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Oil Palm Plantation Expansion: An Overview of Social and Ecological Impacts in Indonesia

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Abstract

This study aims to analyze the extent of land clearing and the role of farmers in land expansion, besides that this study aims to identify the social and ecological impacts caused by land clearing. The method used is descriptive qualitative with primary data collection techniques in the form of interviews and FGD with farmers and related stakeholders, secondary in the form of land cover recording using Landsat 8 TM imagery. The results showed that both private companies, plasma farmers and independent smallholders had a role in land expansion, but private companies were dominant in primary forest expansion. The social impact caused by the conflict between transmigrants (immigrants) and indigenous Malays (natives) triggered by social jealousy and concerns about the loss of Malay descendants caused by the dominance of migrant tribes. Ecological impacts in the form of reduced carbon stocks, deforestation, forest fires and loss of biodiversity. The social impact caused by the conflict between transmigrants (immigrants) and indigenous Malays (natives) triggered by social jealousy and concerns about the loss of Malay descendants caused by the dominance of migrant tribes. Ecological impacts in the form of reduced carbon stocks, deforestation, forest fires and loss of biodiversity. The social impact caused by the conflict between transmigrants (immigrants) and indigenous Malays (natives) triggered by social jealousy and concerns about the loss of Malay descendants caused by the dominance of migrant tribes. Ecological impacts in the form of reduced carbon stocks, deforestation, forest fires and loss of biodiversity.

Keywords
Oil palm expansion; deforestation; ecological impact; biodiversitv

I. Introduction

The massive development of oil palm plantations, which is in line with the increase in foreign exchange, on the other hand, is a dilemma among environmental activists (Colchester & Chao, 2015). Oil palm has become increasingly important globally in recent decades (Corley, 2009). Its low production costs and stability in oil prices in both national and global markets have pushed palm oil to become the most attractive and widely used vegetable oil in the world (Gan & Li, 2014). Palm oil is a high-value commodity in local, regional and global markets because it produces derivative products that can be used as food ingredients, cosmetics, detergents, plastics, industrial chemicals, and biofuels (Gatti, Liang, Velichevskaya, & Zhou, 2019).

Indonesia is a well-known producer of palm oil or CPO (crude palm oil), Indonesia currently supplies around 51.7% or equivalent to 60 million tons of global commodities (Indonesia Investment, 2021). Together with Malaysia, these two countries contribute more

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than 80-90% of global oil production. In 2016, Indonesia produced 32 million tonnes of crude palm oil and exported 80% of total production, generating a profit of USD$18.6 billion (Indonesia Investment, 2021). Palm oil is the largest agricultural industry in Indonesia and its production is expected to continue to increase by 10% per year. Indonesia's total oil palm harvested area grew from 11, 9 million ha in 2017 to around 13 million ha in 2020 and is projected to reach 17 million ha in 2025 (Falatehan & Setiawan, 2020). The palm oil industry directly employs 7.5 million people (Harahap, Silveira, & Khatiwada, 2019) making it an important source of income for many people in Indonesia (Mukherjee & Sovacool, 2014).

State-owned enterprises (BUMN) play a small role in Indonesia's palm oil sector (Rahardjo & Wicaksono, 2017), as they have relatively small plantation areas. Large private companies (eg Wilmar Group and Sinar Mas Group) have a dominant role, private companies produce over half of Indonesia's total palm oil production (Rifin, 2017). Smallholders account for about 40 percent of total production. However, most of these smallholders are very vulnerable to falling global palm oil prices because they cannot enjoy the cash reserves (or bank loans) held by the owners of capital (Indonesia Investment, 2021).

