Towards Sustainable Peatland Management in Indonesia: Strategies for Restoration and Revitalization

Abstract

This report presents sustainable peatland management strategies in Indonesia, focusing on integrating ecological restoration with socio-economic development. It analyses Indonesia's regulations and the role of social forestry in restoration, using case studies from BRIN and CIFOR-ICRAF to highlight successful approaches. These include community engagement, innovative techniques like paludiculture and agroforestry, and fire prevention. The report offers a practical guide for peatland restoration planning and implementation, covering social management, physical planning, and monitoring. Specific recommendations are provided for Sungai Gelam, Jambi, emphasizing a multi-faceted approach with stakeholder collaboration. The report concludes that integrating these elements is crucial for Indonesia to achieve sustainable peatland management, contributing to national environmental goals and global climate change mitigation.

Background

Indonesia's peatland ecosystems are vital not only for biodiversity conservation but also for mitigating climate change and supporting local livelihoods. These ecosystems provide essential services such as carbon sequestration, biodiversity preservation, water regulation, and coastal protection (Lupascu et al., 2023). Indonesia's vast peatland landscapes also face significant environmental challenges. These include deforestation, drainage, and land degradation, which are influenced by human activities and natural factors. When peatlands become degraded, they can pose risks such as land subsidence, fire, and biodiversity loss, which may impact agricultural productivity and food security (Yeny et al., 2022; Lupascu et al., 2023). The expansion of monoculture woody crops, such as oil palm plantations, has highlighted the importance of balancing agricultural productivity with sustainable peatland management to ensure the long-term health of these critical ecosystems and support Indonesia's climate goals (Lupascu et al., 2023).

Restoring peatlands addresses these challenges by improving water retention, reducing fire risks, and fostering ecosystem recovery, thereby supporting sustainable food production while mitigating climate impacts (Budiningsih et al., 2024; Lupascu et al., 2023). Restoration can transform degraded peatlands into productive landscapes suitable for climate-smart agriculture, emphasizing crops like sago, water spinach, and edible ferns. These crops thrive in wet conditions, reduce greenhouse gas emissions compared to drained peatlands, and provide a viable source of income for local communities (Lupascu et al., 2023).

By prioritizing peatland restoration, Indonesia can enhance the resilience of its food estate initiatives and secure sustainable natural resource management for future generations. Integrated efforts to rewet and restore degraded peatlands can prevent further deforestation and ensure that food production aligns with environmental sustainability (Lupascu et al., 2023). This approach demonstrates that food security and environmental conservation are not competing goals but complementary priorities essential for the nation's long-term resilience and prosperity.

Regulatory Framework for Peatland Restoration through Social Forestry

Indonesia has implemented a robust regulatory framework focused on integrating social forestry into peatland restoration efforts. This approach not only aims to protect these valuable ecosystems but also to improve the livelihoods of local communities who depend on them.

The Agrarian Reform Program and Social Forestry

Recognizing the link between poverty and environmental degradation, the Indonesian government launched the Agrarian Reform Program in 2015. This initiative aims to address poverty in villages located around or within forest areas, which had a poverty rate of 36.7% in 2015. The program focuses on distributing legal ownership rights (through the Agrarian Reform Object Land, or TORA) and providing legal access to forest resources (through the Social Forestry

Program). The ambitious goal is to allocate 12.7 million hectares of forest land for social forestry by 2030. As of October 2024, approximately 8 million hectares had been allocated across various forest ecosystem types in Indonesia.

Social Forestry initiatives have been implemented in 18 provinces, covering 3 million hectares of peatland. These initiatives empower local communities to manage and utilize forest resources sustainably. For instance, in Jambi Province, 31,677 hectares of peatland have been designated for Social Forestry across several districts.

Indonesia's regulatory framework for peatland management is built on a foundation of key legislation:

