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# Forest and Land Rehabilitation and Its Contribution to Carbon Stock Enhancement under Social Forestry Schemes in Lampung Province Using the AKSARA Platform

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## ABSTRACT

This study evaluated the implementation of forest and land rehabilitation (RHL) and estimated its contribution to carbon stock enhancement under social forestry schemes in Lampung Province to support Indonesia's Forestry and Other Land Use (FOLU) Net Sink 2030 target. A quantitative descriptive approach was employed using secondary data on critical land, rehabilitation activities, and social forestry from 2015–2024. Carbon sequestration and emission reduction potentials were analyzed using the AKSARA platform developed by the National Development Planning Agency (Bappenas). The analysis incorporated rehabilitation area, seedling survival, planting type, and carbon absorption factors to estimate carbon stock enhancement and carbon dioxide-equivalent ($CO_2e$) sequestration. Results showed that critical land in Lampung Province declined by 284,680 ha between 2018 and 2024, indicating a gradual recovery of the ecosystem. During 2015-2024, RHL activities rehabilitated 32,283.97 ha with 17.63 million seedlings planted. These activities generated an estimated carbon stock enhancement of 174,487.30 $tCO_2e$ and carbon sequestration of 639,788.40 $tCO_{2e}$, equivalent to approximately 0.46% of Indonesia's FOLU Net Sink target. The highest rehabilitation achievement occurred in 2019, contributing more than half of the total rehabilitated area during the study period. Social forestry also demonstrated substantial potential to strengthen community-based climate mitigation, covering 209,408.60 ha managed by 95,707 households through 451 permits distributed across community forests, village forests, forestry partnerships, community plantation forests, and conservation partnerships. The integration of social forestry and RHL through agroforestry practices provides ecological, social, and economic co-benefits by restoring degraded landscapes, increasing carbon stocks, improving watershed functions, and enhancing local livelihoods. This study highlights the strategic role of community-based forest management in supporting sustainable land restoration and achieving Indonesia's climate mitigation commitments.

## 1. Introduction

Land-use change can degrade watersheds (Bieluczyk et al. 2023). Land degradation significantly affects food security, human health, and socioeconomic conditions (Jinger et al.

2023). It causes greenhouse gas (GHG) emissions from the forest and other land use (FOLU) sector (Bhan et al. 2021). Meanwhile, deforestation can disrupt hydrological functions (Hou et al. 2023). Land-use change, land degradation, and deforestation are interrelated. Land-use change often leads to deforestation, the clearing of forests to make way for agriculture, settlements, or industry. This deforestation can lead to land degradation, including decreased soil fertility, reduced water retention capacity and disrupted biodiversity. These three factors influence one another and contribute to declines in ecosystem quality and to increased greenhouse gas emissions. Land degradation can be restored through forest and land rehabilitation or *Rehabilitasi Hutan dan Lahan* (RHL) (Ministry of Environment and Forestry 2021). RHL is carried out, in part, through planting activities such as agroforestry, which combines forestry and agriculture so that farmers become resilient in the face of climate change (Westaway et al. 2023) and play a role in climate change mitigation by absorbing carbon from the FOLU sector (Duffy et al. 2021; Widarti et al. 2024; Yasin et al. 2024).

The concept of social forestry contributes to the success of RHL by granting communities sustainable management rights over forest resources. This approach emerged in response to centralized forest management systems that limit community participation (Kairu et al. 2024). Through social forestry, communities can obtain forest products and economic benefits (Rakatama and Pandit 2020). In addition, it plays a role in preserving forests through forest and land rehabilitation. RHL is more effective if it involves the surrounding community (Dawson et al. 2021).

Currently, the concept of social forestry has evolved to encompass sustainable forest management practices, including climate change mitigation (Wong et al. 2020). Social forestry integrates sustainability principles and employs practices such as agroforestry to improve community well-being (Mahardika et al. 2021; Octavia et al. 2022).

