

# Indigenous Dayak People's Perceptions of Wildlife Loss and Gain Related to Oil Palm Development

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**Abstract**—Controversies surrounding the impacts of oil palm plantations have resulted in some heated debates, especially concerning biodiversity loss and indigenous people well-being. The indigenous people of Dayak generally used wildlife to fulfill their daily needs thus were assumed to have experienced negative impacts due to oil palm developments within and surrounding their settlement areas. This study was conducted to identify the characteristics of the Dayak community settled around an oil palm plantation, to determine their perceptions of wildlife loss or gain as the results of the development of oil palm plantations, and to identify the determinant characteristic of the perceptions. The research was conducted on March 2018 in Nanga Tayap and Tajok Kayong Villages, which were located around the oil palm plantation of NTYE of Ketapang, West Kalimantan-Indonesia. Data were collected through in depth-structured interview, using closed and semi-open questionnaires and three-scale Likert statements. Interviews were conducted with 74 respondents using accidental sampling, and categorized into respondents who were dependent on oil palm for their livelihoods and those who were not. Data were analyzed using quantitative statistics method, Likert Scale, Chi-Square Test, Spearman Test, and Mann-Whitney Test. The research found that the indigenous Dayak people were aware of wildlife species loss and gain since the establishment of the plantation. Nevertheless, wildlife loss did not affect their social, economic, and cultural needs since they could find substitutions. It was found that prior to the plantation's development, the local Dayak communities were already slowly experiencing some livelihood transitions through local village development. The only determinant characteristic of the community that influenced their perceptions of wildlife loss/gain was level of education.

**Keywords**—Wildlife, oil palm plantations, indigenous Dayak, biodiversity loss and gain.

## I. INTRODUCTION

HUMANS and wildlife have been interacting for thousands of years in relation to various socio-economic practices [1], as shown by the indigenous Dayak people living in West Kalimantan Province of Indonesia [2]. The Dayak communities generally use wildlife to fulfil their daily needs for food, medicine, supernatural, and traditional ceremonies [3]. The existence of the wildlife will certainly be affected by the conditions of the ecosystem, while the functioning of ecosystems [4], [5], defines the capacity of natural processes and components in providing goods and services that will directly or indirectly satisfy human needs

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[6]. It provides a mixture of ecosystem services, which directly and indirectly contribute to human well-being [7].

Changes in the ecosystems from forests to oil palm plantations have been said to have impact on the number of wildlife species, both as a loss [8] as well as a gain [9]. Considering that the Dayaks are dependent on wildlife for their survival, the changes in the wildlife compositions will assumably affect the lives of the Dayak people living around oil palm plantations. The characters of the Dayaks who have high dependence on nature [10], suggest that they have little interest in the business world, which is also the cause of their low level of welfare [11], [12]. On the other hand, [13] has found that the local people have been involved in land conversion process into oil palm plantations due to economic factors. Amid the development of oil palm plantations that can improve the village economy [14], there is a question as to whether or not there would be any changes in the characters of the Dayak community in the presence of better economic option.

Loss and gain of wildlife species for the Dayak community is influenced by the value given by the community to a species which is usually influenced by the benefits that the species accrue [15]. It is intriguing to study whether the Dayaks perceived similar value of wildlife loss and gains as their ecological values. Therefore, the perceptions of the Dayak communities regarding the loss and gain of wildlife species surrounding the development of oil palm plantations on their livelihood, is very interesting to be studied.

This study has the objectives to: (a) Identify individual characteristics of the Dayaks living around the NTYE Estate, (b) Determine the Dayaks perceptions on wildlife loss and gain due to the establishment of oil palm plantations; and (c) Identify the determinant characteristic variable(s) that influence their perceptions on wildlife loss and gain.

This research is expected to provide the latest information on the characteristics of the Dayak communities living around oil palm plantations and their perceptions about the impact of the plantations that affect wildlife species diversity.

## II. METHOD

### A. Periods and Location of Research

The study was conducted in March 2018 in Nanga Tayap Village and Tajok Kayong Village. Specifically, data collection was carried out in Sebuq Hamlet which is part of Nanga Tayap Village area, and the Dayak ethnic community of Tajok Kayong Village. The villages are located around

NTYE oil palm estate (1° 34' 0" S; 110° 32' 0" E) in Nanga Tayap District, Ketapang Regency of West Kalimantan Province in Indonesia.

