



## The Spatial Void: Indonesia's Political Ecology of Legal Contradictions Created the humanities incident of flash floods in Sumatra's 2025

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### ABSTRACT

This article examines the regulatory tensions between Law No. 23/2014 on Regional Government, which emphasizes the reconcentration of authority, and Law No. 6/2023 (the Job Creation Law), which mandates the centralization of licensing through a deregulatory framework. The study focuses on Sumatra, a region characterized by high ecological vulnerability and its role as a strategic hub for extractive expansion. Utilizing a juridical-normative methodology complemented by secondary spatial analysis, this study finds that ambiguities in environmental oversight authority have catalyzed a surge in deforestation and recurrent hydrometeorological disasters across the territory. The results demonstrate that deregulation, pursued under the guise of streamlining investment, has systematically dismantled the ecological protection functions previously vested in regional authorities. This "institutional displacement" has created a critical governance vacuum that prioritizes short-term economic output over the long-term bio-geophysical stability of the Sumatran landscape. Ultimately, the findings suggest that without a substantive synchronization of regulations that restores "ecological veto" power to local governments, the island remains at critical risk of systemic ecosystem collapse. Therefore, legal realignment is urgently required to harmonize economic ambitions with regional environmental sustainability and to prevent further ecological degradation in Indonesia's peripheral zones.

### 1. Introduction

Sumatra's current ecological crisis represents one of the most critical environmental challenges in the Global South. As a vital global carbon sink, the island's vast peatlands hold some of the most carbon-dense soil on Earth. However, when these fragile ecosystems are drained for industrial plantations, they undergo a catastrophic shift from carbon absorbers to massive greenhouse gas emitters. This environmental instability is fundamentally tied to a dramatic shift in Indonesian governance: the transition from the decentralized stewardship of Law No. 23/2014 to the centralized, pro-investment mandate of Law No. 6/2023 (the Omnibus Law). This legal evolution has created an "administrative-ecological collision," decoupling regulatory authority from geographical reality and systematically eroding Sumatra's environmental resilience.

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The modern re-centralization of licensing authority has created what scholars call a "big head, short arms" institutional structure. While the central government in Jakarta retains absolute legal power to issue permits, it completely lacks the ground-level infrastructure and personnel required to monitor Sumatra's massive corporate concessions. Environmental oversight has consequently dissolved into a purely administrative, document-based checklist. This dynamic exemplifies a destructive "simplification" of nature, where complex, living ecosystems are reduced to remote statistical data points on a bureaucrat's desk. Because central monitoring capabilities cannot keep pace with the rapid, automated issuance of permits through the Online Single Submission (OSS) system, the legal framework effectively rubber-stamps environmental degradation instead of preventing it (Sukarja, Siregar, & Lubis, 2022).

This regulatory shift operates as a form of "cloaked centralization." By removing power from regional technical units without replacing their operational capacity, the state has created a severe power vacuum. Historically, provincial governments acted as vital ecological buffers; local experts could vet projects based on unique topographical nuances, such as the exact depth of a vulnerable peat dome (Taylor & Francis, 2026). Replacing this localized oversight with a standardized, national digital permit creates deep information asymmetry. The physical and psychological distance between decision-makers in Jakarta and the protected landscapes of Sumatra creates systemic blind spots. Without active local involvement, real-time monitoring of delicate peat hydrology becomes impossible, allowing small-scale environmental violations to accumulate unnoticed until they erupt into large-scale catastrophes. The tangible consequences of this administrative detachment are vividly apparent in Sumatra's altered hydrology. When regional spatial planning (RTRW) is bypassed to meet national strategic quotas, the landscape loses its structural capacity to absorb rainfall. Strategic Environmental Assessments (KLHS), designed to predict flood vulnerabilities, are routinely compromised by accelerated licensing timelines (Syafitri, Nurman, & Mardatillah, 2025).

Recent catastrophes across the Bukit Barisan mountain range demonstrate that devastating floods and landslides are not merely natural weather events—they are direct governance outcomes. The true cost of this "efficient" one-stop investment system is staggering. Ambiguous zoning and centralized forest conversion have triggered trillions of rupiah in economic losses and widespread community displacement. True economic and administrative efficiency cannot exist in a vacuum; it must account for the immense ecological and financial costs of disaster relief generated when central authority is completely severed from local geography (Sahide et al., 2020).

This study identifies a direct correlation between the dilution of local spatial zoning and the increased severity of landslides across the Bukit Barisan range. In 2024 and 2025 alone, the intensification of landslides and floods in Sumatra resulted in trillions of rupiah in economic losses and significant casualties, highlighting a growing vulnerability linked to deteriorating forest cover. By providing empirical evidence from the Sumatran context, this research challenges the prevailing developmental narrative in three critical ways. Current policy often prioritizes a "one-stop" investment system aimed at streamlining bureaucracy. However, this study demonstrates that such a system is fundamentally inefficient if it results in billions of dollars in disaster relief and environmental loss. In regions like the Upper Serayu Watershed, the conversion of protected forests—driven by centralized licensing and ambiguous zoning—has led to material losses reaching

upwards of Rp 29 trillion (JSCSR, 2026). True efficiency must account for the Information Asymmetry that occurs when central authorities lack the ground-level data necessary to assess site-specific ecological risks (Graefrath, 2023).

