

Beyond Climate Change

- *The case of large-scale logging and clearing in Kampung Lebor*



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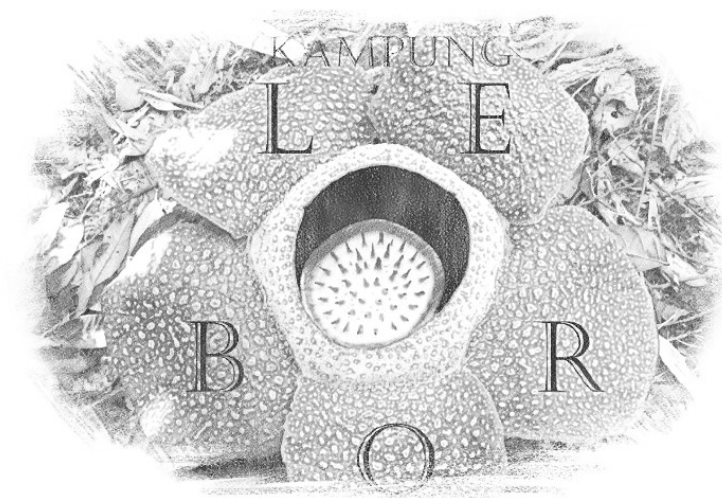
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University of Copenhagen, Interdisciplinary Land Use and Natural Resource Management,
8th of April 2016

Words in Total: 11026

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Acknowledgements

This report is shaped as a part of the course Interdisciplinary Land Use and Natural Resource Management (ILUNRM). Through 12 days of fieldwork in Lebor, Malaysian Borneo, we have collected data through natural and social science methods. It has been a wonderful and unforgettable time, where we have learned so much. We would like to thank all the people who have helped us along the way.

First, we wish to thank all our professors at UNIMAS and University of Copenhagen for sharing your time and knowledge. A special thanks to our coordinators, Dr. Wee Boon Siong and Mohd. Azizul Hafiz Jamian. You have done a great job in making everything work during our stay. Also, we wish to thank Dr. Tay Meng Guan and Professor dr. Gabriel Tonga Noweg for helping us with water samplings and FRA-method. It was very new to us all, and we would not have been able to complete this without you.

Thank you so much, Dr. Astrid Oberborbeck Andersen and Dr. Simon Mundus, our Danish supervisors, for your constant help and support throughout our research. You have been indispensables, and it has been a great adventure meeting you.

We also want to thank our UNIMAS counterparts, Leeya, Kate and Franklin, for a great collaboration. You have been positive and helpful all the way, especially on the natural science methods. We have developed a good friendship along the trip.

We would not have been able to communicate with most villagers, if not for our interpreters, Olivia and Bernadine. Thank you for having worked so hard and for being so flexible - you were ready to help us whenever we needed it during our research.

At last but not least, a big thanks to all villagers in Lebor, who helped us by participating in our interviews, surveys and PRA-sessions. We have learned so much from your sharing, and your openness and hospitality has been amazing. Thank you for letting us stay at your community hall. Thank you to our cooking ladies; you made excellent food for us every day, so we could concentrate on our work.

To all, a great thank you, terima kasih.

Abstract

In the past decades, production of palm oil has increased, which has led to large areas of deforestation in Sarawak, Malaysian Borneo. Many of the large-scale oil palm plantations are located on tropical peatlands. According to academic literature, this transition from peatlands to oil palm plantations contributes to global warming since peatlands serves as a carbon stock.

Additionally, these land use transitions have led to disputes between private companies and indigenous peoples affected by the development of the palm oil sector.

Inspired by a narrative approach, this report examines local perception of social and environmental impacts of large-scale logging and clearing in the village of Lebor, in Western Sarawak. Furthermore, the report unfolds the villagers' understandings of climate change in relation to academic literature.

Through this study we found that Lebor has been impacted both environmentally and socially. This has resulted in a loss of biodiversity, loss of culturally important community lands and a social division in Lebor. Furthermore this study shows that the local people of Lebor are aware of environmental changes in their everyday life thus not relating them to global conceptions of climate change. With these impacts this report argues that the climate change risk established by academic literature is not mirrored in the narratives of the villagers in Lebor.

Keywords: climate change, logging, palm oil, narratives, conflict, environmental degradation

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List of Abbreviations

AGB - Above-ground biomass
DBH – Diameter at breast height
IPCC - Intergovernmental Panel on Climate Change
FRA - Forest resource assessment
NCR - Native customary rights
PRA - Participatory rural appraisal
SSI - Semi-structured interviews

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Introduction

“Palm oil is the new green gold after timber. It has become the most destructive force after three decades of unsustainable logging” – Mark Bujang, executive director of the Borneo Resources Institute of Miri (in Lee, 2009).

Within the last decades, drastic changes in land use have occurred in Sarawak, Malaysian Borneo. Since the 1970s, forest cover in Sarawak has largely decreased due to the rise of large-scale oil palm plantations throughout the state. Previously, the main contributor to degradation and deforestation has been logging, which has later been slowing down as timber production fell behind the palm oil sector (Hon, Shibata, 2013). This deforestation is especially happening in lowland tropical peatlands, a globally rare soil type and ecosystem found in Borneo. Peatlands are, due to high water table, not considered a suitable soil type for most crops, but through modern technique drainage has increased agricultural possibilities on the soil, where especially oil palm is grown. (Verhoeven et al, 2010.)

“Land without development is a poverty trap” (Abdul Taib Mahmud, the former chief minister of Sarawak; Lee, 2009:128). Converting more forest areas to oil palm plantations is part of the government of Malaysia’s plan to transform the country into a developed nation under the *Vision 2020* (Lee 2009, Mohamed, 1991). At this moment Malaysia is the second biggest exporter of palm oil, and accounts for 44 percent of the world’s exports (MPOC, 2016). However, the development through these large-scale palm oil activities is said to cause friction between forces favoring these development schemes and environmentally concerned agents. Furthermore, it has led to numerous cases of disputes between indigenous people of Sarawak and companies entering their community land, since the land is often taken without their consent (Lee, 2009).

Through the latest report of the Intergovernmental Panel on Climate Change (IPCC), the global scientific community shows high confidence of anthropogenic climate change taking place on all continents. The large-scale activities in Malaysia are no exception to this anthropogenic cause. According to established literature on climate change and peatlands, the transition from peatland to oil palm plantations aggravates global warming with significant consequences, since peatlands serve as a carbon stock.

The state of Sarawak in Malaysian Borneo hosts many large-scale oil palm plantations, as does the small village of Lebor. Former peat areas have now been converted to large-scale oil palm plantations, which have both environmental and social impacts, as the peatlands used to be the village’s community area.

Through our study in Lebor, we seek to analyze the influence of these transitions on the local level. While there is an abundance of research on the overall effects of large-scale logging and clearing, we are specifically interested in understanding what these impacts actually mean in local people’s lives. Specifically, we wish to unveil the local villagers’ *perceptions* of the changes. What kind of impacts they observe and what reasons they give for them. Furthermore, we wish to mirror these perceptions to measurable changes in the physical environment to see how they cohere with each other. Finally, we will

relate these findings to the academic literature on climate change. Therefore, our research objective and questions are as follows:

Research Objective

Our aim is to investigate social and environmental impacts of large-scale logging and clearing of land in the area of Lebor, and how the villagers perceive such changes in land use. Secondly we seek to analyze local understandings of climate change, through the villagers' perceptions of changes in Lebor, and to see how it relates to the academic literature¹.

Research Questions

1. Can there be measured any changes in tree biodiversity and water resources that could be linked to recent land use changes in Lebor, which?
2. What changes do the villagers of Lebor perceive regarding the environment and social relations after the large-scale companies came to Lebor?
3. How does the academic literature on climate change relate to local understandings of climate change?

Before starting the fieldwork, we were already aware of the presence of the large-scale palm oil company Tabung Haji, located on peatlands. Soon after arriving, we also heard about logging activities on the mountain behind Lebor. Logging and palm oil activities are thus the two large-scale land use changes that have been identified by the villagers of Lebor.

In our research questions, the concepts of logging and clearing are derived from local understandings of these terms. During our data collection, it became apparent that "logging" referred to private companies entering the village and cutting big trees for timber production. This would not include the cutting of trees villagers do themselves, for example when collecting construction material. "Clearing" was used to describe any kind of land use change when some vegetation was to be removed so clearing includes both cultivated lands and forests, which has happened at the Tabung Haji plantation. Our study focuses on large-scale activities. This will therefore rule out the clearing the villagers do on their own lands, since they only operate on smaller scale.