By 2030, Indonesia is committed to reducing greenhouse gas emissions, aiming for the forestry sector and other land uses to contribute an ambitious 60% of the total national GHG reduction target (Arifanti et al. 2024; Ministry of Environment and Forestry 2022; Murdiyarso et al. 2024; Resosudarmo et al. 2019). To achieve this commitment, Indonesia has developed a nationally determined contribution (NDC) implementation strategy that includes GHG emission reduction targets. Indonesia has set a target to reduce emissions by 29% through its own efforts and by 41% with international assistance **(**Ministry of Environment and Forestry 2023). This target has been updated to 31.89% through its own efforts and 43.2% with international support, as stated in the enhanced NDC document (Forest Digest and Yayasan Madani Berkelanjutan 2022). Indonesia must reduce emissions from the FOLU sector, namely deforestation, forest degradation, and peatland degradation (Meehan et al. 2019). Efforts to overcome this require implementing sustainable forest management through land-based mitigation activities, such as forest enrichment (Iskandar et al. 2023) or reforestation (Aryapratama 2023).

Agroforestry is a reliable tool for climate change mitigation that also offers economic benefits (Chavan et al. 2023) and can enhance the success of land rehabilitation (Massante et al. 2023). In terms of ecosystem balance, agroforestry plays a role in regulating water (Awazi et al. 2024), sequestering carbon (Hartoyo et al. 2025; Huynh et al. 2023; Image et al. 2023; Mukhlis et al. 2022), and reducing land degradation (Ahammad et al. 2023). Carbon stocks in agroforestry cropping systems are higher than in monoculture cropping systems (Maharjan et al. 2024; Panwar et al. 2022).

Climate change mitigation activities based on land use, such as forest and land rehabilitation, support the Sustainable Development Goals (SDGs). Consequently, these rehabilitation efforts generate comprehensive and sustainable impacts across economic, ecological, and social dimensions. Maintaining and improving upstream conditions by rehabilitating forests and land is highly effective in reducing the risk of flooding during the rainy season and drought during the dry season. Furthermore, these initiatives involve communities within social forestry groups, aiming to restore the environment while also providing economic benefits (Padovezi et al. 2022).

Ecosystem restoration through RHL aims to mitigate and adapt to climate change (Naime et al. 2020). Reducing GHG emissions is a primary target of SDG 13 (Zulkarnain et al. 2024). Consequently, tracking the success of these efforts requires accurate estimates of GHG emissions and absorption (Nyawira et al. 2024).

Although social forestry programs continue to expand, empirical evidence linking their implementation to RHL outcomes, as well as estimates of their benefits in increasing carbon stocks at the provincial level, remains limited. Social forestry, which grants communities the rights to manage forest resources sustainably, has the potential to make a significant contribution to forest and land rehabilitation, often in combination with agroforestry practices. Agroforestry, which involves integrating trees with agricultural activities, can enhance ecosystem sustainability while supporting the rehabilitation of degraded land.

This study assesses the implementation of RHL in Lampung Province (2015–2024) and estimates its contribution to increasing carbon stocks using the AKSARA platform. The novelty of this study lies in linking social forestry and RHL by applying agroforestry practices to increase carbon stocks at the provincial level, thereby contributing to achieving the 2030 FOLU net sink target in Lampung Province. Lampung Province was selected as a case study location because it has extensive critical land areas that require rehabilitation.

Forest areas in Lampung Province are actively utilized through social forestry schemes, which are vital for achieving the 2030 FOLU net sink target. By integrating these schemes with forest and land rehabilitation, the province can substantially increase its carbon stocks and support national greenhouse gas reduction goals. Therefore, Lampung Province serves as an ideal case study for estimating the direct impact of social forestry on carbon sequestration and emissions reductions.

## 2. Materials and Methods

### *2.1. Research Design*

This study employed a quantitative descriptive approach to explore the role of forest and land rehabilitation (RHL) and social forestry in achieving the 2030 FOLU net sink target. The study relies on secondary numerical data processed through the AKSARA platform to quantify carbon sequestration. Administrative consultations were conducted solely to obtain and verify data from relevant institutions.

### *2.2. Data Collection and Processing*

Data verification and clarification were conducted through administrative communication with relevant officials, including personnel from the Watershed Management and RHL Division of the Lampung Provincial Forestry Service, the Watershed Planning and Evaluation Section of

the Way Seputih Sekampung Watershed Management Office (BPDAS WSS), Forest Management Units, and other related administrative staff.

The data used are secondary data on critical land, social forestry, and RHL spanning 10 years (2015–2024). Data processing was conducted using the AKSARA application developed by the National Development Planning Agency (Bappenas), a platform designed for low-carbon development planning and monitoring.

