



THE URGENCY OF DISASTER-BASED SPATIAL PLANNING: A JURIDICAL REVIEW OF ECOLOGICAL CONCERNS IN THE NATIONAL LEGAL SYSTEM

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Abstract

Spatial planning in Indonesia plays a strategic role in balancing regional development, environmental sustainability, disaster mitigation, and public safety. This study aims to critically analyze the legal framework of spatial planning from the perspective of ecological justice and disaster mitigation, with particular attention to the role of Detailed Spatial Plans (RDTR), spatial control, and law enforcement. This study employed a normative juridical research method using statutory and conceptual approaches. Legal materials were obtained through library research and analyzed qualitatively using a descriptive-analytical method by examining the relationship between normative legal provisions and implementation challenges. The findings demonstrate that although Indonesia has a comprehensive spatial planning regulatory framework, a significant gap remains between legal norms and their implementation. The effectiveness of spatial planning is constrained by limited institutional coordination, uneven availability of digital RDTR, weaknesses in spatial supervision, and inconsistent law enforcement. The study further finds that disaster-risk mapping and ecological carrying-capacity considerations need to be integrated into spatial planning as preventive instruments. Strengthening administrative and criminal enforcement, digital RDTR, public participation, and legal protection of spatial and land rights is therefore essential to establish spatial governance that promotes environmental security, public safety, and intergenerational ecological justice.

Keywords: Disaster Mitigation; Ecological Justice; Law Enforcement; Spatial Planning; Sustainable Development.

INTRODUCTION

Spatial planning is a fundamental instrument for directing regional development, managing land resources, protecting environmental functions, and ensuring public safety. Land and space are limited resources that must accommodate various interests, including residential development, economic activities, infrastructure, environmental conservation, and disaster risk reduction. In the context of Indonesia, the complexity of spatial governance is further influenced by rapid urbanization, population growth, infrastructure expansion, land-use conversion, and the geographical characteristics of an archipelagic country. Consequently, spatial planning can no longer be regarded merely as an administrative mechanism for regulating land utilization, but must also function as an instrument for achieving environmental sustainability, disaster resilience, and intergenerational justice (Ahmad, 2022; Budianto et al., 2024; Kalingga & Gulo, 2023; Rojikhah et al., 2024). The limited availability of land also requires spatial planning to be transparent, accountable, effective, and supported by multi-stakeholder participation in order to create spatial arrangements that promote security, productivity, and sustainability (Anggriawan et al., 2024b). The urgency of disaster-oriented spatial planning is closely associated with the increasing exposure of settlements and economic activities to natural hazards. Indonesia is vulnerable to multiple hazards, including floods, landslides, earthquakes, tsunamis, volcanic eruptions, and coastal hazards. These hazards do not automatically become disasters; rather, disaster impacts are often intensified by inappropriate land-use decisions, settlement expansion into hazardous areas, inadequate infrastructure, and weak enforcement of spatial planning regulations. Research conducted in Palu City demonstrated that insufficient mainstreaming of disaster risk reduction into spatial

planning can contribute to development in disaster-prone and high-risk areas. The study emphasized that disaster risk reduction needs to be integrated throughout the preparation and implementation of spatial plans through a risk-based planning approach (Wulandari, 2021). Similarly, research on spatial planning in Surabaya found that the integration of disaster risk reduction into spatial planning documents remained relatively low and recommended the use of hazard and risk maps, restrictions on development in hazardous areas, appropriate infrastructure, and clear incentives and disincentives (Pamungkas et al., 2024). These concerns are consistent with the broader legal perspective that land-use regulation requires effective governmental intervention to prevent inappropriate utilization and protect public interests (Ahmad, 2022; Anggriawan et al., 2024b).

The relationship between land-use change and disaster risk is particularly evident in areas experiencing rapid urbanization. Urban expansion can alter drainage systems, reduce infiltration areas, increase impervious surfaces, and encourage development in flood-prone areas. Handayani et al. (2020), examining the northern coast of Central Java, demonstrated the relationship between urbanization, land-use change, and increasing flood risk and emphasized the importance of better land-use policy and flood management. Similar concerns are identified in developing countries, where hazard-informed land-use planning remains insufficient and land-use patterns may evolve without adequate consideration of flood hazards (Der Sarkissian et al., 2022). Thus, spatial planning should incorporate disaster risk information into land-use allocation rather than treating disaster management as a separate policy sector.

