Utilization of GIS for Ecosystem-Based Adaptation with Community Participation in Flood Disaster Management in Pati Regency

Pemanfaatan SIG untuk Adaptasi Berbasis Ekosistem dengan Partisipasi Masyarakat dalam Pengelolaan Bencana Banjir di Kabupaten Pati

M Indra Hadi Wijaya[1)a)*], Anang Wahyu Sejati[2)a)], Lutfia Diah Arsynindia[2)a)] , Reinhart Christopher Junjungan[3)a)], Maman Eka Kardiman[3)b)]

[1)] Perencanaan Wilayah dan Kota, sekolah Vokasi Universitas Diponegoro

[a)] Jl. Prof. Sudarto Kampus Tembalang, Kota Semarang, 50275, Jawa Tengah

[2)] Departemen Perencanaan Wilayah dan Kota, Universitas Diponegoro

[3)] Program Studi Magister Perencanaan Wilayah dan Kota, Universitas Diponegoro

[b)] Jl. Prof. Sudarto Kampus Tembalang, Kota Semarang, 50275, Jawa

*Email: indrahadiwijaya@live.undip.ac.id

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ABSTRAK

Daerah aliran sungai (DAS) merupakan bentang alam yang menyatu dan rentan terhadap bahaya seperti banjir, yang sering diperparah oleh faktor-faktor seperti perubahan tata guna lahan dan penanggulangan bencana yang reaktif. Penelitian ini menganalisis perubahan tutupan lahan dan hubungan spasialnya dengan daerah rawan banjir menggunakan pendekatan Adaptasi Berbasis Ekosistem (EbA). Pendekatan ini mengintegrasikan penginderaan jauh dengan metode partisipatif untuk meningkatkan pengurangan risiko bencana. Penelitian ini mengadopsi desain metode campuran, menggabungkan analisis spasial citra Landsat 8 (2000–2023) dengan data kualitatif dari diskusi kelompok terfokus (FGD), pemetaan partisipatif, dan wawancara yang melibatkan masyarakat lokal dan pemangku kepentingan pemerintah. Variabel-variabel utama yang dianalisis meliputi jenis tutupan lahan, luas spasial perubahan, kedekatan dengan sungai, elevasi, dan zona bahaya banjir yang telah dipetakan. Studi ini berfokus pada DAS Silugonggo di Kabupaten Pati, Indonesia, sebuah daerah dengan risiko banjir tinggi. Hasil penelitian menunjukkan peningkatan signifikan pada area terbangun (menjadi 17,18%) dan penurunan tutupan vegetasi (luas hutan berkurang menjadi 7,57%), terutama di bagian tengah DAS, yang berkontribusi pada peningkatan limpasan dan risiko banjir. Keterlibatan masyarakat sangat penting dalam mengidentifikasi penyebab banjir lokal dan mengusulkan strategi adaptasi seperti reboisasi, zona penyangga riparian, dan sistem drainase yang lebih baik. Temuan ini menekankan pentingnya mengintegrasikan EbA dan partisipasi masyarakat ke dalam perencanaan pengurangan risiko bencana.

***Kata kunci**: banjir bandang, daerah aliran sungai, , manajemen bencana, partisipasi masyarakat*

ABSTRACT

Watersheds are unified landscapes vulnerable to hazards like floods, often exacerbated by factors such as land-use changes and reactive disaster management. This study analyzes land cover changes and their spatial relationship to flood-prone areas using an Ecosystem-based Adaptation (EbA) approach. It integrates remote sensing with participatory methods to enhance disaster risk reduction.The research adopted a mixed-methods design, combining spatial analysis of Landsat 8 imagery (2000–2023) with qualitative data from focus group discussions (FGDs), participatory mapping, and interviews involving local communities and government stakeholders. Key variables analyzed included land cover types, spatial extent of change, proximity to rivers, elevation, and delineated flood hazard zones. The study focused on the Silugonggo River Basin in Pati Regency, Indonesia, a high-risk flood area. Results reveal a significant increase in built-up areas (to 17.18%) and a reduction in vegetation cover (forest area decreased to 7.57%), particularly in the midstream, contributing to increased runoff and flood risk. Community engagement was crucial in identifying localized flood causes and proposing adaptive strategies such as reforestation, riparian buffer zones, and improved drainage. These findings emphasize the importance of integrating EbA and community participation into disaster risk reduction planning.

