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Vulnerability to coastal flooding and response strategies: The case of settlements in Cameroon mangrove forests

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ABSTRACT

Worldwide, millions of people experience coastal flooding each year, with devastating effects especially in rural coastal settlements in tropical developing countries. This paper investigates the vulnerability of local settlements in the Cameroon mangrove forest zone to flooding, and improves understanding of perceptions and responses to past and current coastal flooding. Six communities in the coastal mangrove forest zone of the extreme SouthWest of Cameroon were investigated. A questionnaire was administered to a total of 200 individuals supplemented by other participatory rapid appraisal tools. The ground positions of the sampled sites as well as their altitudes were recorded for subsequent geospatial analysis.Statistical analysis was performed to show trends. The coordinates of the study sites were superimposed on base topographic maps of 1965, to investigate coastal changes over a period of 43 years. Results show that: (1) changes in coastal area have occurred in the past 43 years either through inland retreat or seaward shifts and accordingly, settlements are differentially vulnerable; (2) settlement submergence, house damage, and landscape deformation are the key impacts of flooding; (3) coastal flooding promotes the deforestation of mangrove forest for fuel wood; (4) current adaptive measures include retreat of settlement, abandonment, and house design modifications; and (5) most adaptive strategies are reactive

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individual actions which are likely inefficient and unsustainable from a longer term perspective given their limited scope of implementation. The paper recommends external support to improve adaptive capacity in mangrove settlements, review and improvement of existing policies, and development of integrated coastal management strategy for the region.

1. Introduction

Climate-driven disasters have emerged as the most glaring challenge of climate change in recent decades, with floods being the most disastrous, frequent and widespread consequence (Dhar and Nandargi, 2003). Developing countries bear the primary burden of climate-related extreme events and regionally, South, South-East and East Asia, Africa and small islands are the most vulnerable (IPCC, 2007). Ninety-four percent of climate-driven natural hazards between 1990 and 1998 have occurred in developing countries (IUCN, 2007). In recent decades extreme floods have affected many areas around the world especially in developing countries, with resulting extreme economic damage and human misery particularly in rural areas (Mirza, 2003). With projected sea level rise due to climate change, flood occurrence is expected to quadruple by 2080 (Small and Nicholls, 2004). Although there are some uncertainties about the nature and magnitude of sea-level rise and climate change, scientific evidence implies that present day coastal issues will likely be exacerbated (Perez et al., 1999; FAO, 2009). This is particularly a concern given that coastal areas are among the most populated in most countries with an estimated 23% of the world's population living within 100 km distance of the coast, and < 100 m above sea level (Molua and Lambi, 2007; Small and Nicholls, 2004). Sea level rise and extreme events will also likely result in degradation of protective coastal systems such as mangroves, further increasing the vulnerability of coastal settlements to flooding.

Significant destruction and human deaths due to flooding have been reported in many coastal African cities, including in Cameroon, within the last decade (Douglas et al., 2008; Feka and Ajonina, 2011; MINATD, 2007). The impacts on Africa's coastal megacities are exacerbated by concentration of development close to the sea, and are further expected to intensify with sea level rise (Adger et al., 2005;Ajonina et al., 2008; Vordzorgbe, 2007). In fact, flooding has been identified as a major factor preventing Africa's growing population from escaping poverty, and impeding the attainment of the United Nations 2020 goal of achieving significant improvement in the lives of the population (Adelekan, 2009; Action Aid, 2006). This is due to the fact that predominant enabling factors such as the lack of infrastructure to withstand extreme weather conditions, poor planning and governance challenges place the African coastal populations most at risk (Adelekan, 2009). Past attempts to quantify the impacts of floods on Africa's coastal cities (Douglas et al., 2008; MINATD, 2008) have typically focused on property damage/loss and human deaths (Baxter, 2005). Often these estimates are made on the basis of isolated events and impacts on ecological systems (Din et al., 1997; Ajonina and Usongo, 2001; Ajonina et al., 2005) while post-event stress on social systems has received lesser attention. At the same time, flood risk areas within less established settlements have not received the same level of attention as the mega cities.

Research also suggests that the magnitude of the adaptation challenge is not well understood, constrained by uncertainties about how adaptation is taking place (Berrang-Ford et al., 2011). This is true of Cameroon where little has been done to identify coping strategies to coastal flooding in the country. Ultimately, it is difficult to establish the adaptive capacity of the people and hence to mainstream local and indigenous strategies and resources into broad-based management and climate change adaptation mechanisms. In addition, many climate change studies in Cameroon establish the extent of climate change and its impacts, with only a few opting for the 'vulnerability-led' over the 'impacts-led' approach (Ayonghe, 2008; Molua, 2002; Sonwa et al., 2010, 2012a,b). Efforts to establish the extent of vulnerability of specific human and ecological systems on the ground and to investigate interactions between climate-influenced factors and human and ecological systems are regrettably limited.