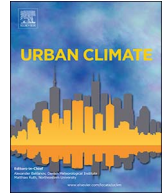




Contents lists available at ScienceDirect

Urban Climate

journal homepage: www.elsevier.com/locate/uclim

Assessing climate change vulnerability and local adaptation strategies in adjacent communities of the Kribi-Campo coastal ecosystems, South Cameroon

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ARTICLE INFO

Keywords:

Exposure
Sensitivity
Adaptive capacity
Adaptation
Kribi-Campo coastal area

ABSTRACT

This study assesses vulnerability to climate change and local adaptation strategies in the Kribi-Campo coastal area. Variables of exposure, sensitivity and adaptive capacity are described and assessed based on the community's perception and biophysical evidence. Historical changes in rainfall and temperature variables, mangrove cover and occurrence of extreme climatic events are taken as indicators of exposure. Losses of property and income structure are used as indicators of sensitivity. Human, natural, social, financial and physical assets are used as elements of adaptive capacity. Focus group discussions were held with key informants in 12 settlements, and a survey was conducted with 150 household representatives (14 Bagyeli pygmies and 136 Bantou) to gather perceptions on climate change and adaptation strategies. Results show evidence of increased -vulnerability due to decreasing rainfall and irregular rainfall patterns, increasing occurrences of extreme climatic events and increased levels of coastal erosion. These have resulted in several effects, most significantly in the decline of agricultural production, reported by 57% of respondents, and damages to housing reported by 30% of respondents. Adaptive capacities are low. > 60% of respondents do not use any adaptation strategy. All sectors considered, the identified responses to climate related phenomena include early harvesting of crop, farm abandonment, change of productive activity, change of farm location, house reinforcement. The study concludes that households living here are susceptible to the possible impacts of climate change. Income diversification, mangrove afforestation and climate education should be considered as priorities for adaptation in this area.

1. Introduction

Global climate change will have serious impacts on social, economic and ecological systems and in coming decades the frequency and magnitude of extreme weather, as well as the sea level is likely to rise (IPCC, 2014). Coastal areas in particular are highly vulnerable to extreme climatic events, such as storms or flooding. In addition to climate-related threats, increased population

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<https://doi.org/10.1016/j.uclim.2017.12.007>

Received 25 June 2017; Received in revised form 27 July 2017; Accepted 19 December 2017

2212-0955/ © 2017 Published by Elsevier B.V.

pressure and exploitation of coastal resources are currently transforming and degrading coastal lands, including economically and ecologically important ecosystems. Mangrove forest, despite their values (sheltered nursery for a number of fish varieties, structural support for the coastline, protection against storm surge, etc.) have been degraded and destroyed because of indiscriminate human exploitation (Oyebade et al., 2010). Between 1980 and 2009, an increasing frequency of tropical storms have killed over 400,000 people and affected over 466 million more globally; but it is unlikely that the total impacts of these can be accurately measured due to (a) the paucity of publicly available data and (b) the discrepancies in reporting (Doocy et al., 2013). The impacts of climate change on rural coastal populations are compounded by the anthropogenic degradation of the coastal environment, and this cycle heightens the vulnerability of these populations to climate change.

Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity. It is “the degree to which a system is susceptible to or unable to cope with adverse effects of climate change, including climate variability and extremes” (IPCC, 2014). The United Nations Framework Convention on Climate Change (UNFCCC) has called on all parties to formulate and implement programs to facilitate adaptation to climate change, and the methods for vulnerability assessment have developed throughout recent decades. Based on the Intergovernmental Panel on Climate Change (IPCC) guidelines, researchers have developed several assessment frameworks:

- Turner et al. (2003) and Locatelli et al. (2008) proposed a multidimensional framework for exploring the vulnerability of socio-ecological systems as a function of exposure, sensitivity and adaptive capacity
- Wongbusarakum and Loper (2011) proposed a set of 10 indicators to assess social vulnerability to climate change including: (i) demographically vulnerable groups, (ii) dependence on vulnerable resources and services, (iii) current household livelihood and income diversity, (iv) perceived alternative and supplementary livelihoods, (v) awareness of household's vulnerability to climate hazards, (vi) access to and use of climate-related knowledge, (vii) formal and informal networks supporting climate hazard reduction and adaptation, (viii) ability of a community to reorganize, (ix) governance and leadership and (x) equitable access to resources
- The Magnan (2009) framework for assessing adaptive capacity defined 6 influential factors including spatial configuration, environmental sensitivity, social cohesion, economic diversification, political-institutional structuring and living conditions
- Dolan and Walker (2004) identified broader determinants of adaptive capacity: access and distribution of resources, technology, information and wealth; risk perceptions; social capital and community structure, institutional frameworks that address climate change hazards.

These approaches provide a core set of best practices for use in studies of climate change vulnerability and adaptation; and an array of variables to measure the main components of vulnerability: exposure, sensitivity and adaptive capacity. Exposure is “the nature and degree to which a system is exposed to significant climatic variations” (Folland et al., 2001). Sensitivity is “the degree to which a system is affected, either adversely or beneficially, by climate-related stimuli” (Folland et al., 2001; Gallopin, 2003). Adaptive capacity is “the ability of a system to adjust to climate change (including climate variability and extremes), to take advantage of opportunities or to cope with the consequences” (Folland et al., 2001).

Some attempts have been made to understand the impact of climate change and adaptation strategies in coastal areas of Cameroon. Molua (2009) identified mud slides, high tides, storm surges, salt water intrusion, flash floods, rain storms, landslides and lava flow from eruption as natural hazards experienced in the south western coast of Cameroon, which have caused houses flooded, houses collapsed, class rooms damaged, agricultural land flooded, cars destroyed, loss of lives, injuries as a result of flooding in the municipality of Limbé in 2001; maize field crops damaged as a result of wind storms along the Southwestern coast during the years 2000, 2003 and 2007; houses and banana fields damaged and loss of household appliances reported as a consequence of mudslides in Limbe and Isokolo in 1998, 2001 and 2003. Investigating the extent of vulnerability to coastal flooding in South-West and Littoral Regions of Cameroon, Munji et al. (2013) reported that flood-triggered migration has been responsible for the relocation of settlements some 3.5 km inland over the past 45 years, with a corresponding loss of about 989 ha of mangrove forest cover. House damage, loss of farmland, domestic animal loss, agricultural crop loss, and landscape deformation were further effects on settlement. Ellison and Zouh (2012) showed that the Douala Estuary mangroves of Cameroon have overall resilience but noted some inherent vulnerability due to the low tidal range of the area.

These works are indicative of the extent of vulnerability of Cameroon's coasts to climate risks. However, the Kribi Campo area is undergoing more intensive urban and infrastructural development, and little knowledge is available concerning the vulnerability of this part of the coastal system. This study is designed to assess variables of exposure, sensitivity, adaptive capacity and vulnerability to climate risks, and local adaption strategies.

The work seeks to answer the following specific questions:

- How vulnerable are local communities to climate hazards and what are the underlying causes of vulnerability shaping these communities?
- How do they respond (with coping or adaptive strategies) to the perceived changes, and are these responses adequate and sufficient?

This study adds to the body of knowledge useful information for adaptation planning in this area.

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