



Characterization of climate change manifestation in Nigeria coastal community

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General Note



Article is recommended to print as color version in recycled paper. *Save Trees, Save Climate.*

ABSTRACT

The impact of Climate change on the coastal regions of the world is unprecedented especially as it relates to sea level rise which stimulates coastal flooding and the submergence of several coastal communities. However, Nigeria coastal communities are characterized with various climate change manifestations with different magnitudes and severity. Using Ayetoro community in Ilaje Local Government Area in Ondo state as case study, a GIS and Remote Sensing model was built to determine the land area to be inundated in the study area in a scenario of 0m, 1m and 2 meters sea level rise using the Digital Elevation Model of the area. Results show that 1.08% (19.05km²), 4.71% (83.03km²) and 12.68% (223.63km²) of the total land area would be inundated at 0-meter, 1-meter and 2-meter sea level rise scenarios respectively. The implication of this there is need to make provision for these region that is likely to be affected by these sea level rise scenarios so as to minimize the resulting damage.

Keywords: climate change, coastal flooding, coastal community, Urban and Regional Planning

1. INTRODUCTION

Climate change refers to all changes in climate be it as a result of human activities or natural variations (Ifeanyi-obi, Etuk & Jike-wai, 2012). The issues and problems associated with coastal and marine resources, and their current or potential relationship to climate, have continued to receive a high level of national and international attention (Boesch, Field, & Scavia 2000). As the issue of vulnerability of coastal zone to climate change continues to repeat itself as the headline of news, topic of seminars and theme of different conferences action needs to be taken to address this pressing issue. Headlines draw attention to subjects ranging from sea level rise, disastrous hurricanes and one of the strongest El Niño events in recent history, to the latest collapse of marine fish stocks and massive coral reef die-offs associated with elevated sea surface temperatures.

Global climate changes are expected to affect coastal communities around the world, many of which are already considered vulnerable to on-going climatic variability (IPCC, 2001; MONIRUL and MIZRA, 2003). In recent times, it has been observed from the climate models that the societal weather patterns are changing and as a result of this, sea levels will rise. The consequence of this for many coastal communities will be devastating (Dolan & Walker, 2004).

Thus it should come as no surprise that climate variability, and the potential consequences of future climate change are of considerable interests to stakeholders, policymakers and the general public, especially as they may act as an additional stressor to coastal and marine resources. The heightened impacts of climate change in Nigeria and other developing countries, which are likely to intensify in the coming years, have overwhelmed local and traditional knowledge and technologies, leaving many people with inadequate information and little means to deal with the challenges (NEST, 2011).

Climate change is already having an impact in Nigeria (BNRCC, 2011). Weather-related disasters have become more frequent in the past four decades and the trend continues (BNRCC, 2011). Nigeria's natural and agricultural ecosystems, including freshwater and coastal resources, are highly susceptible to the effects of climate change (Ejembi & Alfa, 2012). These vulnerability factors make clear the urgent need to respond to the challenge of climate change in a comprehensive and systematic manner that at the same time, addresses broader development priorities, taking account of the gender-differentiated needs and roles of the society (BNRCC, 2011) and with Africa been generally acknowledged to be the continent most vulnerable to climate change (Ejembi & Alfa, 2012).

In view of the fact that stability and sustainability of development around the coastal environment is essential, in other to retain its high value and to ensure sustainability and functionality and bearing in mind the great threat posed by climate change to the realization of this goal, it becomes very important to give climate change issues serious consideration and seek some adaptation strategies that can help increase its resilience. The study therefore attempts to characterize the effects of climate change in the community and to evaluate possible inundation effect with 0 meter, 1 meter and 2 meter scenarios.

2. MATERIALS AND METHODS

Research Locale

The study area (Aiyetoro) is a community located in Ilaje Local Government Area of Ondo state (Figure 1). The people of Ilaje are a very versatile, dynamic set of individuals and the people are mostly located along the coastline. Ilaje consists of over four hundred towns and villages, covering an area of 234,000 square kilometres and a population of 290,615 at the 2006 census. Ilaje Local Government is the largest Local Government in Ondo State in terms of land mass, it has a shoreline covering about 180 km thereby making Ondo state the longest coastline in Nigeria (Ibidun, 2010).