The abundant profits from the oil palm sector open up opportunities for land expansion. The expansion of oil palm plantations is not only carried out by oil palm plantation companies, but also oil palm farmers (Obidzinski, Dermawan, & Hadianto, 2014). Oil palm plantation companies tend to expand oil palm in the Hak Guna Usaha (HGU) area, unlike oil palm farmers who expand oil palm plantations on their own land such as forests, fields or plantations. Some oil palm farmers are also expanding oil palm plantations in the forest area around their homes which results in deforestation and loss of biodiversity. Expansion of oil palm plantations should be carried out in Other Use Areas (APL) and Non Forestry Cultivation Areas (KBNK), however, what often happens is that the expansion of oil palm plantations is carried out in forest areas and national parks on a massive and illegal basis (Wilcove & Koh, 2010). Land expansion is also carried out on peatlands and land that produces minerals (Ramdani & Lounela, 2020)

Oil palm plantations are located in primary forest, secondary forest and production forest (Koh & Wilcove, 2008) resulting in deforestation (Afriyanti, Kroeze, & Saad, 2016) (PrawiraW et al., 2021) soil erosion (Ayompe, Schaafsma, & Egoh, 2020) and habitat fragmentation, loss and biodiversity (Fitzherbert, et al., 2008). The expansion of oil palm plantations in forest areas also has an impact on changing the ecological landscape that threatens many dangers (de Almeida, Vieira, & Ferraz, 2020).

Oil palm plantations not only make a significant contribution to the agricultural sector but also become an effective weapon in reducing poverty by stimulating and accelerating development in rural areas, especially in the North Sumatra regency. Much evidence can be conveyed that oil palm plantations have a positive effect on increasing income in rural areas. Providing permanent employment in oil palm plantations and industrial activities can stimulate economic activity and reduce poverty in rural areas (Hasibuan, A. et al. 2020).

II. Research Methods

The data collection process was carried out in Tabir Timur District, Merangin Regency, Jambi Province. This research uses descriptive qualitative method. The data used in this study include primary data and secondary data. The primary data used in-depth interviews and FGD data collection techniques with plasma farmers and independent smallholders. This is intended to determine farmers' perceptions of the impacts caused by the increasingly massive expansion of oil palm plantations. Secondary data used in this study includes data obtained from Landsat 8 TM images recorded in 2020, 2021 and other strategic documents.

III. Result and Discussion

3.1. Typology of Farmers in Merangin District

There are three criteria for oil palm farmers based on the processing and ownership of oil palm land in Tabir Timur District, namely: plasma farmers, plasma farmers who have independent oil palm plantations; and independent farmers.

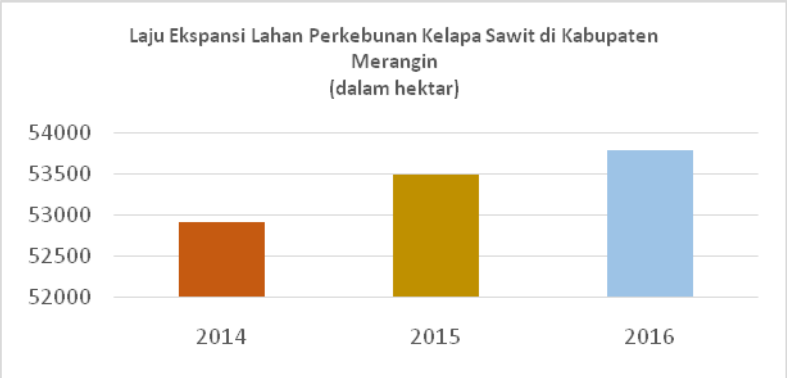
1. Plasma farmers are oil palm farmers who carry out their oil palm cultivation with the support of bank funds facilitated by private plantation companies (But & Setiawan, 2018; Yulian, Dharmawan, Soetarto, & Pacheco, 2017). In addition to providing funding, the company also helps to clear new land for the expansion of plasma oil palm plantations. Land clearing is usually carried out by private companies using heavy equipment such as excavators and other tools (Hadiguna, 2012). After the oil palm bears fruit, the so-called Fresh Fruit Bunches (FFB) must be sold to the oil palm plantation company which is the core company (Köhne, 2014). The average area of plasma plantations is 2-5 ha per household. In addition to plasma plantations, plasma farmers also usually own other cultivated land, such as rubber plantations and fruit orchards. a small number of plasma farmers also maintain their land to grow fruits, rubber and rice, but most of the other plasma farmers want to improve their household economy by clearing plantation land independently on their own land. Based on this, there is a second type of farmer, namely: plasma farmers who have independent oil palm plantations.
2. Plasma farmers who have independent plantations are oil palm farmers who have plasma plantations and also manage independent oil palm plantations by clearing land such as wilderness using heavy equipment or burning land on a limited basis (Wildayana, Zahri, Mulyana, & Husin, 2013). Usually they will take advantage of seed assistance from the government and seed assistance from oil palm plantation companies. the average area of their independent oil palm plantation is 10 Ha. In addition to land clearing, plasma farmers who want to have independent land will usually buy land to be used as oil palm plantations (Lathifah, 2020).
3. Independent smallholders are oil palm farmers who expand oil palm plantations using private capital by clearing land with heavy equipment or burning limited land. In addition, they get land by making purchases which will later be repaid in installments to the bank. Their average independent oil palm plantation area is 5 ha. Usually these farmers sell their FFB through four alternative ways, namely (1) FFB is sold to the company by becoming a member of a cooperative; (2) FFB is sold to companies by entrusting FFB to cooperative members; (3) FFB is sold to middlemen (Hidayat, 2018).

