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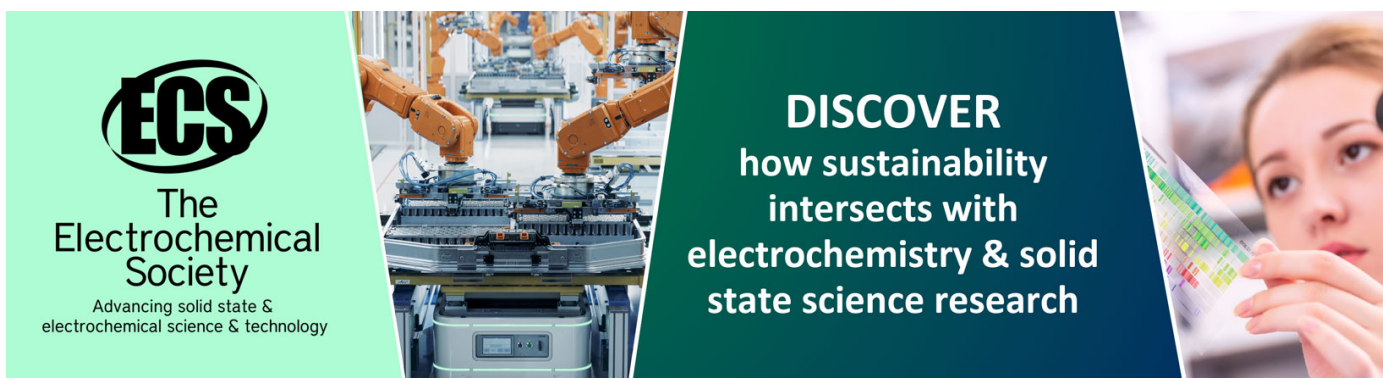
Characteristics and community perception on mitigation of Human-Tapanuli Orangutans conflict around Dolok Sipirok Natural Reserve, South Tapanuli

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Characteristics and community perception on mitigation of Human-Tapanuli Orangutans conflict around Dolok Sipirok Natural Reserve, South Tapanuli

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Abstract. The frequency of human-tapanuli orangutan (*Pongo tapanuliensis*) conflict has been increased with the widespread on degradation and fragmentation at Batangtoru Forest, South Tapanuli Regency. Orangutans often come on community lands to look for food, especially while the durian fruit season. This study aims to obtain information on socio-economic characteristics and public perception index to mitigate on human-tapanuli orangutan conflict around the Dolok Sipirok Nature Reserve, South Tapanuli Regency. Data was collected using a questionnaire distribution, interviews and descriptive observations, starting from October 2019 to January 2020. Respondents were selected by purposively sampling method, i.e. people had met and interacted with orangutans as many as 61 respondents from three villages. Data analyzed using frequency tables, likers scale and spearman rank correlation. The results showed that the community is Muslim majority, productive age, education below senior high school, farmers and income below IDR. 4,000,000. The public perception has declared orangutans as animals that consume community plants. They will drive away the orangutans found in processed land. The perception of conflict mitigation has strongly agreed with the program that must be done including providing compensation for losses, increasing patrol programs, developing local wisdom and building corridors in state forests. The characteristics were a significant ($\alpha < 0.01$) influence on the perception index assessment i.e. the level of education, household member and family income.

1. Introduction

Forests as habitat for a wildlife species are predicted will continue to fragmented and reduced area [1]. Human activities such as logging, clearing for agricultural land, and plantations, especially oil palm and rubber, have resulted in degraded forests and decreased animal habitats [2,3]. States forest degradation in Indonesia until 2015 was estimated at 59.0 million ha and 11.3 million ha has become plantation land and settlements [4]. This condition results in a connectivity loss of the animal home



range and a decrease in genetic flow between populations that are a serious threat in wildlife conservation, including for primate [5–7].

Wildlife populations are isolated in limited areas by human activities, including around conservation forests [8]. The same, the buffer zone has been utilized by local people for a living site. The use of space and natural resources are the same around conservation forests to have an impact on conflicts between humans and wildlife [9]. This phenomenon will continue to increase as happened on tapanuli orangutans around the Dolok Sipiok Nature Reserve [10]. Tapanuli orangutan (*Pongo tapanuliensis*) has designated as a different species from the Sumatran orangutan/*Pongo abelii* [11]. The IUCN Red List of Threatened Species states that tapanuli orangutans have been categorized as critically endangered species [12]. Orangutans in Sumatera are on the verge of extinction due to fragmentation and poaching [13,14]. Orangutans are also still hunted for trading or pets [15,16].

