3 IMPACT OF SEA EROSION ON SUSTAINABLE COASTAL TOURISM DEVELOPMENT IN GHANA. THE CASE OF SALTPOND BEACH RESORTS

Eric Kojo Wu Aikins

Abstract

Sea erosion forms one of the major negative impacts of climate change on sustainable coastal tourism development worldwide. Generally, this negative impact is more pronounced in developing countries where available beach resorts are struggling to persist. Principally, the challenge of operating a successful coastal beach resort in Ghana is aggravated by unexpected destruction of beach resort facilities by sea erosion that leave some affected facilities unsafe for public use (e.g. Saltpond @ the Beach resort along Saltpond coast). Based on the experiences of Saltpond beach resorts, the study analysed the impact of sea erosion on sustainable urban coastal tourism development in Ghana. Mainly, the study found that climate change and human induced factors contribute to the persistent sea erosion along the coast of Saltpond. Finally, the study recommended the implementation of three principal sea erosion mitigation strategies; integrated coastal development planning, building of sea defence wall, and combined mitigation measures.

Keywords: climate change; sea erosion, sustainable coastal tourism development; urban beach resort; integrated coastal development planning.

INTRODUCTION

Climate Change, Global Warming, Sea Level Rise and Sea Erosion Nexus

Generally, the climate of the earth has changed. Currently, the earth is warmer than it was in the late 19th century (Aikins, 2012; Aikins, 2011; IPCC, 2023; IPCC, 2022; IPCC, 2022*; Nicholls, 2003; Neumann et al., 2000; World Meteorological Organization, 2023). For instance, global surface temperatures have risen from 1.5ºC to about 4 ºC between 1850 and 1900 resulting in a higher incidence of global warming (IPCC, 2023; IPCC, 2022; IPCC, 2022*; World Meteorological Organization, 2023). Specifically, the current annual mean global near-surface temperature for the period 2023-2027 is predicted to be 1.1ºC and 1.8ºC (98% confidence). Which is higher than that of the pre-industrial levels of 1850-1900 (IPCC, 2023; IPCC, 2022; World Meteorological Organization, 2023).

This predictable increase in global surface temperature is expected to worsen the current negative impacts of global warming including rising sea levels, increasing thawing of Arctic/Antarctic ice, increase mean sea temperatures that are associated with increased sea erosion in coastal areas of the world (Aikins, 2012; Aikins, 2011; Mentaschi et al., 2018; Nicholls, 2003; Neumann et al., 2000).

Globally, sea levels are estimated to increase by between 0.26-0.63 metres in low emission scenario and 0.33-0.82 metres in high emission scenario by the end of 2100 (IPPC, 2013). Specifically, climate change is expected to be associated with substantial

sea level rise along the coast of the United States where current estimates indicate that over the past century sea levels have risen from 10cm to 20cm.

University of Cape Coast, Department of Geography and Regional Planning, Cape Coast, Ghana.
*Email:*eaikins@ucc.edu.gh/ekwaikins@gmail.com
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With global warming accelerating at an unprecedented rate in recent years, mean sea levels of the United States are expected to increase from 1.0-2.5mm per annum to about 5mm per annum corresponding to about 50cm rise in mean sea level per century (Cai et al., 2009; IPPC, 2013; IPPC, 2007). Practically, this rate could be higher when recent greenhouse scenarios are applied. The cost of the 50cm sea level rise is estimated to be between US$20-150 billion (Neumann et al., 2000). Also, by 2100 global mean sea level is expected to rise between 28 and 98cm higher than the average between 1986-2005 (Dean and Dalrymple, 2001; Toimil et al., 2020;).

According to Moore and McInnes (2020), in England one of the major predicted impacts of climate change on sea erosion is the rising sea levels that are over 1 metre. The authors intimated that this level is expected to increase to about 2.5 metres in the nearest future. Similarly, Masselink and Russell (2013) reported that coastal areas of Ireland, England and Wales are experiencing coastal erosion more than 10cm per annum due mainly to sea level rise and could increase in the future. Also, they reported that damages due to coastal erosion in the United Kingdom is estimated to be about £15 million per annum and may rise to £126 million per annum by 2080.

Coastal Zone and Sea Erosion Interrelationship

Traditionally, costal zones form one of the key climate change hot spots that are undergoing faster and dramatic negative social and environmental changes, primarily due to the negative impact of sea erosion (Dean & Dalrymple, 2001; Torresan et al., 2012). According to Cai et al. (2009) about 60% (two-third) of major cities in the world that house about 60% of the world's urban population have more socio-economic developments located in costal zones. For example, in Australia about 85% of the population live in coastal zones within 50km of the coastline, which could be costly (Australian Bureau of Statistics, 2001-02). Specifically, Moore and McInnes (2020) noted that the economic cost of living in coastal areas within 500 metres away from the sea could be estimated to be about €1,000 million in Europe.