¹ By academic literature, we refer to scientific literature acknowledging climate change. This specific focus was chosen, since taking the entire international discourse as a reference would be too broad for this report and would require too many generalizations.

² The IPCC states that an increase of more than 2 C° in the average annual temperatures from pre-industrial levels will trigger a cycle of climatic changes that will further intensify global warming (IPCC, 2014a).

³ In this study, we only look at changes in carbon stocks as an indicator of climate change impacts. A more

Village Description

The fieldwork of this study is conducted in Kampung Lebor, an Iban Remun village located 75 km southeast of Kuching in Sarawak, Malaysian Borneo. Lebor consists of 186 households with approximately 700-800 residents divided into five unofficial residential zones. Each zone has different services such as shops, a library, school and an internet café.

Lebor and the surrounding areas are located on both hilly, flat and peat areas with rivers and streams running through the locality, supplying the villagers with water from gravity feed. The climate in Lebor is a tropical rainforest climate with 3'000 to 5'000 mm of annual rainfall (Ichikawa, 2007). The majority of the residents are farmers, the dominant crops being rice, rubber, pepper, fruit trees and oil palm (Appendix 1).

Through research before our field trip, we learned that there was a court case going on due to the establishment of Tabung Haji the large-scale oil palm plantation on the village's community Native Customary Rights (NCR) land in 1997. The court case began when the villagers sought compensation and a share per hectare for each household in Lebor. When that did not happen the case was brought to the High Court of Kuching, which Lebor won. An appeal was made by Tabung Haji, and a second trial took place, again won by Lebor. Since Tabung Haji has appealed again, the case is still going, now at the Federal Court.

The court case has led to a conflict in the village, which we became aware of early in our stay. The conflict has resulted in a division of two groups in Lebor. The two groups call themselves A and B, with the A group being more passive in the conflict against the company, whereas the B group are activists and want to fight for their land. Both the conflict and the court case will be unfolded further in this report. Throughout this report we will refer to our informants as A or B when analyzing our data. This is to secure the anonymity of our informants. This division of our informants is done due to varying stances on the court case and the conflict.

Literature Review

In Southeast Asia, the average annual temperatures have and are projected to increase, exceeding the critical 2 C° in the mid-21st century. Also annual rainfall has increased within the last decades, and is estimated to rise even further. (IPCC, 2014b.)

Investigating understandings of climate change in Lebor became highly relevant after gathering literature about large-scale logging and clearing of forests. By taking up atmospheric carbon dioxide, trees naturally store carbon that could otherwise warm the climate. Therefore, cutting down trees leads to carbon emissions. (IPCC, 2014a.) Degradation and loss of tropical rainforests in the region are estimated to produce greenhouse gas emissions of 0,55 Pg of carbon (C) annually (Houghton, 2012). This is

² The IPCC states that an increase of more than 2 C° in the average annual temperatures from pre-industrial levels will trigger a cycle of climatic changes that will further intensify global warming (IPCC, 2014a).

outstanding, as annual carbon emissions from fossil fuel combustion in the entire world are estimated as 8,3 Pg C (Andres et al., 2013).

Nearly half of the above emissions estimated by Houghton (2012) come from draining and clearing of peatlands in Southeast Asia (Houghton, 2012). Before planting, peatlands must be drained, leading to peat decomposition when the organic matter is exposed to the oxygen (Jauhiainen et al., 2008). Carbon stored in the organic matter throughout thousands of years of peat accumulation is then released into the atmosphere. This is particularly important in the state of Sarawak, where our study site is located. Across all forest types in Southeast Asia, peatlands in Sarawak have experienced the fastest deforestation rates within the last decade (Miettinen et al., 2011). Sarawak has therefore become an arena of exceptionally high greenhouse gas emissions³.

Furthermore, disturbance of forests in Southeast Asia is particularly alarming because of the region's exceptional biodiversity. Southeast Asia hosts a fifth of all animal and plant species on the globe, with a high proportion of these species being endemic. (Hon, Shibata, 2013; Miettinen et al., 2011.) Many species are sensitive to changes in their habitat, so large-scale logging and clearing can have radical impacts on local flora and fauna: Wilcove et al. (2013) find that conversion of forests to oil palm plantations can result in extinguishing up to two thirds of bird and fish species.

³ In this study, we only look at changes in carbon stocks as an indicator of climate change impacts. A more thorough analysis would include accounts of fluxes of all prominent greenhouse gases: carbon dioxide (CO₂), nitrous dioxide (N₂O) and methane (CH₄). Due to complex methodologies, we were not able to conduct measurements of these fluxes, however, which is why we investigate only carbon stocks. Of possible carbon stocks, we decided to focus solely on carbon stored in above-ground biomass instead of including carbon stored in below-ground biomass and in soils, as suggested by our resource persons (Mundus, 2016, pers. comm; Bruun, 2016, pers. comm.).

Methodology

This section will provide a description of the methodologies used in this report. First we will commence on how we have used a narrative approach as a methodology and analytical tool. After this, we will elaborate on a few of the most important social science methods used in the report (see comments on the rest in Appendix 2), followed by the natural science methods. In the end of this chapter, there will be a brief discussion on how we have integrated the different methods in our work, and how they have been shaped by the different disciplines in this group.

Below, we provide a list with all the methods used during our fieldwork.

Social Science Methods	Natural Science Methods
<ul style="list-style-type: none">- Questionnaire- Narrative interview- Semi-structured interviews (SSI)- In-situ interviews- Focus group interview- Participatory photography- Walkabouts- Participatory Rural Appraisal (PRA): Community Map of past and present, Timeline, matrix-ranking and environmental ranking- Deep hanging out, informal conversation and participatory observation- Nvivo	<ul style="list-style-type: none">- Forests Resource Assessment (FRA)- Water-sampling- Transect walks with GPS- QGIS

Table 1: List of methods used

A Narrative Framework

Working from the premise that the villagers of Lebor are the ones who know their surrounding environment the best, the aim of this report is to depict the environment with their words. With this report rooted in a narrative approach, the data we present about the environment and social factors in Lebor is constructed by the narratives from the villagers. Hereby, the report becomes influenced by constructivism (Bruner, 1991). By analyzing the narratives from Lebor we wish to discover what they highlight as important social and environmental consequences and see how these perceptions cohere with academic established literature on climate change. We never asked directly about climate change, but asked very open and general questions about the environment. While a few villagers used the term “climate change” directly, the analysis is highly based on our interpretation of the villagers’ narratives about environmental changes, which we related to understandings of climate change.

Being aware of the major differences in access to knowledge in rural Malaysian areas like Lebor and in the areas where academic literature is circulating, we have an assumption that access to knowledge also affects understandings of climate change. We will explain how the perceptions of the villagers differ from the academic established literature that we came across, rather than discuss whether such perceptions are right or wrong.

Carrying out a Narrative Interview

In total 11 narrative interviews were carried out. The interviews varied a lot, since it to a great extent depended on how much the informant had to say. Therefore there was also a variance in the length from 40 minutes to the longest lasting 2,5 hours (see Appendix 3 for interview guide). Some of the interviews were conducted using participatory photography, which opens a space for discussion and gives a more creative way for informant to express him-/herself (Gotschi et al., 2009).

A Narrative Analytical Tool

Polkinghorne (2003) distinguish two types of analysis methods within the narrative approach: *analysis of narratives* where data is in the form of stories that are then categorized under different themes and concepts, and *narrative analysis* where the data can be in a multitude of forms, from which the researcher draws elements of narratives, such as a plot and characters, to put the data in the form of a story. In our analysis, we are inspired by both methods.

Because we want the narratives to lead the analysis, we have applied inductive reasoning. To start the analysis, we categorized our qualitative data under themes and analytical concepts in Nvivo program. The themes were topics that were explicitly mentioned in the data, such as *logging* and *burning*, whereas the analytical concepts required our interpretation, resulting in categories such as *understanding of consequences* and *climate change*. However, if we could detect characters, roles, a plot and a setting (as in Polkinghorne 2003) in the recurrent themes, we could employ the *narrative analysis* method: unveil and construct a story, which was then used to answer our research questions. The last approach was especially applied to narratives about the court case.