The importance of integrating disaster risk reduction into spatial planning is also demonstrated in coastal and small-island areas. Coastal communities are particularly exposed to flooding, erosion, tsunami, sea-level rise, and other hazards. Widowati (2022) explains that Indonesian spatial planning legislation provides a legal basis for spatial planning as a non-structural disaster mitigation instrument in coastal areas. The integration of spatial planning, coastal management, and disaster management is therefore essential for reducing vulnerability and preventing inappropriate development in hazardous coastal zones. Furthermore, research on Sangehi Island shows that multi-hazard risk analysis can provide an important basis for spatial planning in small-island regions, where exposure to multiple hazards requires a more integrated planning approach (Hadianti et al., 2021). These findings reinforce the argument that disaster mitigation should be embedded within spatial planning rather than implemented only as an emergency response.

Environmental carrying capacity is another critical consideration in spatial planning. Development that exceeds ecological capacity can result in environmental degradation, loss of biodiversity, water scarcity, flooding, and increased vulnerability to disasters. Rojikhah et al. (2024) demonstrated that ecosystem-service carrying capacity should be considered in agricultural spatial planning because inappropriate land-resource management can reduce environmental quality and undermine the sustainability of development that ecological footprint considerations are important for evaluating whether spatial planning adequately addresses land-use pressures, food security, biodiversity, and sustainable development. Therefore, spatial planning needs to incorporate ecological carrying capacity and environmental limits as fundamental considerations in determining appropriate land utilization is also reflected in Ahmad (2018), who examined the role of environmental authorities in managing water quality and controlling water pollution under Indonesian legislation. Similarly, Kalingga and Gulo (2023) emphasized the legal implications of resource utilization and the need for regulation to prevent environmentally harmful exploitation. Therefore, spatial planning needs to incorporate ecological carrying capacity and environmental limits as fundamental considerations in determining appropriate land utilization.

The relationship between land-use planning and water management further illustrates the importance of environmentally sensitive spatial planning. Land-use change can significantly affect water retention, runoff, groundwater recharge, and flood potential. Hidayat et al. (2024) demonstrate that land management and spatial planning should be considered together with water-retention infrastructure in watershed management. Their findings indicate that water-resource management cannot rely exclusively on physical infrastructure but should also consider how land use contributes to the production, retention, and distribution of water resources. Such an approach is highly relevant to disaster mitigation because the loss of natural water-retention functions may increase flood and water-shortage risks.

Another important issue concerns the conformity between planned and actual land utilization. Although spatial plans establish the intended allocation and function of space, implementation in the field may differ from formal planning documents. Budianto et al. (2024) found a substantial gap between land-use conditions and spatial planning in a food-estate planning area in Kapuas Regency. The findings indicate that spatial planning needs to be continuously evaluated and updated to reflect development dynamics and ensure consistency between planning objectives and actual land utilization. Similarly, research examining land development in relation to slope characteristics demonstrates that physical land characteristics are important determinants of built-up-area expansion

and should be incorporated into spatial planning and land suitability assessments (Nagara & Wibowo, 2024). The legal protection of land use and the responsibilities of parties involved in land transactions also demonstrate the importance of maintaining consistency between legal rights and actual land utilization (Ahmad, 2022; Muhlizar et al., 2023). Furthermore, Anggriawan et al. (2024a) emphasize the role of government in structuring legal arrangements for land ownership disputes, reinforcing the importance of governmental control over land-related issues.

The availability and quality of Detailed Spatial Plans (Rencana Detail Tata Ruang/RDTR) are also essential for effective spatial governance. RDTR provides a detailed framework for regulating land utilization and serves as an important instrument for development control and licensing. Santo et al. (2024) identify local-government commitment, data availability, managerial capacity, policy support, and information and communication technology as important factors affecting the acceleration of RDTR preparation in Indonesia. The limited availability and uneven quality of RDTR can weaken spatial control and create uncertainty in development decision-making. Therefore, strengthening the availability, quality, and implementation of RDTR is an essential component of improving spatial governance.

Digital transformation provides opportunities to improve spatial planning and public access to spatial information. The development of GISTARU, including RTR Online and Interactive RDTR, has enabled broader access to spatial planning information through web-based geographic information systems. Rachmawati et al. (2024) found that GISTARU has significant potential to support spatial planning and smart-city development, particularly by improving public access to spatial information and supporting smart governance. However, the study also identified inconsistencies in data entry and integration between spatial planning components. This finding demonstrates that digitalization alone is insufficient; it must be accompanied by accurate data, institutional coordination, interoperability, regular updating, and effective monitoring.

