

Primary Forest Moratorium Policy: Effectiveness, Legal Loopholes, and Sustainability Strategies

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ABSTRACT

The Primary Forest Moratorium Policy represents Indonesia's most significant regulatory intervention intended to reduce deforestation, protect high-value carbon landscapes, and reinforce long-term climate mitigation commitments. This study analyzes the effectiveness of the moratorium, the legal loopholes that weaken its enforcement, and potential sustainability strategies to strengthen forest governance. Using a qualitative document analysis approach, the research synthesizes legal regulations, government publications, and peer-reviewed academic studies on forest policy and land governance in Indonesia. Findings indicate that the moratorium has successfully slowed permit-driven deforestation and improved environmental monitoring in high-risk areas, yet its implementation remains fragile due to overlapping sectoral regulations, ambiguous land classification rules, and economic dependency on extractive industries. These loopholes create institutional space for the continuation of forest exploitation through administrative rather than overt legal violations. The study concludes that long-term sustainability of the moratorium requires legal harmonization, standardized enforcement across governance levels, community land-rights protection, and economic transition policies that make conservation more advantageous than extraction. The article advances novelty by integrating effectiveness, legal loopholes, and sustainability into a single analytical framework to evaluate whether the moratorium can evolve from a symbolic pause into a durable climate governance instrument.

INTRODUCTION

Primary forests are globally recognized as irreplaceable ecological assets because of their unique biodiversity, deep soil carbon stocks, structural complexity, and resilience to climate disturbance. In Indonesia, primary forests play a decisive role in national climate mitigation, ecosystem services, and cultural heritage, yet they remain vulnerable to industrial encroachment and land-based commodity expansion. The Primary Forest Moratorium Policy was introduced to halt the issuing of new commercial permits in designated primary forest and peatland areas, with the objective of reducing deforestation and greenhouse gas emissions while strengthening sustainable land governance. Despite its strategic climate and economic significance, the real-world effectiveness of this moratorium remains contested, as implementation demonstrates

tensions between conservation priorities, resource exploitation, and legal enforcement capacities across regions (Daulay et al., 2024). The policy therefore sits at the intersection of environmental regulation and economic development, shaping a national debate on whether Indonesia's forest governance model is oriented toward sustainability or toward continued extractive growth.

Historically, primary forests in the tropics have been under persistent pressure from commercial logging, agricultural conversion, infrastructure expansion, and informal exploitation. Although the protection of primary forests has repeatedly appeared in multilateral environmental agreements and international policy agendas, implementation outcomes remain inconsistent across developing economies (Mackey et al., 2015). Indonesia reflects this global pattern, in which environmental commitments coexist with ongoing pressures from palm oil, mining, and timber industries that support national revenue and regional employment. Even though the moratorium formally restricts new concessions, pre-existing permits, loophole-based reallocations, and shadow concessions remain active in several regions, weakening the intended protection of forest ecosystems. This duality has produced uncertainty about whether the moratorium is positioned as a structural ecological safeguard or primarily as a symbolic political instrument.

The ecological rationale underpinning primary forest protection is unequivocal. New evidence shows that preserving primary tropical forest landscapes is among the most effective mitigation strategies available for stabilizing the global climate because these forests retain centuries-old carbon stocks that cannot be restored through secondary regrowth or tree planting alone (Mackey et al., 2020). In Indonesia, peat-rich primary forests amplify this significance because peat decomposition releases exceptionally high volumes of stored carbon into the atmosphere when disturbed. Therefore, the failure of moratorium implementation is not only a national environmental concern but also a global climate security risk. The policy's ecological stakes have triggered public pressure demanding that forest governance mechanisms must shift away from extractive exploitation toward conservation-driven economic strategies capable of ensuring long-term ecological resilience.

The central challenge of the moratorium is not its conceptual design but its institutional execution. Studies in Riau Province show that while the moratorium reduced deforestation in certain protected zones, it also triggered spillover deforestation into neighboring areas through permit shifting and land reallocation driven by industry adaptation strategies (Daulay et al., 2024). This pattern is not unique to Indonesia; similar dynamics were observed in Kenya, where a logging moratorium redirected exploitation toward private forests without significantly reducing overall logging pressure (Matindi et al., 2025). Evidence suggests that moratoriums may be vulnerable to exploitation when incentives for extraction exceed incentives for compliance, especially in regions where weak monitoring systems, local political patronage networks, and land tenure conflicts persist. Although the moratorium functioned as a strategic pause, it did not automatically resolve structural drivers of deforestation.