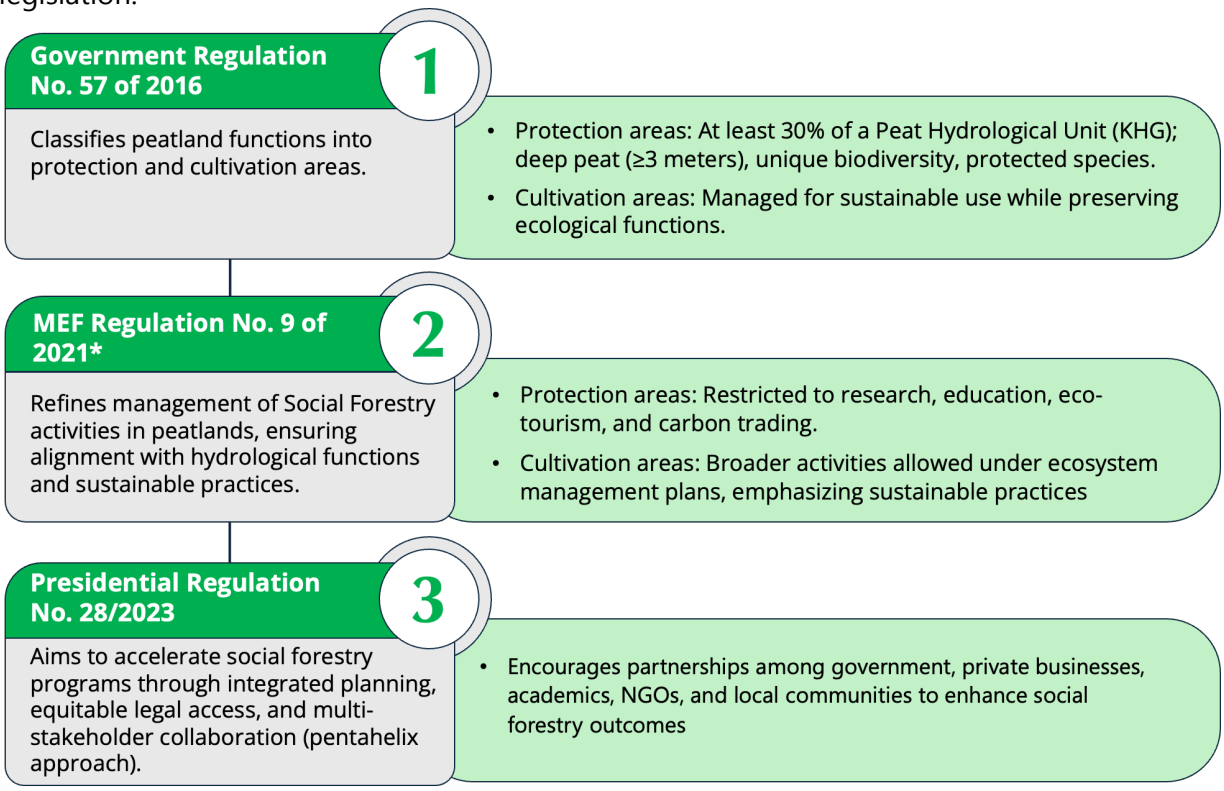


Figure 1. Social Forestry in Indonesia's Peatlands: Regulatory Guidance

**Note: MEF (Minister of Environment and Forestry)*

Balancing Ecology, Community Welfare, and Sustainable Progress

Social forestry programs in Indonesian peatlands aim to balance ecological restoration with local community well-being. These programs promote sustainable livelihoods like agroforestry, fisheries, and non-timber forest product use, leading to increased incomes and reduced forest degradation. Successful examples include agroforestry in Dayun, Riau, and fisheries/honey production in Tuwung, Central Kalimantan. Beyond resource access, programs like KUPS empower communities, including women and marginalized groups, through capacity building, financial support, and market development. Challenges remain, however, including ensuring compliance, strengthening market access for sustainable products, and scaling successful models across diverse contexts. Addressing these challenges will solidify Indonesia's leadership in sustainable peatland management and contribute to national and global goals.

The 3R Framework for Restoring Indonesia's Peatlands

The National Research and Innovation Agency (BRIN) introduced peatland restoration strategy known as 3R framework: Restoration of Hydrology, Rehabilitation of Vegetation, and Revitalization of Communities. BRIN focuses on rewetting dried-out peatlands (restoration of hydrology). This involves blocking canals that were dug to drain water and implementing careful water management strategies. Raising the water levels in peatlands helps to prevent further degradation, reduces the risk of fires, and creates conditions for the ecosystem to recover.

