International Journal of Scientific & Engineering Research, Volume 2, Issue 11, November-2012
ISSN 2229-5518

Coastal Erosion in Sierra Leone

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Abstract— Sierra Leone is a West African country bordering the North Atlantic Ocean, between Guinea and Liberia. The country which has a total land mass of 71,740 sq km and has 406 km of coastline has been having problems with coastal erosion due to various natural as well as human coastal activities. Some of the possible causes of the eroding landscape and coastline synonymous to Sierra Leone were highlighted and discussed. Various erosion mitigation measures were raised for the benefit and attention of concerned parties, with the aim of aiding the formation of an Integrated Coastal Zone Management policy for Sierra Leone, which would effectively address coastal erosion management, prevention and mitigation.

Key words— Coastal erosion, erosion mitigation measures, coastal zone management policy for Sierra Leone,

1. INTRODUCTION

Sierra Leone is a tropical country with an average annual temperature of 27 degrees centigrade and average annual precipitation varying from 5,080 mm along the coast to 2,160 mm in the extreme interior. There are two distinct seasons, the dry season from November to April and the rainy season and the wet season from May to October. Air humidity is as high as 80-90% during the dry season and a humidity of 70-80% during the rest of the year. The country is found on the West coast of Africa having a total area of 72.325km2 with a coastline of 402 km. It lies between latitude 6°55 and longitude 10°00. It is bordered in the Northeast by the republic of Guinea, in the south and southeast by Liberia and in the West by the North Atlantic Ocean. The coastline stretches along 402km. The continental shelf has a width of 125km. The 50m isobaths is 15 km to the south and at around 100km from the coastline in the north. The coastline is also very irregular in formation. The coastal land form of Sierra Leone can be seen in figure forming many bays and peninsulas. Fresh water swamps and mangrove swamps occupy large extents of the coastline and the coastal plain is characterized with a large number of estuaries.

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Erosion along the coast in Sierra Leone is phenomenon that has long been of great concern to the most affected communities. Its causes usually range from global to local.

Sierra Leone is one such nation which is experiencing coastal erosion due to natural and man -made causes. During the stormy months of August and October, wave heights can reach up to 3 meters along the coast. Fishing activities is very much part of the lives of

many Sierra Leoneans along the coast. Other activities such as diamond and gold mining along rivers is also very common. In other words, the 402 km coastline of this small West African country is interwoven into the daily activities of its inhabitants. An eroding coastline is eminent in most areas with a greater extent in the Kabala region in the North. To most of the local inhabitant it may be seen as just a natural phenomenon, for which they need not worry about. Owing to inadequate sensitization, high illiteracy among coastal communities and to some extent ignorance, the issue of erosion has not been given the attention it deserves. In most cases inhabitants along rivers and coastlines fail to understand that their activities may have some effects on the environment, thus leading to erosion.

Erosion is more or less the wearing off of a surface or loss of land due to wind water and other natural or man-made causes. This process can take place over a period of time or may happen at an instant, depending on the prevailing circumstances. For a coastal region the concept is more or less the same but very much dependent on sediment motion, tidal currents, beach dynamics and human activities. The coastal form of Sierra Leone can be seen in **Figure 1**.

2. METHODOLOGY

The likely causes of erosion in general were looked at, and the causes which were found to be more prevalent along the Sierra Leone coast were elaborated on, as seen bellow:

Causes of erosion along the coast of Sierra Leone:

(1) Gold and Diamond Mining along river channel (Alluvial Method)

Sierra Leone is a country which has gold and diamonds, along flowing streams and rivers. Channel gravel mining (Alluvial method) activities by the locals, involve gravel collection. This activity mostly takes place along the Moa River, Mano river, Sewa River, Bafi and Woa Rivers where diamond and gold deposits are high along the banks. Huge quantities of gravel suspected to have diamonds and gold are collected from these rivers on a daily basis. The gravel is then sieved to obtain the precious gems. In most cases, the gravel residue is never returned to the extraction site but used for domestic purposes such as building local mud houses. This will consequently have an effect on the sediment deposition along the beach or coastal areas, thus triggering erosion.