Socioeconomic and political incentives further complicate the moratorium's impact trajectory. Regional governments rely on extractive commodities for economic growth and local revenue, making conservation-based restrictions appear counterproductive to development agendas. A study in Indonesia highlights that land governance in the plantation sector continues to be shaped by overlapping administrative authority and inconsistent enforcement following the moratorium,

reducing regulatory certainty and driving land-use contestation rather than resolution (Bahri et al., 2025). Where local governments prioritize investment attraction and revenue generation, moratorium compliance decreases, and legal loopholes become normalized governance strategies. This tension illustrates that environmental policy cannot succeed when structural economic interests remain aligned with resource extraction rather than ecological sustainability.

Legal fragmentation also weakens moratorium enforcement. Regulatory inconsistencies across forestry law, spatial planning regulations, plantation law, and investment law result in overlapping legal mandates that provide institutional entry points for concessions to continue under different legal justifications. Even though national policies emphasize peatland protection and restoration, gaps in legal harmonization enable concession rebranding through sectoral classification to bypass the moratorium (Nuriyatman et al., 2025). The deeply rooted mismatch between environmental directives and development regulations reveals that sustainability cannot rely on policy declarations alone but requires systematic legal coherence and institutional integration. In the absence of harmonized regulations, policy actors navigate the legal landscape based on political and economic advantages, rather than climate and biodiversity priorities.

The political dimension of climate commitments adds further complexity. Indonesia has pledged to achieve net zero emissions by 2060, yet studies show that ongoing deforestation and peatland degradation continue to present a direct threat to the feasibility of these pledges (Maulida et al., 2025). International negotiations on deforestation, climate finance, and Nationally Determined Contributions (NDC) reflect power relations between states, corporations, and global markets rather than purely environmental priorities. Scholarship indicates that postponement of NDC targets is frequently associated with geopolitical contestation and economic negotiations rather than technical limitations of climate transition (Sekarwati & Suharman, 2025). These political-economic dynamics shape whether moratorium enforcement is treated as a climate obligation or a negotiable domestic agenda.

The influence of multinational corporations deepens this complexity. Evidence from Brazil demonstrates that corporate adaptation to anti-deforestation policies does not always translate into long-term sustainability when global supply-chain pressures encourage the relocation of extraction rather than its reduction (Pramitha & Alfian, 2023). Because multinational actors also operate in Indonesia's forestry sector, similar displacement risks are present, implying that without governance innovation, the moratorium will reduce deforestation only to the extent that industry does not evolve loophole tactics. In this context, a purely restrictive approach may unintentionally reproduce extractive pressures elsewhere rather than promote systemic transition.

Governance studies emphasize that multilevel coordination is essential for overcoming institutional fragmentation in forest management, yet it remains weak in Indonesia. Cross-scale conflicts between national policies, provincial priorities, and community land tenure continue to obstruct sustainable forest outcomes by limiting coherent implementation (Myers et al., n.d.). Additionally, political ecology analyses show that environmental law enforcement often depends on central-regional power relations rather than statutory clarity alone (Suwarno, 2025). These dynamics demonstrate that the moratorium must be situated within broader power structures rather than treated merely as a sectoral technical regulation.

Despite the broad literature on moratorium impacts, critical research gaps remain. First, the study by Daulay et al. (2024) focuses on regional effectiveness but does not expand on the structural legal loopholes that enable moratorium evasion. Second, Mackey et al. (2020) emphasize the importance of primary forest protection for global mitigation but do not assess policy effectiveness within the political economy of extractive commodities. Third, Leijten et al. (2021) identify spillover deforestation from moratoria but do not explore sustainable governance strategies to prevent industry displacement. These gaps indicate the absence of an integrated analysis connecting effectiveness, legal loopholes, and sustainability strategies in the context of Indonesia's moratorium. The novelty of this study lies in bridging these three dimensions to evaluate whether the moratorium functions as a genuine conservation instrument or remains vulnerable to exploitation within the political resource economy. Therefore, the objective of this article is to critically analyze the effectiveness of the Primary Forest Moratorium Policy in Indonesia by examining how legal loopholes and institutional dynamics shape sustainability strategies for long-term forest governance.