### B. Tools and Instruments

The tools used in the study comprised of stationery, voice recorders, digital cameras, laptops with Microsoft office software and Statistics Program for Social Science (SPSS). The instruments used were map of the research location, interview guide, questionnaire, Likert-Scale statement and village monograph.

### C. Data Collection Method

- 1) *Selection of Respondents*: The survey design involved a multi-stratified sampling with household as the basic unit of analysis. Respondents were selected using accidental sampling, by selecting respondents who happened to be present or available in the study area in accordance with the context of the study [16].
- 2) *Interview*: Respondents interviewed were the indigenous local Dayak communities who were living around NTYE. The communities were further stratified into households with oil-palm related livelihoods and non-oil palm related livelihoods. The total numbers of respondents were 27 people with livelihood related to oil palm (dependent on oil palm) and 47 people who did not have employment background related to oil palms (independent of oil palm). Interviews were conducted to obtain respondents' perspectives on the diversity of wildlife species around the oil palm plantations in the periods before and after the establishment of NTYE oil palm estate, the benefits of the wildlife species, and their influences on the economic well-beings of the respondents.

Data collection was carried out through in-depth and structured interviews, using qualitative approach with semi-open and closed questionnaire instruments to identify the characteristics of respondents, wildlife loss and gain and to assess perceptions, using Likert Scale statements. Perception measurement in this study uses a three scale Likert statements which consists of positive statements with four alternative choices for each answer, with consecutive scores of agree (3) to don't know (0) (Table I).

TABLE I  
 LIKERT SCALE LEVEL OF AGREEMENTS

Likert Scale	0	1	2	3
	Don't know	Disagree	In Doubt	Agree

Data that have been obtained were analyzed using various methods. To achieve the first objective, community characteristics data were analyzed using quantitative descriptive method. As for the second objective, the Dayak community perceptions on wildlife species loss and gain were also analyzed using quantitative descriptive method. To achieve the third objective, data on the individual characteristics of the Dayaks and their perceptions on wildlife species, the loss and gain due to the presence of oil

palm plantations were analyzed using Chi-Square, Spearman coefficient correlation, and Mann-Whitney relationship test methods.

- 3) *Quantitative Descriptive Analysis*: Processing of data on the individual characteristics and perceptions were done using basic statistical processing techniques (descriptive) in the form of percentages (%) and diagrams.
- 4) *Test of the Relationship between Individual Characteristic and Perception*: Analysis of the relationships between characteristics and perceptions were conducted using Chi-Square Test (numerical: gender and livestock ownership), Spearman Test (ordinal: age, education, time spent working in oil palms, and distance from home to plantation), and Mann-Whitney Test (comparison of two populations of different occupational/income) at a 10% level of significance.

Calculations for Chi-Square Test were done using SPSS or the following formula:

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E}$$

The magnitude of the X2 value could indicate the level of suitability of the relationship between the two factors tested. The hypothesis tested would result in either the following:

- H0 = No relationship existed between variables
- H1 = Relationship existed between variables

Calculations for Spearman Test were done with SPSS or the following formula:

$$r_s = 1 - \frac{6 \sum_{i=1}^n d_i^2}{n^3 - n}$$

where: rs is the coefficient of rank correlation; di is the difference in rank between the two ranking; n is the number of observations.

Calculations for the Mann-Whitney Test were also conducted using SPSS with the aim of comparing perceptions of the two populations (dependencies on oil palm-related livelihood). The populations used for this research comprised of the Dayaks population who were dependent on oil palm plantations for their livelihood and those who were independent of oil palm. The two populations were compared.

## III. RESULTS AND DISCUSSION

### A. General Conditions of the Research Site

Geographically, Nanga Tayap Sub-district is located in the southern part of West Kalimantan Province with a total area of 1,728 km<sup>2</sup>. Nanga Tayap Sub-district consisted of 20 villages with the following boundaries: the northern part bordered the Sandai Sub-district; the southern part bordered by Pemahan Sub-district; the western part bordered by

Matan Hilir Utara Sub-district and Muara Pawan Sub-district; the eastern part bordered with Hulu Sungai Sub-district and Central Kalimantan Province [17].

NTYE plantation is located in Nanga Tayap Sub-district of Ketapang District and surrounded by 2 villages, namely Nanga Tayap Village and Tajok Kayong Village. The total area of Nanga Tayap Village is 4.98% and Tajok Kayong Village is 6.26% of the total Nanga Tayap Sub-district area [17].