Type 1 smallholders (plasma farmers), they have no market choice because they are structurally bound to their nucleus oil palm plantations so they have to sell their oil palm to a party appointed by the nucleus company. Meanwhile, type 2 and type 3 farmers have the same alternative of selling FFB. The decision to sell FFB depends on the social and economic conditions experienced by the farming household at that time and the price of FFB at that time. In determining the decision to sell FFB, farmers always weigh the pros and cons. Oil palm plantations developed independently by plasma smallholders who have independent oil palm plantations and independent smallholders, some are not partnered and some are partnered with nucleus plantation companies through cooperatives. The plantation land in partnership with the nucleus plantation company still overlaps with the Cultivation Forest Area (KBK) covering an area of 206 hectares, the HGU of the nucleus plantation company covering an area of 130 hectares, mining concessions covering an area of 46 hectares, and HPH covering an area of 39 hectares. Based on farmer typology, the most economically profitable farmerare plasma farmers who have independent oil palm plantations (Hutabarat, 2018).

3.2. Expansion of Oil Palm Plantation in Merangin District

The need for palm oil products is increasing every year. This is influenced by the development of the food and non-food industries that use palm oil as their raw material. In order to meet the high demand for palm oil, it is necessary to increase palm oil production. Increased production can be achieved if the area of oil palm land also increases (Ardian & Azahari, 2020).

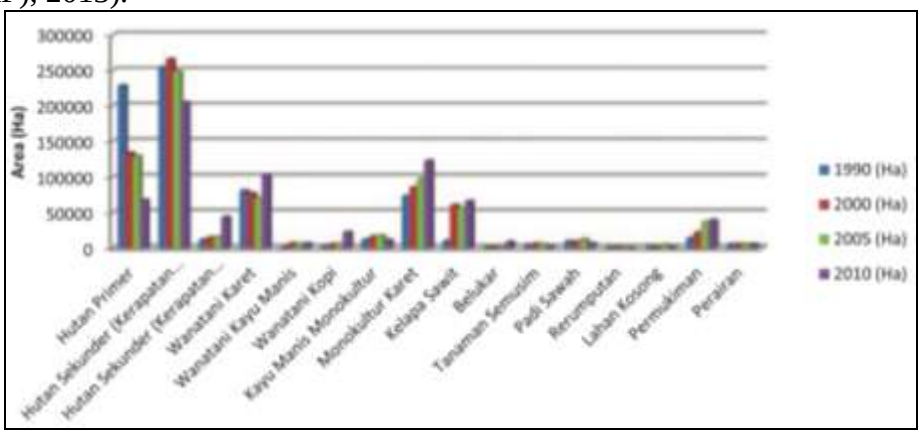
Graph 1 shows that the rate of expansion of oil palm plantations from 2014 to 2016 where the expansion of oil palm plantations was carried out by farmers and oil palm plantation companies operating in Merangin Regency which was originally a forest and is now starting to cause deforestation. In 2014 the expanded land area was around 52.9 thousand hectares and within 2 years, in 2016 the expanded land area was 53.7 thousand hectares. The total increase is almost a thousand hectares in a period of 2 years (BPS Kab. Merangin, 2021).



