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ETUDE DE SUIVI DU TRAIT DE COTE
ET SCHÉMA DIRECTEUR LITTORAL
DE L'AFRIQUE DE L'OUEST

ETUDE DE CAS EN SIERRA LEONE

REPORT OF EROSION CASE STUDY: SHENGE, PLANTAIN ISLAND AND BONTHE.

2010

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E. T. Ndomahina & al

TABLE

EXECUTIVE SUMMARY

The shoreline evolution/changes and its associated impact on socioeconomic, political and infrastructural development in Shenge, Plantain Island and Bonthe Township were assessed using a combination of qualitative and quantitative methods. Greater emphases were made in the qualitative methods because we lack long term historic data on the shorelines considered in this study. We only had dataset for Shenge (1986 and 2000) and many residents and key informants of the township had clear evidence/mental records of coastal erosion phenomena that dated back to the 1960s and & 70s. The reliability of this method is judged to be very high because residents of the townships and Islands studied were very knowledgeable about their natural environment and were directly affected by the phenomenon of coastal erosion. Also we had key informants in the study that had lived in the study areas for over 50 years, either as active fishermen or involve in local level administration of their communities.

The study results and findings showed that Resident of Plantain Island were predominantly fishermen and those who do not fish were engaged in fishing related livelihoods (fish processing and trade, fuel wood supply and fish transport and boat/net repairs). Shenge and Bonthe residents were engaged in a mixture of more diverse livelihoods activities and strategies ranging from local level governance (District and Town Councils administration, School Teachers, Clargies, Agriculture, petty trading).

The hydrographic conditions were very variable, with moderate conditions recorded in the rainy season (low to medium salinities), but very high and violent waves that erodes softer parts of the coastline, particularly at Plantain Island.

At Bonthe, high water levels resulting from high river discharge and sediment loads have caused serious problems of siltation in the main river basin and consequent flooding of adjacent river banks causing what may have appeared to be a shift in the shoreline profile, but actually drowning of the original shoreline.

High salinities, particularly in the dry season had caused corrosion of metallic parts of coastal infrastructure, as recorded at Bonthe and the remains of the Slave pen at Plantain Island.

Coastal defence structures at Shenge and Bonthe and lateritic rock outcrops at Plantain and Shenge had demonstrated a significant resistance to the phenomenon of coastal erosion. Even at Plantain Island, where the highest erosion rate was recorded, significant resistance to erosion was recorded in areas where rock outcrops were found. This suggest that, the rate of erosion can be significantly reduced by construction of coastal defence systems at the worst affected Island of Plantain and in some areas of the Shenge headland.

Current rates of erosion at plantain Island, if not prevented/controlled could lead to a complete disappearance of the Island in 50 years or only few rocky Islets remaining as in the case of Monkey, Birds Islets and the slave pen. With the current population of the Island and dependent on fishing by the residents of the Island, a complete disappearance of the Island could be disastrous to the residents and country at large.

In conclusion, results/findings of the study indicated serious erosion problems in Plantain Island and Shenge, and that this phenomenon could be greatly reduces by construction of coastal defense structures like sea walls or piling rocks/gravel along the shoreline in areas where highest erosion rates were recorded. At Bonthe, erosion rate is much slower, but predicted sea level rise could pose a more serious threat to resident of the township.

The livelihoods of most residents of the study sites and infrastructure, particularly at Plantain Island are threatened. At the time of the study, residents of Plantain Island can not cut trees on the island for use as fuel wood for smoking their fish. However, the need for traveling with boats for long distances to fetch wood for fish smoking would be reduced when the fish landing/processing facility constructed at Shenge by the Ministry of Fisheries and Marine Resources is completed and put into use. A similar facility is in Bonthe and could serve in the same capacity, thus reducing deforestationrate of the Mangroves in the Tuners peninsula.

I. INTRODUCTION AND BACKGROUND TO THE STUDY

Sierra Leone has a coastline of about 560km and the shelf covers an area (to 200m depth) of 30,000km2 (Figure 1). The shoreline consists of both rocky and sandy shore backed by swamp communities. Some 200,000 – 3000, 000ha of mangrove swamps fringe the coastline.

Figure 1: Map of Sierra Leone showing location on the West Coast of Africa, whole length of coastline and some parts of neighbouring Guinea and Liberia, inland waterways/water bodies and main cities.

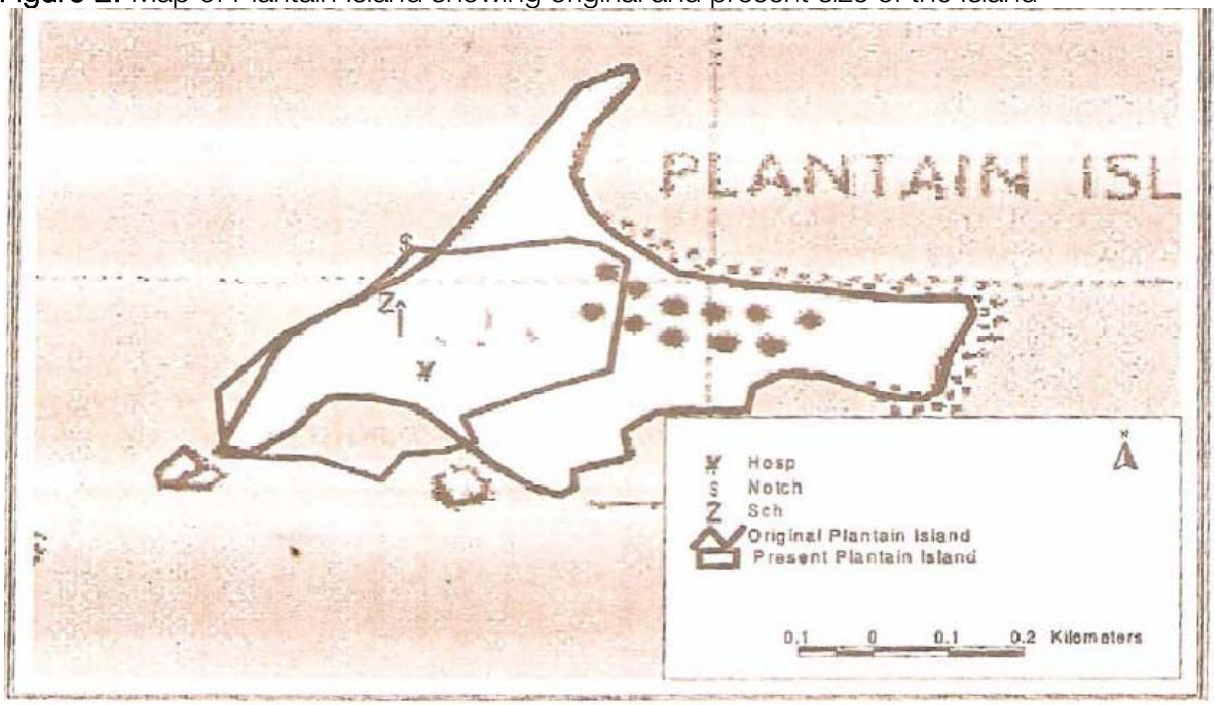
Source: FAO- AQUASTAT, 2005 (http://www.fao.org/nr/water/aquastat/countries/sierra_leone/

The drainage system consists of a series of rivers from North to South including the following:
Great Scarcies, Little Scarcies, Rokel, Jong, Sewa, Moa and Mano. The three (3) main estuaries are part of the following riverine systems: Scarcies, Rokel and Sherbro.