Climate change further increases the need for adaptive spatial planning. Spatial planning has an important role in reducing climate-related vulnerability because decisions concerning land use, settlement patterns, infrastructure, green areas, and environmental protection influence the capacity of communities to adapt to changing climatic conditions. Zhou et al. (2023) demonstrate that spatial planning can serve as an important mechanism for integrating climate-change adaptation into territorial development. Similarly, research on European spatial planning instruments shows that spatial planning can support climate adaptation when environmental risks and long-term climate scenarios are incorporated into planning instruments and implementation mechanisms. Therefore, disaster-mitigation-based spatial planning should increasingly consider not only historical hazard patterns but also emerging risks associated with climate change.

Urban resilience also requires spatial planning to address the social and ecological dimensions of disaster risk. Rapid urbanization may concentrate vulnerable populations and critical infrastructure in areas exposed to natural hazards. Research on smart cities and disaster risk reduction indicates that unplanned urbanization can increase vulnerability to spatially relevant hazards such as earthquakes and floods (Kodag & Kodag, 2023). Spatial planning should consequently be designed to reduce exposure, protect critical infrastructure, provide accessible evacuation routes, preserve ecological buffers, and ensure equitable access to safe urban spaces.

The concept of ecological justice provides an important normative framework for strengthening spatial planning. Development decisions may produce unequal distributions of benefits and environmental burdens. Economic benefits generated by land development may accrue primarily to particular actors, while environmental degradation, flood risk, loss of green space, and disaster impacts may be experienced disproportionately by local communities. Pineda-Pinto et al. (2022) emphasize that ecological injustice can be addressed through planning approaches that recognize the interconnectedness of social and ecological systems and incorporate nature-based solutions into urban planning. Consequently, spatial planning should not only ask whether development complies with formal regulations but also whether spatial decisions distribute environmental benefits and risks fairly among communities and across generations.

The legal dimension of spatial planning becomes increasingly important as spatial utilization becomes more complex. Contemporary development increasingly involves not only surface land but also aboveground and underground spaces. Such utilization creates potential conflicts between different holders and users of spatial rights. Falahiyati et al. (2024), in their study of the protection of land-right holders in the utilization of underground space, demonstrate that differences between surface land rights and underground-space utilization may create legal conflicts. The study emphasizes that when underground utilization has the potential to interfere with public interests or the rights of surface land holders, legal protection and binding agreements are necessary. This finding is highly

relevant to spatial planning because spatial governance must provide legal certainty while simultaneously protecting the rights and interests of communities affected by spatial development.

Spatial planning also requires public understanding and community participation. Regulations may have limited effectiveness when communities do not understand their rights, obligations, and the purposes of government policies. Yeltrina and Batubara (2024), through their community legal-socialization activity in Kwala Bekala, Medan Johor, demonstrate that socialization of legal regulations can increase community knowledge and encourage greater awareness of legal provisions. This perspective is reinforced by Muhlizar, Joharsah, and Warman (2023), who emphasized the importance of legal education and community involvement in environmental protection. Their study demonstrates that legal awareness can strengthen the community's role in protecting environmental interests. This perspective is relevant to spatial planning because communities are not merely objects of development but should also become informed participants in spatial governance, particularly in monitoring land-use changes and protecting their environmental interests.

A further challenge is the gap between spatial planning regulations and their implementation. The existence of comprehensive regulations does not necessarily guarantee compliance in practice. Weak institutional coordination, inadequate data, limited technical capacity, insufficient public participation, and inconsistent enforcement may result in deviations from spatial plans. Azzahra et al. (2024), in their evaluation of disaster-mitigation-based spatial planning policies in West Sumatra, identified weak coordination among stakeholders, limited resources, and inadequate public participation as important barriers to effective implementation. The findings indicate that effective spatial planning requires not only regulatory instruments but also institutional capacity, stakeholder coordination, community involvement, and consistent enforcement.

