EVIDENCE-BASED POLICYMAKING FOR HAZE AND CLIMATE NATURE-BASED SOLUTIONS IN SOUTHEAST ASIA'S PEATLANDS

RECOMMENDATIONS:

1. *Enhance evidence-based peatland management practices across scales and borders through quantifying uncertainty, increased transparency of scientific data, and including complementary community inputs*
2. *Constructively engage with data uncertainty by adopting carbon accounting approaches foregrounding uncertainty and peatland community buy-in*
3. *Value broader sustainability benefits of peatlands in decisions, particularly those which support long-term community interests and participation*

CONTEXT:

Importance of tropical peatlands: Peatland ecosystems in Southeast Asia are globally significant carbon stores, rich in terrestrial and aquatic fauna and flora, and important sources of livelihood for local communities. However, agribusiness-driven land-use change and drainage cause peatland degradation, leaving peatlands prone to fires that generate "haze" air pollution, causing significant economic losses and health impacts. Disturbed peatlands also become substantial sources of greenhouse gas (GHG) emissions, driving climate change. Due to their importance for sustainable development, peatlands are a focus of policymaking, particularly in countries with large peatland areas, such as Indonesia and Malaysia (Figure 1).

Trends in policymaking: At the national and regional levels, peatland policy has shifted from an initial focus on conservation, to mitigating fires and haze, and currently to integrating peatlands into national climate and biodiversity strategies and targets within global governance frameworks like the Paris Agreement and the Global Biodiversity Framework. Land-based carbon emissions and removals appear to be crucial considerations for countries with substantial peatland areas in progress towards long-term national goals of "net zero" GHG emissions. However, data related to tropical peatlands can be limited and contradictory, which can weaken policy and governance decisions.

METHODOLOGY: Our study explores gaps related to the current status of scientific data, and the incorporation of community knowledge, for policymaking in Southeast Asia's peatlands, through:

- Analysis of open-access peatland-related datasets across Indonesia and Malaysia, including overlay and uncertainty visualisation of geospatial datasets.
- Hybrid workshop with peatland experts from NGOs, academia, and government from Indonesia, Malaysia, and Singapore
- Policymaker and policy-adjacent stakeholder interviews in the same three countries
- Focus Group Discussions (FGD) with peatland community representatives in Kuala Selangor, Malaysia and Limbung, Indonesia (marked in Figure 1).

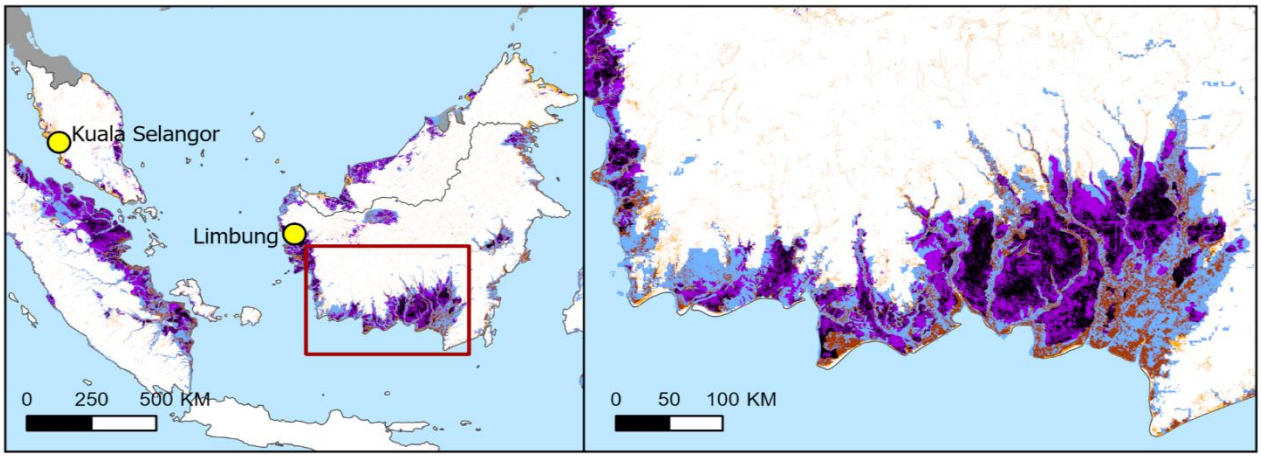

Figure 1: Map illustrating the large differences in peatland extent among three widely used spatial datasets for Indonesia and Malaysia. The areas where all three datasets agree are in black. Yellow dots indicate this project's fieldwork sites.

Our findings highlight opportunities to inform action towards achieving net-zero and other sustainability goals. This policy brief summarises key findings from our project outputs (details at the end).