## 2. Methodology

This study employs a normative-juridical research method to evaluate the shifting landscape of environmental governance in Indonesia, focusing on the "normative friction" caused by transitioning from a decentralized oversight model to a centralized, investment-oriented regime. To bridge the gap between legal theory (*das Sollen*) and physical field realities (*das Sein*), the research integrates two primary legal approaches with political ecology frameworks. First, a Statute Approach is utilized to dissect and compare the regulatory frameworks of Law No. 23/2014 on Local Government and Law No. 6/2023 (the Omnibus Law on Job Creation). This comparative analysis focuses on competency mapping and identifying normative conflicts where centralized mandates override regional supervisory powers, particularly regarding Environmental Impact Assessments (AMDAL) and the Online Single Submission Risk-Based Approach (OSS-RBA). Second, a Conceptual Approach applies Environmental Governance Theory and Political Ecology to evaluate how the decoupling of authority from local capability impacts the chain of accountability. It scrutinizes the "big head, short arms" phenomenon, where the central government holds absolute licensing power but lacks the ground-level monitoring infrastructure to protect complex ecosystems (Amania, 2020; Dinasti Research, 2023).

### 2.1 Research Scope, Locus, and Data Triangulation

The temporal scope spans 2020–2025, selecting Sumatra Island as the critical "ecological laboratory" due to its high concentration of plantation concessions and rising frequency of hydrometeorological disasters. To ensure validity, the study employs a data triangulation method via a scalar nexus approach, recognizing that environmental degradation is driven by multiscalar political relations. Data streams are categorized into three distinct analytical functions (Damayanti et al., 2023).

**Table 1** Triangulation Framework: Law vs. Ecology

Data Type	Source	Analytical Function
Legal/Normative	Laws & Govt. Regulations	Identifying shifts in licensing authority and oversight mechanisms.
Physical/Spatial	Global Forest Watch (GIS)	Quantifying the rate of land-use change post-centralization.
Impact/Outcome	BNPB Disaster Database	Correlating administrative shifts with the frequency of ecological disasters.

### 2.2 Qualitative Analysis Framework

The systematic analysis is conducted through a three-stage framework (AgEcon Search, 2025; Ekberg et al., 2023):

1. Comparative Legal Analysis: Pinpoints structural contradictions where "cloaked centralization" dilutes regional environmental oversight.
2. Longitudinal Synthesis: Correlates the chronological timeline of legal centralization with spatial and empirical datasets on forest loss. (Creswell, 2018)

3. Ecological Accountability Evaluation: Assesses how the state's preference for digital "legibility" via document-based OSS audits creates institutional blind spots.

Ultimately, this synthesis isolates how the administrative "supervision void" functions as a direct catalyst for ecological catastrophes, exploring how rendering complex peat hydrology into simplified data effectively legalizes degradation far from Jakarta's reach (Amania, 2020; Dinasti Research, 2023).

### **3. Results and Discussion**

#### *3.1 Regulatory Disharmony and Institutional Displacement*

The interface between legal texts and biophysical realities reveals a profound systemic fracture within contemporary Indonesian environmental governance. Rather than functioning as a cohesive mechanism for ecological stewardship, the current statutory framework operates as a driver of institutional fragmentation and territorial degradation. This dynamic is best understood by examining the paradigm shift from the deconcentration model of Law No. 23/2014 on Regional Government to the recentralized, market-oriented mechanism of Law No. 11/2020 (the Job Creation Law, subsequently codified via Law No. 6/2023). This transition illustrates how state-enforced legal uniformity systematically ignores regional environmental pluralism, local governance capacities, and site-specific biophysical imperatives.

#### *3.2 The Theoretical Framework: Legal Centralism vs. Ecological Realities*

The structural transformation of Indonesia's environmental licensing regime can be critically analyzed through the lens of Legal Centralism. According to Griffiths (1986), legal centralism presumes that the law is an exclusive, unified tool of the state, emanating from a singular center of authority and uniformly applied across all spaces. This paradigm deliberately obscures "legal pluralism"—the co-existence of distinct normative orders, customary (*adat*) institutions, and decentralized administrative layers—while actively ignoring the biophysical specificities of local ecosystems (Saputra & Dhianty, 2022).