The implementation gap also has significant implications for environmental sustainability and disaster prevention. Spatial planning regulations may designate particular areas as protected, restricted, or unsuitable for development, but ineffective supervision can allow inappropriate land utilization to continue. The result may be the conversion of green areas, agricultural land, water-infiltration areas, riverbanks, and other environmentally sensitive spaces into settlements or economic activities. Such processes may increase ecological vulnerability and generate cumulative risks that become visible only when disasters occur. Consequently, law enforcement should be integrated with spatial monitoring, digital spatial information, environmental assessment, and public participation.

Based on the above conditions, the urgency of disaster-mitigation-based spatial planning lies not only in preventing inappropriate development but also in ensuring that spatial governance contributes to ecological sustainability, legal certainty, public safety, and social justice. Spatial planning must be able to bridge the interests of economic development with environmental protection and disaster risk reduction. It must also provide mechanisms through which communities can participate in spatial decision-making and monitor changes in land utilization. The integration of hazard maps, ecological carrying capacity, RDTR, digital spatial information, land-use control, and effective legal enforcement is therefore essential for developing resilient and sustainable territories.

The present study is consequently important because it examines spatial planning from an integrated legal and ecological perspective. The study focuses on the urgency of strengthening spatial planning based on disaster mitigation, particularly through the integration of ecological justice, environmental sustainability, RDTR, spatial information systems, and law enforcement. This approach is consistent with the argument that spatial planning should move beyond its conventional function as an administrative instrument toward a preventive and protective mechanism capable of reducing disaster risk and protecting ecological functions.

The objective of this study is to critically analyze the legal framework of spatial planning in Indonesia from the perspective of disaster mitigation and ecological justice. Specifically, the study examines the extent to which spatial planning regulations can prevent environmentally harmful land utilization, integrate disaster-risk considerations into spatial planning instruments, strengthen the role of RDTR, and support effective enforcement against spatial violations. The study also seeks to formulate a conceptual direction for strengthening spatial governance so that economic development can proceed without compromising environmental sustainability, public safety, and the rights of future generations.

Ultimately, disaster-mitigation-based spatial planning requires a transformation from reactive and sectoral governance toward integrated, preventive, adaptive, and participatory spatial governance. Such transformation requires synchronization between regulations and institutions, accurate and accessible spatial data, comprehensive disaster-risk mapping, environmentally sensitive land-use allocation, effective RDTR implementation, consistent monitoring, and meaningful public participation. Spatial planning should therefore become an instrument that simultaneously supports development, protects ecological functions, reduces disaster vulnerability, ensures legal

certainty, and promotes ecological justice. In this way, spatial planning can fulfill its broader function as an instrument for creating territories that are safe, productive, equitable, resilient, and sustainable.

METHOD

This study employed a normative juridical research method (normative legal research) to critically examine the legal framework of spatial planning in Indonesia, particularly its relationship with disaster mitigation, ecological justice, sustainable development, and spatial law enforcement. The normative juridical method was selected because the study focuses on examining legal norms, principles, regulations, and the consistency of the existing spatial planning framework, including the relationship between statutory provisions and their implementation. The analysis was directed toward identifying the extent to which the existing legal framework is capable of integrating disaster mitigation and ecological protection into spatial planning governance.

The research applied two principal approaches: the statutory approach (statute approach) and the conceptual approach (conceptual approach). The statutory approach was conducted by examining relevant laws and regulations governing spatial planning, environmental protection, disaster mitigation, and land utilization. Particular attention was given to Law No. 26 of 2007 concerning Spatial Planning, Law No. 6 of 2023 concerning the Stipulation of Government Regulation in Lieu of Law No. 2 of 2022 concerning Job Creation into Law, Government Regulation No. 21 of 2021 concerning the Implementation of Spatial Planning, and other relevant implementing regulations. The statutory analysis was used to identify the hierarchy, consistency, and legal implications of changes in spatial planning regulations, particularly with regard to regional authority, spatial utilization control, environmental protection, and disaster-risk reduction.

The conceptual approach was used to analyze the spatial planning framework through the concepts of sustainable development and ecological justice. This approach examined whether the existing spatial planning regulations adequately accommodate environmental protection, disaster mitigation, public safety, and the rights of present and future generations. The conceptual analysis also considered the relationship between economic development, ecological carrying capacity, land-use control, and the equitable distribution of environmental benefits and risks.