The population of Ilaje local Government Area according to the National population census 2006 is at 289,838 and their present population is less than 350,000 persons going by a projection from the 2006 National Population Commission census figures (Emmanuel & Akinbode, 2012).

Ilaje is a local government area in Ondo state and shares boundaries with Ikale by the North, Ijebus by the West, Itsekiri by the East, Atlantic Ocean by the South with the Apoi and Arogboljaw to the North East (Figure 2). It is located within longitude 5.166667°E and latitude 7.366667°N.

Aiyetoro community is a settlement in Ugbo Kingdom which is considered as the major Kingdom in Ilaje (Adekulne, 2016). Aiyetoro is a Yoruba name literally indicating a calm and settled world (Gbadamosi, 2016) (figure 3).

The people of Aiyetoro are reputed for their commercial living and advanced technology in fishing, transportation, industry such as carpentry and furniture, shoe making and marine business. The town was said to be popular so much to attract the attention of Chief Obafemi Awolowo and the communist world in the 1950s, particularly the USSR. Many of the children from Aiyetoro were educated through a bilateral agreement with countries like USSR, West Germany, Hungary and Austria and United Kingdom (Gbadamosi, 2016)



Figure 1 Map of Nigeria Showing Ondo state (Source: Authors' GIS work)

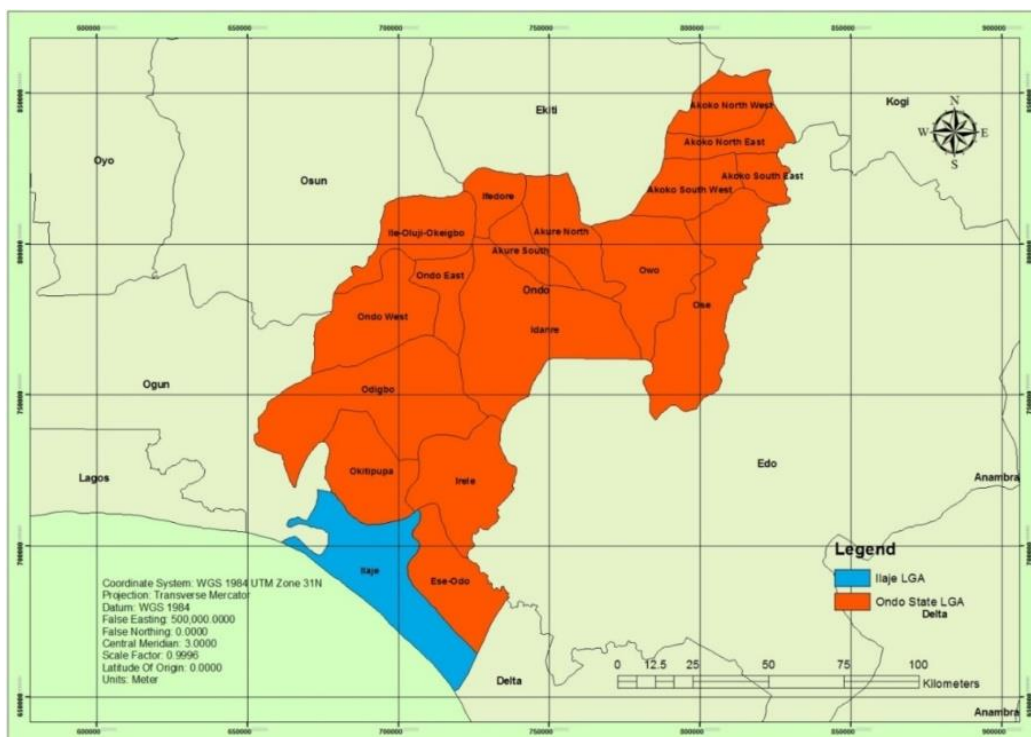


Figure 2 Map of Ondo state showing Ilaje Local Government (Source: Authors' GIS work)



Figure 3 Map showing the boundary of Aiyetoro settlement (Source: Google map, 2018)

Methods

Primary data was collected through structured questionnaires. A total of 108 respondents were sampled in the community. The Statistical Package for Social Sciences (SPSS) software would be adopted for the processing of data.

