Subsistence Foods
to Export Goods

The impact of an oil palm plantation on local food sovereignty
North Barito, Central Kalimantan, Indonesia

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"Memang kami tidak semuanya kaya, ada juga yang miskin. Tetapi kemiskinan kami tidak sampai mati kelaparan! Karena kami masih ada hutan, masih bisa bertani. Ada hutan wilayah untuk berladang, ada sungai untuk mencari ikan memancing."

***

"It's true that not all of us are rich, there are poor people too. But our poverty is not that poor that we starve from hunger! Because we still have forest, we can still farm. There are forest lands to open new farming lands to cultivate crops and there are rivers to catch fish."

Villager of Tongka
In the documentary Subsistence Foods to Export Goods, 2007

"Sekarang kami berladang gunung, tidak bisa lagi membuka hutan. Hanya tempat kami lari adalah sawah Maliau, tetapi sawah Maliau sekarang setelah habis, digarap oleh PT AGU, ditanam sawit.
Bagaimana cara hidup masa depan kami?"

***

"Now we are farming intensive, because we can't open up forest anymore. The only place for us to run is sawah Maliau, but now sawah Maliau is gone, converted to oil palm by PT AGU.
How can we survive in the future?"

Villager of Butong
In the documentary Subsistence Foods to Export Goods, 2007

Abstract

Forest, farming lands and rubber gardens have been cleared for oil palm plantation development, reducing livelihood options of the indigenous communities, while fertilizer leaks outside of the plantation grounds and waste water from the CPO mill pollutes the river Barito. The forest area and farming lands are getting limited, and therewith the availability of local food, which the indigenous people usually obtain from the forest or farming land. This affects the food sovereignty of the nearby villagers, by reducing their opportunities for fishing, hunting, NTFP collection and access to clean water.

This study tests the significance of the difference of these indicators of local food sovereignty between 3 villages in different proximities of an oil palm plantation. The conclusion has been drawn that local food sovereignty has indeed been affected. Possibilities for other land uses that do not endanger local food sovereignty have been explored.

Keywords: oil palm, food sovereignty, Indonesia

Ringkasan

Hutan, lahan pertanian dan kebun karet telah dibabat untuk pembangunan perkebunan kelapa sawit, menghilangkan kebebasan mata pencaharian masyarakat adat, sementara pupuk berserakan diluar areal kebun dan limbah cair dari pabrik minyak sawit mencemari sungai Barito. Areal hutan dan lahan pertanian menjadi terbatas, bersamaan dengan itu ketersediaan pangan lokal, yang masyarakat adat biasanya dapat dari hutan atau ladang bertani juga berkurang. Ini berdampak pada kedaulatan pangan orang kampung yang tinggal dekat kebun, karena ini mengurangi kesempatan mereka untuk memancing, berburu, mengumpul produk hutan dan akses air bersih.

Penelitian ini menguji signifiknsi perbedaan indicator-indikator kedaulatan pangan lokal di antara 3 desa dengan dekatnya beda dari salah satu kebun sawit. Kesimpulannya ketahanan pangan masyarakat terpengaruh oleh pembangunan kebun kelapa sawit berpengaruh pada kedaulatan pangan lokal. Sedang diupayakan kemungkinan pemanfaatan lahan yang tidak membahayakan kedaulatan pangan lokal.

Kata kunci: kelapa sawit, kedaulatan pangan, Kalimantan Tengah

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Part of this report has been compiled on information distributed by the media, governmental institutions and non-governmental organizations, especially from Sawit Watch, but also Elang, BULOG in Muara Teweh and Tabloid Berita Metro have been particularly helpful. I would like to thank those who have made this information available for the purpose of this report.

Despite all assistance received, any errors are my own.

Meri Orth

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Acronyms

Adat	Traditional Indonesian unwritten customs and customary laws
Adat community	Customary law community, often translated as indigenous community or indigenous people
ANOVA	Analysis of Variance
B	Village group Butong
BULOG	*Perusahaan Umum Badan Urusan Logistik*; National Food Logistics Agency
CDM	Clean Development Mechanism
CPO	Crude Oil Palm
DBH	Diameter breast height
EFB	Empty Fruit Bunches
FFB	Fresh Fruit Bunches
FGD	Focus Group Discussion
GPS	Global Positioning System
H	Village group Hajak
HGU	*Hak Guna Usaha*; Land Use Rights
HOV test	Homogeneity of Variance test
NGO	Non-Governmental Organisation
NTFP	Non Timber Forest Products
PKM	Palm Kernel Meal
PKO	Palm Kernel Oil
PIR	*Perkebunan Inti Rakyat*; Nucleus Estate Smallholder Scheme
Plasma	Oil palm smallholder
POME	Palm Oil Mill Effluent
PT AGU	Antang Ganda Utama Company Limited
Raskin	*Beras Miskin*; Rice for the poor
RSPO	Roundtable on Sustainable Oil Palm
SPSS	Statistical Program for Social Sciences
T	Village group Tongka

1. Introduction

This report gives an analysis of a field study, where a comparison of the food sovereignty is made between 3 groups of villages with different distances to the same oil palm plantation owned by Antang Ganda Utama Company Ltd. (PT AGU). This plantation is located in North Barito district, Central Kalimantan, Indonesia. In this case study food sovereignty will focus on the system of food production of the villagers, with a main focus on land availability.

The purpose of this report is to examine whether or not local food sovereignty is affected by the presence of an oil palm plantation. And if food sovereignty is indeed affected, how? A focussed, in-depth insight and analysis will be given. Following this analysis, possibilities to encounter possible threats are explored and elaborated. Several options for a solution for a possible problem of the endangerment of food sovereignty on village level will be given to the district government and the management of PT AGU.

This study does not claim to be exhaustive. Apart from many limitations in time and resources, there was a lack of access to key documents and information on the extent of the exact plantation area and communal and private lands of the villages studied. These areas and land uses have not yet been documented by means of GPS. Due to pro/contra conflicts within the villages sometimes interviews were more difficult to be carried out.

The findings, interpretations and conclusions expressed in this paper are entirely those of the author. They do not necessarily represent the views of Sawit Watch or the University of Larenstein.

This report is part of the thesis work of Meri Orth, 4th year BSc student of Tropical Forestry at Larenstein University of Professional Education. Submission of the thesis represents the completion of the final requirement to fulfil the degree.

1.1 Relevance of the research

The Indonesian government has oil palm expansion plans for over 21 million ha (Sawit Watch database) to meet the rising demand for oil palm, amongst others for biofuels. The government of North Barito district, Central Kalimantan, plans to allocate 431.100 ha of its 830.000 ha area for plantation purposes (Banjarmasin Post July 17, 2006). According to government documents, current concessions cover 159.849 ha, on top of the already existing oil palm plantations.

Up to recently a regulation applied that limited plantation concession sizes of a given company to 20.000 ha per province and up to a maximum of 100.000 ha for the whole of Indonesia (Plantation Use Permit Regulation 107/Kpts-II/1999, as found in Casson, 1999). On February 28th 2007 a new regulation (Guidelines Plantation Use Permit Regulation 140/2/2007) had been introduced, which withdraws the concession size per province. This means a given company is still allowed to have a maximum concession size of 100.000 ha, but this can be within one province. The total plantation area can be 100.000 ha, instead of the prior 20.000. This new regulations supports expansion of oil palm plantations.

Demand for palm oil is expected to keep rising, partly due to the rising interest in biofuels. Biodiesel made from palm oil is cheaper than biodiesel made from any other crop, mainly due to it's high yield per ha (Journey to Forever). "*Palm oil is best suited to cover the growing world biofuel demand mainly because you don't have to deal with the protein problem*," Oil palm is grown primarily for the oil from the palm fruit, unlike soybeans and rapeseed, which are primarily produced for meal, used as a protein source to feed animals. Thomas Mielke, director of ISTA Mielke, which publishes OilWorld, once stated in Reuters: "*Even if it is another oil that goes into biodiesel, that other oil then needs to be replaced. Either way, there's going to be a vacuum and palm oil can fill that vacuum - be it for biodiesel or for food*," said Carl Bek-Nielsen, vice chairman of United Plantations Bhd, a major palm oil producer in Malaysia to the same newswire. Considering these arguments, it is expected that demand for oil palm will continuously increase. But if the current plantations already cause problems to the indigenous people, what will become if even more oil palm is grown on Indonesian soil?

Considering these initiatives from both import and production side of the trade cycle of biofuels, expansion of oil palm plantations is expected in Indonesia. A study on how the current plantations affect local food sovereignty is appropriate to assess the impact of the planned oil palm expansion.

While advocators of oil palm mention these plantations can provide the local people with a steady cash income, it may in fact have an adverse effect on the food situation. If too much land is taken for tree crops, the land left available for the production of food crops under a system of slash and burn may become rigorously limited. According to local communities, the given concessions overlap with village lands, which often have belonged to the local communities for many generations, but for which they do not have official ownership certificates.

For the indigenous peoples of North Barito land is an important part of their existence, as many of the Dayak tribes rely on some form of shifting cultivation. Traditionally they are highly self-subsistent in their food supply, by means of slash and burn practices and collection of non-timber forest products (NTFP's) as a production method. Expansion of oil palm plantations may threaten the land available for farming and the forest used for gathering of NTFP's. Consequently shifting cultivation and NTFP collection become limited or are no longer possible and a shift is made to intensive agriculture or no agriculture at all. Communities change from self-subsistent farmers to a cash society. There is not sufficient land to supply a whole village with food on a sustainable basis, so that this has to be bought from other areas. In this hypothetical model food sovereignty is exposed.

2. Research methodology

This research is based on data collection and data analysis. Both qualitative and quantitative data was collected by literature study, participant observation, focus group discussions (FGD), semi-structured individual interviews, household surveys and maps.

The observations, FGD, surveys and interviews were held within several villages, which are illustrative case studies for this research. In order to draw conclusions a comparison is made between villages where land has been taken for oil palm purposes and villages where there is abundant land and where villagers rely mostly on farming. These villages were selected based on field observations and their physical distance to the plantation.

To answer the research question posed, a total of 109 people from 4 different villages in North Barito district have been interviewed. A complete profile of these villages can be found in the appendix. The survey was carried out between May and July 2007. The respondents were divided into 3 different village groups. The first group, named Tongka is made up of 2 villages which are located about 50km from the plantation area and where still some patches of primary forest can be found. The second village group, named Hajak, is a large village of which the centre is situated 21km from the main office of the plantation. The plantation borders and sometimes overlaps with the village grounds. The third group is Butong, a smaller village where much of the village lands have been converted to oil palm plantations. The distance from the village centre to the main office of the oil palm plantation is 12km, although some people live within 1km of the plantation. Each group consists of at least 30 correspondents, which were selected randomly. Random in this research means those who where at home at the time of the interview and willing to respond. In group interviews the owner of the house where the interview was held invited other villagers who were also willing to join.

The surveys were carried out in Indonesian by the author with the head of the household or his wife, as it is assumed these 2 people will have the most information on the discussed topics, with confirmation from other family members if present. Taking the surveys personally required less reading and writing skills of the villagers, which is worth considering since some of the people have trouble reading or writing. It also gave the possibility to explain questions if they were not fully understood, to further interrogate if an answer was incomplete and to start spontaneous discussions to further support the understanding of local food sovereignty issues. In some cases the questions had to be explained and translated into local languages by an assistant, who joined to all of the villages. Both individual interviews and group interviews, consisting of 3 to 5 people, were used, which both had their weaknesses and benefits.

FGD were used to collect data on village level and household level, such as production systems within the community, income sources and the presence of institutional organisations. Due to potential lingual difficulties and to keep focus, the group size was limited to 7, preferably 3 to 5 persons. In each village group there were special FGD to set up a list of NTFP's obtained from the forest.

Besides food sovereignty, an assessment form has been used to include other information on village-level –site and community description- on each case study, such as geographical data, economy, social and cultural aspects, demography, available facilities and land use. Part of the site and community description was obtained from (regional) secondary data, such as local government statistics. This profiling can be used to achieve a better understanding of the issue and to support an in-depth description.

Thus the methodology of the illustrative case study within this research consists of direct gathering of data from a case study, to be able to give an illustrated, detailed description of the phenomenon of potential endangerment of local food sovereignty in these villages for the thesis report.

2.2 Choice of research area

Central Kalimantan was chosen as the research area for this research, as it is subject to expansion plans, covering approximately 3 million ha. Also, in Central Kalimantan there hasn't been a lot of research on oil palm yet and for the facilitating organisation of this research, Sawit Watch, that was a fairly important condition. North Barito district was chosen after visiting several other areas. Seruyan district, in the west of the province, was chosen first, as there was a participatory mapping project going on and maps of the village areas and converted areas would thus be readily available. Unfortunately a field visit showed that this area was often flooded. Therefore fishing was more important than farming, and thus water more important than land. As the planned research area was flooded at that moment, there were no farming activities. A clear link with the oil palm plantation in that area was not directly visible. In Kapuas district, more to the east, there were many farming activities. However, a field visit again showed the area was not suitable for this research. The local government was strongly opponent to large-scale oil palm plantations and these farming activities were not threatened by oil palm plantations. Also most of the farming was already relatively intensive.

PT AGU was chosen as at the moment it is oil palm plantation with the largest expansion plans in North Barito. The villages Tongka, Siwau, Hajak and Butong were chosen in relation to their distance to the oil palm plantation. Siwau and Tongka are two neighbouring villages at the end of the road, bordering with another sub-district and still some patches of primary forest. Farming is the most important activity in these villages and mostly for their own subsistence, with several crops for trade as well. Hajak is located north of the plantation and some people are finding trouble with a deficiency of land. Butong is nearest to the plantation. All people interviewed do not have enough land to farm as they had before the arrival of the plantation and many have stopped farming rice. There are obvious troubles in this village due to pro/contra oil palm conflicts. According to the villagers the water is polluted and farming and NTFP collection has become extremely difficult compared to prior the plantation entered the area. Interviews were also taken in 2 smallholder villages. However, these data are not used in the report, as the majority of the people interviewed are transmigrates from Java and Flores islands, so that the socio-cultural background does not comply with the other villages.

2.3 Statistical analysis

The results from the interviews have been analysed using Excel and SPSS. Comparing the different village groups, for each indicator of food sovereignty the null-hypothesis has been accepted or rejected, ultimately leading to acceptance or disposal of the main research hypothesis.

In SPSS the one-way ANOVA test has been run, to test whether the difference in means between the villages are significantly different, thus to the null hypothesis that village group means on the dependent variables (the expected changes related to presence and nearness of the oil palm plantation) do not differ. The one-way ANOVA test is based on the difference in the means, the group sample sizes and the group variances.

The one-way ANOVA test makes the following assumptions:

- the dependent variables are normally distributed
- the groups have approximately equal variance on the dependent variable

The significance of each effect (indicator) is tested with a significance value of 5% or less, to conclude if the effect is indeed valid or due to the chance of sampling. This means the P is set at 95%, as common for social sciences. A hypothesis will be accepted if it can be said that there is a 95% probability the answers from any respondent from Hajak or Butong will significantly differ from a respondent from the control village Tongka. In the presented tables this will mean the significance is equal to or smaller than 0,05.

The test will indicate whether or not the independent variable (in this case the presence and nearness of the oil palm plantation) has an effect on the dependent variable (e.g. the length of the shifting cultivation cycle, perceived land availability and the number of people cultivating rice). If a significance has been found, the strength of the correlation is revealed by the significance level.

The same settings are used as much as possible. For the statistics output 'descriptive' and 'Homogeneity of Variance test' is chosen. The latter one, also called Levene's test, tests the assumption that the groups have equal variances. If the significance is larger than 0.05, equal variances may be assumed, if the significance is smaller than 0.05, equal variances may not be assumed.

In this research Tongka is considered a 'control' village, where the other two villages, Hajak and Butong, are considered villages with a 'treatment'. In other words, Tongka is a village without any oil palm plantation nearby and is considered a village without any treatment, thus without any changes. Hajak has the treatment 'oil palm plantation nearby' and Butong has the treatment 'very close to oil palm plantation'. The research hypothesis claims that those villages with a treatment (in this case the proximity of an oil palm plantation) differ from the village without a treatment. A formula would be as follows: $T \neq H$ and $T \neq B$. Taking into consideration that the treatment for Butong is higher than for Hajak, or simply that the plantation is closer to Butong than Hajak, it is expected that the difference between Tongka and Butong will be higher than the difference between Tongka and Hajak.

With a Post Hoc test it can be tested which villages are significantly different. A Post Hoc test that considers the control group is Dunnett's test, a specialized multiple comparison. If after a Homogeneity of Variance test equal variances may be assumed, a one-sided Dunnett's t test will be run. If after the HOV test it appears that equal variances may not be assumed, the Dunnett's T3 test will be run.

A regression model has not been made, as there would only be three values for the y-variable. Causal relationships are based on arguments from the respondents and common sense.

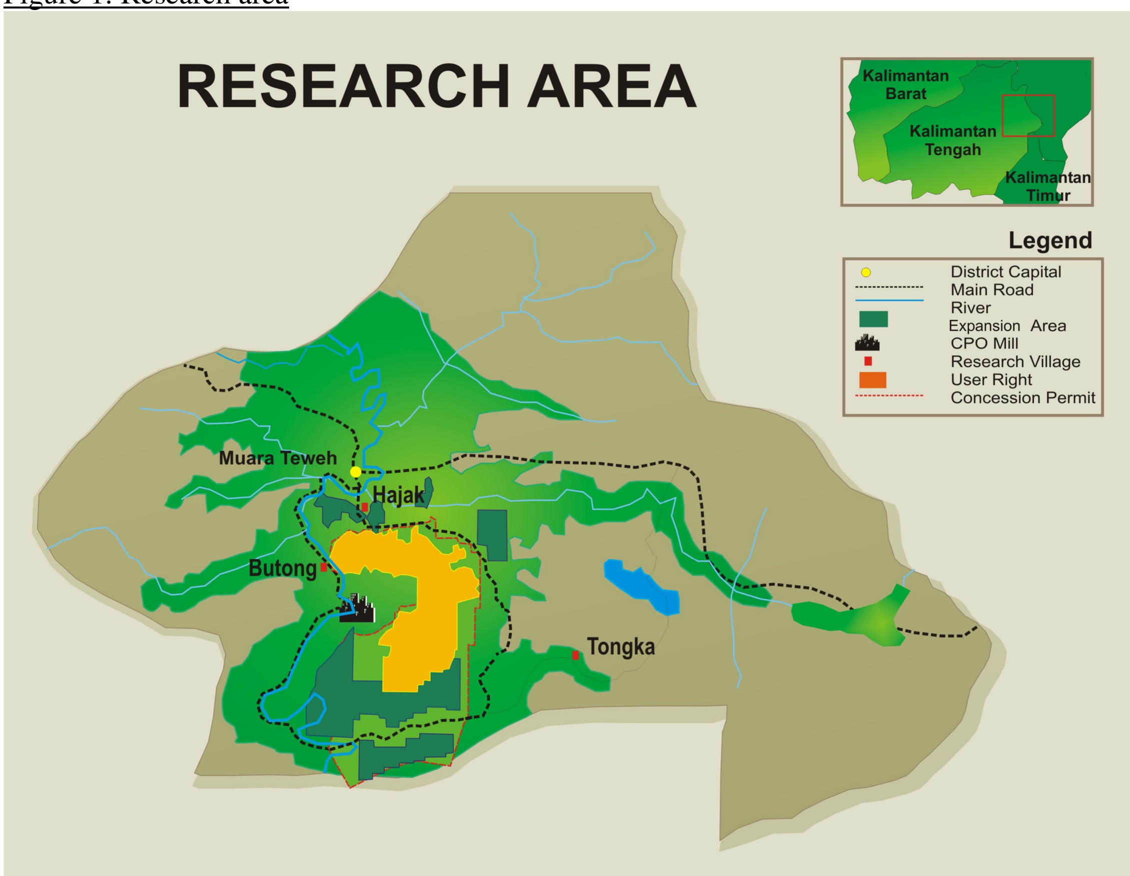
3. Profile of the research area

3.1 North Barito district

North Barito district lies in the east of Central Kalimantan province, bordering with East Kalimantan. The capital city is Muara Teweh. The district, divided into 6 sub-districts and 89 villages, has a size of 8.300km^2, or 830.000 ha. According to the latest census in January 2007, the total population amounted 114.903 people, with a population density of 13,8 people per km^2. The majority of the population follows Islam (68,3%), a less significant number (15,3%) follows Hindu Kaharingan –a form of animism-, while a relatively smaller part of the population is Protestant (9,8%), Catholic (6,4%) or Buddhist (0,1%). The most important waterway is the Barito river, with 900km the longest river of Borneo.

