Biodiversity loss and gain based on indigenous people’s perception. (Case study: Tajok Kayong and Nanga Tayap Villages, West Kalimantan Province)

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Abstract. Loss and gain on biodiversity of plant species that have been resulted from the establishment of oil palm plantations have often been accused as the reasons for the changing pattern in community means of living. Such a shift has also been highlighted as related to the destruction of the indigenous people livelihoods. Indigenous people were often dependent on the local plants for survival, yet land use change to oil palm plantation has caused changes in plants composition. This research was conducted to identify the indigenous people’s perceptions related to gain and loss of plant species diversity due to the establishment of oil palm plantation. The study was carried out in the indigenous Dayak Villages of Tajok Kayong and Nanga Tayap, West Kalimantan Province of Indonesia in March 2018. Data were collected using field observation and interviews. The overall perceptions of Dayak and Malay communities (the two indigenous groups of West Kalimantan) on the plants conditions related to oil palm development, showed similar results, except related to plant diversity, in which 75.00% of the Malays perceived a decreased in plant diversity, while on the contrary, 75.68% of Dayaks perceived it as an increase, in terms of flowering plants and other functional plants. The results indicated that the establishment of oil palm plantation has resulted in the gain of 27% plant species and loss of 73% plant species with functional values (medicine and food). However, the lost species could be substituted with other plants and could also be replaced by chemical medicine from public health service and purchased from the local market. Both indigenous people of Dayak and Malay were not affected by the species loss since before the plantation’s establishment, their living patterns had already transformed into semi-modern and modern living styles where the people have lower dependences on their surrounding plants.

1. Introduction

Biodiversity has a very important value for the surrounding community, such as various types of plants that are used by indigenous peoples in West Kalimantan [1]. According to [2] for indigenous peoples, their land or territory is a means for their survival. This is also supported by [3] statement that indigenous peoples in West Kalimantan have a high dependence on natural resources in the forest to live their lives. The existence of various types of plants is influenced by the existing ecosystem conditions. One of the changes in ecosystems that still become world attention for several decades ago is the conversion of forest land into oil palm plantations [4], [5]. Conversion of forest areas into oil
palm plantations causes the Dayak community to have difficulty in obtaining various types of plants that they previously used as food and life sources [3].

On the other hand, the results of [6] show that local communities have participated in the process of converting land into oil palm plantations due to economic factors that encourage them to get better results. The results of Siraduddin's research [7] also show that oil palm plantations make the economic conditions of the surrounding communities become increasingly developed. Various literature states that indigenous people in West Kalimantan are Dayaks, whereas there are also Malay people who are indigenous ethnic groups in West Kalimantan [8]. Dayak and Malay communities have different cultures and habits in living life, especially in terms of the use of natural resources around it [9], so that changes in ecosystems are thought to affect the patterns of life of indigenous peoples. This makes the perception of the two ethnic groups becomes important to know, where reference [10] state that people's perceptions of the types of natural resources are influenced by the benefits that can be felt from that type before. Community perception is also an important factor in determining the success rate of oil palm plantation management in addition to ecological factors [11]. In connection with this matter, it is necessary to study the perception of indigenous peoples on gain and loss of plant species that related to oil palm plantation.

2. Instruments and methods

2.1. Time and location research

The research was conducted around NTYE, Tajok Kayong Village and Nanga Tayap Village, Nanga Tayap Subdistrict, West Kalimantan Province. The duration of our research was 1 month, starting from March 12, 2018.

2.2. Instruments

The instruments used in this research consists of an audio recorder, Microsoft Excel, Microsoft Word, camera and GPS (Global Positioning System). We used an interview guide that contains a list of structured questions and five-scale Likert statements.

2.3. Data collection

Methods of data collection used to identify species diversity based on community perception were based on both interviews and field observations, together with literature study. Interviews were conducted through depth-structured interviews. Data were recorded under the form of species composition from the knowledge of the community about the types of plants, both emerging and lost or the type of increase and decrease since the palm plantation was established and also the public perception related to it. The price data of the types of plants were obtained by economic valuation method by doing 3 types of approaches which are market value approach, replacement value approach and regulatory value approach.

