BRIEF

Community Mangrove Forest Management Plans

Advancing Sustainable Planning

THAILAND

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Landesa

RECOFTC

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Landesa
1601 Fifth Avenue, Suite 1900
Seattle, WA
United States

AUTHORS

Juan Robalino – Climate Change and Land Tenure Specialist at Landesa

Matteo Bonetto – Forest Tenure Specialist at Landesa

KEY TECHNICAL CONTRIBUTORS & REVIEWERS

Rawee Thaworn – Capacity Development and Research Coordinator at RECOFTC

Sorawitch Thammarativong – Research Officer at RECOFTC

Peeruch Pommirat – Project Officer at RECOFTC

Rachel McMonagle – Climate Change Program Director at Landesa

Nayna Jhaveri – Senior Research and Evaluation Advisor at Landesa

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Executive Summary

Thailand has demonstrated growing commitment to sustainable forest management through its community forestry (CF) framework, including applications in mangrove forest management. However, the current planning process as part of the CF registration process—driven largely by standardized forms that do not adequately link proposed forest activities to the unique contexts, priorities, and needs of communities—limits the ability to design effective, sustainable mangrove land and resource-use and management plans. This challenge is compounded by the absence of a shared understanding of what constitutes a comprehensive and sustainable forest management plan. As a result, opportunities to meaningfully use available information to align local activities with broader national and international development and environmental conservation goals are often missed.

In the face of climate change, growing climate variability, and shifting ecosystem services, resource use planning must go beyond simply defining permissible activities, as is currently the case when developing Community Forest Management Plans. A planning process that truly supports sustainability requires assessing land productivity and ecosystem condition as shaped by the interaction of climate, ecological processes, and human activities, particularly under changing climate conditions. It also requires understanding historical land use dynamics and anticipating future changes in resource quality and availability. Only by recognizing these cross-scale interactions, their potential synergies, and their trade-offs can resource use planning genuinely advance sustainable outcomes for all stakeholders and the environment.

Building on Landesa's collaboration with RECOFTC-Thailand—under a Memorandum of Understanding with the Department of Marine and Coastal Resources (DMCR) to strengthen stakeholder capacity for coastal mangrove conservation and improved mangrove health—this brief presents a practical and innovative pathway for moving toward community mangrove forest management plans. It demonstrates how traditional planning processes can be strengthened through the explicit integration of climate risk analysis and future landscape variability using accessible online decision-support tools. In doing so, it turns existing planning frameworks into forward-looking, actionable tools tailored to coastal and mangrove ecosystems, supporting government officials, communities, and local civil society organizations working on sustainable community-based mangrove management.

Drawing on the experience gained from two of the 13 target sites where community forest registration processes are being supported by Landesa, this brief illustrates how these tools—and their combined application—generate evidence that can inform mangrove forest management plans in the context of climate and environmental stressors, as well as the status of ecosystem services and biodiversity. These factors directly influence the viability of community economic activities and provide a referential framework to maximize the benefits from mangrove forests. Ultimately, building on Landesa's experience, this brief demonstrates how using these tools and results has enabled Landesa to strongly advocate for positioning mangroves as nature-based resilience systems that reduce climate risks, safeguard biodiversity, and strengthen climate-resilient livelihoods.

Introduction

In 2019, the *Community Forest Act B.E. 2562* (2019) was enacted in Thailand, granting formal rights to communities to manage and use community forests and providing a legal foundation for participatory decision-making mechanisms. The Act formalized community forests that had already been functioning for several years, with the overarching objective of ensuring that people and communities benefit from forests while managing them sustainably, with a strong emphasis on environmental conservation. Community forestry enables communities to engage in the conservation, rehabilitation, management, maintenance, and use of natural resources, the environment, and biodiversity, in coordination with pertinent government authorities (RECOFTC, 2021).

The authority for Community Forest (CF) registration rests with the Royal Forest Department (RFD) for terrestrial forests and with the Department of Marine and Coastal Resources (DMCR) for mangrove forests. Under the *Community Forest Act*, communities seeking registration of terrestrial CFs are required to prepare and submit a Community Forest Management Plan (CFMP) to the RFD. While the *Community Forest Act* represents Thailand's most significant legislative recognition of community-based forest management and has influenced broader community forestry approaches, mangrove community forests are governed through a distinct legal and administrative framework under section 16 of the *Marine and Coastal Resources Management Promotion Act B.E. 2558* (MCRMA, 2015) and related DMCR regulations. Section 16 promotes the participation of coastal communities in the management, planting, maintenance, conservation,

restoration, and sustainable use of marine and coastal resources. Under this framework, communities develop a Community Mangrove Forest Project for approval by the DMCR, typically covering a 10-year implementation period. Unlike the CFMP required for terrestrial community forests, the Community Mangrove Forest Project functions primarily as an activity and implementation plan, outlining objectives, management activities, responsible actors, and expected outcomes, rather than serving as a comprehensive area management planning instrument. Mangrove CFs should therefore be understood within Thailand's marine and coastal resource governance system led by the DMCR, rather than solely through the framework established by the Community Forest Act.

In 2023, Thailand launched its *National Biodiversity Action Plan B.E. 2566–2570* (2023–2027), strategically designed to guide the country's comprehensive efforts to protect, conserve, and promote the sustainable use of biodiversity. The Action Plan aligns with and translates the Kunming–Montreal Global Biodiversity Framework (GBF), adopted in 2022 at the 15th Conference of the Parties to the Convention on Biological Diversity, as well as the Sustainable Development Goals (SDGs). Under Target 2, the Action Plan aims to conserve, restore, and expand Protected Areas and to increase Other Effective Area-Based Conservation Measures (OECMs) to enhance ecosystem integrity and connectivity (Office of Natural Resources and Environmental Policy and Planning, 2024).