The increasing human-orangutans conflict around the Dolok Sipiok Nature Reserve (DSNR) need the right mitigation strategies. These conflicts can be caused by widespread agricultural land, human growth, settlement and seizing of forest products, such as durian (*Durio zibethinus* Murray) and petai (*Parkia speciosa* Hassk) as orangutan feed plants [17,18]. Prolonged conflict will accelerate the extinction in tapanuli orangutans because of the human tendency to win the conflict [19]. To develop conflict mitigation strategies, one of the important information to know is how people perceptions of orangutans and their programs can develop for mitigation.

This study aims to obtain information on the social-economy characteristics and community perception indices to develop mitigation strategies of human-orangutan tapanuli conflict around the Dolok Sipiok Nature Reserve, South Tapanuli Regency.

2. Methodology

2.1. Study sites

We have done the study in villages as the Dolok Sipiok Nature Reserve buffer zone, South Tapanuli Regency, starting from October 2019 to January 2020. The DSNR is the part area of the Batang Toru forest landscape that determined by Minister of Agriculture Decree of Number 226/Kpts./Um/14/1982, with a total area of 6,970 ha. This area has an altitude between 600-1,200 meters above sea level and topographic with a slope up 40 % [10, 20].

More than 60% of the people around DSNR are farmers who manage land with various cultivated plants/agroforestry systems [21]. That is cultivated by the community include zalacca (*Salacca zalacca* (Gaertner) Voss), rubber (*Hevea brasiliensis* Muell.Arg), cinnamon (*Cinnamomum burmanii* [Nees & T, Nees] Blume), durian, sugar palm (*Arenga pinnata* Merr), petai as well as vegetables. Rice fields are founded around settlements [10]. We identified the DSNR area is administratively included in two sub-districts, namely Sipiok Sub-district (4 villages) and Arse Sub-district (3 villages). The villages as the research locations were selected by using a purposive sampling method, especially on villages that have a conflict with orangutans, namely Luat Lombang, Rambas Siasur and Arse Nauli Villages (Figure 1).

2.2. Method

The study was conducted through the distribution of questionnaires, interviews and descriptive observations. Research respondents in three villages were selected using a purposive sampling method [22]. The criteria used in the selection of respondents are people who have met, interacted and it is land is often visited by tapanuli orangutans. Questionnaire entries included the socio-economic characteristics and human perceptions of orangutan and programs for conflict mitigation.

