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# Household adaptation address strategy in dealing with the ecological establishment in the expansion of palm plantation in Mamuju Central District, Indonesia

R Fatmasari<sup>1</sup>, D Salman<sup>2</sup>, R Darma<sup>2</sup>, and Y Musa<sup>3</sup>

<sup>1</sup>Graduate Student, Department of Agriculture Sciences, Hasanuddin University, Jalan Perintis Kemerdekaan Km.10, 90245, Makassar, Indonesia.

<sup>2</sup>Department of Agribusiness, Faculty of Agriculture, Hasanuddin University, Jalan Perintis Kemerdekaan Km.10, 90245, Makassar, Indonesia.

<sup>3</sup>Departemen of Agronomy, Faculty of Agriculture, Hasanuddin University, Jalan Perintis Kemerdekaan Km.10, 90245, Makassar, Indonesia

E-mail: *reni.fatmasari@unimuh.ac.id*.

**Abstract.** Oil palm plantation expansion occurs massively in several regions in Indonesia, one of them is in Mamuju Tengah Regency. The area of oil palm plantations in 2014 covering 25,220 hectares and in 2016 increased to 45,562 Ha. The impact of the expansion of oil palm plantations is the occurrence of ecological vulnerability that the soil becomes so dry that it is not suitable anymore planted with rice and melted the number of pest populations of rats that attack rice plants so that farmers often experience crop failure. The condition is a pressure that destabilizes the livelihood of farm households in Mamuju Tengah Regency. Agricultural data shows the decrease of harvest area of paddy in Central Mamuju regency since 2012 as wide as 14,276 Ha to 11,189 Ha in 2016. This study aims to find out the adaptation strategy that farmers do in facing the ecological vulnerability behind the expansion of oil palm plantation. Data are analyzed using the DFID sustainability framework that provides an overview of the context of vulnerability, livelihood assets, organizations, structures and policies affecting, livelihood strategies, and livelihood outcomes from communities. The results showed that farmers' households had several strategies to survive, among others, namely: selling rice fields, converting rice fields into oil palm plantations, giving them land to work on others while doing other work such as collecting grains of fruit bunches or call "brondolan" and grazing cattle.

## 1. Introduction

Palm oil commodities are plantations that occupy the first position regarding expansion area when compared with the extent of other plantation crops in Indonesia. Data from Indonesian Plantation Statistics 2014-2016 indicate an increase in land area and oil palm production, both cultivated/owned by Perusahaan Besar Negara (PBS), Large Private Companies (PBS) and smallholder farmers [1]. Oil palm expansion in some developing countries like Indonesia contributes positively by encouraging rapid economic growth and poverty alleviation [2]. Also, the expansion also has a positive impact of increased household incomes, job security, large employment, increased access to social infrastructure and services, and increased land values [3, 4].



On the other hand, the expansion of palm oil also has negative impacts such as deforestation, loss of food crop area, rising atmospheric CO<sub>2</sub> levels, loss of biodiversity, loss of water sources causing drought, rising temperatures and greenhouse gases driving natural disasters, reduced water catchment areas resulting in floods, land conflicts and the destruction of flora and fauna habitats that result in conflicts between animals, as well as animal conflicts with humans [5–8].

Massive oil palm plantation expansion in Mamuju Tengah Regency in recent years has led to changes in the ecological landscape and land use. For example, land cover change, land use, deforestation, and loss of biodiversity [9, 10]. Food land that is usually planted with rice after the presence of oil palm changed the soil to dry, whereas previously the area of the cultivation area is wet marshes. This is because palm oil plants need water ranging from 1,500-1,700 mm of rainfall per year to meet their growth and production needs, compared to hardwood or other oil palm plantations, including plants that require relatively high-water availability [11]. Palm oil processes about 6 mm of water per day and requires sufficient rainfall throughout the year. Moderate to severe water pressures can suppress the yield, as it affects the opening of new leaves [12]. The change of agrarian structure that explains the occurrence of land cover change is a logical consequence of the process of oil palm plantation expansion. Where the main characteristics of oil palm plantations are operations include clearing land from previous vegetation such as food land, forest, and mixed plantation into a single commodity that is oil palm.

