7. Independent Smallholders Farmers

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Independent Smallholders Farmers Group Sustain Biodiversity, Social and Economy After a Roundtable on Sustainable Palm Oil Certification: Case Study Sites in Jambi Province, Indonesia

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Abstract. The purpose of this research is to analyze environmental impacts by assessing the number of forest crops planted among oil palm plantations, comparing soil qualities between certified and non-certified areas, analyze economic impacts by calculating the group's income, and analyze the strategies used by strengths to be balanced biodiversity and economic development. The data collection uses observing, interviewing, and sampling the soil in the oil palm plantation and control site. The economic analysis was analyzed by using cost and benefit analysis. There has been a very significant change as the location of the river border has been planted with several types of forest plants. The chemical properties of soil in Gapoktan and non-Gapoktan farming areas were low pH or acid soil reaction. However, organic C, total N, and available P in Gapoktan soils were higher than in the non-Gapoktan soils. Smallholders' strategies can maintain the sustainable management of oil palm plantations. It can be concluded that plot scales in smallholder plantations can support the biodiversity of oil palm plantations; so that runoff water can be restrained, and the biodiversity enrichment in oil palm can generate synergies between economic, social, and ecological functions.

1. Introduction

Globally, pressure demands increased palm oil to be produced sustainably, especially according to the roundtable on sustainable palm oil (RSPO) standard. To date, adopting sustainable palm oil standards is voluntary for many countries. Also, it is unclear whether early adopters achieve better financial positions than those who do not practice the standards [1]. Land conversion to produce oil palm has been recognized as one of the main drivers of tropical deforestation [2]. Smallholder oil palm plantations have increased from 3,125 ha in 1979 to more than 6 million hectares in 2019, accounting for about 41% of Indonesia's total oil palm plantations [3].

Reducing tropical deforestation caused by expanding agricultural and other commodities, especially palm oil, requires good interventions for engaging small-scale farmers. However, smallholders identify their main challenges in achieving certification [4]. Furthermore, independent oil palm smallholders are grouped according to many categories, based on landholding size, the farmer's ethnicity, local or migrant farmers, and the farm location of palm oil plantation (peat or minerals soil). The largest categories of farmers in their study owned, on average, 49.6 ha [5]

The black campaign *Elaeis guineensis* associated with oil palm's reputation as the deforestation driver has driven many buyers from Europe and North America to demand sustainability-produced palm oil. Industry groups created voluntary certification systems, such as the Roundtable on Sustainable Palm Oil (RSPO). Although the overall RSPO-certified area is small compared to the total oil palm area, there have been some reports of the limited success of RSPO in reducing deforestation [6]. Are there any studies about the RSPO impacts on biodiversity? However, smallholder participation in this certification program has been limited until now due to their limited capacity to organize and comply with the complicated certification process [7]. More literature reviews are here for smallholders in advancing RSPO monoculture [8].

Many studies argue that oil palm plantations in Indonesia have low biodiversity values being a monoculture system [9]. However, limited empirical studies have measured the impacts of smallholder RSPO certification on livelihood and biodiversity. This integrated assessment can help us understand the effectiveness of RSPO in meeting competing needs.

In general, smallholder palm oil production in Indonesia can be divided into two groups: independent smallholders and scheme smallholders [10]. Independent smallholders of palm oil manage their plantations individually or in a group (Gapoktan) and are not totally helped by the government [11].

This study focuses on one independent smallholder farmer's group (Gapoktan) in Jambi Province, Indonesia, Gapoktan of Tanjung Sehati which obtained RSPO certification and implemented environmentally friendly agricultural practices. This RSPO positively impacted their environment, economy, social and institutional contexts [12].

The result is significant for this study. Therefore the purpose of this research is to analyze environmental impacts by assessing the number of forest crops planted among oil palm plantations and comparing soil qualities between certified and non-certified areas, to analyze economic impacts by calculating the group's income, and to analyze the strategies used by strengths to be balanced biodiversity and economic development. Hopefully, the results of this study will help generate strategies to protect the social systems of oil palm by planting other plants sustainably.