Sierra Leone has a submergence coastline with many drown valleys and offshore Islands (Yeliboya, Banana, Plantain, Bonthe and Turtle). The country's population is approximately 6 million and grows at an annual rate of 2.6%.

The phenomenon of coastal erosion/siltation have led to changes in the contours of the entire shoreline of Sierra Leone (more than 500km long), but this has been recorded to be of greater impacts/concern in small offshore Islands like Yeliboya Island in the North which has changed within the last 80years (1930-2010); Plaintain Island, has been reduced to less than half its original size in 100 years (Figure 2); Shenge, Katta and Tissana which together cover a stretch of 10km of coastline and important coastal ecologies had also suffered from the erosion menace.

Figure 2: Map of Plantain Island showing original and present size of the Island



Source: (Baio,2009)

At Bonthe Island defensive walls against erosion had to be erected to protect the township (figure 3). On the Turners Peninsula the Catholic Mission and some villages on the peninsula had disappeared in the last 100 years. The waterways leading to Sherbro Island are clogged due to heavy siltation thus greatly impeding coastal navigation. The estimated annual sea rise is 0.2cm/yr and the estimated sedimentation rate is 0.5cm-2cm/yr.

Figure 3: Part of the shoreline of Bonthe Town showing the defensive wall constructed to reduce erosion. Now the high tide water goes over this coastal defense barrier.

II. OBJECTIVES OF THE STUDY

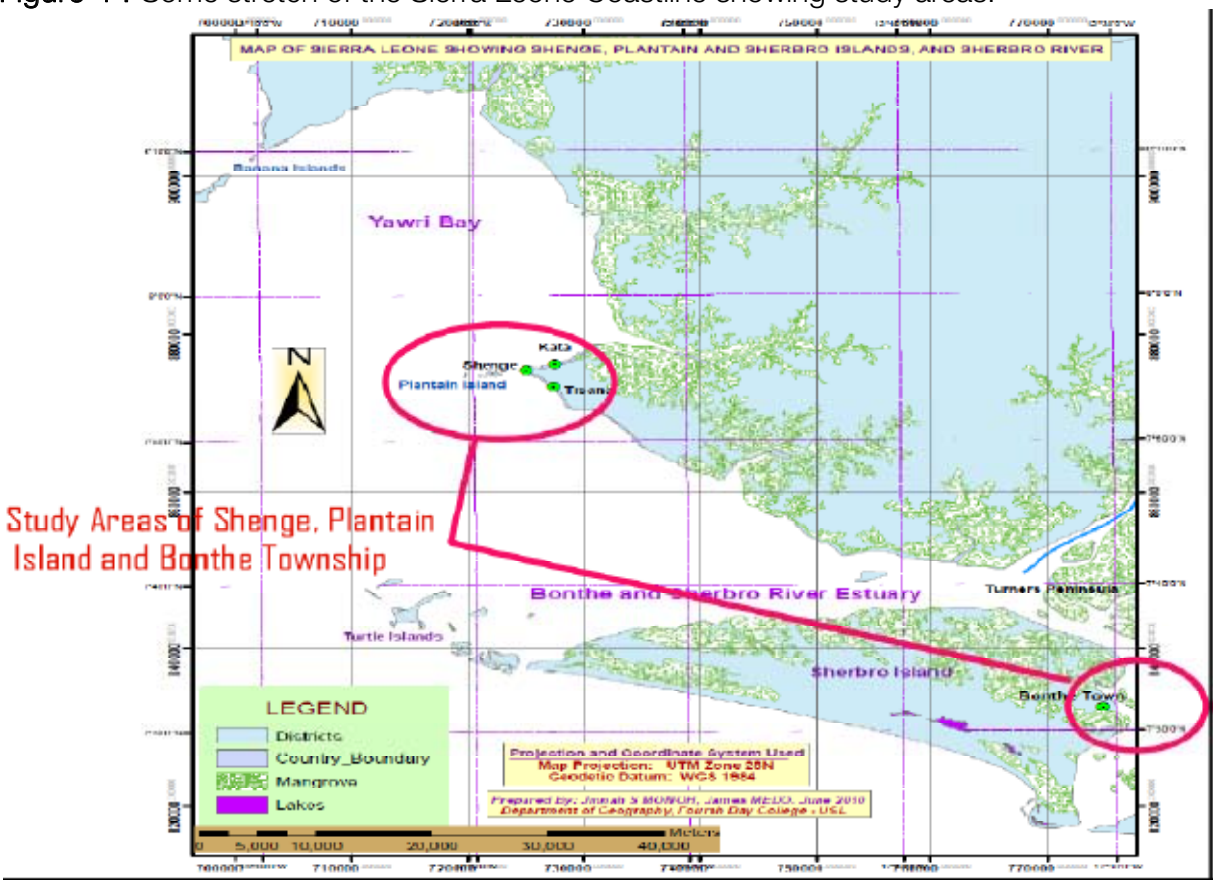
The overall objective of the study is to assess the seriousness and impacts of coastal erosion on the infrastructure and socioeconomic conditions of local communities in Shenge, Plantain Island and Bonthe. Specifically, the rate of erosion is assessed by participatory mapping, observations and historic records of shoreline evolution.

DESCRIPTION OF THE STUDY SITES

1. Plantain Island

Plantain Island is a very important fishing enclave historical site (it was a transit point for the Trans Atlantic slave trade- serving as a Slave Pen and recreational centre for Slavers). The slave pen itself is now completely cut off from Plantain Island and most of its remains now under water. The Island is about 2km from Shenge Town and it is today approximately 500m long 250m wide at its broadest point. This Island is estimated to have been reduced to less than half of its original size by the menace of coastal erosion (Figure 3).

Figure 4 : Some stretch of the Sierra Leone Coastline showing study areas.



Source : Modified from MOMOH and MEDO (June 2010)

The Island's population size is about 3000 of which 1000 are fishers. There are about 200 boats of which 50 are motorised. Fish caught within 7-10miles off the Island's coast are smoked and taken to large towns (Freetown, Moyamba, Bo, Kenema and sometimes Liberia via Tombo and Shenge). There are a few social services (One Health Post, One Primary School, and One Unprotected Water Well a few shops and a video centre), but no toilet facilities.

Figure 5: Fishermen in Plantain Island repairing their fishing nets

Figure 6: Trees uprooted by erosion effects on Plantain Island. Fallen trees were part of the Island

Figure 7: Former Slave Pen now cut off from main plantain Island and most of its remains under water

2. Shenge

Shenge is a Peninsula on the Southern Coast of Sierra Leone adjacent to Yawri Bay. The settlement was founded in 1810 and is today the headquarter Town of Kagboro Chiefdom with population of about 2,500.

