

Analysis of The Effectiveness of The Folu Net Sink 2030 Program on National Emission Targets

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INFO ARTICLE	ABSTRACT
Input : October 12, 2025 Revised : November 10, 2025 Approved : November 22, 2025 Published : November 28, 2025 Keywords: Carbon Emissions, Climate Mitigation, Ecosystem Restoration, FOLU Net Sink	The Forestry and Other Land Use (FOLU) Net Sink 2030 program represents Indonesia's primary strategy to achieve national emission reduction commitments. This study evaluates the effectiveness of FOLU Net Sink implementation during 2020–2024 using a Systematic Literature Review (SLR) approach guided by Snyder (2019) and TranGolar et al. (2003), with thematic analysis based on Braun and Clarke (2021). Findings indicate substantial progress, including record-low deforestation, expanded peatland restoration, mangrove rehabilitation, and strengthened forest moratorium and national MRV systems. However, challenges remain, including regional capacity disparities, climate-risk exposure such as El Niño events, financing gaps, and carbon market integrity concerns. The analysis underscores the need for cross-sector policy harmonization, independent verification mechanisms, and sustainable climate financing, including carbon market instruments. Strengthening institutional capacity, community participation, and spatial monitoring capabilities will be essential for Indonesia to achieve the FOLU Net Sink target and reinforce its leadership in global climate governance.

INTRODUCTION

Climate change is the most significant global environmental challenge of the 21st century, with the land use and forestry sector playing a fundamental role in mitigating greenhouse gas emissions. The Intergovernmental Panel on Climate Change (IPCC, 2022) notes that the Forestry and Other Land Use (FOLU) sector contributes around 22% of total global emissions, making it one of the key sectors in the climate change mitigation agenda. Indonesia, as a country with one of the largest tropical forest coverages in the world, faces both strategic responsibilities and opportunities in reducing carbon emissions. Indonesia's commitment to achieving its Nationally Determined Contribution (NDC) targets in line with the Paris Agreement is reflected in strategic policies formulated since 2015 and reinforced in the 2022 NDC update document, which targets a 31.89% reduction in emissions independently and up to 43.20% with international support by 2030 (KLHK, 2022). The FOLU sector has been identified as the largest contributor to the achievement of this target due to its contribution to



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emissions and its potential for carbon sequestration through increased forest cover, ecosystem restoration, and sustainable land management.

To strengthen the contribution of this sector, the Indonesian government launched the Indonesia's FOLU Net Sink 2030 strategy as an effort to achieve a condition where carbon sequestration from the forestry and land use sectors exceeds emissions. The Ministry of Environment and Forestry (2022) targets a net absorption of –140 million tons of CO₂e by 2030 through a series of comprehensive programs such as deforestation control, forest rehabilitation, peatland restoration, mangrove expansion, and strengthening of Measurement, Reporting, and Verification (MRV). This strategy is not only a technical instrument, but also a pillar of Indonesia's economic transition towards low-carbon development as outlined in the Long-Term Strategy for Low Carbon and Climate Resilience 2050 (LTS-LCCR) agenda. As stated by Santika et al. (2023), the transition to a national green economy is largely determined by Indonesia's ability to effectively manage its forest and peatland landscapes, given their role as both a resource-based economic pillar and a natural carbon sink.

However, the dynamics of land and forest management in Indonesia still face significant challenges. A study by Adenäuer et al. (2022) shows that although the rate of deforestation has declined in the last five years, pressure on forest areas remains high, especially in Kalimantan, Papua, and Sumatra, due to plantation expansion, illegal logging, and infrastructure development. Data from the Ministry of Environment and Forestry (2023) shows a decline in net deforestation to around 104,000 ha in 2022, compared to an annual average of 450,000 ha in the 2010–2015 period. However, this trend does not guarantee sustainability because extreme climate phenomena such as drought and forest and land fires (*karhutla*) have the potential to increase emissions in Indonesia's tropical land areas again. A study by Golar et al. (2023) found that an increase in the frequency of El Niño events could undermine the effectiveness of *karhutla* control policies through longer dry seasons, as well as increase the risk of significant emissions from peatlands.