In line with these policy directions, the DMCR is developing a framework for Locally Managed Marine Areas (LMMAs) to be recognized as OECMs. This initiative seeks to advance community-led marine and coastal conservation as a means of expanding effective area-based conservation beyond formally designated protected areas, in support of national biodiversity targets and related international commitments. At the same time, the LMMA framework could provide a mechanism to further operationalize and strengthen the implementation of Section 16 of the *Marine and Coastal Resources Management Promotion Act B.E. 2558* (2015) by enabling more structured participation of coastal communities in the conservation and sustainable use of marine and coastal resources. In this context, CFMPs could serve as a practical planning instrument for integrating mangrove community forests into the LMMA framework and supporting more systematic approaches to management, monitoring, and conservation.

Although the framework is still under development, the proposed criteria, procedures, and operational pillars of LMMAs closely align with established Community Forest approaches. In particular, the LMMA registration process is expected to require community regulations governing resource use and access, as well as an area management plan. As such, the LMMA framework may provide an institutional entry point for the use of CFMPs within mangrove community forest areas, addressing a gap in existing planning arrangements while supporting more systematic management, monitoring, and conservation.

Currently, communities participating in the Community Mangrove Forest Project under DMCR are provided with standardized planning forms that allow them to outline management activities in general terms. However, these forms do not require communities to link planned activities to their specific contexts and needs. In addition, communities often lack the capacity to develop practical

and effective management plans that align both their local priorities and the principles of sustainable forest management. Consequently, the use of existing and readily available tools becomes imperative in the planning process, particularly when seeking to align forest management planning with sustainability objectives.

Landesa's Coastal Livelihoods and Mangroves Program

Landesa, through its **Coastal Livelihoods and Mangroves Program**[1], is strengthening coastal land tenure rights in the Bay of Bengal (Bangladesh and India), Southeast Asia (Myanmar, Thailand, Cambodia, Malaysia and Indonesia), and Africa (Kenya and Tanzania). This ambitious program aims to sustain livelihoods, conserve mangrove forests, and mitigate climate change through context-specific and gender equality and social inclusion (GESI) responsive activities in each country. These include policy advising, legislative support, community assessments, forest cover mapping, and locally led climate adaptation and mitigation.

In Thailand, Landesa has a Memorandum of Understanding (MoU) with the DMCR aimed at strengthening stakeholder capacity for coastal mangrove conservation and improved mangrove health. As part of this collaboration, Landesa conducts supportive research on mangrove conservation, management, and sustainable use of mangrove resources, working closely with partners on research design, training in new methods, and the provision of technical assistance to local stakeholders.

Under this MoU, Landesa has partnered with RECOFTC-Thailand to, among other activities, support the development of CFMPs for Community Forest registration in mangrove areas. This work is carried out within a framework that promotes biodiversity conservation and sustainability, climate action, and GESI.

Brief Objective

The primary objective of this brief is to provide practical direction for sustainable forest management planning when developing CFMPs for CF and/or LMMA registration in mangrove areas in Thailand. The brief serves as a core technical reference for government officials, and local civil society organizations supporting the design and implementation of community-based mangrove use and management plans. For community outreach, Landesa and RECOFTC-Thailand have developed complementary materials and activities such as community consultations and simplified summaries to ensure equal and meaningful knowledge sharing.

This brief showcases the use of currently available online tools and their application in developing CFMPs to support the Community Forest registration of two communities, Ban Khok Khai (Moo[2] 1) and Ban Tha Sanook/Tha Kleang (Moo 3), located in Marui Sub-District, Thap Put District, Phang Nga Province, as part of Landesa's work in Thailand.

[1] https://cdn.landesa.org/wp-content/uploads/Coastal-Livelihoods-and-Mangroves-Project-brochure.pdf
[2] Village.

Toward Sustainable Forest Management Plans

In Thailand, according to the *Community Forest Act*, community forests are managed through a CFMP. This plan is the main document that allows a community forest to be established and outlines how the forest will be used. While the Act does not detail the specific contents that the management plan must include, it does require the plan to determine areas for conservation—whether the community forest is for conservation only—or to demonstrate that forest use is aligned with the geographical and living conditions of the community. The plan must show how the community will conserve, rehabilitate, or monitor the environment, biodiversity, and natural resources in both conservation and use areas (RECOFTC, 2021).

The Act does not provide details on the management plan format, nor does it offer guidance to communities for developing the plan. However, the Act identifies the main activities that can be carried out by community forest members, as well as those that are prohibited. According to the Act, community members may: enter the community forest for recreation; benefit from products and services, such as collecting forest products and using timber and other resources for normal household use or public activities; and use the forest for educational and awareness-raising purposes. Community members may not: reside in the forest or make a living from it; clear, burn, or mine; hunt protected animals or degrade the forest; use timber beyond subsistence household or community needs; or construct buildings, unless necessary for community forest activities, such as fire lookout towers (RECOFTC, 2021).

While the *Community Forest Act* has historically played an important role in establishing the framework for community forestry, including requirements related to community forest planning, the governance context for mangrove forests has evolved and is evolving differently, particularly considering DMCR's LMMAs. Since 2002, responsibility for most mangrove forests has been transferred to DMCR. As a result, the responsible authorities, applicable regulations, and management requirements for mangrove community forests differ from those established under the Community Forest Act. Therefore, while the *Community Forest Act* provides an important reference point for understanding community forestry planning in Thailand, mangrove community forest management is currently embedded within Thailand's marine and coastal resource governance system, where planning and management processes are currently and expected to be guided by DMCR mechanisms that reflect the specific context of coastal ecosystems.

Yet, the driving force for developing CFMPs under these frameworks is the need for improved forest management. Consequently, the planning process is mostly influenced by clarifying which activities can and cannot be conducted, and where, in the immediate timeframe, with an emphasis on conservation. However, an understanding of the long-term productive potential of forests and their ecosystem services, as well as their potential future changes, is not integrated. This is a key component when moving toward sustainable forest management.

