

# The Relationship of Community Livelihoods in and Around Forest Reserve Areas to Forest Resources in Humbang Hasundutan District, North Sumatra Province

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**Abstract:** Forest resource management needs to pay attention to the relationship between the community and forest resources. The conversion of forest land into non-forest areas affects the livelihoods of communities around the forest itself; therefore, knowledge of the socio-economic and cultural interrelatedness of communities in and around forest areas is needed thus the sustainability of forest resources and community livelihoods is maintained. This study was an explorative one by describing factors that are thought to influence forest sustainability. The data were obtained based on questionnaires and interviews. The respondents were selected purposely considering the characteristics of the research area. The data analysis was presented using the descriptive method. The observed factors were in the form of land history, land tenure, and livelihoods originating from the forest area. This study showed that the historical and customary norms were related to the conversion of forest land to other land uses. The interrelatedness of the community and the forest area was the provision of forest products, namely rubber latex, incense resin, cinnamon bark, firewood, bananas (*Musa paradisiaca*), durian (*Durio zibethinus*), salak (*Salacca Zalacca L.*), jengkol (*Archidendron pauciflorum L.*) and petai (*Parkia speciosa L.*). Most of the people were not aware of the existence of forest areas legally designated by the government. Consequently, although most respondents did not know the existence of forest areas legally, they were closely related to forest areas in the form of intensive use of forest products. The history and customary norms prevailing in the community were factors related to the conversion of forest land functions.

**Keywords:** forest, land tenure, livelihood

## 1. Introduction

Many areas on the island of Sumatra are being transformed from rural areas to urban areas. This transformation causes the forest cover to decrease [1]. Land use by various interested actors such as government, private sector, and society can cause land use conflicts and changes in the landscape and the natural resources contained in it [2]–[4]. This conflict in the use of natural resources has the potential to damage the balance of the ecosystem which in turn damages the environment and human welfare [5]. Land degradation and deforestation due to land use conflicts are some of the ecological challenges faced causing the climate change [6]. The big dilemma in developing rural areas is how to conserve forests and reduce poverty sustainably.

Communities in and around the forest areas are one of the actors who have an important role in maintaining forest sustainability [7], [8]. The community interaction with the forest resources is one of the determinants of forest sustainability [9]–[11]. The village communities around the forest are generally located in remote areas, access to

communication and transportation is difficult, and the population density is low. This situation causes limited choices of community economic activities [12]. Households with low levels of education, little land tenure, and low income from non-agricultural activities tend to be more dependent on forest areas [13]. Jannat et al [14] suggested that income from forest resources is positively related to dependence on forest resources.

Recently, more and more development policy makers have realized that the success of sustainable development goals requires the involvement of local communities [15], [16]. Furthermore, studies from countries show that cooperation between forestry-related institutions and local communities can effectively protect, improve, and increase the productivity of forest areas which ultimately benefits both parties [17]. Local communities have wisdom in managing natural resources, especially forests. In the Amazon Forest, local communities have a role in biodiversity conservation [18]. Saha et al. [19] show that the zoning of forest areas implemented by the government influences the dependence of local communities in the Simipal Biosphere area, India.

Lawyer et al. [20] showed that the local communities strengthened by government institutions give positive results for forest sustainability.

This study sought to identify and explore the interrelatedness of communities in and around the forest-to-forest resources and the conversion of forest land functions. The identification was needed to explain the characteristics and phenomena of interaction with forest resources. Therefore, certain government policies aimed at sustaining forest diversity are about to be implemented, taking into consideration the livelihoods of people living in and around forest areas.

## 2. Materials and Method

### 2.1. Research location

The selected sample units were villages in and around the Forest Reserve in Humbang Hasundutan District, North Sumatra Province. The sample villages were chosen intentionally (purposive sampling), expected to represent several villages in the vicinity, and had almost the same characteristics. The selection of sample units was based on (1) criteria for forest function, namely forest reserve to see the interrelatedness of forest functions and community perceptions, (2) ethnic origins and the dominance of natives and immigrants, and (3) administrative criteria used to understand related to government policies and condition of forest land cover based on satellite imagery.