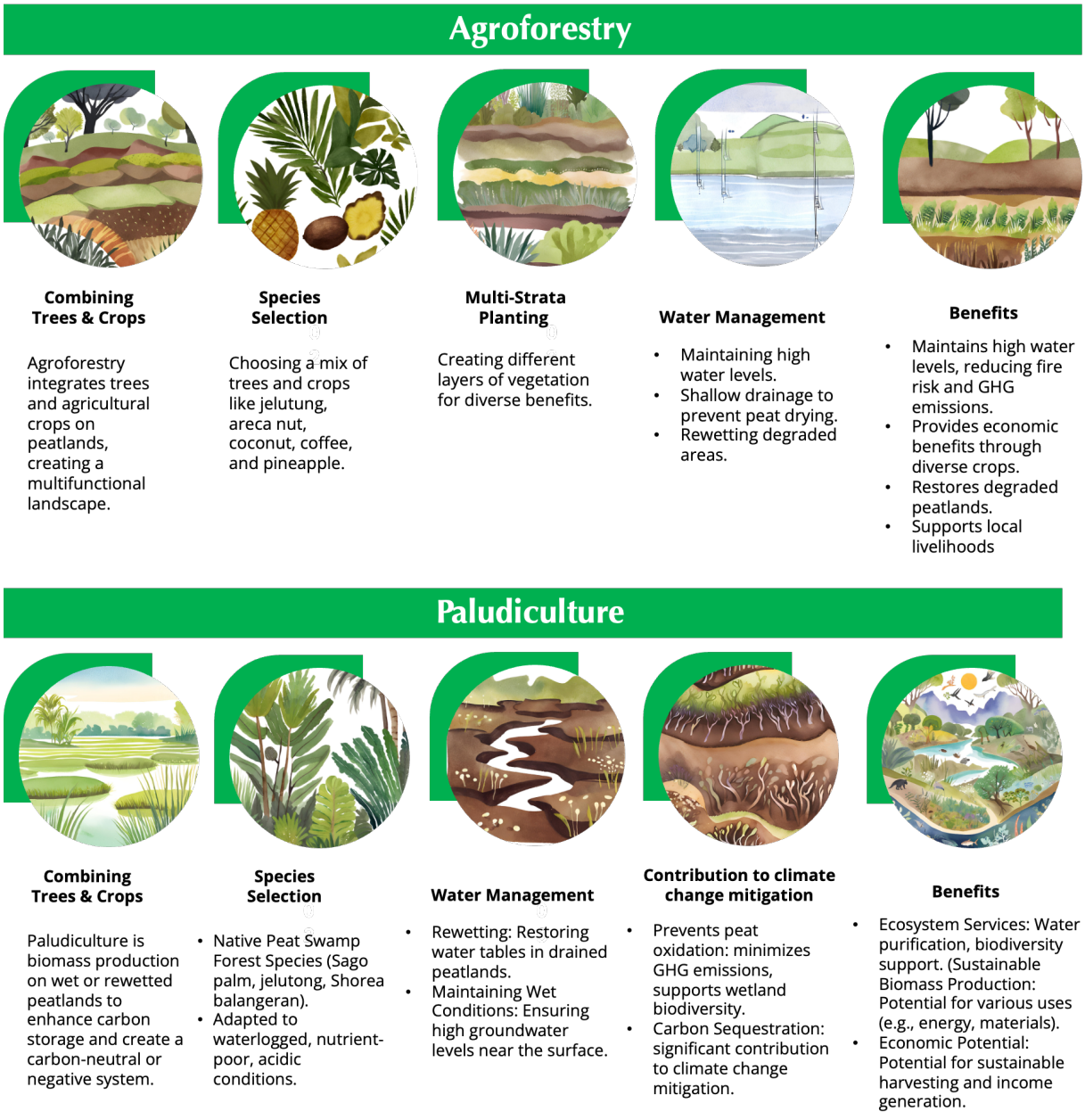


Figure 2. Paludiculture & Agroforestry Approach for Peatland Restoration

To restore the rich biodiversity of peatlands, BRIN plants a mix of native and adaptive plant species (rehabilitation of vegetation). Techniques like paludiculture (wetland agriculture) and agroforestry (integrating trees with crops) are used. These methods not only enhance carbon storage but also provide economic opportunities for local communities.

BRIN actively involves local communities in restoration activities (revitalization of communities) by providing training and introducing alternative livelihoods. This includes promoting the cultivation of peat-friendly commodities like sago palm (*Metroxylon sagu*) and *jelutong*. Its work spans across Indonesia, with projects in several key locations.

In Katingan, Central Kalimantan, in partnership with PT Rimba Makmur Utama, BRIN has established paludiculture demonstration plots. These plots showcase the potential of native species like sago palm and *balangeran* (*Shorea balangeran*) to restore degraded peatlands. In Kepau Jaya, Riau, BRIN collaborates with smallholder oil palm plantations to establish agroforestry systems. By integrating oil palm with liberica coffee and *balangeran* trees, this model promotes biodiversity while providing economic benefits to local farmers. Projections indicate that these systems could store over 15,000 tons of carbon by 2030.

