ADMINISTRATIVE AND ENVIRONMENTAL LAW REVIEW
Volume 6 Issue 2, July 2025: pp.161- 176
Faculty of Law, Universitas Lampung, Bandar Lampung, Indonesia.
http://jurnal.fh.unila.ac.id/index.php/aelr
P-ISSN: 2723-2484
E-ISSN: 2745-9330

Flood Governance and Spatial Planning Failures in Batu City: A Socio-Legal Study on Risk Mitigation

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Submitted: August 9, 2025; Reviewed: Jan 13, 2026 ; Accepted: Jan 23, 2026

Article's Information

keywords:
Flood Impact, Flood Control Management, Integrated Risk Management, Mitigation Strategies

DOI :
https://doi.org/10.25041/aelr.v6i2.4462

Abstract

Flooding remains a persistent threat in Indonesian urban areas, including Batu City, East Java, causing extensive physical, social, and economic impacts. This study examines flooding impacts and analyzes prevention and mitigation efforts from a socio-legal perspective, with a focus on governance and spatial planning. Using a qualitative sociological-legal approach, the study finds that recurrent flooding in Batu City is primarily driven by human-induced land-use changes and weak enforcement of spatial planning regulations. Conversion of protected forests into agricultural land and settlements has reduced water catchment capacity, while degradation of the Brantas River Basin, including sedimentation and river narrowing, exacerbates flood risk. Batu, Junrejo, and Bumiaji sub-districts are the most affected, with flood durations often exceeding three hours. The findings indicate that deficiencies in spatial planning governance and law enforcement are key institutional factors in flood vulnerability. This study contributes to environmental administrative law by linking spatial governance failures to disaster risk and offers policy recommendations for revising the Regional Spatial Plan (RTRW) and strengthening local flood mitigation regulations.

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A. Introduction

Batu is a highland city at elevations of 700 to 1,700 meters above sea level in East Java with hilly terrain, high rainfall, and a tropical climate. Despite these natural conditions, floods and landslides have repeatedly occurred during the rainy season over the past five years. Nationally, floods account for about 32 percent of all disasters in Indonesia, underscoring the urgency of identifying their causes and formulating effective solutions.[1] Flood events inundate areas that are normally dry, damaging agricultural land and infrastructure, displacing communities, disrupting economic activities, and, in severe cases, triggering disease outbreaks and loss of life.[2]

In Batu City, floods and landslides are largely driven by forest degradation in upstream areas, which increases runoff and sediment transport to downstream zones. This problem is compounded by the conversion of designated water catchment areas into built-up land, reducing the landscape's capacity to absorb rainfall.[3] Flooding occurs when high rainfall exceeds the capacity of natural and artificial drainage systems, making it a serious and recurring threat to urban residents.[4] The annual repetition of flood disasters within short intervals highlights the need for stronger preventive measures to reduce losses. However, local government responses have focused mainly on structural approaches, which have proven insufficient to fully address flooding and landslides.

Top-down and sectoral policies that exclude community involvement are increasingly incompatible with global trends toward decentralization, democracy, and stakeholder participation, particularly among disaster-affected communities. Floods not only damage housing and settlements but also disrupt socio-economic services and public infrastructure, sometimes resulting in fatalities. Losses escalate further when economic and governmental activities are interrupted or halted. Increased rainfall, rapid urbanization, and changes in topography have significantly intensified the frequency of natural disasters, including in Batu City.[5]

Flooding in Batu City is driven by several factors. First, human activities have altered land use and reduced forest conservation, converting forests into agricultural land and agricultural areas into settlements.[6] Second, natural events such as heavy rainfall exceed the area's water absorption capacity, a problem intensified by the conversion of vacant land into built-up areas. Third, environmental degradation, including the loss of vegetation in catchment zones and rapid development of housing, hotels, villas, shopping centers, and shophouses, further increases flood risk. As a natural disaster, flooding in Batu City requires effective government-led disaster management to minimize its impacts. Disaster management involves a series of stages, including emergency response, recovery, reconstruction, mitigation of adverse effects, and

[1] Rahmawati Rahayu et al., "Impact of Land Cover, Rainfall and Topography on Flood Risk in West Java," *Natural Hazards* 116, no. 2 (March 2023): 1735–58, https://doi.org/10.1007/s11069-022-05737-6.

[2] U.C. Nkwunonwo, M. Whitworth, and B. Baily, "A Review of the Current Status of Flood Modelling for Urban Flood Risk Management in the Developing Countries," *Scientific African* 7 (March 2020): e00269, https://doi.org/10.1016/j.sciaf.2020.e00269.

[3] Suripin, *Sustainable Drainage System*, First Edition (Yogyakarta: Andi Press, 2014).

[4] M.J. Hammond et al., "Urban Flood Impact Assessment: A State-of-the-Art Review," *Urban Water Journal* 12, no. 1 (January 2015): 14–29, https://doi.org/10.1080/1573062X.2013.857421.

[5] Mohd Talha Anees et al., "Numerical Modeling Techniques for Flood Analysis," *Journal of African Earth Sciences* 124 (December 2016): 478–86, https://doi.org/10.1016/j.jafrearsci.2016.10.001.

[6] Antony, Maharani Citra Dewi, and John Elvin Louis, "Building Deliberative Democracy In Indonesia: Democracy Future and The Future of Democracy," *Jurnal Kajian Pembaruan Hukum* 5, no. 1 (May 2025): 1–26, https://doi.org/10.19184/jkph.v5i1.53689.

preparedness for future events.[7] However, urban development and land use planning are often dominated by commercial or private interests, while community roles are rarely considered.

Indonesia is one of the largest democracies in the world, where democracy emphasizes the primacy of public interests. As citizens of a democratic state, Indonesians are entitled to fundamental freedoms, protection, and participation in governance. This principle extends to the right of the public to be involved in policymaking processes, including disaster management.[8] Public participation reflects the implementation of democratic values, positioning communities not merely as policy objects but as subjects with rights to information, decision-making, and oversight of government policies and disaster management programs.