Carbon sequestration calculations on the AKSARA platform are based on planting activities and account for annual growth according to plant species. The calculations incorporate carbon sequestration factors for each plant species, derived from studies conducted by the Forestry Research and Development Agency under the Ministry of Environment and Forestry (Ministry of National Development Planning and Low Carbon Development Indonesia 2022). Plant species are categorized into fast-growing, slow-growing, and plantation crops. Carbon sequestration was calculated using Equation 1.

$$Absorption = Area \times Number\ of\ Plants\ Absorption\ Factor \quad (1)$$

where *Absorption* is the total carbon sequestration based on planting activities, *Area* is the planting area (in ha), *Number of Plants* represents planting success based on the growth percentage, and *Absorption Factor* is the value based on the type of crop grown.

To obtain $CO_2$-equivalent values, the carbon sequestration value was multiplied by 3.67. This factor is used to convert carbon (C) into carbon dioxide ($CO_2$) in accordance with the Intergovernmental Panel on Climate Change (IPCC) and the land-use, land-use change, and forestry (LULUCF) protocols.

In the AKSARA platform, technical data inputs include planting location, activity type, land cover type, forest function, soil type, plant species, planting distance, planted area, plant age at reporting, number of surviving plants, responsible institutions, plant cycle, survival rate, and source and allocation of funding for planting activities. The survival rate is based on information obtained from staff who directly monitor planting activities. The system processes these inputs to generate outputs, including carbon stock values and estimated emission reductions.

### *2.3. Data Analysis*

Data were analyzed descriptively, a method used to summarize and present data systematically (Balaka 2022), to evaluate the implementation of social forestry and forest and land rehabilitation, and their contributions to increasing carbon stocks in support of the FOLU Net Sink target in Lampung Province.

## 3. Results and Discussion

### *3.1. Forest and Land Rehabilitation in Lampung Province*

Critical land is land located inside and outside forest areas that has experienced a decline in its function for production and watershed management (PP No. 26, 2020). Between 2018 and 2024, the area of critical land in Lampung Province declined by 284,680 ha, from 1,088,665 ha to 803,985 ha. Critical land of this extent is included in priority I and priority II. These numbers consist of 772 ha of highly critical land, 374,695 ha of critical land, and 428,518 ha of moderately critical land. This critical land area serves as a reference for identifying locations for land restoration activities (Wang et al. 2022).

As a reference for forest and land rehabilitation (RHL) activities, critical land is classified by severity: highly critical and critical land are categorized as Priority I (main targets), moderately critical land as Priority II, and potentially critical or non-critical land as Priority III (not targeted). **Table 1** shows the critical land area for the year 2024. **Fig. 1** illustrates the spatial distribution of critical land in Lampung Province in 2022, providing a visual overview of areas requiring forest and land rehabilitation.

**Table 1.** Critical land areas in Lampung Province in 2024

| District/City | Very critical | Critical | Moderately critical | Potentially critical | Not critical | Total (ha) |
|---|---|---|---|---|---|---|
| Bandar Lampung | - | 636 | 3,883 | 1,042 | 12,811 | 18,372 |
| Metro | - | - | - | 799 | 6,522 | 7,321 |
| Lampung Barat | - | 74,878 | 56,709 | 20,486 | 34,681 | 186,754 |
| Lampung Selatan | - | 6,097 | 43,795 | 90,478 | 81,514 | 221,884 |
| Lampung Tengah | - | 19,630 | 8,478 | 230,690 | 196,096 | 454,894 |
| Lampung Timur | - | 698 | 6,833 | 203,152 | 176,025 | 386,708 |
| Lampung Utara | - | 28,430 | 40,131 | 122,457 | 62,133 | 253,151 |
| Mesuji | - | - | 779 | 48,223 | 171,741 | 220,743 |
| Pesawaran | 27 | 42,216 | 34,994 | 20,555 | 30,168 | 127,960 |
| Pesisir Barat | 660 | 40,967 | 46,563 | 49,738 | 156,562 | 294,490 |
| Pringsewu | - | 12,636 | 7,220 | 17,269 | 24,372 | 61,497 |
| Tanggamus | 32 | 124,983 | 90,050 | 30,847 | 44,286 | 290,198 |
| Tulang Bawang Barat | - | - | 3,160 | 57,588 | 66,973 | 127,721 |
| Tulang Bawang | - | - | 2,460 | 153,256 | 154,487 | 310,203 |
| Way Kanan | 55 | 23,524 | 83,463 | 122,597 | 133,254 | 362,891 |
| **Total** | **772** | **374,695** | **428,518** | **1,169,177** | **1,351,625** | **3,324,787** |

Note: Source from the Way Seputih Way Sekampung Watershed Management Office (2025).

