

Landscape Ecological Changes and Livelihood Dilemma of the Rural Household around the Oil Palm Plantation

Reni Fatmasari[#], Rahim Darma^{*}, Darmawan Salman^{*}, Yunus Musa⁺

[#]Graduate Student, Department of Agriculture Sciences, Hasanuddin University, Indonesia
E-mail: reni.fatmasari@unimuh.ac.id

^{*}Department of Agribusiness, Faculty of Agriculture, Hasanuddin University, Indonesia
E-mail: rahimdarma@gmail.com; darsalman1963@gmail.com

⁺Department of Agronomy, Faculty of Agriculture, Hasanuddin University, Indonesia
E-mail: yunusmusa@yahoo.com

Abstract— The pressure of global market demand for palm oil is driving a massive expansion of oil palm plantations in Indonesia. Although it provides benefits in economic terms, it also has social and environmental impacts. The impact is in the form of changes in the ecological landscape, conversion of agricultural land, rural household livelihood systems, reduced biodiversity, deformation, plant monoculturalization, and even a monostructuring of livelihood. This study aimed to provide an overview of changes in the ecological landscape that resulted from the expansion of oil palm plantations and the socio-economic impact of the expansion of oil palm plantations on farmers' household livelihood systems. The study was conducted in West Sulawesi, Indonesia. This study uses the livelihood survey method by selecting 30 farmer households selected by random sampling. The results of the study found the fact that oil palm plantations seemed to provide welfare for rural households, but what happened was a vulnerability and high livelihood dependence on income from the wages of oil palm plantations. The expansion of oil palm plantations has created the integration and dependence of rural economies on the global political economy of oil palm, but at risk to even undergoing household livelihood dilemmas due to the two villages' deliberate divergence of livelihoods because of shifting ecosystems now leading by palm oil commodities.

Keywords — oil palm; expansion; livelihood; dependency; vulnerability.

I. INTRODUCTION

Oil palm plantations in the last few years have continued to accelerate very rapidly and now reach an area of 14 million hectares, which makes it the first rank as the most expansive plantation commodity in Indonesia. The world demand for crude palm oil, which continues to rise [1] is a driving force for palm oil expansion in developing countries including Indonesia. The share of palm oil in the consumption of four major global vegetable oils increased rapidly from 22 percent (1980) to 39 percent (2015), while the share of soybean oil fell from 55 percent to 34 percent in the same period. Reference [2] shows demonstrating the expansion of the use of soybean oil for biodiesel in the US has a significant impact on the world vegetable oil market. The majority of replacing vegetable oils is most likely to occur through palm oil substitution. Increasing demand for

palm oil products for human and livestock consumption, raw materials for the cosmetics industry, and the use of alternative fuels (biofuels) as a whole have driven oil expansion [3], [4]. Another driving factor is that palm oil is a contributor to income from the country's foreign exchange and national economic growth in the Southeast Asia region, especially Indonesia and Malaysia [5].

In addition to continuing to experience widespread palm oil and provide a positive impact on the national economy, on the other hand, these commodities also have a negative impact on social and environmental aspects. The expansion of oil palm plantations in Indonesia is one of the causes of changes in the ecological landscape [6] and land use [7]–[10]. It includes land cover changes, land use, deforestation, loss of food crops, increased CO₂ levels in the atmosphere, loss of biodiversity, loss of many water sources that trigger drought. Also, it influences the increased temperatures and greenhouse gases that encourage natural disasters, reduced

water catchment areas so that the rainy season results in flooding, land conflicts and destruction of flora and fauna habitat resulting in conflicts between animals and animal conflicts with humans. Oil palm expansion is also a significant cause of conversion of forest land in West Kalimantan driven by the role of several actors who have the power to determine government policies but are dynamic [11]. In line with research of [12] showed that there were only 8% of oil palm plantation development occurred by the direct clearing of intact forest in the study area in the last 25 years. Oil palm concessions in the last 25 years were mostly developed on the logged forest, agroforests, and shrublands. Palm oil commodities are currently not only developing on a large scale through private companies, but the involvement of local farmers has been very active in oil palm cultivation [13].