When the state attempts to project an idealized, uniform regulatory framework over highly variable ecological terrains, it generates severe institutional friction. As Bedner (2020) notes in his analysis of Indonesian administrative law, the transition to a Risk-Based Approach (RBA) under the Job Creation Law represents a fundamental "paradigm shift" that prioritizes investment efficiency and bureaucratic standardization over localized environmental discretion (Sembiring, Fatimah, & Widyaningsih, 2020). By restructuring the state's administrative architecture, this framework strips regional authorities of their discretionary power and reduces complex, living landscapes into flat data points for distant processing. The systemic contradictions embedded in this statutory evolution are mapped comprehensively below:

**Table 2** Legal Mapping of Regulatory Dualism: Law No. 23/2014 vs. Law No. 6/2023

Objects of Authority	Law No. 23/2014 (Deconcentration)	Law No. 6/2023 / Job Creation Law (Recentralization)	Analysis of Contradictions & Ecological Impacts
Environmental Approval (AMDAL/EIA)	Article 14 & Appendix Letter K: Established a clear division of authority between central, provincial, and district/city governments based on project location and scale.	Article 22 (Revised 32/2009): Reassigns assessment authority to the Central Government for high-risk projects (PSN).	Erosion of Subsidiarity: Eliminates Law regional AMDAL commissions. This facilitates rapid forest conversion as field verification is conducted remotely, creating a dangerous "administrative distance" from the site.
Field Supervision	Article 91: The Governor, as the representative of the central government, holds the authority to supervise district-level environmental implementation.	Article 72 (Revised 32/2009): The Minister holds direct authority to intervene and supervise, often bypassing regional coordination mechanisms for sanctions or permitting.	Authority Vacuum: Creates confusion at the grassroots level. Law Regional governments lose the incentive to monitor operations because they no longer control the
Administrative Sanctions	Article 251: Local governments have the authority to revoke regional regulations or decisions that conflict with the public interest or environmental protection.	Articles 82A & 82B: Prioritizes financial fines administered centrally through the OSS system over criminal sanctions or the freezing of permits by local authorities.	Cost Externalities: Corporations in Sumatra may view these fines as a routine "cost of doing business," encouraging aggressive land expansion without the fear of permanent closure or permit revocation.
Spatial Planning & Concessions	Article 14, Paragraph (1): Government affairs in forestry and marine sectors are shared/divided between central and provincial authorities.	Article 17 (Revised 26/2007): The central government may establish spatial plans for national local environmental carrying capacity in favor of national Regional Spatial Plans (RTRW). quotas.	Land Use Conflicts: Accelerates Law deforestation, particularly in the Bukit Barisan corridor, by facilitating permits that bypass national local environmental carrying capacity in favor of national

### 3.3 The Deconcentration Era (Law No. 23/2014) and Subsidiarity

Under the legal architecture of Law No. 23/2014, Indonesian environmental governance recognized that spatial proximity is essential to effective ecological oversight. By operationalizing Article 14 and Appendix Letter K, the state instituted a tiered division of authority that distributed the *Analisis Mengenai Dampak Lingkungan* (AMDAL) process across central, provincial, and municipal lines. This framework was built on the principle of subsidiarity, ensuring that the environmental vetting of industrial designs was managed by administrative bodies closest to the impacted ecosystems (Fritzen, 2007).

During this era, Regional Environmental Commissions operated as institutional watchdogs. Because these commissions were embedded within the local socio-ecological matrix, they possessed the contextual granularity required to identify site-specific risks. These included localized water table drawdowns, habitats of endemic species, and the unique hydrological sensitivities of regional catchments. By mandating that local governments hold a veto over spatial allocations, the deconcentration era ensured that industrial expansion remained, to some degree, constrained by the empirical carrying capacity of the local environment (Thorburn & Kull, 2015).

### *3.4 The Recentralization Pivot (Law No. 6/2023) and the Administrative Distance*

The enactment of Law No. 6/2023 abruptly dismantled this decentralized architecture. By altering Article 22 of Law No. 32/2009 on Environmental Protection and Management, the Omnibus text pulled environmental approval powers back to the central ministries in Jakarta (Hadi, Hamdani, & Roziqin, 2023). This structural shift is most visible in "high-risk" corporate operations and National Strategic Projects (*Proyek Strategis Nasional / PSN*), which encompass large-scale logging, industrial oil palm plantations, and mining concessions across Sumatra.

This institutional pivot fundamentally erodes the principle of subsidiarity. By dissolving regional AMDAL commissions, the law concentrates environmental decision-making within the central bureaucracy. This represents what Peluso and Vandergeest (2001) describe as the territorialization of authority—a political process where the state asserts control over natural resources by drawing abstract administrative boundaries and governing them from a distant capital, independent of local ecological realities.

This structural shift creates an acute administrative distance (Bunnell & Miller, 2011). When the authority to grant or revoke environmental permits is moved hundreds of miles away from the physical site, the state replaces direct field verification with standardized digital data or remote sensing. While this approach optimizes administrative speed and improves the "ease of doing business" index, it lacks the spatial granularity required to evaluate complex landscapes.