In peat forest reserves in Bram Itam and Londerang, Jambi, BRIN is implementing two distinct restoration approaches. One involves agroforestry systems that combine native trees with areca palms, while the other focuses on block planting of native species. These efforts aim to restore forest cover and carbon stocks while considering the unique social and ecological contexts of each location. Lastly, in Mendawai Village, Central Kalimantan, with shallow peat and natural ponds, BRIN has introduced a unique silvofishery model. This innovative approach combines tree planting with fish cultivation, demonstrating BRIN's commitment to integrated solutions that benefit both the environment and local communities.

BRIN directly addresses critical peatland challenges: altered hydrology, degraded vegetation, and unsustainable community practices. Utilizing paludiculture and agroforestry, BRIN minimizes emissions and restores ecosystems. Stakeholder collaboration on species selection ensures local ecological and economic alignment. These projects deliver concrete socio-economic benefits, fostering community ownership and guaranteeing sustainable impact. This ensures that restoration efforts are not only effective but also sustainable and likely to be embraced by the people who live in and around these vital ecosystems.

The Peat-IMPACTS Project: A Case Study in Integrated Management

Another approach to peatland restoration is demonstrated by the efforts of the Center for International Forestry Research (CIFOR) and World Agroforestry (ICRAF). Their work in Indonesia, implemented through the Peat-IMPACTS project, emphasizes a comprehensive strategy that integrates ecological restoration with socio-economic development. Funded by the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMU) through its International Climate Initiative (IKI), Peat-IMPACTS has been

operational since 2020 in key regions in South Sumatra (Ogan Komering Ilir and Banyuasin districts) and West Kalimantan (Kubu Raya district).