***Keywords**: flash floods, watersheds, disaster management, community participation*

INTRODUCTION

Concerns about land-use/cover change emerged in the research agenda on global environmental change several decades ago, in the mid-1970s, it was recognized that land-cover change modifies surface albedo, in the early 1980s, terrestrial ecosystems as sources and sinks of carbon were highlighted (Lambin et al., 2003). The broader impacts of land use/cover change on ecosystem goods and services are further identified. Of primary concern are impacts on biotic diversity, soil degradation, the ability of biological systems to support human needs and natural disasters (Twisa & Buchroithner, 2019).

Changes in land cover and use in an area occur not only in urban areas but are starting to occur in rural areas. Conversion of forest to agricultural or agricultural land is generally framed as an investment decision driven by the expected returns for alternative uses or appreciation of the value of the land in the future (Dias et al., 2016). Given the current state of land shifting from established agricultural landscapes to remote frontier areas, expectations regarding return on investment are based on very different socio-economic realities.

In mountainous watershed areas, agricultural land use leads to changes in ecosystem services, with trade-offs between crop production and erosion regulation. Intensive farming in these ecosystems reduces the ability to reduce soil loss in exchange for food production and this worsens water quality downstream. Therefore, it is necessary to use land resources effectively under a land management plan, which is a region-specific policy to reduce trade-offs between ecosystem services (Sassolas-Serrayet et al., 2018).

One of the impacts of land use change is flooding in the downstream area of the watershed. On a global scale, flood zone urbanization trends are just as steep and increasing, especially in Africa and Asia (Winsemius et al., 2016). Not only has this meant more and more human assets are being flooded, but urbanization with increased impermeability and a lack of natural drainage is creating additional flooding problems where none existed before. Socio-economic changes are further exacerbated by an increase in extreme rainfall caused by climate change which amplifies the intensity and likelihood of flooding (Jongman, 2018).

An ecosystem-based adaptation approach is needed for regional and urban planning and the impact of land change in the watershed from upstream to downstream. Ecosystem-based adaptation refers to “the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people adapt to the effects of disasters (Nalau, Becken, & Mackey, 2018a). EbA[1] covers the conservation, restoration, and sustainable management of ecosystems, ecosystem processes, and biodiversity to address the impacts of climate change on people's lives and livelihoods (Donatti et al., 2020).

Community involvement or participation can be interpreted as the involvement or inclusion of individuals and the general public physically and non-physically (Ismail, 2019). Besides that, broad community involvement is a form of community participation and involvement either actively or voluntarily from within (intrinsic) or from outside (extrinsic). The community-based approach to disaster preparedness is an increasingly important element of vulnerability reduction and disaster management strategies (Allen, 2006). This strategy relates to policy trends that value the knowledge and capacities of local communities and build on local resources, including social capital (Newport & Jawahar, 2001).

Recognizing the important role of local communities in hazard identification and assessment, the use of hazard mapping with Geographic Information Systems (GIS) is utilized. It is essential to integrate local knowledge, GIS and maps into the disaster risk management process. There are three main reasons for this integration: (i) hazard maps play a key role in disaster risk identification, and are an effective tool for making local knowledge visible; (ii) local knowledge is essential for disaster risk management; and (iii) GIS maps have advantages over conventional maps (Tran et al., 2009).

Community participation-based disaster management approaches through GIS and EBA have been carried out by several researchers but most of them have separate themes. Like the application of participatory mapping through GIS, a lot of modelling is done as a result of land conversion (Ntajal et al., 2017; Tran et al., 2009; Twisa & Buchroithner, 2019; White et al., 2010), whereas how to analyse EbA in disaster management is more about flood disasters as a result of climate change (Indonesia, n.d.; Nalau, Becken, & Mackey, 2018b; Sultana et al., 2023). This study looks at how the community's response to

[1] Ecosystem-based Adaptation (EbA) is defined as the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people adapt to the adverse impacts of climate change .

disaster management is participatory by providing mapping of the results of GIS analysis, as well as combining the application of EBA from upstream to downstream of rivers affected by floods.

As one of the developing regions along the northern coast of Java (Pantura), Pati Regency is experiencing increasing demand for space to support various socio-economic activities, including housing, industry, and services. This development trajectory, while contributing to economic growth, is also accelerating the transformation of land use, particularly in peri-urban and agricultural zones.

According to data from the National Land Agency (BPN), Pati Regency Land Office (2021), there has been a notable increase in land use status changes, particularly involving the conversion of productive agricultural land into residential yards.