In this study, respondents were indigenous Dayak and Malay people who were either related to oil palm cultivation or not with a total of people with a sampling unit of 1 person per family. This is because both indigenous Dayak and Malay people are long-lived and settled in their residential areas around the oil palm plantations so that whatever the type of work they do, they can still feel directly the impacts gain and loss of plant species related oil palm plantation.

The total respondents in Tajok Kayong and Nanga Tayap Village are 110 people. The village of Tajok Kayong has an area of 6.26% of the area of Nanga Tayap Subdistrict, while Nanga Tayap Village has an area of 4.98% of Nanga Tayap Subdistrict [12]. Their types of jobs do vary, with quite high amounts of income as it could be seen from the status of children. There are some who continue studying up to University level, so this proves that the economic prosperity of the people is quite high. Given that one of the most common tribes on the island of Kalimantan is the Dayak community, it is in accordance with the statement [13] that the Dayak people are Kalimantan island residents who occupy a region permanently for a long time This supports the idea that West Kalimantan Province has its uniqueness towards the process of acculturation, because of the Dayak people could face some modern way of living style in several aspects.
3. Results and discussion

3.1. General conditions of study sites

Tajok Kayong Village and Nanga Tayap Village are located in Nanga Tayap District which has an area of 172,812 ha which is 5.47 percent of the total area Ketapang Regency with 3,158,000 ha [14]. Based on their livelihoods, the types of livelihoods of the people in Nanga Tayap Subdistrict can be divided into farmers, fishers, large entrepreneurs, artisans, farm laborers, construction workers, mining workers, traders, transporters, civil servants, ABRI, and farmers. The highest number of population is livelihoods as farmers (11,453 people).

Their types of work are diverse, with a high amount of income, which can be seen from the status of the children they have, there are some who continue to the level of study, so this proves that the economic welfare of the community tends to prosper. Although divided into hundreds of sub-tribes, but they still have some similarities as a distinctive Dayak ethnic, cultural identity, namely the existence of a long betang house, the main pattern of livelihood in the form of rotational cultivation, its view of nature, and a distinctive material culture such as pottery, mandau chopsticks, and Dayak dance. They are inseparable from farming life that represents their customs and beliefs. The Dayak tribe cannot be separated from forest resources which are the source of their livelihood so that Dayaks can be considered as forest nomads [3].

3.2. Indigenous people’s perception of oil palm plantation related to gain and loss of plant species

Community perceptions of gain and loss in plants species are important to be studied from Dayak and Malay communities because indigenous peoples are known for their habit of using species of natural resources around them (table 1).

Table 1. Dayak and Malay people’s perception of plant species diversity related to oil palm plantation

| Statement | Perception (%): Do not know Dayak Malay | Not Agree Dayak Malay | Doubt Dayak Malay | Agree Dayak Malay |
|-----------|------------------------------------------|----------------------|------------------|------------------|
| Plant can be used as a source income | 0.00 0.00 | 74.32 100 | 18.92 0.00 | 6.76 0.00 |
| There is no harmful plants | 0.00 0.00 | 25.68 18.75 | 12.16 6.25 | 62.16 75.00 |
| NTYE oil palm plantation makes community become easier to find medicinal plants | 17.57 0.00 | 75.68 85.41 | 0.00 0.00 | 6.76 14.50 |
| NTYE oil palm plantation makes community become easier to find food plants | 2.70 0.00 | 85.41 83.33 | 8.11 2.08 | 4.05 14.50 |
| NTYE oil palm plantation makes plants become more diverse | 2.70 0.00 | 20.27 75.00 | 1.35 4.16 | 75.68 20.83 |
| NTYE oil palm plantation makes community become easier to plant other plants | 0.00 0.00 | 10.81 0.00 | 0.00 0.00 | 89.19 100.00 |

Most people feel that the existing types of plants do not have an impact on their income, seen with the majority of both Dayak (74.32%) and Malay (100%) stating that they do not agree with the alternative aspects of community income. Malay people give a full response (100%) because they are already first and thorough in buying some of their needs in the market, slightly different from Dayak people where there are some (6.76%) who agree that the availability of plants can be used as an alternative to their income. This happens because the community does not do economic activities involving the plants that are around them. Then, since the existence of NTYE's oil palm plantations caused some types of understorey such as weeds which were found quite a lot by the community, with (62.16%) Dayak people and (75%) Malay people feeling that they did not feel any undersea plants which were felt to be detrimental since the existence of oil palm plantations NTYE, because they both consider that the type of weeds does not cause harm to their daily lives.