(2) Sand Mining for construction

Sand extraction from the coast for construction purposes has also devastated the coastline and made it more prone to erosion. Huge quantity of sand is removed from beaches on a daily basis to support the booming construction works going on in the country. This thus leads to or triggers erosion and creates sink holes. With loose regulations and monitoring, the coastline is stripped off its sand. Places which ones used to be thriving and beautiful coastlines have been devastated by this activity. The huge unemployment in the country has made sand mining an easy source of employment for the youths at the detriment of the coastline. Minor studies have been carried out to ascertain the extent of this damage but visible signs can clearly be seen when one takes a good look at the vastly changing coastal landscape and the reduction in coastline.

(3) Wave Action

Wave action also causes erosion along the coast. This can be observed as waves break on cliffs. For some regions in Sierra Leone, especially the North West part of Sierra Leone, the cliffs are made of softer material and thus when waves break on them with intensity; they gradually collapse into the sea.

(4) Chemical Weathering

When the sea water which usually has a less than pH 7 gets into contact with cliffs due to wave action, it causes what is known as chemical weathering. The greatest effect

is on Limestone cliffs which has a high pH. Limestone cliffs can be seen in some coastal regions.

(5) Poor Coastal Management

What has been of great concern is that there has been poor coastal management in the areas affected and the inhabitants of the affected regions have not been made aware of the effect that their activities may have on the coast. Authorities need to propagate a message to these communities in order to raise their awareness. The issue is also of concern to tourist locations along the beach. Private owners of hotels and other coastal recreational facilities have been implementing developmental activities and corrective measures for the protection of their property with no regard for the effects this may have on the coast. The problem is unchecked or just left to go on since beach nourishment is a concept not practiced in Sierra Leone.

(6) Nature

A more natural cause for erosion is a major storm. A very heavy storm with high wind velocity and wave action has the ability to alter the coastal landscape in a very short time. Sierra Leone experiences very intensive winds during the rainy season and high winds along the coastline. There is a high possibility for the coastline to erode several feet in a single storm depending on its intensity. Local settlements in mostly low lying coastal areas such as Kroo Bay which is a slump in the Capital Freetown is usually submersed in water after heavy downpour of rain. A lot of infrastructure is usually lost in this area and the inhabitants have fought futile battles with nature but have always ended up on the receiving end.

(7) Local construction with the aim of preventing property damage

In most cases, local dwellers with the aim of protecting their household and property may construct undersigned seawalls and other locally designed revetments which are not designed in a way to least disrupt sediment movement along the coast In a sense they may be protecting their own structure along the coast while at the same time disrupting downstream sediment movement along the coast. Since they only care about protecting their own structure, they hardly know or care what their action may have on other ends along the coast such as the downstream.. The eventual outcome is that there will be a net reduction in sediment deposition in the downstream which will gradually lead to loss of shoreline

3. RESULTS

Indicators of coastal erosion observed

Coastal erosion may have diverse forms in which it presents itself, but the eminent indicators observed in Sierra Leone were:

1) **A reduction in beach dunes and areas-** This is visible seen in most beaches in the western Area of Sierra Leone.

2) **A reduction in protective vegetation-** this indicated that an environment was more prone to flooding. Vegetation reduction along rivers and coastal regions can be observed in Sierra Leone

3) **Coastal structures such as walls or trees collapsing and falling into the water-** This was clearly observed in many coastal locations where seawalls put up by property owners have fallen into the sea. Even huge trees can be seen tumbling into the water as the water erodes the soil beneath them.

4) **Very steep cliff faces along cliffs-** most of the coastal cliffs have steep faces which may be due to the fact that chemical weathering has been occurring on the lower part of the cliffs which have been in contact with the seawater.

5) **Vegetation appearing to be dislodged-** as the erosion starts, it will move or alter the position of vegetation which may have had their roots uplifted partially or wholly as the case may

be. This is also very much observed in Coastal Sierra Leone.

4. DISCUSSION AND RECOMENDATION

The following recommendations shown below were made and discussed on. The recommendations aimed to serve as a platform for further studies which would more effectively mitigate coastal erosion and as a whole create an effective coastal zone management policy for Sierra Leone.

(1) It is very important that issues regarding erosion are addressed at both local and National levels in Sierra Leone. Policies and control measures should be put in place to mitigate the loss of shoreline due to erosion. Coastal Agencies must be empowered to monitor activities in and around the coast as well as along river banks to ensure proper use of the environment and prevent activities that will excessively affect natural sediment movement.