Plantation statistics show that the expansion of the last ten years of oil palm plantations in West Sulawesi has increased by 153,379 ha from 57,527 ha in 2007 and increased to 210,906 ha in 2017 [14]. The expansion activities have led to changes in the ecological landscape, changes in agrarian structure, changes in cover and land use. The result is the transformation of the rural community livelihood system around the plantation [15]. The livelihood system that used to consist of various sources and structures of livelihood was then trapped into one source of income, namely palm oil. Farmer households that initially depend on non-oil palm commodity types, now have to coexist with oil palm plantations followed by a landscape change process.

The problems that are the focus of this research are as follows: 1). How far does the ecological landscape change in Tobadak Village?; 2). How far are the impacts of the expansion of oil palm plantations on the farmer's household livelihood structure? The purpose of the study is 1). Identifying changes in the ecological landscape in Tobadak Village, 2). Analyzing the impact of changes in farmer's household livelihood structure and rural economic dependence due to the expansion of oil palm plantations.

II. MATERIAL AND METHODS

The research process was carried out from October 2017 to July 2018. The research was conducted in the Village of Tobadak, Mamuju Tengah Regency, West Sulawesi Province, Indonesia. Selection of research locations because in the Tobadak Village there are oil palm plantation concessions that change the landscape. The selection of farmer households was carried out through a simple random sampling technique of 30 households (KK) because the target population was homogeneous. Selection of informants with snowball system techniques. The data used in this study are primary and secondary data. Primary data is collected from field observations and in-depth interviews with respondents and informants. Secondary data was obtained from the Directorate General of Plantation, the Central Statistics Agency, Statistical Data of West Sulawesi Province and Mamuju Tengah Regency and the journal. This study uses a combination of qualitative and quantitative methods. This combination process is not a mixture of the two, but rather uses them both gradually to understand the critical reality of the countryside. In principle, this research

is dominant using qualitative methods combined with quantitative methods. The research has dismantled the farmer's household livelihood system and the process of dragging the rural economy into global market flows.

III. RESULTS AND DISCUSSION

West Sulawesi Province is the second largest palm oil producing area in Eastern Indonesia after Central Sulawesi. The area of oil palm plantations in West Sulawesi in 2004 (when the West Sulawesi Province was separated from the South Sulawesi Province) which is an area of 52,500 Ha then increased rapidly to 210,906 Ha in 2017. Similarly, the amount of production and the number of oil palm farmers (KK) increased for the past ten years. The following is data on the development of the area, production, and the number of oil palm farmers in the last ten years [14]

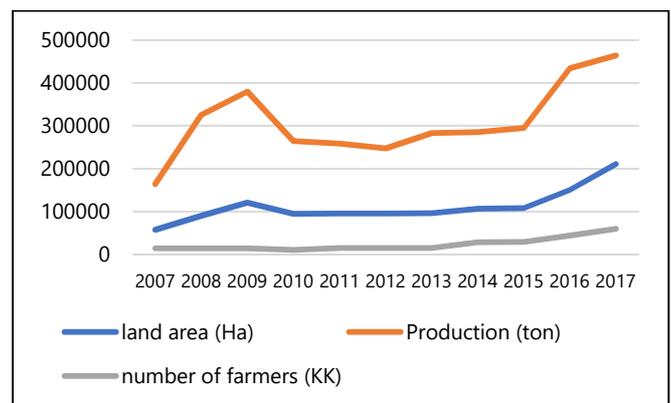


Fig.1 Development of Palm Oil Commodities in West Sulawesi, 2007 – 2017

Figure 1 shows the development of the area, and the amount of palm oil production in West Sulawesi has fluctuated but tends to increase every year. This is due to the strong attractiveness of oil palm plants where the people in West Sulawesi make oil palm as a primadonna in fulfilling their economic needs, including facilitating access to education for children of farmers in West Sulawesi where they have been able to send their children to college. The presence of several large private companies (PBS) that build palm oil mills (PMKS) in the West Sulawesi region has also become a driver of oil palm plantations experiencing rapid development from year to year.

Tobadak Village has an area of 86.42 km², consisting of twelve hamlets and forty-eight RTs with a total population of 8,393 people and 1829 households in 2016 [16]. Tobadak Village is one of the villages formed from transmigration settlements so that the community consists of various tribes, namely the Javanese, Balinese, Bugis, Makassar, and Toraja tribes. Existing facilities in Tobadak Village are electricity, sports facilities, health facilities, worship facilities, schools, and roads. Electricity in the Village of Tobadak is sourced from PLTA Bakaru and PLTD Topoyo. Infrastructure in the form of roads was built several years after the opening of the transmigration area but was still in the form of a gravel road. Later in 2015, the Government began the program of building concrete asphalt from Topoyo to Sejati Village (Tobadak V).