Additionally, coastal areas serve as protective buffer zone between the land and the sea that house about 40% of the world's population (Mentaschi et al., 2018). Within this zone exist important natural and spatio-economic resources (coastal forest, beaches and coastal in-land water bodies) that are often harnessed to cater for the needs of the growing coastal population in the world including Ghana. For instance, global loss of coastal land between 1984 and 2015 was measured to be about 28,000km^2, almost equivalent to the surface area of Haiti (Mentaschi et al., 2018). Also, Mentaschi et al. (2018) found that loss of coastal land due mainly to coastal erosion was more than the accreted land during the period of their study on the long-term observations of coastal erosion and accretion.

Ghana's coastal zone lies in the southern part of the country. It extends from Aplao (East) to Half Assini [West)] (see the insert map in Figure 2). It covers about 6.5% of the country's land area of 238,535km^2 spanning between the southern parts of four administrative regions; Volta, Greater Accra, Central and Western (Aikins, 2018; World Bank Group, 1998). It is a home to about 25% of the country's coastal population and contributes to 80% of fish production along a 550km coastline (World Bank Group, 2018). Additionally, this zone contains Ghana's mangrove vegetation that is estimated to cover about 72.4km^2 of land composing of over 18 million trees distributed from the east coast to the west coast of Ghana with the highest distribution in

the Volta Region and the lowest in the Central Region (Nunoo & Agyekumhene, 2022).

Spatio-economic-wise, the coastal zone of Ghana supports a wide range of activities including agricultural, fishing, commerce and tourism development (Aikins, 2018; Appeaning Addo & Appeaning Addo, 2016; World Bank Group, 1998).

The Problem

The problem of sea erosion is global in nature (Cai et al., 2009; Lyane, 2017). For instance, about 70% of the beaches in the world are receding at an accelerated rate that calls for global effort to mitigate the risk associated with sea erosion (Cai et al., 2009; Lyane, 2017). Specifically, climate change is associated with over 75% of the world's shoreline erosion problems with coastal erosion expected to have greater negative impact on coastal shoreline, particularly in urban coastal regions where some communities risk being removed completely from the urban coastal landscape due to the negative impact of climate change induced sea erosion (Coelho et al., 2023). For instance, in the United Kingdom out of the total 17,381km long coastline about 3,008km (17.3%) is currently under erosion (Masselink & Russell, 2013).

Obviously, coastal erosion has become an environmental problem in the coastal zone of Ghana (Appeaning Addo & Appeaning Addo, 2016; EPA, 2003). Coastal erosion both natural and human induced results in the destruction of coastal infrastructure and properties (Moore & McInnes, 2020; World Bank Group, 2018; World Bank Group, 2016). For instance, Appeaning Addo et al. (2008) reported that Ghana's urban coastal areas are expanding with increasing utilization of coastal zone resources, particularly beach sand through uncontrolled and unsustainable beach sand winning activities in most affected coastal communities (Appeaning Addo et al., 2008).

The coast of Saltpond has experienced frequent sea erosion impacts over the past decades. During these past periods, a sizeable extent of the coconut trees and other coastal vegetation that beautifully decorated the coast of Saltpond making it a suitable place for relaxation and recreation were removed through sea erosion. In recent times (after the year 2000), due to the negative impacts of climate change that is mainly manifested through increasing sea erosion has resulted in a further reduction in the extent of the beach vegetation cover along the coast of Saltpond.

Further, the increased sea erosion activities along the coast of Saltpond is threatening the long term survival and operation of beaches and resorts in Saltpond. Specifically, some beach resort facilities have been destroyed while others have closed down due to the negative impact of sea erosion. For instance, in 2023 Saltpond @ the Beach Resort, a major beach resort along the coast was closed down mainly due to the destructive impact of sea erosion that has left the facility half broken and unsafe for public use (Figure 1). This study therefore analyses the impact of sea erosion on sustainable urban coastal tourism development in Ghana based on the experiences of Saltpond beach resorts.

Figure 1: Photographic Evidence of the Destructive Impact of Sea Erosion along the Coast of Saltpond.
Source: Author, 2023.

The Study Area

Saltpond, the ancient capital of the Central Region of Ghana is located along the coast of Mfantseman Municipality of Ghana. Currently, it is the capital town and the most populous urban coastal community in the Mfansteman Municipality (Figure 2).

It is located 18 miles away from Cape Coast, the ancient capital of Ghana (currently the capital town of Central Regional of Ghana).

By absolute location Saltpond lies on the geographic coordinates: 5.2023°N and 1.0514°W.

