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SUSTAINABLE TOURISM STRATEGIES THROUGH MAPPING DISASTER-PRONE TOURISM AREAS IN SITUBONDO REGENCY, INDONESIA

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Abstract
Tourism development in disaster-prone areas presents both opportunities and risks that demand careful spatial planning and sustainable management. Situbondo Regency, located in East Java, Indonesia, offers diverse natural attractions ranging from coastal landscapes and mountain ecosystems to conservation areas. However, the regency's geographical characteristics also expose many of its tourism destinations to hazards such as floods, landslides, earthquakes, volcanic activity, and coastal abrasion. This study aims to map tourism areas identified in the Regional Spatial Plan (RTRW) of Situbondo and examine their overlap with disaster-prone zones as a foundation for developing strategies toward sustainable tourism. A spatial analysis approach was employed by overlaying designated tourism zones with hazard-prone maps derived from official planning documents and secondary data. The results indicate that several key tourism sites, particularly those situated along coastal corridors and volcanic slopes, fall within medium to high disaster risk areas. These findings underscore the urgency of integrating disaster risk reduction measures into tourism development and policy implementation. The study suggests that sustainable strategies should emphasize infrastructure resilience, the incorporation of disaster-sensitive design principles, and the reinforcement of local community capacity in preparedness and response. In addition, diversification of tourism products that reduce environmental vulnerability, improved early warning systems, and stronger risk communication with stakeholders are essential for minimizing potential losses. Aligning spatial planning instruments with sustainable tourism frameworks is also crucial to ensure long-term destination resilience. This research highlights the importance of disaster-aware tourism planning in Situbondo Regency. By integrating spatial planning, disaster risk management, and sustainability principles, Situbondo can strengthen the safety of its destinations, maintain ecological integrity, and enhance the resilience of its tourism sector in the face of natural hazards.

Keywords: *tourism mapping, disaster-prone areas, spatial planning, Situbondo, sustainable tourism*

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1. INTRODUCTION

Tourism is widely recognized as one of the major contributors to economic growth, employment, and regional development worldwide. According to the UN World Tourism Organization (UNWTO, 2023), tourism not only supports local livelihoods but also fosters cultural preservation and environmental awareness. However, as the industry expands into environmentally fragile regions, particularly in countries located within disaster-prone zones such as Indonesia, the sector faces increasing exposure to natural hazards. Situated along the Pacific Ring of Fire, Indonesia is highly vulnerable to earthquakes, volcanic eruptions, landslides, floods, and coastal abrasion (BNPB, 2022). These hazards pose significant risks to tourism infrastructure, visitor safety, and community welfare. Therefore, the integration of disaster risk reduction (DRR) into tourism planning has become essential to achieving sustainability and resilience.

Sustainable tourism, as defined by Bramwell and Lane (2011) and Saarinen (2014), emphasizes the balance among economic viability, social inclusivity, and environmental protection. Within this framework, disaster resilience represents a fundamental but often overlooked dimension (Becken & Hay, 2007). The Sendai Framework for Disaster Risk Reduction 2015–2030 underscores the importance of incorporating DRR across all sectors, including tourism, to minimize risks and build adaptive capacity (UNDRR, 2015). In the context of tourism, DRR refers to identifying potential hazards, mapping vulnerable areas, and designing adaptive spatial strategies that enhance safety and minimize exposure. However, in many developing regions, local tourism policies and spatial plans still prioritize economic growth over risk-sensitive land use and resilience-based planning (Gurtner, 2016).

Recent studies have highlighted the usefulness of Geographic Information Systems (GIS) as a decision-support tool for sustainable spatial planning. GIS enables the integration of multiple layers of spatial information, such as land use, topography, hazard distribution, and infrastructure to identify the overlap between tourism zones and disaster-prone areas (Baja et al., 2020; Tavares & Santos, 2020). Through spatial overlay analysis, policymakers can visualize hazard exposure levels and integrate this knowledge into land-use and tourism planning. Rahman et al. (2019) emphasized that GIS-based spatial analysis not only improves planning accuracy but also facilitates evidence-based policy formulation, particularly in areas with complex hazard profiles. Despite these advances, empirical applications of GIS for tourism and disaster mapping remain limited at the local government level in Indonesia, where spatial and policy data are often fragmented (Pratama & Nugroho, 2021).