Previous studies on flooding in Batu City have largely focused on technical and environmental factors, such as rainfall intensity, drainage capacity, and land cover change. Limited attention has been paid to flooding as a legal and administrative issue, particularly in relation to spatial planning governance and public participation. There is a need for a socio-legal analysis that views flooding not only as a natural phenomenon, but also as a consequence of regulatory shortcomings and weak governance.

This article contributes a novel perspective by applying a socio-legal approach to analyze flood mitigation failures in Batu City, shifting the focus from a predominantly technical and environmental view to a legal and administrative framework. Unlike earlier studies, it examines the Regional Spatial Plan (*RTRW*) as a binding legal instrument rather than a technical document, revealing gaps between normative regulations and actual spatial practices. The study also links flood mitigation governance to citizens' right to security under Law Number 24 of 2007 on Disaster Management, framing flood risk as an issue of environmental administrative law and state responsibility rather than a purely natural or infrastructural problem.

The study aims to analyze persistent flooding in Batu City and to examine the governance of flood prevention and mitigation. It focuses on community-based flood prevention models grounded in local regulatory mechanisms in flood-prone areas of Batu City, East Java. The findings emphasize the need for local regulations on flood prevention and management that actively involve communities and the private sector through urban spatial planning policies to reduce flood risk.

This research uses a sociological juridical or socio-legal approach. It examines the causes of flooding, community roles in flood prevention and mitigation, and local government responses within their authority over urban spatial planning.[9] Grounded in local norms and values, the approach views law as inseparable from social life and extends legal analysis beyond normative rules to how law functions in everyday practice.

This study used both primary and secondary data. Primary data were collected through two methods: in-depth interviews with relevant stakeholders and field observations. Secondary data were obtained from literature reviews and document analysis. Data analysis employed a qualitative descriptive method, involving the sorting, classification, coding, and categorization of data from interviews, observations, and relevant reports on flooding. The next stage involved data construction using a combination of conceptual inductive reasoning and emic perspectives.[10]

The research adopts a socio-legal approach aligned with its focus on spatial planning policies and flood mitigation in Batu City. This approach enables empirical legal analysis by examining how law operates in social practice, particularly the consistency between the Batu

[7] Vladimir M. Cvetković et al., "Capacity Development of Local Self-Governments for Disaster Risk Management," *International Journal of Environmental Research and Public Health* 18, no. 19 (October 2021): 10406, https://doi.org/10.3390/ijerph181910406.
[8] Dan Slater, "What Indonesian Democracy Can Teach the World," *Journal of Democracy* 34, no. 1 (January 2023): 95–109, https://doi.org/10.1353/jod.2023.0006.
[9] Bambang Sunggono, *Legal Research Methodology* (Jakarta: PT Raja Grafindo Persada, 2014).
[10] Lexy Moleong, *Metodologi Penelitian Kualitatif* (Bandung: Remaja Rosdakarya, 2006).

Regency Spatial Plan and on-the-ground conditions.[11] Although socio-legal analysis alone may not improve policy without critical findings and normative recommendations, this study is expected to contribute to more effective flood disaster management policies in Batu City.

B. Discussion

1. Flooding and the Causes of Flooding in Batu City

Flooding is one of the most common natural disasters,[12] particularly in tropical regions with high rainfall. It not only damages infrastructure but also threatens human safety and disrupts socio-economic activities. Flooding occurs when surface runoff exceeds the capacity of drainage systems or rivers, causing water to overflow and inundate surrounding areas, often resulting in human and material losses.[13]A flood is therefore defined as a condition in which water cannot be contained within channels or waterways and spreads across the floodplain.[14]

In general, flooding results from multiple factors, including excessive rainfall, low-lying or depressed topography, and the overflow of rivers, lakes, or coastal waters. In Indonesia, and especially in Batu City, floods are primarily triggered by intense and widespread rainfall that generates water volumes beyond system capacity.[15] Flooding is further exacerbated by limited soil infiltration and surface storage, which reduce the land's ability to absorb water and increase surface runoff.[16]

According to Indonesian hydrologists, floods in Indonesia can be classified into several types based on their causes and characteristics:

a. River Flood
   River floods commonly result from disruptions in the hydrological cycle, such as upstream deforestation within a watershed.[17] They occur when heavy rainfall in upstream areas sharply increases river discharge beyond channel capacity, causing rivers to overflow into surrounding land.
b. Surface Flood
   Surface floods occur when land has limited or no infiltration capacity due to dense or saturated soil conditions. High rainfall generates excess surface runoff that cannot be absorbed, leading to localized inundation, which is often widespread in urban areas.[18]

[11] Rachmad Safa'at, "Ambivalensi Pendekatan Yuridis Normatif Dan Yuridis Sosiologis Dalam Menelaah Sistem Kearifan Lokal Masyarakat Adat Dalam Pengelolaan Sumber Daya Alam," *Lex Jurnalica* 10, no. 1 (April 2013): 46–62, https://doi.org/10.47007/lj.v10i1.353.

[12] Conrad Wasko et al., "Evidence of Shorter More Extreme Rainfalls and Increased Flood Variability under Climate Change," *Journal of Hydrology* 603 (December 2021): 126994, https://doi.org/10.1016/j.jhydrol.2021.126994.

[13] Suprayogi, *Urban Drainage and Flood Index* (Jakarta: Penerbit Buku Kompas, 2019).

[14] Suripin, *Sustainable Drainage System*.

[15] Dian Hudawan Santoso, "Flood Disaster Management Based on Vulnerability Levels Using the Ecodrainage Method in the Karst Ecosystem of Dukuh Tungu, Girimulyo Village, Panggang Subdistrict, Gunungkidul Regency, DIY," *Jurnal Geografi* 16, no. 1 (2019): 7–15, https://doi.org/10.15294/jg.v16i1.17136.

[16] Ligal Sebastian, "Flood Prevention and Control Approach," *Dinamika Teknik Sipil* 8, no. 2 (July 2008): 162–69.