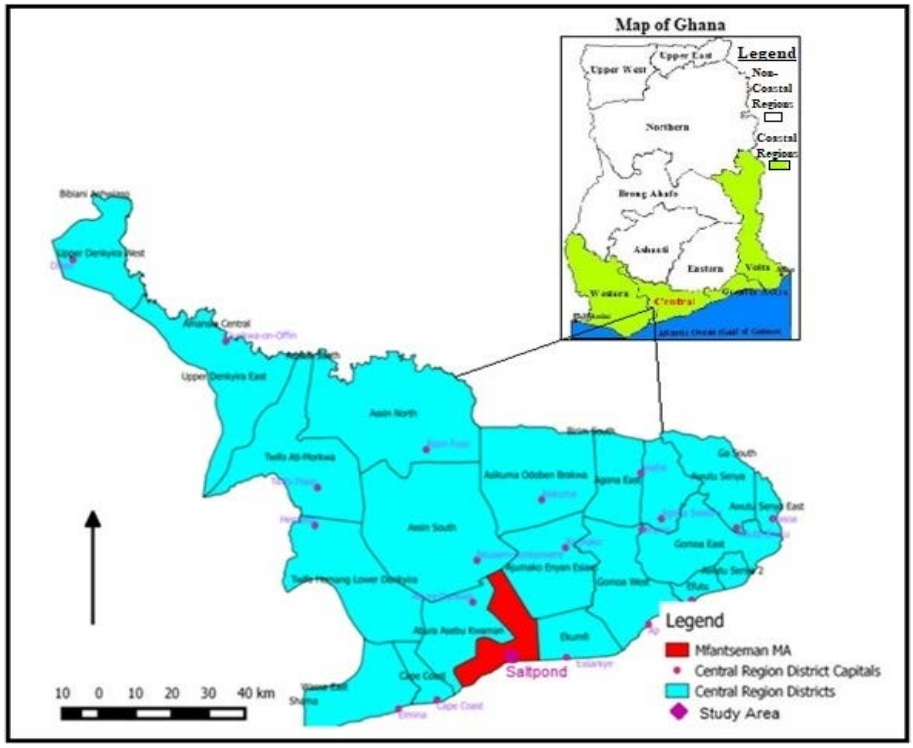

Figure 2: A Map of Central Region in Ghana Showing the Study Area: Saltpond
Source: Mfantseman Municipal Assembly, 2020 (modified by Author, 2023).

The population of Saltpond was 20,114 in 2010 (Ghana Statistical Service, 2014). Currently, Saltpond's population is estimated to be about 24,689 in 2023 (World Population Review, 2023).

The coastline of Saltpond (i.e. only the upper town of Saltpond) covers about 2.2km (from the Atofa lagoon located between Saltpond Upper and Lower towns in the east to Nana Zema lagoon in Kormantse in the west) of the 21km coastline of the Mfansteman Municipality's stretch of the most beautiful beaches in Ghana, which are about 60 metres above sea level (Figures 2 and 3; Mfansteman Municipal Assembly, 2021; Ghana Statistical Service. 2014). A total of six beach resorts mark the beautiful sandy beach of Saltpond. This makes the town one of the most attractive tourist and recreational destinations for both domestic and foreign tourists that travel to Saltpond to enjoy the sunny, clean and beautiful beach that the town offers.

Figure 3: The Coastline of Saltpond.

Source: Author, 2023 (Map based on Google Earth, 2021 Satellite Image).

METHODOLOGY

The study employed the case study research design to assess the negative impact of sea erosion on coastal tourism development at the beach resorts in Saltpond. In practice, the study involved all available stakeholders; beach resorts operators, the Directors of NADMO and Physical/Spatial Planning Unit of Mfantseman Municipality and a representative of the Regional Director of the Environmental Protection Agency (EPA), Cape Coast. The involvement of the relevant stakeholders helped to collect representative data about sea erosion and sustainable urban coastal tourism development along the Saltpond coast. The analyses of the study data helped the study achieve its set objectives and answered the research questions it posed.

The focus of the study was on the beach resorts in Saltpond. The negative impacts of sea erosion are observable in these beach resorts. Traditionally, beach resorts represent coastal tourism facilities (beach residential and recreational facilities) that provide accommodation, recreation, entertainment (spots/bars) and rest spots (lounges) services to the general public and tourist (Gonzales, 2021; Mazlina & Khairil 2018). Similarly, in this study beach resorts are considered to be tourism facilities located along the coast of Saltpond that provide accommodation or entertainment (spot/bar/lounge) or recreational services to the general public and tourist. Thus, beach spots, bars

and lounges along the coast of Saltpond formed part of the beach resorts that the study surveyed. In all, six beach resorts (three traditional beach resorts with accommodation services and three beach spots/bar/lounge) can be found along the coast of Saltpond (Figure 4). The three traditional beach resorts are:

i. Manna Beach Resort: The only active and functional traditional beach resort.
ii. African Vibration Beach Resort (formerly known as Mfansteman Beach Resort): Temporary closed down mainly due to management problems.
iii. Saltpond @ the Beach Resort: Currently closed down mainly due to sea erosion impact.

The remaining three beach resorts are Ocean Side Beach Spot/lounge, Victoria Beach Spot, and Saltpond City Beach Spot (Figure 4). However, the study surveyed four out of the six beach resorts due to the closure of the African Beach Resort and Saltpond @ the Beach Resort.