Consequently, the legal safeguards intended to protect sensitive ecosystems become purely administrative constructs. This generates what may be termed the "Paper Park" Syndrome—a governance failure where environmental protection policies exist on official documents but fail to prevent real-world degradation. The elimination of local vetting mechanisms does not simply streamline bureaucracy; it creates an institutional blind spot where the complex dynamics of regional ecosystems are sacrificed for centralized administrative speed (Thorburn & Kull, 2015).

### *3.5 Bypassing Regional Supervisions and the "Authority Vacuum"*

The similar institutional breakdown occurs within field supervision. Under Law No. 23/2014, Article 91 designated the Governor as the central government's regional representative, creating an administrative bridge between national regulatory standards and local enforcement practices (Butt & Lindsey, 2018). However, the revised Article 72 of Law No. 32/2009 grants the Minister direct, unmediated authority over serious environmental violations, allowing central regulators to bypass provincial hierarchies entirely. As Purnomo et al. (2021) observe, this creates a disconnected bureaucracy. The central government retains formal legal authority but lacks the operational capacity and local oversight needed to monitor remote concessions. This disconnect produces what Bebbington et al. (2018) identify as institutional fragmentation. When local environmental agencies are stripped of their statutory power to issue stop-work orders or enforce compliance, they lose the political incentive to monitor industrial sites. In Sumatra, this regulatory retreat allows land-based industries to operate with minimal day-to-day oversight. Sahide et al. (2020) argue that this "cloaked centralization" induces a severe spatial mismatch: while formal permitting and enforcement powers are concentrated in Jakarta, the resulting ecological degradation is borne by remote ecosystems, safely insulated from the purview of central inspectors (Indrayana & Aminuddin, 2021).

This decoupling of regulatory authority from field enforcement is further exacerbated by the restructuring of legal penalties. Under the deconcentration era, Article 251 of Law No. 23/2014 granted local governments the power to invalidate regional concessions or corporate actions that compromised public welfare or environmental stability. The systematic removal of these local veto powers aligns with Hadiz's (2021) critique regarding the reorganization of power in post-Reformasi Indonesia, where state structures are calibrated to prioritize capital accumulation and investment facilitation over local environmental safeguards (Mochtar et al., 2024).

As argued by Santosa and Bedner (2021), the modern preference for administrative primacy—codified in Articles 82A and 82B of Law No. 6/2023—reflects a pro-investment legal framework that undercuts the deterrent capacity of environmental law. By replacing immediate permit suspension or criminal prosecution with centralized financial fines processed through the Online Single Submission (OSS) platform, the law alters the economic calculations of extractive industries. Corporations can internalize these centralized fines as routine operational expenditures. This represents an erosion of the "polluter pays principle" in favor of administrative convenience (Santosa et al., 2021).

Lubis et al. (2022) demonstrate that substituting local enforcement with centralized administrative fines creates a profound power vacuum. In resource-rich regions like Sumatra, this encourages aggressive corporate expansion. Because central authorities lack the field personnel required to verify empirical environmental damage, corporations can systematically underreport the scale of their landscape impacts. Furthermore, the revised Article 17, which allows national strategic spatial plans to unilaterally override Regional Spatial Plans (RTRW), exemplifies what Indrasti et al. (2021) term spatial injustice. By ignoring regional carrying capacities and ecological limits, the central state facilitates deep land-use conflicts. As Raharjo et al. (2020) observe, these conflicts directly correlate with an increased frequency of severe hydrometeorological disasters along the critical Bukit Barisan corridor (Zulfatah, Hidayati, & Hidayah, 2024).

The structural friction between the decentralization mandate of Law No. 23/2014 and the centralized design of the Job Creation Law has resulted in institutional displacement. This occurs when new regulatory structures undermine the operational capacity of existing local institutions without establishing an effective centralized replacement. By transitioning from proximity-based, field-level supervision to an automated, digital compliance regime via the OSS platform, the state has created an enforcement vacuum at the municipal level. To understand how this administrative distance operates on the ground, consider the testimony of a senior official within a Sumatran provincial environmental agency:

"We are often in a dilemma. Physically, the damaged forest is in our territory, and the community complains to us. But legally, our grip has been cut. Strategic permits now come from Jakarta through the OSS system, so when violations occur, we can only send recommendation letters to the central government without the power to directly freeze operational activities." — *Regional Government Informant, Provincial Environmental Agency (Sumatra, 2025)*

This testimony highlights the operational disconnect produced by recentralization. While local state actors bear the political and social pressures of environmental degradation, they lack the

statutory authority to intervene. This structural impairment transforms regional regulatory bodies into passive observers, capable of documenting ecological crises but legally disempowered from enforcing immediate compliance. This enforcement vacuum is further aggravated by the simplification of environmental permissions into generic "Environmental Approvals" (*Persetujuan Lingkungan*), alongside the replacement of conventional Building Permits (*Izin Mendirikan Bangunan / IMB*) with standard Building Approvals (*Persetujuan Bangunan Gedung / PBG*). In ecologically critical provinces such as Riau and Jambi, eliminating the mandatory veto power of Regional AMDAL Commissions has accelerated the conversion of protected forests into industrial concessions (Zulfatah et al., 2024).

