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Agroforestry Analysis of Mixed Oil Palm on Environmental and Economic Impacts in Muara Tabir District, Tebo Regency, Jambi Province

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ABSTRACT. The existence of forests in Jambi is decreasing due to the conversion of land to oil palm land. Efforts to minimize the negative impact of monoculture plantations are through better garden management can be done through the application of mixed cropping systems (agroforestry). Agroforestry is a land management system consisting of a combination of trees, shrubs, or seasonal crops often accompanied by livestock in the same land. Therefore, research on of mixed oil palm agroforestry is necessary. This study itself aims to determine the environmental and economic impact of the community from the existence of mixed oil palm agroforestry in Sungai Jernih Village, Muara Tabir District, Tebo Regency, Jambi Province with qualitative research methods. Plants that are usually mixed with oil palm plants are jengkol, petai, rubber, and sengan commodities. The environmental impact is maintaining soil quality, reducing the dominance of oil palm due to the presence of other commodities, and reducing environmental degradation. While the economic impact is a guarantee of income stability because it does not only rely on one commodity, the dominance of commodities can be more overcome, as well as an increase in land productivity which has an impact on increasing people's income.

Keywords: agroforestry, mixed palm oil, muara tabir, palm oil.

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1. Introduction

Oil palm (*Elaeis guineensis* Jacq) is one of the plantation crops that occupies the highest position in the agricultural sector in Indonesia. Palm oil is Indonesia's mainstay commodity which is included in the main export group of non-oil and gas commodities. Oil palm is a multipurpose plant. These plants have begun to replace the position of planting other plantation commodities, namely rubber plants (Nengsih, 2016). According to Saputra (2021), Palm oil is a multipurpose plant and is also a source of vegetable oil, which is in great demand by the global market and plays an important role in the country's economy. There are 9 (nine) regions producing the largest Crude Palm Oil (CPO) in Indonesia, namely Riau Province, Central Kalimantan, North Sumatra, South Sumatra, East Kalimantan, Jambi, South Kalimantan, and South Sumatra. Jambi Province is one of the largest palm oil producing regions in Indonesia. The development of oil palm in Jambi province has a positive impact on the economy and plays a role in the absorption of many workers. In addition, it can also provide economic benefits as a contributor to foreign exchange for sustainable development in Indonesia (Syah and Aprio, 2021). According to Nasamsir, et al (2022), Jambi Province is one of the oil palm producing areas with a planting area of 506,462 hectares, including BUMN plantations, smallholder plantations, and large private plantations (PBM). Palm oil products are also

used as raw materials for the processing industry, both semi-finished products such as cooking oil and margarine, as well as finished goods industries such as soap, bread, lubricants and others.

Based on data from the Central Statistics Agency (BPS) of Tebo Regency in 2022, Tebo Regency has an area of 6,461.00 square kilometers located at an altitude between 0-99 meters above sea level. Tebo Regency consists of 12 districts, including: Tebo Ilir, Muara Tabir, Tebo Tengah, Sumay, Tengah Ilir, Rimbo Bujang, Rimbo Ulu, Rimbo Ilir, Tebo Ulu, VII Koto, Serai Serumpun and VII Koto Ilir. The coordinates of Tebo Regency are located at 0° 51' 32" - 10° 54' 50" South Latitude and 10° 48' 57" - 20° 49' 17" East Longitude. The northern border of Tebo Regency is Indragiri Hilir Regency, Riau Province, the southern border is Tabir District, Merangin Regency, the western border is Bungo Regency and Dharmasraya Regency, West Sumatra and the eastern boundary is Batanghari Regency. Tebo Regency, located in Jambi Province, has become one of the largest palm oil producing districts since 1991. The two main plantation commodities in this district are rubber and palm oil. Rubber has been cultivated for generations by the Tebo community for a long time in the form of mixed gardens (Santoso H, 2021). The potential for oil palm production in Tebo Regency has seen very good development in the last 5 years. According to data from the Central Statistics Agency of Jambi Province (2022), the land

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area in Tebo Regency is always increasing every year. In 2017 oil palm plantations were planted in an area of 59,468 hectares, then increased in 2018 to an area of 60,128 hectares, then increased again in 2019 to an area of 110,0004 hectares, then in 2020 it decreased to an area of 60,980 hectares and in 2021 it increased again to 60,985.15 hectares. This production will continue to increase in line with the expansion of plantation areas owned by state-owned and private companies and plantations owned by the people. The increasing need for the palm oil industry (MKS) for food in the community and the state has resulted in the necessity of increasing the amount of palm oil production in Indonesia from year to year (Apriana, 2014).