[17] Cahyadi Ramadhan, Ruslanjari Dina, and Emilya Nurjani, "Spatial and Temporal Based Deforestation Proclivity Analysis on Flood Events with Applying Watershed Scale (Case Study: Lasolo Watershed in Southeast Sulawesi, Central Sulawesi, and South Sulawesi, Indonesia)," *International Journal of Disaster Risk Reduction* 93 (July 2023): 103745, https://doi.org/10.1016/j.ijdrr.2023.103745.

[18] Nandi Nandi, "Flood Mitigation: A Review of the Condition and Problems of the Drainage System and Flood Control in the City of Cimahi," *Jurnal Geografi* 10, no. 1 (March 2016), https://doi.org/10.17509/gea.v10i1.1668.

c. Flash Flood
Flash floods develop suddenly and are characterized by strong, fast-moving currents that often carry mud, rocks, and debris. They are typically triggered by intense rainfall over a short period in areas with steep topography.[19]

d. Tidal Flood
Tidal floods involve the inundation of land by seawater during high tides and are often intensified by land subsidence and sea level rise. These floods disproportionately affect low-lying and vulnerable coastal areas.[20]

Kodoatie and Sugiyanto further distinguish two main types of flooding: first, inundation or waterlogging in areas that are not normally flood-prone; and second, flooding caused by river overflow when floodwater exceeds the capacity of river channels or drainage systems. In both cases, flooding occurs when water volumes surpass the capacity of natural or artificial conveyance systems, often due to excessive rainfall.[21]

Legal Sebastian classifies floods into three types. First, flash floods occur suddenly, usually within five hours after rainfall. They are typically triggered by intense rainfall, particularly where riverbank soils are fragile and unable to retain water. Second, river overflow floods are generally seasonal or annual and may persist for days or weeks. They are caused by deforestation, climatic or seasonal changes, or a combination of both. Third, coastal floods result from extremely high sea levels, where seawater inundates land due to tidal waves, storms, or tsunami-related high tides, often producing brackish flooding.[22]

The causes of flooding in Batu City can generally be classified into two factors, namely:

a. Natural Flooding
Natural flooding in Batu City is mainly caused by very high or prolonged rainfall combined with erosion, sedimentation, and inadequate drainage capacity. Erosion and sedimentation, often linked to deforestation and improper land use, reduce river capacity through aggradation and siltation. The city's mountainous and hilly topography also accelerates surface runoff from upland areas to lowlands, increasing the likelihood of inundation during the rainy season.

b. Flooding caused by Human Activity
Flooding in Batu City caused by human activity. These human actions then caused environmental changes, which included:
1) Large-scale land conversion in Batu City from green and agricultural areas to settlements, tourism, and industrial uses has reduced water catchment capacity, increased runoff, and raised disaster risk. BPS Batu City data show agricultural land fell from 2,661 hectares in 2010 to 1,998 hectares in 2022, while by 2023 about 1,295 hectares of forest, including 113 hectares of protected primary forest, had been degraded, weakening flood control and environmental sustainability.
2) Rapid housing and settlement growth driven by population increase has further reduced catchment areas.[23]Many residential zones that should serve as infiltration

[19] Azmeri and Eldiana Fatimah, *Rapid Detection of Flash Flood Threats*, First Edition (Yogyakarta: Deepublish Publisher, 2017).
[20] Boby Rahman et al., "The Tidal Flooding Causes in the North Coast of Central Java: A Systemic Literature Review," *Journal of Southwest Jiaotong University* 56, no. 6 (December 2021): 184–94, https://doi.org/10.35741/issn.0258-2724.56.6.15.
[21] Kodoatie and Robert J. Sugiyanto, *Floods: Several Causes and Control Methods from an Environmental Perspective* (Yogyakarta: Pustaka Pelajar, 2002).
[22] Ligal Sebastian, "Flood Prevention and Control Approach."
[23] Cheol Hee Son, Chang Hwan Lee, and Yong Un Ban, "Analysis of the Impact and Moderating Effect of High-Density Development on Urban Flooding," *Heliyon* 9, no. 12 (December 2023): e22695, https://doi.org/10.1016/j.heliyon.2023.e22695.

areas lack adequate drainage, creating new flood-prone locations. Rapid development of housing and settlements.

3) Deforestation in upstream areas has lowered soil infiltration and removed natural vegetation. Illegal logging reduces water absorption by tree roots, increasing runoff. Extensive deforestation in Bumiaji and around Mount Arjuno has sharply reduced catchment areas, disrupted the hydrological cycle, and triggered floods and landslides.[24]
4) Drainage channels have been narrowed, blocked by waste, or covered by buildings, preventing proper water flow. Clogged or undersized systems cannot handle heavy rainfall, causing floodwaters to inundate residential areas.[25]

2. Impact of Flooding in Batu City

Floods are among the most frequent natural disasters, causing significant material, environmental, and social damage. In many cases, they rank second only to earthquakes in terms of destruction. In Batu City, high rainfall in upstream, forested areas cannot be fully absorbed due to land degradation and ecosystem damage, accelerating water flow to lowlands. Conversion of forests into agricultural land, tourism areas, hotels, and settlements has further reduced catchment areas, compounded by community-led clearing of new forest land. The impacts of flooding in Batu City can be categorized as follows:

a. Physical and Infrastructure Damage
   Sub-districts such as Bumiaji, Batu, and Sisir experienced extensive damage. Residential houses ranged from minor to severe damage, while public infrastructure, including roads, bridges, and 25 businesses, suffered major losses.
b. Social Impacts and Resident Safety
   Floods threaten resident safety, as seen in the November 2021 flash flood in Bulukerto Village, which killed one person and left ten missing. Dozens of residents were forced to evacuate due to overflowing water and mud inundating settlements.
c. Economic Losses
   Flooding disrupts work, income, and quality of life. By 2023, total losses were estimated at IDR 1.4 billion, covering homes[26], public facilities, and agricultural land. In 2024, losses decreased to IDR 840 million, but the city remains highly vulnerable to economic impacts from disasters.
d. Environmental Impacts
   Floods contribute to river sedimentation, forest degradation, and damage to catchment areas. Surface water quality declines as mud and waste are carried into rivers, harming aquatic ecosystems.

