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EVALUATING THE IMPLEMENTATION OF JEMBER REGENCY SPATIAL PLANNING REGULATION NO. 1 OF 2015 IN GEOMORPHOLOGICAL CONSERVATION OF HUMMOCKS (GUMUK)

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ABSTRACT

Gumuk (hummocks) are distinctive geomorphological features in Jember Regency, East Java, functioning as natural windbreaks, local groundwater recharge, and ecological supports. Although Jember Regional Regulation No. 1 of 2015 formally designates gumuk as Geological Protected Areas, their degradation has continued due to mining and land-use conversion. This study applies a qualitative policy document analysis supported by secondary geomorphological and disasters data to evaluate the implementation of the spatial planning regulation. The results reveal a clear mismatch between regulatory provisions and on-the-ground practices. Disaster records show a significant increase in strong-wind incidents, particularly in rapidly urbanizing districts where gumuk loss is most severe. The findings indicate that gumuk degradation directly weakens natural wind protection, disrupts local groundwater systems, and increases disaster vulnerability. Despite an adequate legal framework, weak enforcement and competing economic interests allow illegal Category C mining to persist. This study concludes that gumuk conservation is not merely an environmental concern but a critical disaster risk reduction strategy. Effective implementation of the spatial plan requires enforceable zoning, scientific mapping of gumuk, strengthened institutional coordination, and community-based conservation initiatives. Integrating geomorphological knowledge into spatial governance is essential to ensure environmental sustainability, regional resilience, and the preservation of Jember's unique geological identity.

***Keywords**: Disaster risk; Gumuk; Illegal mining; Spatial planning policy; Wind hazard.*

ABSTRAK

Gumuk merupakan bentang alam geomorfologi khas Kabupaten Jember yang berfungsi sebagai peredam alami angin, recharge air tanah lokal, dan penyangga ekologi. Meskipun Peraturan Daerah Kabupaten Jember Nomor 1 Tahun 2015 telah menetapkan gumuk sebagai Kawasan Lindung Geologi, degradasi gumuk terus berlangsung akibat aktivitas pertambangan dan alih fungsi lahan. Penelitian ini menggunakan pendekatan kualitatif melalui analisis dokumen kebijakan yang didukung oleh data sekunder geomorfologi dan kebencanaan untuk menilai implementasi kebijakan tata ruang tersebut. Hasil penelitian menunjukkan adanya ketidaksesuaian antara ketentuan regulasi dan praktik di lapangan. Data kebencanaan memperlihatkan peningkatan signifikan kejadian angin kencang, terutama di wilayah perkotaan yang mengalami degradasi gumuk secara intensif. Temuan dalam penelitian ini mengindikasikan bahwa hilangnya gumuk secara langsung melemahkan fungsi peredam angin alami, mengganggu air tanah lokal, dan meningkatkan kerentanan bencana. Meskipun kerangka hukum telah tersedia, lemahnya penegakan hukum dan dominasi kepentingan ekonomi jangka pendek menyebabkan pertambangan ilegal terus berlanjut. Penelitian ini menyimpulkan bahwa konservasi gumuk merupakan strategi penting dalam pengurangan risiko bencana. Implementasi kebijakan tata ruang perlu diperkuat melalui pemetaan ilmiah, zonasi yang tegas, penguatan kelembagaan, serta pelibatan masyarakat untuk menjamin keberlanjutan lingkungan dan ketahanan wilayah Kabupaten Jember.

***Kata Kunci**: Gumuk; Kebijakan tata ruang; Pengurangan risiko bencana; Pertambangan ilegal; Bahaya angin kencang.*

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A. INTRODUCTION

Jember Regency, located in the eastern part of Java Island, is widely recognized for its distinctive geomorphological landscape characterized by numerous small, rounded hills locally known as gumuk (hummocks). These landforms not only define the visual character and natural beauty of the area but also represent a unique geological heritage that is rarely found elsewhere in Indonesia. Due to this remarkable feature, Jember is often referred to as the "City of a Thousand Hills" or "City of a Thousand Hummocks".