Dayaks cannot be separated from the forest in carrying out and sustaining their lives [18]. The Dayak people go to the forest to open fields, cut down big and small trees in the forest. If they cultivate plantation crops, they tend to choose plants that resemble forest plants such as rubber, rattan, and tengkawang [19]. Dayaks who could not farm could be questioned about their Dayak culture, since that would mean that they have shifted from their ancestral culture [20].

### B. Individual Characteristics of the Respondents

Based on BPS Ketapang 2016 projection [17], the total population of Nanga Tayap Sub-district was 30,570 people, consisted of 16,087 males and 14,483 females spread across 20 villages. The populations of men and women were not much different, based on the percentage of gender of the respondents who showed similar figures (women were 48.65% and men were 51.35%), thus it could be said that the gender population was balanced. This was possible since the Dayak culture did not limit the proportion of work of each family member based on gender (balanced men and women) [21], hence both men and women were willing to respond during the interview, unlike other cultures whom women often reluctant to give responses. The number of respondents who earned income from oil palm is dominated by men (77.78%), while those who did not earn from oil palm were dominated by women (63.83%).

Both strata of respondents were dominated by individuals aged 40-49 years (40.54%). Such age range was categorized as productive ages [22], indicated from 100% of the community having jobs, where 36.49% of all respondents were oil palm farmers either as primary or side jobs. This indicated that NTYE's plantation was able to provide great economic opportunities for the local people who are in productive ages. The oil palm plantation in Nanga Tayap is approximately 10 years old and considered as relatively young/new. Therefore, there were no respondents over 60 years old that were dependent on oil palms for their livelihood. On the other hand, as much as 8.51% of respondents over 60 years old were found to have jobs independent of oil palms. People who were over 60 years old tend to maintain a culture of rubber farming and *palawija* crops, while people who were under 60 years old were more open to oil palm plantation activities. This transformation is considered as a condition where people move from static to dynamic and natural conditions in the history of human civilization [23].

The majority of people did not have formal education/did not go to schools (43.24%), especially those who were

independent of oil palms (53.19%). Most Dayaks depend on dry farming as their source of livelihood, in fulfilling their necessities; they need to be always closely related to nature. Land, forests and rivers provided them with life through farming activities [18], [20], [24]. Knowledge of farming systems and forest management had been acquired by the Dayaks for generations. This has made Hoffman [25] referred to Dayak as forest specialists.

The level of formal education of the community is considered very low, as indicated by the absence of people who have tertiary education background. A research by Ruslikan [26] concludes that school is still a new item that is not fully considered important by the interior Dayak community. However, along with the times and development in the villages of Nanga Tayap and Tajok Kayong, the community began to have awareness to send their children to formal schools even obtaining tertiary education. Parents' higher awareness of the importance of education seemed to be positively correlated with the motivation to send their children to school [27].

The average family size within the Dayak community, for both strata was moderate, with a total of 3-4 individuals/households (82.43%). This figure was in line with the average number of individuals per family in Nanga Tayap Sub-district. The average population was 30,570 individuals [17] with a total of 8970 households, so that each household consisted of 3.41 individuals. A great sense of responsibility was the main reason why the Dayaks did not prefer a large family size. Almost all of the people (90.54%) lived in private homes, except the NTYE employees who lived in official houses while working on the plantation. The majority of people did not have livestock (68.92%), while about 18.92% have livestock, comprising mostly of domestic pigs. Generally, Dayak people raised livestock around their houses. However, since the oil palm company issued regulations prohibiting the workers (whom occupied the housings inside the plantation company) to raise livestock, about 8.11% of the community had given up livestock rearing.

The communities with earnings from non-oil palms (24.32%) had an average primary income below IDR 2,000,000 (approximately USD 140). Respondents, with side jobs not based on oil palm, had an average income of also below IDR 2,000,000. The majority of the community's economic orientation of this group was still subsistence (83.78%). The community has not been able to save/invest money for larger businesses because their incomes were only enough to meet their daily needs. Incomes from dry fields and/or rubber plantations were often the only sources of livelihood for the households who are not dependent on oil palms for their living. The Dayak often planted coffee underneath their rubber trees [18]. Additional food needs were obtained by planting vegetables in the yard. On the contrary, Dayaks, who depended on oil palms, enjoyed greater benefits of higher economic income, with 51.85% obtained incomes between IDR 2,000,000-10,000,000. All people who have incomes from oil palm were not all

NTYE's employees, but there were also those who have private oil palm plantations. Most of the smallholdings were under 2 Ha (37.04%). Smallholdings has been increasingly in demand by the public in the past 5 years, which was indicated by the increasing percentage of people who had private plantations since  $\geq 11$  years (7.41%) to 0-5 years (55.56%). The presence of oil palm plantations is able to improve the economy of a region and improve the living standards of its people [7], [21], [22]. This is one of the reasons justifying the shift in livelihood of the local Dayaks to oil palm plantations. The land managed by the community for private oil palm plantations were mostly originated from indigenous land (29.63%) and managed in groups (96.3%). The people spent full time of their working hours in their plantations, since the distance from their house to the

plantation were mostly close (51.85%).