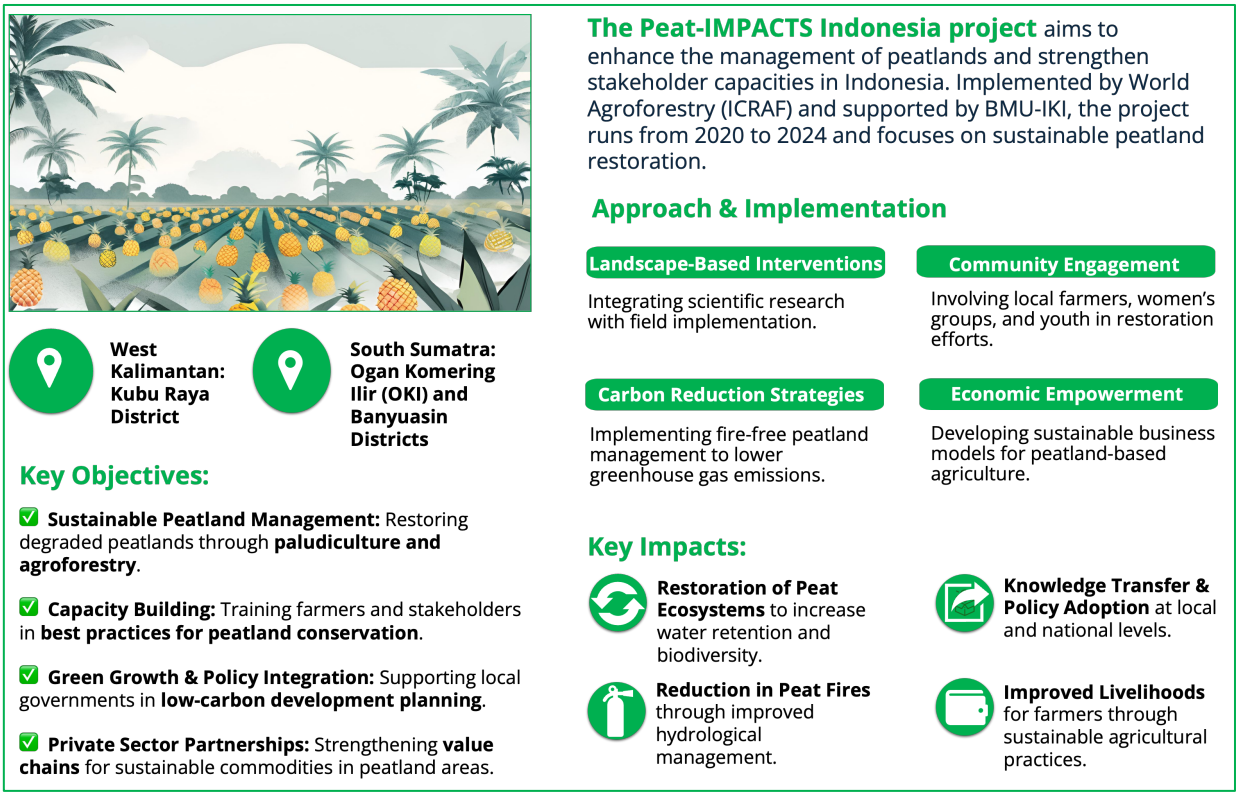


Figure 3. Peat-IMPACTS Indonesia Project (summary presentation)

Integrated Peatland Restoration Approach

Peat-IMPACTS employs a multi-level strategy, linking on-the-ground restoration with policy interventions. The project recognizes peatlands as part of a larger landscape and integrates Land Use Planning for Multiple Environmental Services (LUMENS) into regional development frameworks. This ensures peatland restoration aligns with spatial planning and economic development goals.

Fire-Free Strategies & Sustainable Land Use

Peatland fires are a persistent threat, and CIFOR-ICRAF has developed roadmaps to reduce fire risks through improved land-use planning and hydrological restoration. The project promotes fire-free land management while advancing agroforestry and paludiculture—sustainable practices that integrate native species and economically valuable cropsinto restoration activities.

Community-Based Restoration & Livelihoods

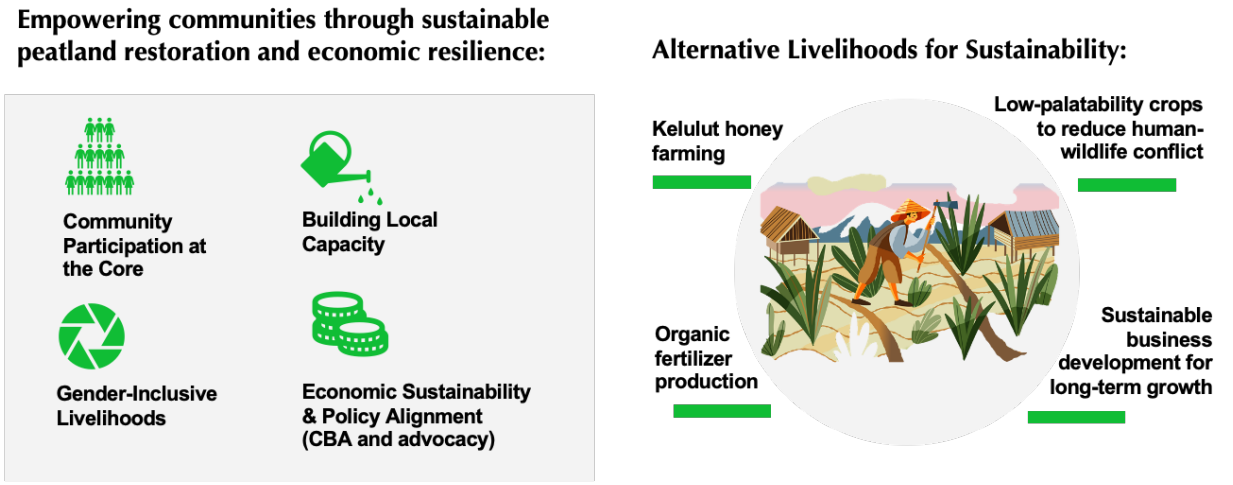


Figure 4. Community based approach of the Peat-IMPACTS

The project places community participation at its core, establishing demonstration plots in pilot villages to showcase agro-silvo-fishery systems (integrating trees, crops, and fish farming) and agroforestry models with rubber, coffee, and oil palm. These plots serve as learning hubs for sustainable practices and provide direct benefits to local farmers, youth, and women-led households.

To build local capacity, Peat-IMPACTS has trained over 400 farmers in South Sumatra and 266 in West Kalimantan in sustainable agriculture, peatland conservation, and entrepreneurship. By fostering a network of 'farmer champions,' the project ensures knowledge transfer and long-term sustainability within communities.