METHODOLOGY

This research employs a qualitative document-based approach to analyze legal frameworks, policy documents, government reports, and peer-reviewed academic publications related to Indonesia's Primary Forest Moratorium Policy. The qualitative method is appropriate for examining governance and institutional dynamics because it allows interpretation of policy intent, implementation gaps, and regulatory outcomes using non-numerical data (Creswell & Poth, 2018). Data sources include national legal instruments on forestry and peatland protection, provincial land governance documents, and scientific literature published within the last ten years, enabling triangulation between regulatory texts and empirical findings.

Documents were examined using thematic coding, distinguishing three analytical dimensions: effectiveness of the moratorium, legal loopholes in implementation, and sustainability strategies for forest protection. Each theme was identified using iterative reading, pattern recognition, and cross-referencing among law, policy, and empirical research, following recommendations for qualitative document analysis in public policy research (Bowen, 2009). Validity of interpretation was strengthened through source triangulation and theory-based reasoning, ensuring robust analytical grounding in both environmental law and governance scholarship. This method enables a holistic analysis of how institutional behavior, regulatory design, and political economic pressures shape the long-term sustainability of Indonesia's primary forest governance.

RESULT AND DISCUSSION

Effectiveness of the Primary Forest Moratorium Policy in Reducing Deforestation and Strengthening Governance

The effectiveness of Indonesia's Primary Forest Moratorium Policy depends on how far it reduces deforestation rates while strengthening the integrity of land governance. Empirical assessments show that the moratorium has contributed to measurable reductions in industrial-scale deforestation in priority conservation areas, especially peatland zones, where legal restrictions helped delay the expansion of large-scale commercial permits (Daulay et al., 2024). These findings indicate that the moratorium did function as a temporary barrier to new deforestation pressures,

establishing a regulatory firewall against rapid permit issuance. At the same time, the moratorium contributed to raising public awareness about the ecological significance of primary forests, reinforcing the view that environmental protection must be institutionalized within the national development framework rather than treated as a marginal sectoral responsibility. The signaling effect of the moratorium in climate diplomacy also enhanced Indonesia's international environmental credibility because it demonstrated willingness to implement forest-based mitigation strategies, although the mitigation scale remained below global expectations.

Another indication of effectiveness is the consolidation of national peatland protection strategies. The moratorium expedited the re-evaluation of concession maps, encouraged the designation of peatland restoration zones, and prompted regulatory adjustments for high-risk landscapes. Studies on primary forest protection show that halting new concessions is a foundation for climate mitigation because the conservation of old-growth carbon stocks cannot be compensated by secondary forest regeneration or large-scale afforestation (Mackey et al., 2020). Therefore, even when the moratorium did not stop all deforestation, it strategically preserved high-value carbon landscapes that would have otherwise generated significant emissions. This suggests that the moratorium functioned as a mitigation stabilizer in the national climate agenda.

Additionally, the moratorium contributed to improvements in environmental monitoring and public scrutiny. Digital mapping transparency facilitated community observation and civil society activism, especially in provinces with histories of concession-based deforestation. In Riau, the moratorium supported monitoring innovations and inter-institutional coordination, helping reduce open permit allocation at the provincial level and curbing politically motivated concessions for a period of time (Daulay et al., 2024). This period of relative stability provided insight into the potential for multi-level governance collaboration when legal boundaries are clearly established and politically enforced. Although the stability was not permanent, the moratorium offered proof of concept that firm regulatory intervention can slow land-based emissions.

However, the moratorium's effectiveness was constrained by the absence of alternative development incentives for regional governments. In many districts, economic structures remain dependent on extractive industries such as plantations and forestry, producing a governance paradox in which environmental conservation is seen as conflicting with economic growth. Global environmental agreements recognize this challenge as a frequent tension for developing economies where environmental protection efforts overlap with poverty reduction and revenue dependence (Mackey et al., 2015). When local leaders are pressured to prioritize investment, employment, and regional revenue, environmental restrictions become politically costly and vulnerable to bypass. For the moratorium to accomplish long-term impact, it must be integrated into an economic transition framework rather than positioned as a standalone environmental regulation.