In the aspect of medicinal use, both tribes showed a similar response, can be seen with most Dayak people (77.78%) and the Malay community (85.41%) felt that medicinal plants were becoming
difficult to find. However, even though the community felt the medicinal plants were becoming more difficult to find, they did not feel lost because they were used to buying drugs at the nearest health center and also the public hospitals around their homes. This is in accordance with the results of the study [15] that traditional knowledge of the community is reduced due to socio-cultural changes that generally affect social values, where the younger generation is looking for more practical alternatives. It also shows that there is a pattern of changes in habits of Dayak and Malay communities that have changed before the impact of increasingly difficult medicinal plants are found so that this makes indigenous people feel that there is no significant influence they feel.

Likewise, the aspects of food plants that received similar responses from the two tribes, namely the Dayak community (85.19%) and Malay (83.88%) who gave a disagreeable response and showed that food plants became increasingly difficult to find. This statement shows that both Dayaks and Malays are equally aware of changes in the types of plants that surround them, even though there are no effects that are directly felt and hinder the fulfillment of their needs because they are used to buying food to the market or taking plants directly yard or field crops from their crops. According to [16], [17] yards are usually planted with a variety of seasonal and perennial crops for daily use. Home yards are often referred to as living barns, living stalls or living pharmacies [18]. The community's perception of this matter was also supported by a large number of Dayak (89.19%) and Malay (100.00) people giving a response agreeing on the easy aspect of planting other plants around their homes.

This can happen because in the Dayak community, they previously had a habit of living closely with plant species so that they would be more easily aware of knowing that new types of plants were gained in species and individual. It is different from the Malay people who basically have a close pattern of life with trade in the market, so they do not pay too much attention to the condition of the types of plants that are around their homes. Thus, as many as 5 of the total 6 statements from Dayak and Malay respondents were found the same results except in the aspect of a variety of plants, where Dayak people felt that plants were becoming more diverse while not for Malay people. Thus, all people in general feel that there is a change in the type of plants around them, but they can take advantage of new types and substitute the loss species with the gained species or by buying in the market.

3.3. Gain and loss of plant species based on indigenous people's perception

Table 2 indicates that there has been acquisition and loss of plant species, as explained by the perspective regarding the increase in the variety of plants by Dayak people (75.68%) and the decreasing variety of plants by the Malay community (75.00%).

Data related to prices are also obtained from the knowledge of the people who did use these types of plants so that ultimately economic valuations can be done based on the prices obtained from the knowledge of the community. The valuation carried out aims to find out how much value there is in biodiversity because the existence of natural resources itself is the initial factor of nature in the process of economic activities that involve these natural resources in the future [19].

Table 2 shows plants species that can no longer be found by Dayak people include Shorea sp. (Meranti), Neolamarckia cadamba (Jabon), Shorea sp. (Tengkawang), Durio kutejensis (Pekawai), Durio sp. (Kusik), Momordica sp. (Pare Hutan), and Artocarpus anisophyllus (Mentawa). In meranti species, the community uses the woody plants for the needs of buildings and others. This species of meranti can no longer be found by the community, but the community does not experience a significant loss because they feel they need a lot of time and energy to enter the area and take the wood. This is consistent with the results of the study [20] that distance is a factor that influences the rate of encroachment and positive interaction. Thus, this is in harmony with the people who feel heavy to travel to the location of taking woody plants due to consideration of time and energy spent.