Source: BPS 2021, data processed by researchers

Figure 1. *The Acceleration Rate of Oil Palm Plantation Expansion in Kab. Merangin 2014-2016*

Based on the results of the analysis of land use change for the period 1990, 2000, 2005, and 2010 in Merangin Regency, there is a dynamic of land cover/use change. Primary forest and secondary forest (high density) experienced a significant and drastic reduction in area, while secondary forest (low density) increased in area. Other land uses have increased in area, especially for monocultural land uses such as rubber and palm oil (World Agroforestry Center (ICRAF), 2013).



Source: LUWES World Agroforestry Center (ICRAF), 2013

Figure 2. *Dynamics of land use change in Merangin District 1990-2010*

Figure 3*. Land Use Conditions in 2020*

Figure 4. *Land use conditions in 2021*

Figures 3 and 4 show that there are differences in land use conditions in 2020 and 2021 where residential land is used for agricultural areas. Expansion of oil palm plantations is carried out in two ways: clearing forest land and clearing bushland. Expansion of land clearing for oil palm plantations through "forest clearing" is indicated as the method used by large private oil palm plantation companies. Meanwhile, the expansion of oil palm plantations through "clearing bushland" is indicated as a method used by private oil palm plantation companies and oil palm farmers, where there are three typologies of oil palm farmers, namely plasma smallholders, plasma smallholders who have independent oil palm plantations and smallholders self-help (Rist, Feintrenie, & Levang, 2010). Each typology of farmers has a strategy in developing its oil palm. Farmers generally sell wood from land clearing to buy oil palm seeds, fertilizers and other gardening needs.

Table 1. Strategies used to expand land based on farmer typology in Kec. Tabir Timur, Kab. Merangin, Jambi Province, 2020

Expansion Strategy	**Variable**	**Oil palm farmer typology**		
		Type 1 (plasma farmer)	**Type 2 (plasma farmers who have independent oil palm plantations)**	**Type 3 (Independent farmers)**
Formal Management Driven Expansion	Land acquisition scheme	PIR scheme	PIR, PPMD, KKPA and Land ID schemes by private companies and land purchases	Through PIR, PPMD, KKPA and Land ID schemes by private companies and land purchases
	Access Capital	Government and Village Unit Cooperatives	Private companies, local governments. private capital and supported by village unit cooperatives	Private companies, government, private capital and supported by cooperatives
	Actor Network	Private companies and village unit cooperative managers	Private companies, government, farmer group associations and village unit cooperative administrators	Local government private companies, farmer group associations and village unit cooperative management
	Social network	enough	strong	strong
Social networking driven expansion	Number of networks	Enough	Lots	Lots
	Market share	Mono Market	Multi market - 50% to private company and 50% to local market	Multi market - dominated by local market

Table 1 explains that plasma smallholders who have independent oil palm plantations are a typology of farmers who have the highest and most strategic benefits/profits because they have a lot of access to private companies, easy access to capital, networks and markets compared to the typology of plasma farmers and smallholders. independent. Therefore, the typology of smallholders who have independent oil palm plantations has many opportunities to expand/expand oil palm plantations in various areas whose land cover is either forest or non-forest compared to the other two typologies of farmers (Kubitza, Krishna, Alamsyah, & Qaim, 2018).

3.3. Social impacts of oil palm expansion

The social risk variable caused by land expansion is in the form of social conflict which can be measured from perceptions of conflicts that occur between farmers and local communities, conflicts with local governments, and conflicts with oil palm plantation companies (Colchester, 2011).