The study collected the samples from the research locations in Parbotihan Village, Onan Ganjang Subdistrict, Purba Bersatu Village and Siambaton Village, Pakkat Subdistrict, and Hudon Julu Village, Parlilitan Subdistrict, Humbang Hasundutan District, North Sumatra Province. Geographically this location is located at  $98^{\circ}12'48'' - 98^{\circ}37'12''$  east longitude and  $1^{\circ}58'21'' - 2^{\circ}27'26''$  south latitude. This area is a mountainous area with gentle to very steep slopes. The location of the four villages is in the geological rock formation of the Kluet formation with metamorphic constituent rocks and brown alluvial soil type with clay and sand deposits as constituents. The climate in this region is wet tropical with two seasons, namely dry (April-August) and rainy (September-March). Its location in the highlands allows a decrease in temperature at higher altitudes. The temperature varied between  $17^{\circ}\text{C} - 29^{\circ}\text{C}$  with an average humidity of 85.94%. The average amount of rainfall based on 2008 was 334.95 mm, with the highest rainfall in March of 548.67 mm and the lowest in February of 154.67 mm. The average number of rainy days is 13.72 rainy days, the highest in January was 18 days, and the lowest was 8.33 days in May.



Figure 1. Study area

### 2.2. Data Collection

The primary data used in this study were (1) identity, (2) origin, (3) community dependence, and (4) distribution of benefits from forest resources (land tenure, land use, shifting cultivation, forest benefits, access to forest product marketing, economic activities developed by the community, and the level of community welfare). The data were obtained from interviews and questionnaires. Whitlock [21] suggests that the history of land use serves as a guide for forest management and conservation. Thiede [22] argues that the ratio of immigrant communities in Latin America's forests has suppressed the indigenous population thus local community empowerment is needed.

The secondary data were (1) population data, (2) economic data (livelihoods, agricultural patterns, forest products, livestock, handicrafts/small scale industries, economic infrastructure and accessibility to the center of the economy, land use data and customary rights, utilization of forest resources (utilization of forest land and utilization/collection of wood and non-timber forest products including animals), and prices of agricultural products and basic needs in a year), (3) customs and social processes in the community, (4) existing socio-economic and cultural institutions, (5) education (level of education and educational facilities), (6) health (number of medical personnel and infrastructure including diseases that the community often suffered from), (7) clean water facilities, (8) sanitation, (9) lighting, and (10) means of transportation and communication. The data were obtained from the relevant agencies. Ayeyarwady [23], Keenan [24], and Frey [25] show that the socio-economic factors of the community affect forest sustainability.

Data collection was carried out using a questionnaire. The questionnaire consisted of two parts. The first part was the questions related to the socio-economic and cultural conditions of the respondents. The second part is related to the description of the respondent's interaction pattern with forest resources. This interaction pattern was in the

form of respondents' knowledge of forest areas and their level of dependence on the forest resources.

The respondents were selected by using purposive sampling, namely those who were the heads of families or those who were considered to know the condition of their families and villages well. The respondents and researcher communicated directly. The number of respondents in each village was 10 people thus the total number of respondents was 40 people.

### 2.3. Data analysis

The study used descriptive analysis. Descriptive analysis was used to interpret the frequency of responses, trends, general description of respondents, socio-economic and cultural factors of respondents, the dependence of respondents on their surrounding environment, and other relevant information. The data were obtained from the questionnaires and interviews which were first presented in the form of tables and graphs to interpret them much easily. The data processing stage included (1) editing to see the completeness, consistency, and relevance of the data, (2) coding to group the data, and (3) tabulation to display the frequency and distribution of the data.