2. Methods

2.1. Study Area

Some communities in Jambi Province of Sumatra, Indonesia, embraced RSPO certification early on. More than half of the total oil palm plantations in Jambi Province are cultivated by smallholders as of 2020, 716,328 ha out of the total is 1.074.600 Ha [13]. One early adopter group of smallholders is Gapoktan Tanjung Sehati, a farmer group certified by RSPO in the year 2014 and maintained its certification until now. Many farmers of Gapoktan Tanjung Sehati have been planting trees within the palm oil plantations and allowing pioneer plants to grow in the border area of the river in their garden area planted with forest crops. Some of the sustainable practices, such as protection of river borders and protection in the basin location, are required by RSPO certification. The Smallholders group, which obtained RSPO certification, must comply with the regulation of Indonesia's law[14].

The research activities were conducted in smallholder oil palm landscapes in Merangin District, Jambi Province, Indonesia. The location of the smallholder (Gapoktan), which received RSPO certification in 2014, is shown in Figure 1.

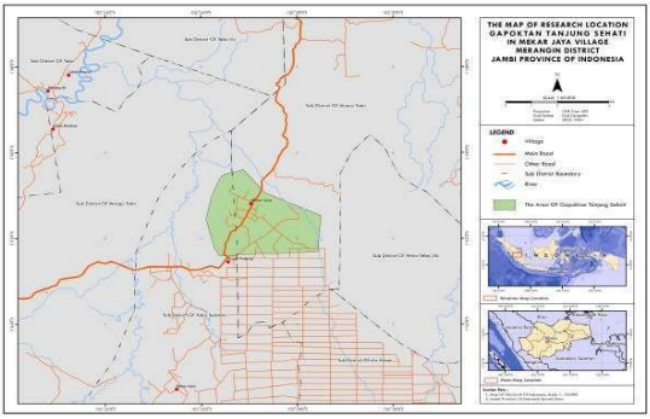


Figure 1. The location of Gapoktan Tanjung sehati

2.2. Materials, data collection, and analysis

Materials of this study were collected from primary data in the field, such as data on plants and areas, while maps of river locations in the plantation and collected by the survey from the local independent smallholder farmers. Biodiversity data were collected through field observations using EFForTSBiodiversity Enrichment Experiment (BEE) method from January to December 2020. Soil samples were taken at four locations in Gapoktan Tanjung Sehati, and two sample points were taken at Sahut Village, which was a monoculture plantation planted only with an oil palm plantation around Gapoktan Tanjung Sehati. Then the data were analyzed in the laboratory. Soil samples were taken at four locations of Gapoktan Tanjung Sehati and two sample points at nearby Sahut village (control Area without Certification).

3. Result and Discussion

3.1. Ecosystem Biodiversity

The results of interviews with farmers Gapoktan Tanjung Sehati revealed that between the years 2000 and 2007, their plantation lands were found still monoculture. Furthermore, the local NGO, Setara Foundation, came to the village and empowered the farmers' community about the management of environmentally sound plantations, and the community began to practice it. In the vicinity of the plantation, there is a small river with a length of approximately 3000 meters, named Sungai Batuah, and the wide plantation area was about 346,57 hectares. There has been a very significant change at the river border area as the location of the river border has been planted with several types of forest plants, as *Swietenia macrophylla, Entada phaseoloides, Nauclea orientalis, Macaranga triloba, Alstonia scholaris, Fagraea fragrans, Artocarpus integer, Durio zibethinus, Tectona grandis, Phoebe hunanensis,* and *Aquilaria malaccensi.*