Agriculture is the most important source of income, with 62% of the total workforce working in the agricultural sector. The fact that the local government finds major potential for development in food agriculture, plantations, fishery, animal husbandry and mining confirms the value of natural resources in North Barito. (North Barito website)

Figure 1: Research area



3.2 Research villages

3.2.1 Tongka

Tongka is a village located in the east of sub-district Gunung Timang, bordering with the sub-district Lampeung in the east, sub-district Gunung Purei in the north and South Barito district in the south. According to the village head, Tongka has a population of 805 (410 male and 395 female), divided over 235 households. In the area of Tongka there is still some primary forest and an abundance of secondary forest. Most of the people belong to the Dayak Taboyan, a subtribe of Dayak Leungan. 93% of the villagers are involved in rubber tapping, while also growing rice, harvest rattan vines and some of the people may gather swallow nests from caves, which can be sold for birds nest soup. Farmers will cultivate fields until the land is depleted and then move on to new fields, or open up previous plots than are not planted with rubber trees.

The distance to the capital city of the district is 84km and the district to the head office of PT AGU Butong is 54km. The village is located about 500m above sea level. The village Siwau is located 5km to the west of Tongka and is quite similar to Tongka in demographic and geographic point of view, although its village area and population size are smaller. A more comprehensive profile of Tongka can be found in the appendix.

3.2.2 Hajak

Hajak is situated in the subdistrict Teweh Tengah, 14km east of the district capital city Muara Teweh, at a height of 59m above sea level. According to the last census in 2005, 3595 people live in Hajak, divided over 814 households. A majority is female (1909 females versus 1686 males). The oil palm plantation of PT AGU operates south of Hajak, with the head office being 21 km from the central housing area. Some villagers live as close as 4km from the plantation.

North from the village grounds there are still some patches of secondary forest, which is partly managed by village groups organised by *adat*. Farming lands are mainly for rubber cultivation, with a smaller part for food crops. A more comprehensive profile of Hajak can be found in the appendix.

3.2.3 Butong

Butong is the village situated closest to the plantation of PT AGU, only 12 km from the head office. When not incorporating the people who live and work on the plantation, mostly migrants from the islands Java and Flores, Butong has 121 households and a total population of 569. Butong, about 43 km from the district capital city, is situated west of the plantation. Although most of the houses are on the west side of the river, some people live on the east side of the river, with oil palm trees only several meters from their houses. Prior to the arrival of PT AGU, many villagers had their farming lands on the east side of the river. Although there still is some protected secondary forest, not much farming lands are left. Many lands have been (voluntary or by force) sold to the plantation, starting from early ’90s.

A more comprehensive profile of Butong can be found in the appendix.

3.3 Profile of the plantation

Head office
PT Antang Ganda Utama
Kyai Haji Wahid Hasyim 188-190
Jakarta 10250
Indonesia
Tel: +62213926877 or +62213926878
Fax: +62213926879 or +62213926880

Hendrik Darmawan	General manager
Wahyudi	Plantation manager
Rudi Harpono	Factory manager

PT Antang Ganda Utama is owned by PT Hari Mahardika Usaha and Matahari Kahuripan Indonesia. PT Hari Mahardika Usaha is one of the investment companies of the Wonowidjojo family. PT Matahari Kahuripan Indonesia is also known as PT Makin, the holding company of the business group Makin Group, which is active in logging, plywood, natural marble, oil palm, industrial plants and fruits. The Makin Group is ultimately owned by the Gudang Garam Group, mainly known for their kretek sigarettes brand, controlled by the Wonowidjojo family as well. (van Gelder, 2005)

At the time of writing the planted area of the plantation of PT AGU in North Barito district amounts 18.036 ha. Land use rights have been given out on May 10 1994 (3.257 ha), October 18 2004 (6.343 ha, according to HGU 90/HGU/BPN/04) and April 25 2005 (8.436 ha, according to HGU 41/HGU/BPN/05). The plantation is located in the sub-district Central Teweh. New land use rights also expand to the sub-districts Gunung Timang and Montallat, totalling another 22.449 ha. A map of the current area and expansion plans of PT AGU can be found in the appendix.

13th of April 2004 a letter (45/DISHUT/II/IV/2004) has been sent out by the forestry department on district level that PT AGU has been operating outside their land use permit (HGU), which at that time was 3.257 ha. The total area of land cleared outside their permit amounted 13.800 ha.

From an interview with the plantation manager Wahyudi, it seemed that PT AGU will open up the land to which the government has given them user rights. If later it seems this land belongs to the local people, they will be paid for the land. This is not in line with the free, prior and informed consent principle, stressed by many NGO's and a requirement for sustainable palm oil according to the RSPO guidelines.

During the field research several local people stated the company had been using burning practises during land preparation. Also some lands of the local communities, planted mainly with rubber, rattan, fruit trees and vegetables, were burned during this process. Several indicators of land burning were seen at the plantation, such as black tree trunks left at the plantation and smoke plumes at daytime. A film recorded by local activists in 2004 also shows burning on the land owned by PT AGU.

Conflicts between PT AGU and local communities have led to several demonstrations and meetings, where the local people asked for their lands to be returned to them. The last meeting was the 26th of June. A vague Memoriam of Understanding had been written, stating that PT AGU would ‘return rights to the people’ and ‘give a compensation’. Nevertheless, at the moment of writing, none of these promises have become more than words on paper.

At the moment villagers of Kandui, Majangkan, Sikui, Baliti, Walur, Ketapang, Rarawa, Malungai, Butong, Sikan, Hajak, Rubei and Montallat II are affected due to land conversion by PT AGU. An unreported further number of villages are affected due to water pollution by this company. A further number of villages will be affected if this plantation expands.

4. Food sovereignty

In April 1996 the global term food sovereignty was launched at the International Conference of the global farmers' movement Via Campesina in Tlaxcala, Mexico (Windfuhr and Jonsén, 2005) as a prerequisite for food security. The commonly accepted definition of food sovereignty is taken from the Declaration of Nyéléni in 2007, which includes the following: '*Food sovereignty is the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems. […] It defends the interests and inclusion of the next generation. […] Food sovereignty prioritises local and national economies and markets and empowers peasant and family farmer-driven agriculture, fishing, pastoralist-led grazing, and food production, distribution and consumption based on environmental, social and economic sustainability. Food sovereignty promotes transparent trade that guarantees just income to all peoples and the rights of consumers to control their food and nutrition. It ensures that the rights to use and manage our lands, territories, waters, seeds, livestock and biodiversity are in the hands of those of us who produce food…*'

4.1 Indicators

As the concept of food sovereignty is still relatively new, indicators have not yet been developed. Therefore practical indicators to assess food sovereignty on village level have been defined, largely based on villagers' perception. Arguments for the choice of these indicators are given, based on the hypothesis. These indicators are divided into 3 groups: land and farming, food and trade, and water resources.

4.1.1 Land and farming

- Forest availability
- Land availability
- Length of fallow period in shifting cultivation
- Soil fertility
- Diversity of edible crops cultivated
- Percentage of households producing rice

With a large part of the population in North Barito being dependent on agriculture, including access to natural resources for their livelihood, land availability is a crucial component of livelihood security and food security on household level. A shortage of land directly leads to resource competition and weakens the local food sovereignty. From the production point of view access to land is a fundamental condition for households to produce food for both subsistence and sale. Lands used for farming and rice production –in the form of shifting cultivation- and forests used as land bank and for NTFP collection, are now converted to oil palm. Farming becomes more difficult, because there is not enough land for the indigenous peoples. The length of the fallow period in shifting cultivation shortens and farming becomes more intensive. Slash and burn methods become less common, as there simply is no more forest left near the village grounds to open up. The intensification of farming means that lands are used more continuous. The soil has less time to regain fertility, so land fertility may decrease. As a result of this many people either do not have land to farm anymore or they feel rice farming is no longer rewarding. The traditional land use system of shifting cultivation has seized. Since people have less land for farming and less people farm rice, there are less edible crops cultivated.

Land availability is a vital condition to continue the traditional land use system and keep sustainability. Without land, the indigenous peoples are not in a position to choose their own food and agricultural systems. With land, villagers are still left the choice to obtain food directly by producing it themselves, while without land, villagers are left no choice but to buy food. Certain kinds of trees and plants only grow in the forest and can not be cultivated. If there is no more forest, food from these trees and plants is not longer available and herewith, the choice of food no longer belongs to the indigenous peoples.

4.1.2 Food and trade

- Number of products sold (income diversification)
- Income
- Kinds of foods bought
- Amount of money spent on food
- Percentage of households joining Raskin

Due to the lack of land, less people farm rice and less products are taken from the forest. It is more difficult to obtain products like rattan, forest animals, honey and bird nests. Less products are sold and income diversification decreases, as does the income in general. Less meat, fruits and vegetables are gathered from the forests, so that these foods now have to be bought and people have to spend more money on food than before the arrival of the oil palm plantation. Also the nature of poverty changes: where it used to be poverty in monetary terms, people always had enough to eat. If they didn't have the financial means to buy food, they could take it from the forest. Now one needs money to eat. There is a shift from subsistence society to cash-society. More families join the governmental subsidized rice program called Raskin, because they are no longer assured of their own rice.

4.1.3 Water resources

- Water quality
- Water availability

In many cases oil palm plantations cause water pollution and a disturbed hydrology. Loss of forest may also disturb the hydrology, so that smaller rivers and creeks may dry up in the hot season and flooding may occur in the rainy season. Palm Oil Mill Effluent or POME is a mixture of water, crushed shells and fat residue. (Wakker, 2004) Its high biological and chemical oxygen demand kills many living organisms in the water up to a long distance downstream. (Ahmed et al., 2003) Although it is possible to recycle POME, some factories may dump this wastewater into local waterways. If oil palms are planted to near to a waterway, pesticides, herbicides and fertilizer can easily leak into this source of water and affect communities downstream. Access to clean water is a main component of food sovereignty and moreover food security.

5. Survey results

5.1 Forest availability

Many products are obtained from the forest. In participation with people from the 3 different village groups, a list (see appendix) has been compiled with over 150 (excluding about 50 bird species) plant and animal species found in the forest for food or medicinal purposes to verify this importance.

J. Falconer and J.E.M. Arnold (1991) have separated the functions of the forest for household food security into 3 groups, being supplementary, seasonal and risk reduction. They mentioned that as a supplementary role, forest foods can add diversity and essential nutrients to the diet and in some cases may increase the overall quantities of the diet. They can be eaten as a snack, used as fodder for domestic animals or as firewood for cooking. Income earned from forest-based activities can supplement the household budget. The forest also has a seasonal importance, providing food during the dry season, flooding season or planting period, when there is little time for cooking, and provide seasonal employment. Providing buffer food during droughts, flooding and other emergency periods, or emergency means for cash, are seen as a form of risk reduction. The forest also provides an insurance, it is seen as an asset for the future. Forest foods are valued because they are free and accessible. These forest foods are no staple foods, but do have a significant contribution to the household food intake.

In the traditional way of life of Dayak Leungan people, forests have a high value. Not only does the forest provide medicines and food, such as honey, fruit, seeds, tubers, vegetables, insects and wild animals, but forests also supply rattan, bamboo, tengkawang and leaves, which can be used self consumption or may be sold for cash income to pay those needs that one can not get from the forest, such as clothing, electricity, transport and school. Without forests, no NTFP's can be gathered and taking into consideration that the Dayak religion called Kaharingan is strongly related to forest and nature, cultural practices may be more difficult to carry out.

Graph 2: Forest availability

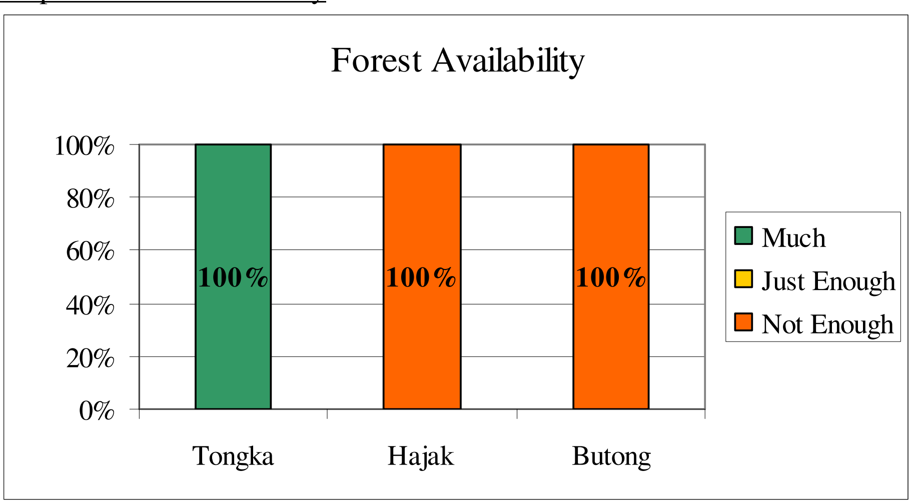


Table 1: Descriptives of forest availability

Village	N	Frequency		
		-1	0	1
Tongka	38			38 (100%)
Hajak	41	41 (100%)		
Butong	30	30 (100%)		
Total	109	71 (66,7%)		38 (33,3%)

-1: Much
0: Just enough
1: Not enough

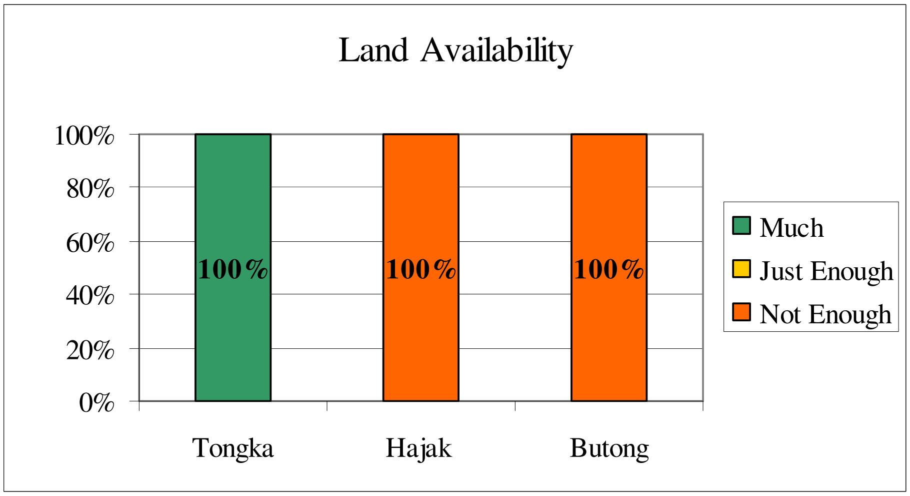
H0: There is no difference in forest availability between Tongka and the other villages. H=T and B=T.
H1: There is a difference in forest availability between Tongka and the other villages. H<T and B<T.

As these answers differed so evidently, an ANOVA test has not been run. Where inhabitants of Tongka mentioned an abundance of forest and also primary rainforest can still be found in the area, inhabitants of Hajak and Butong again unanimously replied there is as good as no forest left in close proximity to their village. The null hypothesis is rejected for the indicator forest availability in favour of the alternative hypothesis.

All respondents from both Hajak and Butong said that there is not enough forest available. In this graph there is no difference between Hajak and Butong. However, although both villages have a deficiency of forest, in practice the intensity of the forest deficiency may differ.

5.2 Land availability

Graph 3: Land availability



Land availability is considered as the main indicator for food sovereignty in this research, because it influences many other indicators. Taking into account that the majority of the indigenous people in North Barito depends on agriculture for their subsistence, land is an important factor. If there is no land, people can't farm. Bearing in mind that many of the indigenous people do not continue their education after primary school, other sources of income may be hard to obtain. If there is not enough land, environmental security is threatened. The latter one should lead to an adaptation of livelihood strategies, but the indigenous people are given no opportunities to improve their livelihood, besides working on the oil palm plantation. Dharmawan (2001) well explains how livelihood security is threatened, if a household is landless. Living is considered to be very insecure, because the household has to live without a permanent source of livelihood and without a firm security necessary to ensure a continuous supply of sustenance. Therefore, the life is extremely vulnerable to any kind of difficulty in which any small negative condition would be large enough to paralyze the households' livelihood.

Table 2: Descriptives of land availability

Village	N	Frequency		
		-1	0	1
Tongka	38			38 (100%)
Hajak	41	41 (100%)		
Butong	30	30 (100%)		
Total	109	71 (66,7%)		38 (33,3%)

-1: Much
0: Just enough
1: Not enough

H0: There is no difference in land availability between Tongka and the other villages. H=T and B=T.
H1: There is a difference in land availability between Tongka and the other villages. H<T and B<T.

As the answers differed so evidently, an ANOVA test has not been run and the null hypothesis has been rejected in favour of the research hypothesis. There is an obvious change in the land availability according to the villagers in Tongka and those in Hajak and Butong, whereas the correspondents from the first village group answer there is still abundant land, where the other correspondents unanimously replied there is not enough land available. The null hypothesis is rejected for this indicator, as it likely enough that there is less land available in the 2 villages near the oil palm plantation than in the control village Tongka.

The responses from Hajak and Butong are the same in terms of statistics, they reason there is not enough land available. However, the intensity of land availability differs. In both villages land has been converted to oil palm plantation, but further interrogations, discussions and a closer look at a map comparing estimated village grounds and plantation area revealed the land availability in Butong is in fact less than Hajak, although both have a deficiency of land.

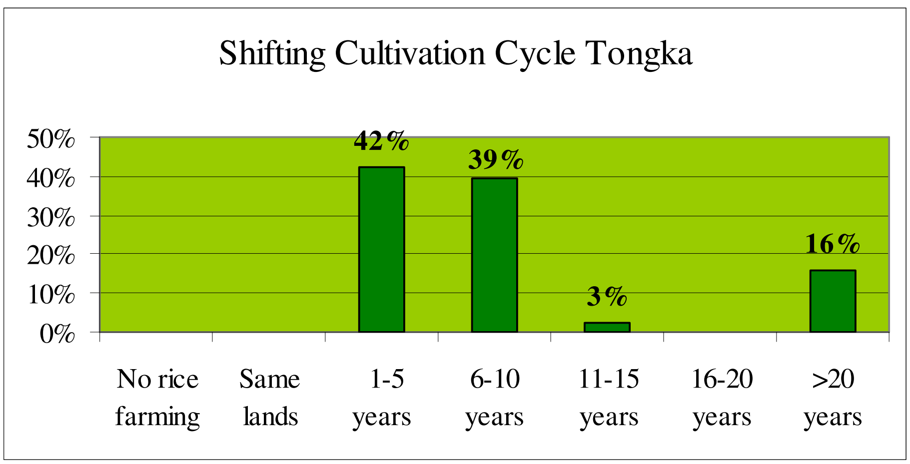
5.3 Length of fallow period in shifting cultivation

Shifting cultivation is part of the Dayak Leungan culture. When a new plot of land is opened, first bigger plants, climbers and small trees (up to 10cm DBH) are removed. After 1 to 2 weeks, the leaves are dry and the bigger trees are cleared. Weeds are not removed. When everything is dry, up to 1 or 2 months later, the land is burned. Afterwards rice, often spatially mixed with vegetables, are cultivated and harvested.