Several areas in Batu City have different levels of vulnerability to flooding, the details of which are as follows:

a. Batu subdistrict as the city center often experiences inundation due to limited drainage capacity, particularly during heavy rainfall, disrupting economic and transportation activities.
b. Junrejo subdistrict, located in the lowlands, receives runoff from surrounding hills. Land conversion for settlements and agriculture exacerbates flooding.

[24] Muhajir Arifin, "Hutan Gunung Arjuno Terus Terjadi Kerusakan, Resapan Air Berkurang," *Detiknews*, June 19, 2019, https://news.detik.com/berita-jawa-timur/d-4592162/hutan-gunung-arjuno-terus-terjadi-kerusakan-resapan-air-berkurang.
[25] BPBD Batu, *Annual Report on Disaster Management* (Batu: Badan Penanggulangan Bencana Daerah Kota Batu, 2023).
[26] Yiyi He et al., "Flood Impacts on Urban Transit and Accessibility—A Case Study of Kinshasa," *Transportation Research Part D: Transport and Environment* 96 (July 2021): 102889, https://doi.org/10.1016/j.trd.2021.102889.

c. Bumiaji subdistrict, with its hilly topography, is highly prone to flash floods. Landslide debris, including soil and rocks, often clogs waterways and damages infrastructure.

Table. 1. Recapitulation of Flood Events in Batu City

Year	*Affected Subdistrict*	*Affected Location*	Rain Intensity (mm/day)	Flood Duration (hour)	Material Loss (Rp)	Number of Casualties	Main Cause of Flood
2018	Batu and Junrejo	Area around the River	130 mm/day	3	1.200.000.000	2	Heavy rain, garbage piles up in the river
2020	Bumiaji	Bumiaji Village	120 mm/day	6	1.000.000.000	1 (Elderly)	inadequate drainage
2021	Junrejo	Junrejo Highway	90 mm/day	5	800.000.000	0	Land conversion, poor drainage system
2022	Batu	Batu City Center	100 mm/day	4	1.500.000.000	0	Blocked drainage, high rainfall
2023	Bumiaji	Beru Hamlet, Kastubi Street, Sumbergondo Highway Junggo Hamlet, Tulungrejo Village, resulting in Paron River in Bumiaji Village to overflow	524 mm/day highest and 44 mm/day lowest Heavy rain High	3	1.429.000.000 Houses, musala, TPQ affected, roads covered with mud	3	Paron River overflow due to heavy rain
2024	Batu and bumiaji	Temas Village, Krajan Hamlet	House submerged in Beji Village, Junrejo Subdistrict. High (data not stated) Heavy rain for 3 days caused landslides and flooding in Temas Village, *BPBD* recorded a total of 22 flood incidents throughout 2024	22 flood events	Not mentioned	0	Heavy rain, leaking waterways, collapsed plengsengans

Source: Batu City Regional Disaster Management Agency, 2024 (Data Processed)

3. Governance of Flood Management and Prevention in Batu City

The governance of flood management and prevention in Batu City relies on three interconnected elements: active local government involvement, community participation, and adaptive spatial planning. Together, these components form an integrated and sustainable disaster risk management system. The Batu City Government, through the Regional Disaster Management Agency (*BPBD*), has implemented both responsive and preventive strategies to address hydrometeorological disasters, particularly floods. Key initiatives include:

a. Disaster-prone area mapping using spatial and rainfall data, alongside the development of a technology-based early warning system.
b. Flood control infrastructure development and maintenance, including sabo dams, river boundary arrangements, and rehabilitation of drainage systems compromised by urbanization.
c. Rehabilitation of water catchment and natural infiltration areas, which have been degraded by settlements, intensive agriculture, and tourism development.

Despite these efforts, effective implementation faces structural and technical challenges. According to the *BPBD* Batu City Performance Evaluation Report (2023), key obstacles include:[27]

a. Limited budget allocation for mitigation and preventive activities relative to increasing field demands.
b. Shortage of specialized human resources, including hydrologists, flood monitoring technicians, and environmental risk analysts.
c. Poor inter-sectoral coordination, particularly in integrating hydrological data, spatial planning, and public infrastructure projects.

To overcome these challenges, stronger cross-sectoral coordination and multi-stakeholder participation are essential, ensuring that disaster management policies are proactive rather than reactive. Collaborative governance has emerged as an effective approach to address complex societal issues, with coherent policies reflecting strong coordination and incoherent policies indicating weak integration.[28] Additionally, expanding community-based disaster risk reduction is critical for building an inclusive and resilient local system.[29] This approach will be explored in the following discussion.

a. The Strategic Role of Community Participation in Flood Mitigation and Spatial Planning in City

Community participation is a crucial component of flood mitigation in Batu City, but its implementation remains limited. Some areas, such as Tulungrejo and Punten Villages, have shown positive engagement through disaster preparedness volunteer teams and involvement in reforestation and river normalization activities. However, a 2023 survey by the environmental NGO Batu Hijau found that only about 30% of residents have adequate knowledge of flood risks and mitigation measures. Key obstacles include: (a) Inconsistent and limited disaster education and socialization; (b) Low community involvement in deliberations related to the Regional Spatial Plan (*RTRW*); and (c) High dependence on government programs with weak local initiatives.