Then, with an exploratory analysis, the effect on the welfare of the community and the sustainability of forest resources was explained. This study was limited to the sample villages located in and around forest reserve areas in the Humbang Hasundutan District of North Sumatra Province. The data were primary data in the socio-cultural inventory of communities in and around the forest taken in 2015. These data were complemented by the available secondary data with several modifications.

## 3. Results and Discussion

### 3.1. Village history, settlements, and land use

#### 3.1.1. Sionom Hudon Julu Village

The village is divided into 4 hamlets, namely Dusun Batugajah (inhabited by 92 family heads), Dusun Silencang (inhabited by 95 family heads), Dusun Alahan Pardomuan (inhabited by 81 family heads), and Dusun Alahan Lebbuh (inhabited by 57 family heads). Based on the information derived from the village head, the majority tribe inhabiting this area was the Pak-pak tribe, having moved from the Samosir area in 1917. Since a long time ago, people have used forest products in the form of incense, rubber sap, *jengkol* (*Archidendron pauciflorum* L.), and *petai* (*Parkia speciosa* L.). However, there are no specific rules or norms governing the use of forest products.

In this village, there is customary land owned by King Tumanggor and is not for sale. The existing hamlet lands are controlled by King Tumanggor. The pattern of land tenure in this village is largely inherited. The largest land use is non-agricultural land.

The most extensive self-owned land tenure is in the form of non-paddy agricultural land, while the most widely leased land area is paddy fields.

#### 3.1.2. Siambaton Village

The village is divided into 2 hamlets, namely Dusun Sumbul (inhabited by 325 family heads) and Dusun Siambaton Julu (inhabited by 632 family heads). Based on the information derived from the village head, the majority tribe inhabiting this area is the Batak Toba tribe. The traditional ruler in this village is Raja Parna (Parna clan). If anyone is buying and selling land or clearing land, they must have the permission of King Parna. Hutan Raja is private property (customary forest) and has boundaries. This forest is managed by the community. In this village, there are village regulations related to forests such as the prohibition of destroying forests.

Based on the village monograph data, the total area of the village is 1,492 Ha, with land use in the form of forest (42%), community-owned forests, and privately-owned parcels of land that are managed for forest purposes (17%) and rice fields (16%). Most of the land in this village is owned by themselves with the largest area of land being paddy fields. At the same time, most of the inherited land is in the form of non-agricultural land.

#### 3.1.3. Purba Bersatu Village

The village is divided into 5 hamlets, namely Dusun Nanggumba inhabited by 57 family heads, Dusun Sihambir Jalan Baru inhabited by 58 family heads, Dusun Temba inhabited by 64 family heads, Dusun Simpang Tolu that inhabited by 10 family heads and Dusun Sijinjak that inhabited by 60 family heads. Based on the information derived from the village head, the majority tribe that inhabits this area is the Batak Toba tribe. The customary rulers in this village have been the Purba clan since 300 years ago. This village used to consist of a combination of two villages namely Temba Village and Sijinjak Village to form the Purba Pardomuan Village. Then Pardomuan Purba Village merged with Sianjur Purba Village to become Purba Bersatu Village. Then this village underwent expansion into Purba Bersatu and Purba Sianjur villages.

Based on the village monograph data, the total area of the village is 4,497 Ha, with land use in the form of forest (67%), community-owned forests, and privately-owned parcels of land that are managed for forest purposes (23%) and farming fields (6%) (Table 1). The pattern of land tenure in this village is mostly inherited with the largest land area in the form of agricultural land, not paddy fields. Meanwhile, most of the leased land is agricultural land, not paddy fields.

### 3.1.4. Parbotihan Village

The village is divided into 4 hamlets, namely Dusun I (inhabited by 123 family heads), Dusun II (inhabited by 139 family heads), Dusun III (inhabited by 101 family heads), and Dusun IV (inhabited by 104 family heads). Based on information derived from the Village Head, the majority tribe that inhabits this area is the Batak Toba tribe. The customary rulers in this village have been the Marbun clan since around 1920 as a transfer from Bakara. It consists of 27 tribal chiefs, all of whom belong to the Marbun clan.