The peat sector is an important focus in the FOLU Net Sink 2030 strategy due to its characteristics as a giant carbon sink that is highly vulnerable to degradation. A study by Iskandar et al. (2021) confirms that peat damage contributes significantly to Indonesia's carbon emissions, which can reach up to 40% of total FOLU sector emissions in years with major fires. The government has initiated a 1.7 million ha peat restoration program since the establishment of the Peat Restoration Agency in 2016, which was later expanded to become the Peat and Mangrove Restoration Agency in 2021 through Presidential Regulation No. 120/2020. Data from the Ministry of Environment and Forestry (2023) shows that by the end of 2023, more than 1.4 million hectares of peatland will have been restored. However, the effectiveness of restoration is still influenced by local hydrological conditions, the level of spatial planning compliance, and the socio-economic dynamics of local communities that depend on land use (Nascimento et al., 2022).

In addition to peatlands, forest rehabilitation and mangrove planting programs are strategic elements in balancing the carbon balance of the FOLU sector. Indonesia has approximately 3.36 million hectares of mangroves, one of the largest in the world, and is striving to rehabilitate 600,000 hectares of mangrove areas by 2024 (BRGM, 2023). The success of mangrove rehabilitation has a direct impact on coastal adaptation and climate change mitigation, as mangroves can store up to four times more carbon than terrestrial tropical forests ((Rudiany & Yesandi 2023)). However, mangrove management faces

challenges in the form of coastal land conversion, conflicts over land use, and economic pressures on coastal communities. The imbalance between conservation agendas and economic needs is one of the key governance issues in the sustainability of this program.

The implementation of FOLU Net Sink 2030 is also closely related to climate financing mechanisms and carbon markets. The Indonesian government has introduced a carbon tax through the 2021 Taxation Harmonization Law (HPP) and launched the Indonesia Carbon Exchange in 2023 as a national carbon trading platform. A study by Wardhana & Prawira (2024) emphasizes that the success of the domestic carbon market requires regulatory certainty, strong MRV standards, and transparency in carbon credit certification. Indonesia is also involved in the international REDD+ mechanism with Norway and supports result-based payments. However, the effectiveness of climate financing still faces challenges such as inter-agency coordination, disparities in local government capacity, and inconsistencies in the governance of local carbon projects (Khoerunnisa & Rahman 2023).

In the epistemic context, a number of international and national studies have analyzed Indonesia's forest landscape management and carbon mitigation policies. However, there is a gap in research that has not been widely synthesized regarding the effectiveness of the integrated implementation of FOLU Net Sink 2030 in the 2020–2024 period, particularly in relation to the correlation between policy targets, technical progress in rehabilitation, MRV governance, and carbon economic instruments. Hasibuan (2023) assessed Indonesia's forest strategy in the context of global carbon mitigation, but did not specifically evaluate the FOLU Net Sink 2030 implementation framework. On the other hand, the study by Yuliani et al. (2022) highlights community-based forest governance and its social challenges, but does not examine the integration of carbon financing mechanisms and emissions monitoring. Meanwhile, the study by Santoso et al. (2023) focuses on the dynamics of carbon financing and the readiness of the domestic carbon market, but does not link it to the effectiveness of real emission reductions in the FOLU sector and progress in Golar monitoring. Thus, there is a research gap that needs to be bridged through a comprehensive analysis that assesses the effectiveness of the FOLU Net Sink policy from the dimensions of ecology, governance, economy, and national climate commitments.

In line with this research gap, this study is novel in integrating a quantitative evaluation of Indonesia's FOLU achievement trends with a qualitative review of governance and land-based mitigation policy instruments. This study places the MRV approach and carbon pricing mechanisms as key variables in assessing the credibility of the 2030 FOLU Net Sink program, while also testing the suitability of the low-carbon development focus with the dynamics of economic adaptation in the forestry and land use sectors. The objective of this study is to analyze the effectiveness of the FOLU Net Sink 2030 program in supporting the achievement of national emission targets through the evaluation of data on forest and land rehabilitation achievements, deforestation reduction, peat and mangrove restoration progress, and an assessment of the compatibility of Indonesia's MRV system and carbon financing framework with global standards.

However, actual achievements in the 2020–2024 period show dynamics that are not entirely linear. The Ministry of Environment and Forestry (2023) reports that Indonesia's net deforestation is at its lowest level in two decades and has been declining since 2019. This decline in deforestation has been appreciated by international institutions, including the World Bank (2023), which cited the success of fire control and

the strengthening of the palm oil moratorium policy as the main factors. However, a number of studies have provided a critical view of the sustainability of these achievements. Yeo et al. (2022) note that part of the decline in deforestation occurred in conjunction with weakening global economic conditions during the COVID-19 pandemic, raising concerns that economic recovery could once again increase pressure for land conversion. Similarly, Nyawira et al. (2024) emphasize that pressure from land-based commodity development, including palm oil, minerals, and plant fibers, will remain a dominant factor in forest cover change, especially in eastern Indonesia, which has weaker monitoring compared to the western region.