Then, people who have experienced a more advanced life change have made their habit of buying building materials even bigger, so they prefer to spend money to build their houses and buildings like public facilities around them. Unlike the Malay community, they did not use the species of woody plants mentioned by the Dayak community. This is because they have already been able to fulfill their living needs by buying goods produced by trading on the market.
Although, overall they still realize that the existence of medicinal plants and food around them is reduced. Malay people also do not feel that the surrounding plants are becoming more diverse, in contrast to the Dayak people who actually realize that there are several species of plants that are increasingly found and even new species can be found. The species of plants that gained consist of Diplazium sp. (Pakis), Limnocharis flava (Genjer) and Ipomoea aquatica (Kangkung). This plant is used by the Dayak community because it has only been found since the existence of oil palm plantations, where previously the community had never found such species. Kaplan et.al [15] explains that in the ethnobotany discipline there is a set of assumptions about the relationship between behavioural patterns and socio-cultural arrangements that are integrated into language, cognitive systems, rules and local cultural ethics. This shows that the pattern of human behaviour in using several types of plants becomes something that will affect the emergence of values for these species. With the existence of new species of plants or new natural resources, humans will automatically find ways to use them. This happens because humans try to use natural resources and the environment based on their experience and knowledge [21].

The economic value derived from the new species found by the community is important because this indicates the presence of oil palm plantation can also have a positive impact that felt directly by the people living around it. Even though valuation has lost more economic value, it does not affect because people can replace these food needs from other sources such as yards, field crops, to markets while for building materials they can buy mild steel which is considered more efficient than taking wood directly from the forest.

### Table 2. Loss and gain of plant species based on indigenous people’s perception

| No. | Loss Species | Average Prices | Gain Species | Average Prices |
|-----|--------------|----------------|--------------|----------------|
| 1.  | Shorea sp. 1,4 | IDR 2,400,000/m³ | Diplazium sp. 2,4 | IDR 2,000/bundle |
| 2.  | Neolamarckia cadamba 1,4 | IDR 950,000/m³ | Limnocharis flava 2,4 | IDR 1,500/bundle |
| 3.  | *Tengkawang* (wood) (Shorea sp.) 1,4 | IDR 450,000/m³ | *Ipomoea aquatica* 2,4 | IDR 2,000/bundle |
| 4.  | *Tengkawang* (fruit) (Shorea sp.) 2,4 | IDR 3,000/Kg | | |
| 5.  | Durio kutejensis 2,4 | IDR 55,000/Kg | | |
| 6.  | Durio sp. 2 | IDR 100,000/Kg | | |
| 7.  | Momordica sp. 2,3 | IDR 3,000/Kg | | |
| 8.  | *Artocarpus alantiphylus* 2 | IDR 5,000/Kg | | |
|  | **TOTAL** | IDR 3,966,000 | | IDR 5,500 |

Note: (1) building material; (2) food needs; (3) medicinal needs; (4) source income

### Table 3. Loss and gain of plants individual based on indigenous people’s perception

| No | Loss Individu | Average Prices | Gain Individu | Average Prices |
|----|---------------|----------------|--------------|----------------|
| 1. | *Calamus rotang* 1 | IDR 1,500/Kg | *Imperata cylindrica* 0 | IDR 0 |
| 2. | *Cucurbita sp.* 2 | IDR 8,000/Kg | ‘Jankos’ *(Volvarriella volvacea)* 2 | IDR 12,500/Kg |
In addition, the existence of public health services and also public hospitals around their homes makes them prefer to go directly to treatment rather than looking for medicinal plants into the forest that requires much energy. This is consistent with the results of the study [already cited on 18] that the ineffective taking of plants in the forest makes people begin to think about planting or cultivating medicinal plants around settlements or yards. Thus, changes in the pattern of life from indigenous people already happened before the existence of the NTYE oil palm plantation. Public perception about the use of medicinal plants is influenced by one of their patterns of life that has become more modern day by day, so this is in accordance with the statement [22] that the existence of modern life will change the indigenous knowledge of Indonesian tribes outside Java.

So with the knowledge regarding the species of plants above, Dayak and Malay communities have experienced some changes in their pattern of life systems before the existence of NTYE oil palm plantations, such as they have switched their habit to buy their needs on the local market, and also use local financial institutions such as existing local cooperatives.

4. Conclusion
In general, Dayak and Malay communities agree that there are changes in the species of plants that exist, although (75.68%) the Dayak community stated that there were several species that consider gained, while the Malay community (75.00%) felt that there were no any gained plant species. There are 8 species of plants that considered loss with the function as food and building material, while there were 3 species of plants that consider gained with the function of food based on the perception of indigenous peoples. The loss species doesn’t affect their livelihood because they can substitute it with other species on their surrounding fields or local markets for food needs, and also through public health services for medicinal needs.

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