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Symbiosis in the Canopy: Unraveling the Evolution and Impact of Social Forestry in Lampung, Indonesia

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ABSTRACT

This review delves into the nuanced relationship between agriculture and forestry within the context of SF in Lampung Province, Indonesia. Over almost 50 years, the region has undergone a transformative journey, culminating in the 2016 SF initiative. This paper examines the symbiotic dynamics between agricultural and forestry interests, emphasizing the challenges and successes encountered in three generations of SF programs. SLR was chosen to be used as a method to produce a comprehensive and in-depth review. The analysis explores the pivotal role of NGOs and international research institutions in influencing policy changes and shaping the success of community forest programs. The research underscores the economic benefits of SF areas and collective resilience to climate change. In three generations of SF, it has experienced a shift in focus from gaining recognition and legality from the government towards knowledge production and policy improvements. Incomplete tenure agendas and the economic intricacies of various agroforestry practices emerge as critical areas requiring attention. Empowering diverse groups requires deeper consideration. This comprehensive examination not only contributes valuable insights to Lampung and Indonesia but also enriches the global understanding of how the interwoven dynamics between agricultural and forestry interests influence the trajectory of SF initiatives.

1. INTRODUCTION

Community-Based Forest Management (CBFM) has been a focal point for nearly 50 years in addressing the relationship between forestry and rural communities. In essence, CBFM hinges on a symbiotic connection between healthy forests and community well-being [1-3]. Numerous global journal articles both support and critique CBFM implementation and its impacts [4]. However, contemporary challenges in achieving CBFM goals have become increasingly diverse and complex [5-9]. Thus, CBFM remains a worthy subject for further examination, integrating local knowledge dynamics, scientific forestry, and the evolving interests of local communities and government authorities [10, 11].

Since 2016, the Indonesian government has consolidated five CBFM programs into a single initiative known as Social Forestry (SF). Originating from programs like Community Forest (CF), Village Forest, and People's Forest launched in the late 2000s [12], SF aims to expand from an initial 1.1 million hectares to 12.7 million hectares [13-15]. Despite rapid policy growth, challenges persist, including uncertainty in land ownership, resource management, and limited community participation in decision-making, posing implementation challenges [16].

To support SF development, scholars have critically reviewed various initiative implementations. These reviews often involve literature studies and case comparisons across regions [8, 9, 14, 16-20], and explore policies and government programs as new institutions for local communities [14, 21]. Therefore, it's crucial to conduct studies that delve into the development of scientific knowledge production related to SF in specific areas over time, providing deeper insights into the situations and challenges of SF implementation.

While a literature review should offer a general overview, the emphasis lies in providing added value [22]. Many believe that ecosystems benefit when actions align with scientific community understanding [23-27]. However, utilizing and implementing research findings is a political process, not always aligning with researchers' intentions [28]. The primary challenge is no longer just producing detailed knowledge but understanding the context of knowledge use and transforming it into sustainable actions [29]. Researchers and policymakers must examine how various socioeconomic contexts influence behavior and how this context relates to fundamental social

practices [30].

Nowotny et al. [31] noted a radical shift in knowledge production and research processes from 'Mode 1' to 'Mode 2.' 'Mode 1' refers to isolated knowledge production focused on separate scientific disciplines, while 'Mode 2' emphasizes application context and transdisciplinarity. The 'Mode 2' concept, introduced by Gibbons et al. [32] suggests that policies and practices are part of the application context in knowledge production. This shift is very relevant to the context of SF development in Indonesia. Fisher et al. [14] stated that in the past, problems in the forestry sector tended to be solved with technical forestry knowledge ('Mode 1'). Currently, SF is a transdisciplinary approach to forestry problems ('Mode 2'), where Dove [33] states that social science research can help forestry experts and social scientists to better understand the needs and desires of farmers, so that they can improve SF.

However, while 'Mode 2' knowledge production offers valuable opportunities for innovation, collaboration, and responsiveness to real-world challenges, it has limitations in terms of quality control, objectivity, and management complexity underscore the need for ongoing reflection, and adaptation of practices to address these challenges effectively [31, 34-37]. Moreover, handling knowledge in 'Mode 2' contexts, especially in intricate and varied settings such as Social Forestry or interdisciplinary research endeavors, can pose difficulties. Managing diverse viewpoints, interests, and priorities within a transdisciplinary context may demand innovative approaches to governance, coordination, and decision-making in order to successfully integrate and apply knowledge.

Dale et al. [24] proposed a conceptual model to enhance the relationship between science, policy, and practice, offering a framework depicting a two-way interaction between science, policy, and practice. This model can be a framework for analyzing the dynamics of the relationship between science, policy, and practice in resource management, including SF. SF as a product of forest resource management policy in Indonesia has experienced dynamics over time in line with political, policy and knowledge developments [14, 38]. Integration between science, policy and practice is expected to influence the achievement of SF results.