Reflections of a Narrative Approach

The data collection and analysis methods for this report are inspired by a narrative approach. The word *inspired* is utilized due to the many shortcomings and biases evident in our methodology, due to mainly a restricted time frame as well as the use of other methods, equally important for gathering of data used in our analysis. A full narrative approach has not been possible to conduct, while simultaneously wishing to gain a more representative and comprehensive understanding of the villagers.

"Just as interview participants tell stories, investigators construct stories from their data"
(Riessman, 2008:4)

We acknowledge that our analysis of the villagers' narratives is our own construction. It will never fully reflect what was told, as we are intermediaries with our backgrounds and values.

The narrative approach, and other information in general, is also influenced by our use of interpreters. Firstly, the lack of experience of one of our interpreters affected our data. She had difficulties translating some parts, and often had to discuss rephrasing

with the informant before translating to us, which interrupted the flow, making it difficult to carry out a narrative approach.

Secondly, a narrative approach has been difficult to apply due to the language barrier. Some of our informants could talk for 10 minutes before it was translated to us. It is impossible for an interpreter to recall all the details from those minutes, so it became a general resume of what had been said. This is evident in our analysis, where our quotes are often short sentences, because we simply did not have longer descriptive translations. Due to this, we feel that we have obtained fragments of narratives instead of complete narratives, which is important to be aware of when we construct our arguments. However, we still believe that a narrative approach gave a more elaborated description of the environmental and social impacts than we could have obtained through semi-structured interviews, since pre-determined questions would have disturbed the flow of speech. Still, due to our limited experience in narrative methods, some of the interviews became mixed between semi-structured interviews and narratives. From our evaluation we find that 4 of the 11 interviews had a narrative approach throughout the interview, while the remaining started with a narrative approach with open questions, but the last part was more structured by us. Sometimes, we were perhaps also a bit too eager to ask certain questions, thereby not letting the narrative lead the way. Through SSI the researchers have more control (Casley and Kumar 1988), which was more difficult to let go off than we had anticipated.

Questionnaires

Questionnaires were conducted in 23 of the 186 households. Our intention with the questionnaire was to get background information about the village, livelihood aspects and general impressions of the environmental changes in Lebor. Questionnaires are useful tools to get an overall description and statistic of a population (Babbie, 2002). To select our informants, we used random sampling principle, where we selected every fifth house in all zones in the attempt to be as representative as possible (see Appendix 4 for the questionnaire).

Interviews

Besides the narrative interviews, three SSI interviews were carried out with the headman, the former headman, and one villager (A4). Here we wished to obtain certain information, and therefore a narrative approach was not applied. Besides the interviews, two focus groups were carried out. During deep hanging out sessions in the village, we had informal talks with several villagers, where we also obtained information for the analysis (see Appendix 5 for example of SSI-guide).

Participatory Rural Appraisal

The strength of using PRA-methods is to get an insight of the local knowledge through participatory collaboration. The methods used were mapping, timeline, matrix ranking and environmental impact ranking⁴ (Mikkelsen, 2005). These PRA exercises triggered

⁴ The environmental ranking was inspired by the procedure for matrix ranking from Mikkelsen (2005).

rich reflections and generated discussion among the informants, giving us insightful information for our analysis. However, during the first PRA session, it was difficult to get an insight of our informants' perceptions due to hierarchies that exist among them, and perhaps also due to the large number of people attending.

Sensitive field

Lebor was a sensitive field to do research in due to the division of group A and B. As we were accommodated at the community house of the A side, it was difficult to win the trust of B-members. This resulted at first in closed doors from B-persons, and a representative of the headman monitoring our interview with a B-person. Due to this, we relied on help from our interpreters. To be an interpreter is a multi-faced job, because one also has to be a guide and understand the social codes (Kerani, n.d.). One of our interpreters was from Lebor, and became our local guide, advisor and informant as well. She helped us point out A and B-members, so we did not mix them in PRA-sessions, and to get an even representation of A- and B-members in our research. As our local interpreter was involved in the conflict, she only translated for her group to avoid that her background would affect our data, and put her in an uncomfortable situation.

To work as researchers in a field with a social conflict was a difficult task for us. We did not want to worsen the social relations, so we were reflective on what impression we sought to give the villagers: we were there to get a representation of all villagers of Lebor, rather than depict one group's side of the court case or social division. To emphasize this, we never asked directly into the social division, and we were careful of when and how to ask about the court case with Tabung Haji. It was also difficult to get perspectives on the Tabung Haji case from both groups. In general the A-members did not seem as willing to discuss this subject, as people from the B-group were, which was very evident when an informant from the A-group asked us not to ask about the case during a PRA-session.

Natural Science Methods

From the villagers' narratives we identified logging and the oil palm plantation as the leading factors of changes in the environment. Logging was said to have affected water quality and biodiversity in Lebor, while the oil palm plantation caused a loss of peat swamp forest and some cultivated land, leading to other environmental consequences. Therefore, we conducted water sampling and Forest Resource Assessment (FRA) to see if they can provide any support for the narratives we collected through social science methods and also to see possible climate change impacts.

Forest Resource Assessment

We calculated the above-ground biomass (AGB) in the forest behind the village and in a smallholder oil palm plantation. We wished to see how conversion of forest to oil palm plantation changes the above-ground carbon stock, in order to estimate how the conversion might impact the global warming. Although there is literature available,

these measures are highly context-specific, which is why we wished to conduct our own measurement instead of relying on secondary sources. In addition, we identified tree species in the measured plots in order to assess tree biodiversity. Explicit description of the methods is provided in Appendix 6.

Water Sampling

Water samplings were done in order to investigate if the oil palm plantation may have polluted the river downstream and if the water from the gravity feed was contaminated. According to the villagers, the river providing drinking water used to be polluted due to logging. We used the “National Water Quality Standards for Malaysia” (wepa-db.net) to compare our results and see how polluted the rivers are compared on a national level. The tested parameters and sampling stations are described in Appendix 7.



Combining our Methods

In a narrative approach, it is *“inappropriate to ask if it is the ‘real’ or ‘true’ story”* (Polkinghorne, 2003:20). Instead, we wish to use natural science methods to understand the narratives better: where they might come from and how they might relate to realities measurable by natural science methods. In an ideal situation, we would have measured all environmental changes that appeared in our data gathered through social science methods. Evidently, this was not possible with the resources we had. Nevertheless, the measurements we conducted enabled reflections on where the collected narratives originate from, as well as on challenges of combining these two methodological approaches.

Our different disciplines have of course influenced how we approached our research. In our 8-persons group with the Malaysian students we had different expertises. In our Danish-Finnish group, we were mostly social science students, which made our collaboration with the Malaysian students really fruitful, due to their natural science backgrounds. Everybody participated in the different methods, and those who were more skilled guided the others. In the final report writing, the overrepresentation of social scientists is evident, since it reflects our backgrounds and academic skills incorporated in the report.

Results from Natural Science Methods

Water Sampling

From the conducted water samplings, the results (Appendix 8) showed that the water sample done after the oil palm plantation (station II) generally ranked more severe in classification than the sample from the gravity feed (station I).

Even though the phosphate level in the water from the gravity feed is lower than the water from the oil palm plantation, it exceeds the reference for polluted rivers, 0,05-0,1 mg/L⁵, in both. Seeing that the numbers for station I and II were 0,18 mg/L, and 0,375 mg/L, the numbers definitely exceed the concentrations that “*will certainly have impact on a river*” (fosc.org). We cannot state that the high numbers are due to either logging or oil palm, as many causes can affect the number. It would have required previous samples before the oil palm plantation and logging entered the area. However the high level of phosphate (class V), nitrate and nitrite (min class III) can indicate use of fertilizer upstream (Appendix 8).

The dissolved oxygen in water needs to be above 7 mg/L to be seen as “*very good for most stream fish*” (fosc.org). The water from station I, was above 9 mg/L, so it can provide as a habitat for the fish. The water from station II is 6,31±0,05 mg/L, which means that it is close to be considered as a very good stream for fish to live in, although other parameters should also be accounted for⁶. Overall, the water classification at station I ranges between I and IIB, which means conventional treatment is required that includes filtration or disinfection, such as boiling before drinking. Station II ranges between I-V, with most representations in the high end of the spectrum. Therefore, most often extensive treatment would be the minimum requirement at this station, and for some of the parameters it should only be used for irrigation.

Forest Resource Assessment

According to our informants, the area at Tabung Haji plantation has for a large part been forest before, although some areas were under cultivation. We will here estimate the environmental impacts of converting forest into palm oil plantation, our focus being on changes in the AGB and climate change effects. Also the possible effects of logging are reflected, in terms of tree density and biodiversity.