The legal materials used in this study consisted of primary, secondary, and tertiary legal materials. Primary legal materials included Law No. 26 of 2007 concerning Spatial Planning, Law No. 6 of 2023 concerning the Stipulation of Government Regulation in Lieu of Law No. 2 of 2022 concerning Job Creation into Law, Government Regulation No. 21 of 2021 concerning the Implementation of Spatial Planning, and other regulations relevant to spatial planning, environmental protection, and disaster mitigation. Secondary legal materials consisted of scholarly books, scientific journal articles, legal literature, academic opinions, and relevant reports concerning spatial planning, disaster mitigation, ecological justice, environmental sustainability, RDTR, and spatial law enforcement. Tertiary legal materials included legal dictionaries, encyclopedias, and other reference materials used to clarify legal concepts and terminology.

The collection of legal materials was conducted through library research (literature study). Relevant legislation, scholarly publications, legal documents, and supporting literature were identified, selected, classified, and reviewed according to their relevance to the research objectives. The selection process focused on materials addressing spatial planning law, disaster-risk reduction, environmental protection, ecological justice, sustainable development, RDTR, land-use control, and law enforcement. The literature was subsequently organized thematically to facilitate comparison between legal norms, theoretical perspectives, and identified implementation challenges.

The data analysis was conducted qualitatively using a descriptive-analytical method. The analysis did not merely describe the contents of the relevant regulations but also critically interpreted the relationships, consistency, and potential conflicts among legal norms. The analysis compared the normative legal framework (*das Sollen*) with the ecological, institutional, and socio-legal conditions identified in the literature (*das Sein*). This analytical process was used to assess the effectiveness of the spatial planning legal framework in integrating disaster mitigation and ecological justice into spatial governance.

The analysis was conducted through several stages. First, relevant statutory provisions were identified and classified according to their regulatory functions. Second, the provisions were examined to determine their consistency and relationship with the principles of sustainable development, ecological justice, and disaster mitigation. Third, the findings from the literature were compared with the normative framework to identify implementation gaps, particularly regarding spatial supervision, RDTR, environmental protection, institutional coordination, and law enforcement. Finally, the findings were synthesized to formulate a conceptual understanding of how spatial planning law can be strengthened as a preventive instrument for disaster mitigation and ecological

protection. The research design can therefore be summarized as a normative legal analysis that integrates statutory examination, conceptual analysis, literature review, and qualitative descriptive-analytical interpretation. Through this design, the study seeks to provide a comprehensive legal assessment of the transformation of spatial planning from an administrative instrument for regulating land use into a strategic legal instrument for disaster prevention, environmental protection, public safety, and ecological justice.

RESULTS AND DISCUSSION

1. Transformation of Spatial Planning Law and the Role of RDTR

The analysis shows that spatial planning in Indonesia has undergone a significant transformation from a predominantly administrative planning mechanism toward an instrument that is increasingly integrated with development licensing, environmental protection, and disaster-risk reduction. The regulatory framework establishes spatial planning as an important basis for determining whether development activities are compatible with designated spatial functions. This transformation is particularly evident through the implementation of spatial conformity requirements and the increasing role of Detailed Spatial Plans (Rencana Detail Tata Ruang/RDTR) in controlling land utilization.

RDTR has an important position because it translates broader spatial planning policies into more detailed spatial allocations and zoning provisions. In principle, the availability of detailed spatial information can reduce uncertainty in development decisions and provide clearer guidance for government institutions, investors, and communities. Santo et al. (2024) demonstrate that the acceleration of RDTR preparation is influenced by institutional commitment, data availability, managerial capacity, policy support, and information technology. This finding indicates that the effectiveness of RDTR depends not only on its legal status but also on the institutional and technical capacity required to prepare, update, and implement it.

The analysis further indicates that digitalization has created opportunities to strengthen spatial governance. GIS-based platforms such as GISTARU can improve access to spatial information and facilitate the integration of spatial planning into digital governance. Rachmawati et al. (2024) found that GISTARU has the potential to support spatial planning and smart-city development by improving spatial information accessibility and analysis. However, digitalization should not be interpreted as an automatic guarantee of spatial compliance. Digital systems remain dependent on the accuracy, completeness, consistency, and regular updating of spatial data. Therefore, digital RDTR needs to be complemented by field verification and effective post-licensing supervision.

The findings also demonstrate that spatial planning must be understood as a multidimensional legal instrument. Spatial utilization involves not only land allocation but also questions concerning ownership, rights, obligations, environmental protection, and public interests. Falahiyati et al. (2024) demonstrate that the utilization of underground space may create conflicts when different rights and interests overlap. The protection of land-right holders is therefore an important component of spatial governance, particularly when development involves increasingly complex three-dimensional utilization of space. This finding reinforces the need for spatial planning regulations to provide legal certainty while protecting affected communities and land-right holders.