Previous studies have primarily examined gumuk from a physical and geomorphological perspective, emphasizing their formation processes and ecological functions. While these studies provide a strong scientific basis for understanding gumuk, they have rrely addressed how such scientific knowledge is translated into spatial planning policies and, more critically, how these policies are implemented within local governance systems. As a result, the effectiveness of gumuk conservation policies remains underexplored from a policy implementation perspective, creating a significant gap between scientific knowledge and spatial governance practice.

This gap is evident in Jember Regency, where Regional Regulation No. 1 of 2015 (RTRW 2015–2035) formally designates gumuk as protected geological features and natural windbreaks in disaster-prone areas. The central issue, therefore, is not the absence of policy, but the limited effectiveness of its implementation. Despite clear regulatory recognition, ongoing mining activities, land-use conversion, and landscape flattening continue to occur within designated protection zones. This persistent discrepancy between regulatory intent and on-the-ground realities raises critical questions regarding institutional capacity, enforcement mechanisms, and coordination among stakeholders in spatial governance.

The urgency of evaluating the implementation of the Regional Spatial Plan (RTRW) has intensified due to accelerating infrastructure development, increasing demand for Category C mining materials, and the rapid expansion of both legal and illegal extractive activities. As the RTRW 2015–2035 has reached its mid-implementation phase, this period constitutes a critical moment to assess whether spatial planning objectives are being effectively operationalized or remain largely symbolic. Without timely evaluation and corrective action, Jember faces the risk of irreversible geomorphological loss, erosion of regional identity, and heightened disaster vulnerability.

Against this background, this study analyzes the implementation of Jember Regency Regional Regulation No. 1 of 2015 using a qualitative policy document analysis supported

by secondary environmental and disaster data. The study aims to identify the mismatch between spatial planning policy and practice and to highlight the importance of integrating geomorphological knowledge into effective regional spatial governance for sustainable development and disaster risk reduction.

B. MATERIALS AND METHODS

This study employs a qualitative reseach design using a policy document analysis dan secondary data approach to analyze the status, significance, and protection of hummocks (gumuk) in Jember Regency (Figure 1), with a focus on the implementation of local policies, particularly Jember Local Regulation No. 1 of 2015. The objective is to assess how current legal frameworks and scientific understanding address the conservation of these unique geological formations.

Relevant academic sources, policy documents, and government regulations were collected from both national and international databases, including Google Scholar, Scopus, ScienceDirect, Garuda (Garba Rujukan Digital), and official websites of the Indonesian government.