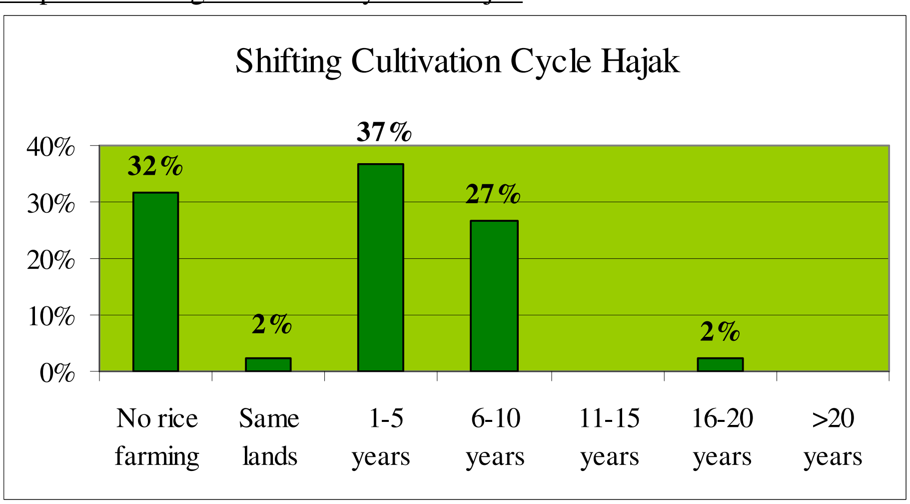
There are many cases where after the harvest the land is cleared from weeds (but not burned) and perennial crops are planted, such as rubber, fruit trees or rattan. After this a new plot is opened up. If no perennial crops are planted, one will return to a plot opened up before, usually within 5 to 7 years, but land may also lay idle for over 30 years. If no more fertile plots are available, old forest will be opened up. Vegetation is cleared and the land is burned to prepare the plot for farming activities. This adapted system of shifting cultivation is commonly called slash and burn. Obviously, if there is no more forest, slash and burn is only possible on a limited amount of land.

The average length of the fallow period has been asked to several people. Their answers have been grouped into several classes, being the first class whether or not they still farm rice (class 0). If people do not farm rice anymore, this means they also do not participate in the system of shifting cultivation. Then follows the class with the most intensive farming, being still farming rice, but continuously cultivating on the same land (class 1). Subsequently come the classes 1-5 years (class 2), 6-10 years (class 3), 11-15 years (class 4), 16-20 years (class 5) and more than 20 years of fallow period (class 6). More than 20 years in general applies to those households that only open up forest and say to never return to the land where they have already cultivated before, or only return when this has regrown to forest again. Class 1 is considered the most intensive form of farming in this study, while the latter class is considered the least intensive.

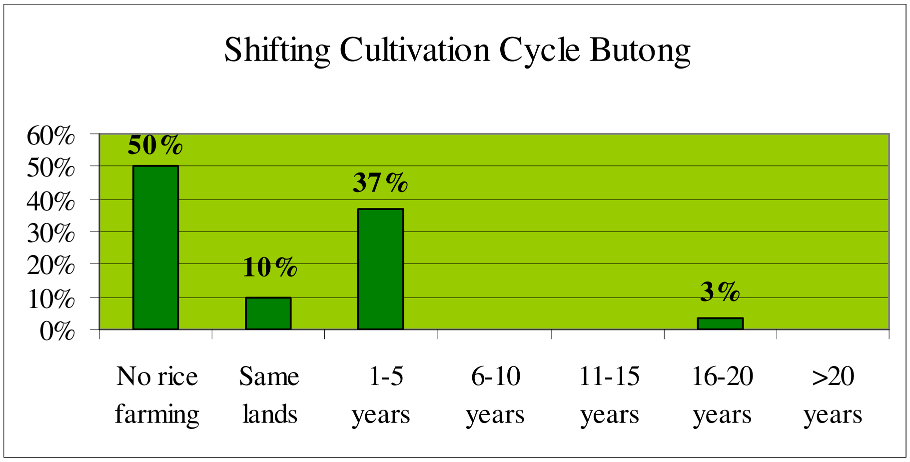
Graph 4: Shifting cultivation cycle in Tongka



Graph 5: Shifting cultivation cycle in Hajak

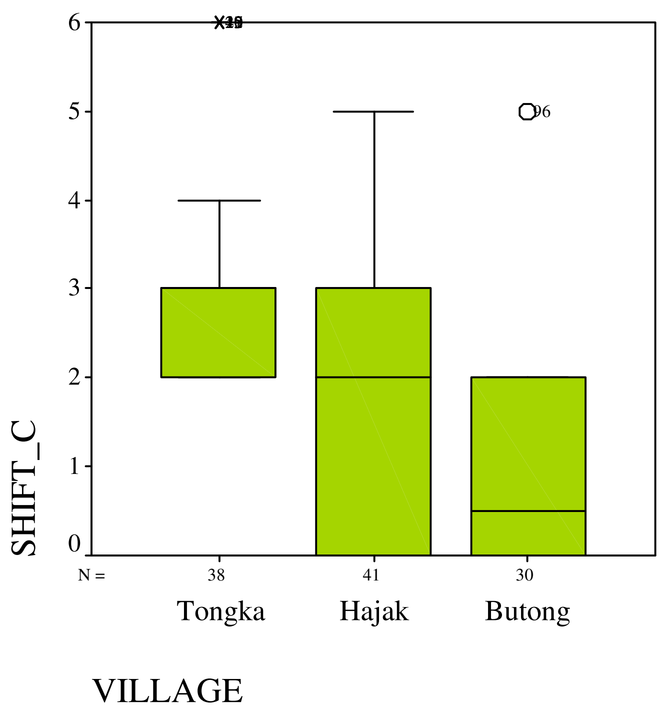


Graph 6: Shifting cultivation cycle in Butong



To give a better overview to compare the villages, a boxplot has been drawn for the 3 different villages, also based on the classes mentioned earlier.

Graph 7: Shifting cultivation cycle boxplot



H0: There is no difference in the shifting cultivation cycle between Tongka and the other villages. H=T and B=T.
H1: There is a difference in the shifting cultivation cycle between Tongka and the other villages. H<T and B<T.

When looking at the boxplot and the bar graphs, several conclusions can be drawn. The medians, minima and maxima differ. Farming in Tongka is more homogenous than in the other villages. The median lies at class 3, meaning that most of the people return to a previous farming land between 5 and 10 years. An outlier is shown at class 6, where several households will not return to previous farmed lands within 20 years.

Hajak is the village with the most differences within the village. A considerable part of the respondents does not farm, while also a noteworthy part keeps farming on the same land, and another notable part will return to a previous farmed land within 1-5 years or 6-10 years. An outlier can be found with one household returning to a previous plot within 16-20 years. From this the conclusion can be drawn that the impact of the oil palm plantation on farming and shifting cultivation in Hajak has different intensities.

In Butong the median lies between not farming rice and always using the same farm land. A number of respondents said to return to a previously farmed plot within 1-5 years, with only one extreme saying to return to a previous farming land within 15-20 years. When looking at the boxplot, shifting cultivation in Butong is quite homogenous.

Considering the observations above, it seems that there is a clear difference between the shifting cultivation classes in the 3 villages.

A one-way ANOVA test is run in SPSS to test this observation. The test of Homogeneity of Variances shows that the 3 villages indeed have equal variances, so that the Dunnett’s t test will be run. The ANOVA test shows that the difference between the 3 villages is significantly different. The Dunnett’s t test shows that the difference between both Tongka and Hajak, and Tongka and Butong is significant. The mean difference between Tongka and Butong is higher than between Tongka and Hajak, which confirms the expectation that the closer a village is situated to the plantation, the higher the impact will be.

<u>Table 3: Descriptives of shifting cultivation</u>

df within groups 2							
df between groups 106				95% Confidence Interval for Mean			
Village	N	Mean	Std. Err.	Lower Bound	Upper Bound	Min.	Max.
Tongka	38	3,08	,224	2,62	3,53	2	6
Hajak	41	1,68	,205	1,27	2,10	0	5
Butong	30	1,00	,220	,55	1,45	0	5
Total	109	1,98	,149	1,69	2,28	0	6

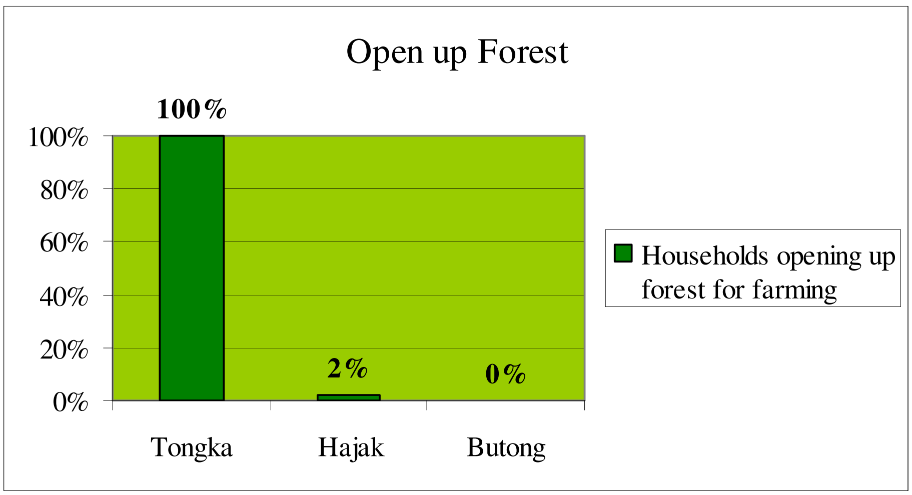
<u>Table 4: Significance of shifting cultivation</u>

sig. ANOVA	sig. HOV	Mean difference T-H	Mean difference T-B	Dunnett's t H<T	Dunnett's t B<T
,000	,748	1,40	2,08	,000	,000

In FGD’s the villagers of Hajak and Butong were asked if according to them the fallow period had changed, to which many responded that there was not enough land available to continue their traditional system of slash and burn, especially relating to the presence of forest to create new farming lands. Therefore the change in shifting cultivation period is linked to a lack of land and to the presence of the plantation.

Next to the data concerning the shifting cultivation cycle, respondents have been asked if they still open up forest. Those who do not open up the forest will be farming on the same plots of land. Those who do open up forest, herewith create new farming lands. The percentage of those households opening up forest and those who do not open up forest has been summarized. Clearly those who do open up forest do not frequently return to the lands they cultivated before, in contrast with those who do not open up forest. Thus not opening up forest is considered more intensive in comparison to opening up forest for farming.

Graph 8: Open up forest



H0: There is no difference in the percentage of households opening up forest between Tongka and the other villages. T=H and T=B
H1: There is a difference in the percentage of households opening up forest between Tongka and the other villages. T>H and T>B.

Table 5: Descriptives of open up forest

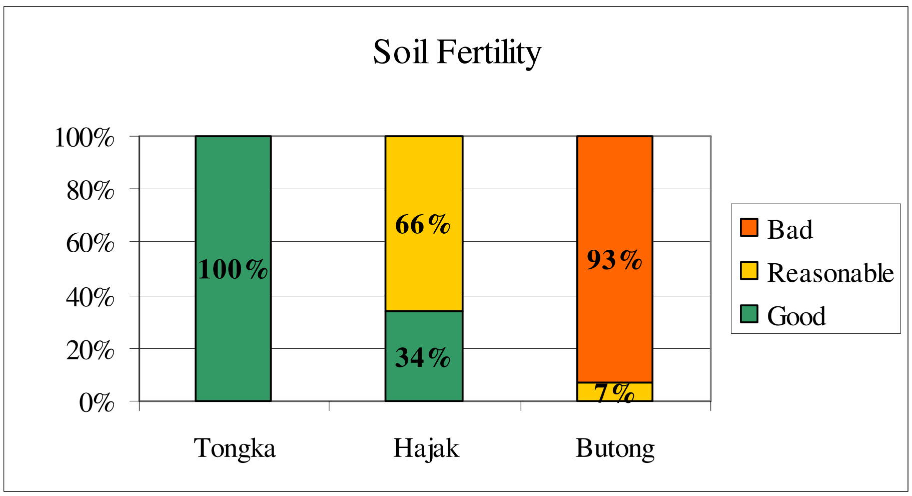
Open up Forest			
	n	Yes	No
Tongka	38	38 (100%)	
Hajak	41	1 (2%)	41 (98%)
Butong	30		30 (100%)

As one compares the answers relating to the fallow period and land availability, one can see these have a clear and strong relationship. If not enough land is available, farmers are forced to reduce the fallow period. An even stronger correlation is seen when looking at the availability of forest and whether or not households open up forest, simply as there no longer is forest to open up. An outlier can be found in the village Hajak, where one respondent answered they still open up forest and another extreme in Butong, where one respondent has a fallow period of 20 years in contrast to an average of 1,6 years of the other respondents in Butong. These two exceptions can be explained as these households are both farming in another village, where there is still an abundance of land and forest - or at least more than in their own village. The availability of land and forest thus has a strong impact on the intensity of farming activities. The null hypothesis has enough ground to be rejected.

5.4 Soil fertility

If farming because more intensive, the land may have less time to regain fertility, leading to a loss of fertility. To test this, all villagers have been asked how fertile they judged their lands. The table shows a clear decline, but to test the significance of the difference, again a one-way ANOVA test will be run. The values bad, reasonable and good have been converted to the numbers -1, 0 and 1, with -1 being the lowest option for bad fertility and 1 being the highest number for good fertility.

Graph 9: Soil fertility



H0: There is no difference in soil fertility between Tongka and the other villages. H=T and B=T.
H1: There is a difference in soil fertility between Tongka and the other villages. H<T and B<T.

Table 6: Descriptives of soil fertility

df within groups 2							
df between groups 106				95% Confidence Interval for Mean			
Village	N	Mean	Std. Err.	Lower Bound	Upper Bound	Min.	Max.
Tongka	38	1,00	,000	1,00	1,00	1	1
Hajak	41	-,34	,075	-,49	-,19	-1	0
Butong	30	-,93	,046	-1,03	-,84	-1	0
Total	109	-,04	,082	-,20	,14	-1	1

Table 7: Significance of soil fertility

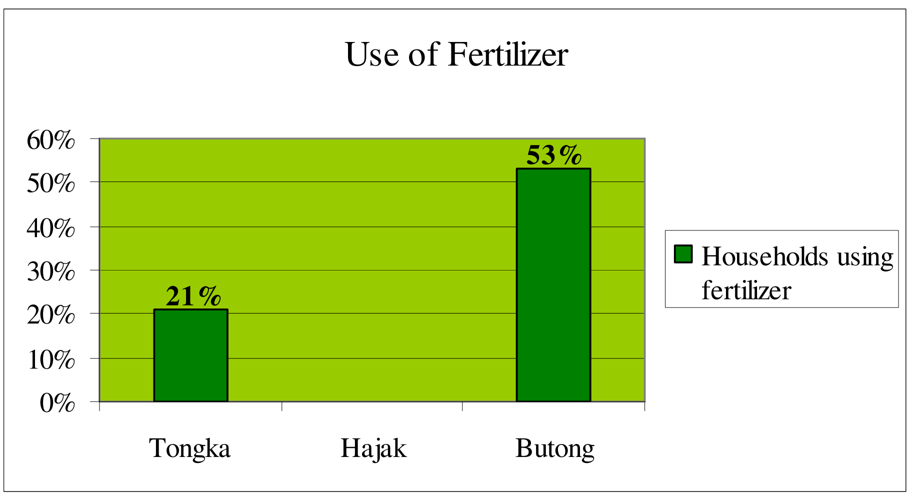
sig. ANOVA	sig. HOV	Mean difference T-H	Mean difference T-B	Dunnett's T3 H<T	Dunnett's T3 B<T
,000	,000	1,34	1,93	,000	,000

The ANOVA test confirms that the difference between the 3 villages is significant, while the Dunnett's T3 test shows there is a significant difference between each of the village groups. The null hypothesis is rejected, while the hypothesis that soil fertility declines for the villages situated closer to the oil palm plantation, is accepted. The Dunnett's T3 test even shows that there also is a significant difference between Hajak and Butong (of 0,59). The soil is less fertile in Butong than in Hajak. The conclusion is drawn that the closer the proximity to the plantation, the more soil fertility is affected.

It is logical to assume that if the soil is less fertile in the villages near the plantation, they may be using more fertilizer than the control village. Respondents have been asked whether or not they use fertilizer.

H0: There is no difference in the percentage of households using fertilizer between Tongka and the other villages. H=T and B=T.
H1: There is a difference in the percentage of households using fertilizer between Tongka and the other villages. H>T and B>T.

Graph 10: Use of fertilizer



An ANOVA test has been run on the data to test if there is a difference between Tongka and the other 2 villages. In this case the number 0 has been used for households not using fertilizer and the number 1 stands for a household using fertilizer. So if the lowest possible is 0, meaning the village does not use fertilizer and the highest possible is 1, meaning all the households in the village use fertilizer. Any number in between will be a combination of using or not using fertilizer.

In the bar graph it is visible that there is difference between Tongka and Hajak and between Tongka and Butong. However, in Tongka the use of fertilizer is higher than in Hajak, which contradicts with the hypothesis that fertilizer use will increase when villages are situated closer to the plantation. The significance calculated is 2-sided, which means it is calculated for both fertilizer use being higher than in Tongka and for fertilizer use being less than in Tongka. This is due to the fact the Dunnett's T3 test has been run.

In Butong the fertilizer use is clearly higher than in both Tongka and Hajak. During interviews reasons for the use have been asked and observed. The use of fertilizer in Tongka has just started with the commence of a government program that gives out free fertilizer. In Hajak there is no such program. In Butong the use of fertilizer is relatively high, because it is easy to buy. Empty fruit bunches are sold by the plantation as a form of organic fertilizer.

