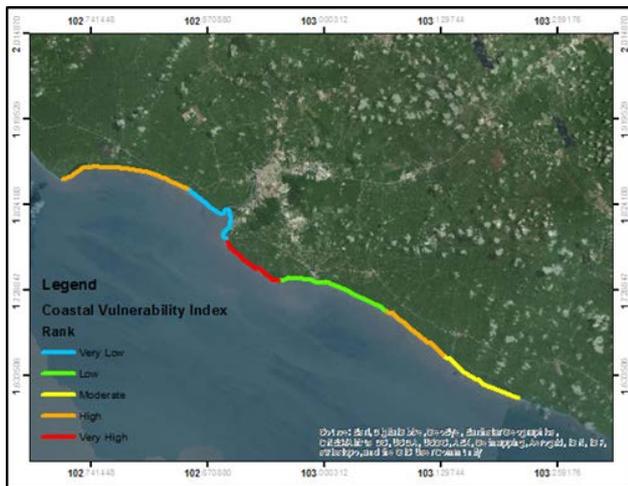


Figure 17. CVI Map

The CVI map represent, the very high vulnerability in MU-3 where involve Teluk Serting, Kampung Sungai Ayam and Sungai Buluh. High vulnerability at MU-1 and MU-5 which is Kampung Sungai Balang, Kampung Sungai Parit Kuda, Kampung Sungai Parit Simin, Kampung Sungai Parit Botak, Kamung Sungai Punggor, Sungai Parit Perpat and Sungai Rengit.

Land Used statuses for all coastal area are agronomy which is most of land cover by palm trees. Stated by respondent, palm tree is very sensitive with salt water. It will effect soil fertility and also will reduce the production of palm oil up to half compared before.

Figure 18 below shows a risk area of coastal to be changed. The figure shows the land use information especially for agriculture area within the coastal zone area.

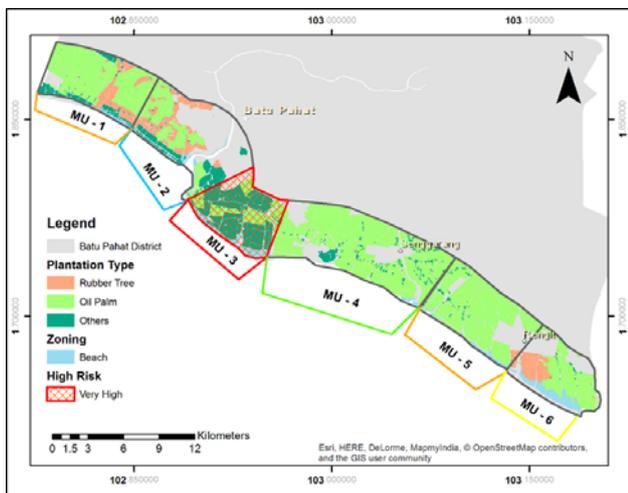


Figure 18. CVI Map for Very High Vulnerability

Areas that are at risk to change are the MU-3. This area involves some villages such as Kampung Minyak Beku, Kampung Teluk Buloh, Kampung Sungai Suloh, Kampung Patah Pedang, and Kampung Sungai Ayam. The main activity of this area in accordance with the land use map information is made up of agricultural, residential, farming and aquaculture, industry, commerce, and services.

Figure 19 below show land used for risk area with very high vulnerability. Based on the Figure 19 below indicates that the agricultural area covers approximately 80% of land use. This number clearly shows the source of income for the community in this area was mostly dependent on agriculture and plant sources of income. Communities that depend on a source of income from a plant and agriculture will be interrupted if the coastline changes continuously over time. People who live in that area should also make planning for the future with a more serious with risk is expected to occur in the area of their residence.

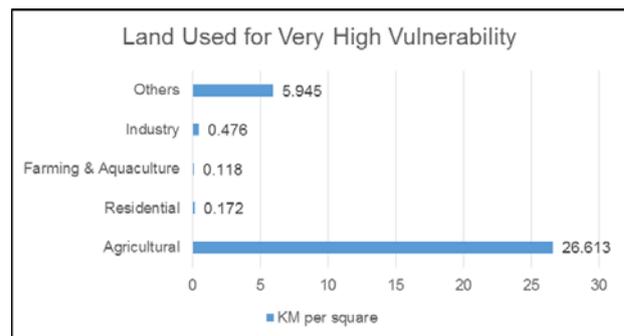


Figure 19. Land Used for Very High Vulnerability

MU-1 and MU-5 is an area that has a high vulnerability values, land use for the area is a lot of oil palm plantations. This area should also be noted that the land use of the area also provides the main source of income for people in the area who depend on the production of the oil palm plantation.

5. CONCLUSION AND DISCUSSION

Through the research has been conducted, the aim and objective of the study were achieved. For the first objective is to identify the factor of coastline changes. In this stage, reading and knowledge from other studies need to be done to understand in depth the key issues in the study. Through these issues, it is important to find methods or solutions to handle and control this issue from continuing to happen.

The shoreline will still continue to get changes. Based on the factor of coastline changes that has been discuss in Chapter 2 can be conclude that, the changes may come from many factors such as natural phenomena and by human activities. It may give impact to community because of one factor and also both. The phenomena of global warming may increase the risk of coastline to be change because it will increase sea level rise. It may give impact for low area where it will expose to flood during tide.

It also will impact on socio-economy especially for sources of income where to depend on the plantation or agriculture production such as coconat, oil palm, and so on. In addition also to the physical damage of land and housing. Some of community stay in coastal area has lost their own land like Kampung Sungai Lurus.

The cost of which must be spent in repairing the damage need to be taken care seriously by the local authority. The area has been experiencing erosion critical, if not controlled, would have an impact worse than what is happening now. But, most of erosion area is handle by local community itself with their own cost to protect their land from erosion process.

These studies initially expected the most effect income cause of coastline changes is to fishermen. But after conducting field studies and meet with the communities involved, the beginning of the study results are not the same as a final result.

The study also shows that erosion happens are not limited to the eroded area only. This erosion has resulted in some low areas that will be flooded in the event of high tide. If this happens frequently, it will affect the fertility of the land and will affect agricultural output.

Any effort to prevent erosion from occurring by the local authority and people of the area always is aware. However, this erosion will occur continuously and will definitely have an impact on the socio-economy's community.

This research is expected to give attention for people to be ready with the phenomenon of shoreline change. Society must make long-term plans for dealing with this situation so that losses and expenses can be reduced.

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