



An Indigenous Based Forest Management for Achieving Sustainable Development Goals: Reducing CO₂ Emissions in Pelalawan District, Indonesia

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Abstract. One of the ways to reduce CO₂ emissions in Pelalawan District is potentially by Indigenous-based Forest management (IBFM) focusing on ecosystem services. This study aims to develop a roadmap of sustainable forest management to support the achievement of sustainable development goals (SDGs), especially the 13th Goal: mitigation and adaptation to climate change. The research was conducted in Langgam Village, Pelalawan District, Riau Province, Indonesia. The research method used was qualitative descriptive interpretative. The relevant secondary data were collected from various sources. The results showed that the indigenous peoples in Langgam Village had maintained the natural forest both inside and outside the forest area. However, the current forest management has not been optimally supported by the stakeholders to be registered as a carbon offset project. The strategy to achieve CO₂ emissions reduction is by facilitating indigenous people to improve the dimensions of current forest management into a conservation business movement with ecosystem services products to support low carbon development that is integrated with regional development plans and in line with global carbon market standards. The study results are recommended as one input for policymakers to achieve the SDGs, especially on climate change mitigation and adaptation through community-based forest management.

Keywords: CO₂ emissions reduction · community-based forest management · conservation business · indigenous knowledge · SDGs

1 Introduction

Forests have an important role in providing environmental services that support human life. Forest ecosystem services can be grouped into four main categories, such as; provisioning, regulating, supporting, and cultural [1]. One of the forest functions related to the achievement of the Sustainable development goals (SDGs) is as a regulator for balancing and reducing CO₂ emissions. Strengthening this regulatory function is one of the ways to mitigate climate change [2].

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Riau Province has a high forest destruction rate in Indonesia relatively. During 2018–2019, the reported deforestation rates reached 142,011 ha, of which 136,998 ha occurred in forest areas and 5,013 ha outside forest areas [3]. Deforestation in Riau Province is mostly also with forest and land fires. It is indicated by the forest and land fires area during 2018–2019 reaching 127,786 ha and contributing to CO₂ emissions of 109,318,610 tons, the highest in Indonesia [4]. As one of the districts which have the largest peatland and forest area (more than 60% total district area) in Riau Province, Pelalawan District has an important role in supporting the achievement of the SDGs, especially in reducing greenhouse gas (GHG) emissions.

In some areas, local people still adhere to indigenous knowledge to preserve the forest as part of customary forest management known as Rimbo Sialang Kepungan [5]. Local communities conserve forests by utilizing non-timber forest products (NTFs) [6], and some are used to increase tourist attractions [7]. Forest management practices based on local wisdom are more oriented towards sustainability by maintaining production capacity across generations [8]. The application of indigenous knowledge integrated with the appropriate application of modern management and technology will increase the sustainability of forest management [9]. Indigenous knowledge with a proper management system can provide effective solutions for climate change mitigation and adaptation [10]. Thus, the application of forest management based on indigenous knowledge has the potential to be used as an alternative method to support the achievement of the SDGs, especially in reducing CO₂ emissions.

This study aims to develop sustainable forest management (SFM) roadmap based on indigenous knowledge to support the achievement of SDGs, which is the achievement of CO₂ emissions reduction. The results of this study are expected to enrich the existing modern forest management knowledge system. It is also expected to become one of the inputs for policymakers in establishing a sustainable forest management system, especially to support the achievement of the SDGs: climate change mitigation and adaptation.

2 Material and Method

The research was conducted in Langgam Village, Pelalawan District in June–August 2021. The research method used is a qualitative descriptive method with interpretative and constructivist induction emphasizing the understanding of the author's theoretical concepts accompanied by supporting data and interactions with the research object [11]. The data used in this study is secondary data which are: (1) Land cover of research location based on supervised classification of Landsat-8 and Sentinel-2 satellite imagery using ArcGIS 17 Software; (2) Government administration map; (3) Strategic environmental assessment of middle long term development plan 2021–2024 of Pelalawan District; and (4) Related previous research results. The data were collected from various online media and verified by interviews with local government staff and indigenous people leaders. The formulation of a sustainable forest management roadmap based on indigenous knowledge is established by considering the principles, criteria, and indicators of sustainable forest management [12] with a focus on achieving CO₂ emission reductions.