Table 8: Descriptives of fertilizer use

df within groups 2							
df between groups 106				95% Confidence Interval for Mean			
Village	N	Mean	Std. Err.	Lower Bound	Upper Bound	Min.	Max.
Tongka	38	,21	,067	,07	,35	0	1
Hajak	41	-,02	,024	-,07	,02	-1	0
Butong	30	,53	,093	,34	,72	0	1
Total	109	,21	,041	,13	,29	-1	1

Table 9: Significance of fertilizer use

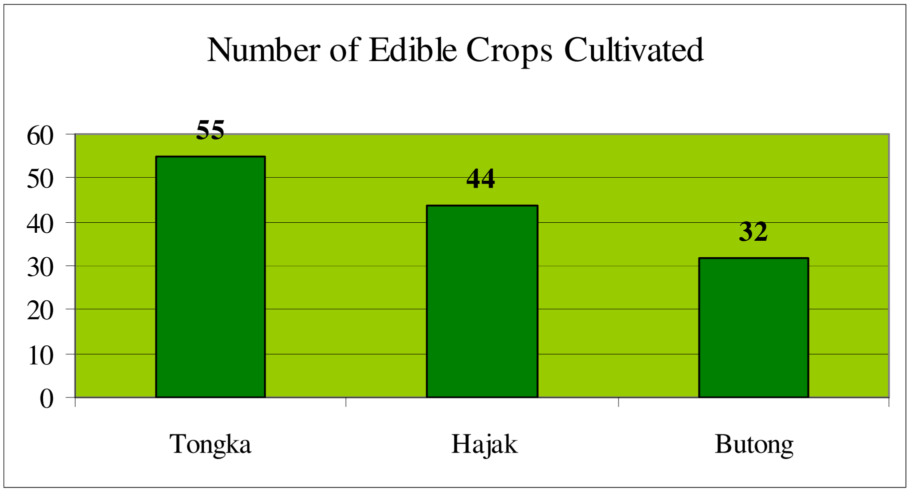
sig. ANOVA	sig. HOV	Mean difference T-H	Mean difference T-B	Dunnett's T3 H≠T	Dunnett's T3 B>T
,000	,000	,23	-,32	,006	,020

According to the ANOVA test there is a significant difference, so that the null hypothesis is rejected, but it can not be said that the use of fertilizer increases in line with the proximity of an oil palm plantation. In this case H≠T and B≠T is true, but H >B and B>T is not true. Neither the null hypothesis or the research hypothesis is accepted. The control village Tongka is not free of any treatments, because of the governmental program. Would there not have been this governmental program, both Tongka and Hajak would not be using fertilizer, so there would not be a difference between Tongka and Hajak. It seems that the use of fertilizer depends mostly on the availability of and access to fertilizer, rather than on the soil fertility.

5.5 Number of edible crops cultivated

Farming in Tongka is based on diversity. The diverse crops help farmers to preserve soil fertility, give protection against possible pest problems and ensure a year-round supply of foods. The diversity of cultivated crops is very high, with over 70 common plant species identified for this research. The number of uncultivated species used as food is also very large. Over 120 plant species found in the forest were documented by local people as food or medicine. Many uncultivated plants can be found in and around agricultural fields and home gardens that are also used by the indigenous people for food or medicinal purposes. While in general the term ‘rumput’ (weeds) may be used to refer to plants that were not meant to be cultivated, it does not imply that these plants are useless or unwanted by the indigenous people. From this perspective what outsiders consider ‘weeds’ may actually be part of the harvest.

Graph 11: Number of edible crops cultivated



H0: There is no difference in the number of edible crops cultivated between Tongka and the other villages. H=T and B=T.
H1: There is a difference in the number of edible crops cultivated between Tongka and the other villages. H<T and B<T.

The table shows a clear decline in the cultivation of edible crop species as one gets closer to the plantation area. Reasons villagers mentioned for this decrease was that they no longer grow rice or that there is not enough land anymore to farm more species. A decline in the diversity of subsistence foods grown is observed. To test if this decline is significant, a one-way ANOVA test has been carried out. The HOV test showed equal variances may be assumed, so that subsequently a Dunnett’s t test was pursued.

Table 10: Descriptives of edible crops cultivated

df within groups 2							
df between groups 106				95% Confidence Interval for Mean			
Village	N	Mean	Std. Err.	Lower Bound	Upper Bound	Min.	Max.
Tongka	38	55,11	1,467	52,13	58,08	37	71
Hajak	41	43,78	1,745	40,25	47,31	11	64
Butong	30	31,87	1,498	28,80	34,93	17	44
Total	109	44,45	1,272	41,93	46,97	11	71

Table 11: Significance of edible crops cultivated

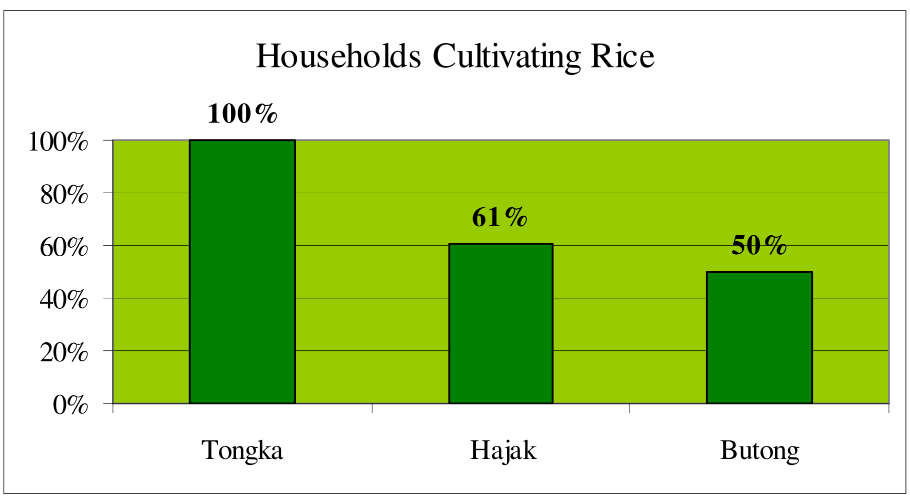
sig. ANOVA	sig. HOV	Mean difference T-H	Mean difference T-B	Dunnett's t H<T	Dunnett's t B<T
,000	,882	11,32	23,24	,000	,000

The results from the ANOVA test show that the decrease in number of edible crops cultivated is significant. The Dunnett's t test shows that the significance of the difference (H<T and B<T) is valid for both villages near the oil palm plantation, although the mean difference is higher between Tongka and Butong than Tongka and Hajak. In other words, the number of crops cultivated in Butong is not only less than in Tongka, but also less than in Hajak,. The null hypothesis has been rejected in favour of the alternative hypothesis that in proximity of the oil palm plantation less edible crops are cultivated, is accepted.

5.6 Percentage of households producing rice

For Dayak Leungan people, rice is the most important food crop, in both dietary and cultural terms. In the questionnaire each respondent has been asked whether or not they are still cultivating rice. In Tongka all of the respondents said to be cultivating rice, while in Hajak and Butong the rice cultivation has considerably decreased, as can be seen in the table below. Further interrogation of the respondents elucidated that the actual production of rice showed an even larger gap between the villages. In Tongka villagers said their rice production was more than sufficient for one year, whereas many respondents from Hajak and Butong mentioned their rice yield was not enough for a whole year. Unfortunately, the rice production has not been measured or documented.

Graph 12: Households cultivating rice



The number of households farming rice declined with 50% between the village furthest from the plantation and the village nearest to the plantation. In Hajak a drop in rice farmers can be seen as well. FGD's confirmed this decline. Villagers said that while 15 years ago all inhabitants cultivated rice, now only an estimated 60% still did so.

H0: There is no difference in the percentage of households cultivating rice in Tongka and the other villages. H=T and B=T.
H1: There is a difference in the percentage of households cultivating rice in Tongka and the other villages. H<T and B<T.

To make the analysis easier, the number 0 has been used to indicate households who do not farm rice, while the number 1 has been used to indicate those households that do farm rice. These numbers are thus categorical.

Table 12: Descriptives of households farming rice

df within groups 2								
df between groups 106				95% Confidence Interval for Mean				
Village	N	Mean	Std. Err.	Lower Bound	Upper Bound	Min.	Max.
Tongka	38	1,00	,000	1,00	1,00	1	1
Hajak	41	,61	,077	,45	,77	0	1
Butong	30	,50	,093	,31	,69	0	1
Total	109	,72	,043	,63	,80	0	1

Table 13: Significance of households farming rice

sig. ANOVA	sig. HOV	Mean difference T-H	Mean difference T-B	Dunnett's T3 H<T	Dunnett's T3 B<T
,000	,000	,39	,50	,000	,000

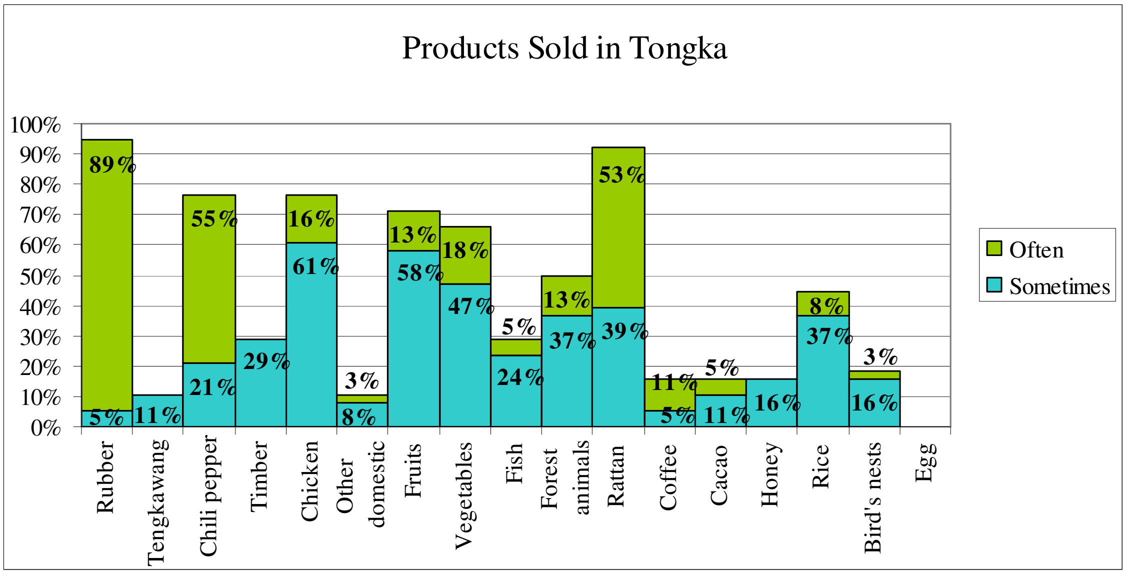
The one-way ANOVA test has been run to test whether the difference between the 3 village groups is significant at the 95% confidence level and have not occurred due to sample chance. The difference is significant and therewith the null hypothesis will be rejected. There is a significant difference in the percentage of households cultivating rice between the 3 village groups.

To see where the difference between the 3 village groups lies, a Post Hoc test has been run. A HOV test showed a significance below 5%, so that equal variances are not assumed. Therefore the Dunnett's T3 test has been run. It shows that there indeed is a significant difference between Tongka and Hajak, and between Tongka and Butong. The hypothesis that there is a difference in the percentage of households cultivating rice in Tongka and the other villages is accepted. The mean difference between Tongka and Butong is higher than the mean difference between Tongka and Hajak, which can be explained by that there are even less households farming rice in Butong than in Hajak. However, taking a look at the Dunnett's T3 test again, shows that there is no significant difference between Hajak and Butong.

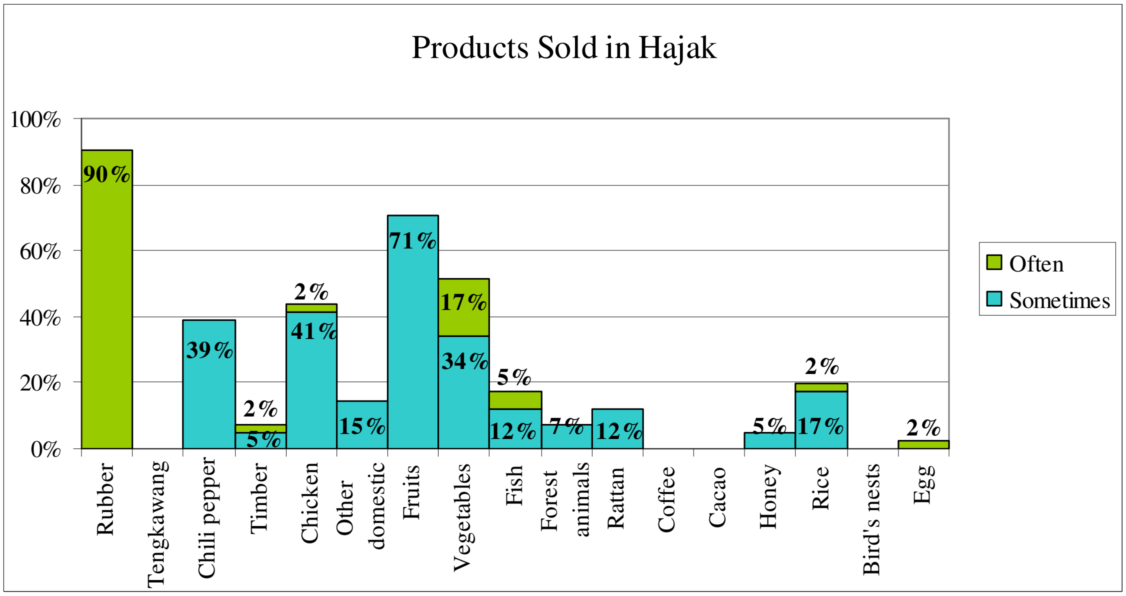
5.7 Products Sold

If less land is available, less crops are cultivated and less products can be obtained from the forest. It is therefore likely that less products are sold as well and thus income is less diverse. To be able to analyze this hypothesis, a list of frequently sold products has been made. Each respondent has been asked which of these products they sold and with what frequency (often or sometimes). The results are displayed below.

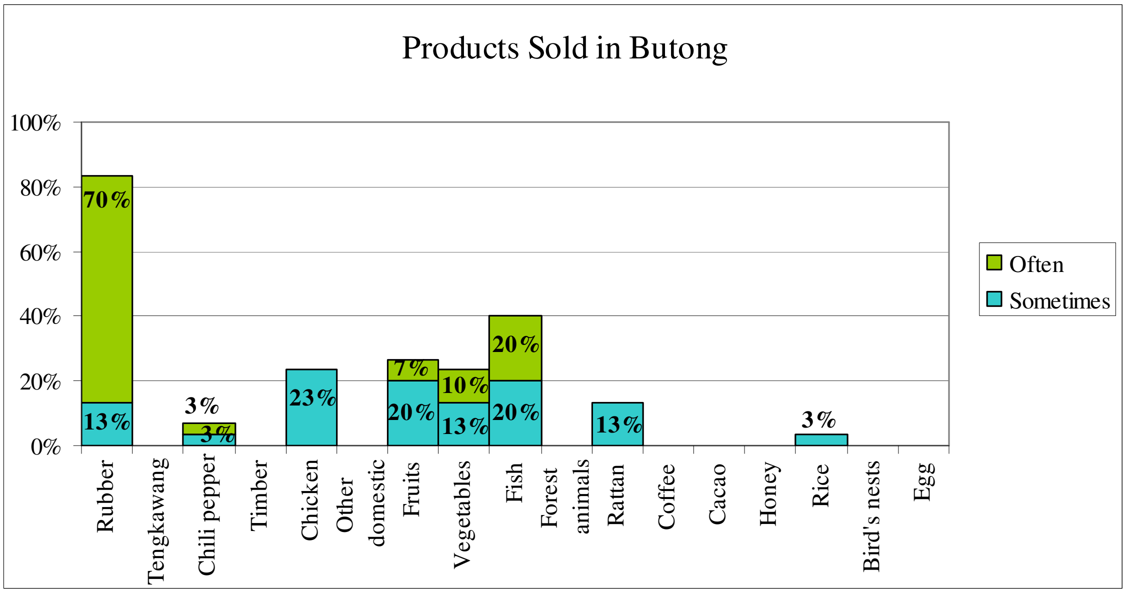
Graph 13: Products sold in Tongka



Graph 14: Products sold in Hajak



Graph 15: Products sold in Butong



If the income becomes less diverse, villagers will be relying on fewer crops. If the availability, market demand or market price of one of these crops will decrease, the villagers will have a larger impact of these fluctuations. A stable income is an important factor in food sovereignty and security, because if a household can not farm enough for their subsistence, they will have to buy foods. But without sufficient financial means, these foods can not be bought. A household can buy a substitute food, which is perhaps cheaper (such as a cheaper kind of vegetable), but not the first choice, or a household may not at all be able to buy such a food (e.g. now they are not able to eat vegetables).

To test if the difference between the means of the villages are significant, the data has summarized. If the data is not summarized, the output will calculate the difference of means for each kind of product that is sold, while it is much more interesting to see a more global picture of whether or not income diversification as a whole has changed. For this a calculation has been made of how much products each respondent sells and how often. If a product only occasionally sold, it has been given 1 point, and if a product is sold often, it has been given 2 points. If a product is not sold, no points are given. So the points each respondent gets are not only based on how many kinds of products they sell, but also on the frequency.

Table 14: Descriptives of products sold

df within groups 2							
df between groups 106				95% Confidence Interval for Mean			
Village	N	Mean	Std. Err.	Lower Bound	Upper Bound	Min.	Max.
Tongka	38	10,08	,752	8,56	11,60	1	23
Hajak	41	5,00	,403	4,19	5,81	0	14
Butong	30	3,27	,328	2,59	3,94	0	8
Total	109	6,29	,417	5,47	7,12	0	23

Table 15: Significance of products sold

sig. ANOVA	sig. HOV	Mean difference T-H	Mean difference T-B	Dunnett's T3 H<T	Dunnett's T3 B<T
,000	,001	5,08	6,81	,000	,000

H0: There is no difference in the number and frequency of products sold between Tongka and the other villages. H=T and B=T.
H1: There is a difference in the number and frequency of products sold between Tongka and the other villages. H<T and B<T.

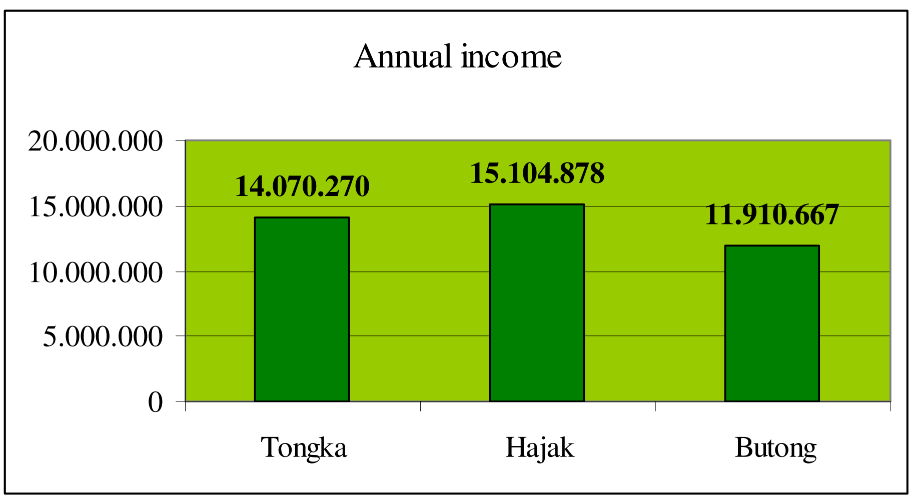
The analysis of variance shows the difference is significant and the null hypothesis is rejected. Not only are both Hajak and Butong significantly different from Tongka, from the Dunnett's T3 test (see appendix for more details) there is also a significant difference between Hajak and Butong of 0,004. From this it may be concluded that besides that the number of products sold, or income diversification, is not only affected by the presence of the oil palm plantation, but that also the distance to the plantation makes a difference.

5.8 Income

Most of the villagers get their income from selling agricultural products. If farming opportunities decrease, it is likely that income will also decrease. In the previous chapter (the indicator number of goods sold), the importance of a stable or adequate income has already been discussed.

H0: There is no difference in the annual income per household between Tongka and the other villages. T=H and T=B
H1: There is a difference in the annual income per household between Tongka and the other villages. T>H and T>B.

Graph 16: Average income per household



Note: The annual income is in Indonesian Rupiah.