The development of oil palm plantations in the village of Tobadak besides being part of the development of PIR - Transmigration there is also a pattern of partnerships or Supported smallholders with PT. Wahana Karya Sejahtera Mandiriyang has been operating since February 2018. PT WKSM has opened approximately 1231.5 hectares of good land used to be forest and swamp in 2014. Although at the beginning of the socialization there had been protests from several communities due to the condition of their strategic land. They demanded that the company be willing to compensate for the costs they incurred when cleaning (removing) land that had previously been in the form of forests and swamps. However, because of government interference, in this case, the regent who was considered a "parent" and a traditional figure for the Mamuju Tengah community they called "Uwe," finally an oil palm plantation was established. To influence the process and implementation of policies, they use their power and capabilities. Power serves as an explanatory factor for the relative gains of individual actors in the social networks and relationships [17].

A. Changes in the Ecological Landscape of Tobadak Village

The expansion of oil palm plantations that occurred in Tobadak Village has changed forest cover, swamps and agricultural land with hetero-culture crops into oil palm plantations with monoculture crops. It makes a change in the ecological landscape, namely from the forest, swamp and agricultural land to oil palm plantations. Changes in the ecological landscape then have an impact on changes in interactions between components such as biotic, abiotic and human. This is because the landscape is a comprehensive system, which has interacting elements [18], [19]. Long before the era of booming oil palm plantations in the Tobadak region, the place was a haven for forest encroachers to open up land to take timber or control the land. Whereas for the community around the swamp area is one of the sources of their livelihood by capturing various types of local fish such as the abundant amount of Mas and Sidat / Moa (local people call it "Masapi fish"). For agricultural land itself is planted with rice and various types of vegetables whose soil conditions are quite fertile but often have problems with pigs.



Fig.2 The oil palm plantation ecosystem which was previously a forest ecosystem in Tobadak Village

Changes in the ecological landscape then result in the loss of biodiversity because forest cover and agricultural land have turned into monoculture crops. Monoculture plants, which are palm oil, cannot provide food for animals that live in forests such as wild boar, so they start to enter people's farmland and are killed because they are considered as pests.

While many other animals run away and die because their habitat has been destroyed, for example, snakes are a natural predator of rat pests. As a result of the reduced snake population, it eventually led to the explosion of rat pest populations which then attacked and damaged the land of rice paddies belonging to farmers who were around oil palm

plantations [20]. Also, other plants such as fruits, vegetables,

and medicinal plants are also lost due to oil palm expansion.