However, on its application, this model has some limitations that should be considered, such as first, the model may oversimplify the complex interactions between science, policy, and practice in coastal management. Second, the model has not been extensively tested in diverse real-world scenarios. Third, the model focuses on the integration of science, policy, and practice, but may not fully address other important aspects such as social equity, cultural considerations, and economic factors [24, 39-41].

Lampung Province in Indonesia plays a unique role in SF development, covering almost 30% of the province's land area. Being one of the most densely populated provinces in Sumatra, Lampung has been a destination for impoverished land migrants from various islands [42]. This migration aims to secure agricultural land and employment, creating high social-cultural diversity and complexity in the relationship between forests and surrounding communities. Due to factors like agro-industrial plantations, transmigration, and shifting cultivation, Lampung, Sumatra, has experienced significant changes in land cover and scenery over the past 60 years [43]. Recognized as a pioneer in implementing SF in Indonesia [44], Lampung becomes an ideal case study.

This paper aims to comprehensively review the development of SF in Lampung Province, understanding the reciprocal relationship between knowledge production dynamics, SF policies, and practices. The insights gained from reviewing SF programs implemented over two decades can provide valuable lessons not only for Lampung and Indonesia but also contribute globally to the science of community-based forest management.

2. RESEARCH METHODOLOGY

2.1 Data sources and international journals used for the review

Systematic Literature Review (SLR) is used as a method to produce a comprehensive and in-depth review [45, 46]. SLR was chosen as a method for synthesizing several pieces of evidence in the form of scientific articles on a topic to reach strong and broad conclusions and implications [45, 46]. The SLR steps are presented in Figure 1.

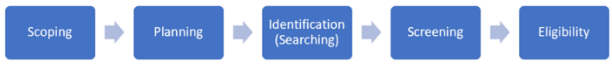

Figure 1. Key steps in conducting a systematic literature review
Source: modified [45]

At the scoping stage, several key issues are determined as the scope of the review article. Key issues are formulated based on the objectives and research questions of the research. Next, in the planning stage, the operationalization of research questions is carried out by breaking them down into individual concepts to determine the terms used in the search. These search terms are important in order to find relevant articles. In this stage, a list of inclusion and exclusion criteria is also formulated to help answer specific research questions and clearly define the boundaries of the review. The inclusion and exclusion criteria used depend on the topic of the review article, theoretical, empirical, and methodological issues specific to the literature. A thorough literature search was carried out at the identification or search stage. Searches were carried out on scientific publications at national and global levels. At least two electronic databases were used to find all written works that answered the research questions. Screening is carried out on search results that need to be filtered to determine potential inclusion. Next, a complete reading of the article is carried out to determine its suitability for inclusion in the review article [45, 46].

The database for this article was prepared in two stages, namely searching databases from international journals and national journals. International journals were explored using SCOPUS and SCIENCE DIRECT and national journals were searched using GOOGLE SCHOLAR. In searching the database we used the Boolean operator concept using the keywords "Social Forestry", "Community Forestry" and "Indonesia" for the international database, and "Social Forestry" and "Lampung" for the national database.

2.2 Inclusion and exclusion criteria for article analysis

International and national journal articles that have been collected are filtered to be used in preparing articles. The inclusion and exclusion criteria used are publication status, non-peer-reviewed, unpublished and duplicates. We searched in August 2023 and found 655 articles; 438 articles are non-peer-reviewed, unpublished and duplicates. The results obtained were 217 articles that matched the topic. Articles that pass the criteria are then selected and extracted to answer research questions. The selection results obtained 106 articles, which were then used to answer four large groups of research, namely Development of Social Forestry in Lampung, Integration Approach Between Agriculture and Forestry, Impacts and Benefits of Social Forestry Program, and Analysis and Evaluation of Social Forestry Program in Lampung. The article selection process is presented in Figure 2.

