Coastal Resilience Workshop

Vulnerability of Ghana's Accra Coast to Sea Level Rise

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1. Introduction

Coastal zones are under severe threat from sea level rise globally. Areas with relatively low elevations will experience either temporal or permanent flooding, while other areas will experience increased coastal erosion. Sea level rise and other factors within the coastal environment combine to either initiate or exacerbate coastal erosion. This phenomenon increases the vulnerability of the coastal dwellers and the ecosystem as they get exposed to the hazards, and thus increasing their risk level. Quantifying the risk levels of the variables that drive change in the coastal zone enable the vulnerability index of a particular location to be estimated.

2. Methodology

Historic rate of erosion was estimated for the Accra coast using the Digital Shoreline Analysis System (DSAS). This enabled the shoreline to be divided into three sections (western, central and eastern). Data (physical characteristics and coastal forcing) for the vulnerability assessment was manipulated by classifying the geologic and environmental data variables into new "risk" [1]. Quantification of the variables was based on the definition of semi-quantitative scores according to a 1 (very low) – 5 (very high) scale. The relative risk variables were used to formulate a coastal vulnerability index (CVI), using the square root of product mean (CVI_5) approach (see ETC-ACC, 2011). This enabled the mean CVI values for the three sections as well as the entire coast to be determined. The CVI_5 calculated were used to construct a histogram. Three risk classes were developed for the study area (i.e., low, moderate, and high risk based on 33 percentile ranges), which enabled the most vulnerable areas to be identified. The SCAPE model [2] was constructed to simulate the future shoreline positions for a 100 year period for the western section. The shoreline positions were overlaid on an orthophoto map to determine buildings at risk. This was used to statistically estimate the number of people at risk to coastal inundation based on the 2010 population census data. The results obtained were used to project an average geometric population growth rate for 2100, assuming An intercensal growth rate of 3.1 and 8.4 persons per house [3] for the Greater Accra Region.

3. Results

The vulnerable areas along the Accra coast are presented in Fig. 1. The average CVI_5 values for the western, central and eastern sections are 11.14, 4.85 and 7.55. The mean value for the entire coast is 7.07. The estimated historic rate of erosion is about 1.13 m/yr while that for the western section is 1.86 m/yr. Predicted future shoreline positions show that Pambros, Glefe and Gbegbeyise coastal communities are at risk to flooding in the western section (Fig. 2).
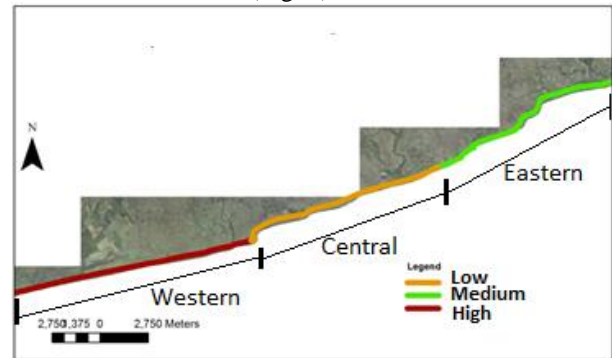

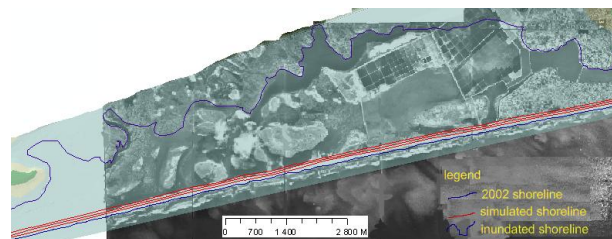Figure 1: Vulnerability areas along Accra coast.

Figure 2: Simulated 100 years shoreline positions.

Analysis of the likely impact of coastal inundation in the western region revealed that in the short term (20 years) about 13,210 people will be displaced, in the medium term (50 years) about 33,480 people will be displaced, while over 157,738 people and 846 buildings are vulnerable to permanent inundation by the year 2100. Inundation in the western section will also flood the Densu wetlands – a RAMSAR site, erode the natural fish landing sites for the small scale fishing business and flood the saltpans of the salt industries. Displaced people will create internal migration problems. The entire coastal zone of Accra can be classified as a medium risk area. Sustainable management strategies should be adopted by the government to manage the situation.

4. Acknowledgment

5. References

[1] ETC-ACC, 2011. ETC-ACC (2011). Methods for assessing coastal vulnerability to climate change. ETC CCA Technical Paper 1/2011.
[2] Walkden, M. J. and Hall, J. W., 2011. A Mesoscale Predictive Model of the Evolution and Management of a Soft-Rock Coast. Journal of Coastal Research: Volume 27, Issue 3: pp. 529 – 543
[3] GSS, 2012. 2010 population and housing census.