From Risk to Resilience: Policy Insights from Flood Hazard Scenarios in Pontianak City

Overview

The FINCAPES Project is conducting a study on **Flood Hazard Scenarios** in Pontianak City, West Kalimantan. While the data is still being finalized, the study aims to provide **preliminary insights** into how flood hazard scenarios can inform policy development and enhance flood resilience in Pontianak. By offering an early understanding of flood risks, these scenarios will support **decision-making** in critical areas such as land-use planning, infrastructure investment, and disaster preparedness. Initial recommendations emphasize the need to prioritize vulnerable groups, invest in flood defense infrastructure, and incorporate climate change adaptation into long-term planning. The effective use of these scenarios will help guide Pontianak City toward a more resilient and sustainable future.

Introduction

Pontianak City, the capital of West Kalimantan Province, Indonesia, is facing an escalating threat from climate-exacerbated flooding. Its low-lying geography and location within the Kapuas River Delta make it particularly vulnerable to various types of floods, including those caused by heavy rainfall (pluvial), river overflows (fluvial), and coastal surges (rob). The city's average elevation of just 0.1 to 1.5 meters above sea level, combined with annual precipitation between 3,000 to 4,000 millimeters, exacerbates the flood risk. Given the rising intensity of these events due to climate change, a comprehensive approach to flood mitigation is essential.

Pontianak has experienced a significant increase in flood frequency and intensity, particularly in West Pontianak and Pontianak Kota sub-districts, where rainfall, high tides, and river overflows create complex flood situations. From 2000 to 2023, annual rainfall exceeded 4,000 millimeters, with more than 300 rain days annually. Concurrently, sea levels have risen, further worsening flood conditions.[1] The impacts of these events are extensive, causing damage to infrastructure, economic loss, and disrupting social and environmental systems. To mitigate future risks, it is crucial to develop detailed flood hazard scenarios to inform flood risk management in Pontianak.

[1] World Bank. (2018). Integrated urban flood risk management practices in Indonesia: Based on reviews of practices in the cities of ambon, Bima, Manado, Padang, and Pontianak. Indonesia Sustainable Urbanization Multi-Donor Trust Fund: Jakarta, Indonesia.

The Flood Hazard Scenarios

Flood risk is influenced by three primary factors: hazard, exposure, and vulnerability. To address these complexities, flood hazard scenarios serve as an effective tool to simulate potential flood events and their impacts.

These scenarios will integrate hydrological, climate, and land-use data to model floods of varying intensities. This data-driven approach will guide planning for flood mitigation infrastructure, emergency response, and long-term urban planning. The development of flood hazard scenarios for Pontianak City involves a multi-step approach designed to ensure the scenarios are comprehensive, accurate, and actionable:

1. Data Collection and Analysis

The field survey conducted as part of this project employed a comprehensive data collection approach, integrating primary and secondary sources to develop accurate flood hazard scenarios.

- **Flood Risk Profile Survey:** Community interviews were conducted in flood-prone villages to gather information about past flood events, identify the most vulnerable groups, and understand the local impact of floods. Vulnerable groups, such as elderly and disabled individuals, were identified to inform risk assessments.
- **Hydrological Survey:** The hydrological profile of the Kapuas River and its tributaries was assessed using the ADCP M9 River Surveyor, capturing critical data on river flow velocity, discharge rates during high tides, and periods of heavy rainfall. River cross-sections, bathymetry, and water surface data were collected to form a comprehensive understanding of river behaviour.