Information on the socioeconomic characteristics of the residents of ayetoro community, ecological indicator of climate change and the activities affected by climate change effect in the community in Ilaje Local Government was acquired using structured questionnaire that was administered to 108 respondents in the community which is 10% of the 1088 total building presenting the community using systematic random sampling technique.

The aerial imagery of aiyetoro community was obtained from Google Earth while, Digital Elevation model (D.E.M) and Landsat imageries were acquired from the United State geological survey's (USGS) server, all these were integrated together to map out regions where these effects of climate change will be felt and at what scale.

Geographic Information System (GIS) was employed to overlay the critical impacts (land, population GDP) with the inundation zones projected for 0, 1 and 2 meters sea level rise (SLR) scenarios from year 2018 to 2100. The 0 meter scenario was based on the thermal effect on the ozone layer as estimated by the International Panel of Climate Change 2016 report which was projected to rise to 2 meters by year 2100 according to USGS. The Digital Elevation Models (DEMs) of the community was acquired and analyzed using the GIS to estimate the total land that will be lost in a scenario of 0-2 meters SLR,.

The results of both questionnaire and GIS analysis were presented in form of tables, and figures.

3. RESULTS AND DISCUSSION

Socio-Economic Characteristics of Sampled Respondents

The field survey carried out for this study as depicted in Table 1 shows that sixty-six percent (66.7%) out of one hundred and eight (108) respondents were male while thirty-three percent (33.3%) were female. During the field survey as presented in Table 1, 56.5% of the respondents fall between the ages of 35-64, while 17.6% between 19 – 34 years. These two classes formed the bulk of people in the working class in the settlement compared to other classes where 12.0% of the respondents are above 65 years and 13.9% that are below 18 years. The mean age of the respondent is 46 years. This therefore implies that people at the age bracket of 35 to 64 years are more involved in the survey which explains their knowledge and awareness of climate change.

Analysis of the field survey as shown in Table1 reveals that 50% of the respondents were married, 34.3% were single, 10.2% were widow/widower and 5.6% divorced. Field survey revealed that fishing is the major occupation in the community due to the fact that it is located on water as 54.6% of the respondents are fishermen, 33.3% are traders, 1.9% of them are Artisans who are majorly into building of ferry, canoe and boats while 10.2% are students (Table1). The analysis above indicated that students are few in the study area. Majority of them might have migrated to the neighboring town where educational facilities and other necessities of life are ready available.

In an analysis to estimate income in the study area (Table1), it was found that few of the respondents 11.0% are earning above ₦18, 000 per month which is the federal government minimum wage, while 49.1% of the respondent are earning between ₦5, 000 – ₦10, 000, 26.9% are earning less than ₦5, 000 while 13.0% of the respondent are earning between ₦11, 000 – ₦18, 000.

Table 1 socio economic characteristics of respondents

| Characteristics | Respondents | Percentage (%) |
|-----------------------|-------------|----------------|
| <i>Sex</i> | | |
| Male | 72 | 66.7 |
| Female | 36 | 33.3 |
| Total | 108 | 100.0 |
| <i>Age</i> | | |
| 0-18 | 15 | 13.9 |
| 19-34 | 19 | 17.6 |
| 35-64 | 61 | 56.5 |
| 65 above | 13 | 12% |
| Total | 108 | 100.0 |
| <i>Marital Status</i> | | |
| Single | 37 | 34.3 |
| Married | 54 | 50.0 |
| Divorced | 6 | 5.6 |
| Widow/Widower | 11 | 10.2 |
| Total | 108 | 100.0 |
| <i>Occupation</i> | | |
| Farming | 0 | 0 |
| Fishing | 59 | 54.6 |
| Artisan | 2 | 1.9 |
| Trading | 36 | 33.3 |
| Student | 11 | 10.2 |
| Total | 108 | 100.0 |
| <i>Income</i> | | |
| Above ₦18,000 | 12 | 11.0 |
| ₦11,000-₦18,000 | 14 | 13.0 |
| ₦5,000--₦10,000 | 53 | 49.1 |
| Below ₦18,000 | 29 | 26.9 |
| Total | 108 | 100.0 |