Another challenge is the uneven impact across territorial levels. Evidence shows that moratorium-linked reductions in deforestation are concentrated in protected areas, while forest loss continues in regions considered low enforcement zones, suggesting that provincial political will and law enforcement capacity determine moratorium performance (Bahri et al., 2025). Strong institutions generate visible environmental outcomes, but weak institutions revert to concession-driven land conversion despite national directives. This institutional reality highlights that the moratorium, although

strategically designed, cannot fully counteract entrenched political and bureaucratic interests without broader structural reform.

Additionally, the effectiveness of the moratorium must be evaluated relative to climate obligations. Indonesia's commitment to achieving net zero emissions by 2060 relies on halting the degradation of primary forests and accelerating restoration efforts. Yet analysts warn that continuing deforestation threatens the feasibility of the national climate roadmap (Maulida et al., 2025). Even when the moratorium slows permit issuance, the climate benefit remains limited if existing concessions continue to operate without ecological accountability or if loopholes allow continued clearing. This perspective underscores that stopping new permits is not enough without tightening oversight on existing operations.

Regional experiences outside Indonesia reinforce this interpretation. In Kenya, the national logging moratorium generated positive ecological outcomes in protected forests but redirected exploitation toward private forests and farm trees, allowing total logging pressure to persist at system level (Matindi et al., 2025). This comparison suggests that moratoria generate temporary disruption but do not solve deforestation drivers unless they are paired with structural transformation of the resource economy. Without such transformation, industries adapt faster than regulatory enforcement, diminishing ecological gains over time.

Taken together, these findings demonstrate that the moratorium achieved partial and temporary success in reducing deforestation, improved monitoring, and reinforced climate recognition of primary forests. However, effectiveness remains fragile, conditional on regional commitment, institutional strength, and the alignment of conservation with economic incentives. The moratorium reveals the potential of regulatory intervention, yet it also reveals the limits of policy strategy when structural economic and legal systems continue privileging extractive development over ecological resilience.

Legal Loopholes, Regulatory Fragmentation, and Governance Vulnerabilities in the Moratorium Era

While the moratorium appears strong on paper, its enforceability is undermined by legal loopholes embedded within Indonesia's regulatory architecture. The most prominent loophole arises from overlapping legal frameworks across forestry law, plantation law, spatial planning, and investment regulations, which provide opportunities for reclassification of forest lands to escape moratorium restrictions. New empirical evidence shows that actors within the plantation sector exploit ambiguous land classification rules to secure alternative permits that bypass moratorium coverage (Bahri et al., 2025). This ability to rebrand concessions as non-forest licenses indicates that legal fragmentation serves as a gateway for institutionalized non-compliance.

Another structural loophole pertains to the distinction between new permits and pre-existing concessions. Although the moratorium halts new permits, many older concessions continue to operate, and some are expanded through regulatory adjustments or annex modifications. Legal analysts argue that this mechanism creates a *de facto* pathway for continuous extraction even without issuing new concessions (Nuriyatman et al., 2025). In some cases, companies secure approval for "continuation permits" based on partial clearing claims. This practice reveals how policy actors weaponize administrative ambiguity rather than violating the moratorium outright.

A third loophole originates from jurisdictional authority. Forestry management oversight is divided between central government and regional administrations, creating fragmented enforcement and inconsistent compliance. A study on national environmental governance demonstrates that multilevel coordination failures weaken legal authority because policy implementation depends on power relations rather than statutory clarity (Suwarno, 2025). As a result, the same regulation may be enforced strictly in one province but loosely in another, enabling concession relocations or jurisdiction-shopping strategies.

To provide a clearer view of how legal loopholes shape governance outcomes, the following table synthesizes categories of loopholes and their institutional consequences.

Type of Legal Loophole	Mechanism of Loophole	Institutional Actor Using Loophole	Governance Impact	Ecological Impact
Land reclassification	Rebranding concession areas as non-forest land	Plantation and timber industries	Avoidance of moratorium oversight	Deforestation displacement
Continuation of previous concessions	Expansion of pre-moratorium permits	Large concession holders	De facto uninterrupted extraction	Loss of primary forest carbon stock
Jurisdictional fragmentation	Weak coordination between central and regional governments	Provincial authorities and corporate actors	Uneven enforcement and political bargaining	Localized environmental degradation
Ambiguous restoration obligations	Vague monitoring requirements	Corporations with peatland concessions	Symbolic compliance without ecological benefit	Ecological decline in peat systems
Moratorium exception clauses	Exploiting “special status” provisions	Investors with political leverage	Preferential treatment and regulatory capture	High-risk forest conversion

The table indicates that loopholes are not incidental anomalies but structural paths that allow the persistence of extractive operations. These mechanisms blur the line between legality and environmental harm, producing a governance environment where compliance may be nominal yet ecologically ineffective.