The effectiveness of the FOLU Net Sink 2030 is also linked to the readiness of carbon monitoring governance through the MRV system. Indonesia has established the National Registry System for Climate Change Control (SRN PPI) as a platform for data collection on national climate action, including greenhouse gas inventories and carbon projects. However, Lestari & Noor'An (2022) emphasize that the consistency of MRV standards and the integrity of Golar data remain challenges due to limited technical capacity at the regional level and methodological inconsistencies between projects. A robust MRV system requires synchronization between agencies, spatial data quality, reporting transparency, and independent verification processes. If these elements are not strengthened, the credibility of the FOLU Net Sink 2030 claim may be questioned, especially as Indonesia becomes more active in domestic and international carbon trading.

In addition to technical aspects, the social dimension is a determining factor in the success of FOLU Net Sink 2030. Forest management that involves local and indigenous communities is a strategic policy in preventing agrarian conflicts and improving rural welfare, in line with the social forestry approach. However, Priatna & Monk (2021) remind us that the success of community-based governance schemes depends on access to funding, local institutional capacity, and tenure security. The FOLU Net Sink program faces the challenge of ensuring that the participatory forest management approach is not merely symbolic, but actually provides decision-making space for indigenous communities who have long been the guardians of the landscape. Failure to involve communities in a substantive manner has the potential to create social resistance and misalignment between conservation goals and local economic needs.

The funding aspect is also a critical indicator of the program's effectiveness. Although Indonesia has received results-based REDD+ financing from Norway and increased bilateral climate financing cooperation, the funding requirements for FOLU Net Sink are still far above the domestic budget capacity. The OECD (2022) states that Indonesia's climate financing needs will reach more than USD 281 billion by 2030, while public allocation to the forestry and environment sectors remains limited. This funding gap has the potential to become an obstacle to implementation, especially in terms of peatland and mangrove restoration, strengthening Golar surveillance patrols, and improving MRV systems. Without innovative financing schemes including blended finance, private partnerships, and carbon financing, it is feared that the program will find it difficult to achieve its expected outcomes comprehensively.

Furthermore, cross-sectoral governance challenges also impact the implementation of FOLU Net Sink. Land use change is often influenced by cross-ministerial, local government, and private sector institutional coordination. Utomo et al. (2024) emphasize that the effectiveness of Indonesia's climate policies requires strong integration between the forestry, energy, and spatial planning sectors, as unsynchronized

sectoral policies can create contradictory incentives. For example, the expansion of plantations and national strategic infrastructure projects could potentially disrupt conservation areas if spatial planning coordination and permit monitoring are not carried out strictly and transparently.

A literature review also confirms that the success of FOLU Net Sink 2030 depends not only on domestic policies, but also on international market dynamics and climate diplomacy. International carbon prices, market access for sustainable products, and the European Union's carbon border adjustment mechanism (CBAM) scheme are external factors that affect the competitiveness of Indonesia's land-based economy. According to Callaghan et al. (2024), Indonesia's green economy transformation requires repositioning in the global market by emphasizing the quality of forest governance, transparency of traceability-based supply chains, and international sustainability certification standards. Thus, the FOLU strategy cannot stand alone but requires integration with industrial, investment, and international trade policies.