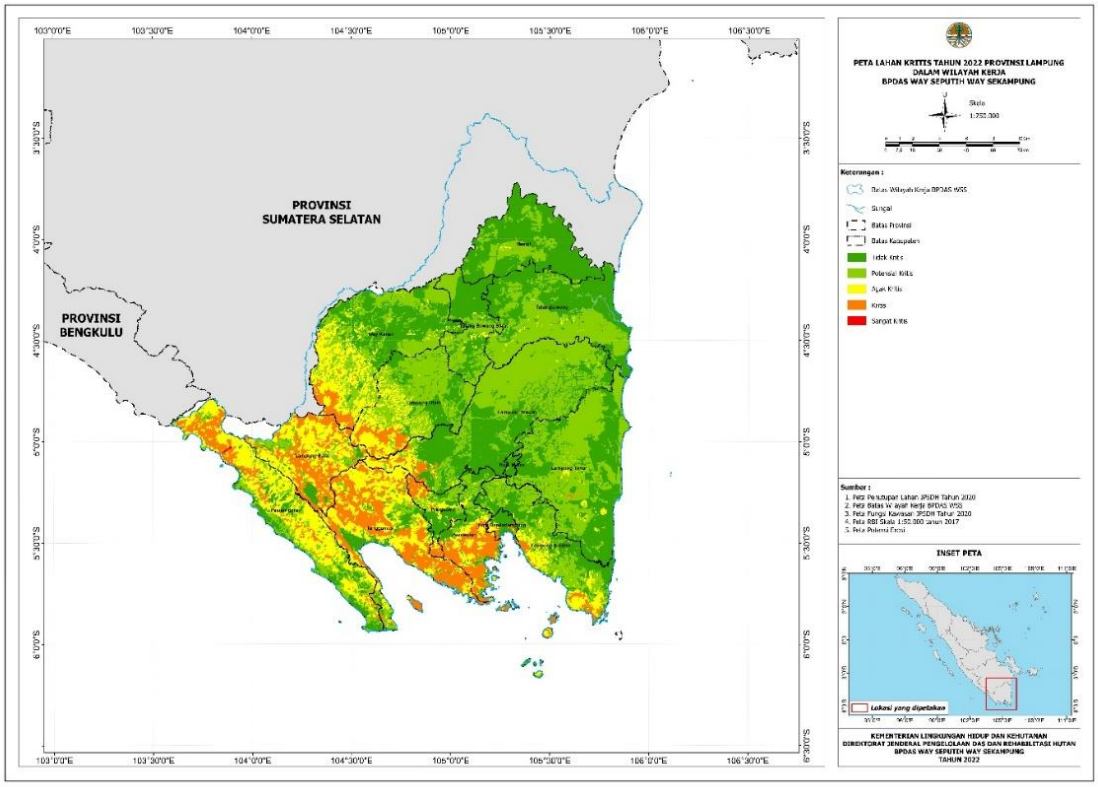


**Fig. 1**. Critical land distribution in Lampung Province in 2022 used to identify priority areas for forest and land rehabilitation under social forestry programs.

RHL is a primary form of land restoration and the most effective solution for improving degraded land (Yu et al. 2024). The restoration of critical land through RHL activities is one of the ways Indonesia is working to achieve its 2030 FOLU net sink target. The total area rehabilitated to increase carbon stocks in Indonesia during the 2015–2019 period reached 1,183,581 ha (an average of 236,716 ha/year).

In the GHG emission-reduction scenario, the forestry and other land use (FOLU) sector is estimated to achieve nearly 60% of the total GHG emission-reduction target. At Indonesia's peak emissions, the FOLU sector is projected to reach a net sink, with emissions of −140 million $tCO_2e$ by 2030. This sink capacity is expected to expand further, reaching −304 million $tCO_2e$ by 2050 (Svensson et al. 2024). The FOLU sector plays a crucial role in achieving the national net zero emissions (NZE) target, especially in balancing emissions from sectors that are more difficult to reduce, such as the energy sector. Therefore, maintaining the net sink trend after 2030 will be a key factor in achieving Indonesia's NZE ambition (Ministry of Environment and Forestry 2022).