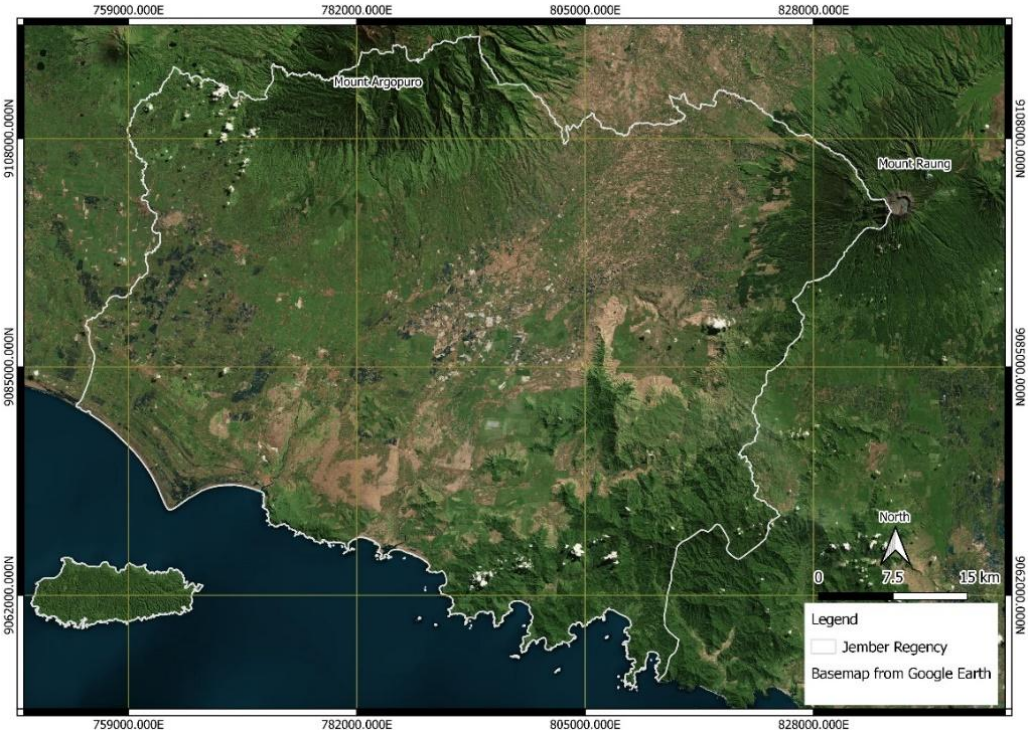

Figure 1. Jember regency map as a research area
source: Authors

In addition, secondary data were utilized to support the policy analysis, including information on environmental risk and disaster data, and relevant geomorphological

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characteristics and ecological roles of hummocks, Legal and institutional frameworks for geological protection in Indonesia Implementation challenges of Regional Regulation No. 1/2015 in Jember and comparative analysis was also conducted to evaluate how similar landforms are protected in other countries or regions, providing broader context and best practices.

C. RESULTS AND DISCUSSION

The Jember Regency Regional Regulation No. 1 of 2015 on the Spatial Planning (RTRW) for the period 2015–2035 contains specific mandates regarding the conservation of geomorphological features, particularly the hummocks (gumuk) that characterize much of the regency's landscape. These hummocks are acknowledged as critical elements within the local ecosystem and spatial planning framework. This recognition shows that gumuk are more than just physical features of the Jember landscape. They are valuable environmental assets that play a crucial role in ensuring regional safety, maintaining ecological balance, and supporting sustainable development.

In this context, the conservation of gumuk in Jember Regency aligns closely with several targets of the United Nations Sustainable Development Goals (SDGs). Specifically, gumuk protection contributes to SDG 11 (Sustainable Cities and Communities), particularly Target 11.4 concerning the safeguarding of natural heritage, SDG 13 (Climate Action), by strengthening local resilience to climate-related hazards such as extreme winds, and SDG 15 (Life on Land), through the promotion of sustainable land use and the prevention of land degradation. Therefore, gumuk conservation should be viewed not only as a local environmental issue, but also as part of Indonesia’s broader commitment to global sustainability agendas.

The Jember Regency Regional Regulation No. 1 of 2015 on the Spatial Planning (RTRW) for the period 2015–2035 paragraph 5, article 38, section 7d explicitly states that in managing areas prone to strong winds and tornadoes, efforts must include maintaining the sustainability of hummocks. This provision recognizes the geomorphological function of hummocks as natural windbreaks, offering protection against environmental hazards such as windstorms and sudden gusts. Furthermore, Paragraph 6, Article 39, section 2 categorizes the scattered hummocks across Jember Regency as Geological Protected Areas. This regulatory mandate is further reinforced by Law Number 32 of 2009 on Environmental Protection and Management. Chapter I, Article 1, Paragraph 17 defines environmental damage as alterations in the physical, chemical, or biological characteristics of the

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environment that exceed established environmental damage thresholds. In line with this, Erwin (2009) conceptualizes environmental damage as a condition in which the environment can no longer perform its original functions. From spatial planning perspective, it's crucial to recognize that gumuk areas should be designated as vital conservation zones within the RTRW framework. This classification is not just a bureaucratic detail, but it fundamentally seafeguards these regions from extractive activities and land conversions that conflict with the planning objectives. Protecting gumuk in this manner is essential for preserving our natural heritage and ensuring sustainable development for future generation. This generation should prioritize conservation and protect these vital areas for the benefit of the environment and community.

Based on Figure 2, it is evident that Jember Regency is a disaster-prone area frequently affected by strong winds or tornado like windstorms. The documented incidents demonstrate the destructive impact of high-velocity winds on residential structures, trees, and public infrastructure. These recurring events highlight the region's vulnerability and the urgent need for effective land-use planning and natural windbreak conservation, such as the protection of local hummocks (gumuk), to mitigate the risks posed by such extreme weather phenomena. The recurrence of these disasters highlights an environmental vulnerability related to landscape changes, especially the loss of natural wind barriers like gumuk that previously reduced local wind speed. It is crucial for the community and government to comprehend the advantages of natural landscapes before converting them. This consciousness is key to assessing the long-term impacts of land-use change on disaster vulnerability, as seen in the use of gumuk in the Jember region.