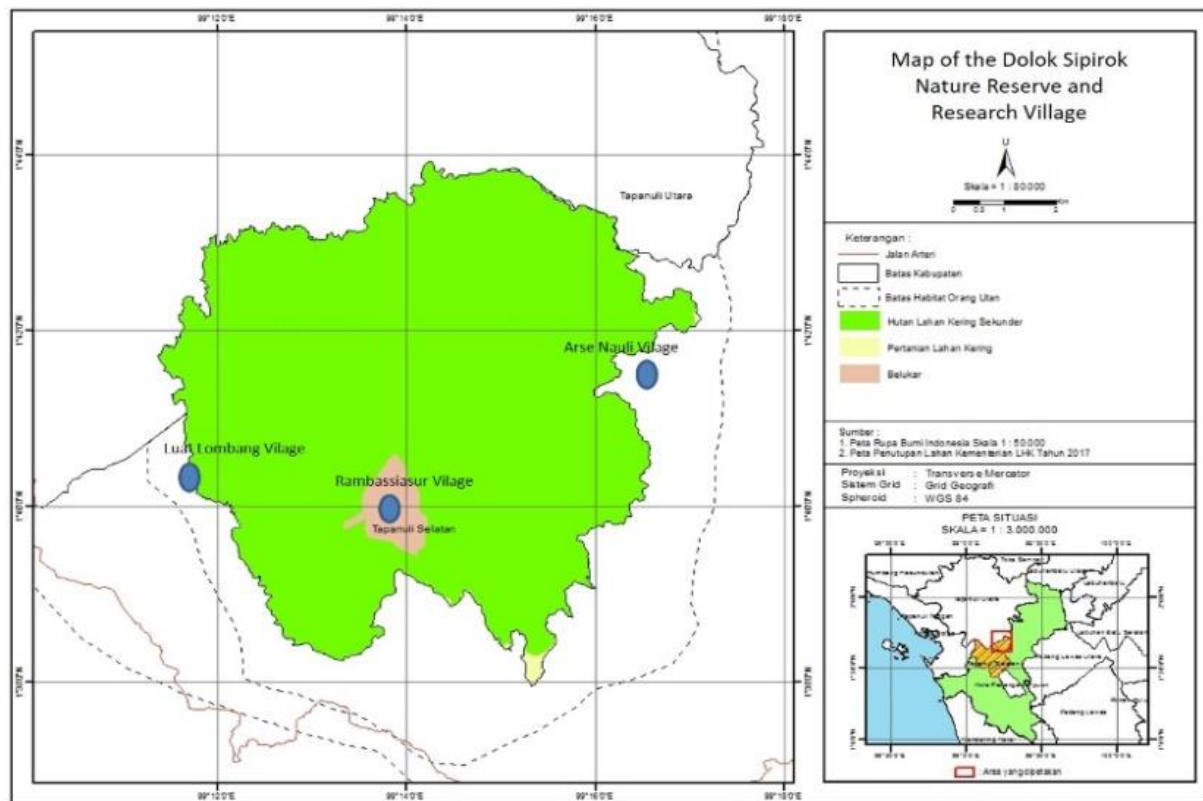


Figure 1. Map of DSNR and villages as a research location

Based on the preliminary research, there were 61 respondents who represented as the householder from three conflict villages. Respondents in Arse Nauli Village were 26 respondents, Rambassiasur Village (16 respondents) and Luat Lombang Village (19 respondents). Perception questionnaires are arranged in five scales using the value of strongly disagree (1), disagree (2), neutral (3), agree (4) to strongly agree (5). Deep interviews were conducted to explore information related to conflicts with orangutans based on the respondent's experiences. Descriptive observations were made on the cultivated land to identify the plant species as a source of orangutan food.

2.3. Data analysis

2.3.1. Frequency

Frequency table is presented for analyzing the of community socioeconomic characteristics. The frequency table contains the number and percentage of each respondent's statement.

2.3.2. Respondents perception index

The respondents' perception index was analyzed with a Likert scale. Scoring for positive statements have a scale of strong agreement (value = 5), neutral (3) to strongly disagree (1) and to the contrary for negative statements [23]:

$$\text{Perception index (\%)} = \frac{\text{Respondents Total Score}}{\text{Highest Likert Score}} \times 100$$

The criteria for interpretation of perception index was based on intervals: 0% - 19.99% = Very disagree/Very poor, 20% - 39.99% = Disagree/Not good, 40% - 59.99% = Sufficient/Neutral, 60% - 79.99% = Agree/Good, 80% - 100% = Very agree/Very good.

2.3.3. Correlation test

The relationship between social and economic factors with the perception index was analyzed using Spearman rank correlation. If the value is close to 0, it means there is no correlation and if it is close to 1 then correlation is very high. Data was analyzed using Software of SPSS 21.0 for Windows [24,25].

3. Results and Discussion

3.1. Respondents' characteristics

The respondent characteristics in three villages are orangutan habitat as presented in Table 1.

Table 1. The results of the analysis of the characteristics of respondents in three villages

Table 1. The results of the analysis of the characteristics of respondents in three villages						
No	Respondent characteristics	Village			Total (n=61)	Percentage (%)
		Arse Nauli (n=26)	Ramba siasur (n=16)	Luat Lombang (n=19)		
1	Religion					
	a. Islam	21	16	18	55	90.16
	b. Christian	5	0	1	6	9.84
2	Age Composition					
	a. Non productive young (< 15 year)			0	0	0
	b. Productive (15 - 64 years)	24	15	18	57	93.44
	c. Non productive old (> 64 year)	2	1	1	4	6.56
3	Household member				0	0
	a. Small (2-4 people)	19	8	7	34	55.74
	b. Medium (5-7 people)	6	5	10	21	34.43
	c. Big (> 7 people)	1	3	2	6	9.84
4	Education Level					
	a. Elementary School	2	4	4	10	16.39
	b. Junior High School	8	7	12	27	44.26
	c. Senior High School	14	4	2	20	32.79
	d. University	2	1	1	4	6.56
5	The main livelihood					
	a. Farmers	23	15	16	54	88.52
	b. Government employees	1	0	1	2	3.28
	c. Trader	1	0	2	3	4.92
	d. Labor	0	1	0	1	1.64
	e. Others (Honorary Teacher)	1	0	0	1	1.64
6	Average of monthly income					
	a. Small (< IDR 2,000,000)	13	7	4	24	39.34
	b. Medium (IDR 2,000,000 - 4.000.000)	8	5	9	22	36.07
	c. Big (> IDR 4,000,000)	5	4	6	15	24.59