Situbondo Regency, located in the eastern part of East Java Province, Indonesia, represents a relevant case for examining the intersection between tourism development and disaster vulnerability. The regency possesses diverse tourism potentials, including coastal, mountain, and agrotourism spread across 17 subdistricts. Geographically, Situbondo is bordered by the Madura Strait in the north and the Ijen volcanic complex in the south, exposing it to multiple natural hazards such as volcanic activity, floods, landslides, and coastal abrasion (PVMBG, 2021). While the Situbondo Spatial Plan (RTRW 2025–2045) and Medium-Term Development Plan (RPJMD 2021–2026) prioritize tourism as a leading sector for regional growth, both documents provide limited attention to disaster mitigation and spatial risk integration within tourism areas. Previous studies on Situbondo's tourism development have focused mainly on potential mapping, community participation, and ecotourism initiatives (Hidayati et al., 2019; Rahmawati, 2021), but few have explicitly analyzed the spatial relationship between designated tourism zones and disaster-prone regions. This lack of spatial-based assessment may lead to increased exposure of tourism assets, visitors, and communities to natural hazards.

To address this research gap, this study aims to develop a spatial and policy-based analysis of sustainable tourism strategies through the mapping of disaster-prone tourism areas in Situbondo Regency. The study specifically seeks to (1) identify subdistricts designated as tourism zones based on the Situbondo Spatial Plan (RTRW), (2) map disaster-prone areas using official hazard data, (3) conduct overlay analysis between tourism and hazard zones to determine exposure levels, and (4) review the integration of disaster mitigation measures in local policy documents such as the RTRW

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and RPJMD. The results are expected to generate spatial evidence for sustainable tourism development and provide recommendations for incorporating DRR into regional tourism policy. By combining GIS-based spatial analysis with policy evaluation, this research contributes to the growing body of literature on sustainable tourism planning and offers practical insights for building disaster-resilient tourism destinations in Indonesia.

2. RESEARCH & METHODOLOGY

2.1 Study Area

This study was conducted in Situbondo Regency, located in the eastern part of East Java Province, Indonesia, covering an area of approximately 1,669 km² and consisting of 17 subdistricts. Situbondo is characterized by diverse geographical features ranging from lowland coastal areas along the Madura Strait to mountainous regions surrounding the Ijen complex. The regency has significant tourism potential, including nature-based, cultural, and agro-tourism attractions. However, these areas are also exposed to multiple natural hazards such as landslides, floods, volcanic activity, and coastal abrasion. These characteristics make Situbondo an appropriate case study for assessing the intersection between tourism development and disaster vulnerability in the context of sustainable regional planning.

2.2 Data Collection

The study employed both spatial and non-spatial datasets derived from secondary sources:

Table.1 Data Needs

Type of Data	Source	Purpose
Spatial Plan (RTRW) Map of Situbondo Regency 2025–2045	Regional Development Planning Agency (Bappeda) Situbondo	Identification of designated tourism zones
Disaster-prone area maps (landslide, flood, volcanic, earthquake, abrasion)	National Disaster Management Agency (BNPB) and Indonesian Geospatial Information Agency (BIG)	Mapping of disaster-prone zones
Administrative boundary map	Geospatial Information Agency (BIG)	Spatial reference for overlay analysis
Regional Medium-Term Development Plan (RPJMD) 2021–2026	Regional Secretariat of Situbondo	Policy analysis on disaster mitigation and tourism
Supporting data (literature, reports, journals)	Secondary references	Contextual and analytical support

All spatial data were processed using Geographic Information Systems (GIS) to ensure consistency in projection, scale, and spatial boundaries.