The problem of rat pest has been long disturbed by rice farmers in Central Mamuju Regency especially after the expansion of oil palm plantations. The explosion of rodent pests is increasingly affecting farmers' rice cultivation area, so farmers are more likely to experience crop failure. Although there is no definitive research on the relationship of oil palm plantation expansion and rodent explosion, however, in the experience of some rice farmers in Kabupaten Mamuju Tengah both are closely related. Ultimately, some farmers' households experience ecological vulnerability that affects farmers' household adaptation strategies. Adaptation strategies not only serve as survival efforts but also serve as a survival strategy to reduce disaster risks and coexist with disaster risks.

The objective of this research is to know the adaptation strategy of farmer household in facing ecological vulnerability behind oil palm plantation expansion. The benefit of this study is that it can contribute to government policy in strengthening the livelihood pattern of household farmers facing palm expansion. This study uses the DFID sustainable livelihood framework that provides an overview of the context of vulnerability, livelihood assets, organizations, structures and policies affecting livelihood strategies, and livelihood outcomes from communities in Tobadak Sub-district [13].

## **2. The Study Methods**

This research uses postpositivism paradigm with a qualitative approach and the method used a case study. The unit case of Tobadak Sub-district, Central Mamuju Regency, West Sulawesi Province. The study was conducted from January to April 2018.

### *2.1. Data Collection*

This research uses postpositivism paradigm with a qualitative approach and the method used a case study. Data collection is done through deep interview and observation (field observation). Field observations were conducted in the form of observing the hydrological conditions of oil palm plantations, conversion of paddy fields into oil palm plantations, livelihood activities and livelihoods, adaptation strategies adopted by farm households in the face of ecological vulnerability behind oil palm expansion. Interviews were conducted by visiting informants' homes with focuses on the vulnerability-related interviews, the sources of livelihoods, assets owned and adaptation strategies undertaken in dealing with the vulnerability. The unit case of Tobadak Sub-district, Central Mamuju Regency, West Sulawesi Province. The study was conducted from January to April 2018.

## 2.2. Data Analysis

Data were analyzed descriptively using the DFID sustainable livelihood framework. Briefly, descriptive research attempts to describe, analyze, and interpret a systematic process of how communities respond to the impact of oil palm expansion through existing adaptive livelihood strategies and how they can meet sustainable livelihood criteria.

## 3. Result and Discussion

The area of oil palm plantation at Tobadak in 2017 is 11.104 Ha with the number of 5.255 KK farmers. The average land area of oil palm plantation per farmer is 1 plot or 2 Ha with production amount 6 to 7 ton per month for palm aged 4 years and above. Before the development of palm livelihoods of people in the Tobadak is a rice farmer. In 2012 the area of rice harvest was 14,276 Ha to 11,189 ha in 2016.

However, after the expansion of oil palm plantations of paddy fields then decreased productivity. This is due to the condition of the soil that once swamps full of water gradually decreased the amount of water and at the end of the soil drought. As a result, farmers' households in Tobadak then experienced ecological vulnerability. The Vulnerability is a manifestation of the social, economic, political, and environmental structure that can be seen from two elements, namely, exposure to risk and coping capacity. One context of vulnerability is shocked which is defined as sudden, unpredictable changes, great influence, paralyzing, destroying, and destroying the livelihood of society. Based on the results of field observations, the vulnerability that occurs is the frequent harvest failure due to rodent pests and reduced rice productivity due to drought. This vulnerability occurs due to the massive expansion of oil palm plantations and difficult to control by the Government. There are no clear rules and clear and clear sanctions on land use in Tobadak. As a result, the farmers simply divert their land into plantation land that converts rice fields into plantations of cocoa and oil palm. This makes the people there highly dependent on the supply of rice and vegetables from outside the district, so they are threatened with food vulnerability.