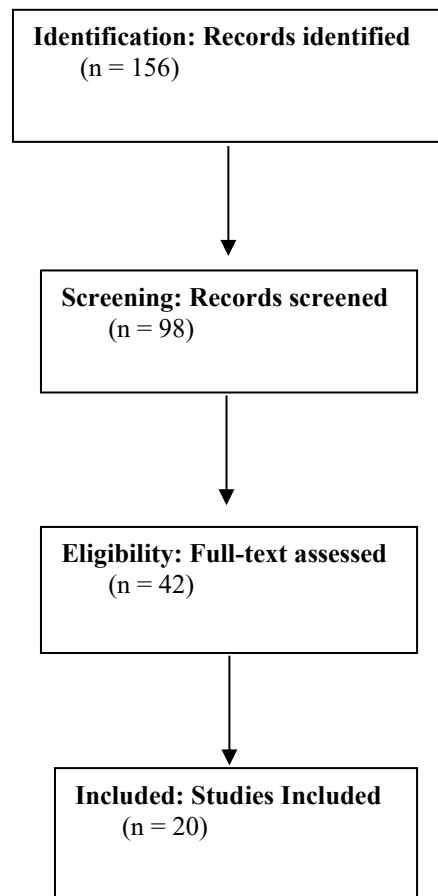
Considering the empirical description, policy dynamics, and theoretical framework, this study takes a strategic position in filling the gap in academic understanding of the performance of the FOLU Net Sink 2030 program in the early stages of implementation. This study combines quantitative achievement analysis (deforestation reduction, ecosystem restoration achievements, and MRV achievements) with policy evaluation that examines compliance with NDC targets, the effectiveness of funding mechanisms, and social inclusion in landscape governance. This approach contributes to efforts to understand the effectiveness of ecosystem-based mitigation policies in developing countries that rely on forestry as the backbone of their climate strategies. Thus, the analysis in this study is expected to provide a strategic basis for stakeholders to strengthen the implementation of FOLU Net Sink 2030 and determine policy priorities in facing the challenges of global climate change.

METHODOLOGY

This study applies the Systematic Literature Review (SLR) method to evaluate the effectiveness of the FOLU Net Sink 2030 program in achieving national emission reduction targets. The SLR method was chosen because it produces structured and transparent analysis through the collection, critical assessment, and synthesis of scientific findings relevant to environmental policy and climate governance issues. This approach refers to Snyder's (2019) conceptual framework and TranGolar et al.'s (2003) methodological guidelines, which emphasize the importance of systematicity, replication, and objectivity in evidence-based public policy reviews. The literature analyzed includes scientific publications, government agency reports, and international organization documents discussing the dynamics of deforestation, ecosystem restoration, Measurement, Reporting, and Verification (MRV) mechanisms, and Indonesia's climate policy for the period 2020–2024, taking into account developments since the 2015 climate commitment.

The analysis was conducted using a thematic synthesis approach as described by Braun and Clarke (2021) to identify substantive themes linking FOLU policy design, empirical emission reduction achievements, carbon finance governance, and regional institutional readiness. The literature selection process followed the PRISMA logic in narrative form, starting from source identification, screening based on topic relevance and scientific validity, to determining studies suitable for analysis. The final results include sources that contribute directly to the evaluation of FOLU Net Sink effectiveness. Thus,

this method ensures that the argumentation is scientifically rigorous, consistent with an evidence-based policy approach, and provides a meaningful academic contribution to the climate mitigation discourse in Indonesia



RESULT AND DISCUSSION

Effectiveness of the FOLU Net Sink 2030 Program in Reducing Deforestation and Forest Degradation

The effectiveness of the FOLU Net Sink 2030 program is primarily reflected in the downward trend in national deforestation in recent years, which has contributed significantly to the stabilization of emissions from the forestry sector. Data from the Ministry of Environment and Forestry (2023) shows that net deforestation fell to around 104,000 hectares in 2022, much lower than the historical trend, which often exceeded 450,000 hectares per year in the 2010–2015 period. This decline is often cited as an indicator of the success of the moratorium on primary forest and peatland permits, increased monitoring, and the implementation of landscape-based governance. The study by Yeo et al. (2022) supports these findings by noting that the moratorium policy and tightening of land conversion permits played an important role in preventing the expansion of deforestation in Sumatra and Kalimantan, especially in areas that were previously at high risk of conversion to oil palm plantations. However, the study also highlights that this success is not entirely structural, but is also influenced by the slowdown in economic activity during the COVID-19 pandemic, meaning that there is

still the potential for deforestation to increase again if it is not accompanied by stronger regulations and Golar monitoring.

Forest and land fire control programs are an integral part of the effectiveness of the FOLU agenda because forest and land fires are a major source of emissions in Indonesia, especially on peatlands. In 2015, emissions from forest and land fires increased dramatically due to a strong El Niño phenomenon, which had a significant impact on regional air quality and Indonesia's carbon emissions (Golar et al., 2023). The government's commitment to controlling forest and land fires through the strengthening of village-based prevention systems, the modernization of hotspot monitoring technology, and integrated aerial operations has contributed to a decline in large-scale fires since 2020. However, the 2023 El Niño event proved that the risk of fires increases again when extreme hydrometeorological conditions occur. This is reinforced by the findings of Golar et al. (2023), which show that increased global climate variability can reduce the effectiveness of fire control policies without adequate adaptive capacity. Thus, the sustainability of FOLU achievements in the context of fire control requires a strong climate-based risk mitigation system and adaptive responses at the institutional and community levels.