In 2020, approximately 200,845 square meters of land were converted from rice fields to yards, and 79,942 square meters from dry fields (tegalan) to yards. This trend reflects the growing pressure on land use driven by the expansion of settlements and infrastructure. The trend intensified in 2021, with 334,112 square meters of rice fields and 417,070 square meters of dry fields converted into yards (Kabupaten Pati, 2021).

This research will identify and analyze the role of community participation in flood disaster management in Pati Regency, Central Java Province, Indonesia,. Current flood management strategies remain reactive, with limited integration of proactive, ecosystem-based approaches and participatory methods involving local communities. How have land use changes, particularly in flood-prone areas, contributed to increased disaster risk in Pati Regency, and how can ecosystem-based and participatory approaches enhance flood mitigation?. And with this research can contributes to the growing discourse on nature-based solutions by demonstrating how spatial analysis and community engagement can support ecosystem-based adaptation (EbA) in flood-prone areas..

LITERATURE REVIEW

Geographic Information Systems (GIS)

Geographic Information Systems (GIS) have been widely used in disaster management, including ecosystem-based adaptation. GIS allows the collection, analysis, and visualization of spatial data to support better decision- making. According to Prasetyo et al. (2021), the use of GIS helps in mapping flood-prone areas and identifying natural ecosystems that can be utilized for risk mitigation. Ecosystem-based approaches, such as wetland restoration and mangrove forest management, can increase the adaptive capacity of ecosystems and surrounding communities to disaster threats. GIS is also an important tool for mapping social and ecological vulnerabilities, which form the basis for more holistic and effective adaptation planning (Andini & Setiawan, 2020).

In addition, Cutter et al. (2003) emphasize how GIS allows for spatially explicit vulnerability assessments by integrating exposure, sensitivity, and adaptive capacity indicators. Goodchild (2006) underscores the significance of spatial data infrastructures in facilitating real-time coordination and decision support during disaster events. Regionally, in Southeast Asia, the application of GIS has been particularly effective in flood hazard zoning and early warning systems. For instance, Niu et al. (2020) demonstrate the utility of GIS-based multi-criteria decision analysis (MCDA) for prioritizing flood mitigation interventions in rapidly urbanizing areas. These combined applications highlight GIS not only as a technical instrument, but as a bridge between environmental data, local knowledge, and adaptive governance in disaster risk management.

Land Use Change and Flood Risk

Land use change, particularly due to rapid urbanization and deforestation, has been widely recognized as a key driver of increased flood risk, especially in low-lying and riverine regions. Urban expansion typically leads to the conversion of natural land covers—such as forests, wetlands, and agricultural land—into impervious surfaces like roads, buildings, and pavements, which significantly reduce water infiltration and increase surface runoff. Dewan et al. (2012) demonstrated through remote sensing analysis in Dhaka, Bangladesh, that a notable increase in built-up areas contributed directly to higher flood frequency and severity due to the loss of natural drainage systems and permeable surfaces.

Abhas et al. (2010) emphasize that unplanned urban growth without corresponding investments in drainage infrastructure has exacerbated flood impacts in many Asian cities. This is particularly problematic in rapidly developing countries, where land use planning often lags behind urban expansion. In the context of Indonesia, Rimba et al. (2017) provide evidence from the Upper Ciliwung River Basin, showing how deforestation and land cover change upstream significantly affected downstream hydrology, intensifying flood events in Jakarta. Their study highlights that vegetated areas play a critical role in water retention and delay of runoff, which are essential in regulating watershed-scale flood risk.

Community participation

Community participation is a crucial aspect of the ecosystem-based adaptation approach to flood management. Involving local communities in spatial data collection, such as participatory mapping, can improve data accuracy and strengthen community awarenes and adaptive capacity. A study by Lestari et al. (2019) showed that participatory mapping through GIS allows communities to identify priority areas for protection and propose ecosystem-based solutions appropriate to local conditions. In addition, integrating GIS with local knowledge provides an opportunity to create more inclusive and adaptive strategies for climate change and flood risk. Therefore, collaboration between modern technologies such as GIS and local community knowledge is key to implementing sustainable ecosystem- based adaptation.

The success of ecosystem-based adaptation in flood-prone areas is largely influenced by several key independent variables, notably the application of Geographic Information Systems (GIS), the extent of community participation, and the types of ecosystem-based approaches implemented. The use of GIS plays a vital role in collecting, analyzing, and visualizing spatial data, which supports more informed decision-making in disaster risk management. Through GIS, flood-prone zones can be accurately mapped, and natural ecosystems with mitigation potential. In parallel, community participation significantly enhances the effectiveness of these efforts. Local involvement in spatial data collection, particularly through participatory mapping, not only improves data accuracy but also empowers communities to contribute local knowledge and propose context-specific solutions. Furthermore, the implementation of ecosystem-based strategies, such as wetland restoration or vegetative buffer zones, directly contributes to increasing the adaptive capacity of both the environment and local residents. Together, these variables form the foundation for sustainable and inclusive flood management strategies.