According to the United Nations, sustainable land management is the use of natural resources for the production of goods and services that meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their

environmental functions. Sustainable land management involves a holistic approach to soil and water conservation, natural resource management, and integrated landscape management, seeking to achieve productive and healthy ecosystems by integrating social, economic, physical, and biological needs and values (FAO, 2025a).

Consequently, a sustainable forest management planning process can be understood as one that supports the selection of appropriate resource uses for specific biophysical and socio-economic conditions, facilitating sustainable land management that is essential for minimizing land degradation, rehabilitating degraded land, ensuring the long-term use of resources, and strengthening resilience (FAO, 2025a).

Planning for sustainable forest management would lead to the integration and management of natural resources at a scale that optimizes ecosystem functions and services within a defined landscape (FAO, 2013) (FAO, 2025b). Here, it is important to pause and understand the characteristics of a landscape. A “landscape” is a socio-ecological system that consists of a mosaic of natural and/or human-modified ecosystems, with a characteristic configuration of topography, vegetation, land use, and settlements that is influenced by the ecological, historical, economic, and cultural processes and activities of the area (Scherr, Shames, & Friedman, 2013).

The spatial arrangement of different land uses and cover types (landscape structure), and the norms and modalities of its governance, contribute to the character of a landscape. Depending on the management objectives of the stakeholders of interest, landscape boundaries—especially when dealing with natural resources—can go beyond jurisdictional boundaries and encompass areas ranging from hundreds to tens of thousands of square kilometers (Scherr, Shames, & Friedman, 2013).

In the face of climate change, increasing climate variability, and shifting ecosystem service conditions—factors that extend beyond the boundaries of any Community Forest and reflect complex ecological, social, and economic interactions across the wider landscape—community forest management planning requires more than defining permissible activities. A forest management planning process that cements the pathway to sustainability requires assessing land productivity and condition as shaped by the interaction between ecosystems, climate, and human activities, with particular attention to variability under climate change. It demands an understanding of historical land-use dynamics as well as anticipated changes in the quality and availability of land and natural resources driven by socio-ecological processes and climate change. Only by recognizing these cross-scale interactions, their potential positive synergies, and their possible trade-offs, the forest management planning can effectively support sustainability as sought by different stakeholders.

Enabling Conditions for Sustainable Planning

According to FAO (1993), and on a broader scale and scope, two conditions enable land-use planning. First, the need for changes in land use, or for action to prevent some unwanted change, must be accepted by the people involved. Second, there must be the political will and the capacity to put the plan into effect.

In Thailand, the enactment of the *Community Forest Act* in 2019 reflects more than 20 years of continuous advocacy by local communities and civil society to secure recognition of community rights in forest management as a pathway to sustainability (RECOFTC, 2025). As of 2025, approximately 1.07 million hectares (6.68 million rai) have been formally registered as community forests across Thailand, encompassing 11,984 distinct sites; however, the vast majority of this national figure consists of terrestrial forests. In contrast, mangrove community forests in coastal areas represent only a small subset of the national total, currently numbering 15 formally registered sites covering 1,416 hectares. These remain under the formal jurisdiction of the RFD[3],

[3] These 15 sites remain under RFD jurisdiction because they were originally registered under the RFD's community forestry program prior to the establishment of the DMCR in 2002 and the enactment of the MCRMA in 2015. Their continued legal status under the RFD is maintained through periodic renewal under the CF Act, without which their registration would lapse.

although in practice the DMCR plays the principal role in their day-to-day management and oversight.

Today, in addition to the willingness of local communities to pursue sustainable forest management and the political commitment enabling them to plan and manage forest resources, there are additional considerations or enabling conditions that facilitate sustainable forest management planning. This section explores three key enabling conditions: a sectoral sustainable agenda, secure tenure rights for sustainable land management, and gender-equal participation.

A Sustainable Agenda with Sectoral Commitments

International commitments, national laws, and a sustainable government agenda become true enabling factors for resource management planning only when the state genuinely honors these obligations and implements them in a transparent, accountable, and inclusive manner. Rather than the mere existence of policies, it is this rigorous and verifiable execution that creates an enabling environment for sustainable governance, providing the overarching vision, coherent framework, and clear pathways necessary to balance economic development, environmental conservation, and social equity. The real influence of a state agenda lies in its operational ability to coordinate action across different levels of government and disparate sectors, ensuring that resource management decisions are not taken in isolation but contribute to a holistic, long-term sustainability strategy. When resource management planning is backed by this level of institutional accountability and aligned with broader national, sub-national, or sectoral measures, it strengthens political commitment, enhances inter-agency coordination, and successfully supports the implementation of practical, sustainable resource-use outcomes on the ground.

Providing an example of this alignment, Strategy 1 of Thailand's *National Biodiversity Action Plan* 2023–2027 sets the direction to conserve, restore, and reduce threats to biodiversity in order to maintain ecosystem services. Relevant to mangrove forests, Target 1 aims to reduce the loss of important biodiversity areas, both on land and at sea, through effective spatial planning. More specifically, it aims to reduce by 50% the rate of natural habitat loss on land and in coastal areas (including wetlands, forest areas, mangrove forests, and coastal ecosystems). Consistent with this direction, Target 2 seeks to conserve, restore, and expand protected areas, as well as increase OECMs, to enhance ecosystem integrity and connectivity. It also emphasizes respecting the rights and responsibilities of Indigenous Peoples and local communities in areas under their stewardship or traditional management. In line with this, Target 2 aims to restore at least 30% of degraded natural habitats and ensure that, by 2030, at least 30% of both terrestrial and marine areas are designated as protected areas or OECMs (forests, mangrove forests, beaches, and wetlands) (Office of Natural Resources and Environmental Policy and Planning, 2024).