Therefore, research on the environmental and economic impacts of mixed oil palm agroforestry in Muara Tabir District is necessary. This study aims to determine the environmental and community economic impacts of mixed oil palm agroforestry in Muara Tabir District, Tebo Regency, Jambi Province.

2. Materials and Methods

2.1 Research Site

The research was conducted from November to December in 2021 at Muara Tabir District, Tebo Regency, Jambi Province, Indonesia. Muara Tabir sub-district was chosen as the research location because the district's mainstay commodities are oil palm and rubber. Muara Tabir District is bordered to the north by Tebo Ilir District and Tengah Ilir District, to the east by Batanghari Regency, to the south by Sarolangun Regency, and to the west by Merangin Regency and Bungo Regency. The area of Muara Tabir District is 602.66 km² or 14.42% of the area of Tebo Regency. The location of Tebo Regency can be seen in Figure 1.

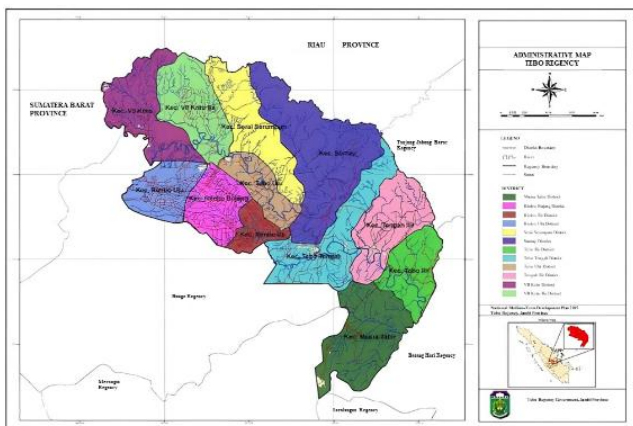


Fig 1. Location of Tebo Regency
Source: Jambi Province RPJMD 2015

2.2 Sample Collection and Research Methods

The working method or research procedure carried out is in the form of qualitative descriptive research. The qualitative descriptive analysis method is carried out by using an interactive model analysis developed by Miles and Huberman through three main stages, namely data reduction or sorting, presenting data in the form of images and descriptions, and drawing conclusions based on the results of research that has been done (Dewanti *et al*, 2020). While the details of how it works include:

- 1) Reduction or sorting of data, the data obtained from the results of data collection both primary and secondary data are then sorted to make it more conical and in accordance with the research objectives. Data on community economic impacts and environmental impacts from observations, interviews, and various secondary data are then grouped and then sorted.
- 2) Presentation of data in the form of images and descriptions, from the process of collection and reduction then data is presented in the form of images and descriptions. The various primary and secondary data are presented in the research description which is accompanied by supporting documentation or pictures.
- 3) Drawing conclusions, is done by determining the points that answer the research objectives.

This study discusses the condition of mixed oil palm plantations and the resulting impact on the environment and the economy of the community in Muara Tabir District, Tebo Regency, Jambi Province. The method used in this research is descriptive qualitative analysis method. Primary data were obtained from direct research and interviews with resource persons to determine the actual condition of the economic and environmental impacts of the application of mixed oil palm plantations. The economic impact can be seen from the stability of the community's economy and field conditions from the results of interviews with resource persons. The environmental impact itself can be seen from the existence of several occurrences of oil palm land expansion which began to be overcome by the addition of commodities in mixed oil palm plantations from the results of direct observations or visits. Secondary data is obtained from literature studies by tracing data in the form of books, journals, research reports, government documents, internet data (websites), and other forms of sources to strengthen research. The data that has been processed is then analyzed descriptively and qualitatively.