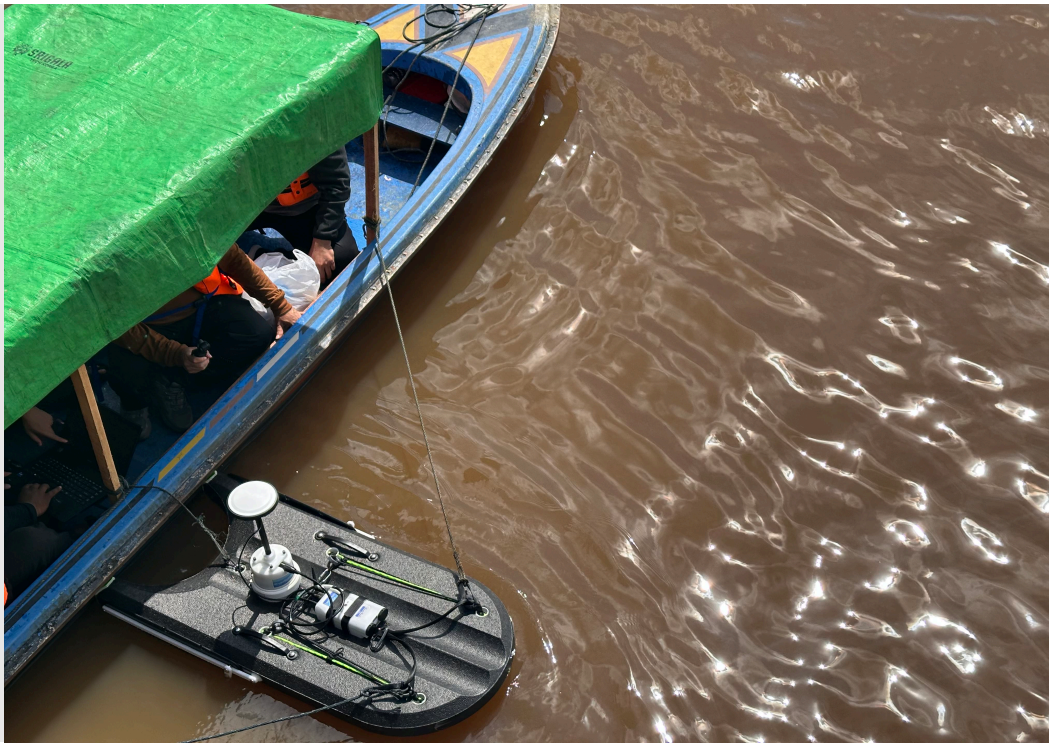

Photo 1. Hydrological survey on the Kapuas River to collect river cross-section, bathymetry, and flow data, measuring water velocity and discharge during high tides and heavy rainfall.

- **Drainage Assessment:** An evaluation of the drainage system was carried out to identify overflow points where tidal surges and increased rainfall result in flooding. These points are crucial for understanding local vulnerabilities and planning future drainage infrastructure improvements.
- **Secondary Data Collection:** Data from various governmental departments, such as Public Works and Housing (PUPR), River Basin Agency (BWS), and Indonesia Statistics (BPS), were integrated into the survey. This secondary data, combined with the collected field data, will support flood modelling and risk analysis.
- **Aerial Imagery:** Using drones equipped with LiDAR sensors, 2D topographic models were created to capture the city's terrain. These models will be used to simulate flood scenarios, enhancing the understanding of flood flows across different zones in Pontianak.

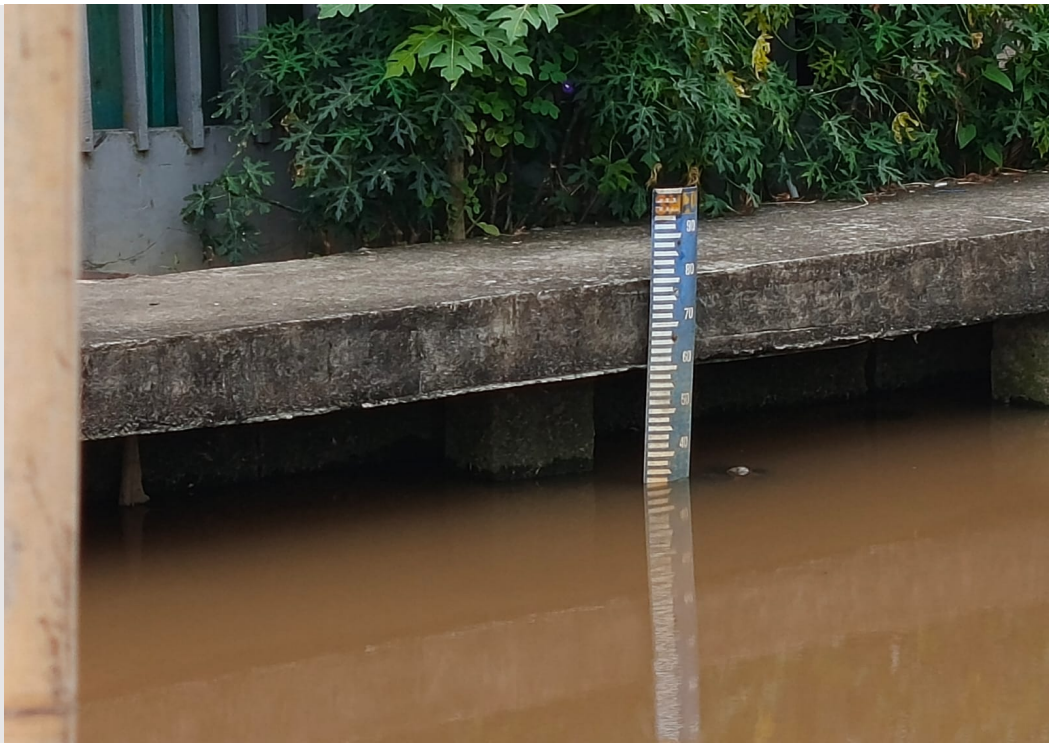

Photo 2. Measuring river depth: crucial data used to inform building codes and guide infrastructure adaptation in flood-prone areas, helping to mitigate potential damage.