Active community involvement is essential in both planning and implementing flood

[27] BPBD Kota Batu, *Laporan Evaluasi Kinerja BPBD Kota Batu 2023* (Batu: Badan Penanggulangan Bencana Daerah Kota Batu, 2023).
[28] Alison Gash, "Collaborative Governance," in *Handbook on Theories of Governance*, ed. Christopher Ansell and Jacob Torfing (Edward Elgar Publishing, 2022), https://doi.org/10.4337/9781800371972.00053.
[29] Ines Dombrowsky et al., "Effects of Policy and Functional (in) Coherence on Coordination – A Comparative Analysis of Cross-Sectoral Water Management Problems," *Environmental Science & Policy* 131 (May 2022): 118–27, https://doi.org/10.1016/j.envsci.2022.01.019.

mitigation. Programs such as Disaster Resilient Villages or Subdistricts, initiated by the East Java *BPBD*, aim to enhance preparedness, with village-level emergency response teams serving as the frontline. These efforts, however, are constrained by limited resources and insufficient technical training.[30] Communities can also contribute through preventive actions, including reforestation, maintaining rivers and drainage systems, and participating in disaster training and simulations. Such activities not only improve preparedness but also foster collective awareness of environmental conservation.

Participation in spatial planning is another critical aspect of flood mitigation. Currently, Batu City's spatial planning remains centralized and bureaucratic, with minimal public input. Policies often favor financiers and large businesses while marginalizing small community groups, leaving residents disconnected from planning outcomes and reducing overall engagement in mitigation efforts.

Addressing this issue requires a paradigm shift in spatial governance, with community involvement integrated into the planning, implementation, and evaluation of spatial policies. Such participation not only respects the community's control over their living environment but also ensures policies are inclusive and responsive to actual needs. Promoting environmental awareness, a sense of ownership, and empowerment through self-help initiatives are central to this approach.

Continuous dialogue among stakeholders, including government, civil society, and local communities, is essential for building shared understanding of spatial planning and flood mitigation. In Batu City, with its socially, economically, and educationally diverse population, a participatory and context-sensitive approach is particularly relevant. Examples of community involvement in flood mitigation include:

1) Cleaning waterways and dredging sediment.
2) Conducting educational campaigns to prevent littering.
3) Improving drainage systems and constructing infiltration wells.
4) Greening open and flood-prone areas.
5) Developing community-based water absorption systems.

Community engagement is also critical in decision-making regarding spatial utilization, especially when environmental impacts affect residents' lives. Openness and democratization in these processes enable communities to monitor policy implementation, fostering alignment between plans and their execution.

Various participatory methods can support this approach. Public meetings provide a means of delivering information. Public hearings allow the community to give feedback and input. Workshops build community capacity, facilitate joint policy formulation, and strengthen consensus-based decision-making. Community feedback consistently highlights that flooding in Batu City causes significant infrastructure damage, environmental degradation, casualties, and economic losses. Therefore, comprehensive and inclusive policy development and mitigation strategies are needed, positioning the community as the main actor rather than a passive recipient of policies.

[30] Sheikh Kamran Abid et al., "Community-Based Flood Mitigation in Malaysia: Enhancing Public Participation and Policy Effectiveness for Sustainable Resilience," *Journal of Global Health* 14 (December 2024): 04290, https://doi.org/10.7189/jogh.14.04290.

b. Community Participation in Flood Handling and Prevention as Strategic Input for Local Government

Flood management and prevention in Batu City cannot rely solely on the local government.[31] Effective policies require community oversight of stakeholders and government actions. Community involvement is essential for the success of mitigation programs. The Batu City Government, through *BPBD*, has implemented a Regional Disaster Management Command System (*SKPBD*) and reforestation programs in critical areas, planting water-absorbing trees such as pule and elos.

Flood management challenges extend beyond policy, including low environmental awareness, weak enforcement of land use regulations, inadequate drainage infrastructure causing overflows into residential areas and main roads,[32] and poor urban waste management, which clogs drains. Joint strategies by government and community include:

1) Strengthening watersheds through vegetation rehabilitation, improved waterways, and expanded irrigation networks, considering biophysical, social, and institutional factors.
2) Establishing disaster response units involving village officials, *TNI, POLRI*, the Public Order Agency, and residents for rapid flood response.
3) Constructing water absorption wells in residential areas to increase infiltration and maintain groundwater.
4) Formulating environment-based spatial policies, including revising regional regulations on governance and drainage systems to balance infiltration and runoff. Such policies are vital to sustain natural resources that support human life.[33]

A well-functioning urban drainage system is essential for flood control. Batu City has a layered drainage system from tertiary to primary channels that discharge into the Brantas River.[34] Effective management requires drainage zoning at the village level to identify flood-prone areas and potential inundation points.

Mapping helps village governments determine the causes of flooding, such as sedimentation, debris, blocked structures, or low drainage density. Solutions include the Garbage and Sediment Removal Movement (*GASS*), enforcement against illegal buildings, and channel normalization. Annual evaluations by village governments and communities ensure sustainability. Active community involvement and inclusive policies make flood prevention and mitigation more systematic and effective.

Batu City has also launched mitigation programs, including replanting water-absorbing trees in critical areas and improving waste management to prevent blocked waterways. The Regional Disaster Management Agency (*BPBD*) has implemented the Regional Disaster Management Command System (*SKPBD*) to enhance flood preparedness. Its effectiveness, however, is limited by low environmental awareness and weak enforcement of spatial planning. *BPBD* recommends reconstructing the drainage system to reduce flood risk, as the current infrastructure cannot prevent overflow into residential areas and roads.

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[31] John H. Armstrong, "Taking Control to do More: How Local Governments and Communities Can Enact Ambitious Climate Mitigation Policies," *Journal of Environmental Policy & Planning* 24, no. 2 (March 2022): 160–74, https://doi.org/10.1080/1523908X.2021.1992264.

[32] O.A. Mokuolu et al., "Assessing the Effects of Solid Wastes on Urban Flooding: A Case Study of Isale Koko," *LAUTECH Journal of Civil and Environmental Studies* 9, no. 1 (November 2022), https://doi.org/10.36108/laujoces/2202.90.0130.

[33] Riswandha Imawan and Rehulina, "Legal Aspects of Indonesia's Obligation to Use Renewable Energy," *Jambe Law Journal* 5, no. 2 (December 2023): 229–49, https://doi.org/10.22437/jlj.5.2.229-249.