Table 1. Key Indicators of Indonesia's FOLU Performance (2020–2023)

Indicator	2020	2021	2022	2023
Annual net deforestation (ha)	~115,500	~110,500	~104,000	~108,000*
Peatland restoration achieved (ha accumulated)	1,000,000+	1,200,000+	1,350,000+	1,400,000+
Mangrove rehabilitation progress (ha cumulative)	34,000	102,000	183,000	260,000
Major forest fire area (ha)	296,000	358,000	204,900	267,900*
Estimated FOLU emissions trend	Decreasing	Decreasing	Stabilizing	Volatility risk (El Niño)

Provisional estimates pending verification.

In addition to reducing deforestation and preventing forest and land fires, ecosystem rehabilitation programs especially peatland restoration, are a key pillar of the FOLU Net Sink 2030 strategy. Indonesia has set a peatland restoration target of 1.7 million hectares, and by the end of 2023, more than 1.4 million hectares had been restored through rewetting, revegetation, and community revitalization activities (KLHK, 2023). The contribution of peatland restoration to carbon sequestration has been recognized in various studies, including one by Iskandar et al. (2021), which shows that hydrological restoration of peatlands can reduce potential carbon emissions by 30–60%, depending on the success rate of groundwater level recovery. However, the effectiveness of peatland restoration is not only determined by technical activities, but also depends on the suitability of land use, local economic incentives, and industry compliance with peatland protection zoning. Nascimento et al. (2022) emphasize that without strict supervision of

post-restorative land use, some peat areas are at risk of being degraded again due to commodity pressures and changes in land use practices at the local level.

Meanwhile, strengthening coastal ecosystems through mangrove rehabilitation contributes significantly to the FOLU agenda, given mangroves' high carbon sequestration capacity and their ecological role in protecting coastlines. Indonesia, with more than 3.36 million hectares of mangroves, has launched a commitment to restore 600,000 hectares by 2024 (BRGM, 2023). Research by Simorangkir et al. (2024) shows that Indonesia's mangrove areas have tremendous blue carbon sequestration potential, with carbon storage levels reaching four to five times that of lowland tropical forests. However, the effectiveness of coastal rehabilitation programs is inseparable from socio-ecological challenges such as pond conversion, coastal space conflicts, and habitat degradation due to local economic activities. Therefore, the success of mangrove restoration depends on multi-stakeholder collaboration that provides space for coastal community participation, sustainable economic incentives, and an adequate long-term monitoring system to ensure that planting results in a truly restored ecosystem, not just planting output.

The FOLU Net Sink 2030 framework also includes strengthening carbon monitoring and inventory management through a Measurement, Reporting, and Verification (MRV) system. The national greenhouse gas inventory reporting system is being developed through the National Registry System for Climate Change Control (SRN-PPI), which consolidates climate action data across ministries and stakeholders. However, Lestari & Noor'An (2022) identified that the quality of Indonesia's MRV still faces challenges in the form of spatial data heterogeneity, limited technical capacity in the regions, and the need for more uniform methodological standards to ensure the integrity of carbon reporting. This confirms that the effectiveness of FOLU depends not only on physical results in the Golar, but also on the quality of scientific data and the transparency of the reporting system, which form the basis for decision-making and international recognition. A robust MRV system is a prerequisite for Indonesia to maximize the benefits of international carbon financing mechanisms, including bilateral carbon trading and results-based payment schemes.

In addition to technical and policy factors, social and economic dynamics are key determinants of program success. The implementation of social forestry, the empowerment of indigenous peoples, and the harmonization of tenure rights are elements that often determine the sustainability of ecosystem restoration. Priatna & Monk (2021) emphasize that the success of community-based forest management requires the recognition of access rights, local institutional capacity, and economic incentive schemes that are aligned with conservation. FOLU Net Sink 2030 has the potential to strengthen community-based governance, but this depends on the ability of policies to address inequalities in access to resources and ensure that conservation approaches do not undermine local livelihoods, but rather expand opportunities for sustainable economic development.