In the smallholder oil palm plantation, the AGB was measured as 30,77 Mg/ha, which results in 12,92 Mg C/ha. This is in line with Henson and Dolmat (2003: Figure 6), where palm trees of approximately the same age and planting density as ours have AGB of 20-32 Mg/ha. Our forest sample, being an estimated generalization of forests in Lebor, had AGB of 181,28 Mg/ha, making 85,20 Mg C/ha. The result is rather close to Kenzo et al. (2014), whose allometric equation we used, where AGB carbon in forests of Sarawak ranges between 96-113 Mg C/ha. Yet, it is remarkably lower than in Morel et al. (2012),

⁵ “In general, concentrations over 0.05 [mg/L] will likely have an impact while concentrations greater than 0.1 mg/L will certainly have impact on a river” (fosc.org).

⁶ The water from the oil palm plantation was classified as: “Fishery III – Common of economic value and tolerant species; livestock drinking.

150 Mg C/ha. Multiple sources of possible biases in our calculations, such as choice of allometric equations, soil type differences, etc., are elaborated in Appendix 9. Despite the biases, our measurement shows a clear drop in above-ground carbon stock when forest is converted into oil palm plantation.

However, comparing forest with young oil palm plantation makes the loss of carbon seem particularly big. Comparison with mature palm trees gives us a more righteous picture of what the carbon content *could* be in a plantation. As we could not access more mature plantations, we can only refer to literature. In Khalid et al. (1999), palms aged 23 years had AGB of 85 Mg/ha, meaning approximately 35,7 Mg C/ha. This can be considered the maximum AGB oil palms can reach, still being considerably less than in disturbed forest⁷.

We could not map the total area of the converted land but it was said that 3'000 ha were given back to villagers after winning the first court case. Using this as an estimated minimum size of the area (assuming that the entire plantation exceeds this), this would mean at least a drop⁸ from 255'600 Mg C/ha to stocks ranging between 38'760 Mg C/ha and 107'100 Mg C/ha stored in AGB, depending on the age of the trees⁹. Therefore, we can argue that this land use change in Lebor has led to noticeable carbon emissions.

Moreover, seeing that our forest plots score lower in biomass than regional references of disturbed forests (Kenzo et al., 2014; Morel et al., 2012), it may suggest that this area in Lebor has been heavily logged. Yet, we cannot confirm this, as we have no baseline from before the logging took place.

However, as the Tabung Haji plantation is located on peatlands instead of mineral soil, taking soil organic carbon into account can change the result dramatically. Due to restricted time, we could not conduct own soil carbon measurements, so we base our analysis on relevant literature. Germer and Sauerborn (2008) suggest converting peat forests to oil palm plantation can result in carbon emissions of over 1300 Mg C/ha, whereas on mineral soils the results are around 650 Mg C/ha. This implies that the carbon emissions in Lebor from draining peat swamps for Tabung Haji plantation can even double the estimated impact¹⁰.

⁷ Furthermore, our palm trees did not have frond bases, which however can contain around fifth of the AGB of oil palms (Khalid et al., 1999). If frond bases are not cut out, our result could be 15,50 Mg C/ha, mature trees scoring up to 42,84 Mg C/ha. Yet, removing frond bases is a common management practice (Brofeldt, 2016, pers. comm.), which is why the results without frond bases are considered closer the truth. This shows, however, that management can curtail the loss of biomass.

⁸ The drop of biomass depends on how old plantation we refer to. Calculating average annual emission over the 25-year lifetime of the oil palm is methodologically a more complex task.

⁹ Calculated by multiplying 85,20 Mg C/ha, 12,92 Mg C/ha and 35,7 Mg C/ha by 3'000 ha.

¹⁰ Here, we have only concentrated on the loss of global carbon sinks that sequester the carbon dioxide warming the atmosphere. Yet, when discussing climate change impacts, also nitrous oxide (N₂O) and methane (CH₄) emissions must be accounted for due to their strong global warming impact. Draining peatlands for agricultural use can actually reduce CH₄ emissions that naturally are high on peatlands (Hergoualc, Verchot, 2014). Nitrogen fertilizers can, then again, lead to N₂O emissions at oil palm plantations (ibid.), however largely depending on management and soil types. Going into depth in these emissions is, however, out of the scope of this paper.

Biodiversity

During the FRA we also identified the species of the trees (DBH¹¹ >5) in the plots. In the oil palm plantation, we only found oil palm (*Elaeis guineensis*) at 300 stems per ha. In the secondary forest, we measured 92 individual trees and found 47 different species. From calculations done in Appendix 6, we get a tree density of 767 (DBH \geq 5) stems per ha and 433 (DBH \geq 10) stems per ha. In a non-logged wet evergreen forest, Bunyavejchewin (2011) finds around 500 (DBH \geq 10) stems per meter. The difference in the expected tree density and our results suggest that there are still measurable effects of the logging.

In our studied 0,12 ha we had 25 different species with DBH \geq 10. Nakagawa et al. (2013) showed that there is 27,2 \pm 13,0 species per 0,1 ha in old fallow (20>year old), 14,6 \pm 4,9 for new fallow (5-10 years old) and 38,1 \pm 8,1 in primary forest. The investigated forest is closest to the lower end of old fallow if we take into consideration that our measured size is bigger than the one used in Nakagawa et al (2013). This may suggest that there have been logging in the forest some time ago.

¹¹ DBH = diameter at breast height

Narratives from the Field

In this chapter, we will commence with a contextual setting of the large-scale activities in Sarawak that also takes place in Lebor, before we start on the narrative analysis. In Appendix 10 there is a description of our informants whom we quote in the analysis.

Development, but for Whom?

The villagers have through their narratives identified logging and the oil palm plantation as the large-scale activities in their village. This coheres with the national strategy for economic development in Sarawak and Malaysia, where the government plans to transform the country into a developed nation by 2020 through e.g. large-scale palm oil projects (Lee, 2009). Malaysia now has one of the fastest growing economies in Southeast Asia (World Bank), but the gain has come at a price. In several communities, like Lebor, the authorities and companies cleared community land and established large-scale plantations. In Lee (2009), Lebor is used as a case to represent the local communities in Sarawak where Jengga Jeli, spokesperson for Lebor's court case, states *"The government is cruel"*, clearly indicating his feelings towards the government's development plans.

In addition, the economic development has influenced local politics, where some groups in society have benefited more than others. In Lebor the villagers depict a narrative about social marginalization in the village after the large-scale activities have entered. According to B1, the villagers had a meeting with Tabung Haji and logging companies about the impacts on Lebor, *"But they didn't want to listen, unless you bring an important person into it"*.

This social marginalization of communities can have contributed to corruption in Lebor, which some of our informant mentions: *"[The government] appoints people [to local political positions]. When I was appointed I knew that in selection committee as an example 90 % were supporting me. But nowadays you can win with only 5 % support. Nowadays it is party politics, and if you are good to the leader then he will select you. There is no election in that sense"* (A8). This quote is further elaborated by B1 stating the bribery *"is obvious to see from the equipment they buy. It shows their success"*.

These comments imply that despite going very well for Malaysia on a national plan, there is no trickle down effect into the communities. The villagers state that in the case of Tabung Haji, only two people from Lebor have jobs at the company, since the labor is imported from Indonesia due to lower wages. *"Tabung Haji also does not hire locals but mostly Indonesians. Only few villagers work there"* (A9). Going against the large-scale companies has in some cases led to threats. B1 describes an incident where he was inspecting illegal logging and was harassed by gangsters, who he believes were sent by the logging company. Furthermore, there has been limited support from the government due to many officials having stakes in the companies. *"The government won't go to [logging or palm oil] companies and tell them about environmental issues because they have shares in the companies"* (B1).

During the next pages, we wish to unfold the narratives from Lebor, and how they perceive the environmental and social effects of this national development plan that has entered their village.

“Bitter Journey”

One of the dominating narratives emerging from our data is that of a “bitter journey”. When the palm oil company arrived in Lebor in 1997, vast areas of village land were lost to the company, which started a long court case that is still going on. B2 described this series of events as a “*bitter journey*”, where “*even after sweet moments of victory*” the villagers still have to “*face hardships*”. This refers to the often repeated fact that the villagers actually have won the rights to the land twice, but they still jam in the legal process, now waiting for the decision from the Federal Court. The trial has continued for more than ten years.