Shenge has a landing facility built in 1989/90. The ramp (150m long and 4m wide) is supported by three layers of Maccaferi gabions of average thickness of 2m. Due to the action of the waves, this jetty has almost collapsed. A new jetty is being constructed under the African Development Project (AFDEP). This facility is under less threat from coastal erosion at its southern side but more prone to erosion impacts from the northern side, so a retainer walls have been erected (E.T. Ndomahina).

Figure 8: Old Jetty at Shenge that has collapsed as a result of coastal erosion

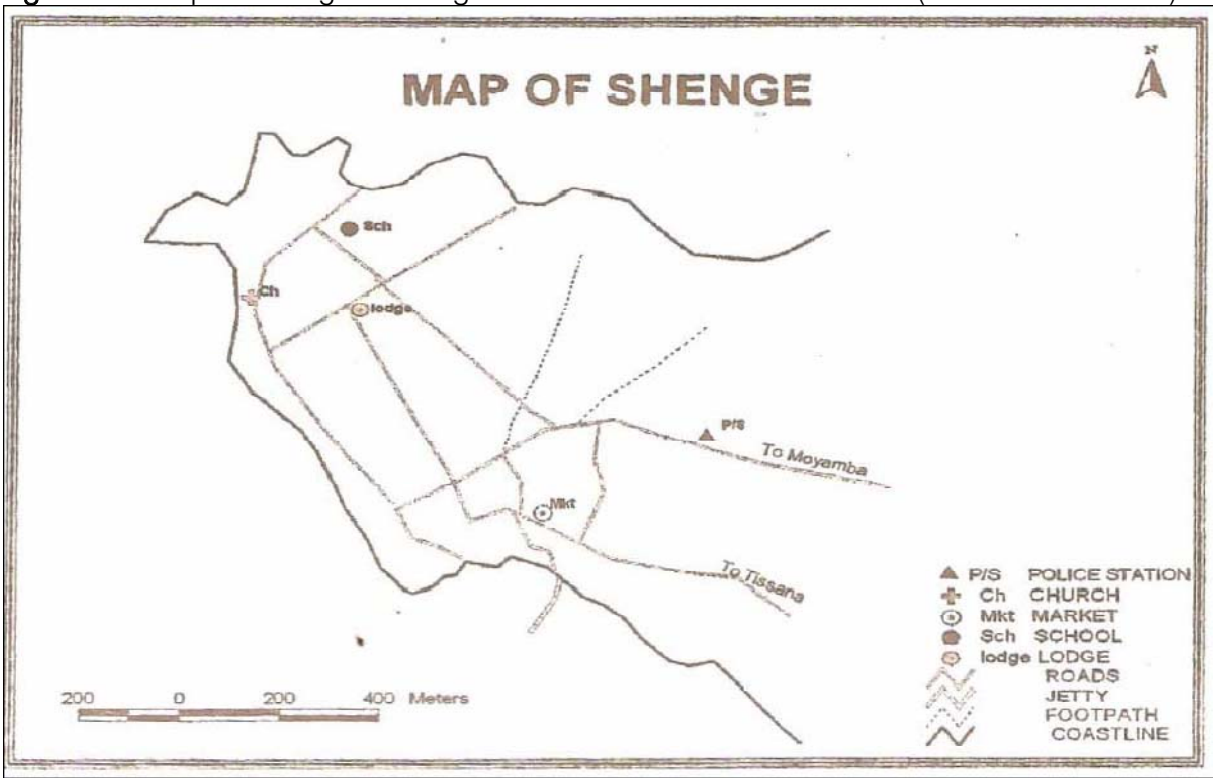
Figure 9: New jetty under construction under the AFDEP Project. Faces lower threat level because the Shenge headland on which it is constructed is far more stable than the area where the first was constructed

The neighbouring villages of Katta and Tissana Point are fishing enclaves founded by migrant Fishermen. Katta has a population of 1000 and Tissana has a population of 2000. Katta has about 40 non motorised boats, one primary school, shops and water well. There is a health centre and Traditional Birth Attendants (TBAs). Tissana point has 1000 fishers and 400 boats.

At Tissana and Katta at low tide, is an extensive shallow/sand with tidal heights of 1.5m. The seashore is advancing very fast with some makeshift houses having been lost over the past 10 years. Residents are moving to higher ground every time from an advancing water front estimated to be about 0.5m per year.

At Shenge, the United Brethren in Christ church founded in 1853 was located on the seafront and has ever since been swept by coastal erosion into the sea (Figure 10).

Figure 10: Map of Shenge showing the former location of the church (now under the sea)



Source: Baio (2009)

The hydrological conditions are similar to those prevailing in the Yawri Bay with surface temperature varying from 26oC - 31oC. Salinity variations are between 31‰-35‰. Wave activities are intensive with heights varying from 0.5m – 1m in the dry season to 2m – 3m in the rainy season. Tidal amplitudes range from 0.5m at lowest neaps to 3.5m at highest springs with coastal erosion very high and wave fronts advancing at a fast rate. Calculation over the past 15 years indicates that the sea level rise is a high as 1.0 – 1.5cmyr-1. The fragile nature of the coastline indicates that Plantain Island will be submerged within a few years (10-20years).

The consequences of the present coastal erosion include:

- Loss of major fishing grounds and communities;
- Loss of historical monuments;
- Destruction of Research Assets;
- Displacement of livelihoods and economic activities; and
- Change in supply of fish, distribution and marketing from that region.

3. Bonthe Town

Sherbro Island the largest of the offshore Island consists of Two (2) chiefdoms (Dema and Sitia). Bonthe Town Municipality is located on the drowned Sherbro River Estuary which stretches for about 80km (as far as Lake Mape). The estuary is stratified and fed by Three (3) major rivers (Kittan, Sewa and Wanje). The mouth of the estuary is about 6km wide at Bendu and the opposite Bank. The 80km long estuary has an average depth of about 3m and maximum depth of 7m around Gbap (20km from Bonthe). This Estuary is under the influence of a semi-diurnal tidal regime. The mean spring tidal range at the mouth between Shenge and St. Ann is slightly over 2m and remains fairly constant between the mouth and York Island before gradually decreasing to 1.25m in the Sherbro Strait.

The estuary is fringed by mangroves for up to 15km. The estuary is vertically and horizontally stratified and in the rainy season the vertical stratification effect could be felt as far as Gbondapi (60km up estuary). The average surface Temperature is about 27oC. The surface salinity values in Bonthe are about 35‰ in the dry season and about 34.8‰ in the rainy season.

At Gbondapi, the surface water is fresh and serves as a source of freshwater all the year round.There is heavy siltation at the mouth of the estuary around Bonthe thereby reducing the depth to less than 2-3m at high tide in the rainy season. The sand is coarse and extends to more than 5km up the Turner's Peninsula. In the middle courses are mud/sand sediments and wave activities are moderate, with heights of about 1m. Coupled with heavy river discharge there has been a deposition of silt in the main channel about 300m from shore. The area is slightly sheltered with tidal heights of about 1.25m to 1.5m. The average surface salinities here are about 22‰ to 33‰. The surface temperature varies from 25oC to 30oC.