(2) Studies must be carried out to address the erosion caused by human activities as well as the more natural ones. Also, monitoring agencies must be set up with the ability to monitor and observe coastal processes and come up with mitigation measures. Sensitization is a very important step towards addressing erosion caused by human activity along the coast. This could be done at community level and could also yield good dividend if it could also be incorporated into the school system.

(3) Building regulations must be reviewed and hence enforced to look into coastal construction and recreational projects which may put up structures in locations which will adversely affect the natural sediment movement along the coast.

(4) Gold and Diamond Mining must be monitored along rivers and streams to ensure that locals use gravel collection methods which do not adversely affect sediment movement. More research must be done into using more modern methods of mining at local levels that have less effect on the environment.

(5) Reducing deforestation along riverbanks and coastlines. The roots of trees and vegetation hold soil together. With the absence or reduction of vegetation along the coast or river bank, the soil along the banks will be looser and thus less capable of withstanding the effects of the forces of the flowing water or wave action. Stakeholders must aid coastal community builders with technical or engineering approaches in the construction of seawalls and breakwaters; however, care must be taken to ensure that these structures do not end up speeding up the processes of erosion. Proper studies must be first conducted to ensure that such structure are adequately designed and constructed in the right locations.

(6) Beach Nourishment should be used to revitalize the coastline. It must also be ensured that beach nourishment is conducted in conjunction with finding ways to stop or reduce the erosion at the same time. If mitigation measures are not put in place, the sand used to nourish the beach will eventually erode again. Therefore, the first priority measure is to find the cause of erosion and mitigate it in conjunction with the beach nourishment.

(7) Re-vegetating the coastline. Replacing coastal vegetation which might have been lost due to previous erosion helps to improve the slope stability of the coast and consolidates sediments. It also reduces the wave impact on the shore by reducing its energy as it approaches the coast.

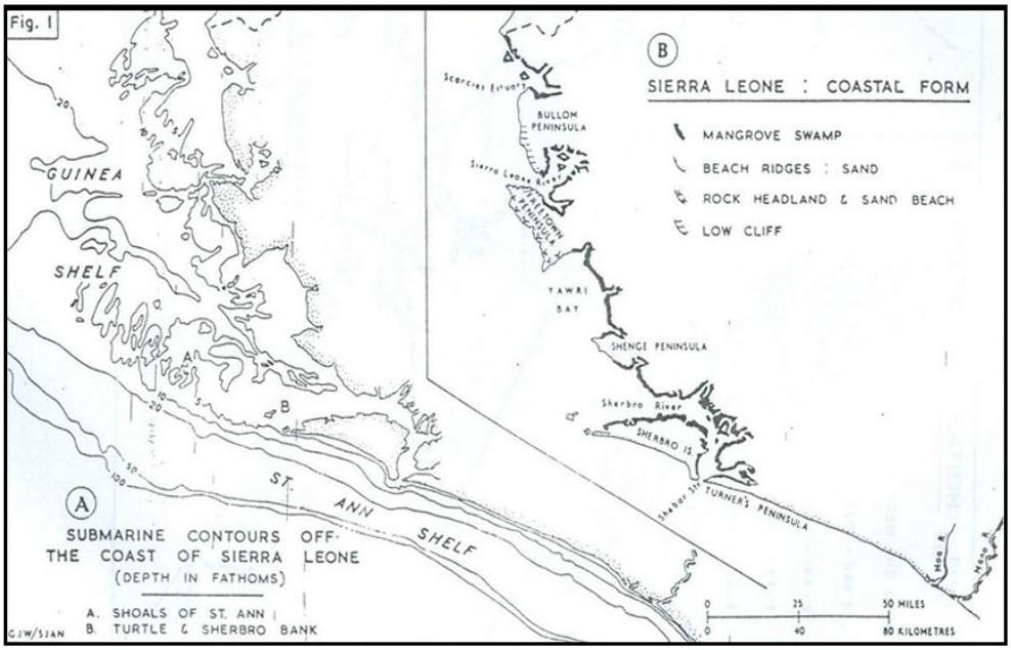

Fig1. Sierra Leone Coastal land forms

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