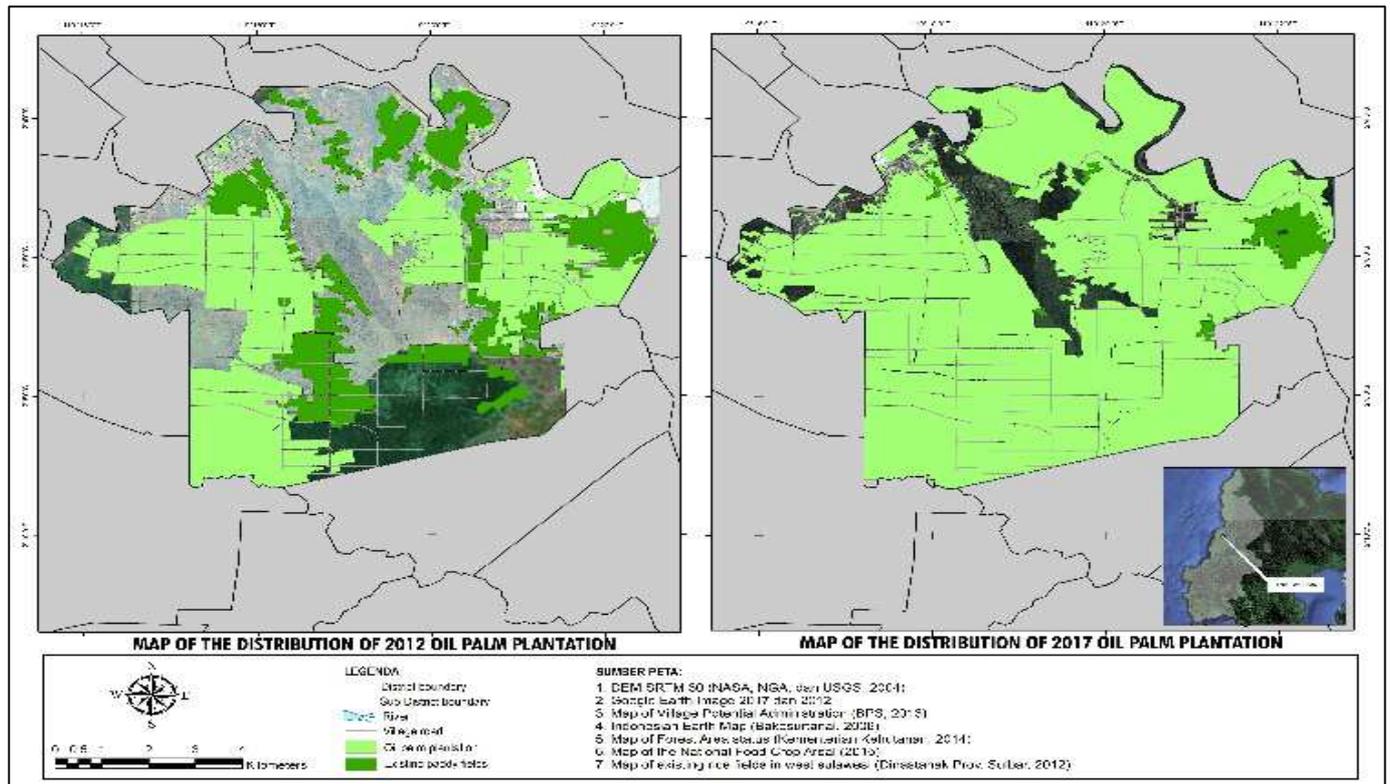


Fig.3 Map of the Distribution Oil Palm Plantation in Tobadak Village

Figure 3 above shows that the expansion of oil palm plantations in addition to changing forest cover also changes land use. Approximately 130 ha of agricultural land, namely wetland rice is converted into oil palm plantations from the total area of wetland rice in 2012 covering 152 ha [21]. As a result, the surrounding community is vulnerable to food security, as evidenced by the entry of thousands of kilograms of rice from outside Mamuju Tengah Regency, such as from Pinrang, Sidrap, and Wajo Regencies.

The development of oil palm plantations in Tobadak Village that occurred massively was inseparable from the role of the Regional Government that issued the Right to Cultivate approximately 16,000 Ha for several large private companies (PBS) in Central Mamuju Regency, including PT. Surya Raya Lestari II (SRL II) and PT. Wahana Karya Sejahtera Mandiri (WKSM). The government also budgeted funds of Rp. One hundred sixty-seven million for the Palm Farmers' HR Improvement Training activities on Pest Disease Maintenance and Prevention in 2016. This was done because the palm oil commodity has become the largest regional foreign exchange contributor compared to other commodities, these commodities are also considered to have increased regional economic activities, seen from the figures Gross Domestic Product (GRDP) which reached 46% came from the plantation sector, provided employment, and reduced poverty to 6.83% from 15%.

The presence of large private companies does have a positive impact on the economy of the surrounding community that the role of oil palm could improve the economy of the community[22]. It has a positive impact on economic value, environment, and socio-cultural aspects of

self-help oil palm plantations, but also have a negative impact especially on the environment [23]. One of the most severe impacts of residents, especially those living around palm oil mills and the company's core gardens, is the number of flies that are increasing year by year. This happened because the activities of stacking *Tongkos* (empty fruit bunches) on the roadside were carried out by the factory because the *tongkos* would be used as manure for oil palm plants. Complaints from residents because of the many flies that enter their homes and the foul smell that comes out of the pile of *tongkos* stacked for days and left on the roadside.

Another impact is water pollution, which is a brown and somewhat oily water condition so the community must filter water before use. Water pollution also occurs in river areas where river water becomes cloudy. This is in line with the results of a report put forward by [24] which states that there are various types of environmental pollution from palm oil production and the most critical impacts include air pollution. The pollution is caused by fire forests and peatlands, heavy sediment content in rivers, pollution caused by excessive or improper use of agricultural chemicals, and the accumulation of palm oil mill waste (POME).