RESEARCH METHODS

This study adopts a mixed-methods design, integrating quantitative spatial analysis with qualitative data from field observations and interviews

Data Collection

a. Spatial Data

   Landsat 8 imagery (2000 and 2023), administrative boundaries, flood-prone area maps from BNPB.

b. Ground Truthing & Institutional Data:

   Interviews with officials from BPBD Pati, Bappeda, and village representatives supported by field observation of flood-prone locations.

The research study area focuses on Pati Regency. Pati Regency is one of the districts located in Central Java Province, Indonesia (Figure 1). Pati Regency borders directly on the north coast of the Java Sea. This area has the Juwana watershed. The data used in this study uses land cover change data processed from Landsat 8 satellite imagery data with a resolution of 30 m, taken from 3-time series (2000, 2010, and 2023). Followed by community involvement data through a primary survey in Pati Regency, the data is grouped based on administrative areas that have river characteristics from upstream to downstream that have been affected by flooding. To deepen the understanding of local dynamics and stakeholder perspectives, Focus Group Discussions (FGDs) were conducted with key stakeholders—including representatives from local government agencies, disaster management bodies, and environmental offices—as well as with community members residing in flood-prone areas. These FGDs aimed to capture qualitative insights on community experiences, perceptions of flood risk, and their involvement in ecosystem-based and participatory. In addition, other supporting data such as regional policies related to disaster risk assessment and disaster management plans.

Methods

Risk assessment is based on two aspects of spatial issues; physical and socio-economic aspects. The physical aspect is analyzed from physical and environmental vulnerability and disaster hazards. Several sources of spatial data come from InaRisk (Indonesian Disaster Geoportal) (Indonesian Disaster Mitigation Agency, 2012). While the socio-economic aspect is analyzed from socio-cultural and economic vulnerability as well as regional resilience and disaster preparedness. The social aspect is obtained through a participatory mapping process so that the community capacity aspect can be mapped accurately which describes the level of regional resilience.

Remote Sensing Analysis:

- Supervised classification with Maximum Likelihood Algorithm conducted using QGIS and SNAP.
- Change detection over 10 years (built-up, agriculture, water body) combined with flood-prone map layers.

This research begins by analyzing the pattern of land cover change that was carried out using GIS in the period 2000-2023 through a guided classification analysis tool. The results of this analysis are the pattern of land change and the amount of land change, followed by identifying the location of the flood disaster with the pattern of land cover change.

Qualitative Analysis:

Thematic analysis on interview transcripts using manual coding to extract institutional capacity, decision-making, and GIS application. The next stage is to identify the role of the community in the mapping results. What is tested at this stage is the causes of disasters and the community's understanding of EBA, followed by recommendations for disaster management planning needs.

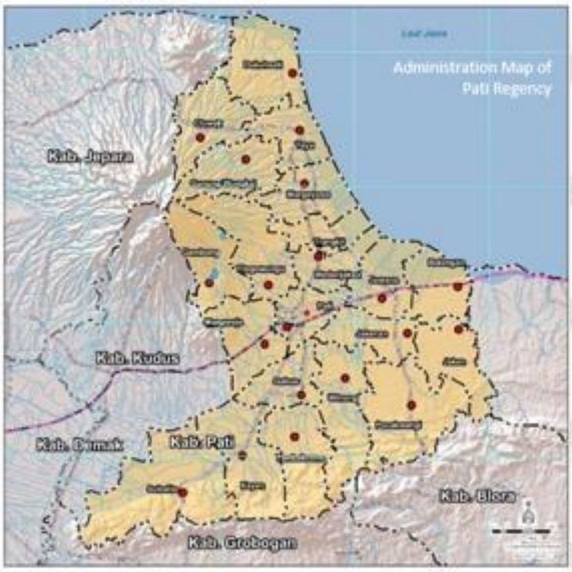

Figure 1.
Study Area

In this regard, the village is a forum for guaranteeing public participation in mapping village boundaries. This is crucial because local community knowledge is needed as primary data in land use planning. Furthermore, according to him, the participatory approach is a method that is accepted by the community as a strategy that can ensure that the community contributes to the mapping. Therefore, the local knowledge provided by the village in the FGD can strengthen and confirm the results of data in the field conducted by surveyors. If there is a dispute in the determination and affirmation of village boundaries, then through the FGD method the problem will find a solution.