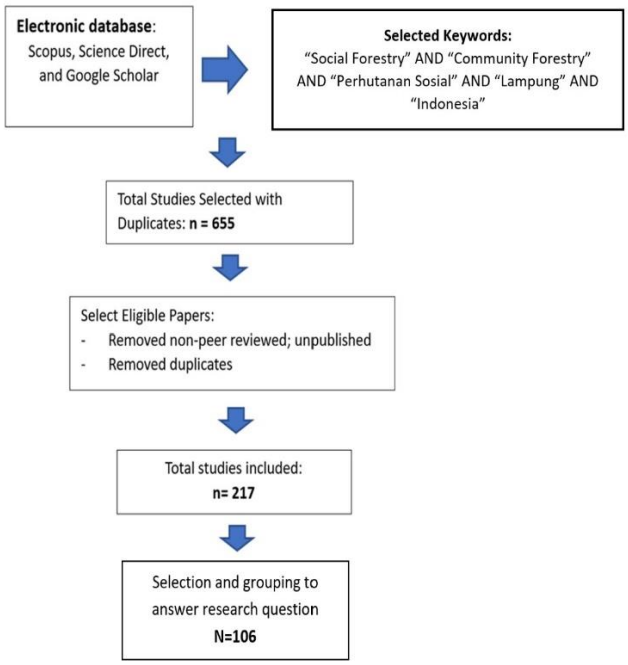

Figure 2. Flow diagram of the article selection process

2.3 Data analysis and information synthesis process

We aim to analyze the development of SF in Lampung Province by contextualizing its historical progression leading to its current form. Drawing from Fisher et al.'s [47] classification of SF development into three generations, namely the first, second, and third, we have modified it to align with the specific circumstances in Lampung.

The first generation of SF in Lampung was influenced by the power dynamics of the New Order, characterized by a strong and centralized governance approach. The first generation spanned until 1998/1999, coinciding with the shift in the national government paradigm that began accommodating SF. The second generation, marked by government support for SF initiatives, is reflected in the formulation of policy frameworks and the CF program. Meanwhile, the third generation of SF is characterized by extensive government backing, both in terms of policies and institutional support, beginning around 2014-2016.

Through this analysis, we unveil the dynamics of the relationship between science, policy, and practices in the context of SF in Lampung Province. Additionally, we present the need for new knowledge production that aligns with the evolving policy and practice landscape in SF.

3. DEVELOPMENT OF SOCIAL FORESTRY IN LAMPUNG

3.1 Introduction to Lampung Province and forests status

Lampung Province is situated at the southern tip of Sumatra Island, Indonesia, covering an area of 33,575 km², approximately 1.84% of Indonesia's total land area. Comprising 15 administrative regions, it includes two cities (Metro and Bandar Lampung) and 13 regencies (Lampung Selatan, Lampung Utara, Lampung Tengah, Lampung Barat, Lampung Timur, Pesawaran, Tanggamus, Pring Sewu, Pesisir Barat, Way Kanan, Tulang Bawang, Tulang Bawang Barat, Mesuji). The largest region is Lampung Tengah Regency, spanning 4,550 km², while Metro City is the smallest at 73.21 km².

The province's land area is diversified, encompassing various land uses, including state forests, which constitute 1,004,735 hectares or approximately 30.43% of the total land area. State forest types include conservation forests (13.99%), protected forests (9.62%), production forests (1.01%), and permanent production forests (5.81%) [48]. SF initiatives in state forests began in 1995, involving local communities in activities such as planting and rehabilitating production and protected forests, known as CF [49].

CF has experienced rapid growth in Lampung Province, with the current achievements comprising 386 concessions involving 8,610 households [50]. In addition to CF, Lampung Province has implemented various forms of SF such as village forests, forestry partnerships, customary forests, and CF plantations [51]. Consequently, the development of SF in Lampung Province has fostered a close relationship among communities, policies, and practices in forest and SF management.

3.2 Government policies related to Social Forestry in Lampung

The SF program has been ongoing for over two decades in Indonesia, commencing with Minister of Forestry Decision No. 622/1995 on CF Guidelines. This initiative involved communities in forest development through a "mixed-cropping project" approach [49]. Subsequent regulations included Minister of Forestry and Plantation Decision No. 677/1998 on Community Forests [51]. This regulation clarified that CF empower communities through a CF Utilization Right for 35 years, especially in production forests, protected forests, and natural conservation areas without other forestry rights burdens.

The CF regulation was later amended by Minister of Forestry Decision No. 31/2001, restricting its application to protected and production forests. It introduced temporary permits (3-5 years for community groups) and definitive permits (25 years for cooperatives formed by community groups) granted by the Regent/Mayor [51, 52]. Subsequently, this regulation was revised into Minister of Forestry Regulation No. P./2007, extending the permit duration to 35 years with two types of permits: CF Utilization Business Permit (CFUBP) and CF Timber Utilization Business Permit

(CFTUBF). These permits were granted by the Governor or Regent/Mayor for CFUBP or the Minister for CFTUBF [53].

This regulation underwent further changes with Minister of Forestry Regulation No. P.18/2009 In 2009, altering activities, verification teams, and facilitation were received by CFUBP holders in production forests and protected forests. In 2010, it was modified again under Minister of Forestry Regulation No. P.13/2010, adding CF Work Areas and amending activities and verification teams [53].