B. Livelihood Structure Farmers' households in Tobadak Village

The massive expansion of oil palm plantations in Tobadak Village not only caused changes in the landscape but also caused changes in the structure of farmer's household livelihood. Before the "booming" palm commodity in this village, the livelihood of the majority of the people was from farming rice fields and netting swamp fish. Since the

beginning, the people of Desa Tobadak worked in rice fields in cooperation, both at the time of planting and harvesting. As well as fishing activities they often go together; they do not even hesitate to commemorate each other and forbid if there are people who use stun equipment to catch fish. However, since oil palm is present as a promising commodity and has become a prima donna in several places in Mamuju Tengah Regency, slowly the farmer households have begun to switch to planting oil palm and leaving paddy fields. Farmers' households flocked to plant oil palms in the garden, on the land and even in their houses.

The dominant source of livelihood in Tobadak Village is non-agriculture (oil palm plantation workers, plantation supervisors, traders, and collector collectors). Farmer households in Tobadak Village try to maintain life and increase resilience by diversifying their income. Diversification activities include planting corn on the sidelines - oil palm plants that are still zero to three years old to get cash income. Livestock income is different for all groups, on average households of middle and upper-class farmers raise cattle, goats, and pigs (Balinese tribe people) then trade them. Whereas lower class farmer households raise more and sell poultry, namely free-range chickens and ducks. Although there are two farmers' groups from the lower classes, who raise cows their status is not as livestock owners but only paid to raise the cattle. Some of the farmer's households are paid monthly, and some are paid using profit sharing for cattle.

For agricultural businesses, most households cultivate corn. Figure 4 shows that the lower classes obtain greater agricultural income than the middle class because on average these households are riding corn on the sidelines of the company's oil palm plantations or community-owned oil palm plantations, where there is no profit sharing system for the farm. Both the palm oil companies and the independent parties give their permission to enter the oil palm plantation because their oil palm plantations also indirectly are preserved by providing fertilizer or spraying disturbing grasses for corn. Palm oil plantations will also look cleaner and tidy if planted with corn, although planting time is only up to three years old or when palm fronds have met each other.

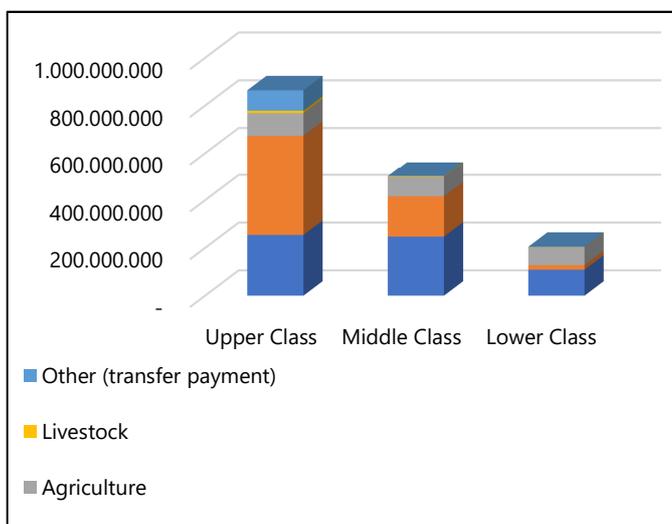


Fig. 4 Average Farmers Household Income in Tobadak Village, 2017

Figure 3 shows that although there are various jobs that can generate cash income, the work is a non-farm income sector that relies on the operation of oil palm plantations. Non-agricultural income relies heavily on the existence of oil palm plantations so that the dependence of farmers on the existence of oil palm plantations is relatively high. The high dependence on income from non-agriculture causes the income structure to be homogeneous makes all layers of farm households experience livelihood vulnerability. Upper-level households experience the highest livelihood vulnerability because the structure of top-income household farmers is very homogeneous, which relies on the on-farm sector, namely the results of oil palm and off-farm plantations.

It is conceivable if the price of world oil goes down there will be a shock for oil palm farmers especially if this oil palm plantation ends; it is likely that the structure of the income will collapse. Farmers as plasma are positioned as suppliers of raw materials in the form of fresh fruit bunches (FFB) for the plants owned by the core. Plasma becomes dependent on the core regarding selling FFB because a cooperation contract binds it. Reference [25] shows that the meeting between capitalist modes of production that come from outside the village with rural agricultural production modes has dragged rural communities into the global economic cycle. Oil palm farmers (plasma) in the villages located on the lower circuits are suppliers of raw materials for the upper circuits, namely the global market for palm oil. The company, in this case, is a pipeline that connects the bottom (village) and the upper circuit (the global market for palm oil). These conditions indicate that farm households experience very high vulnerability due to oil palm plantations. Reference [26] explains that vulnerability occurs when an established living system experience shocks both suddenly and over a long period.

