COASTAL EROSION IN SRI LANKA - CAUSES AND MANAGEMENT

S.M.M.S. Himaya[1]*, A. Asmiya[1]
Department of Biosystems Technology, Faculty of Technology, South Eastern University of Sri Lanka

[1]*himaya1989@gmail.com

1. INTRODUCTION

Sri Lanka is a magnificent island with a 1600-kilometer-long coastline and has numerous world heritage sites. With its bio variety and abundance of natural resources, the country's coastline setting is especially inspiring. People enjoy coastal places because they observe cultural and economic exchanges between different cultures. Coastal landforms are extremely dynamic. Numerous development schemes have been constructed along the shoreline, putting a great deal of pressure on it. This can result in a variety of coastal dangers, including sea erosion, seawater intrusion, coral bleaching, and coastline changes.

The displacement of the shoreline as a result of wave and current forces is known as coastal erosion. Coastal areas became more vulnerable to natural and man-made hazards, which now has resulted in coastal erosion. Coastal stuctures are highly energetic in nature, but due to the abundance of natural resources available, urban expansion and rapid population growth are fast increasing in these locations. Coastal erosion affects nearly every country with a coastline.

The rapid release of carbon dioxide and other greenhouse gases into the air has resulted in a forecast global climate change of around 3 degrees Celsius by 2030 (Asmath, 2021; FitzGerald, Hughes and Marsh, 2019). This rise is enough to elevate global sea levels by as much as 5 meters in a few centuries (FitzGerald, Hughes and Marsh, 2019), which is a relatively small period of time in regard to human habitation of the coastal areas.

This phenomenon has the potential to flood a huge number of vulnerable coastal locations, devastating migratory birds' and some other endangered species' habitats in the process. Shoreline erosion is occurring in concert with these continuing processes, which is expected to damage coastal communities and infrastructure of significant cultural and economic significance in practically most coastal regions around the world.

Sri Lanka's coastal zone is critical to the country's long-term prosperity. This coastal zone's erosion has been noted as a long-term issue. For quantitative and qualitative evaluations of coastal monitoring efforts, remote sensing and GIS tools can be applied. Information about where the shoreline is now, where it has been in the past, and where it is anticipated to be in the future is required for sustainable coastal management and engineering design. Coastal protection designs necessitate this information (Coastal Engineering Research Center, 1984).

In this context, the objectives of this study were

- To assess general overview of coastal erosion in Sri Lanka.
- To identify the primary causes and consequences of coastal erosion, suggestions against coastal erosion in Sri Lanka.

- To analysis of coastal erosion management strategies.
- To know about the economic cost of coastal erosion

2. METHODOLOGY

Since the primary data collection is a long-term strategic procedure, secondary data was obtained from journals, articles, books, and online pages to justify the objective of the study and to generate further research problems and identify the problems rising in coastal regions in Sri Lanka.

3. RESULTS AND DISCUSSION

3.1. Causes and Consequences of Coastal Erosion

Natural events as well as human actions are the leading causes of coastal erosion. The encroachment of the sea on land after a sufficient period of time has elapsed to limit the effects of weather, stormy events, and regional sediment dynamics (Vinayaraj *et al*., 2011). There are some physical factors that contribute to coastal erosion and ecological pollution in the areaThis coastal region is also home to lagoons, estuaries, mangroves, marshes, sand dunes, shores, and shoreline marshy wetlands, as well as a variety of water features. Flooding, coastal erosion, and changes in ecological systems caused by rising sea levels will have varying degrees of impact on all of these habitats (Bastiaanssen and Chandrapala, 2003). The most direct and evident implications of increasing sea levels are in low-lying places. Flooding and coastal erosion could become more probable as sea levels rise (Nianthi and Shaw, 2015).

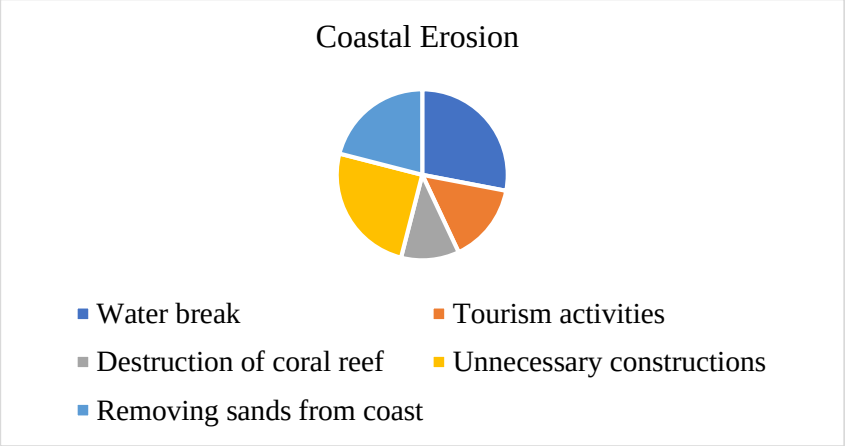

Figure 1: Reasons for coastal erosion, Sample survey, 2015 (Senevirathna *et al*., 2018).