2. Spatial Planning as an Instrument for Disaster Mitigation

The results demonstrate that disaster mitigation needs to be integrated into spatial planning rather than being treated solely as a disaster-response measure. Spatial planning determines where settlements, infrastructure, industrial activities, agricultural areas, conservation areas, and other activities can be located. Consequently, inappropriate spatial allocation may increase exposure to hazards and transform existing environmental hazards into greater social and economic risks.

The literature reviewed in this study indicates that disaster risk reduction can be strengthened through the integration of hazard and risk information into spatial planning. Widowati (2022) emphasizes that spatial planning constitutes an important non-structural instrument for disaster mitigation in coastal areas. Similarly, Wulandari et al. (2021) identify gaps between disaster-risk-reduction knowledge and its implementation in spatial planning in Palu City. These findings indicate that the availability of disaster-risk information is not sufficient by itself; such information must be incorporated into spatial decisions, development controls, and land-use regulations.

The relationship between urban development and disaster risk is also evident in areas experiencing rapid land-use change. Handayani et al. (2020) found that urbanization and land-use change along the northern coast of Central Java contributed to increasing flood risks. Land conversion can reduce infiltration areas, modify drainage systems, and increase exposure of settlements and infrastructure to flooding. Therefore, spatial planning should protect ecological areas that perform important hydrological functions and should restrict development in areas with

high disaster risk. The integration of multi-hazard analysis into spatial planning is particularly important in regions exposed to multiple hazards. Hadiani et al. (2021) demonstrate that multi-hazard risk analysis can provide an important basis for spatial planning in small-island areas. Such an approach enables planners to identify areas where different hazards overlap and to determine appropriate development restrictions and mitigation measures. The implication is that disaster mitigation should become an integral parameter in determining spatial suitability rather than an additional consideration after spatial plans have been established.

3. Ecological Justice and Environmental Carrying Capacity

The results indicate that effective spatial planning must consider ecological carrying capacity and the fair distribution of environmental benefits and risks. Development activities that disregard environmental limits may generate economic benefits in the short term but create long-term ecological costs, including loss of agricultural land, reduction of green areas, degradation of water resources, and increased disaster vulnerability.

Rojikhah et al. (2024) demonstrate the importance of ecosystem-service carrying capacity in spatial planning for agricultural development. Their findings indicate that spatial allocation should consider the capacity of ecosystems to provide essential services and support sustainable development. Similarly, Dom (2024) emphasizes the relevance of ecological footprint considerations in evaluating land use, food security, biodiversity, and sustainability. These findings strengthen the argument that spatial planning should be based not solely on economic suitability but also on ecological limitations.

From the perspective of ecological justice, the consequences of inappropriate spatial utilization may not be distributed equally. Development projects may provide economic benefits to particular groups, while environmental degradation and disaster risks may be experienced by surrounding communities. Consequently, spatial planning needs to consider distributive justice, procedural justice, and intergenerational justice. Communities should have opportunities to understand, participate in, and monitor decisions that affect their environment and spatial rights.

Public understanding of regulations is an important component of this process. Yeltrina and Batubara (2024) demonstrate the importance of legal socialization in increasing community understanding of regulatory provisions and strengthening legal awareness. Although their study focuses on legal socialization in the community rather than spatial planning specifically, its findings are relevant to spatial governance because the implementation of spatial regulations requires communities to understand applicable rules, rights, obligations, and mechanisms for participation.

Thus, ecological justice in spatial planning should not be limited to the formulation of environmental standards. It should also involve meaningful public participation and access to information. Communities should be positioned not merely as recipients of spatial-development decisions but as active participants in protecting environmental functions and monitoring changes in land utilization.

4. Land Rights, Legal Certainty, and Spatial Utilization

The analysis reveals that spatial planning is closely connected to legal certainty concerning land and spatial rights. Development decisions may affect the rights of landowners, communities, businesses, and public institutions. This becomes increasingly complex when spatial utilization involves underground or three-dimensional spaces.

Falahiyati et al. (2024) demonstrate that the utilization of underground space may create legal issues when the rights of surface land holders differ from the interests of parties utilizing underground space. Legal protection becomes necessary when such utilization has the potential to interfere with existing rights or public interests. This finding has important implications for spatial planning because development control must not only determine whether an activity is spatially appropriate but also ensure that the rights of affected parties are adequately protected.