Recognizing the importance of gender-transformative aspects, Peat-IMPACTS has actively involved women and youth in livelihood diversification efforts. Several business models have been developed with women as key actors, ensuring their participation in economic decision-making and income-generating activities. For example, women's groups have played a crucial role in selecting high-value crops such as ginger, which contributes significantly to household income and community resilience.

Additionally, the project has characterized female-headed households to support their economic independence, ensuring that restoration benefits are equitably distributed. A Cost-Benefit Analysis (CBA) has been conducted across all livelihood models, and its findings will be reported to stakeholders at the district level to enhance policy alignment and scalability.

By introducing alternative livelihoods such as kelulut honey farming (stingless bee honey), organic fertilizer production, and low-palatability crops to mitigate human-wildlife conflict, Peat-IMPACTS helps reduce dependency on unsustainable land use while promoting gender-inclusive economic growth.

Policy Integration & Governance

To institutionalize peatland restoration, Peat-IMPACTS works closely with local governments to integrate restoration strategies into jurisdictional plans and green growth policies. By engaging communities, government agencies, NGOs, and private sector partners, the project fosters inclusive decision-making and ensures long-term policy alignment. To support sustainable financing, the project explores public-private partnerships and Payment for Ecosystem Services (PES), compensating communities for managing peatlands in ways that generate environmental benefits.

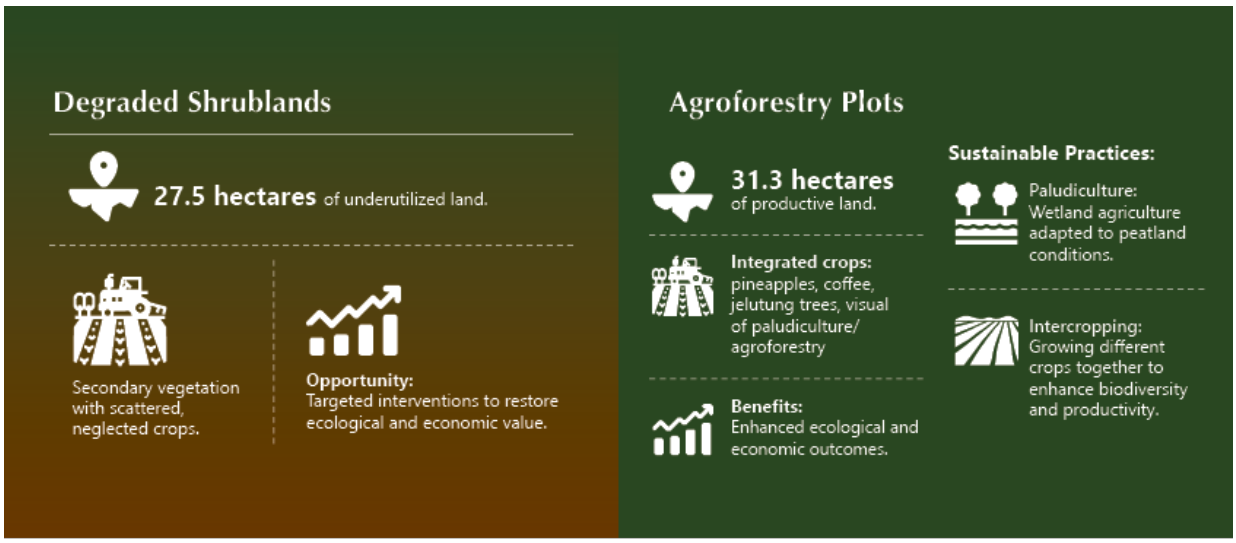
Capacity Building & Knowledge Sharing

Peat-IMPACTS invests in training future peatland scientists and practitioners through the Peat Research Incubator, equipping young graduates from local universities with skills to address peatland challenges. The ALLIR framework (Assessment of Landscape and Livelihoods to Increase Resilience) is applied to develop sustainable peatland roadmaps for 61 villages across Sumatra and Kalimantan, helping communities assess challenges and build resilience.

To scale up knowledge dissemination, the project leverages WikiGambut, an online platform offering accessible information on peatland ecology, management, and research. Additionally, #PahlawanGambut, a social media campaign, raises public awareness and mobilizes action for peatland conservation.