We identified the communities in the buffer zone of DSNR about 90.16% are Muslim. In Sipirok Sub-district, the people majority are Muslim as evidenced by the discovery of mosques in each village. Communities are known to be very religious and respect followers of different creeds. Based on the worker's age, respondents are people time productive with ages between 15-64 years as much as 93.44%. High productive age needs processed land is quite high and to get it will open the forest. According to [10]. The activity of land clearing is getting higher, especially in the other areas which are also habitat for tapanuli orangutans. land clearing that continues to increase can be a cause of human conflict with orangutans [26].

The family members have between 2-4 people of 55.74% and 34.43% between 5-7 people. The average household member in 2018 is 4.0 people and 4.3 people per family in 2019 [21]. This information means that in one household in general there have 2-3 children. In terms of education, respondents who graduated from junior high school were 44.26% and 32.79% as senior high school. Public education in the villages around DSNR generally was very low. Residents in South Tapanuli Regency have 34.55% only reached primary school, 24.73% up to junior high school and university about 6.56% [21].

The increasing of family members and the low level of education has resulted in the community will be dependent on the forest resources around their villages. People around the Batangtoru forest utilize wood, fruits and fish taken from orangutan habitat. The community will expel orangutans if they find them taking fruits or passing through their gardens [10]. The eviction of orangutans can make it more difficult to obtain food and reduce their home range [14, 16]. The livelihood as farmers is the highest on the community in the DSNR buffer zone, which is 88.52%. Farming was a hereditary work for the people because it is difficult to get other work with low education, mostly under senior high school.

Activities such as opening a forest, planting and managing rice fields are daily work carried out by the village communities. Those plants are cultivated very variedly, especially those producing fruits, such as durian, bitter bean/petai, sugar palm as well as jackfruit. In some areas, monocultures have also been developed such as rubber, zallaca and oil palm farms.

Respondents' income each month have below IDR 4,000,000,- about 75.41% and 39.34% below the district minimum wage. The minimum salary standard (*Upah Minimum Regional*) in the South Tapanuli is IDR 2,903,000,- every month. This situation shows that the community around the buffer village has a low income or classified as a poor population. Increasing economic empowerment programs must of course be improved based on other sectors such as services and manufacturing. The diversion of income sources in other sectors is expected to minimize land clearing so that conflict potentials with orangutans can be minimized.

3.2. Community perception

3.2.1. Perceptions on the orangutans

Perception is the process by which individuals regulate and interpret sensory impressions to give meaning to the environment [27]. [28], perception as a cognitive process that allows a person to interpret and understand the surrounding environment. Public perception information is needed to formulate wildlife conflict mitigation, including for orangutans. Based on community perceptions, various programs can be developed to reduce human conflict with orangutans in Tapanuli [29].

Habitat of tapanuli orangutan in the South Tapanuli Regency covers a forest status, both state forest and community land (the other area/*Area Penggunaan Lain*). In three research villages, communities often find orangutans while on their land or looking for non-timber forest products in the DSNR [10]. The Community perceptions of the orangutan's existence in the three villages are presented in Table 2.

Table 2. Respondents' perceptions of the existence of tapanuli orangutans

No	Statement	Village					
		Arse Nauli (n=26)		Rambasiasur (n=16)		Luat Lombang (n=19)	
		Score total	Index of perception	Score total	Index of perception	Score total	Index of perception
1	Orangutan must be protected	99	76.2	62	77.5	71	74.7
2	The community lands becomes an orangutan habitat	54	41.5	28	35.0	66	69.5
3	Orangutans as community plant pest	93	71.5	62	77.5	65	68.4
4	The expulsion of orangutans into community land	105	80.8	73	91.3	82	86.3
5	People often interaction/ conflict with orangutans	87	66.9	66	82.5	76	80.0

In the three villages, the community was stated tapanuli orangutans needed to be protected with an average perception index (PI) of 76.13%, the meaning was included in the agree/good criteria. However, if the land is used as an orangutan habitat it only has an IP of 48.67% (neutral). This is based on their thinking that if the land is used as orangutan habitat, their plants will be destroyed by orangutans. The results of interviews with respondents stated that orangutans will take crop yields on their land, especially durian fruit. Durian and petai are among the foods favored by tapanuli orangutans [10, 30].