In addition to the lack of groundwater that causes drought, farmers also face the explosion of rodent pests that attack farmers' rice crops so they often experience crop failure. Several informants told that since oil palm plants were planted around their rice field, more and more pests attacked rice. Even the first time they lowered the rice seeds in their fields in the afternoon, the next day rats had eaten the seeds. This is also due to the decrease of natural predators of rats that is a snake because the first condition of the land is still peat, but as the development of oil palm plants, snake population is reduced because their habitats are destroyed.

Various adaptation strategies carried out by farmers to overcome the vulnerability that occurs include selling rice paddy fields, convert rice fields into cacao and oil palm plantations and there are also households that provide land to be managed by others.

**Table 1.** Comparison of Farmers' Adaptation Strategy in Facing Ecological Vulnerability in Tobadak Sub-district

Adaptation Strategies	Vulnerability	The effectiveness of Strategy on Sustainability of Livelihood
Selling paddy fields	Rice productivity began to decline due to the reduced water content in the soil due to oil palm expansion	Money from the sale of land used for investment strengthening human capital for farm households
Convert rice plants into cocoa plants	Rice plants have failed to harvest due to attacked by rats	Maximizing the use of paddy fields by planting cocoa as an investment in strengthening the natural capital of farm households
Transfer rice paddy fields into oil palm plantations	The productivity of rice decreased due to pest rats and drought. then the paddy crop is converted to cocoa but not long after the disease	The land of crops affected by the disease is slowly replaced with oil palm crops, as an investment for the strengthening of natural capital
Giving up paddy fields to be worked on by others	Crop failure leads to financial losses of farm households	Strengthen financial capital and social capital with other farm households

### 3.1. *Selling paddy fields*

This strategy is pursued by five farm households with characteristics; the age of the household head is between 63 and 68 years old and the wife is over 50 years old, the average head of household is educated to graduate from elementary school, his wife sometimes helps on the farm but works more at home, and has children who continue school until to the university level. They sell rice fields due to hydrological drought so that their land is not suitable anymore planted with rice paddy. The result of the sale of land then they use for the cost of education of children's school to strengthen their human capital in the future. Farmers' households consider that sending their children to university level will improve their welfare in the future. The results of this study are in line with the findings that states that human capital demonstrates a person's ability to gain better access to their living conditions so that human capital becomes the most important aspect because it is used to organize and manage four other livelihood assets [14].

### 3.2. *Convert rice plants into cocoa plants*

Farmers' households do the strategy of converting rice plants into brown crops because of the explosion of rat pests that attack their rice crops and cause damage to rice crops and often crop failure. As is known, rats are the main pests in the oil palm crops that often cut and damage the growing point, damage the fruit, both young and ripe fruit and can affect the population of beetles *Elaeidobius kamerunicus* who play a role in pollination of oil palm crops. Before farming the farmers, farmers have done various ways to eradicate these pests by installing electrical wire around the rice fields and staying overnight on the ground to drive rats, but the way is not very successful. So they chose a path to convert rice field into cacao plant. For areas that still have swampy they dry by making a ditch.

Four farm households pursue the strategy. Characteristics of households who choose to convert their paddy fields into brown crops are those with land under 4 Ha, lacking sufficient energy to maintain oil palm crops primarily to harvest (harvest palm), and have no capital to purchase oil palm seedlings expensive. According to them cocoa plants are more easily maintained and do not require labor for harvest than oil palm crops. Labor costs are one of the biggest costs in oil palm cultivation. Not only the cost laborers (pendodos) of oil palm (harvest) but there are also other activities that require laborers, among others, activities of launching palm and pruning. The average peasant household is also active and entered into farmer groups for Rice and Cacao crops and has received assistance from cocoa seed and fertilizer from the Agriculture and Estate Crops of Central Mamuju Regency so that they do not need to spend capital to buy expensive palm seeds.