### C. Dayaks' Perceptions on Wildlife Species Loss and Gain

Perception is a person's view, judgment, interpretation, hope, or aspiration towards an object [30]. A person's perception can be used to measure the value of an object according to that person. Of all the statements asked, the Dayak community was able to provide sharp answer, namely agree and disagree. Very few people gave ignorant and neutral responses. This was because they were familiar with their surroundings, or in other words, the forests surrounding the Dayak community are part of their lives [31].

To see the difference in perceptions between the two populations, the perception analysis was divided into two (Table II).

TABLE II  
RESPONDENTS' PERCEPTIONS ON THE IMPACTS OF OIL PALM PLANTATIONS ON WILDLIFE

Likert Statements	Dependent on oil palm (%)				Independent of oil palm (%)			
	Don't know	Disagree	In doubt	Agree	Don't know	Disagree	In doubt	Agree
Less wildlife sightings	0.00	7.41	0.00	92.59	0.00	0.00	0.00	100.00
Increased species number	0.00	92.59	0.00	7.41	4.26	85.11	10.64	0.00
Easier use of wildlife	0.00	59.26	0.00	40.74	25.53	74.47	0.00	0.00
Alternative income	3.70	70.37	3.70	22.22	0.00	74.47	25.53	0.00

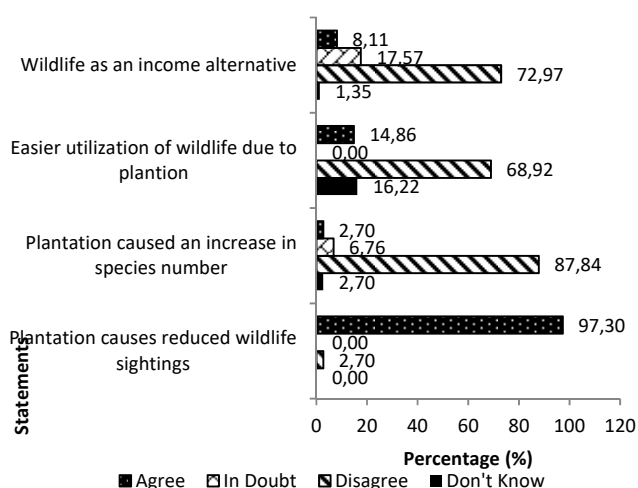


Fig. 1 General perceptions of the Dayaks on the impacts of oil palm plantation on the surrounding wildlife

Table II indicated that the perceptual analysis of the two populations showed similar results. The Dayak people living in Nanga Tayap Village and Tajok Kayong Village generally agreed that the existing wildlife could not be used as an alternative to increase their incomes (72.97%) (Fig. 1).

As many as 59.26% of the people who were dependent on oil palms and 74.47% who were independent from oil palm, disagreed that since the establishment of oil palm plantations, wildlife were easier to be exploited. This was influenced by the declining number of wildlife species that were sighted. A total of 92.59% of those who earned from oil palm and 85.11% of those who were not, disagreed that the number of species of wildlife has increased. In line with

the above, 92.59% (dependent on oil palm) and 100% (independent of oil palm) agreed that oil palm plantations reduced the intensity of their encounter with wildlife. Doubtful answers were given more by the people who obtained their income from non-oil palm sources, because they did not directly utilize the wildlife nor disturbed by the wildlife.

The community expressed disagreement with the statement that the current utilization of the wildlife was easier (68.92%), this was influenced by the number of wildlife species that are currently declining (87.84% of the people disagree with the number of wildlife species increasing) in line with the statement 97.3% of the people who agree that they are currently rarely meet with wildlife.

In addition to changes in habitat composition [32], [33], the decline in the number of species was one of the causes of poaching, which was also the source of the loss of wildlife. There were four types of wildlife which, according to the community, were not found after the conversion into oil palm plantations, including pangolin, orangutans, red langurs, and sun bears. Meanwhile, no species gain was recorded by the local Dayak communities. Of the four types of wildlife, there was only one species that has benefits for the community, namely pangolin. Pangolin benefited the community as food and craft & jewelry products. Meat, skin, scales, and pangolin's body parts are believed to be efficacious as drugs [34].