The perception people have strongly agreed for the orangutan as a disturbing animal or plant destroyer when on their land, with a PI = 72.49%. In the field observation, it was found that there were orangutans entering community land and taking fruits on the field. The community has suffered a loss because they do not get the expected yields so that their income decreases. This perception results in conflicts with orangutans that will continue to occur because they will expel orangutans who come their land to look for food [31]. This is reinforced by their perception if orangutans in the garden must be expelled so as not to damage the plants (PI = 86.3%).

Respondents were admitted often interacted and conflicted with orangutans (PI = 76.47%). People who agreed to have conflicts with the highest PI were found in the Rambassiasur village. The intensity of orangutans entering their land is higher than in other villages. The Rambassiasur village is an enclave in the midst of DSNR so that the land is immediately bordered by orangutan habitat. Interviews with the community identified at least three orangutans who always visited its land. However, the community did not kill orangutans because they knew it was protected by the government. The community also stated that they strongly agreed that hunters or those who killed orangutans should be punished, with an IP = 79.59%.

3.2.2. Perceptions on human-tapanuli conflict mitigation

Human-orangutan conflicts in the DSNR buffer villages are increased during the fruit season. Orangutans have long lived in community lands looking for food because of its abundant availability and easy to get. Conflict mitigation strategies must be developed so that humans and orangutans can coexist and they are not harmed or threatened with death. Community perception as a research respondent to various proposed conflict mitigation strategies around DSNR is presented in Table 3.

Table 3. Respondents' perceptions of mitigation strategies on human-orangutan conflict

No	Statement	Village					
		Arse Nauli (n=26)		Rambasiasur (n=16)		Luat Lombang (n=19)	
		Score total	Index of perception	Score total	Index of perception	Score total	Index of perception
1	Orangutan hunters must be prosecuted	103	79.2	67	83.8	72	75.8
2	Planting an orangutan feed tree on community lands	62	47.7	45	56.3	41	43.2
3	To making a corridor for orangutans	100	76.9	62	77.5	83	87.4
4	Reimburse as costs compensation due to the plants consumed by orangutans	114	87.7	75	93.8	85	89.5
5	To develop alternative economic resources for community	75	57.7	53	66.3	65	68.4
6	Patrol on the conservation forests	119	91.5	71	88.8	83	87.4
7	Communities involved in the management of state forests (nature reserves)	88	67.7	62	77.5	74	77.9
8	To develop local wisdom in managing cultivated land	113	86.9	66	82.5	69	72.6
9	The government is not optimal to protect orangutans	91	70.0	63	78.8	77	81.1

Respondent perceptions of mitigation strategies on human-orangutan conflict expressed in the questionnaire were very diverse. The strategy for planting an orangutan feed tree on community lands has the lowest index (PI=49.03%). This perception is based on their thoughts that planting feed trees will increase the intensity of orangutans coming to their land. They assume that the program is not a solution to minimize human-orangutan conflict within the Batangtoru area.

Strategies with the perception index in the agreed category are development other community economic resources and leave orangutans on arable land (PI = 64.12%), communities involved in the management of state forests (PI = 74.36%) and the government is not optimal to protect orangutans (PI = 76.60%). Perception is including agreeing can be caused by the lack of confidence respondents will be involved in its implementation. For example, respondents mentioned that the community has rarely in orangutan protection programs. The economic empowerment programs also often fail because only based on the project approach. When the program is finished there is no evaluation of the program's success. However, some people will also welcome if the community is assisted in developing the economy of their village or invited to participate in a patrol so get a daily salary. The community is currently hoping for a compensation program for both the government, private sector, NGOs and other stakeholders to compensate for the loss of fruit harvest. People income from selling durian was declined because those trees are destroyed by orangutans [18]. The application of compensation schemes to the community requires a standardization process that is transparent and efficient as well as monitoring the perceived benefits for wildlife conservation.