Legal certainty is therefore an essential element of sustainable spatial governance. Spatial planning regulations should clearly establish the rights and responsibilities of spatial users, mechanisms for resolving conflicts, procedures for development approval, and forms of protection available to affected communities. Without legal certainty, spatial planning may generate disputes even when development activities are formally consistent with planning documents.

The findings also indicate that legal certainty must be accompanied by effective communication of regulations. The legal-socialization perspective highlighted by Yeltrina and Batubara (2024) complements the legal-protection perspective developed by Falahiyati et al. (2024). Public understanding of spatial regulations can strengthen compliance, while legal protection ensures that communities and land-right holders are not disadvantaged by spatial development. The combination of these two dimensions provides a stronger foundation for participatory and equitable spatial governance.

5. Spatial Control and Law Enforcement

The results demonstrate that the effectiveness of spatial planning depends substantially on the ability of government institutions to control and enforce spatial utilization. Spatial planning documents have limited practical value if violations are not detected, investigated, and addressed consistently. The implementation gap between formal spatial plans and actual land utilization is therefore a critical challenge.

Budianto et al. (2024) identified differences between land-use conditions and spatial planning in the context of food-estate development. Such findings illustrate the importance of continuous monitoring to ensure that development remains consistent with spatial plans. Spatial control should therefore include preventive mechanisms before development occurs as well as corrective mechanisms when violations are identified.

Law enforcement should also be supported by reliable spatial data and institutional coordination. Digital spatial information can facilitate monitoring, but technological systems cannot replace human oversight. Field verification remains necessary because spatial conditions can change over time and may not always be accurately represented in digital databases. Therefore, an effective spatial-control system should combine digital monitoring, field inspection, institutional coordination, and public participation.

Public participation can strengthen law enforcement by enabling communities to report spatial violations and monitor environmental changes in their surroundings. The legal-awareness perspective presented by Yeltrina and Batubara (2024) supports the importance of improving public understanding of regulatory provisions. Communities that understand applicable regulations are better positioned to recognize potential violations and participate in the protection of their legal and environmental interests.

6. Implementation Gaps and the Need for Integrated Spatial Governance

The overall analysis reveals a substantial gap between the normative framework of spatial planning and its implementation. Indonesia has developed an increasingly comprehensive legal framework, but effective implementation remains dependent on institutional coordination, technical capacity, spatial data quality, public participation, and consistent law enforcement.

The problem is particularly visible when spatial planning, environmental management, disaster mitigation, and development interests are administered through separate institutional structures. Sectoral decision-making may result in inconsistent land-use policies and overlapping authorities. Such fragmentation can weaken the ability of spatial planning to function as an integrated instrument for environmental protection and disaster prevention.

The availability of RDTR, digital spatial information, and disaster-risk maps can contribute to better spatial governance, but these instruments must operate within a coordinated institutional framework. Santo et al. (2024) demonstrate the importance of institutional and technical factors in accelerating RDTR preparation, while Rachmawati et al. (2024) highlight the opportunities and challenges associated with digital spatial information systems. Together, these findings indicate that spatial governance requires both technological infrastructure and institutional capacity.

The findings also suggest that spatial planning should adopt an adaptive approach. Environmental conditions, disaster risks, land-use patterns, and development pressures change over time. Spatial plans therefore require periodic evaluation and adjustment based on updated environmental and risk information. A static planning document may become inadequate when environmental and social conditions change substantially.

7. Implications for Strengthening Disaster-Mitigation-Based Spatial Planning

Based on the results, several implications can be identified. First, disaster-risk information should be systematically integrated into RDTR and other spatial planning instruments. Hazard and risk maps should become important references in determining land-use suitability, zoning, infrastructure placement, and development restrictions. Second, ecological carrying capacity should be incorporated into spatial decision-making. Spatial allocation should consider ecosystem services, water-retention functions, agricultural sustainability, green open spaces, and other ecological functions. The findings from Rojikhah et al. (2024) and Dom (2024) support the need to incorporate ecological considerations into spatial planning.