2.3 Analytical Methods

The research employed a descriptive and spatial analysis approach, structured in four main stages:

1. Identification of Tourism Zones
   Tourism development areas were extracted from the official RTRW map of Situbondo Regency. Each designated tourism zone was classified according to its corresponding subdistrict (*kecamatan*) to create a spatial tourism dataset.

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2. Mapping of Disaster-Prone Areas
   Hazard layers, including flood-prone zones, landslides, volcanic hazard zones, and coastal abrasion areas, were digitized and standardized into a uniform coordinate system (UTM Zone 49S).
3. Overlay Analysis
   The spatial overlay technique was applied to intersect the tourism zone layer with the disaster-prone area layers. This process produced a composite hazard exposure map, revealing which tourism areas are located within or near disaster-prone zones.
4. Policy and Document Review
   Qualitative analysis was conducted on the RTRW (2012–2032) and RPJMD (2021–2026) documents to evaluate the extent to which disaster mitigation measures are integrated into tourism and spatial development policies.

The integration of these methods allows for both spatial visualization and policy interpretation to support the formulation of sustainable and resilient tourism strategies.

2.4 Analytical Framework

The analytical framework of this study integrates spatial mapping and policy review to assess the sustainability of tourism development in disaster-prone regions. The framework consists of the following logical flow:

1. Identification of tourism spatial designation (RTRW)
2. Identification of disaster-prone zones (BNPB/BIG)
3. Spatial overlay analysis to determine hazard exposure levels
4. Policy review of RTRW and RPJMD regarding mitigation strategies
5. Formulation of recommendations for sustainable and disaster-resilient tourism planning

This integrative framework ensures that spatial vulnerability findings are directly linked with policy implications, providing practical input for decision-makers in regional planning and sustainable tourism management.

3. FINDINGS AND DISCUSSION

3.1 Tourism Zone Mapping Based on the Spatial Plan (RTRW)

The spatial organization of Situbondo Regency, as articulated in the *Rencana Tata Ruang Wilayah (RTRW) Kabupaten Situbondo 2025–2045*, identifies tourism as one of the key strategic sectors for regional economic development. The RTRW envisions Situbondo as a regency that harmonizes ecological sustainability, economic competitiveness, and social inclusivity, with tourism serving as a primary driver for achieving balanced development across its coastal and hinterland zones. Within this framework, four subdistricts, Banyuglugur, Bungatan, Panji, and Kendit, are designated as priority tourism development areas.

From a spatial perspective, the delineation of these tourism zones corresponds to Situbondo's unique coastal morphology, ecological diversity, and cultural landscape. The regency's northern coastal corridor, which extends along the Bali Strait, offers a mosaic of natural and cultural attractions such as coral reef ecosystems, mangrove belts, traditional fishing settlements, and historic coastal communities. Meanwhile, inland areas are characterized by forested hills, agricultural terraces, and traditional agroforestry systems that can be developed into ecotourism and agrotourism destinations.

a. Banyuglugur Subdistrict

Banyuglugur is designated as a marine and coastal tourism zone (kawasan wisata bahari dan pesisir). The RTRW highlights its potential for recreation-based activities, including beach tourism, snorkeling, and coastal ecotourism linked to coral reef and mangrove ecosystems. The subdistrict also has cultural value through local fishing traditions and coastal festivals. Spatially, this area lies along the northern corridor of Situbondo's coastal tourism belt, connecting the western boundary with neighboring Probolinggo Regency. Its development focus emphasizes marine resource-based tourism while maintaining ecosystem conservation principles.

