Policy Brief

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Coastal Flood Risk Trends in the Port-Bouët Bay: From Analysis to Action

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Port-Bouët Bay, located in Cote d'Ivoire is experiencing increasing coastal flooding events, exacerbated by the growing coastal urbanization and the rising sea levels induced by climate change. Despite forecasts predicting more frequent and intense floods, research on coastal flood risk in this area has been limited. This policy brief addresses this gap by presenting insights from the author's PhD Thesis on future trends in coastal flood risk, offering strategic recommendations to bolster resilience in the area.

Key Insights

- Our study reveals that current coastal flood events in Port-Bouët Bay are linked to high extreme sea level conditions, projected to worsen due to rising sea levels.
- By 2100, the flood-prone area is expected to nearly double, disproportionately impacting the Sogefiha area due to the higher presence of people and assets.
- While current risk levels are relatively low for all neighborhoods, future risk trends vary across scenarios and neighborhoods, with Sogefiha facing the highest risk under SSP5-8.5.

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Introduction

Coastal areas, the dynamic interface between land and sea, hold immense ecological, economic, and social significance. Despite spanning a mere 10% of the Earth's surface, they are home to over 40% of the global population [1] and contribute substantially to economic activities, trade, and cultural heritage. However, these vital regions face unprecedented challenges, primarily driven by climate change and rapid urbanization.

The impending impacts of climate change, including rising sea levels and increasing frequency and intensity of extreme weather events, pose a significant threat to coastal communities worldwide. Among these threats, coastal flooding emerges as a prominent concern, leading to loss of life, property damage, and disruptions to livelihoods [2]. Addressing this complex issue requires a comprehensive understanding of current and future coastal flood risk dynamics.

Despite the critical importance of coastal flood risk assessment, many regions, including Port-Bouët Bay in Cote d'Ivoire, suffer from a dearth of comprehensive studies in this regard. Existing research has primarily focused on coastal erosion [3], overlooking crucial aspects such as exposure and vulnerability specific to coastal flood risk.

This brief seeks to address this gap by presenting key findings and recommendations derived from a systematic assessment of coastal flood risk in Port-Bouët Bay.

Methodology

The analysis presented in this brief was conducted at the neighbourhood scale, specifically focusing on Vridi, Petit-Bassam, and Sogefiha. It encompassed a comprehensive assessment of all aspects of coastal flood risk, including hazard, exposure, and vulnerability.

Initially, each component of risk was evaluated individually before being integrated to provide a holistic understanding of coastal flood risk in the targeted areas.

To accommodate various sea-level rise projections, the study used three Shared Socio-economic Pathways (SSPs) scenarios: SSP1-2.6, SSP2-4.5, and SSP5-8.5, representing low, intermediate, and high greenhouse gas emissions scenarios respectively [4].

A diverse range of data sources was leveraged for the analysis, including model-derived data, in-situ measurements, and responses from questionnaire surveys. To analyze the collected data, a combination of methods was employed, including numerical and GIS-based modeling, statistical analysis, and index calculations.

Results

The results of our analysis reveal several key findings:

- **Increased Severity and Frequency of Coastal Flood Events**: Current coastal flood events are already associated with high extreme sea level conditions. As mean sea level continues to rise due to climate change, extremes sea levels will become even higher, occurring more frequently with shorter return periods [5]. Consequently, future coastal flood events in all neighborhoods within the Bay will be more severe and frequent.
  Growing Exposure to Coastal Flooding: Present-day coastal floods affect approximately 21.58 ha of coastal land, posing a significant risk to people and assets. With projected climate change, this coverage is expected to gradually increase, nearly doubling by the end of the century in worst-case scenarios [6].
- **Exposure across Land Use Types**: Informal settlements are the most exposed to coastal flood risks, followed by residential, commercial, and industrial areas [6].
- **Variability in Vulnerability across Neighborhoods**: Sogefiha exhibits higher vulnerability to coastal flood damage compared to Vridi and Petit-Bassam, which currently have lower vulnerability levels.
- **Future Risk Trends**: While the current coastal flood risk is relatively low when considering risk component indices, future trends vary across neighborhoods and

emissions scenarios. By 2100, Vridi may still have low risk, but a shift to high risk is possible under SSP5-8.5. Petit-Bassam is expected to maintain low risk under all SSPs, whereas Sogefiha faces high risk under SSP1-2.6 and SSP2-4.5, with the potential for very high-risk levels under SSP5-8.5.

- **Contribution of risk component to overall risk:** The analysis reveals a consistent trend from 2020 to 2050 in Vridi and Sogefiha, where vulnerability is the primary contributor to coastal flood risk. However, by 2100, the hazard becomes the main factor in Vridi, while exposure dominates in Sogefiha. In Petit-Bassam, vulnerability is currently the main contributor, but the hazard is projected to take over from 2030 onward.

- **Neighborhood's contribution to the overall risk**: Sogefiha accounts for approximately 63% of the total coastal flood risk, followed by Petit-Bassam (22%) and Vridi (15%).

Recommendations

The findings underscores the imperative for concerted efforts to mitigate coastal flood impacts and bolster the resilience of coastal communities in the Port-Bouët Bay area. Local authorities, alongside governmental bodies and stakeholders, must collaborate to develop comprehensive plans and measures tailored to this urban environment. These measures are essential for sustainable and integrated risk management.

✓ **Hazard Reduction** Structural measures, like seawalls and levees, offer protection but pose limitations and concerns. We recommend using them as last resort. Nature-based solutions like dune reinforcement through vegetation planting and/or sand fencing can alternatively promote their natural growth and stability while enhancing their ability to resist extreme sea level elevations,

✓ **Exposure Reduction:** Informing residents about potential flood exposure is Paramount. Measures such as spatial planning, coastal setbacks, and floodable spaces allowance can mitigate exposure and enhance community resilience. Promoting flood-resistant building adaptations and developing evacuation plans are crucial strategies for minimizing risk in this area.

✓ **Vulnerability Reduction:** Effective risk communication and early warning systems are vital for community preparedness. Establishing multilevel governance systems and insurance schemes can also aid in recovery and limit future disaster impacts. Post-crisis support services are essential for facilitating community resilience and recovery efforts.

Implementing these recommendations will enhance coastal community resilience, mitigate flood risks, and foster sustainable development in the Port-Bouët Bay area. Conducting feasibility studies and engaging stakeholders will ensure the proposed measures' effectiveness and suitability.

References

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