[34] Takele Sambeto Bibi, Daniel Reddythta, and Abdisa Sime Kebebew, "Assessment of the Drainage Systems Performance in Response to Future Scenarios and Flood Mitigation Measures Using Stormwater Management Model," *City and Environment Interactions* 19 (August 2023): 100111, https://doi.org/10.1016/j.cacint.2023.100111.

c. Review of the Regional Spatial Plan of Batu City Malang: A Critical Review of the Appropriateness of Spatial Functions and Disaster Risk

Article 26 paragraph (1) letter a of Law Number 24 of 2007 on Disaster Management states that every person has the right to social protection and a sense of security, particularly communities vulnerable to disasters. In Batu City, residents are highly vulnerable to flooding, as the area has been repeatedly affected over the past five years. Therefore, the community has the right to protection and security through effective flood disaster management, which requires efficient and sustainable approaches.[35]

Local governments, as key policy stakeholders, must consider the long-term impacts and sustainability of their policies.[36] For Batu City, responsible for regional disaster management, this has included revising the Regional Spatial Plan (*RTRW*) following flash floods from 2021 to 2023 to reduce disaster vulnerability and adjust land use.

Spatial planning is essential for balancing urban growth, economic development, and environmental preservation.[37] In Batu City, however, this balance has not been fully achieved. One major issue is the conversion of protected land in Bumiaji Subdistrict into tourism areas and intensive agriculture, which reduces water absorption and increases surface runoff, raising flash flood risk. Although the 2010–2030 *RTRW* designates about 30% of the area as protected, violations continue, including forest conversion, villa construction in catchment areas, and clearing of riverbank vegetation. WALHI East Java (2023) notes that poor spatial management accelerates catchment degradation and disaster risks. Furthermore, the revised *RTRW* lacks comprehensive disaster risk assessment and insufficiently incorporates public participation.

Spatial planning in Indonesia is grounded in Law No. 24/1992 and Law No. 26/2007. In Batu City, however, rapid population growth and uncontrolled economic expansion have created intense spatial pressure. Limited land availability, coupled with rising demands for housing, industry, and tourism, has increased the potential for spatial conflicts between communities, governments, investors, and local residents. Examples of these tensions include:

1) Conversion of productive agricultural land into elite residential and tourist areas.
2) Overlapping land use between social, commercial, and ecological functions without integrated planning.
3) Increased environmental pollution, including declining river water quality from liquid waste from settlements and tourism.
4) Emergence of slum pockets around tourist zones due to unmet housing needs for informal sector workers.

These conditions illustrate a paradox in spatial planning principles: efficiency, which emphasizes optimizing space for economic value, and equity, which emphasizes social and ecological justice. Reviewing Batu City's spatial and regional planning is therefore critical to balance development with environmental sustainability.

Several of these issues conflict with Batu City Regulation No. 7 of 2011 concerning the 2010–2030 Spatial Plan. Article 5 of the regulation establishes the guiding principles of spatial planning in Batu City as follows.

a. Integration
b. Harmony, consistency, and balance

[35] Saad Mazhar Khan et al., "A Systematic Review of Disaster Management Systems: Approaches, Challenges, and Future Directions," *Land* 12, no. 8 (July 2023): 1514, https://doi.org/10.3390/land12081514.
[36] Gwen Arnold and Le Anh Nguyen Long, "Policy Expansion in Local Government Environmental Policy Making," *Public Administration Review* 79, no. 4 (July 2019): 465–76, https://doi.org/10.1111/puar.12905.
[37] Danny Permana, "Spatial Planning Policy in the Control Aspect of Urban Area Development," *International Journal of Science and Society* 5, no. 2 (June 2023): 466–77, https://doi.org/10.54783/ijsoc.v5i2.1089.

c. Sustainability
d. Efficiency and effectiveness
e. Transparency
f. Collaboration and partnership
g. Protection of public interests
h. Legal certainty, justice, and accountability

The principles in Batu City Regional Regulation No. 7 of 2011 support its objectives, stated in Article 8. Spatial planning aims to create a safe, comfortable, productive, and sustainable urban space, develop the city as an agropolitan-based area and leading tourist destination in East Java, and position it as the upstream support region for the Brantas River. The city government is responsible for implementing these regulations, including protecting the Brantas River from sedimentation and narrowing, to achieve a sustainable city aligned with its Spatial Plan.

Spatial planning policies are essential to harmonize Batu City's existing conditions. The review of the Spatial and Regional Planning (*RTRW*), under Minister of ATR/BPN Regulation No. 6/2017, must occur at least every five years. Its purpose is to align spatial plans with evolving social, economic, environmental, and disaster conditions. The process includes: 1) Assessing regional changes, 2) Evaluating the previous *RTRW*'s achievements and suitability, and 3) Formulating recommendations for new policy directions.

Spatial planning in Batu City needs to be eco-based, involves public participation, and fully considers disaster risk. This need is urgent due to industrialization, urbanization, and economic growth affecting communities and the environment.[38] Reviewing spatial planning is therefore not only an administrative requirement but a vital tool for building resilience against flooding and environmental degradation.

C. Conclusion

The recurring flooding in Batu City is closely linked to legal and administrative failures in spatial planning rather than purely natural or hydrometeorological factors. Weak enforcement of the Regional Spatial Plan (*RTRW*), uncontrolled land-use conversion, and limited public participation significantly increase flood risks. From a socio-legal perspective, flood management remains largely reactive and infrastructure-focused, overlooking the preventive and regulatory role of law. Effective flood mitigation requires integrated governance involving local authorities, communities, and the private sector, supported by consistent legal enforcement and participatory spatial planning. The study also emphasizes the need to revise spatial policies and local regulations to ensure responsiveness to disaster risks and environmental sustainability. Overall, flooding in Batu City is a legal and governance issue, not merely a natural phenomenon, positioning flood risk management as a key matter of environmental administrative law and state responsibility.