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b. Bungatan Subdistrict

Bungatan serves as an extension of the coastal tourism corridor with an emphasis on community-based tourism and small-scale maritime economies. The area's sandy beaches and accessible coastal road infrastructure make it suitable for tourism expansion. The RTRW categorizes Bungatan as a mixed-use area combining tourism, fisheries, and settlement functions. The plan encourages tourism activities that strengthen local economic linkages through *desa wisata pesisir* (coastal tourism villages) and sustainable fisheries tourism (*wisata perikanan berkelanjutan*).

c. Panji Subdistrict

Panji, located near the Situbondo urban core, is designated as a cultural and nature-based tourism development area. The RTRW identifies Panji as an urban supporting subdistrict that connects natural attractions in the hinterland (such as forest and agricultural landscapes) with urban facilities and cultural heritage sites in Situbondo town. This integration of cultural, educational, and ecological tourism functions positions Panji as a potential model for sustainable urban rural tourism interaction. The proximity to administrative centers and educational institutions also provides an enabling environment for tourism innovation and capacity development.

d. Kendit Subdistrict

Kendit is identified as a strategic ecotourism area, forming a transition between coastal ecosystems and inland agricultural landscapes. The RTRW promotes Kendit's role in developing eco-agrotourism and forest-based tourism, especially within its upland and semi-arid regions. Its location along the Situbondo Banyuwangi corridor makes it a key node for regional tourist mobility, connecting several natural attractions, such as forest reserves, river valleys, and community-based farming systems. The area's potential aligns with the national tourism development concept, emphasizing environmental stewardship and local empowerment.

3.2 Mapping of Disaster-Prone Areas in Situbondo Regency

Situbondo Regency, located on the northern coast of East Java Province, exhibits a complex geomorphological and climatic profile that contributes to a diverse range of disaster risks. The regency's landscape is characterized by a combination of coastal plains, volcanic uplands, and dry low hills, creating multiple hazard environments that vary across subdistricts. According to data from the Indonesian National Disaster Management Agency (BNPB) and spatial information from the Geospatial Information Agency (BIG), Situbondo is categorized as a region with multi-hazard exposure, including both hydrometeorological and geological hazards.

From an ecological and geological standpoint, Situbondo is bounded by the Bali Strait in the north and by a series of volcanic and hilly formations extending toward the south. This topographic contrast results in distinct risk typologies: coastal subdistricts are primarily threatened by hydrometeorological hazards, while inland and upland areas face geological and forest-related hazards. The spatial distribution of these risks underscores the regency's vulnerability, particularly in areas where tourism development intersects with environmentally sensitive zones.

a. Hydrometeorological Hazards

Hydrometeorological hazards in Situbondo are closely related to rainfall variability, watershed conditions, and coastal dynamics. Based on the regional hazard maps, the flood-prone zones (*banjir dan banjir bandang*) are concentrated along river corridors and low-lying areas near the coast, particularly in Banyuglugur, Bungatan, and Panji subdistricts. These areas experience recurrent flooding during the monsoon season due to poor drainage, river sedimentation, and inadequate flood control infrastructure.

Additionally, the northern coastline extending from Banyuglugur to Kendit is classified as highly vulnerable to coastal abrasion and extreme waves (*gelombang ekstrem dan abrasi*). The combination of sea-level rise, coastal erosion, and unregulated shoreline development exacerbates the risks to settlements and tourism facilities situated along the coastal belt. This exposure is particularly critical

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for beach tourism areas where physical infrastructure and community livelihoods depend directly on coastal stability.

b. Geological and Geophysical Hazards

Inland Situbondo, especially in Kendit and Panji, faces hazards associated with geological processes such as landslides (longsor) and liquefaction (likuifaksi). These phenomena are linked to steep slopes, soil instability, and the region's proximity to volcanic formations. Historical data from BNPB indicate that landslides are common during intense rainfall events in the southern parts of Kendit and Panji, where the combination of topographic relief and land-use change (such as agricultural conversion and deforestation) increases slope vulnerability. Liquefaction potential is observed in coastal and alluvial zones with high groundwater tables and unconsolidated sediments conditions found in Bungatan, Banyuglugur, and Kendit. Although large-scale liquefaction events have not been frequently recorded, the geological susceptibility maps classify these areas as "high potential zones," which requires consideration in spatial and infrastructure planning, especially for tourism facilities.