FINDINGS & DISCUSSION: GAPS IN THE USE OF EVIDENCE FOR POLICYMAKING

Gap 1 - Magnitude of Uncertainty in Data for Peatland Management: Mapping peatland areas provides a foundation for policymaking. Our analysis (e.g., Figure 1) indicates substantial uncertainties in peatland extent among geospatial datasets. GHG emission calculations, which depend on accurate estimates of peatland extents, are another key form of data that could inform peatland policy, and that are also uncertain. For example, the UNEP Peatland Assessment ranked Indonesia and Malaysia as the first and fourth largest contributors to estimated global emissions due to peatland decomposition. Both countries note the significant contribution of peatland decomposition to national emissions. However, UNEP estimates are higher than those presented in the latest national Biennial Transparency Reports (BTR) (bottom row of Table 1) of Malaysia and Indonesia. We calculate that if the UNEP values replaced the values in the national emission inventories, national total net emissions (top row) would increase by 14% in Indonesia and by 34% in Malaysia.

*Table 1: National reported GHG emissions and removals (rounded to the nearest $MtCO_{2e}$) from the latest available year in the BTRs published in 2024, focusing on the LULUCF sector where peatlands contribute to emissions. The * values indicate the UNEP Peatland Assessment estimates.*

GHG Emissions Category	Indonesia BTR (2022)	Malaysia BTR (2021)
Total net emissions	**1383**	**107**
Land use, Land use change & Forestry (LULUCF) sector	312	-222
LULUCF - Forest Land category	*-267*	*-258*
LULUCF - Emissions from loss of organic soil (i.e., peatland decomposition)	*479 (*668)*	*54 (*90)*

We found that for Malaysia, the use of a lower implied emission factor in its BTR than in the UNEP report resulted in lower reported emissions. For Indonesia, the UNEP estimate is increased by assuming a larger peat area than is used in the national BTR. Overall, GHG emissions estimates reflecting differing methodologies and assumptions contribute to variability in reported emissions, with major challenges including:

- Varying and poorly mapped peat depth, bulk density, and concentration of organic carbon affect peatland extent and carbon stock estimates
- Natural spatial heterogeneity complicates the extrapolation of local-scale emission measurements across large areas or unmeasured sites
- Temporally fluctuating groundwater table and the dynamics of microbial activities reduce the accuracy of short-term emission measurements

Policies that ignore data uncertainty risk leading to poor (and potentially) biased decisions. For GHG emissions, there are risks of lower confidence in peatland's potential role in meeting reduction targets, and to the integrity and success of projects generating peatland carbon credits. Challenges include:

- Uncertainties and mismatches in jurisdictional and biophysical boundaries, and a lack of clear land tenure, can result in policies that do not support the natural hydrology of peatlands
- Limited access to "official" spatial data can cause stakeholders to use a variety of inconsistent and non-standard datasets in scientific analyses, and for management decisions

Gap 2 - Under-Valuing of Community Knowledge: Policymakers and policy-adjacent stakeholders interviewed for our project opined that climate change is too "complicated" for peatland communities to understand. The communities participating in our FGDs agreed; however, they do have a clear understanding of the causes of fires in peatlands and their resultant effects on their health and livelihoods.

Official documents like the Indonesian Government Regulation No. 71/2014 on Peat Ecosystem Protection and Management and Malaysia's National Action Plan for Peatlands acknowledge that peatland communities have a fundamental right to express their views, be listened to, and directly participate in and influence decisions that affect their lives and livelihoods. However, our findings revealed that local wisdom is often given less priority and visibility compared to scientific knowledge, and these communities tend to be excluded from the decision-making process. Such top-down approaches hinder community buy-in and can result in unintended outcomes like:

- Indonesia's fire bans have made communities wary of using fire to clear land, despite this practice being rooted in traditional wisdom. Peatlands are left to accumulate flammable biomass, increasing risk of fire
- Mistargeted funding and interventions can result in an over-focus on fire-fighting rather than fire prevention, community members becoming reliant on wages from restoration projects, and a lack of infrastructure and support for alternative livelihoods, like eco-tourism (Siman et al., 2021)

RECOMMENDATIONS: The precautionary principle posits that the lack of scientific certainty should not be used as a reason for postponing measures to anticipate, prevent, or minimise environmental harm. Furthermore, given the already long-standing scientific efforts to measure peatlands, uncertainty in peatland data is unlikely to be quickly resolved through further measurement alone. Our recommendations focus on addressing the identified gaps through the supplementary and complementary use of (uncertain) scientific and community-based evidence for more effective peatland policy and management.

Recommendation 1: Enhancing data practices across scales and borders

Our analysis reveals that a key challenge in policymaking in peatland landscapes is not the lack of data, but in determining which dataset is most "fit for purpose" and in incorporating uncertainty within datasets into an overall evaluation of evidence. Treating spatial estimates of peatland properties more like statistical outputs, with error margins and uncertainty bounds, can help in supporting robust and consistent analyses of, and planning for, peatlands. Transparency in explaining and justifying dataset selection and methodologies can also help to clarify the state of evidence being used to support national and corporate decision-making concerning the sustainability of peatlands.