The transformation process that occurs when the expansion of oil palm plantations in rural areas is not only monoculturalization of vegetation as previously stated by researchers, but further has a real impact on monostructuring of livelihoods. Farmers who were previously the subjects of "independence" with their traditional farming systems were forced into the circuit of oil palm plantations, where they had to plant oil palm which upstream to downstream processes were regulated by global and state markets. There is no other choice for them but to work in the oil palm plantation sector because the ecosystem has changed.

The most expenditure is spent by all groups of farmer households as a whole, namely food (rice, side dishes, and kitchen spices). The prices of food items in Tobadak Village are relatively more frequent, especially for rice because most of them come from outside the Central Mamuju Regency such as from Sidrap, Pinrang, Wajo, and Polewali Mandar Regencies.

The expansion of oil palm plantations has a big contribution to the high household expenditure on food. The presence of oil palm commodities has shifted other commodities such as rice and vegetables because most farm households have turned into oil palm farmers. Their reason is that agricultural land is less productive because the land is getting dry, especially there is no irrigation, so they only rely on the rainy season which is now difficult to predict when it

comes. Though water is one of the important elements in rice farming. This is in line with the results of [27] research which states that limited water conditions can cause a decrease in rice productivity, the use of water for rice plants, among others, in the process of fertilization, plant density and crop protection which processes determine actual results and also maximum yield that can be achieved in a cropping system.

Energy expenditure in the form of energy purchases of gasoline because farmer households use motorbikes to go to their oil palm plantations. Meanwhile, energy expenditure can also be in the form of purchasing electricity pulses and gas cylinders for cooking purposes. Social spending is usually for donations of death or marriage. Other costs consist of the cost of purchasing cigarettes, telephone credit and other unexpected needs such as the purchase of building materials, merchandise, including also paying bank loans.

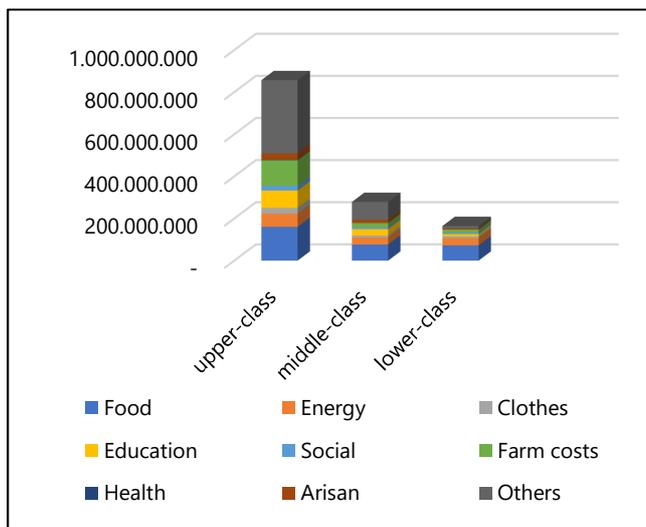


Fig. 5 Average Expenditure of Farmer Households in Tobadak Village, 2017

Figure 5 shows the next largest expenditure of farmer households is on other costs, but the researchers did not make their position higher than the costs of spending on food or education because of their only temporary (seasonal) nature, which does not occur annually — the high cost of other expenditures on the average upper-class farmer household when we interviewed because there was one household that was building a house and one household issued capital to start a printing business. The highest farming costs can be seen in the upper-class with oil palm plantation area between 2 ha to 9 ha because they spend maintenance costs such as fertilizing three times a year and narrowing the grass twice a year. However, the biggest expenditure is on harvesting activities because they pay workers to make oil palm, which is relatively high in dodos labor compared to corn farm workers. The wages of dodos workers range from Rp. 2500 - Rp. Three thousand five hundred per bunch, where once a harvest can get 100 bunches of up to 150 bunches once harvest when the age of oil palm is above five years.

Expenditures for education are also high for the upper and middle class because most of them send their children to tertiary institutions outside Mamuju Tengah Regency such

as in Mamuju Regency and some even study outside the Province of West Sulawesi, namely South Sulawesi Province and Java Province. Farmers' households consider that sending their children to the university level will improve their welfare in the future. The results of this study are in line with the findings [28] of who stated that human capital shows a person's ability to gain better access to their living conditions so that human capital is the most important aspect because it is used to regulate and process four other livelihood assets.