Figure 4: Saltpond Beach Resorts.
Source: Author, 2023.

In terms of data collection the study employed both quantitative and qualitative data collection techniques that helped the study to collect the needed primary data. The field survey data were statistically analysed (based on percent distributions) to help the study address the research problem and achieve the study objectives. Additionally, using the Google Earth Distance Measuring tool and Google Earth Data (2021 satellite image of the earth and recent 2023 photographs of Saltpond beach) spatial/photogrammetric analyses were performed to identify the extent of shoreline change mainly due to sea erosion along the coast of Saltpond (refer to the discussion on Figure 5). Further, field observations (sensory observations with the help of a camera) were conducted where photographs were taken to provide evidence of the state of the sea erosion and its associated negative impacts on Saltpond beach resorts.

Finally, the results of the study data analyses were presented in tables, figures, and maps and were discussed thematically.

RESULTS

Generally, the analyses of the study data (statistical-wise) revealed that Climate change and

human induced factors form the major factors that explain the persistent occurrence of sea erosion along Saltpond coast (Table 1). Additionally, based on the qualitative data analysis (summarized views of respondents) the building of sea defence as a measure for controlling the negative impact of sea erosion on beach resorts was recommended to be the most effective and popular sea erosion mitigation technique. Further, the analysis of the spatial data (Photogrammetric Analysis) revealed a reduction in the size of the beach extent (about 18 metres) in the study area between 2001 and 2023 (Figure 5).

DISCUSSION OF RESULTS

Background Characteristics of Respondents

Table 1 indicates that all beach resort managers/caretakers who were interviewed were males (100%) aged between 27 and 38 years with a mean age of 31 years. The presence of all male beach resort Managers in this study is coincidental since it is common to find females that manage beach resorts and other tourist facilities in Saltpond and in other parts of Ghana. Also, Table 1 reveals that out of the four Managers interviewed two (50%) had attained tertiary level of education with the remaining two had completed Junior High School (25%) and Senior High School (25%) respectively. Generally, the higher level of skills needed to manage traditional beach resorts and lounges explains why 50% of the resort operators had attained tertiary level of education.

In all, the results revealed that all the four beach resort facilities were registered with the Mfantseman Municipal Assembly (MMA) and were operating legally in compliance with the by-laws of the MMA. Comparatively, the study finds this result to be in contrast with the finding of a study by Boafo et al. (2014) that asserted that some of the beach tourism facilities along Bortianor and Kokrobite coast of Accra were unplanned and lacked request permit that could negatively affect the ecological stability of the coastal communities that the resorts operate in.

Table 1: Socio-Demographic Background of Respondents (Beach Resort Operators).

Coastal Tourism Facility	Gender	Age in Years	Highest Educational Level	Registration of Facility with MMA*	Years of Operation of Facility by Respondent
Manna Beach Resort	Male	27	Tertiary	Yes	0.25 (4 Months)
Ocean Side Beach Spot/Lounge	Male	29	Tertiary	Yes	1
Saltpond City Beach Spot	Male	31	Secondary/ Vocational	Yes	1
Victoria Beach	Male	38	Junior High	Yes	13
All Beach Resorts	4 (100%)	Mean Age: 31		4 (100%)	

*MMA: Mfantseman Municipal Assembly.

Source: Author, 2023.

Causes and Mitigation of Sea Erosion along Saltpond Beach

In terms of climate change (natural) related causes of sea erosion two main factors; Extreme

High Sea Tide and Frequency of Sea Wave Impact, which mainly occurs three or more times in a year along the coast of Saltpond were identified and examined (Table 2). Specifically, all the respondents (Yes: 100 %) attributed the natural cause of sea erosion along the coast of Saltpond to Extreme High Sea Tide that could be attributed to high sea rise and increasing thawing of Arctic/Antarctic ice (Aikins, 2012; Aikins, 2011; Mentaschi et al., 2018; Nicholls, 2003; Toimil et al., 2020).

Table 2: Causes and Mitigation of Sea Erosion

Coastal Tourism Facility	Climate Change Related (Natural) Factors: **Extreme High Sea Tide**	Climate Change Related (Natural) Factors: **Frequency of Sea Wave Impact Per Year**	Human Induced (Anthropogenic) Factors	Major Mitigation Measure	Damage Caused By Sea Wave Impact
Manna Beach Resort	Yes	Two times	a. Increasing sand winning activities for urban infrastructural development	a.Protect (Sea Defence Wall)	No
Ocean Side Beach Spot/Lounge	Yes	One time	b. Creation of sea defence along the coast (Elmina/Cape Coast/ Anomabo)	a.Protect: (Sea Defence Wall)	Yes
Saltpond City Beach Spot	Yes	Three or more times	a. Increasing sand winning activities for urban infrastructural development	a.Protect: (Sea Defence Wall)	No
Victoria Beach-Spot	Yes	Three or more times	a. Increasing sand winning activities for urban infrastructural development	a. Protect: (Sea Defence Wall)	No
Total (All Beach Resorts)	4 (100%)		a = 75% b = 25%	a = 100%	No: 75% Yes: 25%

Source: Field Survey, 2023.