c. Forest and Land Fire Hazards

Situbondo's southern and eastern territories, dominated by dryland forests and plantations, are highly prone to forest and land fires (*kebakaran hutan dan lahan*). Seasonal droughts, coupled with anthropogenic activities such as land clearing and hunting, contribute to the recurring fire incidents. Banyuglugur, Bungatan, and Kendit are identified as subdistricts with high fire risk levels. These hazards not only threaten biodiversity and forest ecosystems but also directly impact the aesthetic and environmental quality of tourism destinations located near forested areas or along eco-tourism routes. The degradation caused by recurrent fires diminishes landscape attractiveness and can disrupt tourism operations, particularly in ecotourism and agrotourism sectors.

d. Composite Hazard Zonation

Spatial integration of hazard data reveals that six major disaster types pose a significan risk to Situbondo's territory:

1. Flood (high level)
2. Flash flood (high level)
3. Liquefaction (high level)
4. Forest and land fire (high level)
5. Landslide (high level)
6. Extreme waves and abrasion (high level)

These six hazard categories occur with varying intensity and spatial coverage across the regency's subdistricts. Notably, Banyuglugur, Bungatan, Panji, and Kendit—which are also designated as tourism development zones—are simultaneously identified as multi-hazard areas. The coexistence of these risks highlights the urgent need for spatially explicit disaster mitigation strategies integrated into tourism planning.

3.3 Overlay of Tourism and Disaster-Prone Zones

The overlay analysis between tourism development zones (as designated in the *Rencana Tata Ruang Wilayah* or RTRW Situbondo 2025–2045) and disaster-prone areas (as identified through hazard maps from BNPB and BIG) provides a critical spatial insight into the intersection between tourism potential and environmental vulnerability. This integrative spatial assessment aims to identify which tourism subdistricts are exposed to specific disaster risks, the intensity of those risks, and the potential implications for sustainable tourism planning and policy formulation.

Using a Geographic Information System (GIS)-based overlay technique, tourism spatial zones were superimposed with multi-hazard maps encompassing six major disaster categories: flood, flash flood, liquefaction, forest and land fire, landslide, and extreme waves with coastal abrasion. The resulting overlay reveals that all four tourism-designated subdistricts, Banyuglugur, Bungatan, Panji,

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and Kendit, are located within or adjacent to multi-hazard zones, indicating a high degree of spatial convergence between tourism assets and disaster risks.

a. Spatial Pattern of Risk–Tourism Overlap

The overlay results show that Situbondo's tourism landscape is not uniformly distributed in terms of hazard exposure. Instead, distinct spatial patterns emerge based on physiography and proximity to the coastline:

1. **Coastal Tourism Zones (Banyuglugur and Bungatan)**
   These subdistricts form part of Situbondo's coastal tourism corridor, stretching along the northern Bali Strait. The overlay shows that both Banyuglugur and Bungatan fall within high-risk flood and coastal hazard zones. Specifically:
   - Banyuglugur exhibits overlapping exposure to floods, flash floods, liquefaction, coastal abrasion, and forest fires, indicating multi-hazard complexity.
   - Bungatan, while having similar hydrometeorological exposure, shows slightly lower inland hazard intensity but remains vulnerable to coastal abrasion and extreme wave activity.

The spatial proximity of tourism facilities (such as beaches, resorts, and fishing-based tourism villages) to these hazard zones suggests that even minor changes in coastal morphology or rainfall patterns could directly impact tourism infrastructure and safety. Furthermore, the expansion of tourism settlements without adequate drainage or coastal protection measures may exacerbate hazard impacts.