RESULTS AND DISCUSSION

Land cover change and flash flooding

Indonesia is a country located in Southeast Asia and is prone to a wide range of natural disasters due to its geographical location, which includes being part of the Pacific Ring of Fire and having extensive coastlines. The country's complex geology and diverse climate create conditions conducive to various natural hazards such as disasters caused by hydro meteorology such as in the northern coastal region of Java Island (Buchori et al., 2018). This disaster condition was also strengthened by the conversion of land functions in Koto Regency in Indonesia, such as in the North Coast area of Central Java, with a growth rate of 12% per year, with 37% of the built-up area being spread growth and the built-up areas spreading sporadically with a development pattern that irregular (Dewa et al., 2022).

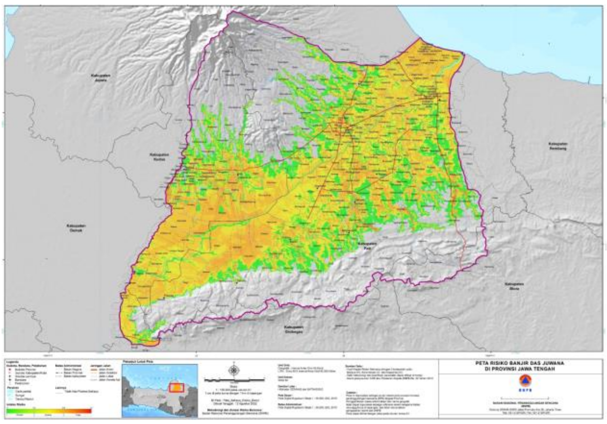

Figure 2. DAS Juwana/Sungai Silungonggo

Pati Regency still has 1178.32 hectares of Protected Forest spread across the slopes of Mount Muria. Protection Debt has an important function in preventing disasters such as floods, landslides, droughts, and flash floods. Residential land use is a land use that is vulnerable to disasters, because in this land use all human activities are included in it including educational activities, trading activities, industry, and other activities. If a disaster occurs in residential areas, of course, the potential for exposure to the population is very high and can hamper all activities, economic, educational, industrial, transportation, and others.

The dynamics of land cover in a watershed are known to influence disaster occurrence. This increases the urgency to observe the dynamics of land cover as an effort to mitigate natural disasters. The watersheds in Pati Regency are within the scope of the Jratunseluna River Basin, agricultural land cover consistently has the largest area compared to other types of cover in the Jratunseluna Watershed. Bare land, on the other hand, consistently has the smallest area compared to other land covers. The cover has gradually declined over the past 3 decades.

In Pati Regency, Central Java Province, which is located in the northern part of Central Java, is also experiencing conditions of land use change and land cover. As shown in Figure 2, the results of the guided analysis using GIS from 2000 to 2023 saw 66.88% of the growth of built- up land throughout the Pati Regency area. This condition occurs because the expansion of urban areas leads to the north and east of Pati Regency.

Meanwhile, forest area decreased by 7.15% and agricultural land decreased by 1.80%, this condition is in line with the growth of built-up areas in Pati Regency.

This condition is indirectly the cause of flash floods that occurred in Pati Regency, especially in the Silugonggo River basin. From the results of the disaster risk study analysis from BNPB (National Disaster Management Agency) Juwana Watershed in 2022, information regarding the potential Risk Area in the Juwana Watershed Area based on the hazard class of each Sub-district, with a total risk area of 84,526.69 Ha. The highest risk area is in Sukolili District, Pati Regency with an area of 8,639.36 Ha, in the low class of 1,350.38 Ha, medium class area of 5,929.62 Ha and high class area of 1,359.36 Ha. The lowest risk area is in Trangkil District, Pati Regency, which is 3.11 Ha, where all risk areas are in the low class

This river basin has river headwaters on Mount Muria to the east in the Gunungsari area and empties into the Bulumanis and Juwana areas. The results of the identification of satellite imagery followed up by field verification carried out through mapping using drones with samples in the upstream, middle, and downstream areas of the Silugonggo River basin, it was found that the upstream part of the river in the Gunungsari area had not experienced significant land change, the land was still being used for coffee plantations and pine forests. In the central part of the watershed, there has been a change in land use, especially on the banks of the river where in 1990 it was still planted with perennial crops, while in the 2010 period until now it has changed to annual crops such as cassava. This condition is because Pati Regency is one of the second largest cassava-producing areas in Central Java after Wonogiri Regency. The area of cassava land in 2015 was 17,781 ha and the productivity was 744,746 kw/ha (Luthfiah et al., 2017).