Overall, this result is consistent with the results of the photogrammetric analyses in Figure 5 that shows that a sizeable proportion (about 18 metres) of the coastal vegetation (coconut trees in front of Saltpond @ the Beach Resort) has been removed by sea erosion between 2021 and 2023.

Figure 5: Removal of Coastal Vegetation along Saltpond Beach between 2021 and 2023.
Source: Author, 2023.

Concerning human induced (anthropogenic) causes of sea erosion along the coast of Saltpond, 75% of the respondents confirmed that Increasing Sand Winning activities for urban infrastructural development forms the major causal factor. Generally, beach sand winning forms one of the major human induced (anthropogenic) activities that hastens the onset and recurrence of sea erosion in coastal communities in Ghana.

In the study area, sand winning activities were found to be prevalent. For instance, Figure 6 shows areas where sand winning activities had taken place during the period that the study's survey data collection and field observations were conducted. Also, Figure 6 shows the presence of shovels and spades that had been used to win sand a moment before the arrival of the researcher at the affected location in the western end of Saltpond coast. Similarly, some bags of beach sand were found packed close to the Manna Beach Resort that signifies the activities of sand winners along the coast close to the beach resort.

In principle, beach sand winning facilitates the lowering of affected shoreline that pave way for an increased inflow of sea water inland-ward that could cause or intensify the rate of sea erosion in affected coastal areas. Practically, this observation supports the result of the present study that principally attributed the cause of human induced sea erosion to beach sand winning along the coast of Saltpond. The photographic evidence provided in Figure 6 supports this result. However, 25 % of the respondents attributed the cause of erosion along the coast of Saltpond to the creation of sea defence walls along the coast of neighbouring coastal

communities, particularly Cape Coast, Elmina and Anomabo (Table 2).

Figure 6: Photographic Evidence of Sea Shore Sand Winning.
Source: Author, 2023.

Similarly, this result coincides with the view expressed in a study by Gbedemah (2023), which asserts that increased construction of sea defence in Ghana could have negative impact on the population of neighbouring coastal communities. For instance, a World Bank Group (2018) study noted that the construction of the Keta defence wall (a hard engineering technique that combined the use of groynes and revetments) led to a down-drift coastal erosion along the Ghana-Togo boarder by 50% (Addo et al. 2008; Appeaning Addo & Appeaning Addo, 2016).

Further, Table 2 reveals that only Ocean Side Beach Spot/Lounge suffered some damages (loss of bottles and destruction of washroom facilities) due to the recurrent sea erosion along Saltpond beach. In all, the cost of the damage was estimated to amount to US$ 1,000.00.

In finding out the most effective (major) sea erosion mitigation measure that could be employed in the study area to help protect lives and properties of vulnerable areas along the coast of Saltpond, the Protect Mitigation Measure through the construction of coastal sea defence wall was mentioned by all beach resorts Managers (100 %) that the study interviewed. This result is expected because the use of sea defence wall in controlling the negative effects of sea/coastal erosion has become popular in recent times although it is not a relatively cheaper mitigation measure (Addo et al. 2008; Appeaning Addo & Appeaning Addo, 2016; Masselink & Russell, 2013).

Impact of Sea Erosion on Saltpond Coastal Tourism Development

In all, four main negative impacts of sea erosion on the available coastal tourism facilities and the general coastal environment were identified and discussed as follows:

Destruction of coastal beach resort

One of the important evidences of the negative impact of sea erosion on sustainable urban coastal tourism development in Ghana is the destruction of some beach resort facilities in the study area. Currently, Saltpond @ the Beach Resort has closed down due to the negative impact of sea erosion that resulted in the breakdown of the front wall and some parts of the bar of the beach resort in 2023 (Figure 1). This has rendered the beach resort

unsafe for public use. Similarly, Figure 1 shows additional damaging effect of sea erosion in the front part of Ocean Side Beach Spot/Lounge where sea erosion has broken down part of the spot's washroom facility and the frontage of the spot. Also, Figure 1 shows the effect of sea erosion along certain parts of the coast of the study area where coconut trees along the beach have been removed or are almost removed from their stable ecological settings.

Destruction of coastal vegetation (Coconuts)

Not only has the recurrent sea erosion in the study area caused physical damage to beach resort facilities but also, it has contributed to the removal of coconut trees that form the most important coastal vegetation along the coast of Saltpond. Figure 7 provides evidence of both natural (removal of coconut trees by sea erosion) and human induced destruction of beach coconut trees (cutting of coconut trees to make way for the construction of beach resort and beach housing facilities). Traditionally, the presence of coconut trees and other coastal vegetation including mangroves are found to help provide vital ecosystem support and services that help sustain coastal ecologies and environments (Jarungrattanapong & Manasboonphempool, 2009). For instance, the roots of beach coconut trees help bind the loose beach sand together and prevent the sand in coconut trees covered areas from being easily washed away by the sea water.