Expectations were that the height of the annual income would decrease for the villages near the oil palm plantation, due to a change in number of goods sold. Based on the interviews a bar graph has been drawn of the average incomes for each village. It seems that there may be differences between the annual incomes in the villages, although not in the form H<T and B<T. Therefore it has been decided not to run the one-way ANOVA test and directly reject the research hypothesis of the indicator income.

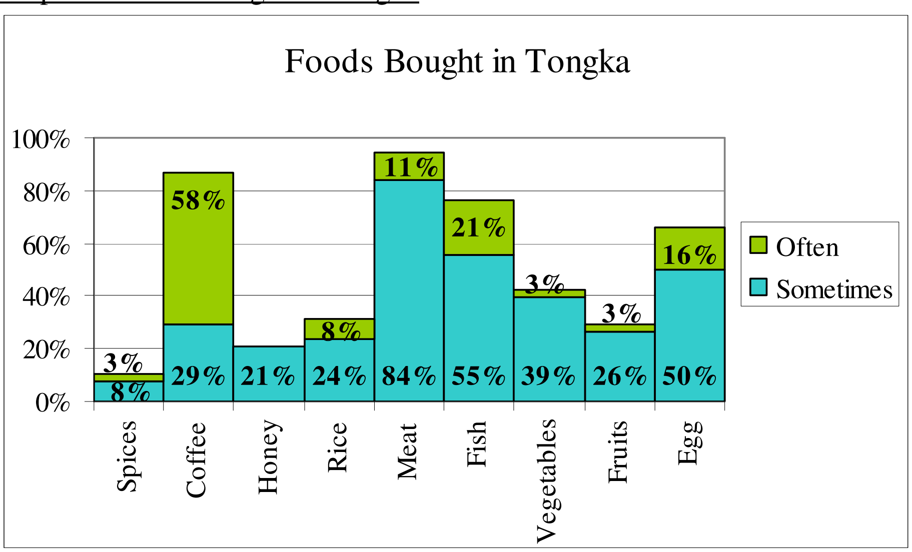
A reason why there is no difference in income, may be due to outside factors. The outside factor in this case is clear: infrastructure and therewith the access to markets to sell their agricultural products. Although Tongka doesn't have an impact from the oil palm plantation, Hajak still has a higher income. The road to Tongka is not accessible by car, while the road to Hajak is relatively good and close to the district capital city. It is still possible that the proximity of the plantation does have an influence, but in this case it is overruled by the factor access to markets.

5.9 Foods Bought

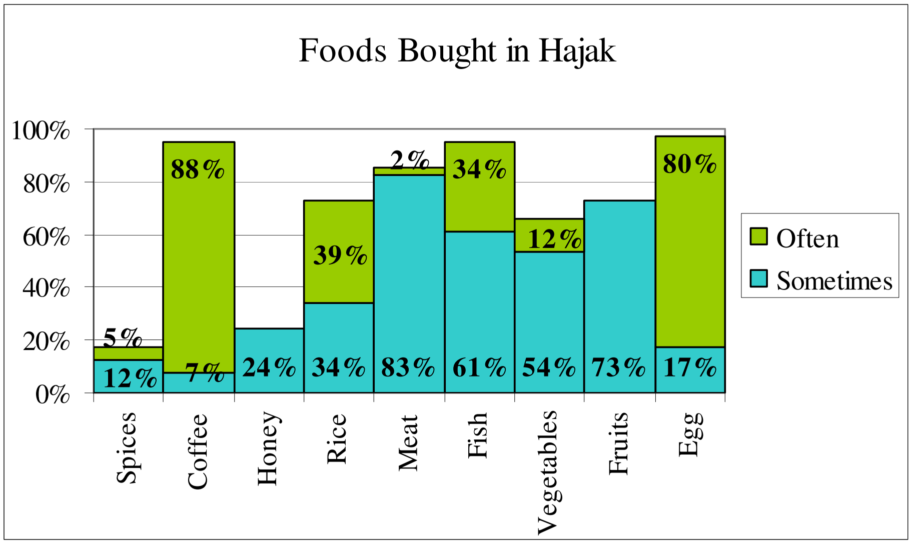
If less products are farmed, a logical effect would be that more food products have to be bought. An increase in the number of foods bought means a decline in food sovereignty, as it can not be obtained directly from farming or natural sources.

H0: There is no difference in the number and frequency of the foods bought between Tongka and the other villages. H=T and B=T.
H1: There is a difference in the number and frequency of the foods bought between Tongka and the other villages. H>T and B>T.

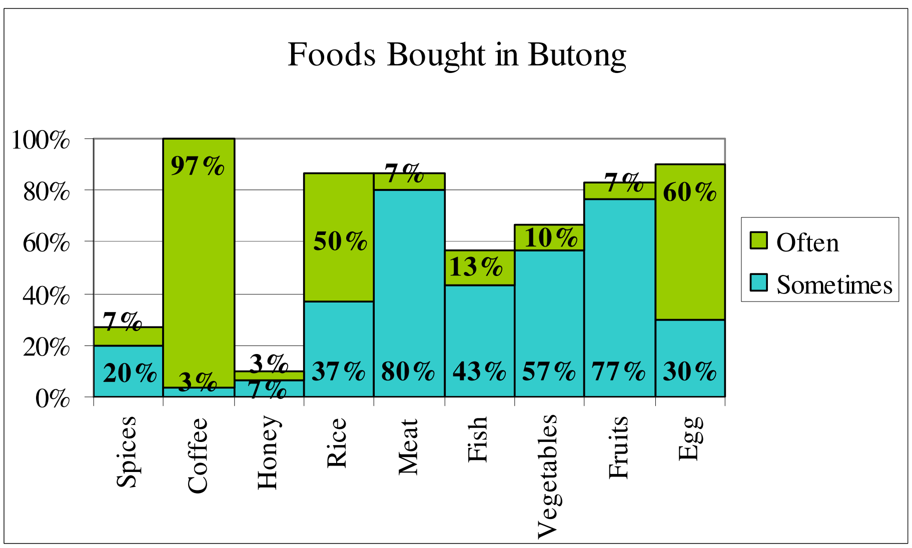
Graph 17: Foods bought in Tongka



Graph 18: Foods bought in Hajak



Graph 19: Foods bought in Butong



Again a one-way ANOVA test will be run to analyse if there is a significant difference in the number of food products bought between Tongka and the 2 villages near the plantation. The same summarization method has been used as for the indicator 'Products sold'. To give a clear image, the summarization method has been figured into a boxplot.

Graph 20: Boxplot of foods bought

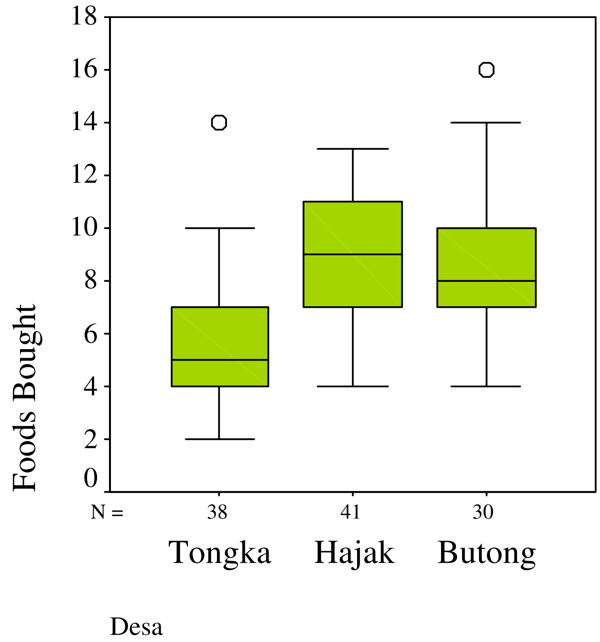


Table 16: Descriptives of foods bought

df within groups 2							
df between groups 106				95% Confidence Interval for Mean			
Village	N	Mean	Std. Err.	Lower Bound	Upper Bound	Min.	Max.
Tongka	38	5,79	,442	4,89	6,68	2	14
Hajak	41	8,88	,363	8,14	9,61	4	13
Butong	30	8,60	,456	7,67	9,53	4	16
Total	109	7,72	,275	7,18	8,27	2	16

Table 17: Significance of foods bought

sig. ANOVA	sig. HOV	Mean difference T-H	Mean difference T-B	Dunnett's t H>T	Dunnett's t B>T
,000	,667	-3,09	-2,81	,000	,000

The difference of number and frequency of foods bought between Tongka and the other 2 villages, is significant according to the tests, so that the null hypothesis is rejected. This significant difference was already expected, as less products can be obtained from the forest and farming activities. In Tongka meat can be hunted in the forest, vegetables and fruits can be plucked from the forest and rice and other crops are cultivated. In the other 2 villages it is much more difficult to hunt, because the small pieces of forest left are not so close to the housing area. Less products are cultivated, so that products previously farmed by the villagers, now have to be bought.

5.10 Food expenses

Following the indicator that more foods have to be bought, food expenses are likely to be higher in the 2 villages in proximity of the oil palm plantation, while earlier the conclusion had been drawn that there is no significant difference in income, so the financial means to buy these foods do not linearly increase. A bar graph shows the results from the questionnaire on food expenses in Tongka, Hajak and Butong. Consequently the one-way ANOVA test will be computed to see if the differences in food expenses are significant, and thus whether or not the hypothesis that food expenses between the villages differ.

H0: There is no difference in food expenses between Tongka and the other villages. H=T and B=T.
H1: There is a difference in food expenses between Tongka and the other villages. H>T and B>T.

Graph 21: Food expenses per person per year

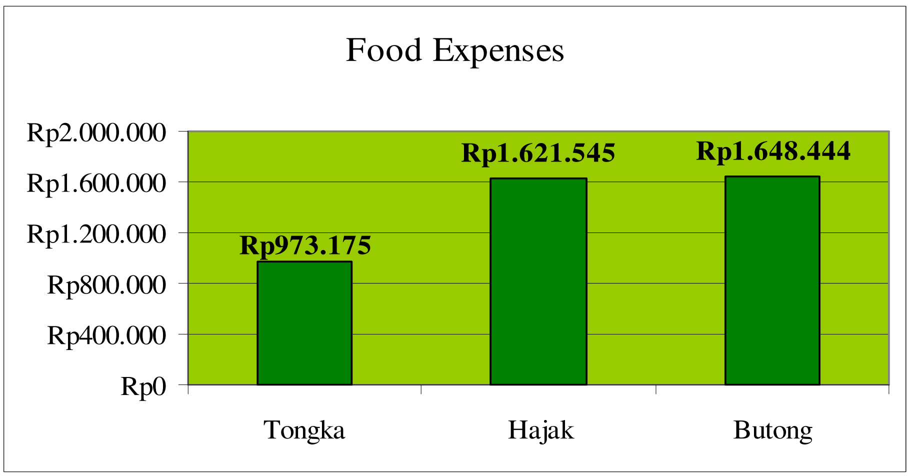


Table 18: Descriptives of food expenses

df within groups 2							
df between groups 106				95% Confidence Interval for Mean			
Village	N	Mean	Std. Err.	Lower Bound	Upper Bound	Min.	Max.
Tongka	38	961249	94395	769986	1152512	200000	2600000
Hajak	41	1621544	112560	1394050	1849038	600000	3250000
Butong	30	1648444	193381	1252935	2043953	600000	6000000
Total	109	1398753	80886	1238421	1559085	200000	6000000

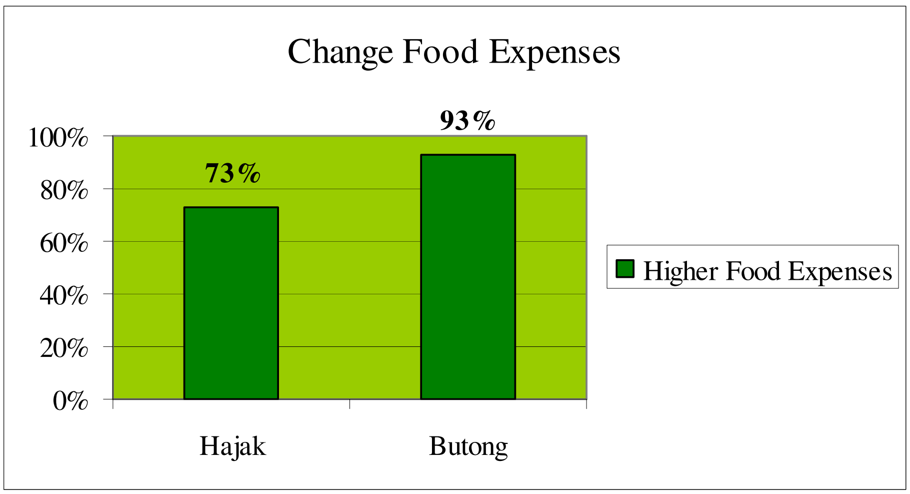
Table 19: Significance of food expenses

sig. ANOVA	sig. HOV	Mean difference T-H	Mean difference T-B	Dunnett's t H>T	Dunnett's t B>T
,000	,422	-660295	-687194	,000	,001

The one-way ANOVA test shows that the differences between the food expenses in Tongka and the food expenses in Hajak and Butong are significant at the 95% significance level, so that the null hypothesis is rejected.

To crosscheck whether food expenses have indeed changed and are not due to the market, as is the case with income, respondents from Hajak and Butong have been asked if their food expenses changed since and due to the arrival of the oil palm plantation. A 0 is used for those households who said their food expenses had not changed and a 1 is used for those households who say their food expenses have changed. From a FGD with the villagers of Tongka the conclusion was drawn that there was no significant change in food expenses for them the last 15 years (excluded the economic crisis in '97/'98). For Tongka a 0% change in food expenses has been used, by giving all the correspondents a 0.

Graph 22: Change food expenses



H0: There is no difference in perception of change of food expenses between Tongka and the other villages. H=T and B=T.
H1: There is a difference in perception of change of food expenses between Tongka and the other villages. H>T and B>T.

Table 20: Descriptives of change of food expenses

df within groups 2							
df between groups 106				95% Confidence Interval for Mean			
Village	N	Mean	Std. Err.	Lower Bound	Upper Bound	Min.	Max.
Tongka	38	,00	,000	,00	,00	0	0
Hajak	41	,73	,070	,59	,87	0	1
Butong	30	,93	,046	,84	1,03	0	1
Total	109	,53	,048	,44	,63	0	1

Table 21: Significance of change of food expenses

sig. ANOVA	sig. HOV	Mean difference T-H	Mean difference T-B	Dunnett's T3 H>T	Dunnett's T3 B>T
,000	,000	-,73	-,93	,000	,000

The one-way ANOVA test shows that there is a significant difference between the change in food expenses between Tongka and Hajak and between Tongka and Butong. The null hypothesis has been disposed and the research hypothesis is accepted. Villagers from Hajak and Butong gave different reasons for this change, such as:

- Not possible to gather NTFP's anymore, such as fruits, vegetables and hunting
- Fishing has become more difficult
- Don't have enough land to farm anymore
- Food has become more expensive

Most of these explanations lead back to lack of forest and lack of land. It is more difficult, or no longer possible, to hunt for meat or obtain fruits and vegetables from the forest. These products now have to be bought. Because there is not enough land, less people farm rice and people farm less edible crop species. A logical result of this is that they now have to buy rice and certain vegetables. Others mentioned that fishing has become more difficult, which perhaps can be related to the next two indicators concerning water. Also a few respondents from Butong mentioned that food has become more expensive. This can be due to a higher demand for foods, while the availability of foods decreased. More foods have to come from outside the village, leading to higher transportation costs. Especially in Butong transportation costs are relatively high, as all transport has to pass the river.

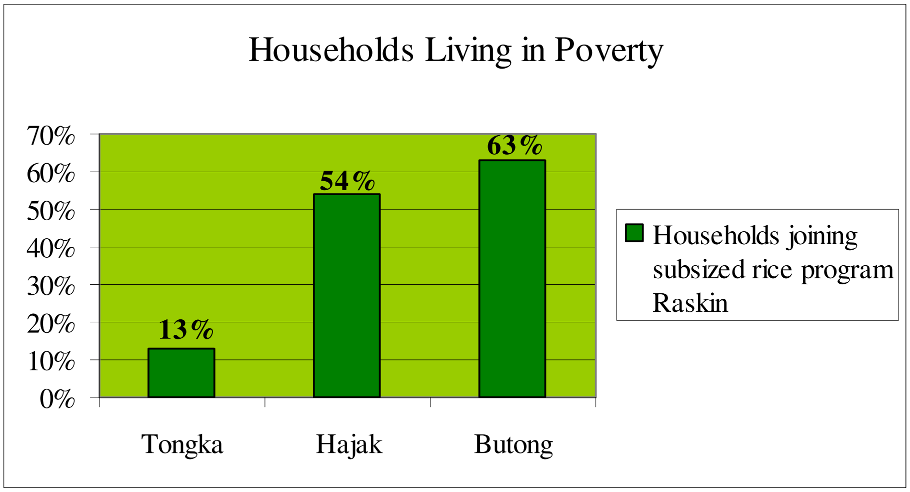
5.11 Number of households joining Raskin

Raskin is an abbreviation for *beras unuk rumah tangga miskin*, or rice for poor households. It's a governmental safety net scheme to improve food security in certain regions, targeting the archipelago's poorest families to receive a monthly amount of 10 kg rice at a subsidized price of IDR1000/kg. The majority of the rice for this program in Central Kalimantan is imported from Move Nas (Vietnam). The final responsibility for the selection of the beneficiary families is in hands of decision-makers at the village level, in general this comes down to the village head and secretary. Every village receives a specific monthly allocation of rice to supply a certain number of families. (Direktorat Jenderal Perberdayaan Masyarakat dan Desa, Departemen Dalam Negeri dengan Perum BULOG. 2007)

According to a study of Hastuti and Maxwell (2003) on the Raskin program, there is a considerable amount of 'leakage'. Many poor families did get some of the benefits of the program, but many non-poor members of the communities also obtained a share of the subsidized rice. As a result many more families are participating in the Raskin program than ever intended and households receive less than the intentional amount. Comparison of data from the regional BULOG office and data collected in the field confirms this study.

According to data from BULOG, a letter from the regent of North Barito district registered under 43/521/BKP/2007 on January 19, 2007, this year there are 136 poor households receiving subsidized rice in Tongka, equivalent to about 58% of the households, 350 poor households receiving subsidized rice in Hajak, about 31% of the households, and 80 poor households receiving subsidized rice in Butong, more or less 66% of the households. The results from the questionnaires are available in the following bar graph.

Graph 23: Households living in poverty



Considering that the data from BULOG and the actual situation are often not the same, it has been chosen not to use the BULOG data, but to ask the respondents themselves. Again, households not joining the Raskin program are given the categorical number '0' and those who do join the Raskin program are given '1'.

H0: There is no difference in the percentage of households joining Raskin between Tongka and the other villages. H=T and B=T.
H1: There is a difference in the percentage of households joining Raskin between Tongka and the other villages. H>T and B>T.