Peatland Restoration: A Collaborative Effort Between FINCAPES and IPB University

FINCAPES, with IPB University, launches a peatland restoration initiative in Sungai Gelam, Jambi, employing Nature-based Solutions. This program integrates research, capacity building, and implementation to build a replicable model, balancing ecological recovery with community benefits. Expanding to Pangkal Babu for mangrove conservation, FINCAPES delivers dual ecological and socio-economic impact. In Sungai Gelam, restoration efforts target two primary land-use types:



The peat soil in Sungai Gelam, over 4.7 meters thick and composed of sapric and hemic layers, highlights its ecological importance but requires careful hydrological management to prevent degradation and carbon emissions. The region's socio-economic dynamics, with communities primarily reliant on agriculture and earning between IDR 800,000 and IDR 2,390,000 monthly, underscore the need for livelihood diversification through sustainable practices.

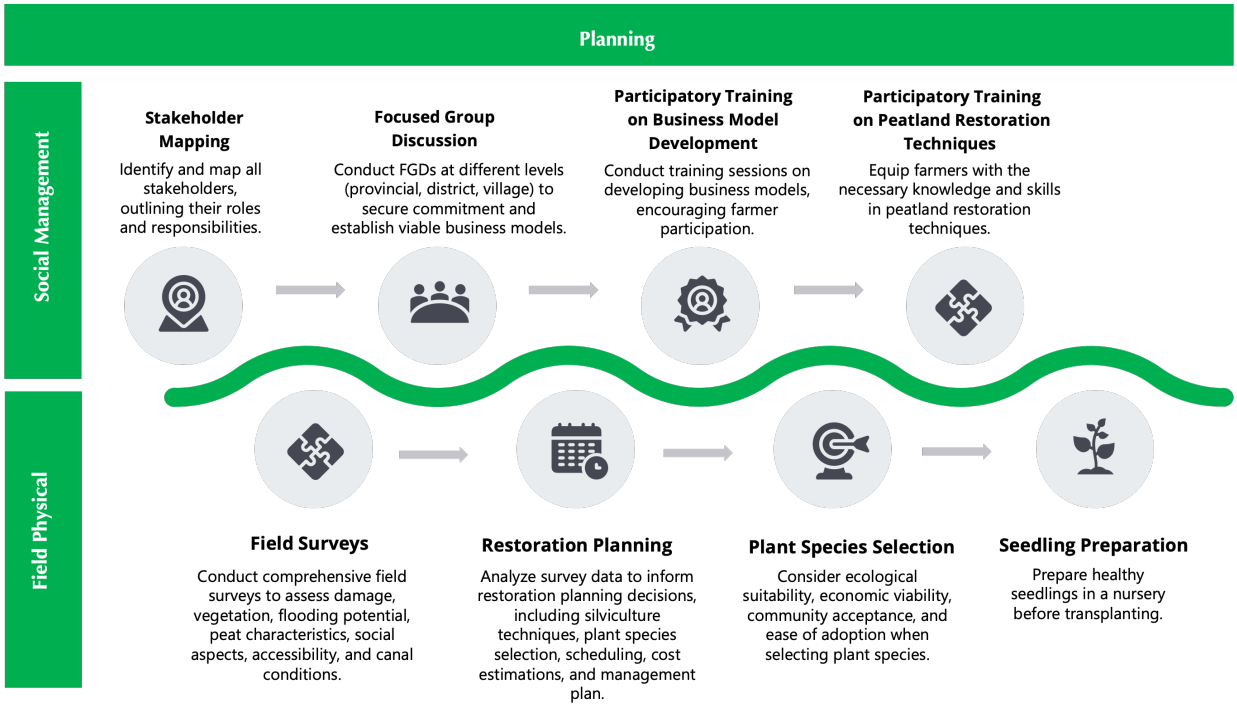
Despite the challenges, restoration efforts in Sungai Gelam are supported by promising socio-economic conditions, including the community's openness to alternative livelihoods like agroforestry and the use of canal systems for hydrological management. These factors position Sungai Gelam as a valuable demonstration site for integrating ecological restoration with socio-economic upliftment through inclusive, science-driven interventions.

Key Insights: Guide to Good Practices

Recognizing the common challenges faced by the FINCAPES/IPB project in Sungai Gelam, this section draws upon the successful frameworks of BRIN's 3R and CIFOR-ICRAF's Peat-IMPACTS projects. These experiences provide a practical guide for planning, implementing, and monitoring peatland restoration, emphasizing the integration of science, community engagement, and innovative techniques like paludiculture and agroforestry.

Peatland Restoration Planning

Effective peatland restoration requires careful planning that integrates both social and ecological considerations, which are crucial for ensuring the success and sustainability of restoration initiatives.