3. Result and Discussion

3.1 Background of Research Location

Tebo Regency has a tropical climate with an altitude between 50 -1,000 m above sea level (asl) and is located in the northwest part of Jambi Province. The Tebo Regency area has good quality soil in its type and distribution, making it possible for the development of agricultural businesses. The type of soil in Tebo Regency is dominated by red yellow podzolic soil which reaches 437,954 hectares or covers 67.8% of the total area of Tebo Regency. Land use in Tebo Regency is dominated by forests and rubber plantations covering an area of 47.2% and 45.74% of the total area of Tebo Regency. Meanwhile, the use of rice fields only covers an area of 0.46% of the total area of Tebo Regency and the area of settlements which only reaches 0.67%. According to data from the Jambi BPS, the population of Tebo Regency in 2019 was 354 485.00 thousand people. Most of the population has a livelihood as farmers. The plantation companies include oil palm, rubber and deep coconuts, while the mixed plantations include hybrid coconut, coffee, cocoa, fruits, and others. Muara Tabir is a new sub-district that was divided from Tebo Ilir District, the capital of which is on the Bengkal River. Muara Tabir District is bordered to the north by Tebo Ilir District and Tengah Ilir District, to the east by Batanghari Regency, to the south by Sarolangun Regency, and

to the west by Merangin Regency and Bungo Regency.km2602.66 or equivalent to 14.42% of the area of Tebo Regency (Wahyudi *et al*, 2022). Muara Tabir Subdistrict, especially Sungai Jernih Village, is inhabited by three community groups, namely the indigenous Jambi community, the transmigrant community, and the SAD (Suku Anak Dalam) so that the culture in Sungai Jernih is heterogeneous. However, for Sungai Jernih Village, the transmigrant community is more dominant than the indigenous people of Jambi and SAD (Suku Anak Dalam) because the village is one of the transmigrant development villages originating from Java Island. The three community groups are used to living side by side, but social conflicts in the form of indigenous vs migrants sometimes still occur. The conflict was not only between the transmigrant community and the indigenous people of Jambi and SAD, but also between the indigenous people of Jambi and the SAD. The three community groups have also implemented mixed gardens, especially mixed oil palm with other plants to meet their daily needs.

3.2 Background of Mixed Palm Oil

Commodity Oil palm is the prima donna because of the huge demand both domestically and abroad. This results in the existence of forests in Jambi decreasing due to the conversion of land to oil palm land. Efforts to minimize the negative impact of monoculture plantations are through better garden management (Dislich *et al*, 2017) while maintaining land cover and supply of soil organic matter, which can be done through the application of mixed cropping systems. Mixed cropping system (agroforestry) is an alternative form of land use consisting of a mixture of perennials (trees or shrubs) and or without seasonal crops and livestock in one plot of land (Junaidi, 2013). The mixed agroforestry system was developed as an effort to reduce the rate of forest conversion. Agroforestry is a land management system consisting of a combination of trees, shrubs, or seasonal crops often accompanied by livestock in the same land (Toding *et al*, 2021). Agroforestry land management aims to maximize land productivity, create jobs, and increase income in rural areas. According to Nursanti *et al* (2017), this mixed agroforestry system can be a prospective alternative to balance economic as well as ecological goals. Agroforestry systems contribute to increased infiltration, higher surface roughness, as well as terraced canopies to reduce the speed of impact of raindrops on soil particles (Tarigan, 2019).



Fig 2. Muara Tabir Mixed Oil Palm Gardens

Source: Santoso, H., on Exploring the Implementation of Corrective Term in the Field, Notes from Community Oil Palm Gardens in Tebo Regency, 2021

Palm oil-based agroforestry management is basically able to integrate with forestry crops. It is proven that the planted

forestry plants are able to grow well, without reducing oil palm productivity and community acceptance of agroforestry management patterns (Muryunika, 2015). Oil palm plantations have great potential for the development of intercropping as mixed crops in agroforestry patterns. Quoting in Santoso's book, H (2021), Since the 1990s, the Faculty of Forestry UGM has initiated the development of a mixed oil palm model with woody plants, especially meranti, rubber, tembesu, gaharu and others. Through the Silva Gama Educational Forest, at that time, various breakthroughs in oil palm agroforestry were built in this area as an effort to anticipate the massive expansion of oil palm into the surrounding forest area, which is currently happening. Mixed palm oil gardens of Muara Tabir District can be seen in Figure 2.