Aligned with Thailand's *National Biodiversity Action Plan*, as well as Thailand's commitments under the 2030 Agenda for Sustainable Development and the implementation of Sustainable Development Goal 14—to conserve, restore, and sustainably manage marine and coastal ecosystems, including mangroves—the DMCR has set a voluntary commitment to protect 30% of Thailand's coastal area by 2030 (UN, 2025). To advance these commitments, DMCR has

identified LMMAs as a form of marine and coastal resource management that is largely carried out by coastal communities, providing a mechanism to translate national policy directions and legal provisions into practical action. As discussed above, LMMAs provide an institutional opportunity to further operationalize Section 16 of the *Marine and Coastal Resources Management Promotion Act B.E. 2558* (2015) by enabling more structured participation of coastal communities in the conservation and sustainable use of marine and coastal resources and by strengthening the exercise of community management rights and responsibilities. At the same time, the framework may help address existing gaps in mangrove forest management planning by creating opportunities to apply more comprehensive planning instruments, such as CFMPs.

Furthermore, through collaboration between the Thai government and the private sector to conserve, protect, and restore coastal ecosystems for the benefit of society, the environment, climate, and biodiversity, the Thailand Mangrove Alliance[4] (TMA) has set a goal to increase the area of effectively managed and restored mangrove forests in Thailand by 30% by 2030. This goal is to be achieved through an integrated approach that balances environmental, economic, and social sustainability and through coordinated efforts between the public and private sectors (UN, 2025).

Tenure Rights and Sustainable Land Management

Sustainable land-use planning is more likely to thrive in an enabling environment characterized by legal recognition of community forestry and community-driven conservation, as well as simplified administrative mechanisms for securing tenure (Anderson, Schang, & Vidar, 2025). This is because tenure rights, particularly for local communities that depend on land and its resources, help ensure that these resources are protected and that communities can benefit from sustainable land management principles and practices in a mutually reinforcing relationship. Because people inherently value, manage, and conserve land more effectively when they have long-term security of tenure, strong and recognized tenure rights become a vital enabler of sustainable resource management and a key condition influencing planning processes that aim to achieve this outcome (Anderson, Schang, & Vidar, 2025).

Global empirical evidence strongly reinforces this principle, showing that strengthened tenure rights for local communities vastly improve their ability to protect land for sustainable use. For instance, in Colombia and Brazil, deforestation rates in community-owned forests have been reported to be between three and seven times lower than in surrounding areas outside community tenure systems, while other cross-country studies demonstrate that secure land tenure rights consistently reduce both deforestation and forest carbon emissions (Anderson, Schang, & Vidar, 2025).

[4] A national multi-stakeholder network led by DMCR (government) in partnership with Dow Thailand Group (private sector), Blue Renaissance Co. (private sector), and 33 private sector and civil society partners, engaging 700 coastal communities.

The enactment of Thailand's *Community Forest Act* represents a significant domestic step in the direction this global evidence supports, establishing a statutory mechanism to formalize community-led stewardship. Beyond legal recognition and streamlined administrative procedures, states can also support communities in meeting planning requirements by providing technical guidance to help strengthen sustainability and productivity within the framework of community forest regulations and in alignment with broader sustainability agendas.

Gender-equal Participation

Despite efforts to promote the inclusion and participation of all community members, local beliefs about women's and men's areas of expertise and roles can inhibit gender equity, even in resource-use planning processes designed to be participatory. For example, studies have shown that social and structural constraints often limit women's participation in spatial planning and resource management, as these areas are traditionally perceived as within men's domain due to customary and religious norms (Social Impact, 2022).

The value and benefits that women and men derive from ecosystems are equally important, with both contributing to and maintaining various aspects of livelihoods, including health, food security, income, and culture. Both uses are valid and essential, and neither should be overlooked when designing approaches for sustainable management. Importantly, women are not merely vulnerable stakeholders—their experiences, perspectives, and knowledge are powerful resources that must be recognized and incorporated as active participants in formulating innovative solutions (IUCN, 2019) (UNDP, 2024).

Sustainable resource-use planning requires the full and equal participation of all community members. Planning processes that exclude either women or men risk missing crucial knowledge that could be key to developing efficient, long-term solutions. Empowering both women and men to contribute to ecosystem management and to develop innovative approaches ensures that gender barriers are addressed, unlocking new opportunities and benefits for individuals and communities alike, while supporting more effective and sustainable outcomes (IUCN, 2019).

In this context, Thailand's *National Biodiversity Strategies and Action Plans* (NBSAPs) are currently under review, with the objective, among others, of integrating a gender perspective that considers impacts on women and promotes women's leadership in protecting and advancing biodiversity at the local level (UNDP, 2026).

Leveraging Online Tools for Sustainable Planning

Balancing environmental and livelihood priorities, while also accounting for climate change and landscape dynamics, represents a critical step forward from conventional resource-management planning toward sustainable resource-management planning. This step forward requires an understanding of historical land-use dynamics as well as anticipated changes in the quality and availability of land and natural resources driven by socio-ecological processes and climate change. Only by recognizing these cross-scale interactions, their potential positive synergies, and possible trade-offs, resource-management planning can effectively support sustainability as sought by different stakeholders, especially community forests. Today, a variety of tools are available to support sustainability, helping stakeholders integrate complex climate and landscape considerations into planning processes.