In 2016, CF became part of the SF concept, as outlined in Minister of Environment and Forestry Regulation No. P.83/2016 on SF. This regulation provides CFUBP based on the SF Area Indication Map determined by the Minister of Environment and Forestry. In 2020, with the enactment of the Omnibus Law on Job Creation, CF included in SF could be granted to individuals, forest farmer groups, and cooperatives, further regulated by Government Regulation No. 23/2021 on Forest Management and Minister of Environment and Forestry Regulation No. 9/2021 on SF Management.

4. INTEGRATION APPROACH BETWEEN AGRICULTURE AND FORESTRY

SF in Lampung adopts an agroforestry approach, seamlessly blending agriculture and forestry. Agroforestry proves effective by delivering economic, social, and environmental benefits. Agroforestry patterns, optimizing land use economically and ecologically, require spatial arrangements for crops [54]. SF conducted in forest areas, emphasizes forest resource management, considering ecological aspects, not solely economic ones.

Damar agroforestry patterns, as practised by Krui farmers, involve planting damar trees amid food and fruit crops. The damar tree arrangement is designed not to hinder the growth of other plants, allowing effective land use and sustainable forest production [55]. Various crops, such as cloves, coffee, and pepper, are cultivated, but the damar grove dominated by Shorea javanica trees provides sustainable economic benefits and supports biodiversity and the ecological functions of the forest.

Wulandari et al. [56] identified three agroforestry patterns applied by the Lampung community, particularly around the Tahura WAR. These patterns involve coffee, cocoa, woody plants, and fruits. Research results indicate that the rubber-coffee-woody plant-fruit tree agroforestry pattern has a higher NPV, demonstrating greater economic benefits. The integration of agriculture and forestry can be a profitable land-use alternative for communities.

Ulya et al.'s [57] study reveals that coffee plants in Lampung, especially in the Way Seputih Sekampung Watershed, are developed through agroforestry. Coffee agroforestry holds promise for future profits with the increasing global market demand and environmental benefits such as carbon emission reduction. Coffee plants also contribute to environmental and ecosystem protection, including spring water protection and deforestation rate reduction. To ensure the long-term success of integrating agricultural and forestry crops, further research should address aspects such as climate change adaptation and sustainable management.

The integration of agricultural and forestry crops is a suitable step in the SF scheme. Nevertheless, specific research on the exact composition is still needed to achieve harmony between the economic interests of the community and ecological sustainability in the context of protected forests. The sustainability of the SF scheme in Lampung can be ensured through a profound understanding of these aspects and the implementation of wise policies.

5. IMPACTS AND BENEFITS OF SOCIAL FORESTRY PROGRAMS

5.1 Community participation in forest management decision-making

The agroforestry management in Krui, as reported by Michon et al. [55], represents the initial phase of damar agroforestry by the local community in West Lampung. Despite its success, conflicts arose when damar agroforestry was considered part of the forest, creating disagreements. This conflict reflects the tension between traditional practices and government regulations. Community involvement in dialogue and responsive policies becomes crucial for managing conflicts and supporting damar agroforestry sustainability.

Suporahardjo and Wodicka's [58] study examined tenure conflicts around damar agroforestry in Coastal Krui. Despite effective resource management, government plans in the early 1990s to convert the area sparked disagreement. Changes in government attitudes and recognition of community rights to damar agroforestry marked a positive shift, emphasizing the importance of dialogue and government involvement.

Siscawati et al. [44] reviewed community participation in Lampung's forest management, particularly regarding the recognition of indigenous community rights to damar agroforestry. The New Order era restricted community rights, but formal recognition of indigenous community rights was eventually realized. SF in the reform era addressed tenure conflicts, encouraging community participation.

Kaskoyo et al. [51] reported on the development of CF in West Lampung. The success of CF depends on the active participation of the local community. However, CF implementation does not always achieve its goals, highlighting the need for community empowerment. Capacity enhancement and community group involvement in decision-making can be a solution to achieve damar agroforestry sustainability.

Budi et al. [59] evaluated community access in SF in Lampung. Although CF permits improved community access, further efforts are needed for independent empowerment. The dynamics of community participation in forest management reflect global changes towards decentralization. Increased access involves the capacity and community networks to support sustainable forest management.

Community participation in Lampung has evolved from the New Order era to the 2016 SF regulations. Despite dynamics, community participation is a positive step towards forest sustainability. Devolving government roles is expected to improve holistic forest management.

To enhance the sustainability of SF, further research is needed to understand the factors influencing participants. This can lead to more effective strategies for increased community involvement. Clear role models are essential for local governments, businesses, and NGOs to build self-sufficiency. Close collaboration among all parties can create a supportive and sustainable environment for SF, demonstrating a balanced integration of economic and ecological needs in forest

management.