In addition to agroforestry in the form of mixed palm oil, the process of replanting oil palm plantations is also carried out to replace plants that are no longer productive with new plants gradually or completely (Rochmah *et al*, 2020). According to Herman and Pranowo (2011), some of the replanted land will be open and get full sunlight. In addition, according to Parulian *et al* (2013) the use of replanting land for new oil palm plantings has drawbacks including land productivity which is influenced by nutrient status and soil fertility levels. Therefore, soil conservation efforts are needed to maintain soil fertility. The intercropping pattern can be used as an alternative to conserve soil in oil palm replanting areas.

The intercropping system has many advantages. Some of the advantages of the intercropping pattern include: increased efficiency (labor, land use and absorption of sunlight), plant populations can be arranged as desired, in one area the production of more than one commodity is obtained, a combination of several types of plants can create several types of plants can create biological stability so that it can suppress pest and disease attacks and maintain the sustainability of land resources in this case soil fertility. The pattern of corn plants as intercrops in oil palm land can be applied as long as oil palm plants are immature and less than 3 years old (Hatta *et al*, 2014). Intercropping among oil palm plantations is to cultivate food crops, plantations and horticulture as intercrops between oil palms are very likely to be carried out (Nengsih, 2016). Oil palm intercropping has several advantages, namely: optimizing land use as determined by the Land Equivalent Ratio (LER), producing a variety of products, obtaining additional yields, improving soil fertility and preventing erosion (Balai Pengkajian Agricultural Technology, 2012).). In addition, with the existence of intercropping, the risk of farmers not harvesting is reduced, and farmers are "forced" to visit their oil palm plantations more often, so they can carry out more intensive monitoring and maintenance (Masganti *et al*, 2015).

3.3 Background and Condition of Mixed Palm Oil in Muara Tabir District

Oil palm which is located in Muara Tabir District, Tebo Regency is a commodity that only entered the area in the 1990s. Oil palm itself is a plant originating from Nigeria, West Africa, and Brazil so that it can be called a foreign plant that thrives in Indonesia (Tety *et al*, 2012). At first, the main commodity in Muara Tabir District, especially in Sungai Jernih Village, was rubber. However, because oil palm has a higher price than rubber, most of the people in Sungai Jernih Village choose to replace their gardens with oil palm plantations. Sungai Jernih village itself is the center of oil palm plantations in Muara Tabir District as well as a transmigrant area. Most of the people are transmigrant people from Java Island who

have settled in Sungai Jernih Village since the transmigration program by the new order government. At first, people never thought that oil palm plantations could increase their income quickly. However, since the first harvest in 1997, people have only realized that oil palm is green gold that can promise high profits in a relatively short time, at least when compared to palawija and rubber, crops that have long been cultivated among transmigrants from Java. If the latter two products are generally constrained by market access, this is not the case with oil palm, whose market is wide open and the distance is not too far from reach. However, palm oil processing factories (PKS) that have sprung up in Muara Tabir Sub-district require a large supply of raw materials to meet their installed capacity.

After palm oil entered and became the main commodity, there were many PKS or Palm Oil Processing Factories that were also present in Sungai Jernih Village. Based on data from the KPH or West Tebo Forest Management Unit, there are 16 business permits for oil palm plantations with a total area of 42,911 hectares. The number of PKS in Muara Tabir District itself reaches 7 PKS which are the estuaries for selling people's palm oil. Smallholder palm oil is an oil palm plantation that is managed directly by the community. The community in Muara Tabir District, especially Sungai Jernih Village, consists of local communities, transmigration communities, and SAD (Suku Anak Dalam) or commonly called jungle people. The management is carried out directly by the community without any partnership with third parties such as palm oil companies. When the harvest season arrives, the new FFB (Palm Fruit Bunches) are sold to PKS as a third party. Sales of FFB directly from the community to PKS can only be done by people who are members of the DO or Delivery Order. Meanwhile, people who are not part of the DO usually sell their harvested FFB through intermediaries at the nearby palm oil sales depots. The Palm Oil Processing Factory plays a role in processing palm oil into CPO or palm oil which is used by the industry to be processed into several products, including cooking oil. The existence of the PKS causes market access for oil palm sales by farmers to be easier than for rubber commodities. Suku Anak Dalam or commonly called SAD as the local community of mixed oil palm gardens at Muara Tabir District can be seen in Figure 3. Pejuang Muda Tebo visited this local community in 2021.