This scenario was developed based on the results of a collaborative effort to correct forestry sector policies over more than seven years, supported by an in-depth analysis of long-standing forestry sector issues. Indonesia's FOLU net sink 2030 plan is summarized in a detailed operational plan, which forms the basis for the implementation of GHG emission reduction measures, and is outlined in systematic working guidelines for handling various activities in the forestry and land use sectors, such as forest fires, deforestation, forest degradation, habitat conservation, biodiversity management, peatlands, and mangroves (Ministry of Environment and Forestry 2022).

**Table 2** summarizes RHL activities over 10 years (2015–2024), revealing significant year-to-year fluctuations in both planting area and the number of seedlings planted. Notably, these activities peaked in 2019, accounting for over half of the total 32,283.97 ha rehabilitated during this decade. These variations are primarily driven by funding availability from regional and central government budgets, NGOs, and other external sources. Ultimately, these cumulative tree-planting efforts directly increase regional carbon reserves. To quantify and monitor these environmental impacts, the Lampung Provincial Forestry Service reports its climate change mitigation activities annually through AKSARA, an online low-carbon development platform developed by Bappenas. These reports are compiled and aligned with the Minister of Home Affairs Regulation No. 90 of 2019 and its amendment (Decree No. 050-3708 of 2020) concerning regional development and financial planning.

**Table 2.** Number of seedlings and planting area for forest and land rehabilitation

| Year | Area (ha) | Seedling (count) |
|---|---|---|
| 2015 | 2,070.39 | 505,437 |
| 2016 | 973.43 | 247,570 |
| 2017 | 2,557.23 | 1,387,443 |
| 2018 | 1,330.26 | 594,725 |
| 2019 | 16,502.55 | 9,001,020 |
| 2020 | 1,624.65 | 3,255,540 |
| 2021 | 2,942.78 | 1,228,785 |
| 2022 | 1,620.44 | 981,144 |
| 2023 | 1,418.48 | 246,008 |
| 2024 | 1,243.76 | 183,802 |
| **Total** | **32,283.97** | **17,631,474** |

Note: Source from the Lampung Provincial Forestry Service.

Climate change mitigation efforts fall into three categories: core, supporting, and prerequisite activities (Ministry of National Development Planning and Low Carbon Development Indonesia 2022). Core activities directly contribute to reducing carbon emissions. Supporting activities facilitate the execution of these core efforts, while prerequisite activities establish the necessary conditions for their implementation. Furthermore, core activities are divided into carbon stock enhancement (CSE) and carbon stock reduction prevention (CSRP), with RHL classified as a CSE approach.

Consequently, the Indonesian Ministry of Environment and Forestry emphasizes that the forestry sector plays a crucial role in achieving Indonesia's FOLU net sink 2030, targeting a net sink—or negative GHG emission level—of 140 million $tCO_2e$ by 2030 (Parimita and Najicha 2023). As detailed in **Table 3**, over the 10 years from 2015 to 2024, the forestry sector in Lampung Province, through RHL activities, has increased carbon stocks by 174,487.30 $tCO_2$ and absorbed 639,788.40 $tCO_2e$, representing 0.46% of the target set by the Ministry of Environment and Forestry.

**Table 3.** Increase in carbon stocks and estimation of emissions absorption from forest and land rehabilitation activities

| Year | Area (ha) | CSE ($tCO_2$) | Estimated carbon dioxide absorption ($tCO_2e$) |
|---|---|---|---|
| 2015 | 2,070.39 | 6,613.61 | 24,249.89 |
| 2016 | 973.43 | 3,019.37 | 11,072.60 |
| 2017 | 2,557.23 | 16,102.35 | 59,041.96 |
| 2018 | 1,330.26 | 2,666.36 | 9,776.67 |
| 2019 | 16,502.55 | 96,284.18 | 353,042.01 |
| 2020 | 1,624.65 | 5,798.35 | 21,260.62 |
| 2021 | 2,942.78 | 11,216.75 | 41,128.10 |
| 2022 | 1,620.44 | 4,851.32 | 17,788.19 |
| 2023 | 1,418.48 | 2,258.75 | 8,282.09 |
| 2024 | 1,243.76 | 25,676.26 | 94,146.27 |
| **Total** | **32,283.97** | **174,487.30** | **639,788.40** |

Note: Data processing results in the AKSARA application; CSE = Carbon stock enhancement.