Under the current framework, environmental impact assessments have shifted from rigorous, field-verified scientific evaluations into superficial exercises in bureaucratic compliance. This transition has drawn sharp criticism from civil society organizations monitoring environmental justice across Sumatra:

"The Job Creation Law is a red carpet for economic development. By limiting the right to sue communities only to those 'directly affected,' the state is systematically excluding public participation and environmental organizations from the courtroom. This is a form of internal colonialism where policies are decided in Jakarta for the sake of GDP, while indigenous communities in Sumatra are deprived of their living space without adequate legal protection." — *Executive Director, WALHI Regional Office (Sumatra, 2025)*

The legal restriction of standing (*persona standi in judicio*) to exclusively "directly affected" individuals represents a calculated retreat from environmental democracy. Under the previous framework of Law No. 23/2014, public interest litigators and environmental NGOs acted as legal proxies for vulnerable ecosystems, deploying technical expertise and financial resources to contest destructive concessions in regional courts. By legally excluding these organizations from the judicial process, the state leaves rural and indigenous communities to confront corporate legal teams alone. This structural exclusion forces marginalized populations to challenge centrally issued permits in distant Jakarta courts, a process that is often financially and logistically impossible (Sahide et al., 2020).

This dynamic illustrates the process of internal colonialism, where the central state treats peripheral islands like Sumatra as resource frontiers to drive national macroeconomic metrics, while forcing local populations to absorb 100% of the ecological and social costs (Guillaume et al., 2018). Political ecology demonstrates that this centralized model converts diverse landscapes into Sacrifice Zones—geographical areas where environmental regulations are selectively weakened to accelerate capital investment. When land-use policies are drafted in urban centers, they systematically overlook the complex topography, hydrological vulnerabilities, and river basin structures of regional landscapes, leading to severe downstream instability.

The structural shift from precautionary to remedial justice alters the foundational logic of environmental jurisprudence (Yofirsta, Danil, & Rembrandt, 2025). By prioritizing post-facto administrative fines over preventative, community-led litigation, the current framework weakens the precautionary principle. Instead of preventing landscape degradation through public consultation and local vetting, the law treats ecological damage as a negotiable transaction. For an indigenous

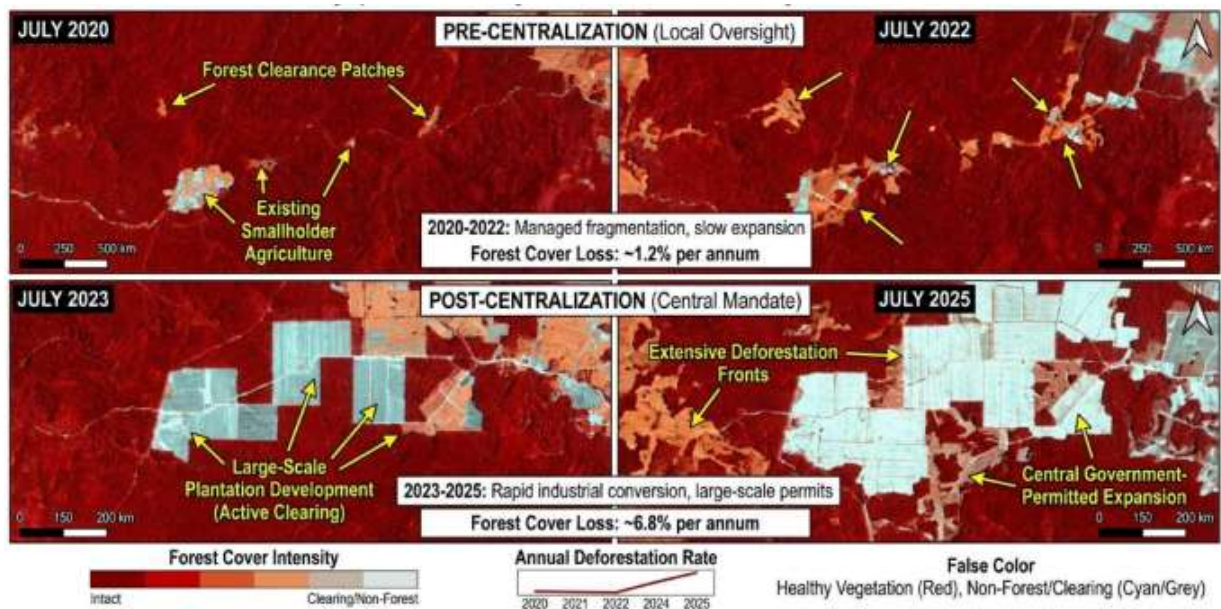
community, a financial penalty paid directly to the central treasury does nothing to restore a degraded watershed, stabilize a collapsing slope, or rebuild a flooded village. This structural gap in accountability functions as an institutional catalyst for ongoing environmental crises across Sumatra.