Fig 3. A Visit to the Anak Dalam Tribe, Palm Oil Plantation, Muara Tabir District

Source: Pejuang Muda Tebo, 2021

The condition of oil palm plantations in Sungai Jernih Village, apart from being planted in monoculture, is also

planted using the mixed garden method. Plants that are usually mixed with oil palm plants are jengkol and petai commodities. Mixed palm oil avoids being mixed with fruit because it has a tendency to social conflict with jungle people, where fruit is an economic space for the Orang Rimba as a source of food. Mixed palm oil itself is one of the applications of agroforestry carried out by oil palm farmers in Sungai Jernih Village. Mixed palm oil was originally intended to maintain the economic stability of farmers in order to be protected from falling commodity prices. By not only depending on one commodity, people hope that their income will be more maintained. Mixed palm oil, apart from being an alternative solution that has economic value, can also provide ecological value as a carbon stock (Alfaizin, 2013). The presence of mixed palm oil in Sungai Jernih itself becomes less and less the more distant the location is from the PKS. This means that the closer they are to the existence of the PKS, the farmers prefer to plant oil palm monocultures because of the ease of access to sell palm oil. The distance that is too far between the plantation and the PKS causes the level of profit to decrease due to the higher capital for transportation. In addition, the marketing chain also becomes longer if it passes through the collectors before being sold or distributed to PKS. The form of mixed oil palm or mixed gardens in Sungai Jernih itself is in the form of blocks or plots per commodity. Oil palm plants in Sungai Jernih Village are mixed with other types of plants in a form that does not line up directly in one garden, so it tends to look monoculture and only looks like mixed gardens when using landscapes.

Agroforestry is a form of land use with forestry plants combined with agricultural crops (Jannah *et al.*, 2022). With this concept, mixed palm oil has been included in the application of agroforestry because it simply has mixed oil palm commodities with several other agricultural crops. While the mixed garden itself is a mixture of several plants that tend to be irregular (Andi *et al.*, 2018). However, from the condition of mixed oil palm in Sungai Jernih Village which is in the form of plant blocks and only appears to be mixed when using the landscape, mixed palm oil in Sungai Jernih Village has not fully implemented the principles of agroforestry. Complex agroforestry itself is the application of agroforestry that is not only mixed oil palm, but is also needed to reduce the rate of forest conversion through empowered mixed oil palm plantations (Nursanti *et al.*, 2017). In the future, it is hoped that mixed palm oil in Sungai Jernih Village can improve the application of agroforestry principles to further maximize the benefits obtained. Although initially mixed plantations were implemented with an economic background, mixed palm oil itself could be an alternative to suppress the expansion of oil palm plantations. Agroforestry itself is also one of the strategies to improve the environment while reducing the risk of commodity dominance (Nugroho *et al.*, 2017). The application of agroforestry in Sungai Jernih should be improved by setting up more complex mixed gardens. The application can be in the form of establishing a pattern of planting oil palm and other agricultural commodities based on an analysis of land needs so that the economic, environmental and social objectives of agroforestry can be achieved properly. In empowering the environment with oil palm agroforestry, synergy between agencies from the government, the private sector, and the community is also needed (Soegiarto, 2017). The engagement and responsibility between these stakeholders becomes the social value achieved in the application of agroforestry values in the practice of mixed palm oil in Sungai Jernih Village. The government itself plays a crucial role as a policy maker in overcoming oil palm expansion and the dominance of the

existing palm oil monoculture (Harmaini, 2021). With various policies and scenarios, the private sector and the community can more confidently apply mixed palm oil as an alternative that has economic, environmental, and social values that are worth trying in overcoming various problems of oil palm plantations.