Source: Authors' Fieldwork, 2018

Ecological Indicator of Climate Change

The major ecological indicator of climate change in the area is increase in water level of local river as 57.9% of the respondent choose increase in water level as the ecological indicator of climate change in the area while 25.3% believe it is loss of vegetation species and 16.8% choose overflow of local river as shown in Table 2. This strongly agrees with (IPCC, 2001) that coastal marine ecosystems are being threatened by anthropogenic global climate change.

Table 2 Ecological indicator of climate change

| Ecological Indicator | Frequency | Percentage |
|-------------------------|-----------|------------|
| Loss of Vegetation | 27 | 25.3 |
| Overflow of local river | 18 | 16.8 |
| Increase in sea level | 63 | 57.9 |
| Total | 108 | 100.0 |

Source: Authors' Fieldwork, 2018

Affected areas

An inquiry was made during the field survey on the areas affected during the occurrence of flood/river overflow/sea level rise and the responses as presented in Table 3 shows that the occurrence of flood/river overflow/sea level rise mostly affect areas that are close to the sea/river as 63.0% of the respondent agreed to this fact while 29.3% claimed that it is the areas that are low lying that is mostly affected while 7.7% of the respondent claimed that this disaster affects the entire community when it occurs. During the field survey buildings that were being affected by flood/river overflow/sea level rise were seen in the community. Plate 1 shows one of the buildings that were affected.

Table 3 Areas affected by the occurrence of flood/river overflow/sea level rise

| Affected areas | Frequency | Percentage |
|-----------------------------|-----------|------------|
| Area close to the sea/river | 58 | 63.0 |
| Areas that are low lying | 27 | 29.3 |
| Entire community | 7 | 7.7 |
| Total | 108 | 100.0 |

Source: Authors' Fieldwork, 2018



Plate 1 Building that has been submerged by water due to the occurrence flood/river overflow/sea level rise (Source: Author's Fieldwork, 2018)

Period of occurrence of disaster

The result of the field survey as presented in Table 4 shows that both coastal erosion and flood/rivers overflow/sea occur mostly between July to September as majority of the respondents 82.4% and 59.3% respectively agreed to this, 2.9% and 26.9% replied it occurs between April to June while 14.7% and 13.9% of the respondents replied that it occurs anytime in the year.

Table 4 Period of occurrence of coastal erosion and flood/rivers overflow/sea

| Month | Coastal Erosion (%) | Flood/Rivers Overflow/Sea (%) |
|----------------|---------------------|-------------------------------|
| April-June | 2.9 | 26.9 |
| July-September | 82.4 | 59.3 |

| | | |
|---------------------|-------|-------|
| Anytime in the year | 14.7 | 13.9 |
| Total | 100.0 | 100.0 |

Source: Authors' Fieldwork, 2018

Climate change effect on economic activities

Information gathered from the field survey as shown in Table 5 reveals that 30.4% of the respondent complained that coastal erosion affects the fishing activities of the people in the community, 9.8% complained that it is affecting their trading activity while 55.9% and 3.9% complained that the coastal erosion has been affecting the movement of people and goods both in and outside the community respectively.

Table 5 Economic activities affected by coastal erosion

| Economic activity | Frequency | Percentage |
|----------------------------------------------------|-----------|------------|
| Fishing | 31 | 30.4 |
| Trading | 10 | 9.8 |
| movement of people and goods within the community | 57 | 55.9 |
| movement of people and goods outside the community | 4 | 3.9 |
| Total | 108 | 100.0 |