Table 2. Characteristics of social conflicts related to oil palm plantations in Kec. Tabir Timur, Kab. Merangin, Jambi Province 2020

Characteristics of Conflict	**Conflict between farmers**	**Farmers with Government**	**Smallholders with private palm oil companies**
scope of conflict	tension between transmigrant farmers from Java and local Malays	farmers with government ahead of elections	unstable price
extent of conflict	between farmers	farmer with cooperative	farming community with private companies related to land certificates
conflict impact	emergence of ethnocentrism and primordialism	distrust of government	eviction and forcible taking of land
external actors involved	there is not any	there is	there is

Table 2 shows that plasma and independent smallholders who are transmigrants are often involved in conflicts with local communities/local independent smallholders and private oil palm plantation companies. Conflicts experienced by oil palm farmers have different characteristics depending on the conflict opponents they face, while conflicts between transmigrant farmers and local communities are caused by social jealousy towards migrants who successfully manage oil palm land in their area, besides being triggered by social jealousy, it is also caused by the fear of the loss of the local entity of the Malay tribe so that the Malay tribe will eventually disappear and be replaced by the dominance of the Javanese tribe. The characteristics of this conflict can be distinguished based on the depth of the conflict, the extent of the conflict,

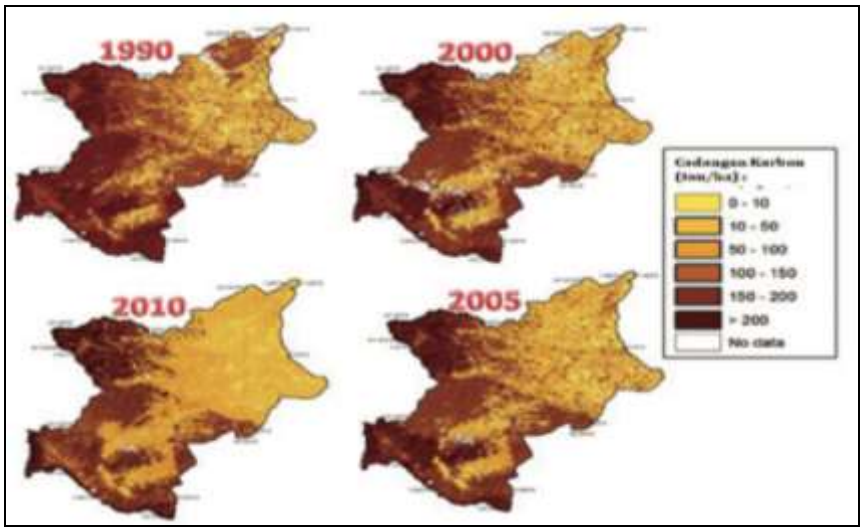
Conflicts can also occur between oil palm farmers due to unclear ownership of land tenure certificates issued by the RT or the Village Head. In addition, conflicts with private oil palm plantation companies are generally caused by environmental pollution caused by oil palm processing activities and related to plasma and land ID residual operating results (SHU) policies that have not found a bright spot. Conflicts between farmers and Village Unit Cooperatives usually occur because of differences of opinion about the distribution of plasma yields and the application of FFB quotas for each land. Conflicts related to plasma production

sharing that continue to this day have resulted in plasma farmers managing and harvesting oil palm themselves in plasma plantation areas with outside assistance. Fruits harvested by farmers from plasma plantations are then sold to private plantation companies using certificates of independent garden land that have not yet produced fruit or independent gardens that have not met the FFB quota or "fake" land certificates. Private plantation companies have tried to resolve conflicts by bringing in mediators such as the plantation and forestry services, but so far they have not found a "bright spot" (Colchester & Chao, 2011).

3.4. Impact of Ecological change due to oil palm plantation

a. Decreased Carbon Stock

Changes in land use that occurred in Merangin Regency also resulted in changes in carbon density at the landscape scale. Changes in carbon stock were obtained from field measurements for each existing land use and extrapolated to land cover/land use data. Figure 1 below shows changes in carbon stocks that occurred during the period 1990, 2000, 2005 and 2010 (World Agroforestry Center (ICRAF), 2013).