### 3.3. *Transfer rice paddy fields into oil palm plantations*

The Cocoa crop was booming in its time but over time accompanied by an expansion of oil palm plantations finally, cacao plants began to attack various diseases. The strategy adopted by farmers' households in dealing with this is by planting oil palm crops between cocoa plants. So they do not directly cut down the cocoa crop and replace the palm, but gradually the cacao plant is cut down if the palm nearby is big. The way they travel so they do not immediately lose their livelihood from cocoa. Cacao crops that are still able to produce their harvest once a week, and which can no longer produce them cut and replace with cocoa plants. The strategy was carried out by twelve farm households with characteristics of 5 Ha, mostly transmigrant farmers' households from Java and Bali, average head of household education of elementary school, the average head of household also worked as laborers palm oil, and households have the same idea if planting oil palm can guarantee their welfare especially now there are many palm factories are open in the District Tobadak. They tend always to want to increase their palm oil plantation. Some of these households sometimes go in groups outside the village to find and open new locations for oil palm plantations.

In that strategy, farmers have been able to make a preference between planting cocoa or switching to planting oil palm. These preferences relate to planting cocoa or replacing it with oil palms. These preferences are then rationally considered about the potential costs they incur for maintaining cocoa crops or the cost of oil palm cultivation, even to increase the social status of the farm households. The

rational choice theory is a rational act of the individual or actor to perform an action based on a particular purpose and that goal is determined by value or choice (preference).

### 3.4. *Giving up paddy fields to be worked on by others*

Characteristic of farmer household with this strategy that is: already do not have the head of household (husband) and most of her family member is a woman, have an animal that is cattle, sometimes work as collector grains of fruit bunches (brondolan) oil palm in Astra garden. They were granted permission by Astra to collect a nesting in the nucleus origin of TBS has been reported to the collection and transportation of TBS. Farmers' households do not want to convert their land into cocoa or palm oil like most other households, although the land is already surrounded by oil palm. Because for them the paddy field is very meaningful, the informant says "It does not matter if I do not have the property as long as I can sleep with the grain". So, they prefer to leave the land to others to work on, while they look for other jobs to meet their living needs. The work they do, among others, is tending cattle and being a collector in the palm oil plantation company. The results of this study are in line with the results of research A. Some farmers are looking for jobs outside agriculture in the face of global climate change that causes drought in rice fields [15].

### 3.5. *DFID Framework*

The expansion of oil palm in Tobadak Sub-district of Central Mamuju Regency is inseparable from the role of government and private parties. The Government is less assertive in addressing land clearing or food conversion activities in the area so that most of the farmers are free to convert their land into oil palm plantations, resulting in paddy fields reduced by almost 80%. The choice of commodities cultivated by farmers is made rationally with consideration of ease in management and high profits. These conditions have the potential to eliminate agricultural land crops, especially rice so that it can threaten food security.