Several informants from both A and B side remember the surprise of the people when the first palm oil company arrived, when “*they just came and took the land*” (B3). Of our questionnaire respondents, 18 out of 23 replied that there was no consultation before the company arrived. Those who remember a meeting taking place always added that this never led to any compensation. Moreover, informants from the B group used the word “*fight*” to describe their actions. They were “*fighting for their land*” (B6), which was taken abruptly by the company. Overall, this is pictured as a sudden and distressing event, which provoked a will to fight back.

In the B group, several villagers also remind that they have got a part of the land back due to the favorable verdict in the first court case. According to them, 3’000 hectares was returned. This gave an opportunity for the villagers to reap some benefits from the production themselves. One of our key-informants also delightedly recalls how a group of villagers managed to block the road to plantations for two weeks, preventing the company to harvest. These are the stories of small victories within a long, continuous struggle.

We can therefore depict a plot where the “*bitter journey*” starts with an unexpected land grab, triggering a response from the villagers, which then develops into an extended “*fight*” in the courtroom and in people’s minds. However, this narrative differed between the two village groups. Only those more involved in the court case tend to use the word “*fight*”. Yet, also the more passive villagers do recognize the storyline of sudden interference of the company and the prolonged court case with some victories along the way. This is natural, since both groups were affected by the case and are thus following the trial but only the other group is actively engaged in the “*fight*”.

Lastly, several villagers, both from A and B group, expressed in a focus group and interviews their concern of other actors, such as the government, “*taking*” their land. The lands are thus not safe even though this case would be won. These narratives of land disputes exemplify the context: official land titles are rare among indigenous peoples in Sarawak, and these cases of the government giving permission to private companies to operate on NCR land are said to be common (Malone, 2016, pers. comm.).

Internally Divided, but Still United

The fight against the company to win their land back has led to the division in the village, where the two groups unofficially call themselves A and B. The A group is not actively involved in the fight against the company, whereas the B group is very

progressive in continuing the court case and the fight. An informant from the B group told us that B stands for 'Betinak', which means 'Protectors of the land' in Iban Remun. According to A8, the division happened when they were collecting money for lawyers for the ongoing court case, and one group went to the opposition party of the government to get funding, *"and suddenly it became about party politics"*, with the A group supporting the government and the B group supporting the opposition. The fact that the conflict also relates to broader politics might have impacted the resilient division even more and as A8 said: *"When Ibans do politics, they kill their community"*. The conflict seems like a narrative of great importance for the villagers since it has also led to a physical division: different community halls, split Sunday prayers and two headmen.

The division became very clear to us, when we one day tried to recruit informants for a PRA-session and invited two men from the B-group in the village, and they declined by saying: *"We are from another group"*¹².

Even though the conflict and the division in the village seemed to be very significant for the villagers and the social relations, we were able to identify another narrative from our data. When conducting our interviews, questionnaires and PRA-sessions the majority of the informants referred to the plantation area as *"our land"*. Informants from the A group told us that *"The company did not ask Lebor for permission"* (A11), *"Tabung Haji came in 17 years ago, it is a huge area of land and our grandparents owned the land"* (A10) and *"it is the villager's land"* A9, *"We want our land back"* (B3), *"Tabung Haji has made people quarrel, you know, it was our native land and now we have a court case"* (A9).

From these narratives we can depict a story of a "villain", namely Tabung Haji. Defining roles of villains and heroes in narratives is often used in the narrative approach. This unveils the protagonists' feelings towards different actors. (e.g. Jones, 2014.) Here the feelings are clearly negative towards Tabung Haji, therefore making the company the villain of the story. On the contrary, a former headman who started the court case is in fact called Hero among the B villagers, as he is accredited for the previous success in the *"fight"* against Tabung Haji. While the narrative of hero is only constructed in one of the groups, the narrative of a villain is still shared among the villagers regardless of group affiliations: the villagers of Lebor might be internally divided but are still somehow united in their opposition to the villain, the palm oil company.

Sustaining a "Legacy"

Lebor has a long tradition of farming, and local land and knowledge has through history been passed from generation to generation, *"Before I used to (...) go to my pepper fields with my father (...) I used to catch fish with my father"* (B2). Access to and understanding of the land is therefore crucial to sustain the indigenous knowledge that has been passed on in Lebor. The importance of this custom became clear to us during the interviews since many villagers mentioned legacy, and wanted to leave a legacy for future generations just like their ancestors had left a legacy for them. These accounts hold in

¹² We met the two men during the village cleaning, but they did not participate in other activities and do not appear in the list of characters.

elements of a tragic narrative, where the protagonist has an objective, here sustaining the legacy, which he is however unable to achieve (Polkinghorne, 2003). Several of the informants had tears in their eyes when discussing this topic, which might illustrate the concern the informants have for future generations.

During a PRA session with B-informants, the women took a long time drawing the graveyard, and when asked why, they smiled and replied *"Ancestors"*. B2 later explained the importance of the graveyard saying *"it's where the founders of Lebor are"*. The notion of legacy illustrates a deeper understanding of the connectedness the villagers of Lebor have with the surrounding environment, due to their dependency on the resources provided by nature. *"The said native customary land which is compromised of land and forest is not just a source or livelihood but also constitutes life itself as the said land is also fundamental to the Plaintiffs social, cultural and spiritual expect as native people"* (Court Case Report¹³). Through the PRA-sessions many of the A and B villagers showed a great emphasis to holy places in Lebor, such as Guna Gayau, a clay crocodile representing a spirit that protects the area. Another special place for the villagers is the Pemakai Menua, which is a community area where all the villagers can hunt, fish and collect forest products. The Pemakai Menua of Lebor was located on the peatlands, their community land, their legacy, that has now been taken by Tabung Haji, here again emphasizing the narrative about the villain.

However, this idea of legacy has been disrupted by the large-scale interventions harming the environment and taking their land, as well as general modernization processes. These modernization processes were expressed in the narratives from the elders. They perceived urbanization and education as *"developing"* youngsters. *"The pencil we hold in our hand is the key for our future"* (B2). This development was both tragic and positive. In the positive part of their narratives, our informants highlighted education and urban jobs. In the tragic part of the narrative, the old generation was concerned of the youngsters not continuing their legacy, since they do not know or will not pass on the local traditional knowledge about farming and nature. *"[The young generation] don't know them [plants] and how to use them. Young people don't even know the name of those plants"* (A3). Still, most of our informants seemed to prioritize that the youngsters *"developed"* in towns even though the future legacy then became uncertain *"The newer generation, they don't like to go to the land. When the older generation is gone, I don't know what will happen to the land"* (A1). They feared that youngsters would not know their land boundaries, which then could lead to land conflicts with neighbors, governments or companies taking their lands. Therefore, in some of the narratives, they pointed out that this generation has fought and is fighting for the land and legacy. They show a deep wish that the young generation will do the same, fight for their rights to the land, and thereby sustain the legacy that has been passed on since the village was founded.

¹³ We are unclear about the use of "expect". In general there were a few words in the document that did not make sense in the context or grammatically. But the overall phrasing of the quote still illustrates the point.

Who is to Blame?

"This is because of logging and oil palm plantation. The plantation is huge. There are no more old trees, virgin jungle is gone" (A4).

The construction of Tabung Haji as a villain is sustained through many aspects of the narratives. Tabung Haji and the large-scale logging companies are again portrayed as the villains when it comes to environmental degradation and its impacts on their livelihoods. The recurrent narratives of environmental degradation are the loss of biodiversity and the adverse impact on the river, which are elaborated in the next paragraphs.

The majority of the villagers have seen a loss or decline in the plants and animals they used to have. In the questionnaires, 20 out of 23 mentioned a loss of plant species, where they mostly named tree species (Appendix 11). Most of the lost tree species were not found in our Forest Resource Assessment: Belian (*Eusideroxylon zwageri*), which was named the most in our questionnaire, was not identified but altogether four Entimau trees (*Ficus gecharis*), also mentioned often, were measured. Due to limited sample, it is nevertheless hard to say how clearly perceptions of tree biodiversity stem from the actual status of the forest.

A little less, 17 out of 23 of the surveyed, have noticed a loss in wildlife biodiversity, where they emphasized three animal groups. Mammals, such as monkeys and deer, were the most often mentioned animal group, followed by birds, in which the hornbill (*Bucerotidae*) was dominating, perhaps because of its importance as a *"our national emblem"* (A1). The third prevailing group was fish. This might imply the relative importance of different animal groups, such as food sources, although the reason can also be that big mammals are easier to detect.