3.4 Economic Impact of Mixed Palm Oil in Muara Tabir District

The presence of oil palm in Sungai Jernih Village has both positive and negative impacts on the economy. Likewise with the application of mixed palm oil in Sungai Jernih Village. Oil palm plantations as a new commodity have a positive impact on the economy such as adding new jobs and increasing people's income (Syamsul *et al.*, 2022). Palm oil also has guaranteed easy market access, easy distribution chain, and even though the distance is far, palm oil can have strong guarantees besides rubber because it is more durable. The economic advantages of oil palm are also shown by oil palm which is Indonesia's leading sector which contributes highly to national non-oil exports (Ewaldo, 2015). Oil palm is seen as green gold so that it is still maintained, while rubber is seen as a side commodity. Palm oil is also considered as the main economic support for both local communities, transmigrant communities, as well as jungle people or the Anak Dalam tribe in Sungai Jernih Village, Muara Tabir District. Oil palm has a high price and has an easy market so it is chosen by the community as one of the main commodities (Susanto *et al.*, 2021). Meanwhile, the negative impact of the existence of palm oil is the potential for palm oil dominance as the main commodity which makes it difficult for other commodities to develop (Mahalizikri, 2019). The dominance of these commodities is also getting stronger due to easy access to the market for the sale of FFB (Palm Fruit Bunches). Communities can cultivate oil palm plantations on community gardens as an independent scheme or have other options in the form of partnerships with companies. Palm oil production in Tebo Regency itself is dominated by the company's plantations which cover an area of 42,911 hectares. Meanwhile, people's oil palm plantations, which are mostly located in forest areas, both mixed oil palm and similar oil palms are only 16,558 hectares. The community can cooperate with the company as a partnership scheme, where a profit-sharing system is applied. With this scheme, the convenience for the community increases and the community is more confident in choosing oil palm as the main commodity to be empowered. In addition, the existence of palm oil also attracts newcomer companies that have the potential to monopolize commodity sales and cause people to tend to be unable to sell their products other than relying on immigrant companies (Hermawan, 2018). Although there is a monopoly opportunity, the presence of a newcomer company can also have a positive impact in the form of market stability from the integration carried out (Zaimah *et al.*, 2018). This can be seen by the price of palm oil which tends to be more stable than other commodities. Oil palm fruit bunches in Tebo Regency transported for the sale process can be seen in Figure 4.

The scenario of mixed oil palm plantations can be present as an alternative solution in the economic field, to solve various problems caused by the presence of oil palm as the main commodity in Sungai Jernih Village. The positive impact of the existence of mixed oil palm plantations in Sungai Jernih Village is that it can guarantee the stability of the community's economy because it does not only rely on one commodity. Agroforestry itself can have a positive impact on the economy

in the form of increasing community income (Kurniawan, 2022). The addition of people's income lies in guaranteeing economic stability because it relies on more than one commodity. In addition, the possibility of a market monopoly by the company can also be more overcome because the mixed oil palm plantations actively involve the community to empower the plantation and themselves. However, mixed oil palm plantations also have the opportunity to have a negative impact on the economy. The opportunity is in the form of a decrease in crop yields due to the selected mixed commodity that is not suitable for oil palm plants to develop. It is even stated that oil palm plants will produce maximum fruit when not mixed with other types of plants. This condition shows that the higher the economic return to be obtained, the higher the economic risk. Planting palm oil in monoculture has a great opportunity to produce more palm fruit, but when the price of palm oil falls, the economic risk is also greater.



Fig 4. Palm Fruit Bunches Tebo Regency, Jambi Province
Source: Dewi, IR., College Student of Environmental Science Department, University of Sebelas Maret, 2021

With the convenience of the market, which is supported by 7 PKS and DO Cooperatives in Muara Tabir Sub-district, it also basically causes the mixed palm oil scenario not to be carried out intensively. This is in contrast to the mixed gardens in Central Kalimantan and North Sulawesi which have been carried out intensively. The community in Sungai Jernih Village prefers to develop a monoculture oil palm plantation or mixed oil palm plantation with the crosier model. The mixed oil palm plantation with the rumpang or cemplongan model is still applied by the community in Sungai Jernih Village because it is considered to have a smaller market risk compared to producing similar plants which are very risky. When there is instability in the selling price and even the selling price falls, big losses can be overcome because it does not depend on only one commodity. The mixed oil palm plantation scenario is an alternative or an economically rational solution.