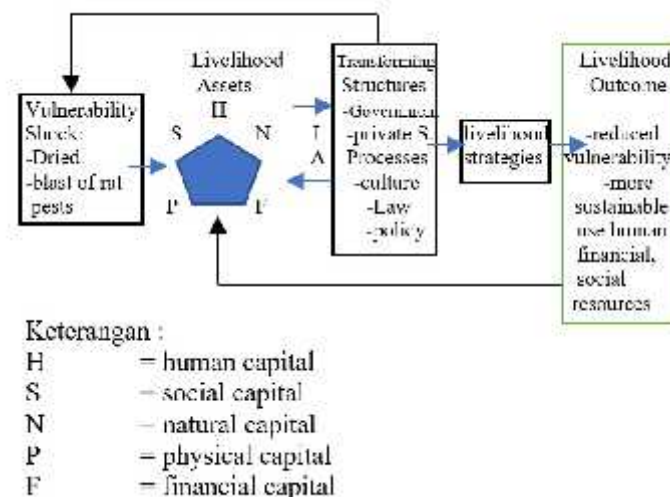
The presence of oil palm companies has had an impact on socio-economic changes in the sub-district of Tobadak. The existence of the private sector to open employment and business field for the community. Examples of cases since the presence of PT. WKSM which opened the forest and swampland in the village of Tobadak then make it palm oil plantation able to create a business field for the community that is planting corn in that location. Before the company came the farmers had difficulty managing their land because the condition was still forests and swamps in, so they were willing to leave the village to find land that could be worked on. There are even some farm households who migrate out of the region (migration) to find work other than farming. The presence of private parties also gave birth to new sources of livelihood for the community such as oil palm, collectors and sellers brondolan that give the impact of increased income for the community. This is in line with the results of research that found stating since the presence of palm oil company PT. Sultra Prima Lestari in Andowia Sub-district, people's income has increased because they have side jobs other than farmers such as traders and services (lodging, workshop, and barber) [16]. The results of research conducted also found since the oil palm plantations PT. Surya Raya Lestari in Bulu Mario Village North Mamuju Regency can improve farmers' welfare with average earnings of dozens to tens of millions of rupiah because people have a permanent livelihood and get a monthly wage to meet daily needs [17].

The weak of Government policy and the presence of private sector parties led to the expansion of oil palm plantations in Mamuju Tengah Regency. This expansion leads to the ecological vulnerability of hydrological farm drought and the explosion of rodent pests that attack rice cultivation, so farmers often experience crop failure. The results found gold mining activities in Bombana Village provide social, economic and environmental impacts [18]. The similarities of the two types of researches are: to be the cause of agricultural land damage (hydrological drought, soil and water pollution), reduced agricultural land in the area, and diverted most of the agricultural labor into garden laborers and gold miners.

Farmers then respond to these vulnerabilities with some strategies by leveraging their livelihood capital and which they can access to survive. The access to various forms of capital will be influenced

and interacted with the structures and institutions both directly and indirectly involved in managing and responding to social, economic and ecological vulnerabilities which in turn can activate or inhibit access to assets and also form the long-term livelihood strategies sought [19]. For example, in the case of farmer households who converted rice paddy fields into oil palm in response to ecological vulnerability. The strategy is influenced by the interaction between farmers and private parties regarding selling palm products. Although on the one hand, the presence of companies is one of the causes of ecological vulnerability, but on the other hand, farmers use it as an access to manage their resources that affect the income and sustainability of their households.

The expansion of palm oil is causing ecological vulnerability also led to a transformation in the traditions and cultures of people in the agricultural sector. Cultural values such as mutual help on land (planting and harvesting of paddy) have begun to experience rapid degradation/erosion. This makes most of the farmers in Tobadak Village prefer to convert their paddy fields into oil palm plantations. Although there are still some farm households who still survive to plant rice or give their land to be worked on by others. Various adaptation strategies were undertaken by farmer households to reduce vulnerability so that they can survive, more prosperous with asset-controlled capital especially human capital and social capital.



**Figure 1.** DFID Framework Farmers' Adaptation Strategy in Facing Ecological Vulnerability Behind Oil Palm Plantation Expansion In Mamuju Tengah Regency.

#### 4. Conclusions

The expansion of oil palm plantations in Tobadak Sub-district has caused the ecological vulnerability of soil drought and rodent pest explosion. Adaptation strategies adopted by farmers' households in dealing with these ecological vulnerabilities include: selling rice fields, converting rice to cacao plants, converting rice fields into oil palm plantations, and giving them land to work on others.