Climate Change & Strata

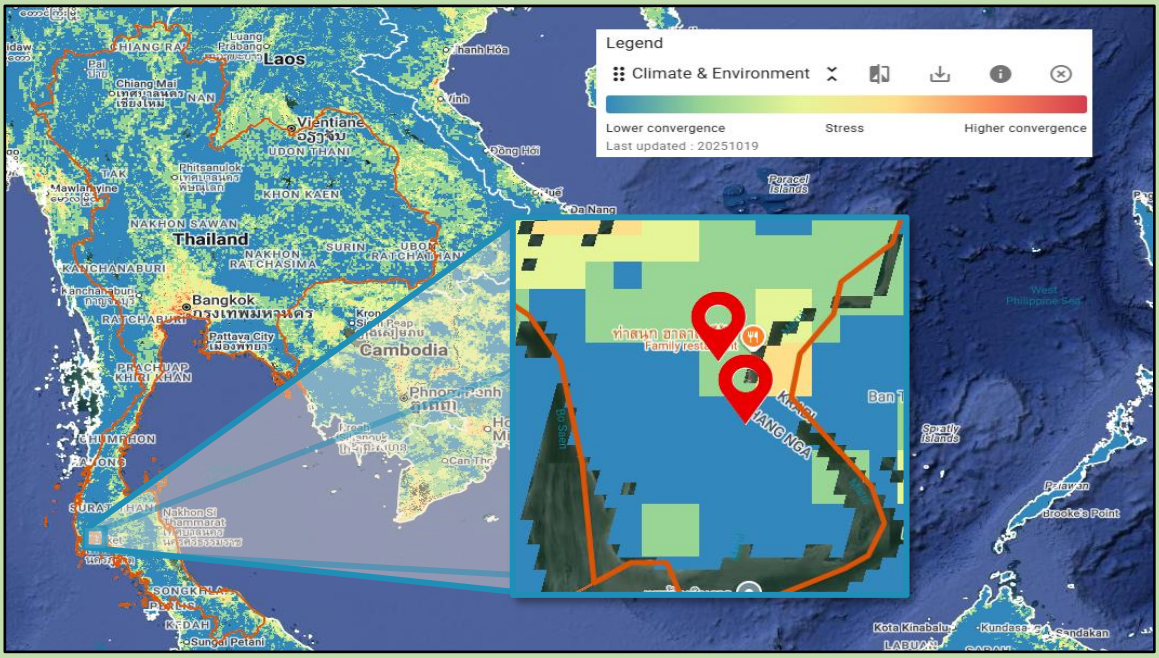
Sustainable resource-management planners require climate and climate change information that enables plans to consider and manage potential environmental impacts. Stakeholders need to understand the risks associated with climate change. Governments, for instance, need to leverage this information to integrate climate change adaptation and disaster risk reduction

measures into land-use planning (Munt & Mireille, 2015) (Denier & et al., 2015). In contexts where tenure arrangements involve the co-management of natural resources, this knowledge is essential not only for communities, who must understand and apply it, but also for government officials responsible for and supporting the planning process. Fortunately, an innovative and easy-to-manage tool that can support stakeholders in understanding climate information and integrating it into planning is currently available.

Strata (strata.earthmap.org/) is an online platform that integrates the United Nations Environment Programme's methodology[5] for mapping climate, environmental, and security vulnerability hotspots with the United Nations Food and Agriculture Organization's Earth Map Platform[6]. Strata simplifies and integrates multiple interdisciplinary data layers to illuminate complex and emerging climate-related security risks. Strata also provides projections for future average temperatures (C°) and precipitation (mm) across two Tier 1[7] greenhouse gas emissions scenarios (Shared Socioeconomic Pathways - SSPs 245 and 585), offering nuanced insights into upcoming temperature trends and enhancing the understanding of climate dynamics.

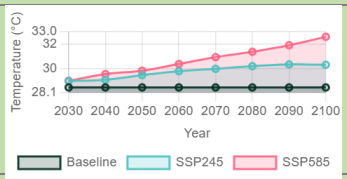
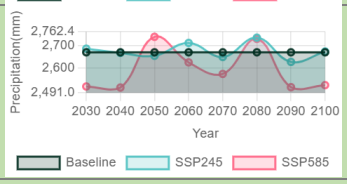
By analyzing climate security, the platform underscores the interconnectedness of climate change, environmental degradation, peace, and security. Among its key objectives, Strata aims to inform and guide the development of policies and programs focused on climate change adaptation, risk reduction, and resilience-building.

Box 1. Strata 2025 results on Ban Khok Khai and Ban Tha Sanook/Tha Kleang villages



[5] Strata: Mapping climate, environmental and security vulnerability hotspots - https://www.sciencedirect.com/science/article/pii/S0962629822002050
[6] https://earthmap.org
[7] International Panel for Climate Change (IPCC) default values and other peer-reviewed literature data.

Box 1. (cont.)

Strata – Climate & Environment Stressors	**Coastal Inundation**	80% area 78% population
	Degraded Land	7% area 6% population
	Heatwave	100% area 100% population
	Risk of Flooding	58% area 60% population
Strata – Socioeconomic Vulnerability	**Irrigation in less than 10% of the area**	100% area 100% population
Strata – Climate Projections	**Average Temp. (°C)**	
	Precipitation (mm)	

Note: Detailed explanations of the indicators are provided in Annex 1.

According to climate and environmental stressors, approximately **80% of the villages' area** is at **risk of coastal inundation**, posing risks to infrastructure, agriculture, and human settlements due to rising sea levels and storm surges. Around **7% of the area is affected by land degradation**, reducing agricultural productivity and ecosystem services, affecting livelihoods and food security. As a matter of concern, **100% of the area is exposed to heatwaves**, which can cause heatstroke, dehydration, and exacerbate existing health conditions, particularly among vulnerable populations. Finally, about **58% of the area is at risk of flooding**, which can damage infrastructure, displace populations, and contaminate water sources, leading to health risks and economic losses.

In terms of socioeconomic vulnerabilities, the **irrigation coverage less than 10% indicator** highlights areas with less than 10% irrigated cropland, suggesting potential vulnerabilities in water resource management and agricultural resilience. For the area, **100% of it is affected by insufficient irrigation coverage**, which can lead to reduced agricultural yields, impacting food security and livelihoods.

Regarding climate projections, and considering both moderate and extreme IPCC scenarios, future estimates suggest an **increase in the annual average temperature**, potentially reaching between 30.33°C and 32.57°C, up from a baseline of 28.52°C by the end of the century. **Precipitation is also expected to become more variable**, potentially ranging from 2,674.22 mm to 2,524.31 mm annually, compared to a baseline of 2,670.74 mm.