Overall, the effectiveness of FOLU Net Sink 2030 in its early implementation phase shows significant progress, particularly in reducing deforestation, expanding peat and mangrove restoration programs, and strengthening the national climate change policy framework. However, these achievements do not fully guarantee the achievement of a net sink by 2030 without further strengthening in terms of funding, Golar supervision, cross-sector policy consistency, and adaptation to extreme climate risks. Therefore, continuous monitoring, improvement of MRV, and multi-stakeholder collaboration between the

central government, local governments, the private sector, and the community are imperative to ensure that the ecological benefits of FOLU can be realized in a tangible and sustainable manner.

Governance, Carbon Financing, and MRV Integrity in the Implementation of FOLU Net Sink 2030

The governance dimension is a fundamental aspect in assessing the effectiveness of the implementation of FOLU Net Sink 2030 because the success of ecosystem-based mitigation programs is highly dependent on institutional coordination, policy consistency, and the sustainability of government support for the forestry sector. The Indonesian government has adopted various policy instruments that affirm its commitment to land-based mitigation, including Presidential Regulation No. 98/2021 on Carbon Economic Value, Presidential Regulation on the Peat and Mangrove Restoration Agency, and the strengthening of the reporting system through the National Registry System (SRN). However, the effectiveness of these policies is not only determined by the existence of regulations, but also by the quality of implementation and the ability to ensure that sectoral policies such as spatial planning, energy, agriculture, and industry do not run counter to the goal of reducing FOLU emissions. Utomo et al. (2024) emphasize that cross-sectoral policy alignment is a major challenge for developing countries, especially when natural resource utilization remains a pillar of the national economy. Thus, FOLU governance requires improved mechanisms for harmonizing development planning, land use licensing, and monitoring compliance in the extractive and agroforestry industries.

Carbon financing is also a strategic element in the sustainability of FOLU Net Sink, as ecosystem restoration and forestry monitoring programs require long-term investments that often exceed the state's spending capacity. The government introduced the Indonesian Carbon Exchange in 2023 as an instrument for utilizing the economic value of carbon. In addition, Indonesia is also involved in a results-based REDD+ payment scheme with Norway as a form of bilateral climate financing. However, the OECD report (2022) states that Indonesia's climate financing needs to achieve its 2030 targets reach USD 281 billion, while public allocation is still limited and not commensurate with the needs of forest restoration, strengthening of monitoring systems, and provision of economic incentives for communities. Wardhana & Prawira (2024) emphasize that the success of the domestic carbon market is largely determined by carbon accounting standards, certification transparency, and the credibility of third-party verification. Thus, strengthening the governance of Indonesia's carbon market requires not only regulatory support but also technical capacity, institutional transparency, and the trust of international investors in order to function as a pillar of national green transition financing.

Beyond financing, the sustainability of FOLU implementation heavily depends on the quality of the MRV system, which is the backbone for assessing Indonesia's emission mitigation performance and the credibility of its climate actions in the eyes of the world. The Ministry of Environment and Forestry has strengthened the greenhouse gas inventory reporting mechanism through the SRN-PPI and a satellite image-based forest monitoring system. However, Lestari & Noor'An (2022) note that technical challenges remain, including data inconsistencies between levels of government, uneven technical capacity across regions, and obstacles to independent verification in the Golar. If left unaddressed, this could potentially reduce the credibility of FOLU sector emissions data and affect the competitiveness of Indonesian carbon credits in the international market. This was echoed

by Hasibuan (2023), who assessed that tropical forest countries require strong and consistent MRV governance to ensure that carbon sequestration claims are not merely administrative but also reflect real ecological changes on the ground.

Social inclusion is also an integral component of successful FOLU Net Sink governance. Social forestry programs and the recognition of indigenous peoples' rights are strategies to ensure that ecosystem conservation does not create distributional injustices or cause tenure conflicts. Priatna & Monk (2021) highlight that the involvement of indigenous peoples in forest management has been shown to increase the sustainability of land use and prevent degradation, but this success only occurs if communities have legal access, technical support, and tangible economic benefits. In the context of FOLU, this reflects the need for community-based carbon benefit-sharing schemes and institutional support that ensure that communities are key actors in ecosystem restoration, rather than mere recipients of policy.

The dimensions of monitoring and law enforcement remain central challenges in FOLU governance. Although deforestation has declined, structural causes such as illegal logging, unlicensed plantations, and spatial planning violations have not been fully addressed. Nyawira et al. (2024) caution that prohibition policies without strengthened Golar monitoring, licensing reforms, and local government accountability are not sufficient to sustain long-term deforestation reduction. Therefore, strengthening law enforcement capacity based on spatial monitoring technology, strict sanction mechanisms, and compliance incentives for industry players are integral parts of controlling reforestation risks and maintaining the integrity of FOLU policies.