The muddy environment and relatively high salinity lead to corrosion of the surfaces of marine structures; the high densities of benthic fouling organisms that often settle on surfaces further cause their deterioration. Sherbro River Estuary is a navigable water way linking important villages and towns. Trade in the coastal areas is mostly by sea. Mining activities and coastal erosion along the Turner's Peninsula have led to the disappearance of many villages and towns in the last 50 years. The right-hand side of the Peninsula (from Mouth upriver) is eroding very fast and taking with it sacred groves, graves and relics (churches, schools). Ngayeinga a village with a population of 500 and 50 houses in 1970 had by 1990 been completely submerged and inhabitants relocated to higher ground. A catholic Missionary Institution (Ma Bay) founded in early 1900's suffered a similar fate.

Bonthe Town has a population of 6000 and is situated on a flat sandy terrain, protected with dense vegetative cover. The town has three (3) secondary schools, a technical college, modern holiday resorts seven (7) primary schools, a well-built government hospital, a district office, library, a Clock Tower and an airfield – all constant reminders that Bonthe was during the colonial period a thriving business community.

The Bonthe Town shoreline was protected by building a defensive wall in the 70s which has now either been seriously eroded or is completely under water at high tide. Important slipways for private companies (PZ, CSE) have been lost. Landing facilities have either been lost or badly damaged. Close to 35 artisanal boats land at Bonthe every day bringing goods

and taking fish and other food items to the mainland. At least 10 artisanal cargo boats (Pampas) are based in Bonthe and on market days in Mattru Jong and Gbondapi as many as 60 boats may use Bonthe as a transit point. A very modern fish receiving and processing centre is under construction.

III. DATA COLLECTION PROCESS

Data was collected from published and official sources (secondary data) and from field work (primary data).

3.1 SECONDARY DATA SOURCES AND COLLECTION METHODS

The Central Statistics Office (CSO) conducts a series of annual Households Surveys collectively called Sierra Leone Integrated Household Surveys (SLIHS); and they conducted a National census in 2004. These surveys are financed by the World Bank and the United Nations Fund for Population studies. Reports and data generated from the surveys and Census are also available on the Official website of Statistics Sierra Leone1

The raw data generated from these surveys and census (electronic) was solicited from the Director of Surveys and processed data and reports from the surveys/census were downloaded from the official website of Statistics Sierra and the World Bank.

Most useful data obtained from the statistics office was the population estimates and the dominant livelihoods in the study areas.

The Ministry of Fisheries and Marine Resources in collaboration with the Institute of Marine biology and Oceanography (IMBO) conducted fisheries baseline surveys collectively known as IMBO Frame Surveys data on all fishing activities (fishing boats, gears, household structures and livelihoods activities, etc) were all recorded. These data were acquired and relevant information extracted.

Landsat images were downloaded from the United States Geological Surveys (USGS)

website2: and from http://wwwmaproom.psu.edu,

3.2 PRIMARY DATA COLLECTION METHODS

To ensure a rapid and complete coverage of the issues of interest Rapid Rural Appraisals (RRAs), Participatory Rural Appraisals (PRAs) and Questionnaire Surveys were integrated. These were used to generate both qualitative and quantitative data socioeconomic conditions of the communities of interest.

Participatory Rural Appraisal (RRA) methods were used because the study sites Bonthe and Plantain Island are isolated from the mainland and communities living in these Islands know and are expected to be concerned very much about the phenomenon of coastal erosion as this may impact directly on their very survival and socioeconomic conditions. Participatory methods of research placed emphasis on learning from the people themselves and identifying their needs and priorities (Townsley, 1996). PRA allows local people to present their priorities for development and get them incorporated into development plans (Townsley, 1996).

Participatory Rural Appraisals (PRAs) tools used in the study included :

- Transect walks,
- Focus Group Discussions (FGD),
- Key Informant interviews,
- Participatory mapping using expert knowledge and GPS

3.3 TRANSECT WALKS

Transect walks are a highly participatory and relaxed technique that enhance local knowledge and can be used in low-literacy communities like Sierra Leone (Barton, Borini-Feyerabend, G., and de Sherbinin, A.,1997). Transect walks carried in this survey were observational walks, during which attention was specifically paid to people, activities, resources, environmental features and impacts of coastal erosion on coastal infrastructure. Key informants lead the walks and as we walked along, we posed several questions on observable features and their perceptions. We conducted two separate walks for each of the sites.

1) Social transects- focus on housing types, infrastructure and amenities, religious and cultural features and behaviors, economic activities, skills and occupations. These were done along the shoreline all round Plantain Island Shenge, Township and across Bonthe Town and along the shoreline. As we moved along, we recorded relevant features using GPS, digital camera, digital voice recorder and field notebook.

2) Land-use transects- focus on environmental features (such as water bodies, land, forests, soil types and elevations). Evidence of Agricultural practices were sought and a boat was required for this aspect of the survey as some of the features of interest were isolated from the landmass by water as a result of erosion for example we used the boat to go to the slave pen, birds Island and some rocks identified by our key Informants to have been part of the main land of Shenge

Before setting of for the walks, PRA team members were briefed on the relevance of the data collection exercises we were about to undertake and given basic training and a decision made as to what issues to focus on and what information needed to be collected and why?

The PRA team comprised of a Research Assistant at IMBO, two extension agents of the Ministry of Fisheries and Marine Resources, the Harbour Master and Master fisherman in each of the sites studied. At Plantain and Bonthe, the naval officers of the Republic of Sierra Leone Armed Forces were also part of the team. The Village Headmen in Shenge and Plantain, the Council Secretary and Mayor of Bonthe Township, Non-Governmental Organisations (NGO) officials, village school teachers and youth leaders were identified as key informants and incorporated in the exercises as and when they were available and willing to participate. The purpose and relevance of the exercise was discussed with the communities involved.

3.4 FOCUS GROUP DISCUSSIONS (FGD)

Focus groups are semi-structured discussions with a small group of persons sharing a common feature e.g., Fishermen in a Village, fish processors and fish traders and wood cutters (Barton, Borini-Feyerabend, G., and de Sherbinin, A.,1997). Participants of Focus group Discussions were people who were knowledgeable and interested in the topics discussed (Barton, Borini-Feyerabend, G., and de Sherbinin, A.,1997); (THEIS, 1991). Two Focus Groups discussions with a minimum of 4 and maximum of 6 participants were held in each of the three study sites. Each discussion lasted for approximately one hour. A list of topics on social amenities was prepared and Google earth images and maps of the sites of interest printed on sheets of papers were used. Group members were given these papers and asked to identify some features on these images/maps. After several discussions, the groups came into agreements and identified the structures/features. They were also able to point out changes that may have occurred over time on the features highlighted on the maps, example some of the Isles were too small to be shown on the maps/satelight images so the groups pointed that out (see Figs 12 and 13)

3.5 KEY INFORMANT INTERVIEWS

These were Semi-structured interviews using lists of broad, open-ended questions. Individuals interviewed were assessed by other community members as being knowledgeable in various aspects of the research e.g. local knowledge on fishing and coastal navigation, involvement in development projects at the local level, land owners and community leaders, Village Headmen and chief and youth leaders. The interviews were conducted in a conversational, relaxed and informal way. The interviewees were people assessed in their communities to be very knowledgeable on use and local management of natural resources.