In regards to biodiversity loss, there are several actors having the role of a "villain". The loss of tree species is mostly said to occur due to logging. As to the loss of wildlife, the informants referred both to logging and the oil palm plantation: *"animals have gone when the plantations came"* A12.

Instead of merely listing species that are fewer nowadays, many informants explain how they used these plants or animals. *"I used to hunt wild boar and deer in peatland forest, and there was rattan. Now they plant oil palm there, at the Tabung Haji plantation."* (A9). This underlines that these species have a purpose in their livelihoods.

Just as much the villagers talked about biodiversity, they were eager to describe how the river has changed. Out of 23 questionnaire respondents, 19 had perceived changes in the river within the last twenty years. That was also clear through our PRA-sessions, focus-groups and interviews. *"Before the clearing of the forests the river was very deep"* (B3), *"water went up to the chin"* (A4), *"you could hear big stones rolling, nothing to stop the water"* (A1). But due to logging *"the forest doesn't catch that much rain anymore"*, and the water *"easily evaporates"* (A4), *"The river is shallow nowadays, it is shallow since around 2002"* (Youths). Oftentimes, the water quality was said to be worse back when the logging was going on, although most of our informants believe the water is *"now clean again"*. The drainage of peatlands at Tabung Haji has also had negative impacts on the rivers through both draining and pollution: *"the drainage for the plantation disturbed*

their habitat and the fish got extinct" (A9). Yet, there is less emphasis on the plantation, perhaps because it is located downstream and thus does not affect their drinking water. Through our water sampling we discovered that the water in the village (station I) was considered safe after boiling, and thus of relatively good quality. This coheres with the dominant opinion of water being fine again. Perhaps this indicates that their perception derives from the measurable reality.

Although many villagers blame either logging activities or the oil palm plantation for the environmental degradation, they often mention also their own actions. When asking the reasons for fewer plants and animals, it is said that the villagers *"cut Belian [precious hardwood] for construction"* (A3) and *"hunt the birds and eat"* (A13). An increase of the population of Lebor has also led to more hunting and fishing and thereby fewer animals. *"We used to have so many kinds of fish before but the population increased"* (A9). Sometimes also people from other villagers are blamed, as due to new roads *"outsiders can come and kill our animals"* (A4). Also clearing and burning of land to prepare rice fields creates environmental problems, such as haze or fires. Therefore, the narrative of large-scale companies' being the villains and the villagers' being heroes is accompanied by reflections of the villagers' own impacts on nature. The roles of the story are thus not set in stone. Nevertheless, some villagers remind that sometimes you must exploit the resources: applying fertilizers might *"decrease the soil fertility (...) but you need it for your crops"* (women from A-group). Therefore, they do not take the role of the villain, as they have a reason for using the nature. Yet, the general tendency is blaming the large-scale companies.

The narrative of villains and heroes becomes interesting if Lebor wins the final court case and thereby the rights to palm oil company on the peatlands. The plan expressed by several members of the B-community is to keep on growing oil palm, and *"keep some land as forest"* (B3). *"Plant old trees. Certain kinds. Conservation and preservation of forest"* (B1). The continued production¹⁴ of palm oil is despite the many negative environmental impacts they had mentioned in the interviews. When asked if the environmental impacts would not be the same if they took over the production the reply was *"The damage is already done"* (B3). This sustains the narrative about the large-scale activities being the villain, and also being the villain for future run of the palm oil production.

¹⁴ Tabung Haji owns one of the two processing mills in the region. From the interviews it seemed that it would be possible for them to use the mill since they would get the rights to the area and the factory on the land, thereby being in charge of the production. However, we are not certain of this fact, and was only something we reflected on back home. So we are not sure if winning the court would imply that they can grow palm oil on the land, and also produce it, since the material factory building could end up being demolished or something else.

Perceptions of Climate Change

Our estimation of carbon emissions due to clearing of the community land suggests that the land use change in Lebor is directly contributing to global warming. Therefore, investigating some local understandings of climate change became interesting. The dominating elements we captured will be analyzed in the next paragraphs.

“Maybe Mother Nature is Getting Tired”

When discussing changes in the weather with our informants, the dominating topic was increasing temperature. Out of 23 questionnaire respondents, 18 experienced increase in temperature, many confirming that it is not only the last years but a continuous phenomenon. *“Hot days are hotter than they used to be. In the 1960’s it was still ok but now, ouch”* (A4). Changes in the rainfall were experienced by more than half of the respondents, 14 out of 23. Yet, the perceptions differed from each other, some mentioning more fluctuation in rainfall patterns and some emphasizing heavier rains.

Both kind of changes were often related to the recent large-scale land use changes. *“It is getting warmer. Rivers dry up during the dry season. (...) This is because of logging.”* (A4) *“It is getting hotter after the oil palm [Tabung Haji plantation]. There are no more tall trees.”* (B5) This can be linked to previously analyzed narratives of villains. It becomes apparent in the villagers’ responses that the companies are the reason also for changes in weather, therefore being the villains of the story.

In addition to changes in weather locally, some of our informants showed awareness of global climatic changes. *“I have read that temperatures have increased already three degrees.”*(A4) *“[The temperature has increased because] the ozone layer is getting thinner”*(A5). These, although few, informants linked changes in their immediate environment to global warming, using scientific terms, such as carbon dioxide and the ozone layer. Yet, they found it hard to explain how cutting trees actually leads to increased temperatures or reduced rainfall. When A5 was asked to elaborate on this, her reply suggested that she only knew the term climate change and the ozone layer, but not the scientific meaning of the terms. Other quotes underline this argument: *“Logging trees increases evaporation. I don’t find any other reasons for warmer climate. Maybe the world is getting old. Mother Nature is getting tired [Laughing]”* (A4). *“Maybe the sun is getting closer”*(A6). The understanding that logging has an effect on increased temperatures coincides with academic literature. Deforestation is found to be one of the big causes of local higher temperatures and other temperature anomalies (Bounoua et al. 2004). It can also have an effect on the local rainfall patterns (Saad et al. 2010).

Same variability in awareness can be detected in the villagers’ perceptions of peatlands and the environmental impacts of using them for cultivation. During our focus group and in interviews, peatlands were not connected to concerns for climate change as in the academic literature used in our literature review,, but instead economy: *“We cannot plant anything because of the water levels. If you have a lot of money you can do something about it [build drainage systems]”* (A8). One informant, however, mentioned a clear link to global warming: *“When you burn land you release carbon dioxide. Even more when you burn peatlands because of the high [level of soil] organic matter”* (A5). Most

villagers either did not associate these two phenomena, or had a more ambiguous idea of how they are related: *"Machines they use for clearing [peatlands] increase temperature"*(A*). *"Drainage is important, peat is the best place for oil palms since in hilly areas [there is] not much water (...) it doesn't have other impacts"* (B4).

Are Concerns for Consequences Connected to Access to Knowledge?

When analyzing the relation between the understandings of the consequences environmental changes have and access to knowledge, two narratives emerged: one expressing concerns and another where no concerns were detected.

Several examples of worries due to environmental changes were mentioned but they rarely included climate change aspects. Many of them related the changes to health issues, *"[concerning burning] from Indonesia there are very measurable consequences that causes health problems, asthma, coughing"* (B3), *"Air pollution in Malaysia causes health problems, coughing and watering eyes"* (B3) and *"the [environmental] changes also affect our health, you become easily ill, we have dengue which we did not have before"* (A4).

When analyzing the villagers' narratives regarding the understanding of climate change, education is important to take into consideration. Many of our informants were from older generations and 55 percent of our questionnaire informants had received little or only primary education (Appendix 12). As B3 said: *"The younger generation know more about the environment because of education"*.

Those few of our informants that explicitly mentioned climate change had their knowledge from tv and newspapers: *"I have read about El Niño in the newspaper, it is supposed to be hot weather in Asia, but here it is raining. That, I believe, is a sign of climate change"* (A2). Another informant watched CNN every night and linked the increase in temperatures to *"1) no more forests 2) too much factory 3) development using chemicals 4) concrete buildings instead of nature 5) too much war, bombs, weapons, North Korea doing nuclear testing"* (A7), which illustrates an awareness of climate change processes.

Access to knowledge, could also be by encountering people affected by climate change. *"So when you've talked to exposed people you know [climate change] is crucial"* (B1). This was realized after a conference with people from different countries in Southeast Asia. B1 further elaborated that in order to reverse the environmental impacts *"all communities have to work together. It is not enough if only one community does"*, which indicates an understanding of climate change being more than a local problem. However, B1 was the only informant to express this understanding of collaboration outside Lebor.