Apriyanto (2016) emphasizes that the loss of gumuk correlates with increased wind damage, while Hariani et al. (2015) and assessments by the Jember Regional Disaster Management Agency confirm that tornado-like wind events are a recurring threat, particularly during the rainy season. Strong winds have been a consistently occurring hazard, peaking significantly in 2022 (Figure 3). This pattern strongly justifies the importance of paragraph 5, article 38, section 7d of the Regional Regulation No. 1 of 2015, which mandates the preservation of gumuk (hummocks) as natural windbreaks. The conversion or exploitation of gumuk for mining or development diminishes their ability to function as natural buffers, leading to broader vulnerability across the regency. This trend highlights that disaster risk is not only driven by climate but is also socially and spatially produced due to the poor enforcement of spatial planning regulations.

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Figure 2. The figures were obtained from the official website of the Regional Disaster Management Agency (BPBD) of Jember Regency at bpbd.jemberkab.go.id. These photographs illustrate the recurring impact of strong winds frequently affecting the region. A) Roof damage to residential buildings caused by intense wind gusts. B) A fallen tree obstructing traffic as it blocks a main roadway. C) A large tree uprooted by strong winds and heavy rain, collapsing onto a house and public road. And D) Another case of wind-induced treefall, disrupting daily activities and transportation due to road blockage.

source: bpbd.jemberkab.go.id

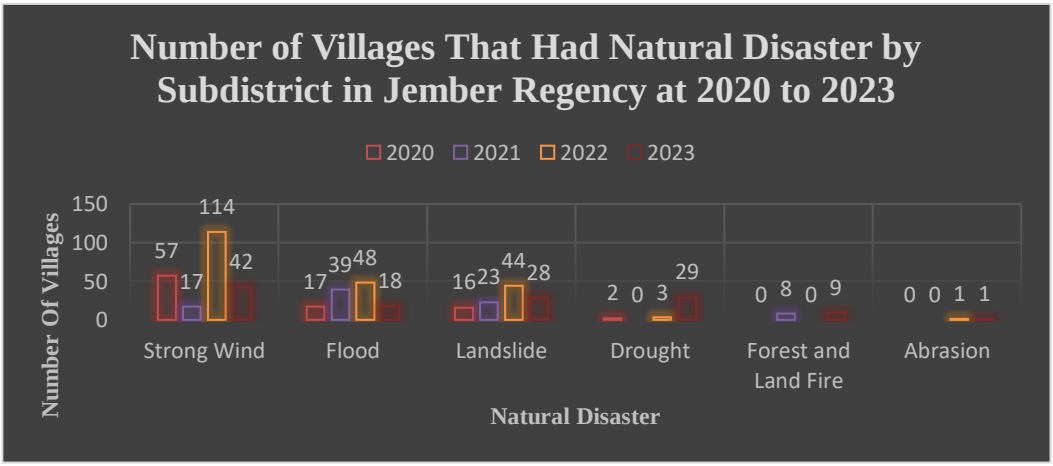

Figure 3. The Graph showing the Number of Villages Affected by Natural Disasters by Subdistrict in Jember Regency from 2020 to 2023