Interview guidance notes were prepared and the Village Chiefs, headmen, Youth Leaders and Women Group Leaders asked to give the names of individuals in their communities that they think are knowledgeable on issues in the guidance notes. The names given were pooled and then those whose names were given by most people were selected as key informant for the above semistructured detailed interviews. Once the list of those to be interviewed in a community was finalised, members of the RRA team were assigned each to a key informant. Using the guidance notes, the key informants were interviewed. The information supplied by the key informants during these interviews were recorded using a digital voice recorder and a field notebook and at the end of the exercise, the responses were pooled together and analysed.

3.6 PARTICIPATORY MAPPING EXERCISES

A Garmin Legend HCx was used to record GPS points of landmarks identified by community elders and key informants as having been on land originally and now under water. Several GPS points depicting historic shoreline profiles were recorded in the GPS as waypoints for later download into the computer. Waypoints descriptions were noted in our field notebook.

The period or date at which recorded shoreline profiles where in existence were also noted for subsequent estimation of rates of shoreline retreat in the study areas. Important landmarks such as small Isles like monkey Island, Birds Island, the Slave pen, rock boulders and tree stumps that were part of the land mass, but uprooted by erosion wave action were used as reference to demarcate the historic shoreline.

Band five of Landsat images for Plantain Island and Shenge for 1986 and 2003 were compared to identify changes on the sizes and numbers of Isles that were there in 1986 and in 2003 and a comparison made with the number of Isles that were there today at the time of the study visit.

Key informants were asked to draw simple maps of Plantain island as they perceive it several years ago and how it looks like today. They were also asked to give reasons why they think these changes had occurred the diagrams were drawn on the sand.

3.7 DETERMINATION OF HYDROGRAPHIC CONDITIONS AT THE STUDY SITES

The hydrographic conditions which included wave height, tidal heights, currents, salinity, pH, dissolved oxygen, temperature and turbidity at the time of the field visit were measured using the insitu metres described below. Additional Information was also solicited on the possible changes in hydrographic conditions at the various sites from the key informants

- Tidal/wave height (VALEPORT Model 740 Portable Tide Gauge)
- Current (VALEPORT LIMITED Model 740 Portable Water Level Recorder)
- Salinity (Waterproof salt tester 10.00ppt)
- pH, conductivity and Temperature (EcoScan pH6 pH/mV/oC)
- dissolved oxygen (CyberScan DO 300: dissolved oxygen/oC/oF Data metre)
- Turbidity (Sechi disc)

3.8 DATA ANALYSIS

Back at the Institute, the GPS points (lat/long in Degrees, minutes and seconds) recorded for the shoreline profiles were entered into excel database and converted into decimal degrees. The converted data was subsequently imported into ArcView GIS as shape file in spatial projection. The same data points were imported into Google earth map for the areas of interest and zoomed out. The zoomed images of interest were copied and pasted into Adobe Illustrator for cartographic work. Data on the Socio-economic conditions of the village communities and how coastal erosion may affect their livelihoods were analysed and reported as qualitative information.

IV. RESULT/ FINDING AND DISCUSSIONS

4.1 HYDROGRAPHIC CONDITIONS

The hydrographic conditions at the selected study sites are given in Table 1 below. The water temperatures ranged from 26o C to 30 o C depending on the season and state of the tide (high or low tide). The pH was slightly alkaline, ranging from 7.8 to 8.7. Salinity values fluctuates from a low of 20 parts per thousand to the highest recorded in Sierra Leonean waters at 35 %o depending on the season (dry or rainy season), with highest values recorded in the dry season and lowest values recorded at the peak of the rains.

Dissolved oxygen at the surface waters was relatively high but highly variable depending on time of the day measured, water temperatures, salinity and sea state (calm waters had lower levels of dissolved oxygen, where as high dissolved oxygen levels were recorded during violent wave actions at the study sites.

Wave heights varied from a low of 0.2meters at Bonthe to a high of 2.0 meters at Plantain Islands depending on the state of the tide. Lowest wave heights were recorded at low tide and highest wave heights were recorded at high tides in all the sites studied. Highest and most violent waves were recorded at Plantain Island at the open sea and lowest waves were recorded at Bonthe which was at the Sharbro River estuary (see Table 1)

Table 1: Hydrographic conditions of the study sites

Study sites	Water Temperature	pH of the sea water	Salinity	Dissolved Oxygen	Wave height	Tidal range and no. of tidal cycles
Shenge village	28 – 30 oC depending on tidal state	8.0 – 8.6	28 – 34 %o	5.44 – 7.42 mg/l	0.5 – 1.5	1 – 2 metres depending on season and lunar moon state
Plantain Island	26 – 30 oC depending on tidal state	8.0 – 8.7	28 – 35 %o	5.92 – 7.12 mg/l	0.5 -2.0	1 – 2 metres depending on season and lunar moon state
Bonth Town	26 -29 oC depending on tidal state	7.8 - 8.4	22 - 30 %o	6.82 – 7.23 mg/l	0.2 – 1.0	1 – 2.5 metres depending on season and lunar moon state

4.2 SOCIO ECONOMIC CONDITION/CHARACTERISTICS OF RESIDENTS OF THE SELECTED

Areas of the study The majority of residents at Plantain Island were either fishermen or engaged in fishing related livelihoods of fish processing, wood supply/transport, boat and net repairs and fish trade. There were more diverse livelihoods in Shenge and Bonthe with activities ranging from academic (teaching in schools), Trading, Local Government administration, and some civil servants. Less fishing activities take place in Shenge and Bonthe but Shenge serves as a transit point for fish landed at Plantain Island, Kata and Tisana point. Even though the motor road from Shenge to Moyamba is in poor condition, there is regular commercial road transport from Shenge to Moyamba.

Table 2 : Socio economic characteristics of the Study sites

Study Site	Population size	Registered voters	No. of fishers	Age range of fishers	No. of fishing boats	Types of boats	No. of boats motorised	Distance from village to fishing grounds	No. of fishing trips per day
Shenge village	3400	500	60	10 - 45	40	Std 1-3 Crew 1-3	All are non motorized except the Dept. of Fisheries Boat	7- 8 miles	1 to 2 trips depending on sea condition
Plantain Island	3200	1000	1200	8 - 70	420	Std 1-3 Crew 3-5 Crew 5-10	60 motorised, the rest are not and used paddles, poles and sales	7 – 10 miles	1 - 3 trips depending on sea condition and fishing methods
Bonth Town	6000	2000	500	10 - 50		Std 1-3 Crew 3-5 Crew 5-10	40	2 miles	1 to 2 trips depending on sea condition

HOUSING AND LIVING CONDITIONS

The housing facilities were essentially built from sticks/poles and mud walls and thatched roofs. Despite the appearance of some of the small makeshift homes, Plantain island is a long established and permanent settlement. The villagers reported that most of them had had to rebuild their houses 3 to 4 times as the water kept displacing them. Asked why they would not build their houses farther away from the shoreline, they said they needed to be close to where they anchored their fishing boats.