Peatland restoration must start with clear objectives and defined stakeholder roles to ensure collaborative efforts and tangible benefits for all involved. Generating income for farmers and engaging the private sector is crucial for developing sustainable business models, value chains, and market opportunities. To ensure equitable and sustainable economic opportunities, Gender Equality and Social Economy Inclusion (GESEI) principles must be embedded at every stage.

Stakeholder mapping should actively engage women's groups, indigenous communities, and marginalized farmers in decision-making. Focused Group Discussions (FGDs) should incorporate gender-disaggregated data to assess the needs of different groups. Business model training must prioritize women's participation, integrating livelihood opportunities for female-headed households and marginalized farmers. Similarly, restoration technique training should be accessible to women and youth, equipping them with skills in nursery management, planting, and fire prevention. Field surveys and restoration planning should assess social impacts, land access, and economic participation, ensuring selected species align with both ecological and market potential.

Social and Economic Considerations in Peatland Restoration

A comprehensive socio-economic study in the project area should further examine how women's roles in restoration efforts—particularly their involvement in decision-making, income-generating activities, and leadership positions—can be strengthened. Ensuring gender-inclusive participation in these activities is crucial for enhancing women's contributions to ecosystem recovery while boosting their economic resilience. Additionally, integrating a gender equality and social inclusion perspective into the Cost-Benefit Analysis (CBA) will provide a holistic assessment of the economic feasibility of restoration initiatives. This approach will ensure that financial returns, long-term benefits, and overall sustainability equitably benefit all local communities, making conservation efforts both ecologically sound and economically viable.

Peatland Restoration Implementation & Monitoring

The technical implementation process involves the following stages:

Before commencing on-the-ground restoration, it is essential to ensure that sufficient human resources, materials, and equipment are available to facilitate smooth field operations. Seedlings must be prepared in advance, ensuring they are healthy and ready for successful transplanting.

Field implementation should align with the agreed-upon business model, ensuring that all stakeholders—including local communities, women, and marginalized groups—actively participate in the process.

Regular monitoring and evaluation of restoration activities is critical to maintaining adherence to the established schedule and expected outcomes. This allows for early identification and resolution of challenges, ensuring that restoration progresses effectively.

Monitoring should cover both biophysical aspects and stakeholder collaboration, incorporating a GESEI-sensitive approach to ensure that commitments made during FGDs are being upheld equitably. This includes:

- Biophysical Aspects for Monitoring:
  - Plant growth success – Tracking seedling survival and health across different restoration sites.
  - Peatland water level monitoring – Ensuring the water table remains stable to support peatland recovery.
  - Subsidence measurement – Monitoring peatland stability to prevent long-term land degradation.
- GESEI-Sensitive Stakeholder Monitoring:
  - Equitable participation – Ensuring women, youth, and marginalized groups are actively involved in restoration activities.
  - Benefit distribution – Tracking whether livelihood opportunities and economic benefits are reaching all groups fairly.
  - Decision-making inclusivity – Assessing how gender-balanced leadership and representation are maintained in restoration governance.

Conclusion

Peatland restoration benefits from a multifaceted approach that aligns with regulations and emphasizes stakeholder engagement. Activities should prioritize research, education, ecotourism, and carbon trading while fostering collaborative business models, capacity building for farmers, and adherence to silviculture techniques. Continuous monitoring and evaluation are essential for success, ensuring effective implementation and long-term sustainability.

As a critical step toward Indonesia's environmental goals and global climate commitments, sustainable peatland management supports ecological conservation, local livelihoods, and food security. Lessons from past initiatives underscore the importance of integrated planning, community participation, and innovation. Collaboration among government, communities, researchers, and the private sector is vital to achieving lasting success in peatland restoration efforts.

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About FINCAPES

The Flood Impacts, Carbon Pricing, and Ecosystem Sustainability (FINCAPES) project is a collaborative, gender-responsive initiative funded by the Government of Canada. Over a 5.5-year period, jointly undertaken by the University of Waterloo's Faculty of Mathematics and Faculty of Environment, the project supports Indonesia in adapting to climate change, mitigating its impacts, and conserving biodiversity in a socially and economically sustainable manner. Aligned with Indonesia's priorities, FINCAPES enhances the nation's capacity in key areas: forecasting and mitigating financial impacts of climate-change-induced floods, promoting Nature-based Solutions for peatland and mangrove restoration, and strengthening climate finance policy frameworks with a focus on carbon financing mechanisms.

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