Figure 7: Photographic Evidence of Coconut Trees Destroyed by the Sea Erosion.
Source: Author, 2023.

Figure 8: Photographic Evidence of Re-littering of Saltpond Coast through Sea Erosion.
Source: Author, 2023.

Re-littering of beaches

Figure 8 portrays the distribution of litter and refuse that has been deposited, accumulated and buried along the coast of the study area. Although on the surface Saltpond beach could be considered to be among the cleanest beaches in Ghana some portions of the beach below the surface are filled with litter. Through beach resort operators' watchfulness cleanliness and sanitation of Saltpond beach has improved considerably. For instance, some beach resort operators have managed to stop the public from dumping refuse along the coast. Nevertheless, the coast of Saltpond could be re-littered overnight through incessant sea erosion that remove the top beach sand cover including coconut trees that allow the accumulated buried refuse to be unearthed and redistributed along the coast of the study area. This phenomenon could be attributed mainly to the removal of coconut trees along the coast due to sea erosion.

Practically, the fibrous roots of beach coconuts bind the buried refuse and the sea shore sand together, which prevents the refuse buried beneath the beach sand to be easily washed away into the sea. However, through increased cutting down and removal of beach coconut trees by sea erosion some of the refuse buried under the beach sand get exposed, washed into the sea and get returned to the beach to re-litter the coast of the study area as secondary litter/refuse. In practice, this phenomenon could limit the effective use and patronage of beach resorts along the coast of Saltpond in particular and sustainable coastal tourism development in Ghana in general. This is because, generally tourist (particularly foreign tourist) would want to enjoy clean and healthy tourism goods (Eshun & Tichaawa, 2019; Mensah, 2006).

Sustainable Urban Coastal Tourism Development along Saltpond Coast: The Role of Policy Regulating Agencies

Table 3 presents information on the major causes of sea erosion, major mitigation measures, and effective sustainable development measures that were identified to be capable of helping to address the devastating impact of sea erosion on sustainable coastal tourism development in the study area. Specifically, Table 3 indicates that all the study regulating agencies respondents (Physical/Spatial Planning Unit of MMA, NADMO and EPA) agreed that Beach Sand Winning and Cutting-down of Beach Coconut Trees form the main causes of sea erosion in the study areas and in Ghana as a whole. Also, climate change related factors (ice melt due to global warming/climate change and sea level rise) were confirmed to be among the major causes of sea erosion along the coast of Saltpond and in Ghana in general (Table 3).

Regarding the quest for major mitigation measures, Table 3 reveals that the Building of Sea Defence Wall was identified to be the most preferred mitigation measure. This result coincides with the result portrayed in Table 1 in which all the managers of beach resorts identified that the building of sea defence wall along the coast of Saltpond could help control and prevent sea erosion in the study area. This result is expected since the building of sea defence wall has been used to control and prevent the devastating impact of sea erosion in other relatively nearby coastal communities of Anomabo, Cape Coast and Elmina.

Table 3: The Role of Policy Regulators in Sustainable Urban Coastal Tourism Development.

Regulatory Agencies	**Major Causes of Sea Erosion Along Saltpond Beach**	**Major Mitigation Measures**	**Sustainable Tourism Development Measures**
Physical Planning Unit (MMA*)	i. Cutting of trees (coconut trees) along the coast ii. Sand winning iii. Climate change related issues	i. Planting of coconut trees along the beach ii. Prevent the cutting down of coconut trees along the beach iii. Sea defence engineering	i. Preparation of physical development plans (building plans) and strict adherence to the implementation of the plans
National Disaster Management Organization (MMA)	i. Sand winning ii. Sea defence in other places iii. Ice melt due to Global Warming/Climate Change	i. Sea defence in coastal areas affected by sea erosion including Saltpond ii. Complete stoppage of beach sand winning activities	i. Improved road network to coastal tourism facilities to allow for easy access of facilities ii. Clean coastal environment and improved sanitation iii. Improved security in coastal tourism facilities and towns
Environmental Protection Agency, Cape Coast	i. Sea level rise ii. Sand winning iii. Population growth iv. Degradation of coastal vegetation (coconuts/ wetland/mangroves)	i. Sea defence ii. Education to bring about positive attitudinal change towards the use of coastal resources iii. Enforcement of bylaws that regulate the use of coastal resources	i. Annual prize to beach resorts/spots/lounges that promotes coastal greening and environmental cleanliness ii. Publish the names of safe and clean beach resorts/spots/lounges in the newspapers and reputable magazines iii. Colour codes could be assigned and displayed on signboards of beach resorts/spots/lounges to alert prospective tourist about the level of quality of tourism good they may patronize iv. Collaboration between all coastal tourism development stakeholders including local chiefs, chief fishermen and land property owners to help encourage sustainable use of urban coastal resources

*MMA: Mfantseman Municipal Assembly.