source: Data from BPS Jember and BPBD

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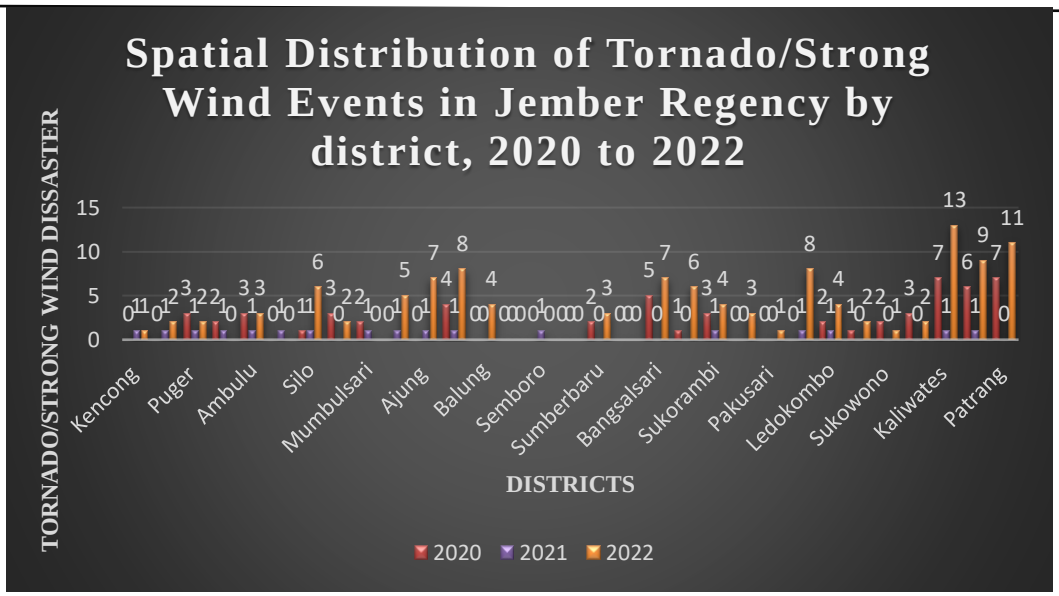

Figure 4. The Graph showing spatial distribution of tornado/strong wind events in Jember regency by district, 2020 to 2022

source: Data from BPS Jember and BPBD

The data (Figure 4), shows the frequency of tornado or strong wind incidents across 31 subdistricts in Jember Regency over a three-year period. The total number of reported cases was 57 in 2020, 17 in 2021, and a significant increase to 114 in 2022, highlighting a sharp escalation in wind-related disasters in the latest year observed. This escalation reflects a critical failure in translating RTRW policy into land-use control. Districs such as Kaliwates, Sumbersari, and Patrang are urbanizing rapidly, and the concentration of wind disasters in these areas indicates that gumuk degradation disproportionately increases risk in densely populated zones.

Table 1. Records of Strong Wind Disasters Identified Based on Literature and Government Documents in the 2004 to 2005 (ppid.jemberkab.go.id, bpbd.jemberkab.go.id, pusatkrisis.kemkes.go.id)

Date (DD/MM/YY)	Type of Information	Damage Caused by the Disaster
31/10/2004	Strongwind and Flood	Disaster caused by rain and wind in Panti Subdistrict. Three houses were damaged
19/11/2004	Strongwind and Flood	Disaster caused by rain and wind in Panti Subdistrict. Twenty-one houses were damaged
28/11/2004	Strongwind and Flood	Disasters caused by rain and wind in Patrang Subdistrict and Pakusari Subdistrict. Three houses were damaged.
05/12/2005	Strongwind and Flood	Disaster caused by rain and wind in Glundengan Hamlet, Petung Village, Bangsalsari Subdistrict

Most affected districts (2020–2022 Combined): Kaliwates: 21 incidents (7 in 2020, 1 in 2021, 13 in 2022), Sumbersari: 16 incidents (6 in 2020, 1 in 2021, 9 in 2022), Patrang: 18

incidents (7 in 2020, 0 in 2021, 11 in 2022), Rambipuji: 13 incidents (4 in 2020, 1 in 2021, 8 in 2022), Kalisat: 9 incidents (0 in 2020, 1 in 2021, 8 in 2022), Ajung: 8 incidents (0 in 2020, 1 in 2021, 7 in 2022). These districts are consistently among the most affected and may require prioritized disaster preparedness and mitigation measures.

The disaster records from 2004 to 2005 based on Ministry of Health of the Republic of Indonesia (pusatkrisis.kemkes.go.id), Jember Regency Government (ppid.jemberkab.go.id and bpbd.jemberkab.go.id) at Table 1, shows that Jember Regency has a long-standing vulnerability to strong wind events, including tornado like storms, often accompanied by heavy rain and flooding. The data indicates repeated occurrences of such disasters across multiple subdistricts, including Panti, Patrang, Pakusari, and Bangsalsari. Strong winds and floods, damaging houses. These recurring incidents spread over multiple years and affecting different areas demonstrate a consistent pattern of strong wind and flood disasters. This supports the conclusion that Jember is indeed a disasterprone region, especially vulnerable to tornado and this reinforces the argument that gumuk conservation is not an optional environmental agenda, but a long-term disaster risk reduction strategy embedded within the RTRW mandate.