2. **Transitional Zone (Panji Subdistrict)**
   Panji serves as a transitional tourism area connecting coastal and urban centers with upland attractions. The overlay indicates that Panji is moderately affected by flooding and landslide risks, especially along river valleys and sloping areas where urban expansion and land use conversion are ongoing. Although the overall hazard level in Panji is relatively moderate compared to coastal zones, the spatial juxtaposition of tourism infrastructure and settlement areas within river catchments underscores the need for integrated water and land management. In the context of urban–rural tourism, Panji faces challenges related to hydrological instability, which can disrupt accessibility and visitor safety during heavy rainfall events.

3. **Upland Eco-Tourism Zone (Kendit Subdistrict)**
   Kendit, which functions as an eco-tourism and agrotourism development zone, displays a high composite hazard index in the overlay analysis. This subdistrict experiences exposure to liquefaction potential, landslides, forest and land fires, floods, and coastal abrasion in its lowland periphery. The overlay indicates that hazard distribution in Kendit is spatially heterogeneous upland areas prone to landslides and fires, while low-lying parts near the coast are affected by hydrometeorological hazards. The combination of geological and climatic risks makes Kendit particularly sensitive to land-use change and unsustainable tourism development. Without strong mitigation frameworks, the expansion of tourism in this area could trigger a feedback loop of environmental degradation and risk intensification.

b. Hazard Typology per Tourism Subdistrict

To further contextualize the spatial overlay findings, Table 1 summarizes the type and intensity of hazards in each of the four tourism subdistricts.

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Table.1 Disaster Vulnerability Mapping

Subdistrict	Identified Hazards (High Level)
Banyuglugur	Flood, flash flood, liquefaction, forest and land fire, landslide, extreme wave, and abrasion
Bungatan	Flood, flash flood, liquefaction, forest and land fire, landslide, extreme wave, and abrasion
Panji	Flood, flash flood, landslide, extreme wave, and abrasion
Kendit	Flood, flash flood, liquefaction, forest and land fire, landslide, extreme wave, and abrasion

This typological mapping reinforces that every tourism subdistrict in Situbondo is exposed to multiple hazards, albeit with varying spatial concentrations. Such overlap presents significant challenges for sustainable tourism governance, particularly in aligning development priorities with safety, resilience, and environmental protection objectives.

3.4 Policy Review: RPJMD and RTRW Analysis on Disaster Mitigation

The policy and regulatory framework guiding Situbondo's spatial and tourism development provides a foundational vision for economic diversification and environmental stewardship. However, the integration of disaster risk management (DRM) into tourism planning and implementation remains limited. A critical review of the *Rencana Tata Ruang Wilayah (RTRW) Kabupaten Situbondo 2025–2045* and the *Rencana Pembangunan Jangka Menengah Daerah (RPJMD) Kabupaten Situbondo 2021–2026* reveals a gap between strategic intentions for sustainable tourism and the operationalization of risk-sensitive development principles.

a. Policy Alignment and Gaps

The RTRW Situbondo (2025–2045) articulates the regency's spatial structure and development direction based on economic competitiveness, infrastructure connectivity, and environmental sustainability. Within this framework, tourism is positioned as one of the key economic sectors for regional growth, particularly along the northern coastal corridor and hinterland eco-tourism zones. However, despite strong emphasis on *eco-tourism* and *natural conservation*, the RTRW does not provide explicit spatial regulations or zoning standards based on disaster risk levels. The delineation of tourism areas, particularly Banyuglugur, Bungatan, Kendit, and Panji was established primarily based on tourism potential, accessibility, and land suitability, rather than integrated hazard exposure assessments.

Similarly, the RPJMD Situbondo (2021–2026) recognizes the importance of environmental protection and disaster mitigation within the general framework of regional resilience. It outlines programs for climate adaptation, disaster preparedness, and community empowerment. Nonetheless, these initiatives are treated as **sectorally separated** from tourism policy and spatial development. There is no clear linkage or cross-sectoral coordination mechanism between *Dinas Pariwisata* and *Badan Penanggulangan Bencana Daerah (BPBD)* in planning or managing tourism areas that are exposed to multiple hazards.