Source: Field Interview, 2023.

Finally, Table 3 reveals that responses on the identification of major sustainable tourism development measure varied widely. In effect, there is no one single measure identified to be the preferred major sustainable tourism development measure common to the study area. Instead the representatives of the three regulating agencies interviewed stated measures that are complementary in nature that could be employed and implemented together to help improve and sustain urban coastal tourism development in the study area and in Ghana in general. For instance, Preparation of Physical Development Plans (beach resort facilities plans) and Strict Adherence to the Implementation of Development Plans by the responsible regulatory agencies could help provide well organised beach resorts that have clean coastal environments and improved beach sanitation (Table 3).

Further, to sustain the level of improved coastal environmental cleanliness and sanitation attained by urban beach resorts annual prizes and award ceremonies could be organize to honour the cleanest beach resorts. The names of award winning urban beach resorts could be published in reputable tourism marketing magazines and newspapers that could provide a form of advertisement for ward winning resorts. Furthermore, this initiative could provide both local and foreign tourist an important information that could help them choose the best clean urban beach resort that they wish to patronise (Table 3).

CONCLUSION AND RECOMMENDATIONS

Conclusion

Overall, the study found that major causes of sea erosion along the coast of Saltpond could be attributed to the interplay of two main forces; climate change related factors (Extreme High Sea Tide and High Frequency of Sea Wave Impact) and anthropogenic/human induced factors (Increasing Beach Sand Winning for Urban Infrastructure Development).

Additionally, the study found that the negative impacts of sea erosion along the coast of the study area were visible and could be easily be identified through an observable physical destruction of beach resort facilities (broken walls of Saltpond @ the Beach Resort and the destruction of the toilet facility of the Ocean Side Beach Spot/Lounge), removal of coconut trees, and re-littering of affected beaches.

Also, the study established that Sea Defence Wall construction (a hard engineering techniques) was adjudged the most effective mitigation measure that could be used to control the recurrent sea erosion and its associated negative impacts on sustainable tourism development along the coast of Saltpond.

Finally, the study suggests the application of effective regulatory measures that involve all coastal tourism development stakeholders. This initiative could help improve coastal environmental cleanliness and sanitation with commensurable motivation and awards that are capable of motivating coastal tourism service providers to maintain clean coastal environment and improved sanitation in Ghana, particularly in the study area.

Recommendations for Controlling the Impact of Sea Erosion for Sustainable Urban Coastal Tourism Development

For a sustainable urban coastal tourism development to be achieved in Ghana, particularly in the study community the following strategies are outlined and discussed:

Integrated Coastal Development Planning.

Generally, Ghana needs a comprehensive plan/guidelines on erosion control for development projects in the country's

coastal zones that foster effective development of coastal zone resources just as in Malaysia (Department of Irrigation and Drainage, 1997).

Integrated coastal development planning forms one of the key strategies that could be employed to help control the negative impact of sea erosion on sustainable urban coastal tourism development in Ghana. Primarily, this could be achieved through effective planning and management of coastal resources by all urban coastal tourism development stakeholders including the MMDAs, Ghana Tourist Board and other government agencies, landowners/chiefs and the people of Ghana (Masselink & Russell, 2013). This participatory approach in planning and development of coastal resources for tourism purposes would ensure that the needs and requirements of all tourism development stakeholders are met before a particular urban coastal tourism development is sanctioned and allowed to operate.

This planning approach could be likened to the comprehensive planning approach in urban planning where planning is done comprehensively enough taking into consideration the needs and concerns of all stakeholders that ensures that the tenets (codes) of an approved comprehensive plan are respected and implemented by all stakeholders. In the end, comprehensive plans that are sanctioned by the laws of respective spatial jurisdictions and countries do not allow no one party/stakeholder to break any code or tenet outlined in the plan. If tourism planning is done similarly, no one stakeholder could take the planning and use of costal resources for granted that could jeopardise the sustainable use of coastal resources for urban costal tourism development purposes.

Building of Sea Defence Wall.

Sea defence wall forms one of the major sea erosion mitigation measures that is common to most developing countries including Ghana. It is a hard engineering technique that combines the use of construction materials such as rocks to develop groynes and revetments to help control sea wave impact and its associated erosive damaging consequences on affected coasts. Other hard engineering sea defence construction techniques include concrete sea walls, tetrapods, gabions, and offshore reefs (Amos & Akib, 2023; FAO, 2007).