Gumuk (hummocks) play a vital ecological and environmental role in Jember Regency. One of their primary functions is to disperse high velocity winds. When strong winds collide with the slopes of gumuk, the airflow is deflected in various directions at lower speeds, thereby reducing the potential for wind-related disasters. Additionally, gumuk serve as part of the earth's natural anchoring system, helping to maintain hydrogeological and ecological balance.

These landforms also support rich ecosystems, providing habitat for various flora and fauna, and contributing to a cooler microclimate in their surrounding areas. Their structure enables them to store large amounts of water, making them crucial in preventing erosion, flooding, and drought. Moreover, their elevated peaks offer scenic viewpoints, making gumuk not only ecologically important but also valuable for eco-tourism and cultural identity.

Given these multiple functions, the preservation of gumuk in Jember Regency is essential. Protecting these landforms is not only a matter of environmental stewardship but also a step toward sustainable regional development, disaster risk reduction, and the protection of local heritage.

The story of Sumber Tunjung in Jember, as reported by Suara Indonesia (2024), highlights a significant yet often overlooked ecological function of gumuk as natural water reservoirs. Historically, this spring located on a gumuk was not only used for daily needs but also served cultural and spiritual purposes, such as in traditional ruwatan ceremonies. This indicates that gumuk are not merely geological features, but also crucial components of local hydrogeology and heritage. This case illustrates the socio-hydrogeological dimension of gumuk, where geological formation with good porosity originating from old volcanic material (Sapei et all, 19992) in the gumuk are embedded within cultural practices and local water management system. The disappearance of gumuk not only signifies environmental degradation, but also cultural and social disintegration.

Jember Regency's geology consists of Holocene alluvial sediments, young volcanic deposits, and older volcanic formations composed of volcanic breccias, tuffs, agglomerates, and andesitic–basaltic lava flows (Sapei et al., 1999). The gumuk are remnants of ancient lava and lahar flows from Mount Raung that became isolated as softer volcanic materials eroded over approximately 2,000 years (Verbeek & Vennema, 1936). As non-renewable geological features, the destruction of gumuk is irreversible on human timescales, providing a strong scientific basis for their designation as protected geological zones within the RTRW.

Figure 5. A Gumuk visitor collecting fresh water directly from Sumber Tunjung (Spring) in Panti Village to drink, illustrating the natural hydrological benefit of the gumuk ecosystem

source: suaraindonesia.co.id

The presence of springs (Figure 5) on gumuk exemplifies their capacity to retain groundwater, regulate surface runoff, and contribute to sustained water availability for surrounding communities. By holding water within their structures and good porosity of

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rocks, gumuk help prevent drought, and flood events, thereby supporting both ecological resilience and the livelihoods of local populations**.**

Therefore, the conservation of gumuk is essential not only for preserving local culture and water resources but also for maintaining the ecological balance of the region. Destruction or degradation of these landforms often due to mining or land-use change can disrupt hydrogeological systems and accelerate environmental degradation. Recognizing the water- egulating function of gumuk strengthens the argument for their protection as part of a broader environmental management strategy in Jember Regency.

Such findings reinforce the critical relevance of spatial planning policies, including Jember Regional Regulation No. 1 of 2015, which mandates the preservation of gumuk (hummocks) as natural wind barriers. Ignoring these historical patterns may lead to repeated and worsening impacts in the future, especially with increasing environmental degradation and climate variability.

The conservation of gumuk in Jember Regency aligns directly with the principles and mandates of Law No. 32 of 2009 on Environmental Protection and Management. As landforms with ecological, geological, and hydrological functions, gumuk fall under the category of protected natural features that require sustainable management. Their continued degradation through mining and land conversion not only violates local spatial regulations but also contradicts the national legal framework on environmental sustainability. Therefore, integrating gumuk conservation into regional planning and community-based programs is essential to uphold the law and ensure ecological resilience in the long term.