Source: Authors' Fieldwork, 2016

Inundation Level Scenario

It has been projected that as a result of recent change in climate there will be an increase in the sea level and the effect of these on coastal communities will be highly devastating as it is possible to experience a sea level rise of up to 2 meters in the 21st century (ASI, 2016). Because of this, 3 inundation levels of sea level rise scenarios were modeled using GIS and Remote Sensing techniques. The Digital Elevation Model of the community, and considering 3 scenarios of seal level rise i.e. 0 meter SLR, 1 meter SLR and 2 meter SLR, the result of this analysis as shown in Figure 4 is that if the sea level should rise by 0 meter 1.08% (19.05km²) of the total land mass of the community will be lost, while 4.71% (83.03km²) of the total land area of the community will be lost as a result of 1 meter rise in the seal level and 12.68% (223.63km²) of the total land area of the community will be lost as a result of 2 meters sea level rise. All these are presented in a map format in Figures 5, 6 and 7 respectively with the red region representing the area of land that will be completely inundated by the respective sea level.

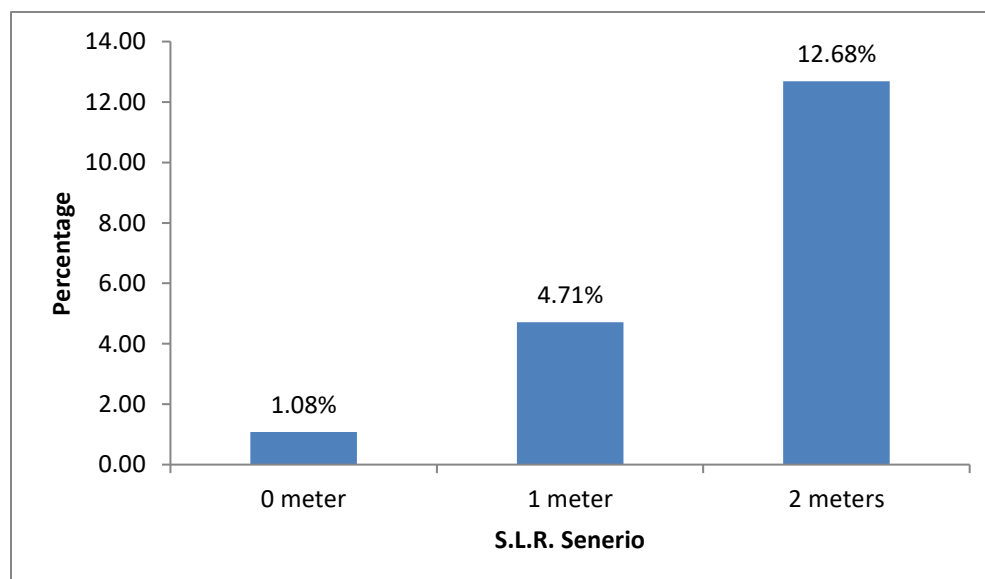


Figure 4 Percentage land loss in scenarios of 0m, 1m and 2m sea level rise (Source: Authors' Fieldwork, 2018)