On the contrary, the housing facilities at Bonthe Island and Shenge were much stronger and not much threatened by coastal erosion. This is apparently because at Bonthe, a coastal defense wall was built to protect most part of the township adjacent to the shoreline. On the northern side of the Township, erosion was recorded to be much higher and in areas where the defensive wall still resists erosion, the areas are flooded including the wall itself.

Figure 11: one of the best houses on the Island with a fence made from sticks and rice bags, threatened by coastal erosion

Figure 12: most common type of housing units found on the Island. The fishermen can rebuild the house if broken down by erosion as most of the building materials are obtained from the natural environment (forest and grassland)

Figure 13: Colonial Government Building where high tide water goes very close now

Figure 14: A residential block built in the 50s now threatened by flooding, especially at high tide

Figure 15: Defensive wall build in the 50s no loner protect the coastline as this wall is under water at high tides

Figure 16: Northern side of the Island where no wall was constructed- erosion rate /flooding effects was recorded to be higher

There was a serious shortage of water in all communities visited; water quality was very poor. Wells in Bonthe and Plantain encountered brackish water at only 3 or 4 meters depth. We encountered two canoes carrying water back to Plantain Island from Shenge.

Figure 17 :

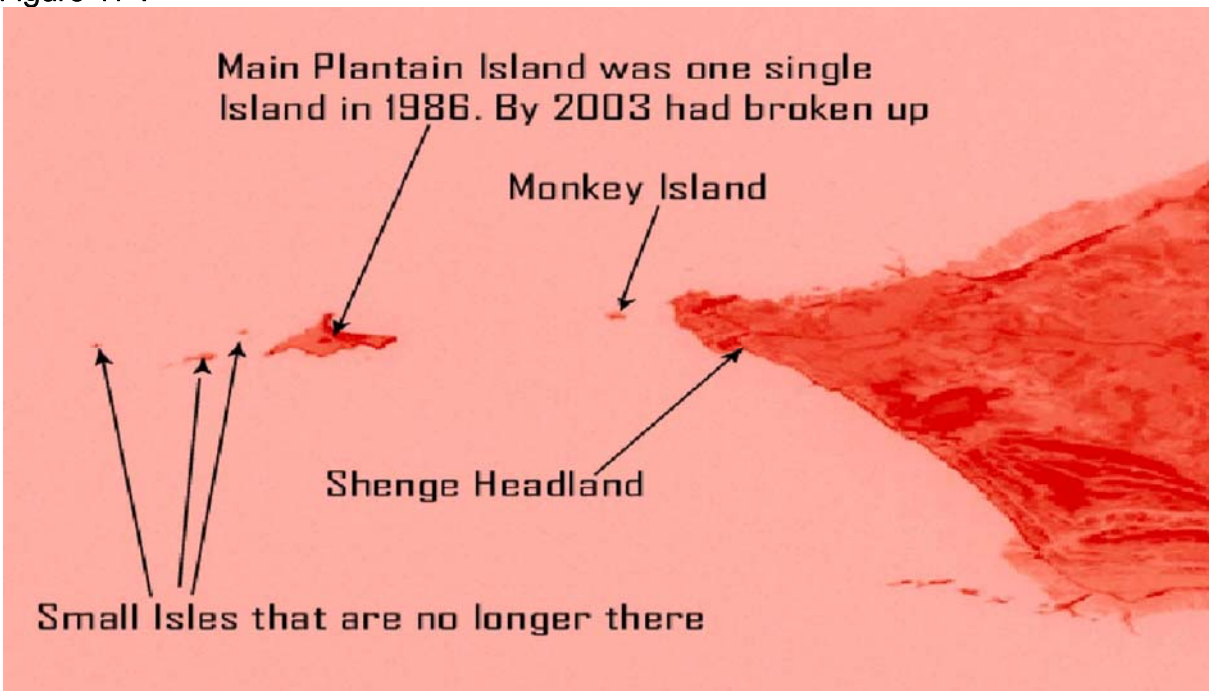
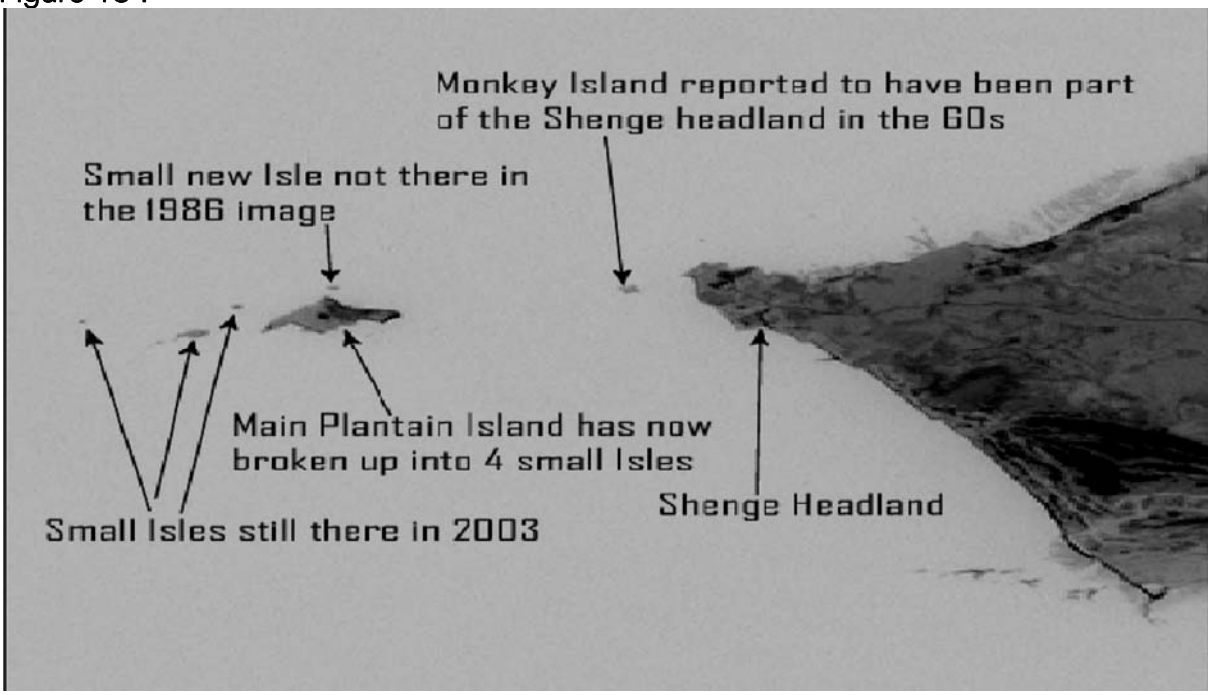
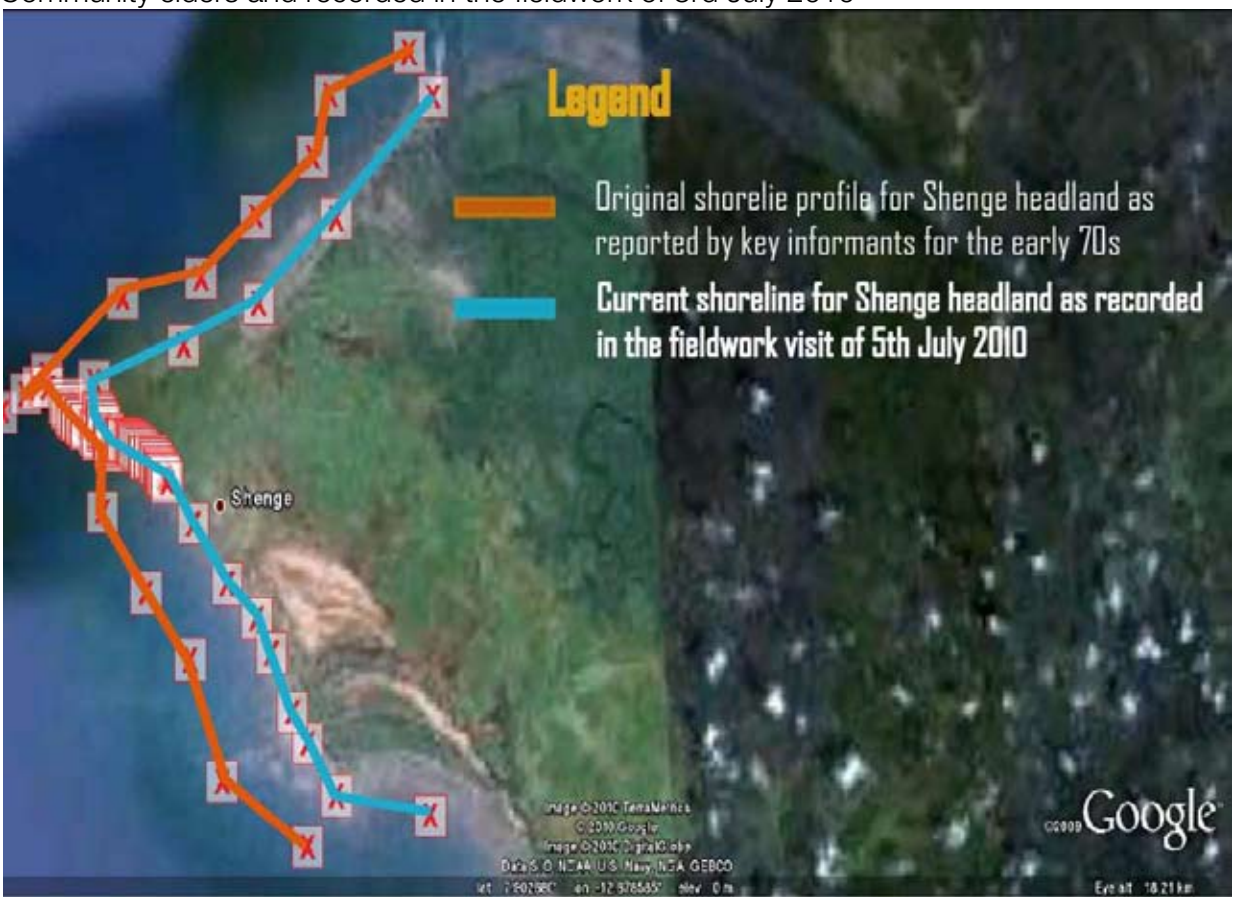