The second narrative expressed little concern of environmental changes, when asked about broader long-term consequences. As one informant said, *"When I heard about climate change, I couldn't care less about it (...) It has no effect at the moment - we don't experience it"* (A1).

A8 said, *"All I see is on television, so I know what is shown. Whatever the tv portrays I know."* When asked if what he saw on television concerned him he replied *"For climate*

change, I can't be bothered to think of it". These accounts indicate an awareness of climate change, but no concern of it.

Both narratives show that the villagers of Lebor seem to be aware of environmental changes having consequences in other places in Sarawak, Malaysia and even the world, but do not seem to connect the occurrences with climate change, unless it perhaps can be directly linked to Lebor. This confirms our prior assumption that access to knowledge shapes understandings of climate change, but does not necessarily entail concern and a deep understanding of the phenomenon and how it affects Lebor. As one of the well-informed villagers pointed out: *"Educate people on climate change and the environment through school is best"* (B1).

Discussion

The narratives of large-scale companies, backed up by the government, taking and operating on the village land fit into the concept of environmental victimization, coined by Christopher Williams (1996). Environmental victims are *"past, present or future generations who are injured as a consequence of a change to the chemical, physical, microbiological, or psychosocial environment, brought about by (...) human act or act of omission"* (Williams, 1996:21). These victims are often individuals or groups that are already in an inferior position to defend their rights, such as indigenous people, opposed to the actor who is causing the harm (White, 2010). This is the case in Lebor as the village has lost land to large-scale activities, and in pursuit of reclaiming that back, has been locked in the court case for more than ten years. The concept of environmental victimization is highly related to the concept of environmental violence that is seen as a *"site-specific phenomenon rooted in local histories and social relations yet connected to larger processes of material transformation and power relations (...) of access to and control over resources"* (Peluso et al., 2001:5). Environmental violence incorporates both the power relations between the large-scale companies and Lebor, Lebor and the state of Sarawak, as well as internal relations between the villagers within Lebor. Throughout the analysis, the narratives often depicted power struggles between the different actors over access to the land and resources at Tabung Haji.

However, being a "victim" does not necessarily imply being passive, unable to respond or rise against the wrongdoer. Williams (1996) reminds that reactions to victimization differ from one group or individual to another. This is visible in Lebor, where a part of the village is actively engaged in the court case, while the rest is more passive.

What we also see in these narratives is a friction between what Igor Kopytoff (1996/1972) calls commoditization and singularization. According to Kopytoff, humans consider everything either a commodity or as singularized. When something is singularized, it is evaluated to be of a too high or low symbolic value to make a commodity. This differs in time and place. According to Kopytoff, humans have a desire to commoditize, where culture functions as a shield against this commoditization. Through culture, certain things are made unique and "sacred". (ibid.)

Through the old generations' narratives, we see a deep valorization of communal land that has now been taken by Tabung Haji. Pemakai Menua has through generations been a place for exerting traditional practices while being in contact with nature. As this area is valorized as unique, we depict a tragic narrative when large-scale companies commoditized the land through oil palm plantations, which relates to conflicts over the control of natural resources in Lebor. For the villagers, this land was not for sale, it was not considered a commodity.

At least the villagers did not consider Pemakai Menua a commodity before the large-scale company took their land. When we asked them what will happen to the land if they win the case and the land back, some of them replied that they will reforest some of the land as a new Pemakai Menua. As for the rest of the land, they will continue to grow oil palm for selling. We believe this as an example of how some villagers may start to perceive some of the former Pemakai Menua area as a commodity. They want to cultivate oil palm for commercial purposes, while they still have a desire for keeping some of the forest, to sustain their legacy.

Through academic literature and data from our natural science methods we could establish that the large-scale activities in Lebor is part of the anthropogenic cause to climate change. This will also continue if they win the court case and Tabung Haji is forced to leave the land, since some villagers express a wish in continuing the palm oil production. Hereby they would commoditize the land, and sustain anthropogenic causes of climate change in Lebor, which according to academic literature will pose a risk to everybody on earth. To broaden the understanding of risk we have chosen to include the theory World Risk Society by Ulrich Beck.

According to Beck (2006:333): "*Risk (...) is a socially constructed phenomenon*". Through the theory we find that risk perceptions from the villagers of Lebor differ from a cosmopolitan risk perception that has a spatial aspect: "*the new risks (e.g. climate change) do not respect nation-state or any other borders*" (Beck, 2006:334). A cosmopolitan risk perception believes that climate change transcends all borders, and thereby affects us all. We found very little empirical evidence of the kind of climate change understanding that would acknowledge the global aspects of climate changes as in academic literature. However, some cosmopolitan spatial aspects were identified, such as health problems due to air pollution stemming from Indonesia, but these did not concern climate change. To go further into why this risk perception differs so much from the cosmopolitan perception of climate change as a risk, we have chosen to include the construal-level theory.

Psychological construal-level theory describes how humans can more easily relate to things that they experience themselves. "*Transcending the self in here and now entails mental construal, and the farther removed an object is from direct experience, the higher (more abstract) the level of construal of that object*" (Trope and Liberman, 2010: 440). According to Trope and Liberman it is easier for people to perceive from a zero-distance that includes "me", "here" and "now". Likewise, it is difficult to perceive things that happen far away from the self or things that lie far in the past or future (ibid.). This was reflected through many of our informants' narratives. They seemed to relate most environmental changes to their personal experiences. Many of the villagers perceived

changes in the water, which we now measured as safe to drink after disinfection. They also identified decline in biodiversity due to logging. While we cannot conclude this from our measurements, the data can suggest that logging has affected the forest's density and diversity. However, our finding of the loss of biomass and resulting carbon emissions was not detected in their narratives.

They mentioned what they have heard, felt and experienced themselves, only few of them expressed understandings of global climate change in their stories about the weather and environmental changes. This might be both due to lack of knowledge on the subject, but even for the informants that did have a certain knowledge of climate change, it was hard for them to explain.

"... would not someone looking at European societies from outside have to acknowledge that the risks which get us worked up are luxury risks, more than anything else?" (Beck, 2006: 332).

The above quote could seem as the case for Lebor, since the cosmopolitan risk perception of climate change was not mirrored in their narratives. While the academic literature acknowledges large-scale logging and clearing, and even more alarming the drainage of peatlands, as some of the main causes for climate change, so evidently happening in Lebor, the villagers have different takes on the consequences these large-scale activities have for them. For them, large-scale logging and clearing does not pose a high risk of climate change. It seems the activities are direct causes of concrete changes in their everyday life: a loss of places for hunting, loss in biodiversity, decline in water quality and separate Sunday prayers. Perhaps these various consequences of environmental violence and victimization are also influencing the perceptions of risks in Lebor. Above mentioned examples of victimization might be preoccupying the villagers, and perhaps this is why concerns of global climate changes are not perceived in Lebor. It seems as a luxury risk, which is not acknowledged as the villagers already have a lot on their plate.

From the narratives we could depict a story where the companies were portrayed as the villain, and the villagers as the "hero". While writing the discussion, a reflection that arose was; if the B-group will win the case and continue the production, would they then actually sustain the environmental victimization and violence imposed by Tabung Haji to the A-group in Lebor, since the court case has led to this strong division? Would the B-group take upon themselves this identity of a villain as they have used to describe Tabung Haji, since they now enter the role?

Sometimes, indigenous peoples are romanticized as nurturing the nature, opposed to large-scale companies who are instead blamed of ravaging it. Little research has been done to what actually happens when victims of land grabbing and land rights win back their land. And furthermore, how do the theoretical concepts of victimization and violence lend themselves to the case when the victim overtakes the responsibilities that earlier belonged to the perpetrator? Seeing the prevalence of land disputes in the region, this reflection opens a window for further research on communities having overcome these conflicts.

Conclusion

In academic literature, large-scale logging and clearing activities on peatlands, which has happened in Lebor, are firmly associated with severe climate change impacts. We estimate that disturbed secondary forests in Lebor contain 85,20 Mg C/ha in above-ground tree biomass, whereas a young oil palm plantation accounts only for 12,92 Mg C/ha, reaching an estimated maximum of 35,7 Mg C/ha. Taking soil carbon loss due to drainage of peatland into consideration, the carbon emissions could be doubled. The decline of carbon stock is thus striking. The villagers of Lebor had perceived a multitude of other consequences of this land use transition. The water sampling collected downstream from the oil palm plantation showed traces of fertilizer and was classified as a habitat only suitable for *tolerant* fish. The majority of informants had observed loss in biodiversity due to logging and the oil palm plantation and our results show a low number in tree species and density in the secondary forest compared to old fallow forest.