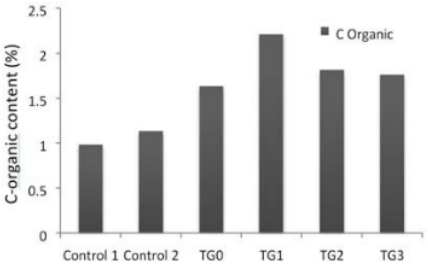
Based on topographic maps and field observations, topography in the study area consists of level (0 - 3%), undulating (3 - 8%), and rolling (8-15%). The dominant topographic conditions are level and rolling. The soil types found in the Gapoktan location are Ultisol and Inseptisol. Ultisol is on the topography of undulating and rolling, while Inseptisol is on the level and undulating topography. The physical and chemical properties of the soil were determined based on the analysis of soil samples taken at four sites on Gapoktan, namely site 1 (TG0), site 2 (TG1), site 3 (TG2), and site 4 (TG3 with RSPO Certification) fields and two sites in control areas which have no implementation of RSPO certification (control 1 and control 2). The results of soil's physical and chemical properties are presented in Table 1.

Table 1. Soil quality in the Gapoktan study area and the control villages

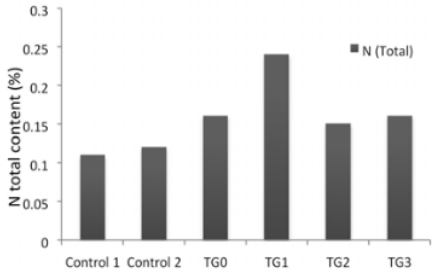
No.	Parameters	Unit	Laboratory result					
			TG 0	TG 1	TG 2	TG 3	Control 1	Control 2
1	pH							
	- H_2O	-	4,6	4,8	4,7	4,6	4,5	4,8
	- KCl	-	3,8	3,7	3,7	3,6	3,7	4,1
2	C- Organic	%	1,6	2,21	1,81	1,76	0,98	1,13
3	N- Total	%	0,2	0,24	0,15	0,16	0,11	0,12
4	C/N ratio		10	9,2	12,1	11	8,9	9,4
5	P- available	Ppm	4,6	4,1	3,8	3,5	2,3	1,8
6	Exchangeable bases							
	Ca, Mg, K, Na	me/100 g	3,5	5,14	4,24	4,48	6,65	5,16
	(CEC)	me/100 g	12	16,5	14,2	14,6	18,6	16,2
	Base Saturation	%	29	31,1	29,8	30,7	35,7	31,8
7	Acidity							
	- Exchangeable Al	me/100 g	2,1	1,94	1,77	2,41	1,92	2,68
	- Exchangeable H	me/100 g	1,8	0,96	1,14	1,35	1,06	1,47
8	Texture		Clay	Clay	Clay	Clay	Clay	Clay
	Coarse sand	%	1,6	1,6	0,9	2,3	0,6	1,1
	Very fine sand	%	4,8	2,6	2,4	2,7	1,2	2,6
	Dust	%	30	23,3	32,9	29,6	26,9	41,6
	Clay	%	64	72,6	63,8	65,4	71,3	54,7
9	Permeability	cm/hour	1,3	0,98	1,35	2,04	1,39	2,36
10	Bulk Volume	g/cm^3	1,3	1,14	1,28	1,3	1,15	1,35

Note: Control 1 and control 2 were the location of samples taken without RSPO Certification TG0, TG1, TG2, and TG3, which were the location of the sample taken with RSPO Certification

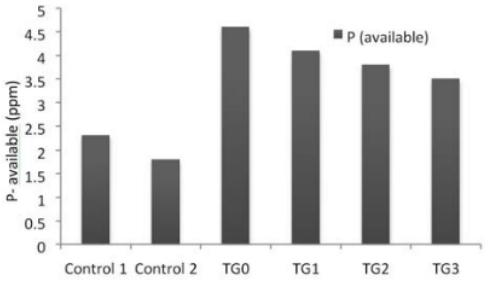
Based on soil analysis in Table 1, it can be seen that the physical properties of soil in Gapoktan and non-Gapoktan areas were clay texture and rather slow to medium permeability. The chemical properties of soil in Gapoktan and non-Gapoktan farming areas were low pH or acid soil reaction. However, organic C, total N, and available P in Gapoktan soils were higher than in the non-Gapoktan shown in Figures 2.