3.5 Environmental Impact of Mixed Palm Oil in Muara Tabir District

The area of oil palm plantations in Jambi Province alone in 2012 reached 532,293 Ha and continues to increase due to oil palm expansion (Anggreany *et al.*, 2016). Oil palm and mixed

oil palm plantations in Sungai Jernih Village, Muara Tabir District have environmental impacts, both positive and negative impacts. Palm oil itself is a leading export commodity in Indonesia with one of the advantages of palm oil which is considered better than crude oil which is difficult to renew (Wahyuni *et al.*, 2021). From this fact, palm oil is considered more environmentally friendly than non-renewable fuels. While the negative impact of the existence of oil palm is the dominance of commodities that cause land expansion. The existence of this land expansion causes the clearing of new land, reduced non-plantation forest area, forest exploitation, reduced carbon sequestration, forest fires to open new oil palm plantations, and various other negative impacts. Palm oil has even begun to be considered a commodity that is considered environmentally unfriendly due to the various impacts of environmental degradation caused. The oil palm boom is one of the main causes of expansion, namely the existence of land such as forests that are open access and the existence of capital from individuals as well as government or banking programs. The expansion or expansion of oil palm land in forest areas is also caused by a lack of periodic monitoring. The existence of oil palm expansion can lead to dominance which leads to a decrease in the diversity of fruits, vegetables, and game animals (Suryadi *et al.*, 2020). Besides having an impact on the environment, land extensification for oil palm plantations also has the potential to cause land conflicts because it intersects with protected forest areas, conservation production forests, limited production forests, and conservation areas (Mustofa and Bakce, 2019). It is even stated that oil palm can cause environmental degradation as well as conflict in partnership schemes and labor conflicts (Syafi'i, 2016). Mixed palm oil gardens of Muara Tabir Subdistrict that mixed palm oil with another trees can be seen in Figure 5. In the Figure 5 can be seen that oil palm is still the dominant commodity compared to other crops.



Fig 5. Mixed Palm Oil Gardens in Muara Tabir Subdistrict
Source: Dewi, IR., College Student of Environmental Science
Department, University of Sebelas Maret, 2021

Agroforestry and mixed gardens themselves are not new knowledge and are knowledge from local community science that has high ecological value (Dadi, 2019). The existence of mixed oil palm plantations that apply the principles of agroforestry has both positive and negative impacts on the environment. The positive impact of the mixed oil palm plantation is the maintenance of soil quality with the variety of plants and the suppression of oil palm expansion. With the

existence of agroforestry or mixed oil palm plantations, peatlands and forests can also be saved because of their impact on maintaining soil quality from damage (Yanarita *et al.*, 2020). From the results of laboratory analysis of soil physical properties in the form of texture, porosity, permeability, bulk density, soil particle density, and soil moisture content, the quality of land from mixed gardens is better than monoculture gardens (Fadel *et al.*, 2021). Maintenance of soil quality in addition to the mixed palm method can also be done by utilizing the remaining wood from oil palm plants into biochar or intake of carbon enhancers for the soil (Siboro, 2021). With the use of oil palm, the soil structure becomes more awake. Mixed gardens can be mixed with sengon and other woody plants for land solutions to increase fertility. Sengon itself was chosen to be one of the mixed commodities of oil palm because it can increase soil fertility and the wood is sold in the market. Mixed oil palm plantations can be cultivated with wood as one of the efforts to achieve social forestry protection regulations which cannot be immediately dismantled because it can cause social conflict. This step implements the practice of slowly inserting oil palm plantations with woody plants or commonly referred to as Benah Term. So it can be concluded that Term Benah is a program that aims to improve the structure of existing plantations and forests. The agroforestry system itself can also help in efforts to overcome climate change because it prevents the exploitation and domination of one commodity (Ilham and Esa, 2018). While the negative impact on the environment with the existence of mixed oil palm plantations is the risk of improving the planting of mixed commodities by burning. However, this has little chance because basically mixed oil palm plantations must maintain the condition of oil palm as a plant that has existed before. If the clearing is done by burning, then the condition of the oil palm plantations can be damaged. The mixture of palm oil commodities with other crop as the environmental solutions can be seen in Figure 6. Other crops play a role in increasing biodiversity from the dominance of oil palm.