This policy disconnect reflects a broader structural issue in Indonesia's regional planning system, where disaster risk reduction (DRR) is often addressed as an emergency management function rather than a developmental and spatial planning concern. As a result, while the regency's strategic vision supports sustainable growth, it inadvertently leaves tourism areas vulnerable to environmental and disaster-related disruptions.

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b. Analysis of Policy Implications

The absence of explicit disaster-sensitive clauses in both RTRW and RPJMD has several implications for Situbondo's tourism sustainability:

1) Spatial Inconsistency – Tourism zones established without multi-hazard considerations may overlap with high-risk areas, leading to unsafe investment and potential loss of assets.
2) Institutional Fragmentation – The separation of mandates between tourism, environment, and disaster management agencies reduces coordination efficiency and delays preventive actions.
3) Inadequate Regulatory Instruments – There are limited local regulations (*Peraturan Daerah* or *Perbup*) that mandate disaster risk screening in tourism project approval processes.
4) Weak Data Utilization – Existing hazard maps and risk assessments by BNPB/BIG are not yet integrated into tourism masterplans or spatial information systems used by local planners.

The combination of these weaknesses results in **policy misalignment**, where tourism development progresses in hazard-prone environments without adequate mitigation strategies. This misalignment undermines the sustainability principles that Situbondo aims to promote through its RTRW vision.

c. Opportunities for Policy Integration

Despite these gaps, both the RTRW and RPJMD contain strategic entry points that can be strengthened to embed DRR principles into tourism governance:

1) Environmental Protection Zones (Kawasan Lindung) in the RTRW could be expanded to include *disaster buffer zones* around coastal, riverine, and slope areas prone to hazards.
2) Regional Infrastructure Development Programs in the RPJMD could prioritize resilient infrastructure (e.g., elevated structures, erosion control, firebreaks) in tourism destinations.
3) Community Empowerment and Local Economy Programs could incorporate *community-based disaster preparedness training* for tourism actors, aligning with the national *Desa Tangguh Bencana* framework.

These opportunities suggest that rather than creating new policies from scratch, Situbondo can achieve substantial progress through **cross-sectoral mainstreaming**—embedding risk awareness and mitigation mechanisms into existing development instruments.

d. Strategic Recommendations

To align Situbondo's tourism development with principles of sustainability and resilience, a set of integrated policy and planning recommendations are proposed, structured under four key pillars:

1) Institutional Integration and Governance

- Establish an Inter-Agency Task Force on Sustainable and Resilient Tourism (SATGAS Pariwisata Tangguh) involving *Dinas Pariwisata*, *BPBD*, *DLH*, and *Bappeda* to harmonize data, programs, and budgets.
- Revise the RTRW 2025–2045 to formally adopt multi-hazard maps as a planning reference, ensuring that tourism zones in high-risk areas are reclassified as *conditional development zones* requiring risk mitigation.
- Integrate Disaster Risk Reduction (DRR) into the next RPJMD (2027–2032) as a cross-cutting policy within tourism, infrastructure, and environmental development programs.

2) Spatial and Environmental Planning

- Incorporate hazard-based zoning into the Situbondo Tourism Master Plan (*Rencana Induk Pembangunan Kepariwisataan Daerah – RIPPARDA*), aligning spatial boundaries with flood, landslide, and abrasion risk maps.
- Develop buffer zones and *setback regulations* along coastal and river areas, particularly in Banyuglugur and Bungatan, to protect tourism infrastructure from erosion and extreme waves.

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- Implement ecosystem-based adaptation strategies—such as mangrove restoration, watershed rehabilitation, and slope vegetation reinforcement—as natural defenses supporting tourism resilience.

3) Capacity Building and Community Resilience

- Introduce a Tourism Disaster Education Program (TDEP) targeting local tourism operators, guides, and village leaders, focused on emergency response, risk communication, and visitor safety.
- Promote community-based tourism (CBT) models integrated with the *Desa Wisata Tangguh Bencana* approach, linking economic empowerment with local preparedness.
- Encourage partnerships between local government, academia, and NGOs to conduct participatory mapping, monitoring, and evaluation of tourism vulnerability.