By leveraging the Strata tool results, Landesa has been able to showcase how the communities in the area of interest face significant environmental and climate stressors, particularly from heatwaves, flooding risk, and coastal inundation. These results highlight the area's vulnerability to water-related disasters, which is compounded by low irrigation coverage, thereby increasing the risk of food insecurity.

The high risk of impacts from heatwaves, flooding, and coastal inundation in the area of interest has allowed Landesa to suggest and advocate for the consideration of comprehensive disaster risk reduction strategies during the management plan development process, especially climate-resilient solutions and strengthened community capacity for adaptation.

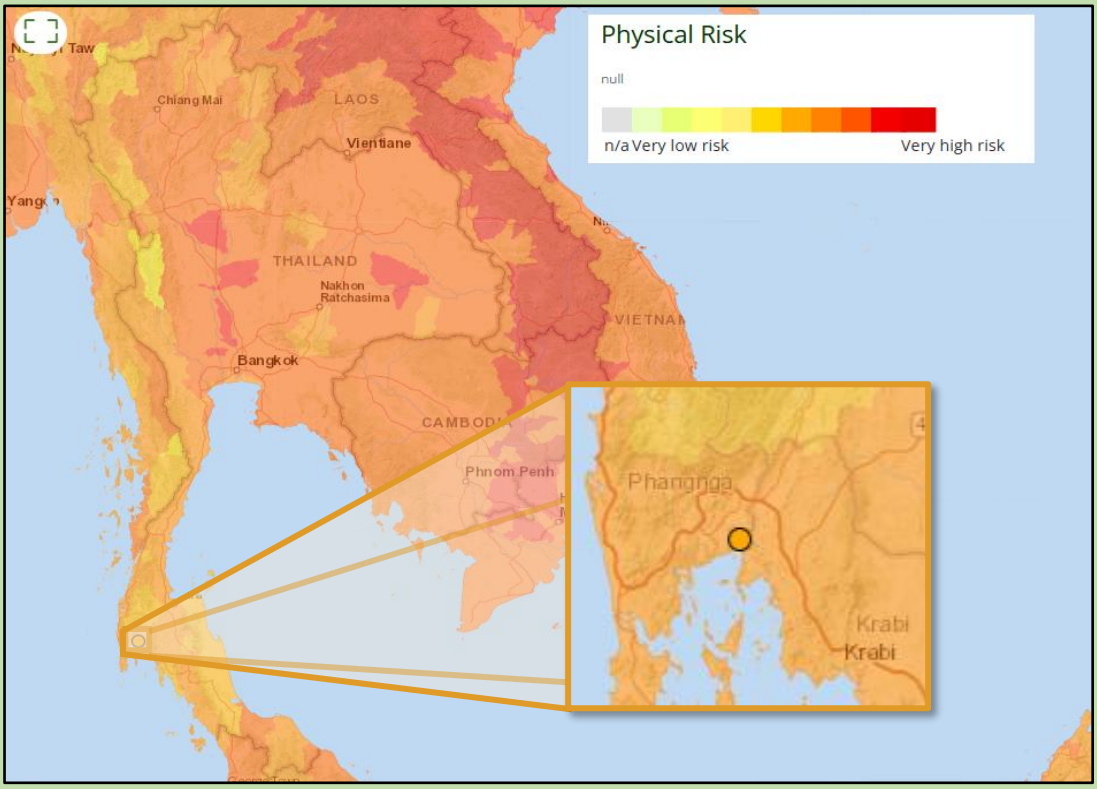
Ecosystem Services & Biodiversity Risk Filter

While sustainable resource-management planning can be understood as *how* people decide to thrive sustainably in a landscape by considering its socio-economic and ecological systems, understanding ecosystem services during this process responds to *what* makes a landscape healthy and productive. Sustainable resource management supports the integrated management of natural resources at scale to optimize ecosystem functions and services within defined landscapes—such as food and agricultural production, economic development, socio-cultural benefits, and ecological regulation (including nutrients, carbon stocks, greenhouse gas emissions, and water flow and supply)—as well as the interactions among these systems (for example, upstream–downstream and terrestrial–aquatic–atmospheric linkages) (FAO, 2025b). Consequently, looking beyond administrative boundaries to understand how communities and people use, affect, and are affected by ecosystem services becomes a necessary step for sustainable resource-management planning.

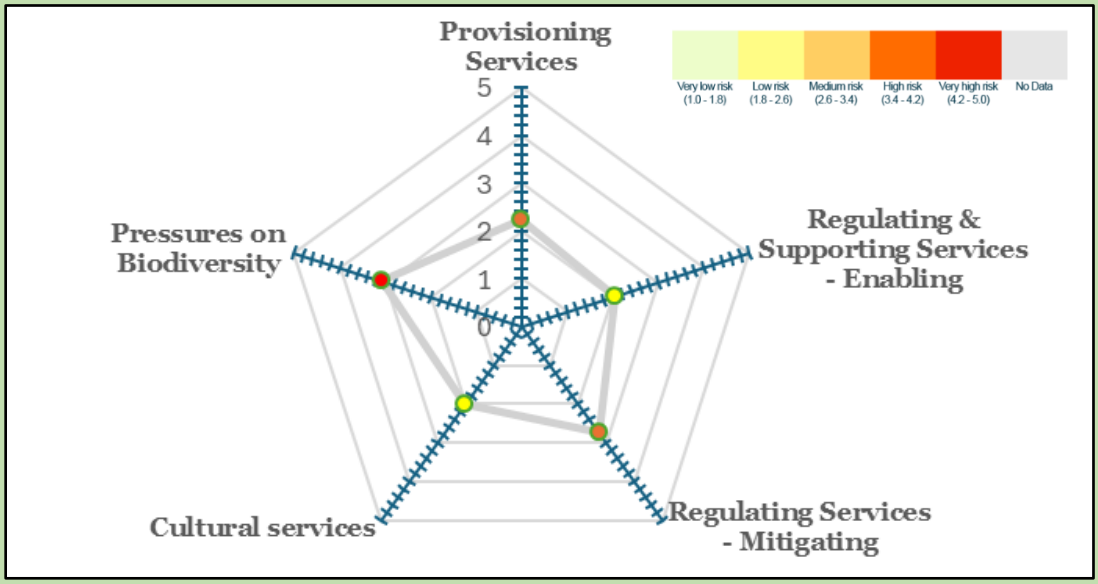
However, understanding ecosystem services and the importance of biodiversity, especially in natural resource-dependent communities, is one of the most challenging aspects of planning. While this process needs to have a scope greater than administrative boundaries, there is also a need for site-level data in order to prioritize actions that mitigate risks and provide the greatest benefits to people and nature (Church, Walsh, & et al., 2022).