### 3.6 Spatial Manifestation of Regulatory Dualism: Satellite Evidence

To verify the real-world impacts of these legislative adjustments, this study couples legal text analysis with empirical spatial data. Sumatra exhibits a marked acceleration in forest cover loss that correlates directly with the rollout of the centralized, risk-based regulatory framework (Miettenen, J., et al., 2016). By overlaying newly issued central concessions against temporal forest inventory maps, this analysis reveals systematic industrial encroachment into critical ecological buffer zones, steep highlands, and protected peat catchments that were previously safeguarded under regional spatial plans (RTRW).

To evaluate these dynamics on the ground, this research examines the Batang Toru catchment and its surrounding forest frontiers in North Sumatra. This region features rugged topography, exceptional biodiversity, and intense pressure from extractive industries, making it a critical site for studying the spatial impacts of regulatory restructuring "(Faxon, Goldstein, Fisher, & Hunt, 2022)

Geografic Focus: Batang Toru Cetchment and Surrounding Forest Frontiers



Note : Geografic Focus: Batang Toru Cetchment and Surrounding Forest Frontiers

Fig 1: Comperative Sentinental-2 Satellite Analysis: Deforestation Dynamic Pre- and Post-Centralization (2020-2025)

The spatial transformation captured in regional geographic analysis reveals a clear division between governance eras. During the local autonomy phase, forest cover loss in this ecosystem was relatively low, averaging approximately 1.2% per annum. This loss was characterized by small-scale, fragmented clearances that aligned with community-managed agroforestry systems. Following the centralizing reforms, however, the annual rate of forest loss rose significantly to 6.8%. This shift is marked by a structural transition from small, scattered plots to large-scale, geometric clearings that

indicate industrial concessions authorized directly by central ministries (Amijaya, Zuada, Samad, & Hairi, 2022).

By late 2025, these clearing dynamics had coalesced into expansive deforestation fronts across the upper catchments. This rapid stripping of the forest canopy significantly reduced the region's overall water retention capacity. When extreme weather systems—such as the late-2025 cyclone—swept across northern and southern Sumatra, the compromised watersheds could no longer regulate the surge. This led to severe downstream flooding in major agricultural basins. The direct social consequences of this ecological breakdown are vividly detailed by rural communities coping with the resulting hazards:

"I am 70 years old, and I have never seen flooding this bad in my life. It has never been this high or this frequent before. We know the forest up there is constantly being cleared for large plantations. We have complained to the district government, but they say that is the central government's responsibility. We feel like we have no one to turn to while our rice fields are submerged and our homes are damaged every year." — *Affected Resident, Downstream Catchment Zone (Sumatra, 2025)*

This community perspective reinforces the core argument of this study: the centralized regulatory framework establishes an institutional distance that isolates decision-makers from the environmental consequences of their policies. By treating complex river basins as flat administrative spaces on a map, centralizing reforms accelerate canopy loss in critical upstream catchments. This compromises the landscape's natural drainage capacity and directly exposes downstream populations to recurrent, high-magnitude disasters (Yofirsta et al., 2025).

### *3.7 Political Ecology of the Sumatra Disaster in Late 2025*

The flash floods and landslides that struck the Bukit Barisan corridor in late 2025 were not isolated natural anomalies. Instead, they represent a systemic crisis produced by the interaction of extreme atmospheric events and a degraded physical landscape (Sands & Peel, 2018). While the disaster was triggered by historically high rainfall—with Indonesian Agency for Meteorology, Climatology, and Geophysics (BMKG) stations recording daily totals exceeding 300 mm in northern Sumatra—the severity of the impact was shaped by historical land-use modifications. This disaster was driven by a combination of atmospheric, topographical, and anthropogenic factors. The primary meteorological driver was Tropical Cyclone Senyar, which formed in the Malacca Strait in late November 2025 and directed moisture-laden air masses onto the steep slopes of the Bukit Barisan range. However, the rapid transition from heavy rainfall to violent, debris-laden flash floods was mediated by the condition of the highland ecosystems. Decades of forest conversion had compromised these natural buffers, causing the landscape to lose its capacity for hydrological regulation (Yofirsta et al., 2025).