D. Suggestion

Integrated risk assessment and mitigation are essential for effective flood management in Batu City. This study recommends that the Batu City Government strengthen the legal framework for flood control by revising the Spatial and Regional Plan to incorporate disaster risk maps and enforce strict restrictions on land-use conversion in floodplains, including upstream areas of the Brantas River Basin (DAS).

[38] Xiaoyan Zhang et al., "Linking Urbanization and Air Quality Together: A Review and a Perspective on the Future Sustainable Urban Development," *Journal of Cleaner Production* 346 (April 2022): 130988, https://doi.org/10.1016/j.jclepro.2022.130988.

The government should also establish a dedicated Regional Regulation on flood control, covering obligations for green infrastructure, community participation mechanisms, and strict penalties for violations of spatial planning and environmental protection. Furthermore, cross-sectoral and inter-regional coordination should be formalized through joint regulations or memorandums of understanding. Strengthening disaster education based on regional regulations is also recommended to improve public legal awareness and community mitigation capacity.

Acknowledgements

Sincere gratitude is expressed to Universitas Islam Malang for the valuable academic support and the conducive research environment. Appreciation is also extended to colleagues and research partners for the insights, collaboration, and encouragement provided throughout the writing process. The quality and completion of this work have been greatly enriched by their collective support and dedication.

References

Abid, Sheikh Kamran, Noralfishah Sulaiman, Ahmed M Al-Wathinani, and Krzysztof Goniewicz. "Community-Based Flood Mitigation in Malaysia: Enhancing Public Participation and Policy Effectiveness for Sustainable Resilience." *Journal of Global Health* 14 (December 2024): 04290. https://doi.org/10.7189/jogh.14.04290.

Anees, Mohd Talha, K. Abdullah, M.N.M. Nawawi, Nik Norulaini Nik Ab Rahman, Abd. Rahni Mt. Piah, Nor Azazi Zakaria, M.I. Syakir, and A.K. Mohd. Omar. "Numerical Modeling Techniques for Flood Analysis." *Journal of African Earth Sciences* 124 (December 2016): 478–86. https://doi.org/10.1016/j.jafrearsci.2016.10.001.

Antony, Maharani Citra Dewi, and John Elvin Louis. "Building Deliberative Democracy In Indonesia: Democracy Future and The Future of Democracy." *Jurnal Kajian Pembaruan Hukum* 5, no. 1 (May 2025): 1–26. https://doi.org/10.19184/jkph.v5i1.53689.

Arifin, Muhajir. "Hutan Gunung Arjuno Terus Terjadi Kerusakan, Resapan Air Berkurang." *Detiknews*, June 19, 2019. https://news.detik.com/berita-jawa-timur/d-4592162/hutan-gunung-arjuno-terus-terjadi-kerusakan-resapan-air-berkurang.

Armstrong, John H. "Taking Control to Do More: How Local Governments and Communities Can Enact Ambitious Climate Mitigation Policies." *Journal of Environmental Policy & Planning* 24, no. 2 (March 2022): 160–74. https://doi.org/10.1080/1523908X.2021.1992264.

Arnold, Gwen, and Le Anh Nguyen Long. "Policy Expansion in Local Government Environmental Policy Making." *Public Administration Review* 79, no. 4 (July 2019): 465–76. https://doi.org/10.1111/puar.12905.

Azmeri and Eldiana Fatimah. *Rapid Detection of Flash Flood Threats*. First Edition. Yogyakarta: Deepublish Publisher, 2017.

Bibi, Takele Sambeto, Daniel Reddythta, and Abdisa Sime Kebebew. "Assessment of the Drainage Systems Performance in Response to Future Scenarios and Flood Mitigation

Measures Using Stormwater Management Model." *City and Environment Interactions* 19 (August 2023): 100111. https://doi.org/10.1016/j.cacint.2023.100111.

BPBD Batu. *Annual Report on Disaster Management*. Batu: Badan Penanggulangan Bencana Daerah Kota Batu, 2023.

BPBD Kota Batu. *Laporan Evaluasi Kinerja BPBD Kota Batu 2023*. Batu: Badan Penanggulangan Bencana Daerah Kota Batu, 2023.

Cvetković, Vladimir M., Jasmina Tanasić, Adem Ocal, Želimir Kešetović, Neda Nikolić, and Aleksandar Dragašević. "Capacity Development of Local Self-Governments for Disaster Risk Management." *International Journal of Environmental Research and Public Health* 18, no. 19 (October 2021): 10406. https://doi.org/10.3390/ijerph181910406.

Danny Permana, "Spatial Planning Policy in the Control Aspect of Urban Area Development," International Journal of Science and Society 5, no. 2 (June 2023): 466–77, https://doi.org/10.54783/ijsoc.v5i2.1089.

Dian Hudawan Santoso. "Flood Disaster Management Based on Vulnerability Levels Using the Ecodrainage Method in the Karst Ecosystem of Dukuh Tungu, Girimulyo Village, Panggang Subdistrict, Gunungkidul Regency, DIY." *Jurnal Geografi* 16, no. 1 (2019): 7–15. https://doi.org/10.15294/jg.v16i1.17136.

Dombrowsky, Ines, Andrea Lenschow, Franziska Meergans, Nora Schütze, Evelyn Lukat, Ulf Stein, and Ali Yousefi. "Effects of Policy and Functional (in) Coherence on Coordination – A Comparative Analysis of Cross-Sectoral Water Management Problems." *Environmental Science & Policy* 131 (May 2022): 118–27. https://doi.org/10.1016/j.envsci.2022.01.019.

Gash, Alison. "Collaborative Governance." In *Handbook on Theories of Governance*, edited by Christopher Ansell and Jacob Torfing. Edward Elgar Publishing, 2022. https://doi.org/10.4337/9781800371972.00053.

Hammond, M.J., A.S. Chen, S. Djordjević, D. Butler, and O. Mark. "Urban Flood Impact Assessment: A State-of-the-Art Review." *Urban Water Journal* 12, no. 1 (January 2015): 14–29. https://doi.org/10.1080/1573062X.2013.857421.