Based on village monograph data, the total area of the village is 2,468 ha, with land use in the form of forest (28%), community-owned forests and privately-owned parcel of land that are managed for forest purposes (15%), fields (22%) and rice fields (16%). Like Purba Bersatu Village, the pattern of land tenure in this village is largely inherited with the largest land area being agricultural land, not rice fields. The largest self-owned land is on non-agricultural land, while most of the leased land is on paddy fields.

Table 1. Land use per village

Land use	Area (ha)			
	Sionom Hudon Julu	Siambaton	Purba Bersatu	Parbotihan
Settlement	50	180	45	80
Rice field	300	240	67	400
Field	425	189	340	738
Shrub	68	3	-	110
Meadow/Reed	102	-	-	95
Community-owned forests and privately-owned parcel of land that are manage for forest purposes	250	260	1.045	366
Forest	-	620	3.000	679

The calculation of population density (Table 2) shows that the village of Sionom Hudon Julu has the highest spopulation density of 113 people per km<sup>2</sup> having the smallest area compared to the other three villages. Meanwhile, Purba Bersatu Village has the

lowest population density of 33 people per km<sup>2</sup>. The area of Purba Bersatu Village is the largest compared to other villages. The population density in the sample villages is still relatively low, so the need for land that has the potential to cause forest conversion is also low.

Table 2. Population density

Village	Population	Area (km <sup>2</sup> )	Population density (person/km <sup>2</sup> )
Sionom Hudon Julu	1.359	11,95	113
Siambaton	957	14,92	64
Purba Bersatu	1.469	44,97	33
Parbotihan	2.045	24,68	83

### 3.2. Community systems and structures

#### 3.2.1. Sionom Hudon Julu Village

The tribes that inhabit this village are the Batak Pak-pak (1,250 people) and Batak Toba (100 people). The customary land is owned by King Tumanggor. Meanwhile, for the resolution of conflicts among the residents, there are 3 customary judges, namely; Boru, Dengngan Sibeltek, and Kula-kula. The majority of the residents are Christians (850 people), others are Catholic (230 people), and Muslims (270 people).

is Christian (455 people) and the rest are Catholic (498 people).

#### 3.2.3. Purba Bersatu Village

In this village, there are several tribes including the Batak Toba (1,462 people), Nias (1 person), Javanese (3 people), Minang (2 people), and Bugis (1 person). The local leader in this village is the Purba clan. The majority of the population is Christian (1,117 people), others are Catholic (320 people), Islam (37 people), and *Aliran Kepercayaan* (10 people).

#### 3.2.2. Siambaton Village

The tribes in this village are the Batak Toba (956 people) and the Nias tribe (1 person). The customary land is owned by King Parna, located in the forest. Buying and selling land or land clearing must be authorized by the king. The majority of the population

#### 3.2.4. Parbotihan Village

The majority of the population of Parbotihan village is Batak Toba (2,040 people), Aceh (1 person), Sunda (1 person) and Javanese (3 people). In this village, the majority are Christians (1,485 people), others are Catholic (697 people), and Muslims (10



people). The customary rulers in this village are the Marbun clan supervising 27 tribal chiefs, all of whom are the Marbun clan. The traditional institution in this village is called Dalihan Na Tolu with members of the Batak Toba tribe with the title of traditional chief of Raja Bius.

The tribal chief plays an important role because every problem must be resolved through Raja Huta. In Parbotihan there is a customary regulation if someone is going to build a house, they must report to Raja Huta (tribal chief). Similarly, rehabilitation of the house must be with the approval of King Huta. Parbotihan village has customary land that is not traded. This village has 580 hectares of customary land. All customary lands are usufructuary, including houses. In addition, there is a community-owned forest.