### *3.2. The Strategic Role of Social Forestry in Forest and Land Rehabilitation to Achieve the 2030 FOLU Net Sink in Lampung Province*

Social forestry is an approach to achieving land justice by empowering local communities (Zhang 2024), and it can also reduce social inequality in access to forest management (Toumbourou et al. 2025). The total forest area in Lampung Province under the jurisdiction of the Lampung Provincial Government is 564,954 ha, divided into a core or protection zone of 76,595 ha (13.56%) and a utilization zone covering 488,359 ha (86.44%). Social forestry is permitted only within the utilization zone.

Human interaction within these forest areas is evident from the presence of 221 definitive villages located either partially or entirely within forest areas (165 in protected forests, 55 in production forests, and 1 in Bukit Barisan Selatan National Park), based on 2025 data from the Lampung Provincial Forestry Service. Communities living in these areas are both influenced by and influence deforestation and forest degradation (Parimita and Najicha 2023). To accommodate and sustainably manage these activities, the government implements social forestry policies that provide communities with legal access to forest management.

In Lampung Province, social forestry covers 95,707 households across 209,408.60 ha, distributed among 451 permits (**Table 4**). These permits comprise five categories of social forestry schemes: village forest (VF), community forest (CF), community plantation forest (CPF), forestry partnership (Partnership), and conservation partnership (CP), which is a specific form of partnership located within conservation areas such as the Wan Abdul Rachman Grand Forest Park (*Tahura WAR*).

**Table 4.** Regional distribution of social forestry schemes in Lampung Province in 2025

| District/City | VF | CF | CPF | Partnership | CP | Total |
|---|---|---|---|---|---|---|
| Bandar Lampung | - | 1 | - | - | 2 | 3 |
| Lampung Barat | - | 64 | 4 | - | - | 68 |
| Lampung Selatan | 22 | 32 | 5 | 2 | - | 61 |
| Lampung Tengah | - | 34 | - | 31 | - | 65 |
| Lampung Timur | - | 7 | - | 2 | - | 9 |
| Lampung Utara | - | 16 | - | - | - | 16 |
| Mesuji | - | - | - | 7 | - | 7 |
| Pesawaran | - | 15 | - | 27 | 75 | 117 |
| Pesisir Barat | - | 7 | 4 | - | - | 11 |
| Pringsewu | - | 6 | - | - | - | 9 |
| Tanggamus | - | 52 | - | 3 | - | 66 |
| Way Kanan | - | 19 | - | 14 | - | 19 |
| **Total** | **22** | **253** | **13** | **86** | **77** | **451** |

Notes: Source from the Lampung Provincial Forestry Service, 2025; VF = Village forest; CF = Community forest; CPF = Community plantation forest; CP = Conservation partnership.

The most widely implemented social forestry scheme is the CF scheme, while the least implemented is the CPF scheme. The very small number of CPF schemes results from their application only to production forest areas. In contrast, most production forest areas in Lampung Province are already managed by holders of forest utilization business permits (FUBP). The highest number of social forestry permits is in Pesawaran District, with 117, because it has three forest types: protected forests, production forests, and conservation forests. Conversely, Bandar Lampung City has the fewest social forestry permits (3 permits), as only a small portion of its area is forested, specifically the conservation forest, Tahura Wan Abdul Rachman. The distribution and number of social forestry permits are greatly influenced by the existence of forests in each region. In regions with larger forest areas, there will certainly be greater opportunities for communities to participate in forest management through social forestry schemes. Thus, the widespread distribution of social forestry schemes in Lampung Province demonstrates significant, measurable potential to carry out RHL activities that support reductions in greenhouse gas emissions.

The distribution of social forestry permits across forest management units (FMUs) in Lampung Province is presented in **Table 5**. Lampung Province has 17 FMUs, of which FMU Muara Dua is the only unit without a social forestry permit, as all forest areas within its jurisdiction are managed by companies under forest utilization business permits (FUBPs). The remaining 16 FMUs manage a total of 451 permits, with Tahura WAR and Liwa having the highest numbers at 77 and 59, respectively.

Social forestry, which provides communities with legal access to manage forest areas, aims not only to preserve forests but also to improve farmer welfare (Loveridge et al. 2023). RHL in social forestry areas is a key strategy for restoring degraded ecosystems. Active community involvement is a primary determinant of successful RHL (Hamidah et al. 2023; Mukhlisa et al.