The state or government serves as a unified force with the authority to make decisions that influence society. Its role is to guide individuals, communities, and social relationships to become more meaningful and beneficial, not only for themselves but also for others and for the environment. In the context of Jember Regency, this role becomes especially crucial in safeguarding the region’s unique geological heritage of gumuk (hummocks). Despite the existence of Jember Regional Regulation No. 1 of 2015, which explicitly recognizes gumuk as part of geological protected areas and mandates their preservation, its implementation has remained far from effective. The continued exploitation and degradation of gumuk landscapes reflect a gap between regulatory intent and practical enforcement. This situation underscores the need for stronger governmental action and community engagement to ensure that gumuk conservation aligns with sustainable environmental governance. This implementation gap reflects weak institutional coordination, limited enforcement capacity,

and competing economic interests that prioritize short-term gains over long-term environmental security.

Figure 6. A) Mining activity on a gumuk (hummock) in Glagahwero Village, Kalisat Subdistrict (radarjember.jawapos.com). B) Gumuk excavation (Category C mining) in the northern area of Jember (suaraindonesia.co.id). C) A once green hill in Wirolegi Village, formerly covered with hardwood vegetation, has been flattened. Heavy machinery is seen excavating rock, sand, and fill soil for commercial and government construction projects near Sritanjung Street, RT 03 RW 02, Wirolegi Village, Sumbersari district, Jember Regency (detikfakta.id). D) Illegal Category C mining in Kojuk, Sukokerto Village, Sukowono district, Jember Regency (jurnalbangsa.com)

source: radarjember.jawapos.com, suaraindonesia.co.id, detikfakta.id, jurnalbangsa.com

Recent reports from multiple news sources reveal the alarming rise of gumuk (hummock) exploitation and illegal Category C mining activities across various areas in Jember Regency, particularly in northern Jember, Wirolegi, Sukokerto, and surrounding districts (Figure 6A-D). As illustrated in Figure 6A–D, mining activities range from active excavation on individual gumuk (Glagahwero Village, Kalisat Subdistrict) to large-scale land flattening in urban and peri-urban areas such as Wirolegi and Sukokerto. These operations have not only intensified environmental degradation but have also contributed to the disappearance of Jember's iconic landscape, once proudly known as the "City of a Thousand Gumuk.". The visual evidence presented in Figure 6 clearly demonstrates how

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gumuk are progressively transformed from vegetated landforms into extraction sites, resulting in permanent geomorphological loss. The persistence of illegal mining indicates that gumuk are treated as expendable resources rather than protected geological assets, undermining the normative authority of the RTRW.

Several articles, including from Radar Jember, infopol and Suara Indonesia, highlight that unauthorized excavation of gumuk for soil, sand, and stone is now widespread. Although these activities may offer short-term economic gain for illegal operators, they do not contribute to regional income, as they bypass legal channels, permits, and environmental safeguards.

Moreover, Detik Fakta and Jurnal Bangsa have documented that many of these illegal mines have resulted in accidents and fatalities, prompting temporary closures that are often ignored or reversed. Despite government crackdowns, enforcement remains inconsistent, and exploitation continues largely unchecked. If such exploitation is not halted, Jember risks losing its natural identity, and the nickname “City of a Thousand Gumuk” will no longer be appropriate. Preserving gumuk is not just a matter of local pride, but a critical step for environmental sustainability, disaster risk reduction, and long-term regional planning.

Spatial planning is a systematic process involving spatial planning, space utilization, and control over space usage, as regulated under Law Number 26 of 2007 on Spatial Planning. A Regional Spatial Plan (RTRW) outlines programs for space utilization, including funding strategies, and is intended to guide the management of land, water, air, and other natural resources. However, in practice, the Jember Regency Government has shown inconsistencies in enforcing its own regulation, namely Jember Regional Regulation No. 1 of 2015 on the Spatial Plan of Jember Regency for 2015–2035. Although this regulation designates gumuk (hummocks) as protected geological features and part of spatial conservation zones, numerous violations continue to occur. These include the exploitation of gumuk for mining and land conversion, which directly contradict the legal mandate for sustainable land use and environmental protection.