Table 22: Descriptives of households joining Raskin

df within groups 2							
df between groups 106				95% Confidence Interval for Mean			
Village	N	Mean	Std. Err.	Lower Bound	Upper Bound	Min.	Max.
Tongka	38	,13	,056	,02	,24	0	1
Hajak	41	,54	,079	,38	,70	0	1
Butong	30	,63	,089	,45	,82	0	1
Total	109	,42	,048	,33	,52	0	1

Table 23: Significance of households joining Raskin

sig. ANOVA	sig. HOV	Mean difference T-H	Mean difference T-B	Dunnett's T3 H>T	Dunnett's T3 B>T
,000	,000	-,41	,-50	,000	,000

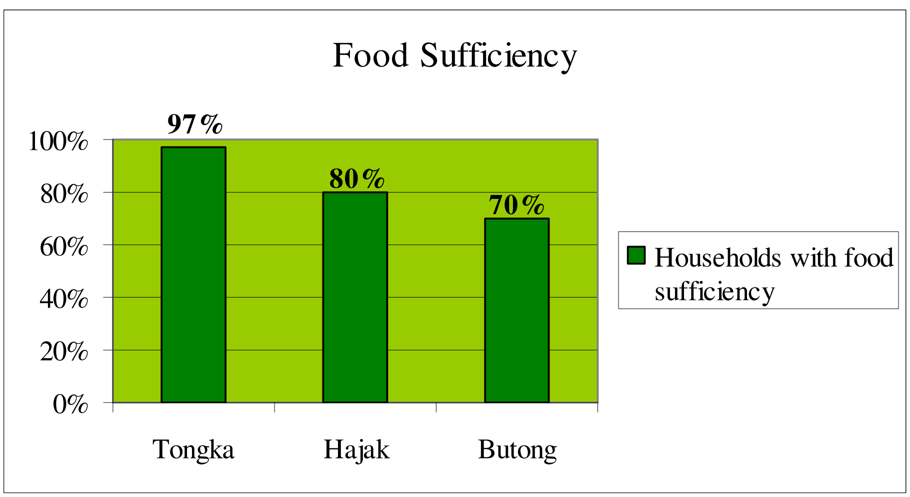
A significant difference between Tongka and the other 2 villages can be concluded. The number of people joining the Raskin program is significantly higher in villages in close proximity of the oil palm plantation. The null hypothesis is rejected. People can apply for the Raskin program if their income is not sufficient. It seems somewhat unlikely that people who cultivate rice themselves and already have sufficient rice will buy rice, although people may join the program to later sell the rice with profit. The previous chapter showed that incomes are not significantly different. Assuming that incomes are approximately the same, the main reason for more people joining the Raskin program in Hajak and Butong than in Tongka may be that less rice is farmed in those 2 villages.

5.12 Food sufficiency

Food sufficiency is an indicator that perhaps would be more suitable to food security, however it was still chosen to include this as food security is a precondition for food sovereignty. Each respondent has been asked whether they could always eat what they wanted to eat, in terms of both quantity and kinds of food. Those respondents answering yes were given the categorical number '1' and those who answered the question negatively were given the categorical number '0'.

H0: There is no difference in food sufficiency between Tongka and the other villages. H=T and B=T.
H1: There is a difference in food sufficiency between Tongka and the other villages. H<T and B<T.

Graph 24: Food sufficiency



The table shows a considerable amount of people answered this question negatively. 3% of the respondents from Tongka can not always eat what they want in the quantity they want, while in Hajak this number is 20% and in Butong even 3 out of 10 respondents can not always eat the desired foods and amounts. Main reasons for this were that they could not always eat vegetables, meat or fish, or little variety. Part of this was due to financial means, but a majority answered they had difficulties because they cultivated less vegetables, couldn't hunt in the forest anymore or because there were less fish. The significance of the difference in food sufficiency will be tested using one-way ANOVA.

Table 24: Descriptives of food sufficiency

df within groups 2							
df between groups 106				95% Confidence Interval for Mean			
Village	N	Mean	Std. Err.	Lower Bound	Upper Bound	Min.	Max.
Tongka	38	,97	,026	,92	1,03	0	1
Hajak	41	,80	,063	,68	,93	0	1
Butong	30	,70	,085	,53	,87	0	1
Total	109	,83	,036	,76	,91	0	1

Table 25: Significance of food sufficiency

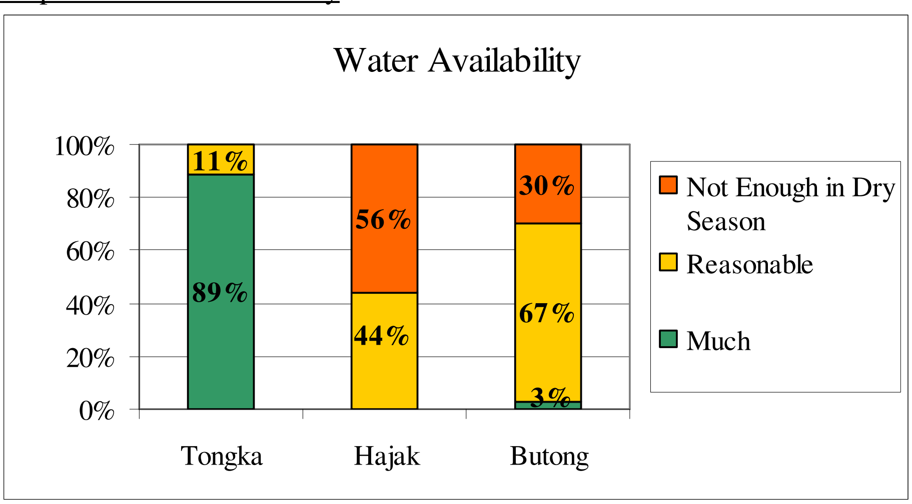
sig. ANOVA	sig. HOV	Mean difference T-H	Mean difference T-B	Dunnett's T3 H<T	Dunnett's T3 B<T
,008	,000	,17	,27	,047	0,012

Computing the one-way ANOVA test shows that there is a significant difference between Tongka and the other 2 villages and therewith enough basis to reject the null hypothesis. In both Hajak and Butong a considerable percentage of respondents are not food secure. In Butong there are 10 times more people who can not always eat the kinds of foods that they want in the quantities they want, than in Tongka.

5.13 Water availability

Deforestation may disturb hydrology and have an adverse effect on water availability. In a previous study in North Sumatra by the author of this research, it was found that many of the local people mentioned water problems since the influx of oil palm plantations. Although these findings can not be supported by a scientific study, it is interesting to examine whether the water availability has changed for the villages in proximity of the oil palm plantation.

Graph 25: Water availability



H0: There is no difference in water availability between Tongka and the other villages. H=T and B=T.
H1: There is a difference in water availability between Tongka and the other villages. H<T and B<T.

In the bar graph a change in water availability can be seen, confirming the hypothesis. To see whether this difference is significant, the one-way ANOVA has been run. To be able to use SPSS, the answers have been converted into categorical numbers, -1 standing for not enough, 0 for reasonable and 1 for much. So with a mean of close to 1 there is more than enough water available, while with a mean of 0 the water availability is reasonable and with a negative mean, there may not be enough water available (mainly in the dry season).

Table 26: Descriptives of water availability

df within groups 2							
df between groups 106				95% Confidence Interval for Mean			
Village	N	Mean	Std. Err.	Lower Bound	Upper Bound	Min.	Max.
Tongka	38	1,00	,000	1,00	1,00	1	1
Hajak	41	-,56	,078	-,72	-,40	-1	0
Butong	30	-,27	,095	-,46	-,07	-1	1
Total	109	,06	,077	-,09	,22	-1	1

Table 27: Significance of water availability

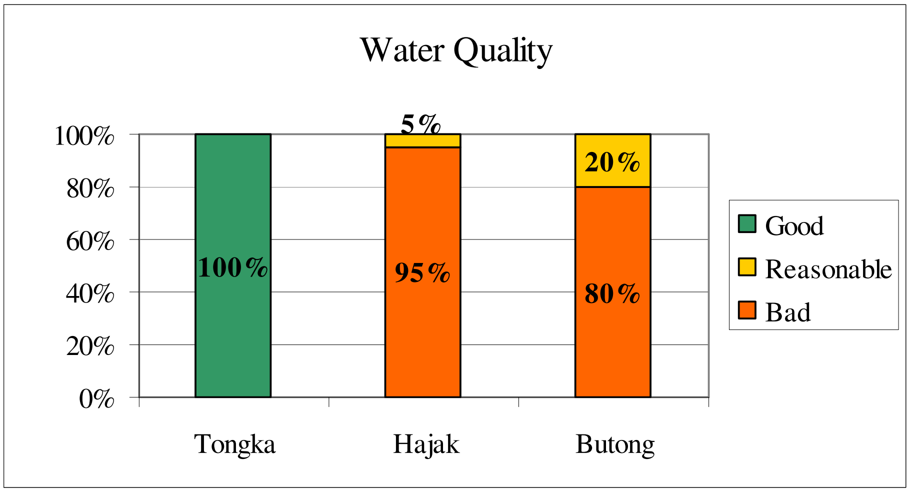
sig. ANOVA	sig. HOV	Mean difference T-H	Mean difference T-B	Dunnett's T3 H<T	Dunnett's T3 B<T
,000	,000	1,56	1,27	,000	,000

The test result verifies the difference between Tongka and the other 2 villages, and the hypothesis is accepted. In FGD’s respondents have been asked why the water availability had changed. Combined with observations, several conclusions are drawn. In Hajak wells for drinking water and smaller rivers than the Teweh river may run dry in the dry season. In Butong a lot of water is available, as Butong is located next to the longest river of Borneo. Contradictory enough, this water is too polluted to be used for drinking purposes. Drinking water comes from lakes further away from the housing area, or from wells. These wells may dry up in the dry season, so that water had to be obtained from a source further away. Most respondents considered the distance to their water source as a part of water availability.

2 possible explanations can be given for the decrease in water availability: a disturbed hydrology due to deforestation and the water requirements of the oil palm trees. Trees are planted as close as 2 meters from the Pandran river, which flows directly into the Barito river. Tree distances near other rivers have not been observed, but it is likely that the planting distances near other rivers may also be relatively close to the riverbed.

5.14 Water quality

Graph 26: Water quality



Water samples have been taken from the main rivers in Hajak and Butong and near the location of POME dumping, to test the amounts of chemicals, such as Glyphosate from the herbicide Kleenup, which is known to be used by smallholders of PT AGU, and the level of pollution by POME. However, due to misinformation these samples did not fulfil the requirements for water samples set by the laboratory. Therefore the analysis of the water quality will be based on the perception of the respondents of the 3 villages, on field observations and information compiled. A one-way ANOVA test will be run to check the hypothesis that the water quality will be lower in the villages near the plantation.

H0: There is no difference in water quality between Tongka and the other villages. H=T and B=T.
H1: There is a difference in water quality between Tongka and the other villages. H<T and B<T.

Table 28: Descriptives of water quality

df within groups 2							
df between groups 106				95% Confidence Interval for Mean			
Village	N	Mean	Std. Err.	Lower Bound	Upper Bound	Min.	Max.
Tongka	38	,89	,050	,79	1,00	0	1
Hajak	41	-,95	,034	-1,02	-,88	-1	0
Butong	30	-,80	,074	-,95	-,65	-1	0
Total	109	-,27	,087	-,44	-,09	-1	1

Table 29: Significance of water quality

sig. ANOVA	sig. HOV	Mean difference T-H	Mean difference T-B	Dunnett's T3 H<T	Dunnett's T3 B<T
,000	,000	1,85	1,69	,000	,000

The results from the test show that there is a significant difference between Tongka and the other 2 villages. The null hypothesis is rejected.

In Hajak the water quality is worse than in Butong, although Butong is closer to the plantation. It seems that upstream the Teweh river, a char coal mine is active, which may be polluting the river. In this case, the oil palm plantation is not the only reason for pollution. River pollution may be due to pesticide, herbicide and fertilizer leaking from the plantation. These chemicals can leak into the groundwater, which will eventually reach the river. According to smallholders the chemicals used include Gramasone and Kleenup (with the active ingredient glyphosate). Glyphosate can cause eczema, elevated blood pressure and allergic skin reactions, and has an effect on reproductive functions, kidney and liver, depending on the amount of intake. It has the potential to contaminate surface water through soil particles in run off. (Buffin and Jewell, 2001) It is well possible that leaking of glyphosate has an impact on the water quality.

Table 30: POME characteristics and standard discharge limits

Characteristics	POME wastewater	Maximum contents
PH	4,0-4,6	6 – 9
Temperature ºC	50-75	
Oil-grease mg/l	5,000-20,000	30
Total solids (TS) mg/l	30,000-70,000	
Suspended solids (SS) mg/l	15,000-40,000	250
Biological Oxygen Demand (BOD), mg/l	20,000-60,000	100
Chemical Oxygen Demand (COD), mg/l	40,000-120,000	500
Total Phosphate mg/l	90-140	
Total Nitrogen mg/l	500-800	

Sources: Proses operasional pabrik/Operational factory process, an internal document of Makin Group. Kep-51/MENLH/10/1995.

During field observations palm oil mill effluent (POME) dumping was detected. In the production process, for every ton of CPO produced, 5-7,5 ton of water will be used, of which about 50% ends up as POME. (Ahmed et al., 2003) With a CPO production of 3.200 tonnes per month (Radar Sampit, August 11, 2007), some 10.000 tonnes of POME are estimated to enter the Barito river every month. This wastewater can cause severe pollution of waterways due to its high oxygen demand and other related effects. (Ahmed et al., 2003) In more practical words, this means that the POME will demand oxygen, that fish and other aquatic forms of life may not have enough oxygen anymore. Monitoring data from the Riau-based institute Elang confirms this, reporting many cases of vast amounts of death fish. Direct dumping of this water in to the Barito river is likely to have an effect on the villages downstream. However, Butong is situated upstream of the location where the POME enters the river and villagers of Hajak get their drinking water from another river. Probably the dumping of POME does not have an affect on the studied villages, but may have a serious effect on other villages in the area.

A local tabloid has already published an investigation of this dumping (Berita Metro, edition 58, 2007), but the management of PT AGU denies this. In an interview, the general manager of PT AGU in Butong, Wahyudi, said that the POME is currently used as a fertilizer for the gardens of people living on the plantation. For verification, several people living on the plantation have been asked about this, but they said only EFB were used as a fertilizer for their gardens. During a short tour through the CPO mill, engineering staff of PT AGU said that all the POME was being recycled at this moment. Statements of the plantation management and field observation are contradictory on the issue of POME dumping.

Wahyudi also stated in 2008 the POME will be recycled. Again, field observations were not necessarily in line with his words. Wooden poles running straight from the CPO mill to the river were detected, of which local people said a new pipeline would be made. It is possible that this pipe is a new course to dump POME, as the current dumping location is already detected and made public.

Although dumping of POME perhaps is not relevant for the case study of these 3 villages, it is likely to have an impact on other villages near the plantation. The impact of the oil palm plantation may be wider than the villages studied. It is advisable to further study the effect of this POME dumping on villages downstream of the CPO mill.

Conclusions

This research aimed to find out how the presence of an oil palm plantation affected the local food sovereignty. From field observations, questionnaires and discussion groups with the local communities, it can be concluded that the oil palm plantation of PT AGU has a significant (95% probability) impact on:

- Forest availability
- Land availability
- Length of the fallow period in shifting cultivation
- Soil fertility
- Diversity of crop cultivation
- Percentage of households cultivating rice
- Diversity of products sold
- Food bought
- Food expenses
- Percentage of households joining the subsidized rice program Raskin
- Kind and amount of food consumed
- Water availability
- Water quality

Forest and land availability have been greatly reduced, making it more difficult for the local communities to obtain NTFP's and leading to a lack of farming lands. As there are not enough farming lands, farming has become more intensive. The same lands are used continuously, so that the soil does not have enough time to regain fertility. As there is not enough arable land, many people have given up rice farming and a linear regression can be seen in the diversity of crops cultivated in relation to the proximity of the plantation. Since NTFP's are much harder to obtain and fewer products are cultivated, the diversity of the products sold decreases. Availability of, and access to foods such as meat, vegetables and fruits has declined, so that more food has to be bought, leading to higher food expenses. More people join the governmental rice program Raskin, but still a considerable percentage of people living near the plantation can not always eat what they want in the amounts that they want. Villages located in proximity of the oil palm plantation have a lower water quality than those without oil palm, it is more difficult to find clean water.

The conclusion can be drawn that local food sovereignty has obviously declined for the villages located in proximity of the oil palm plantation. Where a diversity of subsistence foods used to be cultivated, now only the export crop oil palm is grown; a shift from subsistence foods to export goods.

It seems many of the indicators are interlinked and correlated. If one of these indicators changes, this will often affect one or more other indicators as well.

The indigenous people are losing their food sovereignty, and in some cases even their food security. This also has a big impact on the livelihood, socio-cultural aspects and traditions of the indigenous people. The loss of food sovereignty may have an impact on public health, which is affected by the lack of clean water, the low diversity of the diet and the availability of foods for lower income classes. The context of poverty changes as well, where poverty used to be poverty in purely economic terms, there is now poverty in terms of social structure, natural resources, food and autonomy.

Recommendations

Lately licenses for some 159.849 ha have been given out for oil palm plantation development. Considering the results of this study, expanding the plantation area is likely to have an even higher impact on the local food sovereignty. Development of oil palm plantations should not be continuously insisted upon by the (local) government, as this does not seem to bring economic development to the indigenous people, but paradoxically threatens the local food situation. There are alternatives for generating income for both government and the indigenous people in a way which better fits with the culture of Dayak Leungan.

Since this study shows that the foremost impact on food sovereignty comes from competition for land resources, better land planning should be the main focus. Plantations should be planned outside of village lands. Here the first problem arises, as village boundaries are often not known or mapped and concessions seem to be given out without prior consultation of the local communities affected. The most apparent solution for this would be to document all the village grounds, which could be done with the help of several Indonesian NGO's, but here a second problem arises. Village grounds are based on historical and socio-cultural user rights (referred to as *adat*), rather than on official land tenure. Most villagers do not possess land ownership certificates and do not have the financial means to buy these, so often governmental institutions do not acknowledge this ownership. To solve this issue, the government should start to acknowledge the existence of *adat* laws and ownership. Considering the ambiguous character of Indonesian laws, such as the 1945 Constitution, the Basic Agrarian Law and the Basic Forestry Law, this is not realistic on the national level, but can be started on district level. It can be as easy and practical as accepting the village boundaries of the indigenous communities, registering the land in the land register (but not necessarily with certification) and not giving out location licenses to oil palm plantations on those lands (nor to mining companies, which also apparently cause a considerable problem in North Barito). The district government is the first institution in the sequence of obtaining licenses to open a plantation, so if the district government does not give out any licenses, village farming lands will be protected.

Small scale rubber plantations are better suited for the local communities than large scale oil palm plantations, in both economic as well as socio-cultural terms. Local people are more accustomed to these rubber plantations, which are also called jungle forests. In addition small scale rubber does not seem to have a negative impact on the local food sovereignty. The easiness in which these trees can be combined with agriculture, much more complies with the way of life of Dayak Leungan. If local infrastructure is improved, rubber and other farming products can be sold more easily and with less transportation costs, while more tax revenues can be obtained from the trade. This could be a win-win situation for both government and local communities, as better infrastructure will also support access to education, health services and other facilities.

Interests and inclusion of future generations is also part of food sovereignty. Therefore it is important to preserve and protect regions with a high natural value and areas that are used for farming. This includes idle lands, which may not be used for farming activities at this very moment, but are likely to be used in the near future. Participatory land use planning starting on grass-root level, may help to prevent the conversion of idle lands. Local communities can be contracted to manage the lands, in the way they have always done before. A means of revenues from these lands can be carbon sequestering under the Kyoto Protocol Clean

Development Mechanism (CDM). According to an article recently published in the national newspaper Jakarta Post (Thoumi and Butler, 2007), selling carbon credits from the avoided deforestation can be more rewarding than oil palm plantations. In economic terms the tax revenues can be 10 times greater, while in environmental and socio-cultural terms the benefits will also largely outrun oil palm. In fact it is likely that food sovereignty will not be affected at all and will even be protected on the longer term.