Combined Mitigation Measures

In response to the limitations of sea defence wall construction already outlined in the preceding sections of the paper, the present study proposes a third strategy that considers the combination of both hard and soft engineering techniques and other relevant mitigation measures (FAO, 2007; Gbedemah, 2023; Masselink & Russell, 2013; Oteng-Ababio et al., 2011). Specifically, soft engineering sea erosion control techniques involves the use of the provisions of the natural coastal environment to prevent and control sea erosion. Common examples include beach nourishment, reprofiling, dune nourishment, managed retreat and coastal revegetation (replanting of beach coconuts/mangrove forest) (FAO, 2012). Although the techniques considered under the soft engineering approach present a natural and environmental friendlier means of fighting sea erosion some of the techniques are relatively expensive (for example beach nourishment) than most hard engineering techniques (Amos & Akib, 2023; FAO, 2012).

Regarding the evidence of the impact of sea erosion on Saltpond beach resorts the study propose the application of the combined sea erosion mitigation measure that combines the positive aspects of both the hard and soft engineering techniques and other relevant mitigation measures to help control the observed sea erosion along the coast of Saltpond. For instance, Figure 9 demonstrates the possible use of both hard (sea defence wall) and soft (re-planting of coconut trees) engineering techniques to controlling sea erosion along the coast of selected beach resorts (e.g. Ocean Side Baech Spot/Lounge and Saltpond @ the Beach Resort) in the study area.

Figure 9: Photogrammetric Analysis of Sea Erosion Impact

Source: Author, 2023 (Map based on Google Earth, 2021 Satellite Image).

Particularly, Figure 9 shows the presence of some coastal vegetation (coconut trees) within the 18 metre Green Belt zone in 2021. This zone is located between the Precaution Line (current extent where green vegetation can be found) and the Danger Line (current extent where no vegetation can be found). However, the Green Vegetation Zone was found to be non-existent in 2023 (Figure 5).

To provide ample and natural protection for the coast of Saltpond would require the revegetation of the coast through re-planting of beach coconut trees that form part of the soft engineering technique (FAO, 2012). Although this approach could provide complete erosion protection for the affected coast, the feasibility of this option is weak unless it could be supported with other techniques that would protect the coconut seedlings from being removed by the sea before they mature to offer the needed sea erosion protection.

In order to overcome this challenge the study propose the construction of a sea defence wall within the 28 metre Sea Defence Zone that could block the sea and prevent it from having direct contact with the coconut seedlings planted in the Green Vegetation Zone (Figure 9). By this means coconuts seedlings planted within the Green Vegetation Zone could grow up well to provide the need natural sea erosion protection to the affected beaches and beach resorts in the study area.

As an additional measure to help protect the coastal areas and beach resorts in Ghana from the devastating and destructive impact of sea erosion the study suggests the institution of a Ten Metre Compulsory Green Vegetation Zone, especially in areas that have not yet been developed

or affected by sea erosion. First, the study warns that any other development that will occur within this ten metre buffer zone except for the greening of the beaches should not permitted. Second, offending developers should be made to demolish or relocate their development projects and revegetate any disturbed coastal area at their own cost.

In addition to the preceding measures, the study suggests the setting up of Environmentally Appropriate Designated Sand Winning Zones (EADSWZ) in all coastal communities in Ghana. This suggestion is made because the study considers the winning of beach sand a necessity for urban infrastructure development that needs to exploited systematically and sustainably to help save the coast of Ghana from the dangers associated with sea erosion. Practically, a community survey could be conducted to identify sea shore sand dunes and sea shore sand deposit areas located in front of coastal cliffs and at the mouth of lagoons that could be exploited over a longer period of time with minimal environmental negative consequences. The EPA and the Environmental Units of MMDAs could be task with this responsibility.

Further, beach sand winners could asked to pay appropriate fees for the sand they win in these designated areas. Part of the sand winning fees could be used to rehabilitate affected coast where necessary. This initiative when properly implemented could help in the sustainable and systematic winning and provision of beach sand for urban and rural infrastructural development in and around coastal communities in Ghana.

Finally, the study suggests the setting of Coast Guard Units in coastal communities where environmentally damaging beach sand winning activities are prevalent. Although beach sand winning is prohibited in most coastal communities in Ghana the practice is prevalent because of lack of enforcement of the by-laws that regulate the exploitation and use of beach sand in affected coastal communities. As it stands, the beach sand winning by-laws of MMDAs in Ghana rely on voluntary reporting of suspected illegal beach sand winning activities. Although the law allows for some reasonable quantity of beach sand to be taken for domestic purposes only, what constitute domestic use of beach sand is relative.

Since the law relies on voluntary reporting of beach sand winning offenders the public in most cases do not report offenders because strictly they are not under any obligation to so, especially when the offenders are their own kinfolks. It is about time that this 'Self-help Model' of protecting Ghana's coastal natural resources be changed to employ a more 'Spatio-economic Institutionalised Pragmatic Model' that relies on the use of institutionalised coast guard units. The coast guard unites upon their establishment could be mandated by law to prevent, arrest and prosecute beach sand winning offenders. This would help stop the persistent illegal and environmentally damaging beach sand winning activities occurring along the coast of Saltpond and Ghana in general.

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