Thus, the governance of FOLU Net Sink 2030 is essentially a combination of political commitment, scientific integrity, institutional collaboration, fiscal capacity, and socio-economic support from the community. Structural transformation to achieve a net sink condition cannot be achieved through isolated sectoral policies, but rather through the strengthening of a synergistic coordination framework between the central government, local governments, the private sector, and local communities. In addition, the integration between the green development vision and the sustainable economy agenda needs to be strengthened through the alignment of national development planning with land-based mitigation schemes, so that the transition to a low-carbon economy is not only a normative commitment but is realized in measurable practical achievements.

Prospects, Long-Term Challenges, and Strategies for Strengthening FOLU Net Sink towards 2030 and Beyond

The success of the FOLU Net Sink 2030 implementation is not only determined by the technical achievements of ecosystem restoration and deforestation reduction in the initial phase, but also by Indonesia's ability to ensure institutional stability, adequate funding, carbon market integrity, and the sustainability of socio-environmental governance in the long term. This strategy requires a transformative approach as Indonesia's environmental and economic challenges become increasingly complex amid intensifying global climate change. The IPCC (2022) emphasizes that tropical countries with high carbon stocks have a fundamental role to play in the transition to a low-carbon global economy, but the success of long-term mitigation requires stable governance and consistent financing. In the Indonesian context, the sustainability of the FOLU program depends on the government's ability to maintain low deforestation rates while optimizing forest cover, effectively restoring critical ecosystems, and ensuring that local and national economic interests continue to be met without reducing long-term ecological capacity.

One of the strategic challenges in the future implementation of FOLU is administrative readiness and multi-level governance coordination. Although FOLU regulations have been institutionalized through the Ministry of Environment and Forestry, the National Forestry Agency, and the strengthening of the national registry system, technical implementation in the Golar remains fragmented between the central and regional levels. Utomo et al. (2024) state that harmonizing regional development planning with climate mitigation mechanisms is a critical point for forest policy in Indonesia. The technical capacity of local governments in spatial planning, environmental law enforcement, and MRV implementation still varies between regions, hindering uniform implementation standards. An intensive capacity-building approach is needed, including technical training, geospatial data-based digitalization of monitoring, and performance-based fiscal incentives that can strengthen regional commitment to FOLU targets.

In terms of funding, the implementation of the long-term FOLU agenda requires a sustainable financing structure. The OECD (2022) estimates that Indonesia's climate financing needs until 2030 will reach USD 281 billion, with the forestry sector as one of the largest recipients of the budget. At the same time, Indonesia's domestic carbon market through the Indonesia Carbon Exchange has begun operating, providing opportunities for the accumulation of national carbon credit-based funding. However, Wardhana & Prawira (2024) point out that the effectiveness of the carbon market depends on the clarity of carbon assessment methodologies, transparency of verification, and investor confidence. Without carbon credit quality assurance and strict supervision of REDD+ projects, the carbon market risks producing low-integrity credits, which could damage Indonesia's reputation in the global market. Therefore, long-term strategies must include the development of an independent verification ecosystem, a standardized national certification scheme, and full MRV integration in all registered carbon projects.

The sustainability of FOLU Net Sink is also influenced by global market dynamics that increasingly demand high carbon literacy, supply chain transparency, and international sustainability standards. The European Union has implemented the Carbon Border Adjustment Mechanism (CBAM), and various countries are beginning to impose strict requirements on land-based products, including palm oil and timber. Callaghan et al. (2024) emphasize that tropical commodity-producing countries must integrate forest governance with international trade standards to maintain market access and economic competitiveness. These conditions place the FOLU program as an integral part of Indonesia's environmental diplomacy strategy. If not anticipated, international compliance challenges could put pressure on domestic forest management, including potential conflicts between trade and carbon protection objectives.

Social and environmental justice dimensions also determine the long-term prospects of FOLU. The participation of indigenous and local communities in forest management is not only a normative principle but also an empirical requirement for long-term conservation success. Priatna & Monk (2021) show that indigenous-based management models contribute to increased forest cover stability and local ecological compliance. However, to ensure the sustainability of FOLU programs, policies need to expand the distribution of economic benefits, strengthen carbon benefit-sharing schemes, and guarantee community land rights through tenure reform. Without strong social inclusion, conservation efforts can give rise to new frictions and inequalities that undermine the stability of environmental policies.