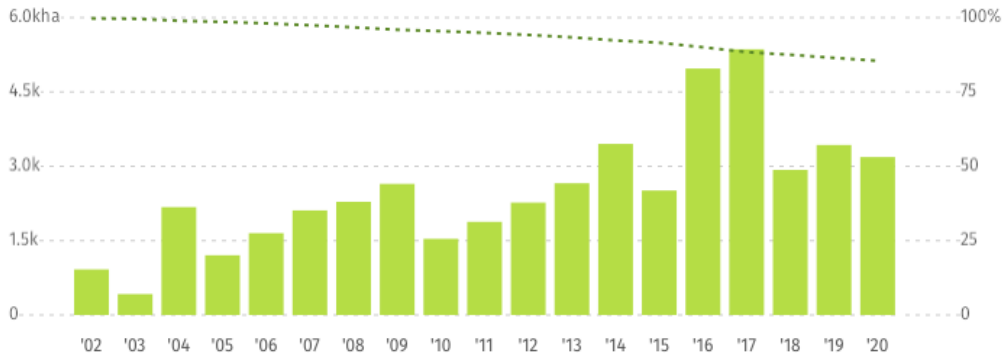
Source: LUWES World Agroforestry Center (ICRAF), 2013

Figure 1. *Changes in Carbon Stock in Merangin District*

Changes in carbon stocks become a source of emission calculations that occur in Merangin Regency. Merangin Regency has a fairly high level of greenhouse gas emissions due to land use changes compared to other districts in Jambi Province. In 2005-2010, the average emission in this district reached 16.66 tons CO2/ha/year. The main cause of greenhouse gas emissions in this district is the decline in forest quality from primary forest to secondary forest, high density secondary forest to low density secondary forest and mixed rubber (Pirker, Mosnier, Kraxner, Havlík, & Obersteiner, 2016).

b. Deforestation

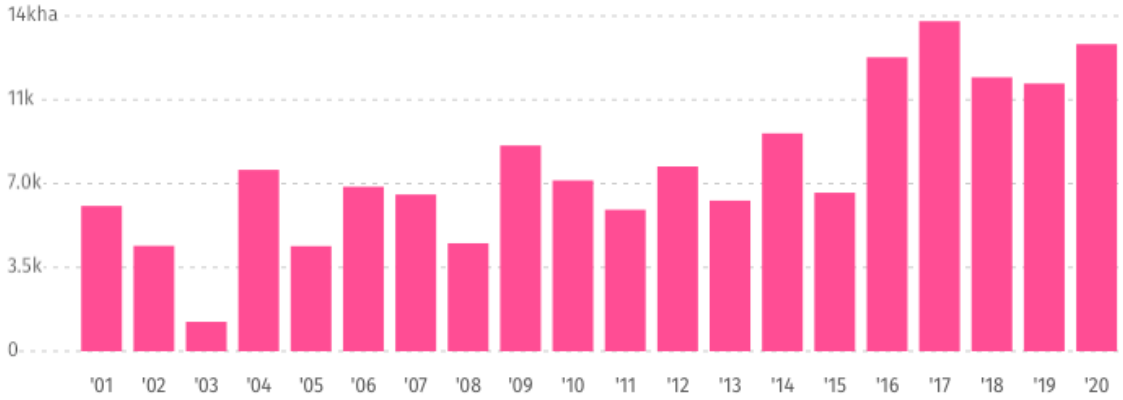
Merangin Regency in 2001 had around 329kha primary forests which spanned more than 44% of its land area. But in 2020, the forest lost 3.19kha of primary forest which is equivalent to 2.54Mt of CO_2 emissions. Primary forest can be defined as natural wet tropical forest that has not been fully cleared or exploited by humans (Global Forest Watch, 2021). This causes higher temperatures caused by global warming (Sayer, Ghazoul, Nelson, & Boedhihartono, 2012).