The lack of firm action and enforcement indicates a disconnect between policy and implementation. This inconsistency undermines the purpose of spatial planning itself, especially regarding the ecological, hydrogeological, and cultural functions of gumuk. Without urgent corrective measures, this failure in spatial governance may lead to long-term environmental degradation and the loss of regional identity associated with Jember as the "City of a Thousand Gumuk."

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The exploitation of gumuk (hummocks) in Jember has increasingly become an attractive business opportunity due to the growing demand for Category C mining materials, such as sand, gravel, and soil. This exploitation driven by rapid infrastructure and construction development across the region. This demand is likely the primary motivation behind the rise in unauthorized and widespread mining activities by local communities. This reflects a structural conflict between development-driven land demand and environmental governance. Without clear zoning and scientific assessment, gumuk exploitation will continue to externalize environmental costs to society.

However, if the local government remains committed to the conservation and sustainable management of gumuk, it must begin by implementing a comprehensive mapping and zoning strategy. This strategy should clearly identify which gumuk areas, if any, may be responsibly mined, and which must be strictly protected. Such decisions must be based on scientific assessments, geotechnical evaluations, and hydrogeological studies, ensuring that conservation efforts are measurable, accountable, and enforceable.

In parallel, there is an urgent need to cultivate public awareness regarding the ecological and environmental significance of gumuk. These landforms serve critical functions, such as acting as natural windbreaks during storms, preserving groundwater as part of the regional hydrogeological system, and offering eco-tourism potential that can be developed sustainably. Engaging youth organizations (karang taruna) and supporting local small businesses (UMKM) could be effective pathways to promote gumuk-based tourism and alternative livelihoods that support conservation goals.

Ultimately, firm governmental action is required, along with collaborative engagement among all stakeholders in Jember Regency, including environmental experts, Universities, civil society, local communities, and the private sector to ensure that the unique landscape of gumuk is preserved for future generations and remains a defining feature of Jember's natural heritage. Strengthening gumuk conservation within the RTRW framework is therefore not only an environmental necessity but a strategic investment in disaster resilience, legal certainty, and sustainable regional identity.

D. CONCLUSIONS

The findings of this study highlight the irreplaceable ecological, hydrogeological, and cultural functions of gumuk (hummocks) in Jember Regency. The analysis demonstrates that gumuk play a critical role as natural windbreaks, groundwater retention structures, and ecological stabilizers, which directly reduce disaster risk in a region that is highly vulnerable to strong winds and flooding. Despite being designated as Geological Protected Areas under

Jember Regional Regulation No. 1 of 2015, these landforms continue to face serious threats due to unchecked mining and inadequate spatial policy enforcement. Empirical disaster records and land-use evidence indicate a clear disconnect between the legal intention of the RTRW and its implementation on the ground, resulting in increased environmental vulnerability and landscape degradation.

Sustainable conservation of gumuk must begin with integrated spatial planning that includes detailed mapping, scientific evaluation, and zoning to determine which areas require strict protection. The findings imply that the RTRW of Jember Regency must be operationalized through enforceable zoning, geospatial monitoring, and clear restrictions on extractive activities within designated gumuk protection areas. Conservation strategies should also prioritize public engagement by raising awareness of the multiple roles gumuk play from natural wind barriers and water reservoirs to eco-tourism attractions. Empowering local communities, youth groups, and small businesses to take part in conservation-oriented economic activities can ensure a broader social commitment to preserving gumuk. Cultural stories, such as those associated with Sumber Tunjung, can be leveraged to deepen this connection.

Ultimately, effective gumuk preservation requires bold leadership and coordination among local government, universities, civil society, and private actors. Strengthening institutional coordination and enforcement capacity is essential to close the gap between spatial planning policy and implementation. The local government must uphold its regulatory responsibility in line with national environmental law (Law No. 32 of 2009) and the Sustainable Development Goals. Without immediate and sustained action, Jember risks losing its defining geological identity and increasing its exposure to ecological and disaster-related crises. Integrating gumuk conservation into formal spatial planning and community-based governance is therefore not only an environmental obligation but a strategic policy instrument for long-term regional resilience and sustainable development. Conserving gumuk is not only an environmental imperative but also a cultural and developmental necessity for future generations.

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