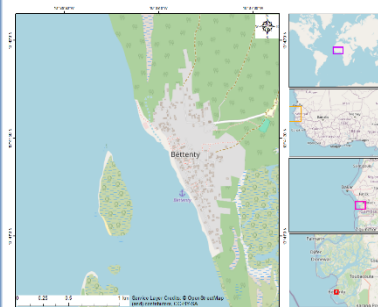




Coastal Risks in the Bettenty Islands in a Context of Climate Change

Introduction

The Bettenty Islands (also known as Bétanti or Bétenty) are located approximately 250 kilometers south of Dakar, along the Petite Côte, within the Saloum Delta. This archipelago is bordered to the north by the Diomboss, to the west by the Atlantic Ocean, to the east by the Saloum Islands Protected Forest, and to the south by The Gambia. As part of the Saloum Delta Biosphere Reserve (RBDS), the islands are increasingly exposed to coastal risks – such as erosion, flooding, and habitat degradation – exacerbated by the effects of climate change.



Objectives

Analyze recent long-term changes in coastal dynamics

Evaluate projected shoreline retreat and levels of marine submersion by 2060 under the IPCC AR6 SSP5-8.5 scenario, which reflects a trajectory of fossil fuel-intensive development.

Materials and methods

Characterization of recent multi-decadal coastal dynamics

Spatio-temporal statistical characterization (Digital Shoreline Analysis (DSAS), Linear Regression Rate (LRR) (FENSTER et al., 1993))

Assessment of shoreline retreat induced by Sea Level Rise (SLR)

Utilisation de la loi de BRUUN (1962) : $R = S \cdot G \cdot L / (b + h)$

Assessment of the level of marine submersion

Utilisation de l'équation de HOOZEMANS et al. (1993) :

$$Dft = MHW + St + Wf + Pf$$

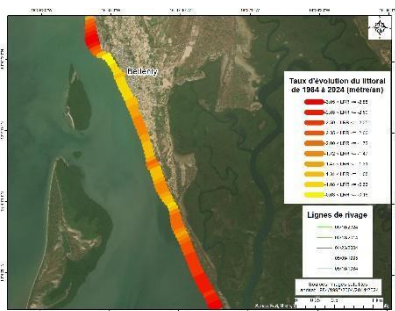
Estimation of areas at risk of marine submersion and environmental and socio-economic impacts

Extraction of submersion levels obtained from a 30 m resolution Digital Elevation Model (DEM)

Overlay of exposed areas on the ESRI Imagery base map

Results

Recent multi-decadal coastal dynamics

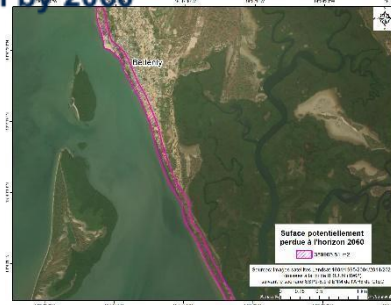


- Erosion along the entire coastline, with rates varying from -0.16 to -3.05m/year
- Average rate of change along the coastline of -1.67 m/year

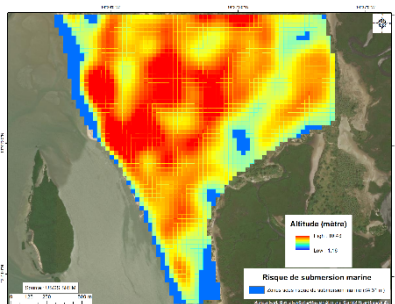
Risk of coastal erosion induced by the ENM by 2060



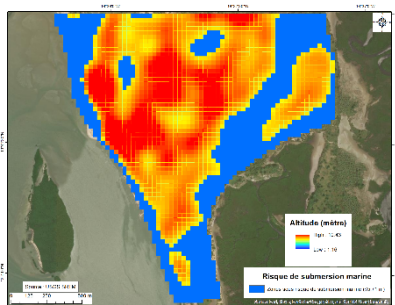
- Recession of -88.47 m by 2060
- Erosion rate of -2.46 m/year
- Loss of 389,905.51 m² of land



Risk of marine submersion and potential environmental and socio-economic impacts

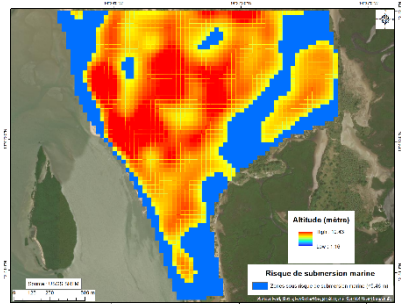


Submersion level of 4.31 m

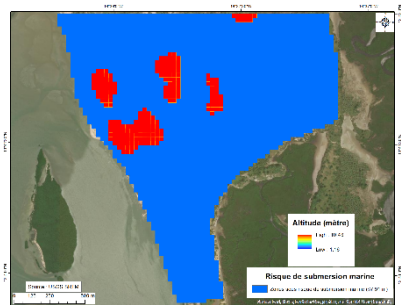


Submersion level of 5.71 m

Devastation of rain-fed agricultural areas, shrub/wooded savannah; Invasion of the fishing wharf and/or port, as well as the mangrove; Degradation of built-up areas, homes, public, private, or tourist establishments and structures, communication routes, recreational areas, conservation areas, places of worship, and protective structures



Submersion level of 5.46 m



Submersion level of 7.91 m

Adaptation options and perspectives

Adaptation measures may include strategic retreat or relocation, artificial beach nourishment or sediment replenishment, the use of sand engines (e.g., zandmotor), dune stabilization techniques, elevation of housing structures, and mangrove restoration or reforestation.

Future direction: Conduct a feasibility assessment of these adaptation strategies.