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FLOOD FACTORS AND HANDLING: CASE STUDY OF INDONESIA AND THE PHILIPPINES

FAKTOR DAN PENANGANAN BANJIR: STUDI KASUS INDONESIA DAN FILIPINA

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Abstract

Flooding is a natural phenomenon that can cause disasters for humans, especially in Indonesia and the Philippines, which often experience significant impacts on the economy, transportation, and social life. This research aims to analyze the factors that cause flooding in both countries, compare the management policies implemented, and provide recommendations for improved mitigation. The method used is a literature review to collect and analyze various scientific sources. The results show that in Indonesia, factors causing flooding include land subsidence, land use change, and climate change, while in the Philippines, flooding is often triggered by tropical storms and extreme rainfall. Indonesia's response strategy focuses on river normalization and drainage infrastructure, while the Philippines implements a National Disaster Risk Reduction and Management Plan that covers prevention, preparedness, and rehabilitation. Despite these efforts, challenges such as urbanization and land acquisition still hamper the effectiveness of flood management. Recommendations include improving infrastructure, sustainable spatial planning, and community education.

Keywords : Flood, Mitigation, Management

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Abstrak

Banjir adalah fenomena alam yang dapat menyebabkan bencana bagi manusia, terutama di Indonesia dan Filipina, yang sering mengalami dampak signifikan terhadap perekonomian, transportasi, dan kehidupan sosial. Penelitian ini bertujuan untuk menganalisis faktor penyebab banjir di kedua negara, membandingkan kebijakan penanganan yang diterapkan, serta memberikan rekomendasi untuk peningkatan mitigasi. Metode yang digunakan adalah kajian literatur untuk mengumpulkan dan menganalisis berbagai sumber ilmiah. Hasil menunjukkan bahwa di Indonesia, faktor penyebab banjir meliputi penurunan tanah, perubahan tata guna lahan, dan perubahan iklim, sedangkan di Filipina, banjir sering dipicu oleh badai tropis dan curah hujan ekstrem. Strategi penanganan di Indonesia berfokus pada normalisasi sungai dan infrastruktur drainase, sementara Filipina mengimplementasikan National Disaster Risk Reduction and Management Plan yang mencakup pencegahan, kesiapsiagaan, dan rehabilitasi. Meskipun berbagai upaya telah dilakukan, tantangan seperti urbanisasi dan pembebasan lahan masih menghambat efektivitas penanganan banjir. Rekomendasi mencakup peningkatan infrastruktur, perencanaan tata ruang yang berkelanjutan, dan edukasi masyarakat.

Kata Kunci : Banjir, Mitigasi, Penanganan

1. INTRODUCTION

Flooding is a natural phenomenon that can be a disaster for humans if it causes losses, both in the form of casualties and material losses (Setiawan et al., 2020). The Big Indonesian Dictionary defines flooding as the submergence of normally dry land due to increased water volume (Astuti & Sudarsono, 2018). Flooding is one of the most frequent disasters in Indonesia and the Philippines, with significant impacts on various sectors, including the economy, logistics, transportation, and agricultural production. In addition, floods also contribute to social losses, including loss of life and disruption to people's lives. Based on data from Indonesia's National Disaster Risk Index in 2021, there are 324 districts/cities classified as having high flood risk, 69 areas with medium risk, and only three areas with low risk

The increase in the frequency and intensity of flooding events in Indonesia is influenced by various factors, especially climate change, which causes rising sea levels, tides, and changes in rainfall patterns that result in high-intensity rain over a longer period of time. In addition to climatic factors, anthropogenic factors such as deforestation, uncontrolled land use change, and inadequate drainage systems also exacerbate the impact of flooding. In the Philippines, floods are often triggered by tropical storms and typhoons, such as those that occurred in September 2024 due to typhoons Bebinca and Gener, which resulted in at least 10 fatalities and several missing persons.

Facing this phenomenon, effective mitigation efforts are needed to minimize the impact of flooding. Measures that can be implemented include more sustainable spatial planning, development and improvement of drainage infrastructure, and community education on flood preparedness. With the implementation of appropriate mitigation strategies, it is expected that the risk and impact of flooding can be minimized so that sustainability can be achieved.

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2. RESEARCH METHOD

This research uses the literature review method, which aims to collect, analyze, and synthesize various scientific sources related to the topic of flooding, its causes, and mitigation efforts. By using the literature review method, this research can provide a systematic and evidence-based overview of the flood phenomenon and the solutions that can be applied to reduce its impact.