Source: Global Forest World 2021

Figure 6. *Narrowing of Primary Forest Area in Kab. Win 2002-2020*

In a period of eight years starting from 2002 to 2020, Merangin District lost 47.6kha wet primary forest which is 32% of the total tree cover loss in the same time period. The highest loss of primary wet forest land occurred in 2016-2017 where 4.97kha-5.36kh of wet forest was exploited by humans. In the 2016-2017 period, there were many forest fires and tree cutting. The total area of wet primary forest in Merangin is reduced by 15% by 2020 (Global Forest Watch, 2021). The narrowing of this wet primary forest area will certainly cause serious problems and can threaten life in the future.

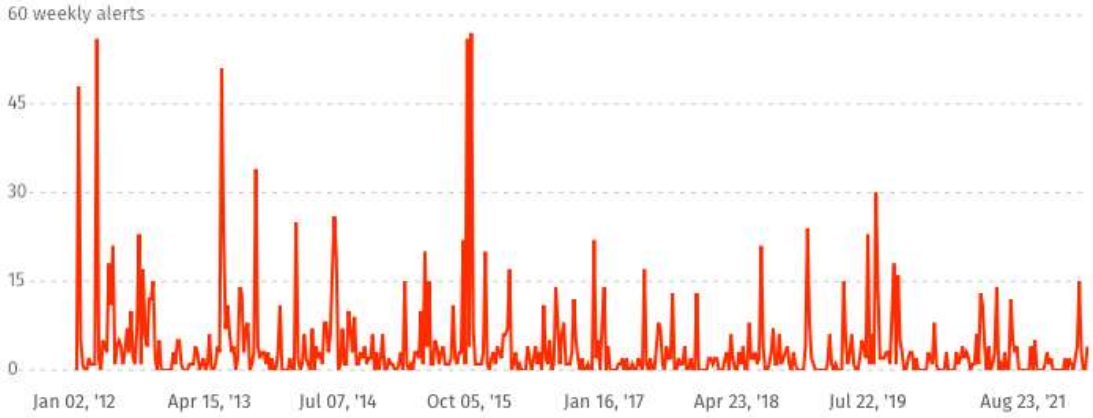


Source: GFW 2021

Figure 7. *Land Cover Reduction in Kab. Merangin 2001-2020*

c. Forest Fires

The forest fires that occurred in Merangi Regency could be caused either by a long dry season or by an element of intent from individuals who intentionally burn forests to clear new land. This is common in areas that still have good landscapes. Data from World Forest Watch records that between 2 January 2012 and 23 August 2021 Merangin experienced a total of 1,934 Alert fire alerts.



Source: Global Forest Watch 2021

Figure 8. *Rates of Forest Fires in Merangin District in 2012-2021*

In 2021 the land burned in Merangin Regency was 68ha, this number is extraordinarily high compared to the total in previous years in 2001. The most fires recorded in one year was 2006 with a total burned area of 1.5kha. Since 2012-2015, the intensity of forest fires has seen quite frequent occurrences and the curve has softened in the following years (Media Indonesia, 2019). Even with the 2018 land clearing moratorium, it also does not become an obstacle for people who burn forests recklessly (KEMKES Crisis Center, 2021).

d. Biodiversity reduction in land clearing areas

Biodiversity or Biodiversity is defined as the number and abundance of species in an ecosystem (Fayle, Turner, & Snaddon, 2010). The advantage of biodiversity is its high resistance to environmental changes both naturally and triggered by intentional land clearing by humans (Vijay, Pimm, Jenkins, & Smith, 2016).

The increase in human population resulting in increased consumption is the main anthropogenic cause of the decline and loss of biodiversity habitat. In addition, another factor that causes the loss of biodiversity is climate change, which is an inevitable factor that causes changes to occur. Climate change and the loss of biodiversity are the greatest challenges today for mankind. Environmentalists estimate that we will lose 20-50% of all species in the next century, some of them even before they were discovered. There are seventeen megadiverse countries that account for more than 70% of the world's biodiversity (Ashton-Butt, Aryawan, & Hood, 2018) (Figure 5). Jambi forest is one of Indonesia's wealth which has a forest area of about 2,179.