5.2 Awareness of the importance of environmental sustainability

Michon et al. [55] state that the traditional management of damar agroforests by the local community has successfully served as an ecologically nearly perfect substitute for natural forests. This diversified plant system may be an optimal replacement for natural forests. The long-term development of agroforestry allows for the recovery of vital biological and ecological processes crucial for the sustainability of agroforestry as an ecosystem. The restored biodiversity in damar agroforests provides sustainable economic returns for farmers, showcasing a harmonious integration of economic and ecological aspects.

Suyanto et al. [60] report that clear land tenure and community involvement are key to successful sustainable land management. Local community involvement in forest management policies in Lampung has proven successful in rehabilitating degraded land through coffee-based agroforestry. Granting legitimate land access to the local community through the SF scheme since 1999 serves as a primary incentive for sustainable land resource management. This study highlights room for negotiation that can yield economic benefits for the local community and environmental improvement through reduced forest fires.

Suyanto et al. [61] emphasize that local community participation dependent on state forests is crucial for the success of conservation programs. The study in DAS Way Besai, Lampung, shows that coffee-based agroforestry applied by farmers can successfully rehabilitate degraded land. Land rights for poor farmers providing environmental services through their activities in state forests can help alleviate poverty.

Pender et al. [62] examine the positive impacts of the CF Program in DAS Sumberjaya, Lampung. This program enhances community income, access to forest resources, and social capital. Environmentally, the program successfully increases forest cover, improves forest quality, and reduces soil erosion. The success of this program depends on addressing challenges such as inadequate funding and weak technical support.

Kaskoyo et al. [51] report the positive impacts of CF on the environment in Lampung after two decades of CF permits. Despite challenges like inadequate funding, this program successfully improves the conditions and sustainability of the forest. The success of the CF program varies widely, depending on the ability to overcome challenges and achieve conservation goals.

Putraditama et al. [63] highlight the importance of Community-Based Forestry (CBF), especially CF in Batutegi, Lampung, in improving the livelihoods of local communities and preserving biodiversity. Although less effective in reducing deforestation compared to National Parks, CF still has a positive impact compared to similar forests without CBF management. Recommendations include considering the bio-physical location, specific support for local communities, and using monitoring technology to measure conservation success.

Overall, these studies affirm the importance of SF, especially in protected forest areas, in supporting environmental sustainability. However, further research is needed to raise awareness of the critical role of SF areas. One research area to explore is the business opportunities for carbon in SF areas, emphasizing the selection of appropriate agroforestry patterns so that SF areas are no longer dominated solely by agricultural and plantation crops.

5.3 Improved community welfare through local economic development programs

Michon et al. [55] investigated the early stages of CF in Lampung, focusing on the sustainable and beneficial damar agroforestry in Krui, managed entirely by the local community. This practice contributes significantly to community well-being and the local economy, highlighting the importance of community involvement in natural resource management.

Suyanto et al.'s [61] study in Sumberjaya reveals that farmers in the Way Besai watershed practice successful multistrata coffee agroforestry, providing the primary income for poor farmers and protecting the watershed. Recognizing the impoverished communities with land access in state-owned forests can reduce poverty and improve the environment. This underscores the need for better coordination between stakeholders and the government to integrate these practices into forest management policies effectively.

Pender et al.'s [62] research on the CF program in DAS Sumberjaya highlights its positive impact on the environment and community well-being. This program permits farmer groups to cultivate in state-protected forests, promoting environmental conservation and poverty reduction. Better coordination is essential for the sustainability of SF programs.

Kaskoyo et al. [49] examined the impact of CF programs in Lampung, concluding that the CF program positively influences various types of farmers' capital, contributing to their well-being. This emphasizes the importance of strengthening community capacity and involvement in the success of SF programs.

Wulandari and Kurniasih [64] stress the need to prioritize facilitation types for SF stakeholders in Lampung, focusing on entrepreneurship. This reflects the awareness of the need for concrete support in developing SF programs collaboratively with the community.

These findings highlight the positive impacts of natural resource management through SF, but future research should focus on business diversification at the group level. Investigating diversification strategies and market potential will provide a solid foundation for more effective policy planning and local economic development programs.

6. ANALYSIS AND EVALUATION

6.1 Successes and challenges of Social Forestry programs in Lampung

The first recognized traditional SF practice in Indonesia emerged in 1998 with the designation of the Special Assigned Area for Repong Damar (KdTI) in Krui, Lampung [17, 65]. This local agroforestry damar system, celebrated for providing income to smallholders and contributing to biodiversity conservation [66], was initially seen as a success [67, 68].

Study by Colchester et al. [69], highlighted the significance of KdTI in sustaining the repong damar system. The decree successfully curtailed planned logging operations, halted oil palm expansion, securing local government recognition and instilling confidence in farmers about the legitimacy of their

livelihoods [70]. However, research by Sari [71] revealed a dual community response in Lampung Barat, with residents relieved about retaining repong damar access but disappointed over the loss of ancestral land rights.