3. RESULTS AND DISCUSSION

Flooding Factors in Indonesia

Prolonged flooding in Indonesia, particularly in Jakarta, has been significantly influenced by ongoing land subsidence. Since the early 2000s, this phenomenon has been observed consistently, culminating in the major flood event of 2007, which was exacerbated by abnormal tides during the annual high tide season. The rate of land subsidence in Jakarta is alarming, reaching an average of 5 to 12 centimeters per year, and in some northern coastal areas, it can reach up to 25 centimeters annually. The primary causes of this subsidence are the overexploitation of groundwater and the heavy load from infrastructure development, both of which put pressure on the soil and reduce its capacity to retain water. According to projections by Takagi et al. (2015), if these trends continue, approximately 110.5 square kilometers or 75% of North Jakarta could be affected by flooding due to land subsidence by 2050. This risk is further heightened by the fact that about 35% of Jakarta's population depends on groundwater for daily use, which accelerates the decline of the water table and diminishes natural water storage.

Changes in land use also contribute to the worsening hydrological condition of Jakarta. Data from the Ministry of Environment and Forestry (KLHK) indicate that between 2000 and 2019, the area of plantation forests in upstream river areas increased by 117.7%, replacing agricultural lands that previously served as effective water catchment areas. Meanwhile, the area of residential settlements in the midstream and downstream regions rose by 47.4%, contributing to the loss of agricultural and green open spaces. In Jakarta itself, green open space coverage reached only 9.8% in 2019, far below the ideal standard. These changes have significantly increased surface runoff, accelerated river overflows, and intensified sedimentation due to high erosion rates in upstream areas.

Flooding Factors in the Philippines

The Philippines faces a different set of challenges. Positioned along the tropical storm track, the country is frequently hit by typhoons and storms that bring intense rainfall within short periods. This has made flooding a regular occurrence, particularly in urban areas like Manila, where drainage systems often cannot accommodate the volume of water during heavy rainfall events. A recent example is Tropical Storm Trami in 2024, which caused severe flooding and loss of life. Similarly, Typhoons Ketsana and Parma in 2009 caused widespread infrastructure damage and disrupted socio-economic activities across the Manila metropolitan area.

In response, the Philippine government has undertaken several flood mitigation initiatives. These include the construction of 8 kilometers of levees, 13.1 kilometers of river embankments, the rehabilitation of 21 major waterways, the installation of 21 pumping

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stations, and the development of 2.7 kilometers of drainage channels. Retention ponds were also constructed to manage excess water during extreme rainfall events. This infrastructure is designed to withstand a 30-year return period flood and is part of a broader national strategy to mitigate the increasing impacts of climate-related disasters.

Flood Management in Jakarta

To address flooding, the DKI Jakarta Water Resources Agency allocated a budget of IDR 3.9 trillion in 2024 for flood control infrastructure and river normalization programs. As of December 6, 2024, the Jakarta Provincial Government had dredged approximately 1,026,879 cubic meters of sediment from various water bodies, including reservoirs, lakes, rivers, and connecting drainage channels across five municipalities. This dredging effort included 587,107 cubic meters from reservoirs and lakes, 286,284 cubic meters from rivers, and 158,486 cubic meters from tertiary channels (PHB).

Despite these efforts, the normalization of the Ciliwung River and other major waterways remains incomplete, primarily due to delays in land acquisition in areas like Rawajati. These delays hinder the overall effectiveness of flood control initiatives. Furthermore, Jakarta's rapid population growth and unregulated urbanization exacerbate flood risks. Based on projections from the 2020 Population Census (SP2020), Jakarta's population reached 10,677,975 in 2024, with a modest annual growth rate of 0.23% from 2020 to 2025. However, urban expansion often comes at the expense of critical water catchment areas, such as swamps and open land, which further reduces the city's ability to manage stormwater effectively.

Flood Management in the Philippines

Flood management in the Philippines is guided by the National Disaster Risk Reduction and Management Plan (NDRRMP) 2011–2028. This plan emphasizes four key areas: disaster prevention and mitigation, preparedness, emergency response, and rehabilitation and recovery. The government integrates disaster risk reduction into development policies across all administrative levels, promotes environmentally sound and climate-sensitive planning, and improves infrastructure resilience. In addition, early warning systems and disaster risk financing are being enhanced to reduce the vulnerability of at-risk communities.