This forest management in the form of carbon credit trade also has a second advantage. If the local government opposes oil palm on village farming lands, forests may not protected in the same way. Concessions and licenses on forest lands are given out on a higher level by the Forestry Department, which overrules the power of the district government. But by giving the forest this purpose, the forest are no longer available for plantation purposes.

With these reforms at the governmental level, oil palm plantation development will no longer have an impact on the local communities, while government profits would not necessarily decline, but could even rise.

During the field study it became clear that not only food sovereignty is affected by the presence of the oil palm plantation, but also many other aspects of life. Part of this is through correlation of the studied indicators with facets such as culture, traditions, social aspects and autonomy. Further research is suggested to study the correlation of the different impacts.

Oil palm plantations should no longer expand in North Barito. Focus should be on long term sustainable development involving the local communities instead of short term profits for investors from outside the area. It would be wise to consider not expanding oil palm in North Barito district, since hardly any benefits for the local communities are observed.

Even though oil palm plantations have proven to have a negative impact on the local food sovereignty, are not fit to the cultural identity of Dayak Leungan and may not bring as much revenues as other forms of land use, the local government may still decide to expand the oil palm area –which is absolutely not advisable. In this case, some options are provided to lower the impact of these oil palm plantations on the environment and indigenous communities surrounding the plantation.

It is advisable for the government to set up stricter rules to obtain licenses for the existing plantations or any future plantations, to prevent possible conflicts. Licenses should be renewed annually, to motivate oil palm plantation companies to stick to these rules, and moreover, these regulations should be better regulated. If a company does not operate in line with the obligations, fines have to be paid, which will be higher if a rule repeatedly has not been followed. These rules include the distance trees are planted from water resources. If the trees are further away from waterways, it is less likely that herbicides, pesticides and fertilizer will leak in such amounts dangerous to human health and aquatic environment. If these areas are left forest or replanted, the vegetation will support the hydrology, contributing to sustenance of the water availability, so that floodings and droughts are less likely to occur.

Wastewater, or POME dumping, from the CPO mill is a second source of serious pollution. However, it is possible to recycle this POME and use it as a fertilizer. Pesticide use can also be limited by using barn owls (Tyto alba) to control the rat population. Consultation with PT AGU has revealed that these activities are not yet utilized. To prevent competition on root level (water and nutrients), small corridors of secondary forest can be planted surrounding the plantation area. These corridors, bufferzones which can be as small as 20 meter, will also reduce the influence of chemicals on neighbouring lands. The bufferzones will be considered part of the plantation area.

Governmental income can be obtained from tax revenues. Tax policies can become much more effective, such as the obligation for a main office within the district. At the moment the main office is located in Jakarta, so that Jakarta receives the tax revenues. Trucks and cars are owned by PT Wahana Surya Perkasi, a company based in Surabaya, and thus have a number plate originating from East Java. Again, tax revenues do not stay in North Barito district, while it is the natural resources of that particular district that are exploited.

For the development of new plantations, better land use planning can help lower the impact of the plantation on local food sovereignty and security. Communication with plantation workers and smallholders showed that it is very difficult to get fresh foods on the plantation. If the area is planned well enough, farming lands can surround the plantation area. Villages surrounding the plantation can cultivate crops here, a part for their subsistence and another part to sell. If the infrastructure is good enough, a market is close and easy accessible to them.

There are several reasons why market forces have not yet made this happen:

- Some villagers simply do not know that there is a high demand on the plantation. For example in Tongka, people sold their hot chilli peppers for Rp. 5.500/kg in June, while on the weekly market on the plantation, the price had increased to Rp. 60.000/kg. If people knew about this demand, they could have sold it directly themselves on the plantation market.
- Bad infrastructure between the farming lands and the plantation.
- There is not enough land to farm.
- People do not dare to farm on lands near the plantation area, because they have the insecurity that these lands may soon be converted to oil palm and they may lose their trees and yields.

It seems that guidance from the government and plantation company is needed, such as the incentives to improve infrastructure and give villagers the security that the farming land will not be converted to oil palm. This last recommendation of farming lands can be part of the corporate social responsibility of the oil palm company.

However, about the last recommendation still some concern exists. Pesticides and herbicides may leak from the plantation to the farming fields and this form of farming may still be too intensive and therewith not fit to the socio-cultural characteristics of the indigenous people.

Discussion

Right to land, fundamental in the concept of food sovereignty, is much more comprehensive than just mere land. So does this study show: right to land is strongly related to forest destruction, water resources, pollution, soil fertility, loss of fish and game, and therewith to sustainable permanent livelihood. Arable land, forest and clean water resources are vital to the life to the Dayak Leungan people, because fishing, farming –slash and burn production systems, not intensive farming- and NTFP gathering are their way of life. But if traditional user rights are denied, so is access to resources essential to continue this way of life.

Slash and burn activities are part of the culture and Kaharingan religion of Dayak Leungan people, where its importance and customariness is shown by their customs and the cultural and religious activities carried out regularly and for many generations, such as offerings, rice harvest ceremonies and taboos. The presence of oil palm plantations interferes with this traditional way of life. Imagine the impact of river pollution, if the river is the main source of water, used to drink, to bathe, to swim, to meet, to fish, to wash the food, to clean the dishes and for sanitary purposes.

The indigenous people are forced to change the structure of their life and their production system, but are given no means to change. By loss of land, forest and access to clean water, they can no longer choose their own production system, which has been developed over many generations. And this choice is the core of food sovereignty.

This research has tried to focus on local food sovereignty, but different indicators of local food sovereignty are correlated with many other impacts of the oil palm plantation, such as culture, traditions, social aspects and autonomy. Let it be clear that not only food sovereignty is affected, but that the impacts are far wider than this.

Domestic prices of palm oil continue to rise, while oil palm plantations keep expanding. Indigenous people receive minimal compensation for land and seem to be paying the costs of the expansion in terms of impact on their livelihood.

It is time to ask ourselves, is conversion of forest and lands of indigenous people to expand oil palm plantations really such a good idea, when the negative impacts are higher than the supposed advantages? Should production of food and fuel for the international market be at the expense of local food sovereignty? Subsistence foods or export goods?

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Appendices

Maliau

In cooperation with the Dutch government, in 1953 a *sawah* (wet rice fields) project for the villagers of Butong officially commenced. The area of this project was former swamp forest and consisted of 400 ha, later to be expanded to 600 ha. A system with dams and small creeks had been formed to irrigate the paddy fields. Until the year 2003 this land has been used by the villagers to cultivate rice. By the year 2003 and 2004 this land had been cleared by PT AGU and young palm trees were planted on these 600 ha. At the moment the villagers of Butong are having difficulties to find land to cultivate rice or other crops and rice production has extremely gone down. Only part of the villagers still cultivate rice, although often the production is not enough to supply a whole family with rice until the next harvest, so that most of the villagers have to buy rice at this moment.

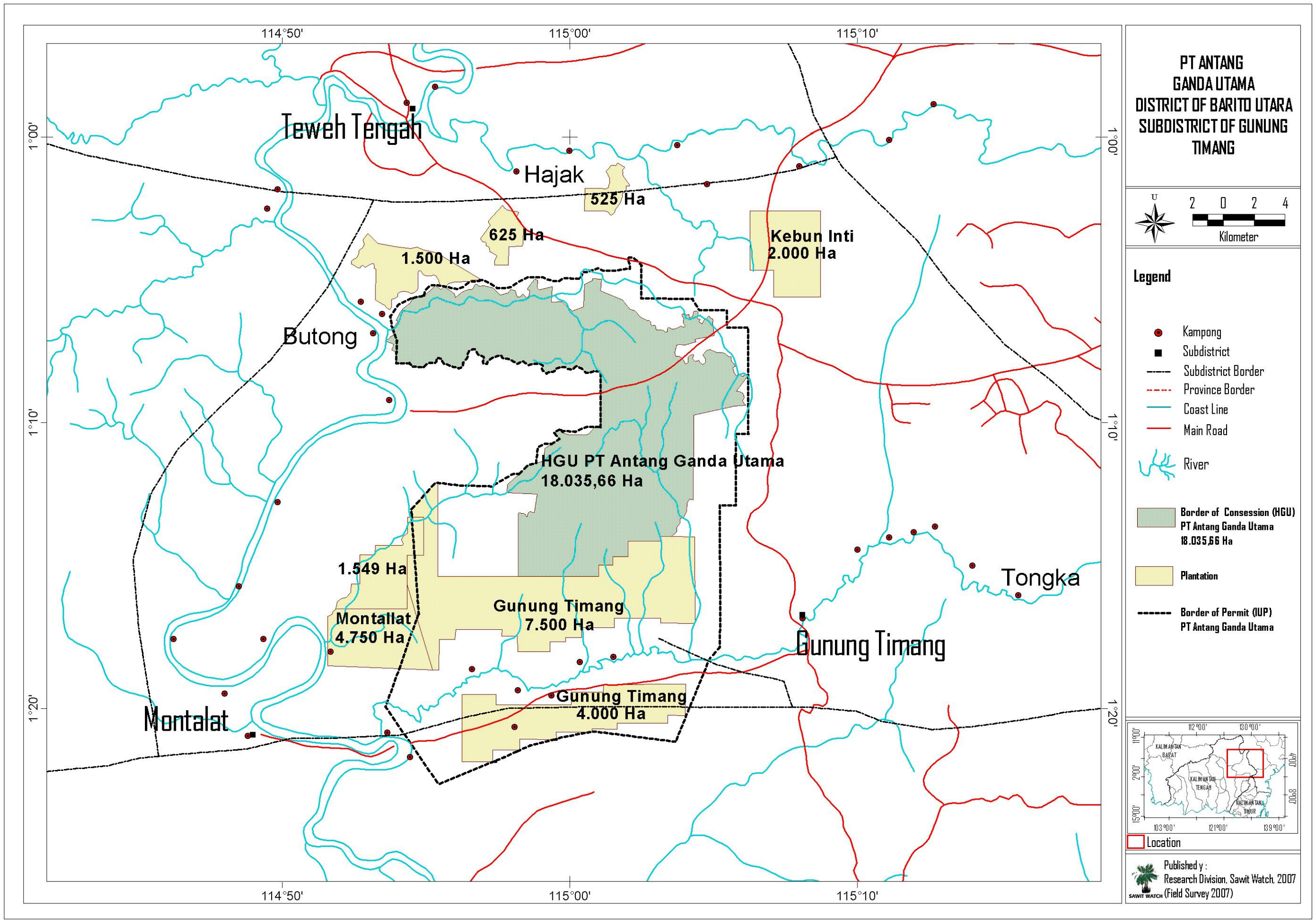
Village profile

Topic	Research location		
	Tongka	Hajak	Butong
Demographic structure			
Population	805 (410 male, 395 female)	3595 (1686 male, 1909 female)	569
Number of households	235	814	121
Average family size	3,4	4,4	4,7
Occupation	Farmer	Farmer	Farmer and some plantation workers
Socio-economic structure of community	Quite homogenous	Less homogenous	Less homogenous
Migration patterns	Transmigrant village, 17km from the housing area. Urbanisation, but not significant.	Migration of men. If a man gets married with someone from outside the village, according to *adat* laws, he will have to live with his parents in law.	
Physical aspects			
Housing area	about 30.000m2		
Infrastructure	Geasfalteerde road in bad condition, not accessible by car	Reasonable access by road, near district capital city	Accessible from the river
Distance from district capital city Muara Teweh	84km	14km	43km
Distance from head office plantation	54km	21km	12km
Drinking water sources	River	River; Well	River; Well

Transportation	Motorcycle, sometimes small boats and canoes	Motorcycle	Small boats and motorcycle
Communication system	not available	mobile phone signal	mobile phone signal
Access to markets	difficult, due to bad state of the road	Relatively easy	Moderate, transport by boat and motorcycle
Electricity	private generators, which are only used if the oil price is low	electricity at night	private generators, which are only used if the oil price is low
Schools	Primary school in village, high school 22km	Primary and junior high school in village, high school 6km	Primary school in village, junior high school 10km, high school 36km
Number of shops	4 shops	30 shops	4 shops
Agricultural system			
Ecological setting	primary forest, slash and burn secondary forest, mixed agroforest and farm lands	secondary forest, mixed agroforest, farm lands	About 400 ha of patches of protected secondary forest somewhat far from the village grounds, mixed agroforest (rubber) about 90 ha. Some fruit trees and farm lands.
Major type of land	Uplands and hilly area	lowlands	lowlands
Existing farming systems	slash and burn practices	Shifting cultivation on the same plots of land	Rather intensive farming
Major subsistence crops	Rice	Rice	Some rice
Major cash crops	Rubber, rattan and chilli	Rubber	Rubber
Fish pounds	From the river	From the river	River Barito, river Butong and several lakes (Muara, Besar, Dulan, Oge)
Land			
Land use	forest and farm lands	Housing, rubber, some farming	Housing, rubber, some

			farming
Land ownership	Communal forest, *Sipung* lands and private farming land	Partly communal forest and private lands	Private farming lands and protected forest
Land inheriting system	Land inherited from parents and possibility to open up forest for new farming lands. Ownership by planting.	Land inherited from parents or bought	Land inherited from parents or bought
Economic			
Main sources of income	Rubber, rattan and chilli	Rubber	Rubber
Institutions and organisations			
Rural institutions and organisations	Aliansi Masyarakat Adat	Aliansi Masyarakat Adat	2 rubber tapping organisations
Religion and culture			
Mosques and churches	protestant church and mosque	8 churches, 3 mosques and one kaharingan house	2 churches
Application of customary laws	Customs still strong, but outside influences on youth. Well-known, well-maintained and effective. Cooperation important, but personal customary sanctions more difficult to apply	Nearness to the capital city has some influence. Still some customs, but sanctions are hardly ever applied.	
Major tribe	Dayak Tawoyan	Dayak Tawoyan	Dayak Dasun Bayan
Religion	Kaharingan 59%, islam 35%, protestant 6%	Animism 52%, Protestant 24%, Catholic 14%, Islam 10%	Catholic 85%, Protestant 11%, Kaharingan 8%, Islam 1%

Map of PT AGU



114°50'
115°00'
115°10'
1°00'
1°10'
1°20'
Teweh Tengah
Hajak
525 Ha
625 Ha
1.500 Ha
Kebun Inti
2.000 Ha
Butong
HGU PT Antang Ganda Utama
18.035,66 Ha
1.549 Ha
Montallat
4.750 Ha
Gunung Timang
7.500 Ha
Gunung Timang
4.000 Ha
Tongka
Gunung Timang
Montalat
PT ANTANG
GANDA UTAMA
DISTRICT OF BARITO UTARA
SUBDISTRICT OF GUNUNG
TIMANG
U
2 0 2 4
Kilometer
Legend
Kampong
Subdistrict
Subdistrict Border
Province Border
Coast Line
Main Road
River
Border of Consession (HGU)
PT Antang Ganda Utama
18.035,66 Ha
Plantation
Border of Permit (IUP)
PT Antang Ganda Utama
KALIMANTAN BARAT
KALIMANTAN TENGAH
KALIMANTAN TIMUR
Location
Published y :
Research Division, Sawit Watch, 2007
(Field Survey 2007)
SAWIT WATCH

Land use types

Land has several uses for the indigenous peoples in the research area. The most important land uses are explained and their output or services are mentioned.

Lumut Mountain and Payuyang mountain
An important sacred place for Dayak Teboyan practising kaharingan religion in North Barito district is Lumut mountain. The mountain is considered to be a rest place for departed souls. Payuyang mountain serves the same purpose, it is considered a place where the spirits live. In funeral ceremonies spirits are guided to these mountains. These mountains are protected and may not be disturbed, as this may anger the spirits, which for example may lead to natural disasters. The latter can be explained in an ecological matter, as Lumut mountain forms up the water catchment area that streams into the Barito river. Products and services from these mountains include:

- Cultural value
- Water catchment area

Reserve forest
This communal forest area is protected by customary law and may be set aside for future generations. One can use the forest for hunting purposes or to harvest NTFP's on a sustainable basis, but one may not exploit the forest in such a way that it may damage the forest. Often these reserve forests are still primary tropical rainforest. Products and services of the reserve forest include:

- Natural forest rattan
- Hunting animals
- Medicines
- Materials for ceremonial use
- Honey
- Timber species for construction, such as iron wood and meranti
- Fruits
- Vegetables
- Swallow nests
- Damar resin

Annual crop area
After forest is slashed and burned, annual crops may be planted, mostly dryland rice. From the so-called padi fields the following products can be obtained:

- Rice
- Ketan rice
- Vegetables

Perennial mixed agroforest
These agroforestry plots are often partially planted after rice cultivation. Main species found in these agroforests can be rattan, fruit trees, construction wood and firewood.

Jungle rubber
After the forest is cleared and rice is cultivated often local variety rubber trees are planted as a cash crop. Rubber competes with regrowth of natural forest. This adapted system of slash and burn is multi-strata, as rubber mixed with different annual crops, rattan and with useful trees

that provide fruits, nuts, resins, timber and other products. Because of this diversity of crops, it also provides a diverse income and subsistence. Due to its high equivalence to secondary forest in terms of biodiversity and structure, these forest fallows are often referred to as "jungle rubber". According to de Foresta (1992) in resemblance of natural forest, it also keeps soil fertility and quality (structure of the soil) and maintains hydrology. Products and services that can be obtained from these mixed agroforests include:

- Rubber
- Rattan
- Coffee
- Fruits
- Nuts
- Medicinal plants
- Vegetables

Modified forest area/secondary forest

After one or two cycles of rice cultivation, fertility decreases and weed competition increases, resulting in lower yields and higher labour inputs. Rather than to cultivate the same plot again, farmers prefer to clear another plot and allow the forest to regrow on the abandoned fields.

These secondary forests can become an important source for NTFP collection. Products and services that can be obtained from these secondary forests include:

- Construction wood
- Firewood
- Bamboo and rattan
- Hunting animals
- Materials for ceremonial use
- Vegetables
- Fruits
- Nuts
- Medicinal plants
- Handicraft materials
- Honey

Water sources

Rivers, lakes and fish pounds provide local people with a variety of services, amongst others:

- Fishing
- Drinking water
- Washing
- Playground
- Meeting area
- Cleaning for cooking
- Sanitary

Housing area

These are the actual village grounds where the people live if they are not working in their fields. It is used for housing, home gardens, meeting area and trade.

Questionnaires

Questionnaire Tongka

Number:
Village:
Name:
Year of birth:
Place of birth:
Sex:
Household size:
Religion:
Last education:
Job:
Loan:
Savings:

Land

3. How much land is available?
4. How much land is available for farming?
5. How much forest is left in your village area?
6. Do you use fertilizer?
7. Is your land fertile?
8. If not, why not?

Farming

9. On average, how many years does your farming land lie idle before you will use it again? (length of shifting cultivation cycle)
10. How many edible crops do you cultivate?

Water

11. How is the quality of your water source?
12. How is the availability of water?
13. If the quality of your water source is bad or there is a lack of water, why is that?

Income

14. How high is your weekly or monthly income?

Sales
Fill in table on products sold.

Buying
Fill in the table on food products that are usually bought.

Food

15. Can you always eat what you want (species and amount)?
16. If not, why?
17. How much money do you spend on food? (per day, week or month)
18. Have your food expenses changed since there is oil palm near your village?