The World Wildlife Fund has developed a spatially explicit **Biodiversity Risk Filter** (BRF) (riskfilter.org/biodiversity/home), an online tool that supports stakeholders through their biodiversity stewardship journeys, considering the strong relationship between biodiversity and ecosystem services, as well as the dependence of every economic activity on biodiversity. The BRF has been designed as a location-specific screening and prioritization tool to help stakeholders better assess and respond to biodiversity risks and opportunities across their activities and value chains. To do so, the tool combines a wide variety of data and provides location- and sector-specific biodiversity assessments (Church, Walsh, & et al., 2022).

Box 2. BRF 2025 results on Ban Khok Khai and Ban Tha Sanook/Tha Kleang villages



Physical Risk is driven by the ways in which **economic activities depend on nature and can be affected** by both natural and human-induced conditions of land- and seascapes. It comprises the risk categories: 1) Provisioning Services; 2) Regulating & Supporting Services – Enabling; 3) Regulating Services – Mitigating; 4) Cultural Services; 5) Pressures on Biodiversity. Therefore, **physical risks account for the status of the ecosystem services** that stakeholders rely on.



Box 2. (cont.)

Risk Category	Indicator	Risk Score
Provisioning Services	**Water Availability**	2.7
	Forest Productivity and Distance to Markets	1.0
	Limited Wild Flora & Fauna Availability	3.0
	Limited Marine Fish Availability	-
Regulating & Supporting Services - Enabling	**Soil Condition**	1.0
	Water Condition	2.9
	Air Condition	2.5
	Ecosystem Condition	1.8
	Pollination	2.0
Regulating Services - Mitigating	**Landslides**	3.5
	Wildfire Hazard	3.0
	Plant/Forest/Aquatic Pests and Diseases	2.5
	Herbicide Resistance	1.5
	Extreme Heat	3.5
	Tropical Cyclones	2.5
Cultural services	**Natural & Cultural Resources**	2.0
Pressures on Biodiversity	**Land, Freshwater and Sea Use Change**	2.2
	Forest Canopy Loss	4.0
	Invasives	2.5
	Pollution	3.6

Note: Detailed explanations of the indicators are provided in Annex 1.

Overall, the landscape where the villages are located and where community members carry out their activities is characterized by a **Physical Risk score of 3.38 out of 5**, indicating a **moderate dependence on ecosystem services** and a **moderately compromised status of these services**, alongside **notable pressure on biodiversity**. The greatest risk stems from increasing biodiversity pressure, highlighting that current economic activities are negatively affecting biodiversity and ecosystem processes—conditions that could, over time, undermine the very ecosystem services on which communities depend.

By leveraging the BRF tool results, Landesa has been able to build an understanding of the importance of avoiding intensive, extractive economic activities and instead promoting the use of mangrove forests to support livelihoods through sustainable management, particularly given the area's dependence on *Provisioning Services* and the existing *Pressures on Biodiversity*. Indicators related to *Regulating and Supporting Services* have helped highlight the critical role of mangrove conservation and maintaining forest cover as a natural climate disaster-risk reduction mechanism, especially considering their coastal protection functions.

Overall, these results have provided the evidence to advocate for a conservation-first approach, followed by a livelihood-supporting resource-use strategy that maximizes ecosystem functions and ensures the sustainable provision of products and services through community stewardship.

Practical Insights for Sustainable Land Use Planning

While Landesa and RECOFTC respect the full autonomy of communities to decide whether and how to develop or revise their CFMPs, Landesa has strongly advocated for acknowledging environmental and climate change risks and opportunities as a means to support communities and local government in advancing toward sustainability.

In this context, Strata and BRF have been applied as early-stage tools to situate fieldwork within a broader landscape perspective, helping to identify potential environmental and climate-related pressures before field engagement begins. This reduces the constraints often associated with initiating community-level assessments without baseline information and allows for more targeted and context-aware field investigations. Once combined with participatory inputs and local knowledge, these tools contribute to a more grounded understanding of site conditions and planning needs.

Field applications of this approach, including participatory assessments conducted by RECOFTC and Landesa, have shown how spatial analysis and community-based evidence can reinforce one another in informing management decisions. In the Marui area, Strata and BRF outputs highlight widespread exposure to multiple climate-related hazards, including coastal inundation, flooding, and extreme heat, alongside land degradation pressures and limited irrigation coverage affecting agricultural resilience. Field observations further contextualize these findings by illustrating how these conditions translate into livelihood constraints and environmental stress at the community level. When interpreted together, these insights help clarify site-specific risks and priorities, strengthening the basis for CF management planning and CF registration processes, and providing planning and monitoring foundations for the emerging LMMA framework.

For instance, recognizing that villages currently face high levels of climate exposure and that the broader landscape experiences moderate to high biodiversity pressure has enabled Landesa to emphasize that further mangrove degradation would directly intensify climate risks faced by communities. Similarly, the severe climate stress affecting villages, alongside only moderate regulating services in the area, indicates that although mangrove regulating functions are present, they are not yet strong enough to fully offset sea-level rise and storm surges. These findings have

informed recommendations to incorporate disaster risk reduction and climate adaptation measures into management planning, including ecosystem-based approaches that strengthen community resilience to climate-related hazards. Existing land degradation, combined with only moderate provisioning services, has also helped highlighting that mangrove forest conversion represents a maladaptive response to short-term livelihood needs. Expansion of agriculture or extractive activities would likely worsen degradation rather than provide sustainable benefits.