(a) Analysis of C-organic content from soil samples taken at four sites of Gapoktan (RSPO Certification) and two sites in control areas



(b) Analysis of N-total content from soil samples taken at four sites of Gapoktan (with RSPO Certification) and two sites in control areas (without RSPO Certification.)



(c) Analysis of P-available from soil samples taken at four sites of Gapoktan (with RSPO Certification) and two sites in control areas without RSPO Certification.

Figure 2. Analysis of soil samples

It is estimated that the higher nutrient contents result from Gapoktan soils because organic fertilizer (cow manure) was applied in the Gapoktan land for many years as the source of macronutrients such as Nitrogen (N) and Phosphorous (P available). The values of soil cation exchange capacity (CEC) and base saturation in Gapoktan and non-Gapoktan are low and have relatively similar results. Inseptisol and Ultisol are soiled with very acid-to-acid soil reactions and low to deficient organic matter and nutrient content [15]. Therefore, organic fertilizers such as cow manure can be an essential source of organic matter to improve soil quality through increasing soil organic matter and nutrients.

According to previous researchers Teuscher et al. [7], this experiment expects a combination of island size, tree diversity levels, and above-average productive and cost-effective composition to achieve high returns in ecosystem function. This involves identifying the best performing tree species in their most productive composition under oil palm plantation conditions, which do not have a negative impact on oil palm yields. The early positive responses of birds and invertebrates to biodiversity enrichment treatments are promising and suggest that tree islands can be a suitable measure for increasing biodiversity in poor landscapes.

3.2 Analysis of Economy impact:

Another term for PTN (Rupiah given by farmers to Gapoktan/kg = Rp. 230) means the agreement of Gapoktan that must be paid per farmer. The farmer has to pay Rp 230/kg for selling.The results of the economic benefit obtained by group smallholders In Managing Oil Palm Plantation (Located in RSPO certified) are 4.882.995 Kg Total of production, The currency Rp.230.- and GCB (GAPOKTAN Cooperation Benefit) Rp.1.123.088.850

The production analysis and the amount of money of farmers set aside for Gapoktan Tanjung Sehati produced rapid economic growth for Gapoktan Tanjung Sehati. Gapoktan Tanjung Sehati cooperative obtained Rp.1,123,088,850/year savings in 2020. The funds are utilized for the needs of cooperative economic activity, meaning transportation fund marketing of Fresh Fruit Bunch. From the fund, the cooperative has purchased two trucks for their group necessary. The funds are also used to finance local Islamic education school for farmer's children, build the water towers for Gapoktan plantation, and build cattle farming. The organic waste from cattle farming is still used for organic fertilizer by Farmer's group. Whereby the expenditure will return as the farmer's benefit, and now it has been realized as the farmer's benefit.

3.3. *Analysis of Social Impact*

At the research location, 6 farmer groups who are members of the Tanjung Sehati Gapoktan have joined. The close relationship between the groups that has been built has enabled farmers to run oil palm farming businesses. Starting from processing to harvesting and marketing are carried out together. This means that socially, the psychological strength among farmers has been built. Farmers can trust in finance and build new knowledge about plant biodiversity. Relating to social analysis [16]. The motivation of independent smallholders to participate in certification schemes seems to be a proactive risk-reduction approach rather than a reactive one that could help mitigate current challenges smallholders face or improve sustainability. This means that smallholders become strong and can share knowledge to understand the meaning of the RSPO certificate. After understanding the farmers together with psychology, who can implement the principles and criteria of the RSPO?