The Dayaks perceived that the occurrence of wildlife loss in terms of ecology did not have the same meaning as the loss of wildlife species seen from the social side. Apart from pangolins, other species that were lost, namely orangutans, red langurs, and sun bears, had no values for their social, economic and cultural life. Although pangolins had high

market value, in reality it is not considered a type of life necessity that must be fulfilled. The benefits of pangolin as a source of food and medicine could be substituted by the Dayaks to adjust to the current conditions. This process could be said to be part of modernization. Modernization is a process of social transformation, a change of society in all aspects, related to development, including the presence of oil palm plantations [35].

#### *D. Relationship between Individual Characteristics and Perceptions*

Several tests have been conducted to determine any existed relationships between the individual characteristics of the community and their perceptions towards loss and gain of species due to the establishment and development of oil palm plantations. Chi-Square Test was conducted to determine whether the respondent's gender and livestock ownership affected their perceptions. As is known, one of the factors that influence perception is gender [36], [37]. Likewise with livestock ownership, the community that decided to raise livestock might be affected by the availability of wild animals in a reduced nature, so that the perception was likely to be affected.

Based on the results of the correlation value analysis of the two variables, namely gender and livestock ownership, there were no significant variables that influence the perceptions of both the people who were dependent and independent of oil palm (10% or 0.1). Gender correlation values and perceptions of Dayak people were above the predetermined level that is, equal to 0.23 or the level of the relationship between the two is only 77%, so that it can be said that gender did not affect perceptions. Likewise, livestock ownership did not affect the perceptions of the people who were dependent on oil palms for their livelihood. The relationship between the two is not significant, because the correlation value of 0.17 is above the predetermined real level. The relationship between the two was 83%, thus it could be concluded that livestock ownership and respondent's perception did not have a relationship.

There was no significant relationship between gender, livestock ownership, and perception of the people who were independent of oil palms, with correlation value of 10% or 0.1. The correlation value of gender and perceptions of the Dayak community was equal to 0.56 or the level of the relationship between the two was only 44%, so it could be said that gender and perception have no relationship. Similar results were obtained with regard to the relationship between livestock ownership and perceptions of the people who did not earn incomes from oil palms. The relationship between the two is not significant, because the correlation value of 0.47 is above the prescribed real level. The relationship between the two is only 53%, so that it can be said that livestock ownership and respondent's perception are not related.

Subsequent relationship tests were carried out using Spearman Test. The variables tested against perceptions of those dependent on oil palms were age, level of education,

time spent working in oil palm plantation, and the distance from house to oil palm plantation, while the variables tested for those independent of oil palms were only age and education level. The results showed that no variables influenced the perceptions of the people who are dependent on oil palms for their livelihood, while the level of education influenced the perceptions of the people who were independent on oil palms for their livelihood. The relationship between the two was significant, because the correlation value was 0.1. The relationship was significant at 97%. The results of the study showed that the perception of the community towards wildlife is influenced by the level of education [38].

The last test conducted to determine the relationship between the characteristics of the community and perception is the Mann-Whitney Test. The variable used in this test was the work of the respondent. From the test results, it is known that the relationship between the two is not significant, because the correlation value of 0.47 is above the predetermined real level. Their relationship was only 87%. Based on this test, it can be concluded that employment did not affect perceptions on the loss and gain of wildlife species due to the establishment of oil palm plantations.

#### IV. CONCLUSIONS

In general, the Dayak people who earned their living from oil palm and those who were not, showed similar individual characteristics. The Dayaks have experienced modernization as seen from the awareness of education for their children. Furthermore, the Dayaks were experiencing a shift in their livelihood system as more and more of the local indigenous people have shifted from rubber and *palawija* farming, into oil palm plantations.

The perceptions between the Dayak people who were dependent on oil palm and those who were not, were similar. The ecological impacts of oil palm plantations decreased the frequency of community encounter with wildlife. However, it was not considered as biodiversity loss for the community because such lost did not affect the social, economic and cultural conditions. Furthermore, the benefits acquired from the species could be substituted using other species.

The only individual characteristic of the community that showed a relationship and influenced perception was the were not dependent on oil palms for their livelihoods with a correlation value of 0.03 (significant by 97%).

#### V. RECOMMENDATIONS

Further research is necessary to identify wildlife species that are still used by the Dayak communities, and to determine whether land use change to oil palms affected the number of individual species.

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