2023). The United Nations also supports community involvement in ecosystem restoration during the 2021–2030 decade (Galbraith et al. 2021). The linkage between social forestry and RHL is highly relevant, as most social forestry areas are degraded and require restoration (Ullah 2024). Integrating these initiatives is a strategic step toward achieving the 2030 FOLU net sink target. Social forestry can be integrated with RHL activities to support climate change mitigation by restoring land cover (Erbaugh et al. 2020). This synergy provides a framework for community-based rehabilitation to restore land conditions, increase carbon stocks, and reduce greenhouse gas emissions.

**Table 5.** Distribution of social forestry schemes across forest management units in Lampung Province in 2025

| FMU | VF | CF | CPF | Partnership | CP | Total |
|---|---|---|---|---|---|---|
| Batu Serampok | - | 11 | - | - | - | 11 |
| Batutegi | - | 25 | - | 17 | - | 42 |
| Bukit Punggur | - | 19 | - | - | - | 19 |
| Gedong Wani | - | 10 | 5 | 4 | - | 19 |
| Gunung Balak | - | 7 | - | - | - | 7 |
| Kota Agung Utara | - | 18 | - | - | - | 18 |
| Liwa | - | 59 | - | - | - | 59 |
| Pematang Neba | - | 17 | - | - | - | 17 |
| Pesawaran | - | 15 | - | 27 | - | 42 |
| Pesisir Barat | - | 7 | 8 | - | - | 15 |
| Sungai Buaya | - | - | - | 7 | - | 7 |
| Tahura WAR | - | - | - | - | 77 | 77 |
| Tangkit Tebak | - | 18 | | - | - | 18 |
| Way Pisang | 22 | 12 | | - | - | 34 |
| Way Terusan | - | - | | 31 | - | 31 |
| Way Waya | - | 35 | | - | - | 35 |
| **Total** | **22** | **253** | **13** | **86** | **77** | **451** |

Notes: Source from the Lampung Provincial Forestry Service, 2025; FMU = Forest management units; VF = Village forest; CF = Community forest; CPF = Community plantation forest; CP = Conservation partnership.

RHL activities in social forestry areas provide not only ecological benefits but also social and economic benefits for surrounding communities, who are the main actors in these activities. These findings show that RHL plays an important role as a community-based strategy for climate change mitigation. Strengthening the integration of social forestry and rehabilitation efforts will therefore help achieve Indonesia's FOLU net sink 2030 target.

## 4. Conclusions

Forest and land rehabilitation (RHL) activities in Lampung Province have demonstrated a significant contribution to ecosystem restoration and climate change mitigation by enhancing carbon stocks. During the 2015–2024 period, rehabilitation activities covered 32,283.97 ha and generated an estimated carbon sequestration of 639,788.40 $tCO_2e$ using the AKSARA platform. The decline in critical land area over recent years further indicates the positive impact of rehabilitation efforts on landscape recovery and watershed improvement. Social forestry has played a strategic role in strengthening the effectiveness of RHL by providing local communities with legal access and active participation in forest management. The widespread distribution of social forestry permits across Lampung Province highlights substantial opportunities to implement

community-based rehabilitation and agroforestry practices that simultaneously support ecological restoration, carbon sequestration, and rural livelihoods. The integration of social forestry and RHL represents an effective approach to achieving Indonesia's Forestry and Other Land Use (FOLU) Net Sink 2030 target through sustainable, participatory, and landscape-based forest management. Strengthening institutional support, long-term monitoring, and community capacity-building will be essential to maximize the contribution of rehabilitation programs to greenhouse gas emissions reduction and sustainable forest governance in Indonesia.

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**Author Contributions**

E.V.A.: Conceptualization, Methodology, Software, Validation, Formal Analysis, Investigation, Resources, Data Curation, Writing – Original Draft Preparation, Writing – Review and Editing; S.B.Y.: Conceptualization, Methodology, Validation, Formal Analysis, Investigation, Data Curation, Writing – Original Draft Preparation, Writing – Review and Editing; A.D.: Conceptualization, Methodology, Validation, Formal Analysis, Investigation, Data Curation, Writing – Original Draft Preparation, Writing – Review and Editing; I.G.F.: Conceptualization, Methodology, Validation, Formal Analysis, Investigation, Data Curation, Writing – Original Draft Preparation, Writing – Review and Editing.

**Conflict of Interest**

The authors declare no conflict of interest.

**Declaration of Generative AI and AI-Assisted Technologies in the Manuscript Preparation**

During the preparation of this work, the authors used Turnitin to provide a more comprehensive and organized discussion. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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