19. Do you join the Beras Miskin government program?
20. If so, how much rice does your household receive per month?

Questionnaire Butong and Hajak

Number:
Village:
Name:
Year of birth:
Place of birth:
Sex:
Household size:
Religion:
Last education:
Job:
Loan:
Savings:

Land

21. How much land is available?
22. How much land is available for farming?
23. How much forest is left in your village area?
24. Do you use fertilizer?
25. Is your land fertile?
26. If not, why not?

Farming

27. On average, how many years does your farming land lie idle before you will use it again? (length of shifting cultivation cycle)
28. Has the length of this shifting cultivation cycle changed since the arrival of PT AGU?
29. If it changed, why?
30. How many edible crops do you cultivate?
31. Has the number of edible crop species you cultivate changed since there is oil palm in the area?
32. If it changed, why?

Water

33. How is the quality of your water source?
34. How is the availability of water?
35. If the quality of your water source is bad or there is a lack of water, why is that?

Income

36. How high is your weekly or monthly income?
37. Has your income changed?
38. If it has changed, why?

Sales

Fill in table on products sold.

Buying
Fill in the table on food products that are usually bought.

Food

39. Can you always eat what you want (species and amount)?
40. If not, why?
41. How much money do you spend on food? (per day, week or month)
42. Do you spend more or less money on food than before the arrival of PT AGU?
43. If you spend more or less money on food, why?
44. Do you join the Beras Miskin government program?
45. If so, how much rice does your household receive per month?

Gender respondents

Gender of the respondents in numbers

Village	Male	Female	Total
Tongka	21	17	38
Hajak	26	15	41
Butong	18	12	30
Total	65	44	109

Gender of the respondents in percentages

Village	Male	Female	Total
Tongka	55%	45%	100%
Hajak	63%	37%	100%
Butong	60%	40%	100%
Total	60%	40%	100%

Descriptions

Shifting cultivation cycle

ANOVA of shifting cultivation cycle

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	78,322	2	39,161	22,853	,000
Within Groups	181,641	106	1,714		
Total	259,963	108			

Test of Homogeneity of Variances of shifting cultivation cycle

Levene Statistic	df1	df2	Sig.
,291	2	106	,748

Post Hoc test of shifting cultivation cycle
Dunnett t (<control)

(I) VILLAGE	(J) VILLAGE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval
					Upper Bound
Hajak	Tongka	-1,40(*)	,295	,000	-,82
Butong	Tongka	-2,08(*)	,320	,000	-1,46

The mean difference is significant at the .05 level.

Soil fertility

Descriptives of soil fertility

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Tongka	38	1,00	,000	,000	1,00	1,00	1	1
Hajak	41	-,34	,480	,075	-,49	-,19	-1	0
Butong	30	-,93	,254	,046	-1,03	-,84	-1	0
Total	109	-,04	,860	,082	-,20	,14	-1	1

ANOVA of soil fertility

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	68,767	2	34,384	328,756	,000
Within Groups	11,086	106	,105		
Total	79,853	108			

Test of Homogeneity of Variance of soil fertility

Levene Statistic	df1	df2	Sig.
96,649	2	106	,000

Post Hoc test of soil fertility
Dunnett's T3

(I) VILLAGE	(J) VILLAGE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Tongka	Hajak	1,34(*)	,075	,000	1,15	1,53
	Butong	1,93(*)	,046	,000	1,82	2,05
Hajak	Tongka	-1,34(*)	,075	,000	-1,53	-1,15
	Butong	,59(*)	,088	,000	,38	,81
Butong	Tongka	-1,93(*)	,046	,000	-2,05	-1,82
	Hajak	-,59(*)	,088	,000	-,81	-,38

* The mean difference is significant at the .05 level.

Fertilizer use

Descriptives of Fertilizer use

	N	Mean	Std. Deviation	S Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Tongka	38	,21	,413	,067	,07	,35	0	1
Hajak	41	-,02	,156	,024	-,07	,02	-1	0
Butong	30	,53	,507	,093	,34	,72	0	1
Total	109	,21	,432	,041	,13	,29	-1	1

ANOVA of Fertilizer use

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5,389	2	2,694	19,352	,000
Within Groups	14,758	106	,139		
Total	20,147	108			

Test of Homogeneity of Variance of Fertilizer use

Levene Statistic	df1	df2	Sig.
65,227	2	106	,000

Post Hoc test of Fertilizer use

Dunnett's T3

(I) VILLAGE	(J) VILLAGE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Tongka	Hajak	,23(*)	,071	,006	,06	,41
	Butong	-,32(*)	,114	,020	-,60	-,04
Hajak	Tongka	-,23(*)	,071	,006	-,41	-,06
	Butong	-,56(*)	,096	,000	-,80	-,32
Butong	Tongka	,32(*)	,114	,020	,04	,60
	Hajak	,56(*)	,096	,000	,32	,80

* The mean difference is significant at the .05 level.

Cultivation of edible crops

Descriptives of edible crops cultivated

	N	Mean	Std. Deviation	S Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Tongka	38	55,11	9,043	1,467	52,13	58,08	37	71
Hajak	41	43,78	11,173	1,745	40,25	47,31	11	64
Butong	30	31,87	8,207	1,498	28,80	34,93	17	44
Total	109	44,45	13,283	1,272	41,93	46,97	11	71

ANOVA of edible crops cultivated

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	9082,902	2	4541,451	48,274	,000
Within Groups	9972,070	106	94,076		
Total	19054,972	108			

Test of Homogeneity of Variance of edible crops cultivated

Levene Statistic	df1	df2	Sig.
,125	2	106	,882

Post Hoc test of edible crops cultivated

Dunnett's t (< control)

(I) VILLAGE	(J) VILLAGE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval
					Upper Bound
Hajak	Tongka	-11,32(*)	2,184	,000	-7,09
Butong	Tongka	-23,24(*)	2,369	,000	-18,64

* The mean difference is significant at the .05 level.

Households farming rice

Descriptives households cultivating rice

	N	Mean	Std. Deviation	S Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Tongka	38	1,00	,000	,000	1,00	1,00	1	1
Hajak	41	,61	,494	,077	,45	,77	0	1
Butong	30	,50	,509	,093	,31	,69	0	1
Total	109	,72	,453	,043	,63	,80	0	1

ANOVA of households farming rice

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4,927	2	2,464	15,134	,000
Within Groups	17,256	106	,163		
Total	22,183	108			

Test of Homogeneity of Variance of households farming rice

Levene Statistic	df1	df2	Sig.
660,499	2	106	,000

Post Hoc test of households farming rice

Dunnett's T3

(I) VILLAGE	(J) VILLAGE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Tongka	Hajak	,39(*)	,077	,000	,20	,58
	Butong	,50(*)	,093	,000	,27	,73
Hajak	Tongka	-,39(*)	,077	,000	-,58	-,20
	Butong	,11	,121	,743	-,19	,41
Butong	Tongka	-,50(*)	,093	,000	-,73	-,27
	Hajak	-,11	,121	,743	-,41	,19

* The mean difference is significant at the .05 level.

Products sold

Descriptives of products sold

	N	Mean	Std. Deviation	S Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Tongka	38	10,08	4,635	,752	8,56	11,60	1	23
Hajak	41	5,00	2,579	,403	4,19	5,81	0	14
Butong	30	3,27	1,799	,328	2,59	3,94	0	8
Total	109	6,29	4,349	,417	5,47	7,12	0	23

ANOVA of products sold

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	887,976	2	443,988	40,760	,000
Within Groups	1154,630	106	10,893		
Total	2042,606	108			

Test of Homogeneity of Variance of products sold

Levene Statistic	df1	df2	Sig.
7,996	2	106	,001

Post Hoc test of products sold
Dunnett's T3

(I) VILLAGE	(J) VILLAGE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Tongka	Hajak	5,08(*)	,853	,000	2,98	7,17
	Butong	6,81(*)	,820	,000	4,79	8,84
Hajak	Tongka	-5,08(*)	,853	,000	-7,17	-2,98
	Butong	1,73(*)	,520	,004	,46	3,00
Butong	Tongka	-6,81(*)	,820	,000	-8,84	-4,79
	Hajak	-1,73(*)	,520	,004	-3,00	-,46

* The mean difference is significant at the .05 level.

Foods bought

Descriptives of foods bought

	N	Mean	Std. Deviation	S Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Tongka	38	5,79	2,723	,442	4,89	6,68	2	14
Hajak	41	8,88	2,326	,363	8,14	9,61	4	13
Butong	30	8,60	2,500	,456	7,67	9,53	4	16
Total	109	7,72	2,873	,275	7,18	8,27	2	16

ANOVA of foods bought

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	219,837	2	109,919	17,341	,000
Within Groups	671,906	106	6,339		
Total	891,743	108			

Test of Homogeneity of Variance of foods bought

Levene Statistic	df1	df2	Sig.
,407	2	106	,667

Post Hoc test of foods bought

Dunnett's t (> control)

(I) VILLAGE	(J) VILLAGE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval
					Lower Bound
Hajak	Tongka	3,09(*)	,567	,000	1,99
Butong	Tongka	2,81(*)	,615	,000	1,62

* The mean difference is significant at the .05 level.

Food expenses

Descriptives of food expenses per person per year

	N	Mean	Std. Deviation	S Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Tongka	38	961249	581891	94395	769986	1152512	200000	2600000
Hajak	41	1621544	720741	112560	1394050	1849038	600000	3250000
Butong	30	1648444	1059191	193381	1252935	2043953	600000	6000000
Total	109	1398753	844484	80886	1238421	1559085	200000	6000000

ANOVA of food expenses per person per year

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	11179003329872	2	5589501664936	8,999	,000
Within Groups	65841565256172	106	621146842039		
Total	77020568586044	108			

Test of Homogeneity of Variance of food expenses per person per year

Levene Statistic	df1	df2	Sig.
,871	2	106	,422

Post Hoc test of food expenses per person per year

Dunnett's t (> control)

(I) VILLAGE	(J) VILLAGE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval
					Lower Bound
Hajak	Tongka	660295(*)	177470	,000	316088
Butong	Tongka	687194(*)	192486	,001	313865

* The mean difference is significant at the .05 level.

Change in food expenses

Descriptives of change food expenses

	N	Mean	Std. Deviation	S Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Tongka	38	,00	,000	,000	,00	,00	0	0
Hajak	41	,73	,449	,070	,59	,87	0	1
Butong	30	,93	,254	,046	,84	1,03	0	1
Total	109	,53	,501	,048	,44	,63	0	1

ANOVA of change food expenses

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	17,222	2	8,611	92,056	,000
Within Groups	9,915	106	,094		
Total	27,138	108			

Test of Homogeneity of Variance of change food expenses

Levene Statistic	df1	df2	Sig.
53,785	2	106	,000

Post Hoc test of change food expenses
Dunnett's T3

(I) VILLAGE	(J) VILLAGE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Tongka	Hajak	-,73(*)	,070	,000	-,91	-,56
	Butong	-,93(*)	,046	,000	-1,05	-,82
Hajak	Tongka	,73(*)	,070	,000	,56	,91
	Butong	-,20	,084	,056	-,41	,00
Butong	Tongka	,93(*)	,046	,000	,82	1,05
	Hajak	,20	,084	,056	,00	,41

* The mean difference is significant at the .05 level.

Households joining Raskin

Descriptives of households joining Raskin

	N	Mean	Std. Deviation	S Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Tongka	38	,13	,343	,056	,02	,24	0	1
Hajak	41	,54	,505	,079	,38	,70	0	1
Butong	30	,63	,490	,089	,45	,82	0	1
Total	109	,42	,496	,048	,33	,52	0	1

ANOVA of households joining Raskin

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5,083	2	2,542	12,529	,000
Within Groups	21,504	106	,203		
Total	26,587	108			

Test of Homogeneity of Variance of households joining Raskin

Levene Statistic	df1	df2	Sig.
29,658	2	106	,000

Post Hoc test of households joining Raskin
Dunnett's T3

(I) VILLAGE	(J) VILLAGE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Tongka	Hajak	-,41(*)	,096	,000	-,64	-,17
	Butong	-,50(*)	,105	,000	-,76	-,24
Hajak	Tongka	,41(*)	,096	,000	,17	,64
	Butong	-,10	,119	,802	-,39	,20
Butong	Tongka	,50(*)	,105	,000	,24	,76
	Hajak	,10	,119	,802	-,20	,39

* The mean difference is significant at the .05 level.

Food sufficiency

Descriptives of food sufficiency

	N	Mean	Std. Deviation	S Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Tongka	38	,97	,162	,026	,92	1,03	0	1
Hajak	41	,80	,401	,063	,68	,93	0	1
Butong	30	,70	,466	,085	,53	,87	0	1
Total	109	,83	,373	,036	,76	,91	0	1

ANOVA of food sufficiency

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1,315	2	,657	5,082	,008
Within Groups	13,713	106	,129		
Total	15,028	108			

Test of Homogeneity of Variance of food sufficiency

Levene Statistic	df1	df2	Sig.
31,437	2	106	,000

Post Hoc test of food sufficiency
Dunnett's T3

(I) VILLAGE	(J) VILLAGE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Tongka	Hajak	,17(*)	,068	,047	,00	,34
	Butong	,27(*)	,089	,012	,05	,50
Hajak	Tongka	-,17(*)	,068	,047	-,34	,00
	Butong	,10	,106	,689	-,15	,36
Butong	Tongka	-,27(*)	,089	,012	-,50	-,05
	Hajak	-,10	,106	,689	-,36	,15

* The mean difference is significant at the .05 level.

Water availability

Descriptives of water availability

	N	Mean	Std. Deviation	S Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Tongka	38	1,00	,000	,000	1,00	1,00	1	1
Hajak	41	-,56	,502	,078	-,72	-,40	-1	0
Butong	30	-,27	,521	,095	-,46	-,07	-1	1
Total	109	,06	,808	,077	-,09	,22	-1	1

ANOVA of water availability

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	52,586	2	26,293	155,146	,000
Within Groups	17,964	106	,169		
Total	70,550	108			

Test of Homogeneity of Variance of water availability

Levene Statistic	df1	df2	Sig.
132,543	2	106	,000

Post Hoc test of water availability
Dunnett's T3

(I) VILLAGE	(J) VILLAGE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Tongka	Hajak	1,56(*)	,078	,000	1,37	1,76
	Butong	1,27(*)	,095	,000	1,03	1,51
Hajak	Tongka	-1,56(*)	,078	,000	-1,76	-1,37
	Butong	-,29	,123	,059	-,60	,01
Butong	Tongka	-1,27(*)	,095	,000	-1,51	-1,03
	Hajak	,29	,123	,059	-,01	,60

* The mean difference is significant at the .05 level.

Water quality

Descriptives of water quality

	N	Mean	Std. Deviation	S Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Tongka	38	,89	,311	,050	,79	1,00	0	1
Hajak	41	-,95	,218	,034	-1,02	-,88	-1	0
Butong	30	-,80	,407	,074	-,95	-,65	-1	0
Total	109	-,27	,909	,087	-,44	-,09	-1	1

ANOVA of water quality

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	79,003	2	39,502	407,256	,000
Within Groups	10,281	106	,097		
Total	89,284	108			

Test of Homogeneity of Variance of water quality

Levene Statistic	df1	df2	Sig.
8,605	2	106	,000

Post Hoc test of water quality
Dunnett's T3

(I) VILLAGE	(J) VILLAGE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Tongka	Hajak	1,85(*)	,061	,000	1,70	1,99
	Butong	1,69(*)	,090	,000	1,47	1,92
Hajak	Tongka	-1,85(*)	,061	,000	-1,99	-1,70
	Butong	-,15	,082	,197	-,35	,05
Butong	Tongka	-1,69(*)	,090	,000	-1,92	-1,47
	Hajak	,15	,082	,197	-,05	,35

* The mean difference is significant at the .05 level.

Edible crops

The following list has been developed in participation with the indigenous people in the research area. Most species names are in Bahasa Indonesia, while small part is in the local Dayak language. Some species that were not mentioned during these FGD have been added to this list during the development of the field research, but should not influence the research results. English translations are given as much as possible.

Crop	English
alpokat	avocado
asam bulau	
asam tungku	
bamboo rebong	bamboo shoots
bawang ganda	
bayam	spinach
belimbing manis	starfruit
belimbing tunjuk	
cabe	chili
cempedak	kind of jackfruit
coklat	cocao
dangu	
durian	durian
gambas	
jagung	maize
jahe	ginger
jambu biji	guave
jelawar	
jeruk	orange
jeruk bali	pomelo
jeruk nipis	lime
kacang hijau	
kacang kecipil	
kacang kedelai	soy bean
kacang panjang	long beans
kacang tanah	groundnut
kangkung	water spinach
kapul	cardamom
karet	rubber
katu	
kelapa	coconut
kelengkeng	kind of lychee
kemiri	
ketungen	
kopi	coffee
kulur	breadfruit

Crop	English
kunyit	turmeric
kuwini	
langsat	
lengkuas	galanga
luwi	
mangga	mango
manggis	mangosteen
mata kucing	
munau	
nanas	pineapple
nangka	jackfruit
padi	rice
papaya	papaya
papuan	
pepaken	
pinang	betelnut
pisang	banana
puak	
rambutan	kind of lychee
ramunia	
randu	
rotan	rattan
sakur/singkut	
sawit	oil palm
serai	lemongrass
sesawi	
singkong	cassava
sirih	
sirsak	soursop
siwauw	
sungkai	
talas	taro
tebu	sugarcane
tebu telor	
terong	eggplant
terong asam	sour eggplant

Crop	**English**
terong pipit	
timok	
timun	cucumber
tomat	tomato
tongaring	
ubi rambat	green potato

List of NTFP's

To support the statements from the respondents from Hajak and Butong that gathering forest products has become more difficult, a list of NTFP's gathered in the research area has been compiled in participation with the indigenous people of the area.

Fruit
akar letaan
aragandang
aye
bangkaran
binyai
cempedak
gandis
irit
jaring
jojot
kapul
kararet kanyato
kehayan
keliwen
keranyi (jaan)
ketungen
kramu
layung
lenamun
leposu
luwi
manggalak
mawoy
munau
muya
nyatu
ontip
oput
papuan
pekalong
peputu
peraro
periyang
posik
punsen
puru
reket
rengarai

(continued)
rukam
rupai
sengkuang
sentulu jaun
sesori
sirsak
sosa
sukua
sulik
tengaring
tengkawang
tewola
torang
toyup
trongolon
keramu

Vegetable
biyungan
danan
enau
kedadi akpah
kedakai
kulat asap
kulat beber
kulat olo
kulat olong
kulat walur
latung
lempeng
liho
munau
nyiwung
pucuk kasteda
pucuk paku
pulur
rebung
regoy
sarap
sidong
sulur keladi
sulur talas
tewu tantaluh
tiwauw
umbut handiung
umbut jua
umbut kotok
umbut liho
umbut niwun
umbut rambia
umbut segauk

Meat
angkis
babi hutan
bekantan
beruang
biawak
50 bird species
biyontung
bumut
kancil
kijang
kelelawar
kodok
kuli pahan
kuli puai
landak
lasio
musang
peuyu
rusa
tranggiling
tupai
ular sawa

Medicine
akar kewatek
akar kinso
akar kuning
akar letaan
akar nangka
akar pakis
akar pangaraya
akar pinang
alang alang
aragandang
ayau
bakah duaya
benuwang
biyontung
bromot
bunga sepatu
burung bubut
cawai anuman
daun ara
daun bekakang
gelingan
kaan
kelimpet
kereho
ketepik
koko dompe
kulat pali
kumis kucing
kuning kucing
kupang
lontar naga
mung
pasak bumi
penawar sampai
penawar seribu
pengerereng
pucuk kramunting
raja mandak

(continued)
saluang belum
sarang burung wallet
sirih
tabat barito
takambat
teraran
tupus