4) Sustainable Infrastructure and Investment Policy

- Enforce risk screening mechanisms for all tourism investments, requiring Environmental and Disaster Impact Assessments (EDIA) prior to project approval.
- Incentivize private developers to adopt resilient design standards, such as elevated structures in flood-prone areas, fire-resistant materials in dryland zones, and green infrastructure that enhances natural drainage.
- Prioritize adaptive tourism infrastructure—such as modular facilities or floating platforms—that can withstand seasonal hazard variability.

Through the implementation of these strategic actions, Situbondo can transition from reactive disaster management to proactive risk governance, positioning itself as a model for resilient and sustainable coastal tourism in Indonesia.

4. CONCLUSION

This study investigated the spatial and policy intersection between sustainable tourism development and disaster risk management in Situbondo Regency, Indonesia. By combining spatial mapping, overlay analysis, and policy review, it sought to identify the extent to which existing tourism zones overlap with disaster-prone areas and to assess whether current regional planning instruments , particularly the *Rencana Tata Ruang Wilayah (RTRW) Kabupaten Situbondo 2025–2045* and the *Rencana Pembangunan Jangka Menengah Daerah (RPJMD) 2021–2026*, have adequately integrated disaster risk reduction (DRR) within the tourism development agenda. The spatial analysis revealed that four subdistricts, Banyuglugur, Bungatan, Kendit, and Panji, are officially designated as tourism development areas under the RTRW framework. These zones were determined based on their natural attractions, accessibility, and strategic location within the regency's economic corridor. However, overlaying the tourism zones with regional hazard maps indicates that all four areas are simultaneously exposed to multiple disaster risks, including high flood potential, flash floods, liquefaction, forest and land fires, landslides, and coastal hazards such as extreme waves and abrasion. This spatial overlap demonstrates a critical vulnerability that challenges the long-term sustainability of Situbondo's tourism economy and ecosystem integrity.

The policy review further revealed that while both the RTRW and RPJMD articulate strong commitments to sustainable development and environmental protection, explicit disaster mitigation measures specific to tourism zones are largely absent. Disaster management is addressed as a sectoral issue—managed by the *Badan Penanggulangan Bencana Daerah (BPBD)* rather than being integrated into spatial zoning or tourism investment guidelines. Consequently, tourism expansion continues to occur in high-risk landscapes without adequate resilience planning, leading to a policy-practice gap between sustainability objectives and spatial realities. From a theoretical perspective, these findings reinforce the need for a paradigm shift in sustainable tourism planning from a potential-based approach, which emphasizes attraction development, toward a risk-informed approach, which balances economic growth with hazard awareness and adaptive capacity. The integration of *disaster risk governance* within the tourism sector is essential for achieving the triple

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bottom line of sustainability, economic viability, socio-cultural inclusivity, and environmental resilience.

In practical terms, this study recommends several strategic actions. First, institutional integration should be strengthened through the establishment of a *Resilient Tourism Task Force* that connects tourism, environmental, and disaster management agencies. Second, hazard-based zoning and conditional development standards must be adopted in the next revision of the RTRW and RIPPARDA, ensuring that all tourism investments undergo disaster and environmental screening. Third, community-based resilience programs should be mainstreamed into local tourism management through education, participatory mapping, and the *Desa Wisata Tangguh Bencana* framework. Lastly, resilient infrastructure and ecosystem-based adaptation should become mandatory elements in all tourism development initiatives, aligning with global sustainability agendas such as the *Sendai Framework for Disaster Risk Reduction (2015–2030)* and the *UN Sustainable Development Goals (SDGs)*, particularly Goals 11 (Sustainable Cities and Communities), 13 (Climate Action), and 15 (Life on Land).

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