2. Flood Modelling and Mapping

Flood modelling is the next step, utilizing advanced software such as GeoHECRAS, Mike 21, and HEC-HMS to simulate various flood scenarios, considering both climate change projections and historical flood patterns. The models will generate detailed flood maps highlighting:

- **Flood depths and flow velocities** to assess the areas most prone to erosion and to inform building codes and urban planning regulations, recommending infrastructure adaptations like elevated housing in flood-prone areas to minimize damage and infrastructure improvements such as embankments.

- **Flood arrival times and durations** to assist government agencies in planning evacuation routes and determining the placement of Early Warning Systems (EWS).

The integration of this modeling approach ensures a detailed understanding of the multiple flood risks faced by Pontianak, covering fluvial, pluvial, and coastal floods.

3. Stakeholder Engagement and Capacity Building

The success of the flood hazard scenarios hinges on active stakeholder participation. A Multi-Stakeholder Task Force, including local government representatives, community leaders, civil society organizations, and environmental experts, will guide the process. Continuous capacity building is integral to this initiative, ensuring that local officials and Task Force members are trained in using flood risk data and scenarios effectively for decision-making.

Workshops, training sessions, and knowledge-sharing platforms will empower local authorities to integrate these flood scenarios into their planning and policy frameworks, improving long-term flood management in Pontianak.

4. Validation and Socialization of Results

Once the flood models are developed, they will undergo validation through focus group discussions (FGDs) and workshops. Vulnerable groups, including women, will be engaged to ensure the inclusivity of the process. This participatory approach allows for community input and validation of flood maps and scenarios.

The final flood hazard maps and reports will be presented in a workshop involving local government, community members, business leaders, and civil society organizations. These results will help inform disaster management strategies, urban development plans, and infrastructure investments to mitigate future flood risks.

Policy Insights of Flood Hazard Scenarios in Pontianak City

Although the full results from the field survey and flood modelling are still being finalized, early observations offer important preliminary insights that can serve as a foundation for future policy decisions. These considerations below, while not conclusive, are intended to stimulate discussion and encourage policymakers to think proactively about potential flood mitigation strategies in Pontianak City.

Informed Urban and Land-Use Planning

Flood hazard maps will provide accurate insights into the timing, duration, depth, and velocity of floods in vulnerable areas. By incorporating these maps into the Regional Spatial Planning (RTRW) and land-use zoning, policymakers can ensure that new developments are not established in high-risk flood zones. This can help reduce property damage and economic losses while safeguarding vital infrastructure such as hospitals, schools, and public utilities.

Strengthening Flood Mitigation Infrastructure

The data on flood flow speeds and erosion risks will guide the construction of flood defenses such as embankments, retention basins, and drainage improvements. For policymakers, this translates into a strategic infrastructure investment plan that prioritizes the most critical areas, ensuring that public funds are allocated efficiently to protect the most at-risk populations and assets.

Disaster Preparedness and Early Warning Systems (EWS)

The flood arrival time and duration data will allow policymakers to pinpoint the optimal locations for installing Early Warning Systems (EWS), enabling timely evacuations and response measures during flood events. These systems can be integrated into local disaster management frameworks, enhancing the city's resilience to floods and protecting lives.

Climate Change Adaptation Strategies

With climate change projections integrated into the flood models, local governments can align their flood risk management policies with climate adaptation frameworks. This ensures that the city is prepared for future scenarios of increased rainfall, rising sea levels, and more frequent storm surges, promoting long-term sustainability.

About FINCAPES

The Flood Impacts, Carbon Pricing, and Ecosystem Sustainability (FINCAPES) project is a collaborative, gender-responsive initiative funded by the Government of Canada. Over a 5.5-year period, jointly undertaken by the University of Waterloo's Faculty of Mathematics and Faculty of Environment, the project supports Indonesia in adapting to climate change, mitigating its impacts, and conserving biodiversity in a socially and economically sustainable manner. Aligned with Indonesia's priorities, FINCAPES enhances the nation's capacity in key areas: forecasting and mitigating financial impacts of climate-change-induced floods, promoting Nature-based Solutions for peatland and mangrove restoration, and strengthening climate finance policy frameworks with a focus on carbon financing mechanisms.

Contact us:

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