Furthermore, the increasingly acute challenge of climate change means that the effectiveness of FOLU depends not only on mitigation but also on ecological adaptation.

Golar et al. (2023) highlight that the intensity of El Niño is likely to continue to increase, leading to higher frequencies of fires and extreme droughts. Thus, ecosystem restoration must be supported by climate infrastructure such as sustainable peat block canals, climate risk prediction modeling, and the strengthening of community-based fire prevention systems. Ecosystem resilience is a key concept: restoration that is only physical in nature without building adaptive ecological capacity will not be able to maintain a long-term net sink.

To provide a more structural overview of institutional readiness and carbon financing aspects in supporting the 2030 FOLU Net Sink, the following evaluative table combines governance indicators and carbon financing readiness:

Table 2. Institutional Capacity and Carbon Finance Readiness for FOLU Net Sink 2030

Dimension	Current Status	Key Challenges	Institutional/Policy Reference
Forest governance coordination	Central framework established; SRN-PPI operational	Uneven regional capacity; inter-sectoral fragmentation	KLHK (2023); Utomo et al. (2024)
Community involvement & tenure security	Social forestry expansion; adat recognition growing	Limited economic incentives; unresolved tenure claims	Priatna & Monk (2021)
Carbon market infrastructure	National carbon exchange operational	Standardization, verification capacity, investor trust	Hartati & Pratiwi (2023)
Peat & mangrove restoration funding	Government bilateral working	Funding gap for large-scale maintenance & monitoring	OECD (2022); KLHK (2023)
MRV system readiness	Registry monitoring platforms exist	Heterogenous data quality; lack of third-party audit capacity	Lestari & Noor'An (2022)

The table shows that the future effectiveness of FOLU requires strengthening technical capacity and credible carbon market-based financing. This strategy cannot stand alone; it must be integrated into the national green economy transition framework. In addition, climate diplomacy needs to be strengthened so that international recognition of FOLU performance can increase the scope for carbon and technology financing.

Thus, the FOLU Net Sink 2030 sustainability strategy points to a policy architecture based on climate adaptation, transparent governance, national carbon literacy, community actor empowerment, and public-private funding mobilization. Through this synergy, Indonesia has the opportunity to not only achieve its national emission reduction targets but also become a global reference for tropical countries in ecosystem-based mitigation architecture.

CONCLUSION

The FOLU Net Sink 2030 program occupies a strategic position in Indonesia's climate change mitigation architecture because the forestry and land use sectors are both

the largest sources and sinks of carbon in the national emissions balance. Research findings show that Indonesia has made significant progress in the form of a reduction in historical deforestation, the strengthening of moratorium policies, and the acceleration of peatland restoration and mangrove rehabilitation in the early implementation period of 2020–2024. These efforts demonstrate a national commitment to integrating ecological approaches, science-based policies, and multilevel governance to achieve a net sink by 2030. However, program effectiveness is not yet uniform across regions and is still influenced by economic dynamics, regional capacity variations, and climate change pressures that increase the risk of fires and ecosystem degradation. The MRV system has developed through the SRN-PPI and the strengthening of satellite-based monitoring, but methodological consistency and independent verification need to be improved to ensure carbon data integrity.

The sustainability of the FOLU agenda requires institutional governance consolidation, credible carbon financing, and effective law enforcement against land use violations. In addition, the involvement of local and indigenous communities must be a substantive element in the design and implementation of forest management strategies so that mitigation implementation does not only focus on biogeophysical aspects but also strengthens social justice. Community-based carbon benefit-sharing schemes, strengthening tenure rights, and increasing local climate literacy are important prerequisites for ensuring the social sustainability of the program. Given the increasingly stringent international sustainability standards and border carbon adjustment mechanisms in trading partner countries, Indonesia needs to strengthen its environmental diplomacy and enhance the credibility of its FOLU policies through transparency, certification, and strict supervision of carbon projects.

Based on the research results, it is recommended that the government expand long-term financing support through green fiscal mechanisms, blended finance, and domestic carbon market incentives integrated with international standards. Increasing the capacity of local governments in land governance, spatial data-based monitoring, and community-based fire mitigation is also an urgent need. In addition, improving the MRV framework through strengthening independent evaluation and adopting advanced geospatial technology will support the legitimacy of emission reduction achievements. If all stakeholders are harmonious in their ecosystem-based mitigation efforts, Indonesia has the potential to become a global model for tropical countries in realizing a transition to an inclusive and climate-resilient low-carbon economy.

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