3 Result and Discussion

3.1 Existing Condition

Based on the interpretation of Landsat-8 and Sentinel-2 satellite imagery downloaded in June 2021 [13], the 2020 forest area map of the Ministry of Environment and Forestry [17] and the Pelalawan district administration map from the Central Statistics Agency 2020 [3], it is known that the forest area conserved by the community inside the convertible forest area is around 1,069.6 ha and outside the forest area is 469.5 ha. The total forest area conserved by the community by applying customary law is 1,566.1 ha or 17.2% of the total village area. Forest management in this village is already supported by customary organizations and norms regulating the mechanism for forest area utilization, the distribution of forest products, and sanctions for violations. However, indigenous peoples have not had the legality of sustainable forest management yet, which causes its management to be under optimal.

On the other side, the pressures on forest sustainability will be higher because 67.7% of the village area has been developed to become oil palm plantations (Fig. 1 and Table 1). Without proper sustainability initiatives, the entry of the oil palm plantation industry has the potential to threaten the preservation of indigenous knowledge owned by the community and increases deforestation inside remaining forest areas instead of outside it. It is indicated by around 1,283.7 ha of oil palm plantation developed inside the forest area. The development of oil palm plantations without considering the sustainability aspect has the potential to change people's social behaviors [15] and wear down their local wisdom [16].

Analysis of the strategic environmental assessments of the regional middle-term development plan (RPJMD) 2021–2024 of Pelalawan District shows that the strategic issues are the main concern. The regional development of Pelalawan District focuses on increasing the legislative availability, administrative, policy frameworks, and documents plan of biodiversity conservation to increase the vegetation covered in the forest area. In this case, Local governments have not considered forest management based on indigenous knowledge yet to reduce CO₂ emissions as a strategic issue that could

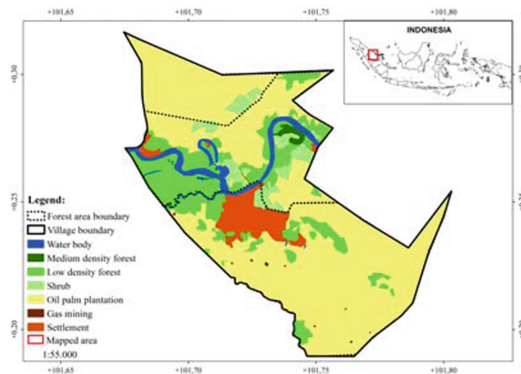


Fig. 1. Landcover inside and outside forest area of Langgam Village.

Table 1. The landcover distribution inside and outside the forest area in Langgam Village

Landcover	Inside Forest Area (Conversion Forest)		Outside Forest Area		Total	
	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)
Water Body	336.6	10.9	52.4	0.9	389.1	4.3
Low density forest	1,014.6	32.8	496.5	8.2	1,511.1	16.6
Medium	55.0	1.8	0.0	0.0	55.0	0.6
Shrub	338.9	11.0	106.3	1.8	445.1	4.9
Oil palm plantation	1,283.7	41.6	4,891.3	81.1	6,175.0	67.7
Gas mining	0.0	0.0	8.4	0.1	8.4	0.1
Settlement	59.9	1.9	479.0	7.9	538.9	5.9
Total	3,088.7	100.0	6,033.9	100.0	9,122.6	100.0

Sources: Spatial analysis of secondary data (2021)

support climate change mitigation, biodiversity conservation, cultural preservation, and improving the local economy [17]. Interviews results with the local government staff handling the environmental sector and indigenous leaders showed that their knowledge about the best practice of community-based forest management (CBFM) was successful in several Indonesia regions that have received limited carbon credit funds. Based on the author's explanation of the carbon offset project, they were enthusiastic to learn about the success stories of CBFM that have received payment of environmental services (PES) certificate.