Third, digital spatial planning should be strengthened through accurate, interoperable, and regularly updated spatial databases. Digital RDTR can improve transparency and efficiency, but it should be supported by field verification and post-licensing monitoring. Fourth, legal certainty and protection of spatial rights should be strengthened. The findings of Falahiyati et al. (2024) demonstrate that increasingly complex spatial utilization requires clear legal arrangements to protect land-right holders and resolve conflicts involving different spatial users. Fifth, community participation and legal awareness should be strengthened. The findings of Yeltrina and Batubara

(2024) demonstrate the relevance of legal socialization in improving community understanding of regulatory provisions. In spatial planning, this approach can be expanded through public dissemination of RDTR, accessible spatial information, community consultation, and participatory spatial monitoring.

Finally, law enforcement should be consistent and supported by adequate institutional capacity. Spatial violations that increase environmental degradation or disaster vulnerability should not be allowed to persist because of economic or political interests. Effective enforcement should combine preventive controls, administrative measures, monitoring, and appropriate legal sanctions.

Overall, the results demonstrate that disaster-mitigation-based spatial planning requires an integrated governance framework in which spatial regulation, RDTR, ecological carrying capacity, disaster-risk information, digital spatial systems, land-right protection, community participation, and law enforcement operate as interconnected components. Spatial planning can thereby function not merely as a mechanism for regulating development but as a preventive legal instrument for protecting ecological systems, reducing disaster vulnerability, ensuring public safety, and promoting intergenerational ecological justice.

CONCLUSION

This study concludes that spatial planning in Indonesia has a strategic role not only as an instrument for regulating land utilization and regional development but also as a legal instrument for disaster mitigation, environmental protection, public safety, and ecological justice. The analysis demonstrates that the transformation of spatial planning regulations, particularly through the development of spatial conformity mechanisms and the increasing role of Detailed Spatial Plans (RDTR), provides an important foundation for controlling development activities and reducing inappropriate land utilization.

The study further concludes that the effectiveness of disaster-mitigation-based spatial planning depends on the integration of disaster-risk information into spatial planning instruments. Hazard and risk maps should not be treated as supplementary information but should become an integral basis for determining spatial allocation, zoning, development restrictions, and environmental protection. Without such integration, spatial planning may continue to permit development in areas with high disaster exposure and consequently increase social, economic, and environmental vulnerability.

The findings also demonstrate that ecological carrying capacity and ecological justice are essential components of sustainable spatial planning. Spatial development that exceeds environmental capacity may generate short-term economic benefits while transferring environmental and disaster risks to local communities and future generations. Therefore, spatial planning needs to ensure a fair distribution of environmental benefits and risks and provide meaningful opportunities for communities to participate in spatial governance.

From the legal perspective, the study highlights the importance of legal certainty and protection of spatial and land rights. Falahiyati et al. (2024) demonstrate that increasingly complex spatial utilization, including the utilization of underground space, may create conflicts between different rights and interests. Consequently, spatial planning regulations need to provide clear legal arrangements and adequate protection for land-right holders and other affected parties. At the same time, Yeltrina and Batubara (2024) demonstrate the importance of legal socialization in strengthening community understanding of regulatory provisions. These perspectives indicate that effective spatial governance requires both legal protection and public legal awareness.

The study also identifies an implementation gap between the normative spatial planning framework and actual spatial utilization. The availability of regulations, RDTR, and digital spatial information does not automatically ensure compliance. Institutional coordination, data quality, technical capacity, public participation, monitoring, and consistent law enforcement remain essential. Digitalization should therefore be accompanied by field verification and post-licensing supervision to ensure that spatial utilization remains consistent with approved plans and environmental requirements.

Based on these findings, future spatial planning development should prioritize the acceleration and improvement of digital RDTR, integration of comprehensive disaster-risk and ecological carrying-capacity information, strengthening of spatial monitoring and post-audit mechanisms, protection of land and spatial rights, and expansion of meaningful public participation. Legal socialization should also be strengthened so that communities understand spatial regulations and can participate in monitoring spatial utilization. Law enforcement should be implemented consistently through preventive, administrative, and, where appropriate, criminal mechanisms against spatial violations. Ultimately, the development of disaster-mitigation-based spatial planning requires an integrated governance model that connects legal certainty, RDTR, disaster-risk reduction, ecological sustainability, digital spatial governance, community participation, and law enforcement. Such an approach can

transform spatial planning from a predominantly administrative instrument into a preventive and protective legal mechanism capable of creating spatial development that is safe, equitable, environmentally sustainable, and resilient for present and future generations.

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