### 3.3. Socio-economic community

#### 3.3.1. Sionom Hudon Julu Village

Based on the village monograph data, there are 306 family heads, out of a total of 325 family heads, have a livelihood as farmers with additional income collecting forest products. The agriculture that is cultivated is paddy, while the additional forest products are rubber and incense. The forest products collected by the respondents were rubber latex, followed by frankincense sap. Some took cinnamon bark. Any wood was also taken for firewood (Table 3). According to the respondents, the forest products tended to decline, especially rubber latex due to a decrease in selling prices therefore they reduced the tapping of rubber sap. The furthest forest product commodities were taken at a distance of 15 km, carrying them on their shoulders, which were then purchased by the financier coming to the village. The majority of the respondents (80%) did not know about the forest areas formally stipulated by the government some knew the boundaries of villages with forest areas in the form of stakes (50%).

#### 3.3.2. Siambaton Village

Based on the village monograph data, there are 709 family heads out of a total of 720 family heads having a livelihood as farmers with additional income collecting the forest products. The agriculture cultivated is paddy, while the additional forest products are in the form of rubber. The forest product collected by the respondents was rubber latex, followed by *Durio zibethinus*. Any wood was also taken for firewood (Table 3).

According to the respondents, the forest products tended to decline, especially rubber latex due to a decrease in selling prices and the volume of rubber produced because it was an old rubber tree. The furthest forest product commodities were taken at a distance of 10 km, by means of a path (Figure 2) by

carrying them on shoulders. These forest products were then bought by the financier coming to the village. The majority of the respondents knew the forest areas formally designated by the government (90%) from the forest officers. Most of the respondents (80%) stated that they knew the boundaries of the village and forest area in the form of stakes.



Figure 2. Village road

#### 3.3.3. Purba Bersatu Village

Based on the village monograph data, there are 350 family heads out of a total of 390 family heads having a livelihood as farmers. Additional income was obtained from collecting forest products in the form of rubber latex, bananas (*Musa paradisiaca*), *salak* (*Salacca Zalacca* L.), and *jengkol* (*Archidendron pauciflorum* L.). Any wood was also taken for firewood (Table 3).

The respondents took the forest products a maximum of 4 km through the path by carrying them, then they would be transported by middlemen who came to buy agricultural commodities from the village. Six respondents (60%) knew the existence of the forest area stipulated formally by the government. Only some respondents (50%) stated that they had seen the boundary stakes of the forest areas.

#### 3.3.4. Parbotihan Village

Based on the village monograph data, there are 360 family heads out of a total of 467 family heads having a livelihood as paddy field/paddy farming farmers. According to the respondents, collecting the forest products was an additional income. The forest products taken were in the form of rubber latex, cinnamon bark, *durian* (*Durio zibethinus*), and *jengkol* (*Archidendron pauciflorum* L.). Any wood was also taken for firewood (Table 3).

The furthest distance to collect the forest products was 2 km by carrying them on shoulders and there were middlemen coming to the village. The majority of respondents (80%) did not know the forest areas formally stipulated by the government.

Table 3. Types of utilization of forest products in sample Village

Forest product	Volume			
	Sionom Hudon Julu	Siambaton	Purba Bersatu	Parbotihan
Firewood	26 m <sup>3</sup> /year	26 m <sup>3</sup> /year	-	-
Rubber latex	1.040 kg/year	1.040 kg/year	1.435 kg/year	1.560 kg/year
Frankincense sap	10-40 kg/year	-	-	-
Cinnamon bark	20-30 kg/year	-	-	520 kg/year
<i>Durian (Durio zibethinus)</i>	-	50-150 fruit bunch/year	-	200 fruit bunch/ year
Bananas ( <i>Musa paradisiaca</i> )	-	-	156 fruit bunch/year	-
<i>Salak (Salacca Zalacca L.)</i> ,	-	-	104 bag/year	-
<i>Jengkol (Archidendron pauciflorum L.)</i>	-	-	20 bag/year	20 bag/year

### 3.4. The interrelatedness of land use and forest areas

The origins of the villagers being studied were varied. The ancestor of Parbotihan village was a transfer from the Bakara area, while the ancestor of Sionom Hudon Julu village was a transfer from the Samosir area around 1917. The ancestors of Siambaton Village and Purba Bersatu Village lived in the village for hundreds of years. Thus, historically the residents of Siambaton Village and Purba Bersatu Village were the original inhabitants inhabiting the area being studied. The forested area in these two villages is larger than the other two villages.