Fig 6. Mixture of Oil Palm Commodities with Other Crop Commodities
Source: Dewi, IR., College Student of Environmental Science
Department, University of Sebelas Maret, 2021

The palm plantations in Sungai Jernih Village, Muara Tabir District occupy HTR or Community Plantation Forests. As stipulated in P 83/2016 concerning Social Forestry, HTR managed by KTH (Forest Farmers Group) Kasang Panjang in Sungai Jernih Village is now being pushed to become a mixed oil palm plantation whose process is facilitated by KPH Tebo

Timur. Mixed oil palm plantations play a role as an embodiment of sustainable smallholder palm oil management in Tebo Regency. FMUs play a role as a mover for the Term Benah, for example, by designing a mixed garden model or oil palm agroforestry such as pathways, gaps, fences, and others as alternative choices for the community. This is a breakthrough for mixed oil palm plantations which were previously only mixed plots of block plots which tended to look monoculture without a carefully designed design. The existence of a mixed oil palm plantation scheme through the Term Benah program does not only act as an environmental solution but also as a production arrangement, especially palm oil. The productivity that has been low so far is expected to be increased through the improvement period. In Muara Tabir District, the role of KPH itself is seen as very real because most of the PS initiations in Muara Tabir District are carried out by KPHs, apart from STN (National Farmers Union) and NGOs (Non-Governmental Organizations). However, institutionally, both the West and East Tebo KPHs, the two KPHs that have been actively promoting the acceleration of PS in Tebo, are constrained by limited resources, both human and funding resources. The West Tebo KPH, for example, has so far only been supported by 6 human resources, consisting of 1 KPH Head, 1 forestry technical staff, and 4 Bakti Foresters. Meanwhile, the available budget so far is also very limited, only around 200 million/year.

A thing that has a big impact on the environment if then the expansion of community oil palm plantations into the surrounding forest area occurs so intensively. However, the initiative of KPH and local NGOs to include and propose it in the PS scheme is a breakthrough that should be appreciated. Because as we know, P 83/2016 concerning Social Forestry does not actually provide a free gap for the development of oil palm plantations in the PS area. With this regulation, it is hoped that mixed oil palm plantations will become one of the breakthroughs that have a high positive impact on the environment. Several things can be done to implement mixed oil palm plantations as a step for sustainable smallholder palm oil management, things that can be done in Tebo Regency, especially for Sungai Jernih Village, Muara Tabir District, namely by developing a pilot model of mixed oil palm plantations or oil palm agroforestry which is used as a reference for Public. In addition, the preparation of curriculum and training on the mechanism for implementing Term Benah in the mixed oil palm plantation scheme also needs to be carried out by KPH, KTH, PS managers, and the community as all stakeholders involved. The Tebo Regency Government can also strengthen the institutional capacity and human resources of KPH as a companion institution for the development of mixed oil palm plantations (mixed palm agroforestry) as well as conduct a policy review, especially on P 83/2016 related to Social Forestry so that the realization of sustainable oil palm PS development can be more strongly implemented.

4. Conclusion

The existence of oil palm as the main commodity and the application of mixed oil palm plantations in Sungai Jernih Village, Muara Tabir District, Tebo Regency have various impacts in the economic and environmental fields. The positive impacts of oil palm in the economic field are the addition of new jobs, an increase in people's income, the existence of a leading sector with a high contribution to national non-oil exports, and oil palm as green gold as the main economic support for the community in Sungai Jernih Village. Meanwhile, the negative

impact is the dominance of palm oil which makes it difficult for other commodities to develop. The application of mixed oil palm plantations itself has an economic impact in the form of guaranteeing the stability of economic income because it does not only rely on one commodity and the reduced opportunities for market monopolies by the private sector as a positive impact and there is a risk of decreasing oil palm productivity if the mixed crops are chosen incorrectly. The impact of palm oil on the environment is that oil raw materials are considered more environmentally friendly than petroleum raw materials as a positive impact as well as land expansion which causes a reduction in non-plantation forest areas, forest exploitation, reduced carbon sequestration, and forest fires for land clearing as a source of energy negative impact. Meanwhile, the positive impacts in the environmental sector from the existence of mixed oil palm plantations are the implementation of an improvement period that suppresses oil palm expansion, maintaining soil quality due to the heteroculture system, and minimizing other environmental damage. The negative impact of the mixed oil palm plantation itself is the risk of planting mixed commodities by burning. However, the risk is relatively small because it can damage other plants in the vicinity. The mixed oil palm plantation also has social value because it empowers the community and involves all existing stakeholders. This makes mixed oil palm plantations an alternative solution for sustainable palm oil management that has economic, environmental and social sustainability values by minimizing the negative impacts.

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