Colchester et al.'s [69] findings exposed KdTI's failure to meet farmers' demands for land ownership recognition, potentially perpetuating dependence on the Ministry of Forestry. Despite its significant breakthrough in gaining state acknowledgment for CF management practices, the first generation of SF fell short in its development, as communities aspired for true ownership beyond mere recognition of acquired practices.

Prior to the year 2000, there was little interaction and coordination between researchers, policymakers, and practitioners in the field of Social Forestry in Indonesia when it came to scientific research, policy formulation, and field operations. The "evidence-policy gap" and an emphasis on top-down strategies and conventional forest management techniques resulted from this [72]. A change toward more inclusive and sustainable forest management techniques was signaled in the 1990s by the introduction of the "sustainable forest management" concept and the creation of the Forest Stewardship Council (FSC) certification program [73, 74]. The second generation of SF in Lampung began in 1998, shifting from the centralized political system of the New Order to decentralization amid economic shocks and political transformations of 1997/1998 [75]. In this context, local communities in Lampung, motivated by soaring coffee prices and the transitioning government regime, reopened forest areas [76]. Ministerial Decree No. 677 on Community Forestry, signed in 1998, outlined the second-generation program (CF). Subsequent policy shifts in 1999 gave more authority to districts, rendering KdTI irrelevant [77].

In 1999, a new CF program reached the village of Tribudi Syukur in Lampung. It granted farmers long-term licenses for coffee production on degraded protected state forest land under the condition of preserving the remaining forest, planting agroforestry trees, and employing conservation techniques [78]. This initiative, exemplified by 493 farmers in Sumberjaya, received their CF license in 2000. They effectively managed the forest, met regularly, planted agroforestry seedlings, and formed a local ranger organization to monitor the remaining forest areas.

One significant impact of the CF policy was a reduction in forest fire incidents, often linked to weak land tenure security, prevalent in protected forests [61]. CF policies, by providing more secure land rights, played a role in enhancing land use management techniques among farmers [60].

In Indonesian Social Forestry, the relationship between scientific research, policy formulation, and field practices changed dramatically between 2000 and 2014. Community involvement, sustainable practices, and evidence-based policy formulation became increasingly important [19, 73]. As a result, evidence-based policymaking, the adoption of sustainable forest management, the growth of Social Forestry initiatives, and adaptive management were all achieved [79, 80]. The third generation of SF in Lampung shifted its focus from supporting community agroforestry practices to evaluating policy implementation outcomes. Both policy and scientific production consistently adopted the term "Social Forestry" as an umbrella for five schemes. Kuncoro and Cahyani [81] discussed the performance of SF in Lampung, revealing increased production, income, and job opportunities for farmers. Puspasari et al. [82] research indicated that agroforestry activities practised by three CF groups in West Lampung contributed to farmers' income by 66%. They recommended farmers plant more types of multipurpose plants and undergo training for more optimal land management. However, participants in the CF program could not expand their cultivation area.

In addition to economic impacts, some research teams also conducted ecological evaluations of CF implementation. The research results of Yustika et al. [83] stated that community farming practices in CF areas, such as agroforestry coffee, cover crops, and contour systems, effectively reduce soil erosion. The research results of Putraditama et al. [63] indicated that CF is less effective compared to Conservation Forests in reducing forest cover loss but more effective than similar forests without Community-Based Forestry management. Recently, SF has been proposed as having the potential to contribute to climate change mitigation and adaptation. Syakila et al. [84] analyzed SF's contribution to Lampung's Nationally Determined Contribution (NDC) goals. They found that the carbon stock changed in a limited and localized way, and the increase's magnitude was insufficient to counteract the overall decrease.

With an emphasis on growing Social Forestry programs and bolstering community management, the link between scientific research, policy creation, and field activities on Social Forestry in Indonesia continued to change between 2014 and 2016. While the World Bank's Strengthening of Social Forestry in Indonesia project aimed to promote access to forest land use rights and strengthen community management, the Indonesian government sought to extend Social Forestry designations from less than 1% to over 12.7 million hectares [14]. These patterns show a persistent emphasis on growing Social Forestry initiatives, enhancing community governance, and incorporating biodiversity preservation into business strategy plans [85]. Currently the CF policy in Lampung has succeeded in providing guarantees of land rights which have an impact on increasing production, income, employment opportunities for farmers and improving the quality of forests and environments that have been degraded. However, limitations on the size of cultivation areas can be overcome through optimizing agroforestry by planting more types of multi-purpose plants.

The long-term challenge for CF is the sustainability of those positive impact. To maintain sustainability and even increase economic and ecological impacts in the long term, strengthening Social Forestry business governance is key in the licensing granted by the government for 35 years. Market aspects, capital and assistance are the keys to sustainable business governance and management of limited managed land.