Previous studies have found that built-up land cover is more vulnerable to disasters. Densely populated activities carried out on built- up land can increase the losses incurred when a disaster occurs. Conversion of land cover from canopied vegetation to agriculture can also increase disaster vulnerability. The inferior ability of agricultural crops to bind the soil and absorb water compared to canopy vegetation is also known to increase disaster vulnerability. Floods, flash floods, and landslides are known to be affected by the condition of the land cover they shelter.

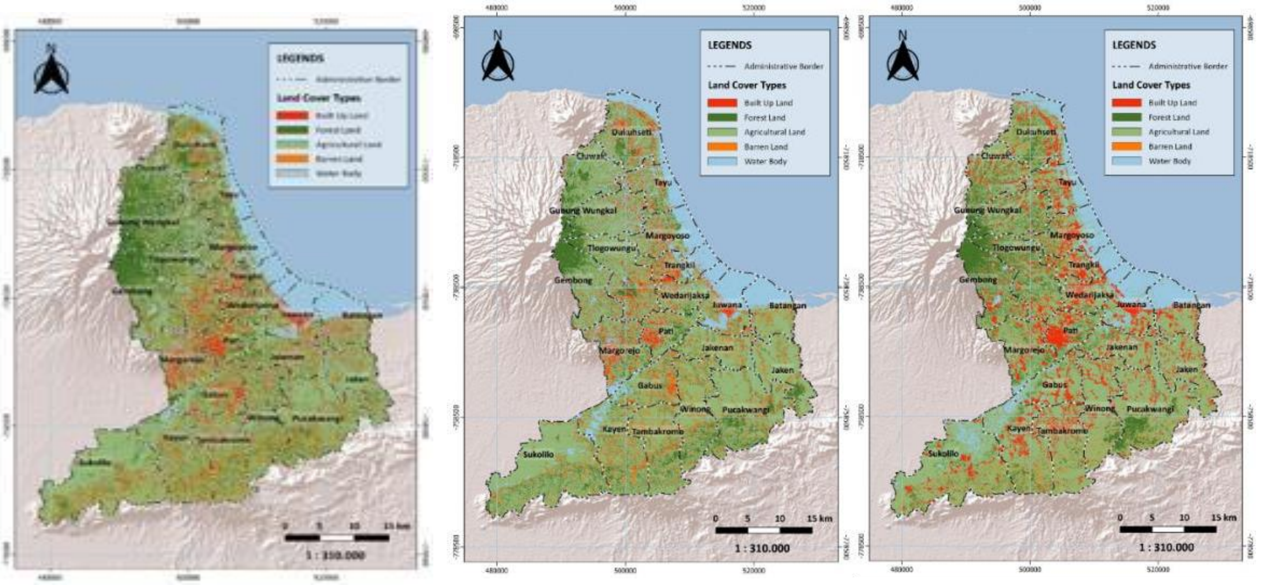

Figure 2.

Land cover change 2000-2023 in Pati Regency

Flood conditions due to changes in land use and cover are also influenced by topographic conditions not only seen from the slope of the slopes but also through the altitude. The altitude of the place will affect the potential for inundation. As much as 12.88% of the Pati Regency area has a height of less than 5 meters above sea level, so it is prone to flooding, especially during the rainy season. On the other hand, there are 23 watersheds in Pati Regency, with the largest watershed area being the Juwana watershed. Juwana Watershed has an area of 90,776.82 hectares with a river length of

62.8 km. Juwana River is a river that often overflows and causes floods. This phenomenon contributed to 15 flood events that occurred in 2020 (BPDAS Pemali Jratun, 2022a). Findings from (BPDAS Pemali Jratun, 2022b) said that most of the protected areas in the Juwana watershed had 97.42% vegetation cover with a very good class. However, the assessment of vegetation cover (PPV) analysis shows that the area of permanent vegetation in the Juwana Watershed is in the poor category (29.1%). This shows that the permanent vegetation cover is not proportional to the size of the Juwana watershed according to the PPV standard. Meanwhile, in the lower reaches of the river, in urban areas, changes in land use are mostly carried out in the form of residential buildings. Housing growth began in early 2010 with the emergence of cluster-type housing scattered in the urban areas of the Districts of Pati to Juwana. Where the condition of the river is experiencing siltation, sedimentation, narrowing of the cross-sectional area, coupled with high rainfall resulting in flooding and flash floods (most of the rivers in Pati Regency experience physical changes such as the river body narrowing in the lower reaches of the river). These conditions occur in the Gung Wedi, Simo, Sani, Silugonggo, Suwatu, Gung Wedi, and Godo Rivers. These disturbances arise due to the dumping of garbage into the river and boat parking. The villages of Bulumanis Kidul (Sub District Margoyoso), Ngurenrejo (Sub District Wedarijaksa), and Sinomwidodo (Sub District Tambakromo) are examples of areas that were damaged by floods and flash floods as a result. Changes in land use from forests to agricultural activities that reduce the ability to mitigate floods and flash floods exacerbate this condition.