The transformation of farmer household livelihood systems due to the expansion of oil palm plantations also has social, economic and ecological risks. Farmer households in Tobadak Village become increasingly commercial so that they will pose a risk of economic disparity, social conflict, and waning trust between neighbors. The livelihoods of farmer households are threatened and under pressure from the existence of oil palm plantations so that they can pose economic risks in the form of poverty — ecological risks such as those currently occurring due to the presence of oil palm plantations. The risk also is palm oil processing plants, namely the pollution of rivers by waste and fertilizer from oil palm plantations, air pollution due to the negligence of vehicles carrying fresh fruit bunches, and water sources that reduced due to reduced forests and swamps due to the expansion of oil palm plantations.

IV. CONCLUSION

Some interesting findings emerged from our study, first the changes in the ecological landscape that occurred in Tobadak Village, Mamuju Tengah District encouraged the occurrence of vegetation monoculturalization and monostructuring the livelihood of households, making them more vulnerable if there was a decrease in oil prices. The expansion of oil palm plantations has created the integration and dependence of rural economies on the global political economy of oil palm; the two villages around oil palm plantations seemed prosperous due to the presence of oil palm plantations. However, vulnerable to even experiencing household livelihood dilemmas because in reality their villages slowly and surely lost diversity (diversification) of livelihoods due to changing ecosystems currently dominated by palm oil commodities.

REFERENCES

- [1] R. Cramb and G. N. Curry, "Oil palm and rural livelihoods in the Asia-Pacific region: An overview," *Asia Pac. Viewp.*, vol. 53, no. 3, pp. 223–239, 2012.
- [2] J. Cui and J. I. Martin, "Impacts of US biodiesel mandates on world vegetable oil markets," *Energy Econ.*, vol. 65, pp. 148–160, 2017.
- [3] McCarthy and J.F, "Processes of inclusion and adverse incorporation: Oil palm and agrarian change in Sumatra, Indonesia," *J. Peasant Stud.*, vol. 37, no. 4, pp. 821–850, 2010.
- [4] M. A. Sukiran, F. Abnisa, W. M. A. Wan Daud, N. Abu Bakar, and S. K. Loh, "A review of torrefaction of oil palm solid wastes for biofuel production," *Energy Convers. Manag.*, vol. 149, pp. 101–120, 2017.
- [5] L. Rist, L. Feintrenie, and P. Levang, "The livelihood impacts of oil palm: Smallholders in Indonesia," *Biodivers. Conserv.*, vol. 19, no. 4, pp. 1009–1024, 2010.
- [6] D. C. Morton *et al.*, "Cropland expansion changes deforestation dynamics in the southern Brazilian Amazon," *Proc. Natl. Acad. Sci.*, vol. 103, no. 39, pp. 14637–14641, 2006.