The largest land use in the form of forest and community forest is in Purba Bersatu village, but according to the respondents, the community preferred farming and rubber farming. There has been use of environmental services in the form of micro-hydro power plants in the Nanggumba hamlet since 2010. The land tenure is mostly inherited from hereditary land, especially on non-agricultural land. In the village of Purba Bersatu, the highest inheritance land is on agricultural land, not paddy fields. In the four villages analyzed, the land rent is only minimal, especially on paddy fields, thus generally the non-paddy land is the one processed and used by the owners.

### 3.5. The interrelatedness of community systems and structures and land use

The people in the four villages where this research was conducted are patrilineal people who follow the line of descent from the male side (father). The majority of the population is Christian and Catholic. The ethnic groups in the Parbotihan, Purba Bersatu, and Siambaton villages are relatively the same, namely from the Batak Toba tribe. The characteristics of the community of this tribe are very dependent on the King or the ancestral clan who becomes the forerunner in the village. Parbotihan village has King Marbun, Purba Bersatu has King Purba, and Siambaton village has King Parna. The local leaders, both village heads and other

elements of the community leaders must be from the clan.

The transfer of land ownership must also be with the approval of the King in the village. Even in Parbotihan house rehabilitation must be approved by the King Huta/tribal chief. In the village of Sionom Hudon Julu, although the majority of the people are from the Pak-pak tribe, there are also similarities in the community system, namely the existence of a traditional ruler, Raja Tumanggor. In this village, three customary judges are still active in resolving disputes among the residents.

In general, the land use in these four villages is highly dependent on the traditional leaders. Changes in the land use must be approved by the customary leaders. Utilization of existing land resources in the form of forest land and other built-up lands is based on the approval of the customary leaders. In consequence, the sustainability of the existence of forest land in this area is highly dependent on the perception and interaction of the traditional leaders towards the forest resources. As a result, to achieve the goal of sustainable forest management in this region, it is necessary to have a close relationship among the policymakers, government practitioners, and traditional leaders.

### 3.6. The interrelatedness of livelihoods and forest areas

The community in the study area is an agrarian society that depends on agriculture and plantation products for their livelihood. All of the respondents in the four observed villages maintain their agriculture permanently. The leading commodity in the four sample villages is natural rubber. The highest production was in Purba Bersatu village. These four villages rely on the natural rubber from the forest areas. Other products obtained from the forest areas are firewood, incense resin, cinnamon bark, fruits, and forest environmental services in the form of water for micro-hydro.

The furthest distance of collecting the forest products is 20 km from the Sionom Hudon Julu Village, while the closest distance is 2 km from the Parbotihan Village. The access road is in the form of a footpath. The products are transported on the shoulders and purchased by the middlemen coming to the villages.

#### 4. Conclusion

Some respondents in the sample villages did not know that their village area was located or adjacent to a forest area legally designated by the government. Yet, the respondent's relationship with forest resources can be seen from the history of the existence of the village, prevailing customary norms, and additional income that can be obtained from the forest resources. The existence of these customary norms plays an important role in the sustainability of forest resources. The forest resources directly utilized by the respondents were rubber latex, incense resin, cinnamon bark, firewood, durian (*Durio zibethinus*) fruit, salak (*Salacca Zalacca L.*), petai (*Parkia speciosa L.*) and jengkol (*Archidendron pauciflorum L.*).

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