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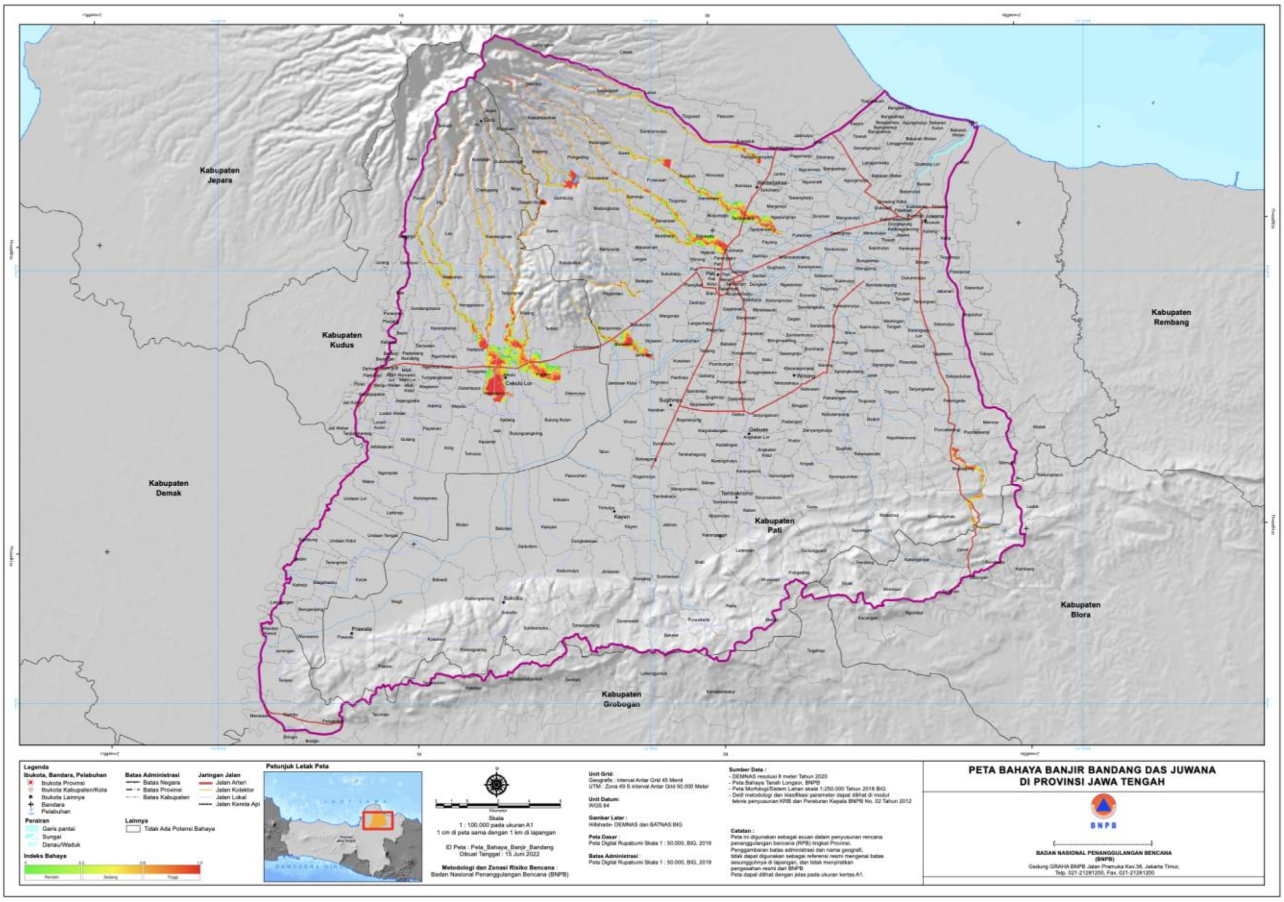

Figure 3.
Level of Flash Flood Hazard

Level of community participation

The community involvement process in mapping potential disasters and management plans is carried out through the FGD process. Community participation plays a very important role in ensuring and ensuring the availability of appropriate field data. In this case, community participation regarding the mapping of potential disasters and causes of flooding is urgently needed, especially the information provided by the village to the people living in the location. The village party can provide an overview that represents the knowledge of the local community (Cahyono et al., 2020; Wahyuni et al., 2020).