3.4. *Sustainability Strategy*

Based on the research undertaken by smallholders in the plantation areas, the right strategy is to maintain other tree crops and oil palms. This is because the monoculture of oil palm will accelerate the water runoff process, causing rainwater containing various nutrients to be released to the sea's surface. Accordance to field results, Oil palms have been planted with other tree crops plants well. In the plantation areas, oil palms are planted by intercropping (plot scale) systems. Previous researchers, Gerard et al. [9], mentioned that past events that biodiversity enrichment in oil palm could result in a trade-off between economic and ecological functions under certain conditions. In its initial phase, EFForTS-BEE significantly increases yields per oil palm, which compensates for yield losses from oil palm removal at the plot scale. In this analysis of net yield changes, the researchers found an overall neutral effect on outcomes for small plots and varied widely but generally had a significant positive effect for large plots. An early sign of the negative influence of tall trees on oil palm yields, this positive effect may change in the long term. However, this study's results encourage further research to identify more diverse management strategies for oil palm plantations that harmonize ecological and economic benefits.

Moreover, previous researchers also made similar statements [17]. There is a need to encourage wider adoption of the RSPO P&C scheme by oil palm smallholders for better agricultural management, social justice, environmental protection, and smallholder welfare. Such strategies can contribute to rehabilitating ecosystem functions and increasing the resilience of local livelihoods in the face of fluctuations in world market prices and environmental changes. Future results of this experiment will shed more light on whether the area is suitable for diversifying oil palm and, if so, which management strategies are specific and of concern to all stakeholders. The following strategies that farmers apply are maintaining the riparian areas by planting pioneer trees on the left and right sides to maintain soil fertility and moisture.

The CRC-EFForTS Biodiversity Enrichment study is planned to answer questions about the potential of enriched oil palm landscapes to maintain or enhance biodiversity and ecosystem functions and services while minimizing economic losses. The expected outcome of this experiment is a combination of island size, tree diversity level, and above-average productive and cost-effective composition to achieve high benefits in ecosystem goals [7]. Furthermore, the authors claim that Biodiversity in oil palm plantations can synergize between economic and ecological functions under certain conditions. For example, the tree species are Sungkai (*Peronema canescens*), Petai (*Parkia speciosa*), and Jengkol (*Archidendron pauciflorum*), which show the best growth performance in terms of tree diameter, as well as have high survival rates when they coexist with oil palm plantations.

The Partnering experience is one of the important points for smallholders in applying RSPO principles and criteria. In line with previous research conducted by Gatto [18]. A general policy implication of our results from Jambi is that the contract schemes between village communities and palm oil companies contributed positively to economic development. However, it is stated that not all

independent smallholders who get an RSPO certificate can improve their economy through the market price. This could RSPO failure implementation [7]. Meanwhile, the interviews of the smallholders showed that the farmers' trust in certification schemes did not work, which was supposed to be a precondition for good governance [19]. A few smallholders even accused the certification process of being unfair because all smallholders had to wait many years to get their certificates because the audit failed. This finding contrasts with Rametsteiner et al. [20] previous research, which claimed that independent audits incentivize improving management practices. Another smallholder reported that members of an already certified farmer group did not receive the premium price as promised for their fresh fruit brunch price agreement, which led to disappointment and mistrust among the smallholder farmers.

4. Conclusion

Based on the results, it can be concluded that oil palm plantations' biodiversity has many benefits. Moreover, biodiversity and economic ecosystem management strategies are compatible and have benefitted the sustainability of smallholders' plantations and economic welfare. Implementing RSPO certification has resulted in positive changes in the environmental knowledge of independent smallholder farmers. The farmers also have a positive impact on their economy. Independent smallholders can reduce sales transportation costs because they have arranged transportation through group collaboration. From a social perspective, independent smallholders have gained the power to market access, knowledge about sustainable plantation management, and RSPO principles and criteria. There has been a very significant change as the location of the river border has been planted with several types of forest plants. The chemical properties of soil in Gapoktan and non-Gapoktan farming areas were low pH or acid soil reaction. However, organic C, total N, and available P in Gapoktan soils were higher than in the non-Gapoktan soils.

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