There are four national parks in Jambi: Kerinci Seblat National Park (TNKS), which has been designated a World Heritage Site; Berbak National Park, which is the site of the Ramsar Convention wetlands with a relatively intact peat swamp forest landscape and the largest in Southeast Asia; Bukit Duabelas National Park; and Bukit Tigapuluh National Park. Thus, Jambi Province has a very important role in the carbon cycle and as a reservoir of biodiversity (Melati, 2019)

The conversion of tropical forests to oil palm plantations has resulted in a significant reduction in the number of species that can be supported to live in them. Trees not only support vegetation and plants but are also a habitat for animals. Natural tropical forests are able to support the life of 704 species, consisting of 392 species of birds, 200 species of reptiles and amphibians, and 112 mammals. Meanwhile, damaged forests are only able to

support the life of 54 species, consisting of birds, reptiles and amphibians as well as mammals (Putz, Blate, Redford, & Robinson, 2001).

A study conducted by the Tiga Beradik Institute in Merangin Regency, Jambi Province, found that the diversity of wildlife species found in the Baru Village Cluster, Gedang Village, Jernih Jaya Village and Talang Kemuning Village was determined using the Shannon-Wiener Diversity Index. Based on the results of data analysis that has been carried out, the index of mammal species diversity in the Baru Village Cluster is 2,013, the Gedang Village Cluster is 2,136, the Jernih Jaya Village Cluster is 1,662, and the Talang Kemuning Village Cluster is 1,674. The herpetofauna diversity index in the Baru Village Cluster was 1,413, the Gedang Village Cluster 1,714, the Jernih Jaya Village Cluster 1,438, and the Talang Kemuning Village Cluster 1,234. The diversity index of aves (birds) in the Desa Baru Cluster is 1,706, the Gedang Village Cluster is 1,641, the Jernih Jaya Village Cluster is 2,408,

Destruction of nature and loss of habitat are causing tens of thousands of species to be threatened with extinction. Of the 20 countries in the world whose natural species are threatened, Indonesia ranks 5th, where there are 1126 endangered species, consisting of mammals, birds, reptiles, amphibians, fish, and mollusks (Garcia, Cabeza, Rahbek, & Araújo, 2014).

Based on the results of interviews with informants in Tabir Timur Village, Merangin Regency, there was a very significant decline in flora and fauna, especially aves (birds). In early 2000 there were still kaswari, srigunting, stone magpie, kacer and several mammals such as tigers and red monkeys. However, since 2016 there has been a significant decline in the presence of these fauna species. Even in certain harvest seasons, the existence of which should be visible today is not visible at al.

IV. Conclusion

The need for palm oil products is increasing every year. This is influenced by the development of the food and non-food industries that use palm oil as their raw material. This increasing need has encouraged various parties, both large companies, independent smallholders and plasma farmers to clear forests. In 2014-2016 the land expanded was around 52.9-53.7 thousand hectares and in a period of 2 years. The total increase was almost a thousand hectares in 2 years. The impact of land clearing is in the form of social and ecological impacts. Social conflicts due to the opening are more likely to occur due to social jealousy between transmigrants (immigrants) and people of Malay ethnicity (Indigenous). The Malay population has concerns about the disappearance of the Malay tribal entity if the transmigrant migrants continue to expand their land.

In addition to the social impacts, there are also negative impacts on ecology, increased carbon emissions due to reduced land cover. The main cause of greenhouse gas emissions in this district is the decline in forest quality from primary forest to secondary forest, high density secondary forest to low density secondary forest and mixed rubber. Deforestation also occurred because Merangin District lost 47.6kha wet primary forest which is 32% of the total tree cover loss in the same time period. Forest fires are also frequent, data from World Forest Watch noted that between January 2, 2012 and August 23, 2021, Merangin experienced a total of 1,934 fire alerts. The conversion of tropical forests to oil palm plantations has resulted in a significant reduction in the number of species that can be supported to live in them. Merangin Regency experienced a very significant decline in flora and fauna, especially the type of aves (birds). In early 2000 there were still kaswari, srigunting, stone magpie, kacer and several mammals such as tigers and red monkeys. However, since 2016 there has been a significant decline in the presence of fauna species.

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