According to the literature, south-west monsoon winds are significantly stronger than northeast monsoon winds. The west coast monsoon far more intense wave conditions during the south-west monsoon than the east coast does at the northeast monsoon. This is also one of the factors contributing to the country's southern coast's growing erosion.

3.2. GIS and Remote Sensing Applications

Coastal shoreline protection from coastal erosion and accretion trends can be achieved by remote sensing and GIS techniques. In this sense, quantitative and qualitative analyses of

monitoring activities in coastal regions are imperative with the use of remote sensing and GIS applications. Shorelines are a key source of information on coastal dynamics and dealing with coastal GIS. Since the shorelines are rapidly changing, frequent observation and detection of their position is necessary to follow the changing patterns and maintain the levels within the limit. They can be identified by remote sensing devices, topographical maps, satellite data, and equipment such as RADARS (Muthukumarasamy *et al*., 2013). For example, RADAR images taken in 1972 have been used to detect changes in coastal region shorelines over the last three decades. Remote sensing enhanced the coastal zone at least 1 cm (Prasad and Kumar, 2014). Meanwhile, a study done in the Unawatuna coastal area, analyzing satellite images in 2007, 2009, 2011, 2013, and 2015 to identify the degree of coastal erosion, concluded that each and every year the land area close to the sea decreases more than anticipated and reduces vegetation, especially due to the misbehaviors of the human population rather than natural hazards. However, as a remedy for coastal erosion, GIS-based disaster management helps to control the condition and is mostly used (Mahmood *et al*., 2002). Anyhow, according to Stettner, Bailey and Richmond, 2001 installing new satellites can improve remote sensing more than before.

3.3. Coastal Erosion Management

Worldwide climate change due to man-made activities results in sea-level enhancement and induces natural hazards such as coastal erosion. Since it’s a long-term aspect of treating erosion, management strategies require a legislative and administrative framework as well as a well-organized coastal observation program. In this sense, reallocation of land use and infrastructure close to the coastal region (managed realignment (MR)) has the potential to mitigate the effect of both coastal flooding and erosion on coastal anthropogenic structures (Williams *et al*., 2018). The MR strategy alters flood defenses and helps to reduce the negative impacts of climate change (Leggett *et al*., 2018).

In fact, management of coastal erosion is linked with various planning and rules and regulations such as high-risk area identification and rearranging structure types in terms of buffer zones, concerning easiness to relocate and environmental impact assessment. Setback is another strategy to cope with buffer zones; leaving undeveloped land in designated areas by removing structures from hazard zones minimizes the damage to properties due to coastal erosion. Even though sea walls are an alternative solution to sea erosion, set back is considered a low-cost method with numerous benefits. Vertical and horizontal are the two setbacks that occur generally where horizontal distance setbacks vary from country to country (Chile: 80 m and Colombia: 50 m, Sri Lanka: 100 m) (Williams *et al*., 2018).

3.4. The Economic Cost of Coastal Erosion

Externalities and economic costs to the environment are created by climate change results such as rising sea levels, coastal erosion, and floods. It reduces the economic value of resources and sectors of industries as the costs to society exceed the social benefits. Based on the past estimates, due to coastal erosion, land resources, tourism sector, industries, rice and coconut production declined by Rs. 1242 million, Rs. 200 million, Rs. 152 million, Rs. 64.5 million, and Rs. 83 million, respectively. It is a great loss to the country's GPD and economic growth (Bastiaanssen and Chandrapala, 2003).

4. CONCLUSION

Sri Lanka's coastline is a lovely environment, and the country's coastal regions protects the country's land areas. Coastal erosion is becoming one of the country's most serious threats for a number of reasons. When engaging with coastal GIS, shorelines are an important source of information on coastal dynamics. To keep records of the altering patterns, it's important to keep an eye on them and identify their location on a regular basis. The altering patterns of shorelines are tracked using remote sensing devices, topographical maps, satellite data, and equipment such as RADARS. The Managed Realignment (MR) method adjusts flood defenses and helps mitigate climate change's detrimental effects. Another approach to dealing with buffer zones is setback, which involves leaving undeveloped land in specific places. The use of a sea wall as an alternative to sea erosion is considered a low-cost option. Coastal erosion lowers the economic value of natural resources and industry sectors. It's a huge blow to a country's GDP and economic growth.

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