The implementation of participatory mapping was carried out in June 2023 throughout the Pati Regency area, for detailing land conversion which resulted in flooding carried out in the Juwana River basin. The mapping process involves all relevant stakeholders, starting from village officials, village disaster volunteers, and sub-district officials to local governments such as the Pati Regency Regional Disaster Management Agency. Activities started by focusing on providing direction and education about understanding maps, understanding environment-based adaptation, and identifying disaster risk areas through maps. The next stage is to identify the factors that are the cause of the flood disaster in Pati Regency and take input related to the desired planning from the community, especially in solving flood problems and land conversion.

From this process, maps of flood-prone areas were obtained along with locations that indicated changes in land use and cover and what factors caused flooding. One of the things that often happens is the conversion of land from annual crops to seasonal crops, such as cassava for tapioca flour. The next stage is planning carried out by stakeholders in flood disaster management that occurs downstream of the river. The response of the community in the upstream area of the river from the results of the discussions carried out was to continue to preserve plants and forests by planting annual crops such as coffee and pine. Mitigation is carried out in the central part of the watershed by planting bamboo plants on the banks of the river to reduce erosion. Whereas in the lower reaches of the river, the concept of planting vetiver grass which has strong roots is recommended by BPBD Pati Regency with a program to be implemented.

Figure 4.
Participation Process in Identification Mapping

Figure 5.
Flood Disaster Conditions in the Lower Juwana River (June 2022)

Adaptation based on environment

The understanding of environment-based adaptation in participatory discussion activities carried out by all stakeholders in affected areas has not been fully understood and implemented. In understanding the concept of EbA for disaster management, there are several aspects that must be defined, such as Nature-based solutions, community participation, resilience and adaptability, and multiple benefits.

The first aspect is the utilization of natural resources by trying to integrate natural processes and ecosystem services into strategies for disaster risk reduction and climate change adaptation. For example, restoring or conserving wetlands and mangroves can help protect areas from flooding. For some locations, especially in the upstream part, environmental conditions have been considered and supported by regional policies related to protected areas. Meanwhile, in the central part of the watershed, cassava is planted to increase the local economy, while this impact affects the downstream area where sedimentation from open land occurs.

The aspect of community participation related to disaster management plans emphasizes the active involvement and involvement of local communities in the decision-making process.

Community knowledge and traditional practices often provide valuable insights into ecosystem management and disaster risk reduction that are not yet fully established. The problem that occurs in the EbA concept which refers to upstream and downstream management is sectoral ego, what is meant by sectoral ego is that each region is more concerned with the interests of its own region.

Aspects of resilience and adaptation to increase the resilience and adaptability of ecosystems and communities. By protecting and restoring natural habitats, ecosystems are better equipped to absorb and recover from disturbances caused by disasters or climate change. Currently, the Pati Regency community is only found in a few places, such as in the lower reaches of the Juwana River, where the community has begun to build and rehabilitate the river from siltation which results in frequent flooding.

Meanwhile, from the aspect of benefit by providing many additional benefits, including better livelihoods, better biodiversity, and ecosystem services that support human welfare, currently, the community has not felt the benefits.

CONCLUSION AND ACKNOWLEDGMENTS

Conclusion

This research was successful in identifying the role of community participation in flood disaster management in Pati Regency, Central Java Province, Indonesia. The application of community participation-based disaster management with analysis tools for changes in land cover and land use to map the sources of flood disasters. Land-use change, driven by urbanization, agricultural expansion, and infrastructure development, has significant implications for ecosystems and their ability to provide essential services to people.

The next result is that the application of EbA has not been fully carried out in Pati Regency which is used as a research locus. The problem found is sectoral ego from several regions in one upstream-downstream watershed area which results in a source of disaster for the area where it is located. This condition must be resolved immediately by coordinating across sectors and regions with local government facilities.

As a means for development for the region and the province, first for the Pati district government, where it is necessary to study and enforce spatial planning and spatial use regulations in the watershed. Second, for the Provincial Government of Central Java, inter- regional coordination is needed, because the DAS does not only involve one administrative area but across regions.

Acknowledgments

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