Figure 18 :



4.3 SHORELINE PROFILES AT SHENGE HEADLAND AND COASTAL EROSION RATE

Figure 19: Original and current shoreline profiles of Shenge as reported by Village Community elders and recorded in the fieldwork of 3rd July 2010



Coastal erosion is roughly uniform along the northern side and lower southern side of the Shenge headland, at the tip of the headland (Shenge Town) and towards Tisana village in the southern end f the Peninsula (Figure 13), erosion rate was reportedly/recorded to be slower.

Figure 20: Laterite rocks outcrops that dampens wave energy before hitting the shoreline

Figure 21: sandy shore suffering greater erosion impact. Coastal defense wall had to be erected to reduce the impact of wave action on the shoreline

Figure 22: Digital photo of rocky Shenge shoreline were slower rates of erosion were recorded for the period 1970 to 2010

Figure 23: Digital photo showing sandy and silt shoreline with high coastal erosion rate at the northern side of the Shenge headland for the period 1970 to 2010

It was observed during the participatory mapping exercise that areas along the shoreline that are rocky recorded slower erosion rates relative to sandy silt and clay shoreline areas (Figures 20 - 23). Similarly, at some point near the Shenge Township, a protective wall was built in 1989 which has also contributed to the slower rate of erosion close to the tip of the Shenge headland.

Most of the shoreline along the Shenge Peninsula was either sandy, silt, clay or a mixture of all these at various proportions, thus the relatively uniform erosion rate recorded all along the shoreline except in at the rocky tip and point where the protective wall is constructed (Figs21).

4.4 SHORELINE PROFILES AT PLANTAIN ISLAND AND COASTAL EROSION RATE

Figure 24: Original and current shoreline profiles of Plantain Island as reported by Village Community elders for the early 70s and recorded in the fieldwork of 4th July 2010

The rate of erosion at Plantain Island was very high all around the Island except on the north eastern tip where laterite rock outcrops slow down the rate of erosion. Vegetation cover on the Island do not seem to deter the erosion rate at all as could be seen by the remains of trees uprooted by the phenomenon littering places that used to be part of the Island landmass(Figures 25 -27).

Figure 25: South western end of the Island

Figure 26: Northern end of the Island

Figure 27: Southern end of the Island showing erosion effect on trees

Figure 28: Lateritic rock outcrops slowing down erosion at the north-eastern side of the Island.

Observation during the participatory mapping exercise with Harbour Master and Master fisherman.

There was no coastal defense system in place for this small Island and it is believed that if nothing is done to protect the remaining small landmass inhabited by this fishing community, the whole Island could be lost into the sea. Local fishermen were aware of this threat and reported that this was the main reason why they were mostly living in make shift houses which would not be expensive to rebuild when washed away by waves (Figure 11 and 12).

A relatively small area along the Islands' shoreline had some laterite rocks outcrops which had prevented rapid erosion recorded on the north eastern side of the Island (Figures 28).

On the other hand, monkey Island which is much smaller than Plantain Island has resisted rapid erosion over the same period because it has laterite rocks on the shoreline all around it (Fig. 30).

Figure 29: Digital photo from current shoreline of Plantain Island showing land marks at a distance identified by local communities as marking original shoreline in the 70s.

Figure 30: Monkey Island reported by key informants to be originally part of the Shenge mainland in the early 60s. the Island is now over 300 meters away from the Shenge mainland.

4.5 SHORELINE PROFILES AT BONTHE TOWN AND COASTAL EROSION RATE

Figure 31: Original and current shoreline profiles of Bonthe Township in the Sharbro Island plotted onGoogle earth image as reported by Village Community elders for the 60s and recorded in the fieldwork of 5th July 2010.