6.2 Factors contributing to program success

Krui stands out as a success story in CF in Indonesia [86]. The success of designating a 29,000-hectare agroforestry area in Krui as KdTI in 1998, marking Indonesia's first SF program, was a result of knowledge production and policy advocacy efforts by various stakeholders. This began in 1993 when NGOs and international research institutions collected data on native agroforestry in Krui by engaging in damar resin collection activities [87]. At that time, the Krui area was designated as a forest region but was threatened by oil palm expansion and forest concessions. Studies on biodiversity, silviculture, and participatory mapping were gathered as

evidence of the excellence and social-environmental benefits of the Krui system. With this knowledge base, the Minister of Forestry was urged to designate the Krui system as a special area, and the effort succeeded.

The implementation of the CF program marked the second generation of SF in Lampung. The political changes in Indonesia and the support of NGOs and university staff with scientific knowledge production and advocacy were crucial factors in the success of policy formulation and CF implementation. Compared to previous regulations, the new framework represented a significant advancement [88]. The development of the new framework and the wording of the decree involved extensive participation from various NGOs and university personnel [88]. Internationally recognized CF principles defined the program, emphasizing that the forest management system relies on current community-based practices and involves local communities as the main actors [88]. The success of communities obtaining CF is closely linked to bridging social capital [78].

To broaden the CF initiative's reach, domestic and foreign non-governmental organizations have collaborated since 1995. Their focus was on ensuring farmers could harvest the trees they planted and strengthening local population involvement in decision-making, especially regarding agroforestry system structures [89]. Due to funding received by ICRAF to support negotiations and promote the program, the CF process in Sumberjaya is more advanced than in other parts of Indonesia [78].

One knowledge production by ICRAF's research team revealed that transforming monoculture coffee gardens into agroforestry systems with shade trees enhances watershed functions, reduces soil erosion, and increases coffee productivity [90]. Their research also showed that the current agroforestry landscape generates higher water yields than in the past, enabling hydropower plants to increase their electricity production targets. This contradicted past assumptions used to justify the eviction of coffee farmers from protected forest areas. The CF-based multistrata coffee model in Lampung is considered a success and serves as an example for other regions in Indonesia.

In 1999–2000, CF became the focal point of Lampung's forestry policy, given high priority by the Ministry of Forestry regional office as a suitable solution to forestry conflict and degradation in the province [91]. Until 2013, Ministry of Forestry data showed that Lampung had the largest CF area in Indonesia, covering 29,555.66 hectares [92]. This was because CF permits were usually granted to forest areas already used by communities, and the allocation of production forests in Lampung available for concessions was limited, making the SF scheme the only option to retain state control over land [92].

In the era of the third generation of SF, Budi et al. [59] conducted a case study on the implementation gap in SF policy in one CF group in Lampung. They found that non-governmental organizations (NGOs) play a significant role in facilitating the rights and obligations of licensed communities, indicating that advocating for SF remains an intriguing issue for NGOs. This may also mean that communities' dependence on NGOs' facilitation has not changed since the first generation of SF. The lingering question in the context of SF development is who truly needs facilitation: the community, the government, businesses, or the NGOs themselves.

This situation is quite problematic for the development of CF in the long term. Amidst the limitations of CF groups, the existence of NGOs with financial support and intensive assistance is still needed. For this reason, it is necessary to map the assistance needs of the group by considering the strengths of the group so that assistance is more targeted, and the CF group is not just an object of development. The devolution of government's role over time can be proof that CF group is able to progress further.

6.3 The Lampung Social Forestry model: Catalyst for national and global change

The first-generation SF model in Lampung, known as KdTI, marked a pivotal moment in the nation's history. Designated as a Special Assigned Area and officially recognized as a community-managed forest in 1998 [65], KdTI became a beacon for efforts by scholars and activists to convince the state of the community's capability to manage forests. Scientific knowledge production and policy advocacy, initiated in 1993, played a crucial role in this success. The Minister of Forestry, leveraging the evidence of Krui's ecological and social benefits, declared KdTI a special area, initiating national and global discussions on the value of community-managed forests [69].

Building on the success of Krui's damar resin production, NGOs extended and refined the SF model to other communities with proven management capabilities [65]. Traditional forest management practices, documented by diverse researchers [93-96], influenced legislative changes. Notably, a 2012 Constitutional Court ruling recognized indigenous people's rightful ownership of customary forests nationwide [97], aligning with the principles embedded in Lampung's early SF endeavours.