Referring to the metadata of the SDGs indicators in Indonesia, reducing GHG emissions is one of the indicators of achieving the national SDGs, especially in climate change mitigation and adaptation. This achievement will be supported by other sustainable development targets related to sustainable forest management (Table 2) [18]. The discrepancy between national and regional development goals is because there are still sectoral and structural egos in achieving the SDGs. The sectoral ego caused by each sector has different development interests still oriented towards increasing economic development. Meanwhile, the structural ego was influenced by the local government's commitment to achieving the national SDGs, regional autonomy, and political regional leadership succession. Panjaitan stated that the achievement of the SDGs involving multi-stakeholders experienced many obstacles due to weak coordination, which led to overlapping in programs and budgets. Apart from the lack of coordination, at the regional level, the CO₂ emission reduction program has not been considered as a part of the conservation business movement that can increase local economic value through CBFM as a provider of environmental services [19]. Arbaaz et al. stated that two commodities make conservation more profitable, ecotourism and carbon credit. Its development requires adequate information at the local level and investors to increase its success [20].

Table 2. Targets and indicators of national SDGs related to CO₂ emission reduction

Target SDGs - 13th related to GHG emission reduction		Target of SDGS 15th related to forest management for GHG emission reduction	
Targets	Indicators	Targets	Indicators
Integrating climate change mitigation actions into national policies, strategies, and plans	CO ₂ emission reduction and its intensity	Conservation, restoration dan sustainable management of dryland ecosystem	Forest area proportion of total area
			High conservation value (HCV) area
Implementing the developed country commitments through the UNFCCC for shared fund mobilization	Public funds amount (budget tagging) has been shared to support climate change mitigation program	Improve sustainable forest management with zero deforestation	The forest management units (FMU) improvement
		Stop desertification and restore degraded land	Number of developed FMU
			Proportion of degraded land of total area

Sources: Bappenas [18]

The local government’s role is extremely essential in encouraging or marketing (endorsement) the development of CBFM for ecosystem services providers to reduce CO₂ emissions, either through strengthening customary forests or social forestry. Besides being supported by high indigenous knowledge of the local community, there are several private palm oil plantation and gas mining companies that have the potential to become donors and facilitate the carbon offset program as part of low carbon development in Langgam Village. Vagnoni & Moradi explained that the role of government is very strategic in understanding, informing, and guiding local communities, businesses, and industries to achieve sustainability targets [21]. Nieuwenhuis et al. explained that the presence of the private sector has the potential to become a facilitator of low-emission development programs and connects it with carbon markets and global finance [22].

The entry point to implement indigenous SFM as CO₂ emission reduction services is started with program socialization, strengthening the capacity of local human resources by conducting comparative studies on several CBFM institutions that have been certified and received PES. The PES fund was available to improve the local economy, especially in pandemic Covid-19, as social Safety fund [23]. Alviya et al. explain in their research that socialization and capacity-strengthening are the initial stages in building reliable management institutions that can register carbon offset projects in compliance with the standards set by each carbon market [24]. Rifardi et al., based on their research, explained that the socialization of the program through counseling would increase public understanding significantly of simple methods for mitigating environmental damage. This method has a positive impact on sustainability aspect [25].

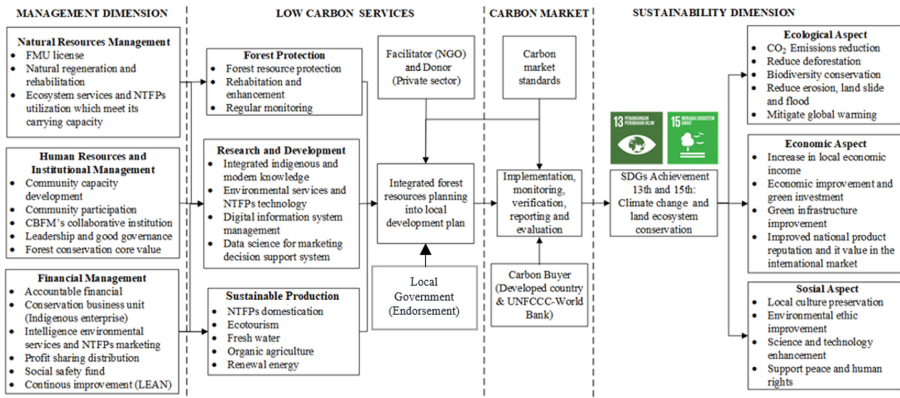


Fig. 2. Roadmap to achieving sustainable development goals in reducing CO₂ emissions through indigenous based forest management

3.2 SFM Roadmap

Based on the analysis of the existing condition of indigenous-based forest management in Langgam Village, a roadmap could be drawn up to improve current forest management as an ecosystem services provider to reduce CO₂ emissions and achieve SDGs 13 and 15 simultaneously. These efforts could be acted by improving the management dimension aspect, which includes: forest resources, human institutions, and financial resources. The essential matter in the forest resources management aspects is the certainty of forest management units’ area for the indigenous community. The form was FMU concession permits recommended by local governments and determined by the central government (Fig. 2).