Preparedness strategies include public education, community training, and the development of emergency response frameworks. During flood events, emergency operations focus on life-saving measures, rapid evacuation, temporary shelter provision, and the delivery of social and health services, including psychosocial support for affected populations. In the recovery phase, efforts are directed at rebuilding disaster-resilient infrastructure and restoring economic livelihoods under the "build back better" principle. Funding for these activities comes from multiple sources, including the National Disaster Risk Reduction and Management Fund (NDRRMF), national budgets, donor support, and other financial mechanisms. However, despite these comprehensive plans, the implementation of engineering and relocation policies has led to new socio-economic problems. For instance, the relocation of approximately 6,000 households in Manila has resulted in the formation of new slum areas with inadequate access to basic services. Moreover, poor communities living in coastal regions often remain unprotected, highlighting gaps in equitable flood protection and social justice.

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Discussion

The causes of flooding in Jakarta and Manila differ significantly in both characteristics and impact, yet both cities reflect the complex challenges of flood management. In Jakarta, flooding is largely driven by anthropogenic factors, particularly land subsidence caused by excessive groundwater extraction and the burden of heavy infrastructure development. In contrast, Manila's flooding is primarily triggered by natural phenomena, such as tropical storms and extreme rainfall that occur frequently due to the Philippines' geographical position along the tropical cyclone belt.

Jakarta's flood problem is increasingly complicated by the interconnection between land subsidence, land use change, and uncontrolled urbanization. The heavy reliance on groundwater, combined with intense infrastructure development, has severely compromised the soil's ability to absorb water. This situation is worsened by the reduction of green open spaces and the expansion of impervious surfaces due to residential and road construction. As a result, the city's natural capacity to manage rainwater runoff has diminished, making flood control efforts more difficult. Government initiatives such as river normalization and sediment dredging indicate a commitment to addressing flooding. However, the actual impact of these efforts has been limited. One of the main obstacles is land acquisition, which continues to delay progress in projects like the normalization of the Ciliwung River. Moreover, increased budget allocations have not been sufficient to offset the escalating pressures from population growth and urban expansion, which further strain the city's environmental carrying capacity.

In contrast, the Philippines has adopted a more structured approach through the National Disaster Risk Reduction and Management Plan (NDRRMP) 2011–2028. This framework addresses all stages of disaster management, from prevention to recovery. The government's strategies go beyond physical infrastructure, focusing also on strengthening early warning systems, integrating disaster risk reduction into development planning, and building community resilience to climate-related hazards. Nevertheless, some policies, particularly relocation strategies have created new socio-economic issues. The displacement of thousands of households from flood-prone areas to relocation sites lacking adequate access to basic services has led to the formation of new informal settlements. This highlights the risk of technical and structural interventions that fail to consider social justice and the well-being of affected populations. Furthermore, flood protection in coastal areas inhabited by low-income communities is often insufficient, leaving these groups highly vulnerable to future disasters.

Both megacities face major challenges in achieving sustainable flood resilience. Jakarta must prioritize sustainable groundwater management, expand green open spaces, and implement spatial planning that accounts for disaster risk. Meanwhile, Manila must ensure that infrastructure development and relocation policies are inclusive and protective of vulnerable communities. A balanced approach that integrates technical, ecological, and social dimensions is crucial for building long-term resilience to the increasing threat of urban flooding intensified by climate change.

4. CONCLUSION

Flooding in both Jakarta and Manila presents a multifaceted challenge that stems from a combination of environmental, infrastructural, and socio-political factors. In Jakarta, prolonged flooding is primarily driven by human-induced land subsidence, overextraction of groundwater, inadequate land use planning, and the rapid pace of urbanization that sacrifices natural water catchment areas. Despite substantial investments in infrastructure such as river

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normalization and sediment dredging, these efforts have yet to significantly mitigate flood risks due to implementation barriers, especially land acquisition issues.

Meanwhile, in Manila, flooding is largely attributed to its geographic exposure to tropical cyclones and extreme weather events. The Philippine government's response, anchored in the National Disaster Risk Reduction and Management Plan (NDRRMP) emphasizes a holistic strategy that includes not only flood-control infrastructure but also early warning systems, community preparedness, and climate-sensitive development planning. However, challenges remain, particularly in the social dimension, as relocation efforts have often exacerbated poverty and created new vulnerable settlements.

Both cities highlight the urgent need for integrated, long-term flood risk management strategies that balance physical infrastructure with ecological preservation and social equity. Jakarta must improve sustainable urban planning and groundwater management, while Manila must ensure that disaster response measures do not marginalize vulnerable populations. Ultimately, strengthening urban resilience to flooding requires coordinated action across sectors, consistent policy implementation, and inclusive planning that considers both present risks and future climate uncertainties.

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