The second-generation SF icon, known as CF, aimed to improve access to forestry and agriculture-related programs and gained national recognition for securing community rights [78]. CF's success in Sumberjaya, Lampung, showcased the innovative collaboration between NGOs, local communities, and the government, providing a groundbreaking example for farmers in other provinces [77]. Even though initially there is limited trust and learning, the support of external networks such as NGOs, government and scientists will increase the success of CF, as happened in Tanzania [98, 99].

As Lampung entered the early phase of the third generation of SF, the emphasis shifted towards knowledge production derived from over fifteen years of CF implementation. Researchers explored community opinions, revealing changing needs for facilitation, from institutional strengthening to entrepreneurial support [64]. However, limited research exists on the long-term issues and concerns of farmers post-CF implementation. A different situation occurs in Bolivia, knowledge recommendations for forest management do not seem to have much influence on management practices because the available scientific knowledge does not match the needs of CF [99, 100].

Reviewing SF development in Lampung illustrates the dynamic interplay between ecological conservation and economic needs. Most protected forest areas have transformed into farmland through harmonized SF schemes. The promotion of coffee and other valuable trees in Lampung's SF aligns with global concepts of green economics [57]. Rakatama and Pandit [19] explained that SF programs can be successful and sustainable by implementing and developing agroforestry patterns. The application of this agroforestry pattern is expected to produce major commodities sustainably such as firewood, construction wood, animal feed, green

manure, local food, fruits, ecotourism, carbon, and others. Some studies also show that selling NTFPs can help increase the income of SF member farmers [101].

The hope is that finally environmental damage (forests and other resources) can be minimized and field production capacity can be maintained, so as to realize the sustainability of SF. But keep in mind also some success factors of SF programs that are not always the same in one region with another. As stated by Khaine et al. [102], the success of SF programs on the livelihood and welfare of farming communities is complex, varying based on household, gender, job skills, rules governing access to forest resources, SF locations, and types of state forests (production forests or protected forests), as well as SF resources in the area.

Global case studies underscore that successful forestry development results from tenure reform [103]. The success of the SF program cannot be separated from the contribution of supporting factors, in order to realize the goals of the SF program itself. Sanudin and Awang [104] explained that the HKm Policy (legal certainty of forest land tenure) is one of the success factors of the SF program because it provides a sense of security and comfort for communities around the forest in managing land to earn income, besides that there is a responsibility that accompanies them in securing forest sustainability.

It is also explained by Kyi et al. [105] that farming communities that have SF licenses have legal rights to equality and justice and can stop illegal activities of outsiders. Yet, the tenure agenda for SF in Lampung and Indonesia remains incomplete [91]. This is currently a challenge for CF development in Lampung and Indonesia in general. Although legally addressed, the problem of people's tenure security over forestland requires further attention for effective collective forestry management. The strengthening of collective forestry remains an ongoing agenda, necessitating further scientific knowledge production and policy improvements. Strengthening collective forestry is still an ongoing agenda, requiring the production of scientific knowledge and further policy improvements in order to obtain long-term solutions.

7. CONCLUSION

SF emerges as a middle ground for forestry development in Lampung Province, an administratively limited forest area densely populated by farmers. A review of SF science in Lampung, Indonesia, highlights the intricate balance between agricultural and forestry interests across scientific, policy, and field practices. In the first and second generations of SF, community farming practices, both traditional and contemporary agroforestry, required scientific support for recognition and legality from the government. In the third generation, SF policies become a government priority, necessitating scientific support to align farming practices within the SF framework with diverse global agendas.

Furthermore, the literature review shows that community participation moves dynamically and positively towards forest sustainability. The devolution of the government's role is expected to improve holistic forest management. Collaboration between all parties can create a supportive and sustainable environment for CF, demonstrating a balanced integration of economic and ecological needs in forest management. Formulating agroforestry pattern is needed to diversify products that provide economic benefits, both conventional and ecological economic benefits in the form of carbon trading and preserving forests. So that the economic and ecological impacts can be sustainable and even increase, strengthening CF business governance is key in the licensing granted by the government for 35 years. Market aspects, capital and assistance are the keys to sustainable business governance and management of limited managed land.

Considering the various findings above, future research is directed at producing optimal agroforestry patterns to provide long term economic and ecological benefits. Tenure issues remain interesting to study because of the dynamics that occur due to devolution, limited land and changes in generations of CF members. To improve the sustainability of CF, further research is needed to understand the factors that influence participants to produce more effective strategies in order to increase community engagement and collective resilience to climate change and policy.

Community-based forestry in Lampung provides farmers with land tenure security, increased income, and reduced fire incidents, but success depends on site-specific factors and technical support [106]. Therefore, it is time to shift the focus towards knowledge production and policy improvement. The economic benefits of forestry in various agroforestry practices within SF areas need more attention. Additionally, empowering diverse farmer groups participating in SF requires deeper consideration, especially regarding their collective resilience to climate change and policies.

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