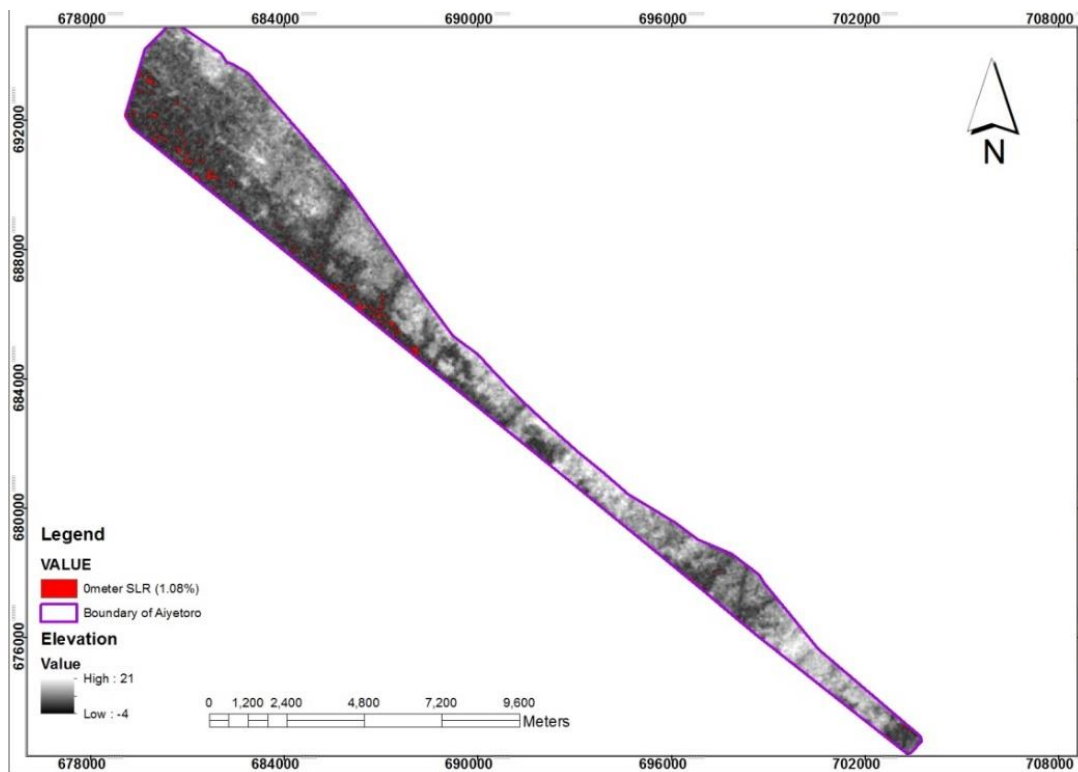


Figure 5 Affected land area by 0 meter Sea Level Rise (Source: Authors' Fieldwork, 2018)

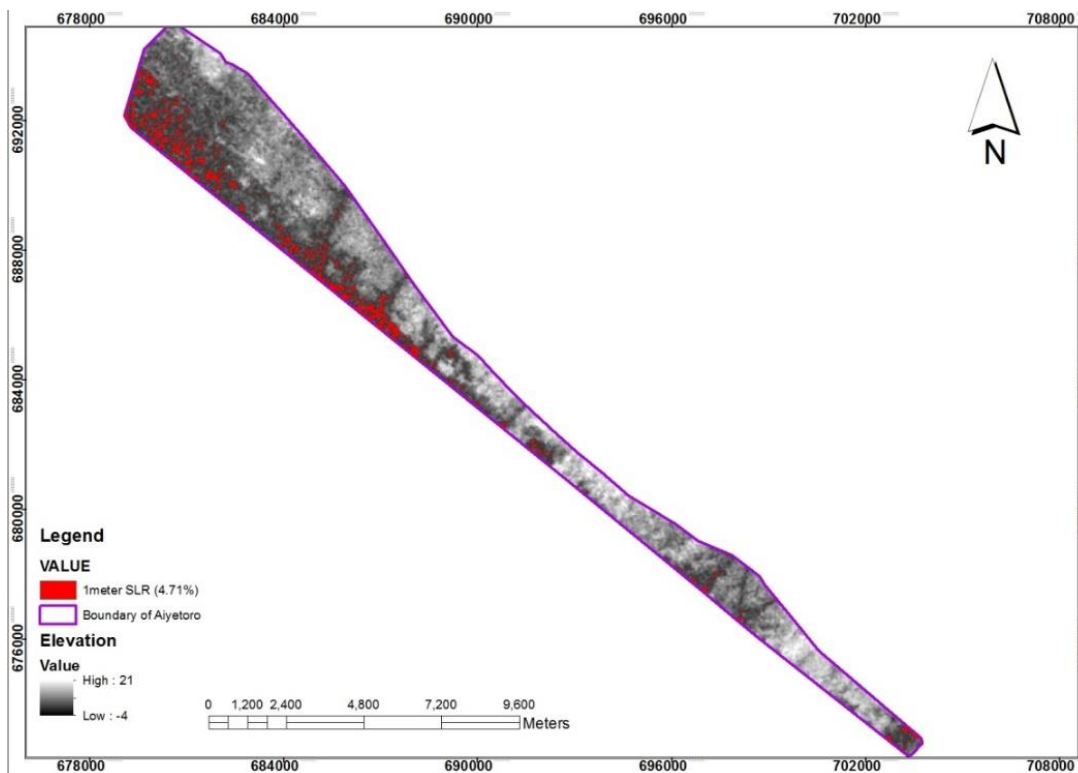


Figure 6 Affected land area by 1 meter Sea Level Rise (Source: Authors' Fieldwork, 2018)