In the granting permits process, local communities should ideally be facilitated by various parties to increase their capacity and develop customary institutions to plan and manage sustainable forests. The utilization of forest resources takes into account the environmental carrying capacity. Support from multi-stakeholders, especially local governments, private sectors as donors, and non-governmental organizations as facilitators, has an important role for the indigenous community to allocate financial resources in an accountable manner and develop sustainable forest management programs.

The SFM program covers the following aspects: forest resources protection, research - development, and sustainable use. The products produced during the carbon offset project are to be directed to the land management intensification outside the forest area to reduce pressure on the forest area. While inside the forest area, the development is directed toward forest ecosystem services and non-timber forest products (NTFPs) management. It will reduce deforestation from timber extraction. Warningsih et al., in their research, explains that the development of ecosystem services in the form of nature tourism can support local economic development and the preservation of natural resources [26]. In the utilization, NTFPs products and community participation are required by researchers to optimize its utilization in a sustainable manner [27].

The program prepared must comply with the standards required by the carbon market and be integrated into achieving regional development. Monitoring, evaluation, and

reporting on the success of the program should be documented properly as a source of verification to obtain carbon offset project certification. The carbon offset project certificate can be used to disburse PES funds. During the carbon offset project, there is a potential for achieving SDGs 13 and 15, which are produced and can balance the sustainability of ecological, economic, and social functions (Fig. 2). Ecosystem services produced from carbon offset activities are valued as a systematic low-carbon development process. This process involves a supply chain. In this case, it manages forest resources into a value chain [28]. It is necessary to do good risk management in the supply chain to increase the achievement of program success [29].

One major attention in carrying out the carbon offset program in Indigenous SFM was how to enrich local knowledge with modern knowledge. The enrichment was particularly in the management dimension, which is the creation and utilization of SFM technology through research and development. Indigenous peoples also need to enrich their capacity in the financial aspect, especially the utilization of digital marketing technology and the application of a sustainable improvement system (LEAN) to increase the success of managing forest ecosystem services.

Nguyen et al., in their research, state that four factors in quality management contribute to sustainability performances including: top management support, product/service design, data quality, reporting, and continuous improvement [20]. Pratihast et al., in their research, show that the development of an integrated mobile-based application system designed for local communities can increase the efficiency of community-based forest management [31]. In the national development scheme, this sustainable forest management initiative can be integrated with village development, namely the creation of economic independence and sustainable village development (Village's SDGs) [32].

4 Conclusion

The analysis result showed that the indigenous peoples in Langgam Village maintain several natural forest areas both inside and outside the forest area of 1,566,1 ha or 17.2% of the village area. On the other side, 67.7% of the village area was converted to palm plantations threatening forest sustainability and the loss of indigenous knowledge. The communities with their local wisdom have not been supported yet by strong programs by local governments and third parties to make this management a conservation business for providing forest ecosystem services to reduce CO₂ emissions. It is indicated by the unfulfillment of the legal aspects of customary forest areas in form of granting concession permits. The lack of understanding of indigenous peoples and local government about the carbon offset project caused the program not accommodated into the regional middle-term development plan. Local government and third parties should contribute to improving the current management system to support the indigenous community in developing SFM for CO₂ emission reduction program with a carbon credit system by some agendas, which are: (1) Improve management dimension aspect to create programs to preserve the natural resources; (2) Continuous research and development; and (3) Sustainable use. This effort should be done by multi-stakeholder support that links it to the carbon market and regional development. This multi-stakeholder program

has the potential way to increase the SDG's achievement, especially the 13th goal: climate change mitigation and adaptation, and the 15th goal: conservation of terrestrial ecosystems that can create sustainability of ecological, economic, and social functions in balance manners.

The research result is recommended as one of the inputs for local governments to improve the achievement of the pillars of sustainable development, especially in climate change mitigation and adaptation through sustainable forest management. For the next researcher, the authors recommend to enhance this research by increasing the literature and primary data collection.

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