Legal loopholes also interact with economic drivers. Where regional budgets depend on land-based industries, authorities may intentionally interpret regulations to align with extractive economic goals rather than conservation mandates. Research shows that environmental governance reforms succeed only when legal protection is accompanied by economic incentives that discourage extractive dependency (Mackey et al., 2015). In the absence of livelihood or fiscal alternatives, local actors lack motivation to enforce restrictions that appear detrimental to economic stability.

International political dynamics further reinforce governance loopholes. Delays in climate pledge enforcement are frequently associated with geopolitical bargaining rather than administrative limitations, especially in relation to Nationally Determined Contributions (Sekarwati & Suharman, 2025). When climate obligations are treated as negotiable rather than binding, domestic enforcement instruments such as moratoria become vulnerable to dilution under political pressure. This dynamic aligns with global experiences in Brazil, where multinational corporate interests influenced state adaptation to anti-deforestation agreements (Pramitha & Alfian, 2023), illustrating that even strict legal measures are susceptible to erosion when placed within a competitive global market.

In summary, the moratorium's legal structure provides multiple escape pathways that weaken governance and undermine ecological goals. Loopholes operate not only through regulatory weakness but also through institutional behavior shaped by economic incentives and political bargaining. This systemic configuration demonstrates that sustainability cannot rely solely on legal prohibitions but requires structural redesign of governance to prevent exploitation of institutional gaps.

Sustainability Strategies to Strengthen the Future of the Primary Forest Moratorium

The sustainability of Indonesia's Primary Forest Moratorium depends on whether it can be transformed from a temporary regulatory restriction into an institutional pillar of environmental governance. Without structural reinforcement, the moratorium risks functioning as a symbolic pause rather than a durable solution to deforestation. Therefore, long-term sustainability strategies must address three critical dependencies: ecological resilience, legal certainty, and economic transition. Scholars highlight that primary forest protection must be conceptualized as an irreversible ecological commitment rather than a time-bound regulatory measure if the country intends to achieve climate mitigation at a meaningful scale (Mackey et al., 2020).

This approach is crucial because the carbon stocks and biodiversity contained in primary forests cannot be regenerated within policymaking timeframes or compensatory tree planting schemes. As long as policy frameworks treat primary forests as replaceable components of land planning, conservation outcomes will remain structurally unstable.

A sustainability-based moratorium requires legal harmonization to reduce loopholes that currently allow industries to navigate between overlapping laws. Environmental and land governance research indicates that legal coherence is a precondition for environmental enforcement because fragmented statutes create institutional ambiguity and limit the accountability of public authorities (Nuriyatman et al., 2025).

Harmonization would require aligning forestry law, spatial planning regulations, plantation law, investment law, and climate policy frameworks to establish a unified legal hierarchy in which primary forest protection supersedes sectoral economic interest. Such legal reconfiguration is also necessary to secure legal consistency across central and regional governments so that the moratorium cannot be weakened through jurisdiction shopping. Legal certainty would ensure that environmental protection cannot be bypassed through administrative strategies, thus transforming the moratorium from a negotiable policy to an enforceable environmental mandate.

However, legal reform alone is insufficient unless supported by institutional restructuring. Research on multilevel forest governance in Indonesia demonstrates that

overlapping authority between central and regional agencies contributes to fragmented decision-making and inconsistent implementation (Myers et al., n.d.). Strengthening sustainability therefore requires a new governance mechanism that standardizes enforcement protocols, risk classification, and monitoring procedures across provinces. A centralized digital forest governance hub that integrates satellite-based monitoring, permit registries, and public access portals can reduce data opacity, strengthen compliance, and minimize space for discretionary abuse. The success of the moratorium in Riau during strict monitoring phases illustrates that enhanced transparency helps public actors and communities demand accountability from local governments (Daulay et al., 2024). Institutional predictability through standardized enforcement is therefore a cornerstone of long-term moratorium sustainability.