The perception index with strongly agrees are reimbursement as costs compensation due to the plant consumed by orangutans (PI = 90.31%), patrol on the conservation of forests to prevent orangutans from entering community land (PI = 89.22%), develop local wisdom in managing cultivated land (PI = 80.68%) and to make a corridor for orangutans (PI = 80.60%). The strategy, according to respondents, is quite appropriate to develop in mitigating orangutan conflicts around DSNR. The community stated that patrol can detect and prevent orangutans who will come to community land. Likewise, local wisdom that began to disappear in the young generation in utilizing the forest needs to be taught and reapplied. Previous studies reported that the application of local wisdom in the form of knowledge, rules and wise behavior in managing nature will increase the human appreciation of the importance of protecting the wildlife habitat, as in the communities around Lake Toba [32–34]. The interviews with respondents stated that the corridors that need to be developed for orangutans around community land can migration to conservation forests. The observation found the orangutan tracks have been opened to roads and other development activities. Corridors or linkage zones can facilitate the movement of animals with having large home range such as orangutan [35]. Corridor construction should be designed on state forests or land purchased to ensure there is no land-use change in the future [10].

The community perception index in three villages on the development of orangutan conflict mitigation strategies was 75.9%, included in the agreed/good category. The majority of the public will welcome the efforts to mitigate conflict from stakeholders. The community hopes the existence of orangutans in their village will sustainable but do not disturb plants as a source of food and their livelihood. The benefits of orangutans have been felt by the presence of outsiders doing research and creating programs to help the communities and protect orangutans.

3.2.3. Correlation between respondent characteristics and perception index

The results of Spearman rank are showed respondents' characteristics that influence the public perception index to assess conflict mitigation strategies to be implemented in their area, as presented in Table 4.

Table 4. Correlation between the characteristics with the perception index

No	Characteristics of respondents	Correlation Coefficient	Sig. (2-tailed)
1	Religion	0.31	0.095
2	Age compositions	.363*	0.048
3	Household member	.508**	0.002
4	Education	.419**	0.001
5	The main job	0.166	0.154
6	Family income per month	.515**	0.000

Remarks: ** significant at $\alpha = 0.01$; * significant at $\alpha = 0.05$, $n = 61$

Based on Table 4, we know that people's perception index can be influenced by their socioeconomic characteristics. The characteristics have influenced a very significant ($\alpha < 0.01$) is level of education, household members and family income. The working-age group affects a significant level of 95% ($\alpha < 0.05$) while religion and main occupation are not related to people's perceptions ($p < 90\%$). The family income has the highest correlation coefficient ($cc = 0.973$) with a positive sign (+), meaning that the higher earnings the index of perception of the human-orangutan conflict mitigation program will be better.

Communities have a higher income will tend to help the orangutan conservation program. Respondents with an income above IDR 4,000,000 have chosen the criteria of strongly agree to develop a conflict mitigation program. [36] the higher of one's income, perceptions and behavior of forest and land resources will be more positive because a person will have more opportunity to obtain information about benefits the forest to humans, including the existence of wildlife, from various media such as television and internet.

The education level also was a positive correlation with behavior on nature conservation [37, 38]. The higher the education level is a tendency to have an understanding and knowledge that wildlife needs habitat, including those distributed on community land. The duration of formal education will be positively related to the formation of the mindset to accept logical things from the surrounding environment. The questionnaire shows that respondents are educated senior high school or universities, in general, give an assessment that strongly agrees on the proposed mitigating strategies of human-orangutan conflict.

The main work as farmers does not have a significant correlation with conflict mitigation. This shows that farmers will prioritize their income from managing the land. The existence of orangutans has been considered as plant pests and they will expel the orangutan are in their gardens. The community has suffered a lot of losses. They will let the orangutans if there is help to replace crop damage, both from the government and other institutions. The interview results obtained information that 10-20 years ago it was very rare to be in their gardens because of their abundant food in the forest. Forest damage causes orangutans to often visit their fields to look for fruits, such as durian and petai. [39], the implementation of compensation schemes to the community is needed so that people feel the benefits of wildlife conservation programs. Providing compensation can reduce competition and overlapping interests in the use of resources between humans and wildlife [40].

4. Conclusions

The characteristics of the community around DSNR are more than 90% Muslim, 93.44% are of productive working age and have *household members* between 2-4 people. The majority education is below senior high school with the main livelihood as farmers and earning a month under IDR 4,000,000. Community perceptions of orangutans are animals that often damage and consume cultivated plants, such as durian, petai and sugar palm. Public perception of conflict mitigation programs is agreed with the right strategy to be developed including reimbursement as costs compensation due to the plant consumed by orangutans, patrol on the conservation forests to prevent orangutans from entering community land and develop local wisdom in managing cultivated land. Characteristics that significantly influence the perception index assessment are the level of education, the household members and the family income ($\alpha < 0.01$). Communities with greater education and incomes are more likely to participate in the human-tapanuli orangutan human conflict mitigation.

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