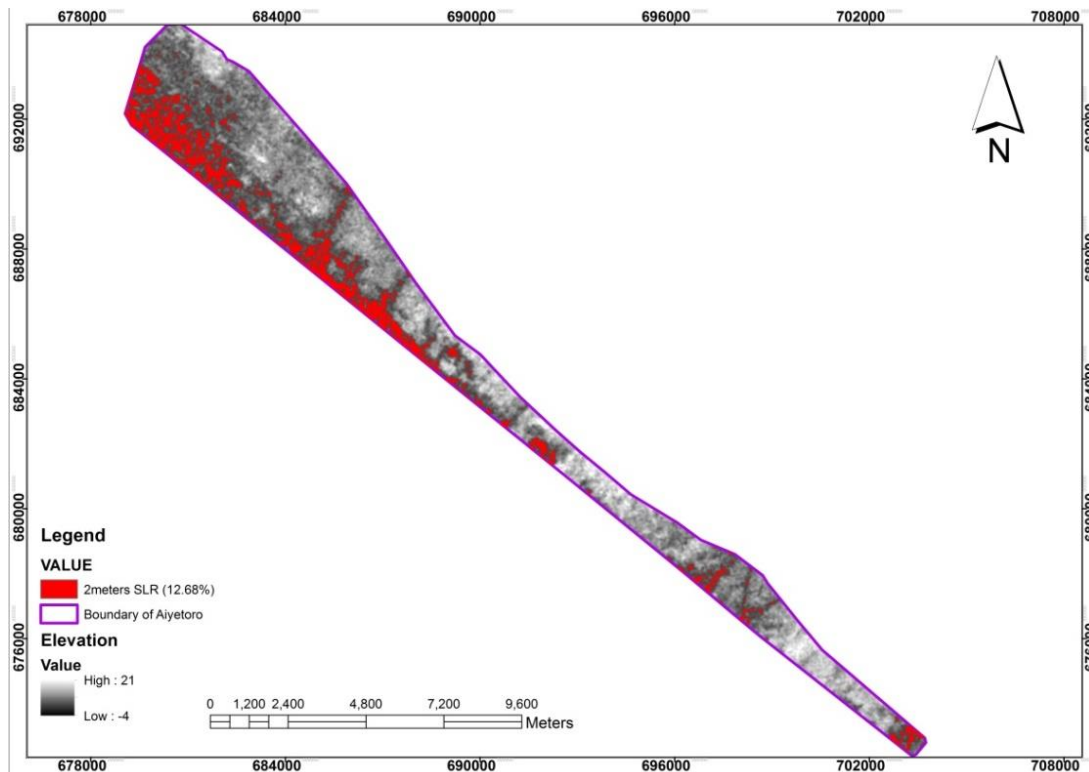


Figure 7 Affected land area by 2 meters Sea Level Rise (Source: Authors' Fieldwork, 2018)

4. CONCLUSION

The coastal communities in Nigeria are experiencing the impact of climate change on their livelihood and they are aware that climate is changing with increase in temperature and rainfall variability and Aiyetoro community, Ilaje Local Government Area is not an exemption. The risks from climate change in the coastal zone of Aiyetoro are increasing, and in some of its part will be more felt in the near future. The effect of these changes on its population and gross domestic product in the near future will be devastating as they will be experiencing a huge loss of land and as a result of this economic activities in inundated areas will be paralyzed and also population will be displaced and this calls for the development of adaptation strategies to contest the present and future effect of climate change in the community so as to reduce to the barest minimum the resulting damage for these hazard in case of eventualities. This can be done m=by relocating people from sensitive areas and regions liable to coastal hazard especially sea level rise along the coast.

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