If available data is not fit for purpose, it should be supplemented. Supplementary evidence can come from community-led monitoring, data collection, and validation. Such a participatory approach can foster data accuracy, ownership, and culturally appropriate information. It ensures context-specific interventions, builds trust in community-managed areas, and supports sustainable stewardship through verified, locally-relevant data (Box 1).

Concerted efforts to enhance peatland data practices can be considered at the regional, national, and sub-national scales. As a starting point, the ASEAN Peatland Management Strategy 2023-2030 encourages harmonised data practices in the region and data sharing across member states. Such data harmonisation can support the inclusion of credits derived from sub-national peatland projects into regional carbon markets, as discussed below.

Box 1: Community case studies

- *In Ogan Komering Ilir district in South Sumatra and Pulang Pisau district in Central Kalimantan, contributions from the community played an essential role in developing Indonesia's Peat Fire Danger Rating System (Robins et al, 2022).*
- *Exploratory surveys among peat communities in Perak and Selangor in Malaysia revealed that 74% of community members sincerely wanted to contribute to peat conservation through community-based management (Nath et al., 2016).*

Recommendation 2: Constructively engaging with data uncertainty

Generating carbon credits from protecting and restoring peatlands and incorporating them into local and international carbon markets has been highlighted as an important opportunity for Southeast Asian countries to generate financial revenue and to meet climate and wider sustainability objectives. However, to date, there have been fewer carbon projects in peatlands than might be expected based on the large potential emission reductions. Claims of future carbon performance are complicated by uncertain baselines and ambiguous intervention outcomes, which can hinder quality assessments and lead to integrity risks such as over-crediting.

"...in September 2024, the Singapore Government sought to identify projects from around the world that could generate high-quality [Nature-based Solution] carbon credits with high environmental integrity" - National Climate Change Secretariat Singapore

Major Southeast Asian economies are currently developing their own carbon markets. Singapore started the first carbon exchange, Climate Impact X, in 2021, which was followed by Malaysia's Bursa Carbon Exchange and the Indonesia Carbon Exchange in 2023. This formative stage presents an opportunity to adopt

approaches that foreground uncertainty and are more grounded in the precautionary principle (Box 2). Such approaches are likely to reduce risks to the integrity of outcomes and to confidence in the value of peatland projects. They could inform the development of an ASEAN Common Carbon Framework that started in 2023 with active engagement by the ASEAN Alliance of Carbon Markets, a private-sector, civil society-led initiative (Seah et al, 2025).

Box 2: Proposed approaches foregrounding uncertainty in carbon credit projects and markets

- *Issuing credits based on retrospective analyses of a project's actual impact and additionality, instead of predictions of future performance (Swinfield et al., 2024; Delacote et al., 2025)*
- *Designing stratified carbon markets by separating more uncertain (higher risk) credits as being ineligible for use in offsetting emissions (Filewod et al., 2023)*
- *Shifting from commodified carbon accounting (i.e. paying for tonnes of carbon) to models that pay for ongoing delivery of sustainability and ecosystem "services" that support the resilience and expected carbon outcomes of a landscape (Wells et al. 2023)*

As many peatland carbon projects depend heavily on the buy-in of peatland communities, more community-friendly (i.e., quicker, less technically challenging) approaches to Monitoring, Reporting, and Verification (MRV) processes could also help to ensure that promised revenue from credits to the communities involved is not delayed or (partially) denied (Indriatmoko et al., 2014).

Recommendation 3: Valuing broader sustainability benefits

The benefits of effective peatland interventions in Southeast Asia extend beyond carbon markets, with the potential to yield substantial but hard-to-quantify additional benefits. Such "co-benefits" are represented in some current valuation frameworks, such as Verra's Climate, Community and Biodiversity (CCB) Standard, but even these treat carbon as the primary quantification and outcome, with co-benefits affording an optional premium.

During our fieldwork, the word "berkelanjutan", which translates to sustainability, frequently came up in stakeholder interviews and community FGDs. However, both groups had different interpretations of the term, with policymakers generally referring to the sustainability of ecosystem services or the environment, while peatland communities often discussed the sustainability of programs and assistance provided by external parties, alongside income certainty. The community sentiment appears to align with a "contributions" based approach to peatland interventions, which moves away from an emphasis on projects framed narrowly around precise but uncertain quantification of carbon outcomes (i.e. tonnes for dollars). Therefore, we recommend that policies and governance mechanisms for peatland areas should not be over-dependent on their carbon potential alone. Embedding more locally-relevant biodiversity indicators, fire risk metrics, and socio-economic data into assessments of management and project effectiveness can enhance alignment with the Sustainable Development Goals and improve intervention legitimacy among community stakeholders.

"Sustainable" interventions in peatlands could then be framed as supporting long-term community participation, to empower peatland community livelihoods, with other outcomes like ecosystem services, biodiversity conservation, and indeed GHG emissions reductions, as co-benefits. For example, as fire and resulting haze pollution in peatlands are typically human-driven, fire risk reduction interventions can contribute directly to the livelihood sustainability of peatland communities, while engaging communities through a more locally relatable issue.

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