- [7] R. Unjan, A. Nissapa, and P. Phitthayaphinant, "An Identification of Impacts of Area Expansion Policy of Oil Palm in Southern Thailand: A Case Study in Phatthalung and Nakhon Si Thammarat Provinces," *Procedia - Soc. Behav. Sci.*, vol. 91, pp. 489–496, 2013.
- [8] K. G. Austin, A. Mosnier, J. Pirker, I. McCallum, S. Fritz, and P. S. Kasibhatla, "Shifting patterns of oil palm driven deforestation in Indonesia and implications for zero-deforestation commitments," *Land use policy*, vol. 69, no. February, pp. 41–48, 2017.
- [9] J. S. H. Lee, S. Abood, J. Ghazoul, B. Barus, K. Obidzinski, and L. P. Koh, "Environmental impacts of large-scale oil palm enterprises exceed that of smallholdings in Indonesia," *Conserv. Lett.*, vol. 7, no. 1, pp. 25–33, 2014.
- [10] Oksana, M. Irfan, and M. U. Huda, "Pengaruh alih fungsi lahan hutan menjadi perkebunan Kelapa sawit terhadap sifat Kimia Tanah," *J. Agroteknologi*, vol. 3, no. 1, pp. 29–34, 2012.
- [11] D. Prabowo, A. Maryudi, Senawi, and M. A. Imron, "Conversion of forests into oil palm plantations in West Kalimantan, Indonesia: Insights from actors' power and its dynamics," *For. Policy Econ.*, vol. 78, pp. 32–39, 2017.
- [12] S. D. Tarigan, Sunarti, and S. Widyaliza, "Expansion of Oil Palm Plantations and Forest Cover Changes in Bungo and Merangin Districts, Jambi Province, Indonesia," *Procedia Environ. Sci.*, vol. 24, pp. 199–205, 2015.
- [13] L. Feintrenie, S. Schwarze, and P. Levang, "Ecology and Society_ Are Local People Conservationists_ Analysis of Transition Dynamics from Agroforests to Monoculture Plantations in Indonesia," vol. 15, no. 4, 2010.
- [14] Badan Pusat Statistik (BPS), *Statistical Office of Sulawesi Barat Province*. Mamuju: CV. Parahyangan, 2017.
- [15] N. Hidayah and A. H. Dharmawan, "Ekspansi Perkebunan Kelapa Sawit dan Perubahan Sosial Ekologi Pedesaan," *Sodality; Jurnal Sociol. Pedesaan*, no. 4.3, 2016.
- [16] Badan Pusat Statistik (BPS), *Statistical Office of Mamuju Tengah Regency*. Mamuju: CV. Parahyangan, 2017.
- [17] A. Wibowo and L. Giessen, "Absolute and relative power gains among state agencies in forest-related land use politics: The Ministry of Forestry and its competitors in the REDD+ Programme and the One Map Policy in Indonesia," *Land use policy*, vol. 49, pp. 131–141, 2015.
- [18] R. Amalia, A. H. Dharmawan, and E. I. K. Putri, "Perubahan Lanskap Ekologi dan Resiliensi Nafkah Rumahtangga Petani di Sekitar Hutan di Kalimantan Timur," *Sodality J. Social. Pedesaan*, vol. 03, no. 03, pp. 121–127, 2015.
- [19] J. Sayer, J. Ghazoul, P. Nelson, and A. Klintuni Boedhihartono, "Oil palm expansion transforms tropical landscapes and livelihoods," *Glob. Food Sec.*, vol. 1, no. 2, pp. 114–119, 2012.
- [20] R. Fatmasari, D. Salman, R. Darma, and Y. Musa, "Household Adaptation Address Strategy In Dealing With Ecological Establishment In Expansion Of Palm Plantation In Mamuju Central District, Indonesia," in *The First International Conference on Global Issue for Infrastructure, Environment, and Socio-Economic Development (GIESED-2018)*, 2018.
- [21] Badan Pusat Statistik (BPS), *Tobadak Subdistrict in Figures 2017*. Mamuju: BPS-Statistics of Mamuju Regency, 2017.
- [22] Salma, "Peranan Hasil Pertanian Kelapa Sawit Terhadap Peningkatan Ekonomi Masyarakat dalam Perspektif Ekonomi Islam Di Desa Karossa Kecamatan Karossa Kabupaten Mamuju Tengah," Universitas Islam Negeri Alauddin Makassar, 2016.
- [23] P. Hafizh, N. Annisa, Arifin, M. A. W., and Soemarno, "Nilai Ekonomi, Lingkungan dan Sosial dari Perkebunan Sawit Swadaya di Kabupaten Seruyan, Kalimantan Tengah Indonesia," *Teh. Lingkung.*, vol. 2, no. 1, pp. 71–77, 2016.
- [24] W. Eric, "Greasy palms: The Social and Ecological Impacts of Large-scale Oil Palm Plantation Development in Southeast Asia," 2005.
- [25] McGee and T.G., *Circuits and networks of capital: The internationalization of the world economy and national urbanization*. London: Croom Helm, pp.23-36, 1986.
- [26] Scoones, *Sustainable livelihood and rural development*. UK: Practical action publishing Ltd., 2015.
- [27] N. A. Fuadi, S. D. Tarigan, J. Barat, and J. Barat, "Kajian Kebutuhan Air Dan Produktivitas Air Padi Sawah Dengan Sistem Pemberian Air Secara Sri Dan Konvensional Menggunakan Irigasi Pipa," *J. Irig.*, vol. 11, no. 1, pp. 23–32, 2016.
- [28] R. Wijayanti, "Strategi Penghidupan Berkelanjutan Masyarakat Berbasis Aset di Sub DAS Pudur, DAS Bengawan Solo," vol. 4, pp. 133–152, 2016.