**Table 3** Compounding Risk Factors

Factor Category	Specific Element	Impact on Disaster Scale
Meteorological	Tropical Cyclone Senyar	Provided the massive volumetric input of water (>300 mm/day).
Topographical	Upstream Degradation	Reduced the "time of concentration," leading to rapid, violent runoff.
Anthropogenic	Land-use Change	Stripped the soil of its absorptive capacity, turning rain into debris-laden flows.

To understand how these regulatory changes manifest as physical disasters, it is necessary to examine the biophysical mechanics of upstream catchments. As noted by Dr. Hatma Suryatmojo, a specialist in Forest Hydrology and Watershed Conservation at Gadjah Mada University (UGM), removing the forest cover triggers a systemic collapse of the natural water cycle.

In a healthy state, a tropical forest functions as a highly efficient hydrological regulator through four primary processes:

- **Interception:** The initial capture of precipitation by the multi-layered forest canopy, which prevents the direct impact of rainfall on the forest floor.
- **Infiltration:** The movement of water into the soil profile via root channels and organic matter, which replenishes regional aquifers and controls surface flows.
- **Evapotranspiration:** The continuous return of moisture to the atmosphere through plant transpiration, which helps regulate regional microclimates.
- **Surface Runoff Control:** The physical slowing of water movement across the land by leaf litter and root networks, which dramatically reduces soil erosion.

When these functions are compromised, the landscape loses its capacity to buffer intense precipitation. Empirical research across tropical catchments indicates that an intact forest canopy can intercept between 15% and 35% of total rainfall before it ever touches the ground. Without this vegetative sponge, the structural balance of the watershed breaks down, as detailed in the matrix below:

**Table 4** Structural Vulnerability Matrix

Hydrological Function	Status: Intact Forest	Status: Deforested/Degraded
Water Retention	High (Deep infiltration)	Low (Immediate runoff)
Sediment Load	Minimal (Root stabilization)	Extreme (Massive erosion/Debris)
Peak Flow Velocity	Attenuated (Slow release)	Accelerated (Flash flood trigger)
Precipitation Buffer	15%–35% Intercepted	0% Intercepted (Direct impact)

The fundamental biophysical impact of forest conversion along the Bukit Barisan corridor is the destruction of the infiltration-runoff balance. In an undisturbed ecosystem, up to 55% of precipitation flows into deep subsurface aquifers through root-aerated soils, while surface runoff is restricted to a manageable 10% to 20%. This distribution ensures a stable hydrologic cycle, preventing downstream flooding during the monsoon while maintaining baseflows during dry periods. When these highland forests are cleared for commercial concessions, the removal of the canopy and root systems causes the soil to compact and lose its porosity. As a result, infiltration drops to negligible levels, and 80% to 90% of the rainfall is instantly converted into high-velocity surface runoff. During extreme weather events like Tropical Cyclone Senyar, this structural degradation triggers a destructive chain reaction:

**Table 5** Summary of Hydrological Shift

Mechanism	Intact Forest	Degraded/Gundul Forest
Infiltration	High (~55%)	Negligible / Blocked
Surface Runoff	Low (10–20%)	Dominant / High Velocity
Primary Function	Groundwater Recharge	Downstream Discharge
Disaster Risk	Low (Regulated)	High (Flash Floods & Landslides)

This hydrologic shift demonstrates that the late-2025 catastrophes were not simply natural phenomena driven by extreme weather. Instead, they represent the physical manifestation of a collapse in the landscape's biological infrastructure.

By prioritizing rapid resource extraction over regional ecological constraints, the centralized regulatory framework treats dynamic, interconnected river basins as flat data fields on an administrative map. This creates the conditions for systemic environmental instability along the length of the island.

### *3.8 The "Digital Abstraction" Trap: The Failure of the OSS Risk-Based Approach*

The core failure of the modern regulatory regime lies in its conceptual reduction of the environment. Under the framework of Law No. 6/2023 and the automated Online Single Submission (OSS) platform, the state treats complex ecosystems as flat, two-dimensional administrative commodities. On a digital interface in Jakarta, an extraction concession appears as a simple polygon bounded by precise coordinates (Atkinson & Alibašić, 2023). This digital abstraction strips the landscape of its physical characteristics: its steep slopes, soil depths, underlying geology, and critical river connectivity are completely lost in the automated system. This digital approach produces a dangerous decoupling of regulatory classification from field reality. The OSS framework evaluates environmental risk through predetermined, standardized industry templates. It lacks the capacity to analyze how a specific commercial project might interact with the unique vulnerabilities of an individual river basin (Damayanti et al., 2023).

For example, a logging or mining project may be classified as "medium risk" within a standardized database " (Moore, 2015). However, if that project is located on an unstable slope upstream from a populated valley, its actual ecological risk is severe. By replacing localized scientific review with automated digital approvals, the state creates an institutional vulnerability that allows corporate projects to bypass meaningful oversight. Furthermore, this digital abstraction undermines local environmental democracy. Because the automated platform is designed to expedite industrial investment, it treats public consultation and regional opposition as bureaucratic obstacles rather than essential safeguards. Local communities and regional environmental monitors are excluded from the digital permitting loop, preventing them from contributing valuable field-level knowledge to the review process (Amimah et al., 2025).