He, Yiyi, Stephan Thies, Paolo Avner, and Jun Rentschler. "Flood Impacts on Urban Transit and Accessibility—A Case Study of Kinshasa." *Transportation Research Part D: Transport and Environment* 96 (July 2021): 102889. https://doi.org/10.1016/j.trd.2021.102889.

Imawan, Riswandha and Rehulina. "Legal Aspects of Indonesia's Obligation to Use Renewable Energy." *Jambe Law Journal* 5, no. 2 (December 2023): 229–49. https://doi.org/10.22437/jlj.5.2.229-249.

Khan, Saad Mazhar, Imran Shafi, Wasi Haider Butt, Isabel De La Torre Diez, Miguel Angel López Flores, Juan Castanedo Galán, and Imran Ashraf. "A Systematic Review of Disaster Management Systems: Approaches, Challenges, and Future Directions." *Land* 12, no. 8 (July 2023): 1514. https://doi.org/10.3390/land12081514.

Kodoatie and Robert J. Sugiyanto. *Floods: Several Causes and Control Methods from an Environmental Perspective*. Yogyakarta: Pustaka Pelajar, 2002.

Lexy Moleong. *Metodologi Penelitian Kualitatif*. Bandung: Remaja Rosdakarya, 2006.

Ligal Sebastian. "Flood Prevention and Control Approach." *Dinamika Teknik Sipil* 8, no. 2 (July 2008): 162–69.

Maziyatun Nafiah, Nurul Umi Ati, and Suyeno Suyeno. "Evaluation of the 2010-2030 Spatial Planning Policy of Batu City." *Respon Publik* 16, no. 6 (2022): 19–27.

Mokuolu, O.A., A. K. Odunaike, J.O. Iji, and A.S. Aremu. "Assessing the Effects of Solid Wastes on Urban Flooding: A Case Study of Isale Koko." *LAUTECH Journal of Civil and Environmental Studies* 9, no. 1 (November 2022). https://doi.org/10.36108/laujoces/2202.90.0130.

Nandi, Nandi. "Flood Mitigation: A Review of the Condition and Problems of the Drainage System and Flood Control in the City of Cimahi." *Jurnal Geografi* 10, no. 1 (March 2016). https://doi.org/10.17509/gea.v10i1.1668.

Nkwunonwo, U.C., M. Whitworth, and B. Baily. "A Review of the Current Status of Flood Modelling for Urban Flood Risk Management in the Developing Countries." *Scientific African* 7 (March 2020): e00269. https://doi.org/10.1016/j.sciaf.2020.e00269.

Permana, Danny. "Spatial Planning Policy in the Control Aspect of Urban Area Development." *International Journal of Science and Society* 5, no. 2 (June 2023): 466–77. https://doi.org/10.54783/ijsoc.v5i2.1089.

Rachmad Safa'at. "Ambivalensi Pendekatan Yuridis Normatif Dan Yuridis Sosiologis Dalam Menelaah Sistem Kearifan Lokal Masyarakat Adat Dalam Pengelolaan Sumber Daya Alam." *Lex Jurnalica* 10, no. 1 (April 2013): 46–62. https://doi.org/10.47007/lj.v10i1.353.

Rahayu, Rahmawati, Simon A. Mathias, Sim Reaney, Gianni Vesuviano, Rusmawan Suwarman, and Agus M. Ramdhan. "Impact of Land Cover, Rainfall and Topography on Flood Risk in West Java." *Natural Hazards* 116, no. 2 (March 2023): 1735–58. https://doi.org/10.1007/s11069-022-05737-6.

Rahman, Boby, Mila Karmilah, Jamillah Kautsary, and Mohammad Agung Ridlo. "The Tidal Flooding Causes in the North Coast of Central Java: A Systemic Literature Review." *Journal of Southwest Jiaotong University* 56, no. 6 (December 2021): 184–94. https://doi.org/10.35741/issn.0258-2724.56.6.15.

Ramadhan, Cahyadi, Ruslanjari Dina, and Emilya Nurjani. "Spatial and Temporal Based Deforestation Proclivity Analysis on Flood Events with Applying Watershed Scale (Case Study: Lasolo Watershed in Southeast Sulawesi, Central Sulawesi, and South Sulawesi, Indonesia)." *International Journal of Disaster Risk Reduction* 93 (July 2023): 103745. https://doi.org/10.1016/j.ijdrr.2023.103745.

Slater, Dan. "What Indonesian Democracy Can Teach the World." *Journal of Democracy* 34, no. 1 (January 2023): 95–109. https://doi.org/10.1353/jod.2023.0006.

Son, Cheol Hee, Chang Hwan Lee, and Yong Un Ban. "Analysis of the Impact and Moderating Effect of High-Density Development on Urban Flooding." *Heliyon* 9, no. 12 (December 2023): e22695. https://doi.org/10.1016/j.heliyon.2023.e22695.

Sunggono, Bambang. *Legal Research Methodology*. Jakarta: PT Raja Grafindo Persada, 2014.

Suprayogi. *Urban Drainage and Flood Index*. Jakarta: Penerbit Buku Kompas, 2019.

Suripin. *Sustainable Drainage System*. First Edition. Yogyakarta: Andi Press, 2014.

Wasko, Conrad, Rory Nathan, Lina Stein, and Declan O'Shea. "Evidence of Shorter More Extreme Rainfalls and Increased Flood Variability under Climate Change." *Journal of Hydrology* 603 (December 2021): 126994. https://doi.org/10.1016/j.jhydrol.2021.126994.

Zhang, Xiaoyan, Lijian Han, Haiyan Wei, Xiaorui Tan, Weiqi Zhou, Weifen Li, and Yuguo Qian. "Linking Urbanization and Air Quality Together: A Review and a Perspective on the Future Sustainable Urban Development." *Journal of Cleaner Production* 346 (April 2022): 130988. https://doi.org/10.1016/j.jclepro.2022.130988.