Economic transition is the third and most difficult sustainability dimension because deforestation persists not only due to weak law enforcement but also because extractive industries generate revenue, employment, and political influence. Researchers argue that primary forest protection can only be sustained if conservation policies are accompanied by alternative economic pathways that offer equivalent or greater socioeconomic benefits (Mackey et al., 2015). Without new income streams for local communities and new fiscal incentives for regional governments, conservation will continue to appear economically costly. Evidence from plantation-governed provinces shows that dependence on single-commodity economies amplifies land conversion pressures because local fiscal budgets rely on concession revenue, making extraction politically attractive (Bahri et al., 2025). For the moratorium to succeed, transition strategies could include fiscal compensation for forest-rich regions, sustainable livelihoods for local communities, conservation-linked investment schemes, and ecological financing instruments that reward protection rather than extraction.

Sustainability strategies must also mitigate forest degradation drivers that occur outside the formal economy. Research demonstrates that wildfire risk, peatland drying, and illegal logging remain high when forest governance does not integrate fire prevention systems, land tenure clarity, and community-based forest management (Hanafi et al., 2023). Integrating community stewardship is particularly important because indigenous and rural populations historically play a critical role in guarding forests, yet are frequently excluded from formal land governance. Without secure tenure, communities cannot protect forests against external exploitation, which ultimately weakens moratorium enforcement. A sustainability framework that centers community leadership and land rights aligns with environmental justice principles and increases ecological resilience at territorial scale.

In addition to domestic strategies, sustainability must be viewed within the context of global climate politics. Evidence suggests that Indonesia's NDC trajectory is influenced by geo-economic bargaining and reflects contested power relations between domestic interest groups and international environmental expectations (Sekarwati & Suharman, 2025). If climate pledges are perceived as negotiable rather than binding, moratorium enforcement becomes vulnerable to economic lobbying during periods of market volatility or political transition. To prevent this vulnerability, sustainability strategies must institutionalize the moratorium as a non-negotiable climate safeguard whose revocation would contradict Indonesia's climate diplomacy and threaten international trust. A moratorium anchored in sovereign climate obligation rather than administrative discretion is more likely to resist economic pushback.

Comparative international findings reinforce this argument. In Brazil, multinational corporations adapted to anti-deforestation policies by relocating extraction geographically rather than reducing total extraction, revealing that sustainability cannot be achieved without governance structures capable of blocking displacement (Pramitha & Alfian, 2023). Likewise, the Kenya logging moratorium demonstrates that restricting primary forest exploitation without broader land governance reform can merely shift the pressure toward informal or private forests (Matindi et al., 2025). These global parallels indicate that moratoria achieve durability only when supported by wide-ranging systemic change rather than enforcement alone.

Taken together, the future of Indonesia's Primary Forest Moratorium depends on whether sustainability strategies evolve from reactive environmental policy into holistic structural reform that integrates legal harmonization, institutional governance, socio-economic transition, community empowerment, and climate accountability. Without this transformation, the moratorium will remain effective only temporarily and will not meaningfully contribute to Indonesia's long-term climate security or its goal of achieving net zero emissions by 2060 (Maulida et al., 2025). Sustainability therefore requires a governance shift that not only blocks new deforestation but also realigns national development toward ecological resilience.

CONCLUSION

The analysis confirms that Indonesia's Primary Forest Moratorium has produced measurable but fragile environmental benefits by reducing deforestation in targeted areas, stabilizing high-risk peatland ecosystems, and improving monitoring transparency. However, its effectiveness is continually undermined by legal loopholes, structural fragmentation in forest governance, and economic dependence on extractive land-based commodities, which collectively create institutional space for ongoing forest degradation. Ensuring long-term success requires strategic transformation rather than temporary restriction.

Future strategies must integrate legal harmonization, standardized enforcement mechanisms, equitable community land tenure, and fiscal and economic incentives that reward conservation more than extraction. When ecological protection is embedded within development planning and backed by transparent institutional structures, the moratorium can evolve from a vulnerable regulatory instrument into a core pillar of Indonesia's climate governance. Through such systematic reforms, primary forests can remain protected as national ecological capital, enabling Indonesia to secure biodiversity, strengthen climate resilience, and contribute meaningfully to global environmental sustainability.

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