Beyond its role in technical planning, this integrated information base supports more transparent and structured dialogue with communities and authorities, particularly around tenure recognition and governance arrangements. It also helps align local management decisions with broader coastal sustainability priorities in Thailand, with LMMA and OECM arrangements offering a practical framework for implementation and recognition.

Overall, having these indicators available has enabled Landesa and RECOFTC to advocate for mangrove forest management that positions mangroves as a nature-based resilience system, supporting communities in reducing climate risks, safeguarding biodiversity, and ultimately strengthening climate-resilient livelihoods.

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Annex 1

Strata Indicators

Coastal Inundation – This is assessed for areas below 10 meters above sea level using SRTM data. Currently, this data is available for 2000, and in Strata it is shown with a spatial resolution of 100 m. This indicator highlights regions most vulnerable to rising sea levels and coastal flooding.

Degraded Land – This highlights areas experiencing significant land degradation. It is based on the Land Productivity Dynamics (LPD) model at 1 km spatial resolution and filters the map using only the class “Decline.” The dataset is updated annually and refers to 2024.

Heatwave – A heatwave is identified when temperatures exceed 35°C for at least three consecutive days, highlighting areas impacted by extreme heat. Data is from ECMWF ERA5, with an 11 km resolution, using records from 1981 to date. It is updated monthly to describe the last twelve months.

Risk of Flooding – Flood risk indicates areas likely to experience coastal and/or riverine flood exposure. The dataset is from WRI’s Aqueduct Floods. This dataset is available for the year 2020 at 927.6 m spatial resolution. Updates are ad hoc.

Irrigation in Less Than 10% of the Area – Irrigation presence is assessed using FAO’s AQUASTAT Global Map of Irrigation Areas and NASA’s GFSAD1000 cropland cover dataset. This indicator highlights areas with less than 10% irrigated cropland, suggesting potential vulnerabilities in water resource management and agricultural resilience. The resolution is 10 km and refers to 2005.

Biodiversity Risk Filter Indicators

Water Availability – This refers to the physical abundance or lack of freshwater resources. A high-risk score for this indicator results from high dependency on this resource in combination with a high location risk score.

Forest Productivity and Distance to Markets – This refers to the physical abundance and commercial accessibility of realizable timber provisions. A high-risk score for this indicator results from high dependency on this resource in combination with a high location risk score.

Limited Wild Flora & Fauna Availability – This refers to the unavailability of commercially harvested species. A high-risk score for this indicator results from high dependency on this resource in combination with a high location risk score.

Limited Marine Fish Availability – This refers to the stock status of marine fish. A high-risk score for this indicator results from high dependency on this resource in combination with a high location risk score.

Soil Condition – This indicates whether soil can perform basic functions to benefit human use and ecosystems alike. A high-risk score for this indicator results from high dependency on this ecosystem service in combination with a high location risk score.

Water Condition – This indicates whether the water quality is fit for human use and ecosystems alike. A high-risk score for this indicator results from high dependency on this ecosystem service in combination with a high location risk score.

Air Condition – This indicates whether the air quality is fit for human use and ecosystems. A high-risk score for this indicator results from high dependency on this ecosystem service in combination with a high location risk score.

Ecosystem Condition – This indicates whether the natural environment is intact and connected. A high-risk score for this indicator results from high dependency on this ecosystem service in combination with a high location risk score.

Pollination – This assesses whether there is enough natural habitat surrounding cropland to support natural pollination. A high-risk score for this indicator results from high dependency on this ecosystem service in combination with a high location risk score.

Landslides – This assesses the potential threat of rainfall- and earthquake-triggered landslides. A high-risk score for this indicator results from high dependency on the absence or mitigation of this natural hazard in combination with high location risk scores.

Wildfire Hazard – This assesses the potential threat of wildfires due to fire weather intensity. A high-risk score for this indicator results from high dependency on the absence or mitigation of this natural hazard in combination with high location risk scores.

Plant/Forest/Aquatic Pests and Diseases – This assesses the potential threat from transboundary animal and plant pests and diseases. A high-risk score for this indicator results from high dependency on the absence or mitigation of this natural hazard in combination with high location risk scores.

Herbicide Resistance – This assesses the number of occurrences of herbicide-resistant weeds. A high-risk score for this indicator results from high dependency on the absence or mitigation of this natural hazard in combination with high location risk scores.

Extreme Heat – This assesses the threat of extreme heat during a 5-year return period. A high-risk score for this indicator results from high dependency on the absence or mitigation of this natural hazard in combination with high location risk scores.

Tropical Cyclones – This assesses the predicted maximum wind speed (mph) on a 50-year return period. A high-risk score for this indicator results from high dependency on the absence or mitigation of this natural hazard in combination with high location risk scores.

Natural & Cultural Resources – This measures the availability of natural and cultural resources such as valuable land, seascapes, or specific sites. A high-risk score for this indicator results from

high dependency on the presence of natural and cultural resources in combination with high location risk scores.

Land, Freshwater, and Sea Use Change – This measures cropland expansion, river fragmentation, and pressures on marine environments through shipping and direct human impact. A high-risk score for this indicator results from high impact on biodiversity through economic activity pressure in combination with high location risk scores.

Forest Canopy Loss – This measures tree cover loss. A high-risk score for this indicator results from high impact on biodiversity through economic activity pressure in combination with high location risk scores.

Invasives – This is based on the presence of the world's worst invasive species. A high-risk score for this indicator results from high impact on biodiversity through economic activity pressure in combination with high location risk scores.

Pollution – This is based on nutrient, pesticide, and air pollution. A high-risk score for this indicator results from high impact on biodiversity through economic activity pressure in combination with high location risk scores.

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