At Bonthe Town, the shoreline profile change between 1950s and 2010 suggest a higher erosion rate at the north than the South. This could be as a result of the fact that the coastal defensive wall constructed along the southern end of the Island.

Figure 32: Landsat image (JPG) of Bonthe Town showing shoreline changes between the 60s and 2010

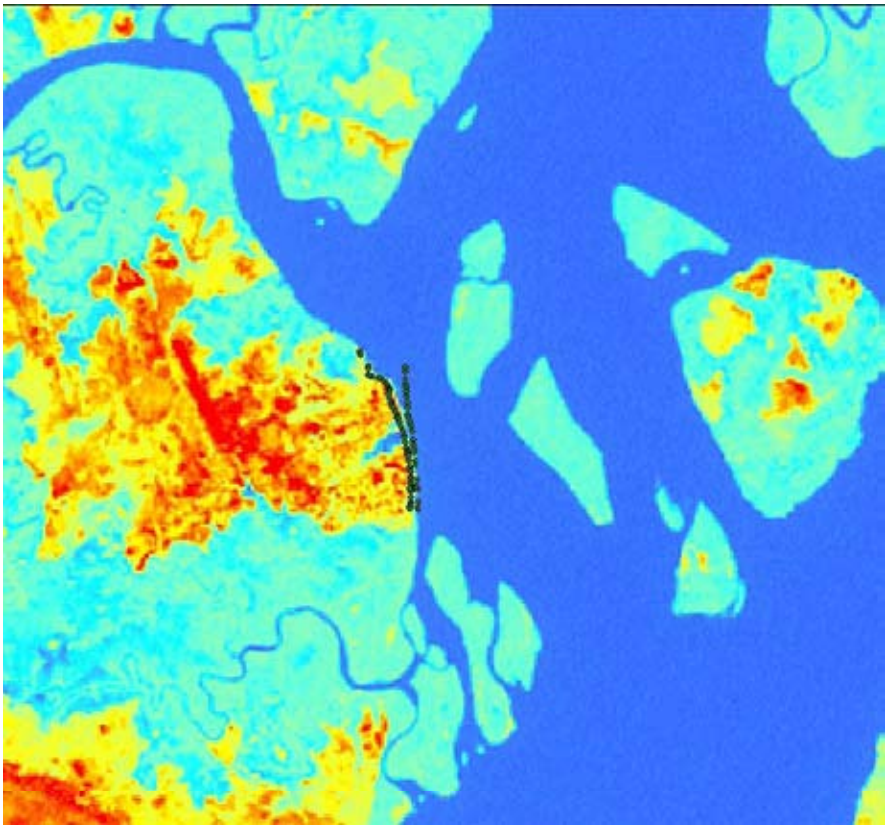
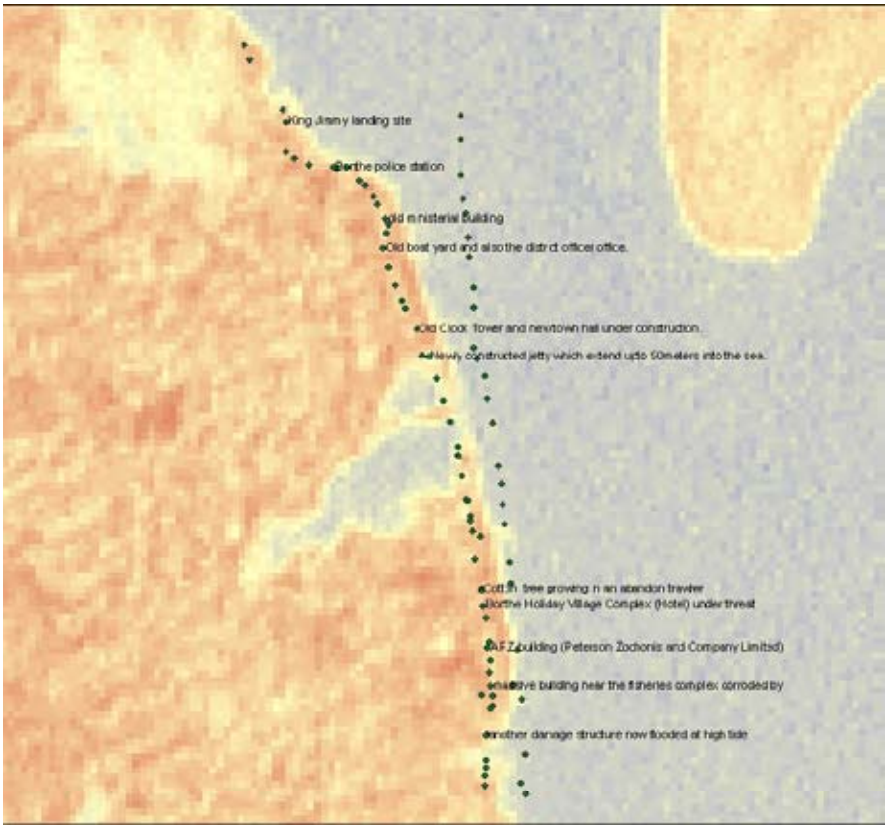


Figure 33: Landsat image of Bonthe Town showing threatened infrastructure mainly by flooding



It appears that the change in shoreline profile of the township may be partly attributed to some river water level rise as a result of siltation in the Sherbro river estuary. Siltation is high in this estuary because of the mining activities of Sierra Rutile Mining Company, former Sieromco Mining Company, and the Diamond mining at Kono which is causing a high discharge of sediments into the estuary through the panpana and Sewa Rivers. It is suspected that because the Sherbro river basin volume has been reduced as a result of siltation from the mining activities, the water displacement is causing local flooding in Bonthe Island which has been recorded in this study as shoreline changes. The siltation is now more of an obstruction to coastal and inland water transport than it is to erosion problem. What was recorded to be more of a problem is corrosion of metallic structures.

V. CONCLUSION

The result of the study showed that Plantain Island had experience the highest rate of erosion as is in a more violent wave environment and erosion is taking place all round the Island. Also the absence of rocks all around the Island is the may have facilitated the recorded high rate of erosion on the Island. Much more damage to infrastructure and historic site were also recorded in this Island than Bonthe and Shenge put together and there is a likelihood that the Island may completely disappear in 20 years if the geology of the Island is all sand with only the patch of laterite rock outcrops on the Northeastern tip.

At Shenge, the calmer waters of the Bay (Yawri Bay) may have been responsible for the relatively lower rate of erosion on the headland. However on the southern side of the headland, erosion could have been a lot higher than recorded in this study had it not been for the rocky geology and the coastal defense wall constructed in some parts if this headland.

At Bonthe, erosion is negligible; rather silt mud and sand transport from the Pampana and Sewa Rivers from the mining activities is the main concern. At the current rate of siltation, dredging activity may need to be carried out to facilitate easy inland and coastal transport into and out of the Island.

VI. RECOMMENDATION

There is urgent need to construct a coastal defense structures around the Plantain Island before further damage is caused on the tiny bit of the Island that is remaining. The Defensive wall at Bonthe should be rebuild/strengthened but more so extended to areas previously not protected and the city had expanded into those northern areas of the Island.

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