The state's reliance on digital systems creates a profound governance gap: while the automated platform successfully reduces administrative timelines in the capital, it leaves downstream populations to bear the real-world consequences of unmonitored landscape degradation.

### **3.9 Synthesis: The Political Ecology of Centralized Deregulation**

The intersection of legal centralization, institutional displacement, and landscape degradation across Sumatra reveals that contemporary environmental crises are inherently political. The transition from the localized oversight of Law No. 23/2014 to the centralized, market-oriented architecture of Law No. 6/2023 demonstrates how statutory frameworks can be redesigned to prioritize industrial expansion over regional environmental stability. By consolidating permitting authority within central ministries and reducing environmental reviews to automated data processing, the state has systematically dismantled the regional checks and balances that previously constrained resource extraction.

This regulatory shift produces a clear pattern of spatial and environmental injustice. The economic benefits of accelerated resource extraction flow primarily to corporate offices and central treasuries, while the structural costs—including compromised water tables, eroded soils, and severe flooding—are borne entirely by local communities along the Bukit Barisan corridor.

The state's reliance on automated compliance platforms like the OSS creates an administrative distance that insulates central planners from the physical consequences of their decisions. This arrangement allows environmental degradation to continue unmonitored until it manifests as a major disaster.

Ultimately, the severe hydro-meteorological crises of late 2025 demonstrate that regional landscapes cannot be effectively managed through centralized administrative mandates. When statutory frameworks treat complex, interconnected river basins as simple commercial plots, they trigger a breakdown in the landscape's natural defenses. To prevent ongoing ecological instability, environmental governance must move beyond automated compliance models and return to models based on local subsidiarity, thorough field verification, and regional public participation. Without these fundamental changes, the administrative distance between central policy and regional ecology will continue to produce recurrent disasters across Sumatra's vulnerable landscapes.

## **4. Conclusion**

The ecological disasters witnessed in Sumatra at the close of 2025 are the direct manifestation of policy frameworks that deliberately marginalized the Precautionary Principle. The reveal is that the harmonization between Law No. 23/2014 on Regional Government and the Omnibus Law on Job Creation did not result in a substantive alignment of interests; instead, it established a rigid hierarchy that prioritized extractive industries over environmental safeguards. This structural contradiction has birthed a state of ecological legal uncertainty. While "deconcentrating" was theoretically intended to bolster regional oversight, in practice, it was neutralized by a centralistic deregulation drive. This shift has rendered local authorities impotent, transforming them into administrative spectators while the "administrative distance" from Jakarta facilitates rapid land-use conversion without site-specific accountability.

The architecture of a manufactured disaster of catastrophic hydrometeorological events in Sumatra is not merely an "act of God" but is the logical conclusion of a governance-environment mismatch. The empirical data reveals a systemic collapse of the island's hydrological integrity. The transition from a regulated system (55% infiltration) to a volatile runoff model is a direct consequence of stripping the upstream "biological infrastructure." This crisis is rooted in regulatory capture, where

the "administrative distance" between Jakarta and the Sumatran frontier has allowed industrial ambitions to bypass the precautionary principle. When the state functions as a facilitator for extraction rather than a regulator of ecological safety, the result is a landscape that has lost its threshold for resilience, turning standard seasonal rains into lethal debris flows.

#### Policy Recommendations: Restoring Ecological Autonomy

Restoration of the "Ecological Veto": Legislative synchronization must return discretionary power to regional governments, granting them a "veto right" over industrial projects that threaten the specific biogeographical characteristics of Sumatran watersheds. Decentralized oversight mechanisms and regulatory authority must be decoupled from the current centralistic model. Oversight should be re-localized to ensure that monitoring is conducted by agencies with immediate proximity to the affected ecosystems. This approach would empower local communities to safeguard their natural resources while fostering a more sustainable relationship between development and environmental preservation. By prioritising ecological integrity, we can mitigate the risks posed by climate change and enhance the resilience of vulnerable regions. Proximity to the physical ground truths of the frontier. Substantive harmonization of land-use law: the conflict between Law No. 23/2014 and the Omnibus Law must be resolved by enshrining the inviolability of catchment areas. Legal frameworks should prioritize the maintenance of the island's hydrological integrity (e.g., the 55% infiltration baseline) as a non-negotiable prerequisite for any economic activity. Implementation of biogeographic zoning policy must shift from generic national standards to site-specific governance. This involves tailoring industrial permits to the unique soil porosity, slope stability, and peatland dynamics of Sumatra rather than applying a "one-size-fits-all" regulatory lens from the capital.

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