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#### References

- [1] Dirjenbun 2016 *Statistik Perkebunan Indonesia: Tree Crop Estate Statistics of Indonesia 2014-2016* (Jakarta: Directorate General of Estate Crops) p 79
- [2] Sayer J, Ghazoul J, Nelson P and Klintuni Boedhihartono A 2012 Oil palm expansion

- transforms tropical landscapes and livelihoods *Glob. Food Sec.* **1** 114–9
- [3] Moreno-Peñaranda R, Gasparatos A, Stromberg P, Suwa A, Pandyaswargo A H and Puppim de Oliveira J A 2015 Sustainable production and consumption of palm oil in Indonesia: what can stakeholder perceptions offer to the debate? *Sustain. Prod. Consum.* **4** 16–35
  - [4] Wicke B, Sikkema R, Dornburg V and Faaij A 2011 Exploring land use changes and the role of palm oil production in Indonesia and Malaysia *Land use policy* **28** 193–206
  - [5] Oksana, Irfan M and Huda M U 2012 Pengaruh alih fungsi lahan hutan menjadi perkebunan kelapa sawit terhadap sifat kimia tanah *J. Agroteknologi* **3** 29–34
  - [6] Unjan R, Nissapa A and Phitthayaphinant P 2013 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.* **91** 489–96
  - [7] Fitzherbert E B, Struebig M J, Morel A, Danielsen F, Brühl C A and Donald P F 2008 How will oil palm expansion affect biodiversity? *Trends. Ecol. Evol.* **23** 538–45
  - [8] Koh L P and Wilcove D S 2008 Is oil palm agriculture really destroying tropical biodiversity? *Conserv. Lett.* **1** 60–4
  - [9] Obidzinski K, Andriani R, Komarudi H and Andrianto 2012 Environmental and social impacts of oil palm plantations and their implications for biofuel production in Indonesia *Ecol. Soc.* **17** 25
  - [10] Potter L 2015 *Managing Oil Palm Landscapes* (Bogor: Center for International Forestry Research) p 154
  - [11] Nasution S H, Hanum C and Ginting J 2014 Pertumbuhan bibit kelapa sawit (*Elaeis guineensis* Jacq.) pada berbagai perbandingan media tanam solid decanter dan tandan kosong kelapa sawit pada sistem single stage *J. Online Agroteknologi* **2** 691–701
  - [12] Woittiez L S, van Wijk M T, Slingerland M, van Noordwijk M and Giller K E 2017 Yield gaps in oil palm: A quantitative review of contributing factors *Eur. J. Agron.* **83** 57–77
  - [13] DFID 1999 *Sustainable Livelihoods Guidance Sheets Introduction: Overview Sustain Livelihoods Guid Sheets 10* (London: Department for International Development)
  - [14] Wijayanti R 2016 Strategi penghidupan berkelanjutan masyarakat berbasis aset di sub DAS pusur, DAS Bengawan Solo *J. Wilayah dan Lingkungan* **4** 133–52
  - [15] Kamaluddin A, Ala A, Salman D 2012 The adaptation of rice paddy farmers towards climate change *Am-Euras. J. Agric. & Environ. Sci.* **12** 967–72
  - [16] Hendriono W 2016 *Studi dampak Perkebunan Kelapa Sawit Terhadap Kondisi Sosial Ekonomi Masyarakat Di Kecamatan Andowia Kabupaten Konawe Utara* (Kendari: Universitas Halu Oleo)
  - [17] Darwis I 2015 *Dampak Keberadaan Perusahaan Kelapa Sawit Terhadap Kesejahteraan Sosial Masyarakat di Desa Bulu Mario Kabupaten Mamuju Utara* (Makassar: Universitas Hasanuddin)
  - [18] Meisanti, Ali M S, Jusoff K, Salman D and Rukmana D 2012 The impacts of gold mining on the farmer's community *Am. J. Sustain. Agric.* **6** 209–14
  - [19] Kasmianti, Dharmawan A H, and Bratakusumah D S 2016 Ekowisata, sistem nafkah dan decoupling sustainability di Wakatobi, Sulawesi Tenggara *Sodality J. Sociol. Pedesaan* **4** 158-164