Inspired by a narrative approach we collected fragments of the villagers' narratives about impacts of large-scale activities on environment and social relations. The presence of the large-scale company, Tabung Haji, has led to a social division among the villagers, as they were divided into two groups due to the court case against the company. We could unfold stories of "villains", namely the logging and palm oil companies that entered the village and took community land without consultation or giving compensation. We see these accounts as examples of environmental victimization, where natural surroundings of the villagers have been changed, thus violating the people. Furthermore, we unveiled a narrative of "tragedy" where the old generations were concerned of not being able to sustain their legacy, due to the environmental impacts affecting their traditional practices and the transmission of knowledge inherited from earlier generations.

Investigating perceptions of environmental consequences of the mentioned large-scale activities revealed some notions of climatic changes, such as locally increased temperatures due to deforestation, therefore cohering with academic literature. Yet, these understandings were not linked to global changes and in general climate change was not something they seemed concerned about in Lebor. Beck's conceptualization of *risk* and the construal-level theory help us argue that the concrete consequences in the everyday life of Lebor leave little space for global concerns of climate change. As the academic literature perceives climate change as a global risk, we did not see much connection between the local and academic spheres.

Seeing the wide array of social and environmental impacts observed in Lebor, this report describes a village where the perceived consequences of large-scale activities are not limited and often not linked to global warming but instead, they go beyond climate change.

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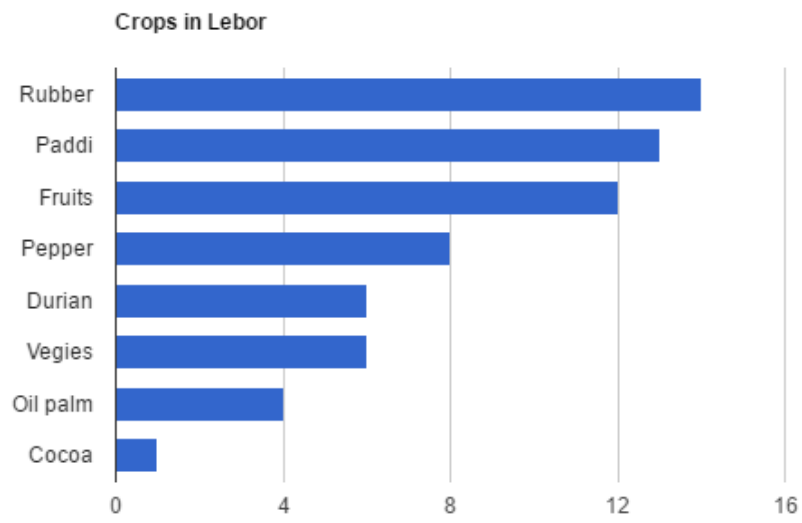
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Appendices

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Appendix 1: Graph of the most dominant crops in Lebor from the questionnaire



Appendix 2: Elaboration of social science methods used in our report

This appendix gives an elaboration of the social science methods used in this report. Examples of interview guides will come in the following appendices.

Below is a small table of content for the included methods.

- Questionnaire
- Interviews
 - Narrative
 - Semi-structured
 - Participatory Photography
 - Focus Group
- PRA
- Transect walk, walkabout, in-situ
- Deep hanging out, informal conversation and participant observation
- Working, planning and sharing data

Questionnaires

We designed a questionnaire draft in Copenhagen, and elaborated on it after a few days in the field with help from our interpreters. We conducted a pilot-test with one villager. Most of our informants were men and women above 50 years old. The questionnaire took around 30 minutes to conduct.

We filled out the questionnaires with the villagers, which has its strengths, such as not putting them in an awkward situation if they could not read or write. We were also able to make sure that our informants understood and answered our questions. The questionnaire made us meet many villagers, and thus helped to find informants for further interviews if their answers were of particular interest to us.

Questionnaires as a method also had its shortcomings. It was not possible to change the questions along the way, even though we got new information every day, since the answers have to be comparable. Our standard questions were rarely sufficient, so we combined it with follow-up questions afterwards.

Interviews

- Narrative interviews

We asked broad, overall questions to give our informants a free space for explaining what they thought was of importance. We asked about their life story, what changes they remembered in Lebor, and how the nature looked like, as far as they could think back. We had some few overall questions ready, rather than an interview-guide for this kind of interview, since we sought to follow the flow of the informant as much as possible. We mostly interviewed the older generation, since we assumed they had experienced most changes. The strength with this form of interview was that the our presumptions did not structure the interview, giving space for what the informants wanted to emphasize. The shortcomings were that the method was challenging to accompany with translation, as long lines of thought were not translated to us, contrary to the idea of narratives of having longer descriptions to analyze. Moreover, we did not

have much control of the interview, and what the informants decided to tell us was at times of little relevance to us.

- Semi-structured interviews

We sometimes combined the narrative interview with a semi-structured, to make sure that our informants replied all our questions. One of the interview guides is provided in Appendix 5.

- Interviews from Participatory Photography

We asked some informants to take some photos of changes in the nature in Lebor, and later on we asked them explain what the photos portray and why they had chosen those topics. This was a good way to make our informants lead the interview, showing us what they thought of as important. The strengths with this way of interviewing, was that it was very participatory and open. Our informants had time to consider and prepare what to tell us through his photos. The photos became concrete elements in more abstract stories of change. The only shortcoming was that one informant's photos (out of three informants) accidentally did not get saved in the camera, as he did not know how to take pictures. Here are 5 pictures taken of another informant:

Picture of the road



Picture of water



Picture of cultivation





Picture of the sky - no more birds



Picture of the mountain - logging

- Focus group

We conducted two focus-group interviews (Mikkelsen 2005:89), one with farmers that had their peatlands taken in the area that Tabung Haji now use for their plantation, and one with youngsters between 18-30 years old living in Lebor. Both groups consisted of mixed gender, the first group due to the common denominator, the second group due to lack of participants for separate sessions for boys and girls. Our motivation with the first focus group was to get an understanding of the socio-economic consequences of land grabbing, and how our informants perceived peatlands. Through broad questions, we encouraged them to discuss about cultivation, peatlands and clearing of forest. We then asked them questions about Tabung Haji, which we assumed was a more sensitive topic. We received more information about peatlands than on the land grabbing, which confirmed our idea of Tabung Haji as a sensitive topic.

Our motivation with the second focus group was to understand some of the Lebor youngsters' perception of the environmental changes, and their idea of climate change. Younger generations were not the informant group of our interest but we had the idea of hearing their views on the last day of field work, in order to see if something relevant would come up. We asked broad questions about their own and their parents' wishes for their future, their ideas of changes in the environment and what they knew about climate change. Unfortunately, only the girls were discussing, especially one girl took the lead while the rest seemed too shy to reply.

PRA

We found our A informants by asking some at church, on the street or at their house, also asking the local interpreter if she thought that these people, who she all knew, could collaborate. We found our B-informants through the B-group's headman, as it was difficult to win their trust at first. In both sessions with A and B-group, we divided men and women in two groups of around 10 in each group. The reason for the division was to make sure, that our informants felt comfortable working together, and to see if there was any difference between what different genders pointed out as important. We presented our informants for the following participatory tasks:

- Map: We asked our informants to draw a present map of Lebor. Secondly, we asked them to put post-its on the map to mark the past of Lebor. We noticed

what was discussed, included and excluded on the map, and what our informants highlighted and downplayed. Our intention was to get an idea of their perception of the changes that have been in the area and an impression of the social relations among our participants.

- Time-line: We asked them to draw a timeline of Lebor, with a start and ending point that they decided. This was to get an idea of the most important events that they could remember.
- Matrix-ranking: We asked them to rank different crops according to statements. We wanted to know about their experiences, ideas and choices when cultivating.
- Environmental ranking: Here they were asked to rank the scale of impacts of different environmental and weather phenomena as well as land use changes on Lebor on a scale from 0-5. From this we could see which had the biggest impact on Lebor, and we would ask questions for why they had ranked as the had, to get a better insight into their understanding of environmental impacts as well as see if there was a connection to climate change

Environmental ranking

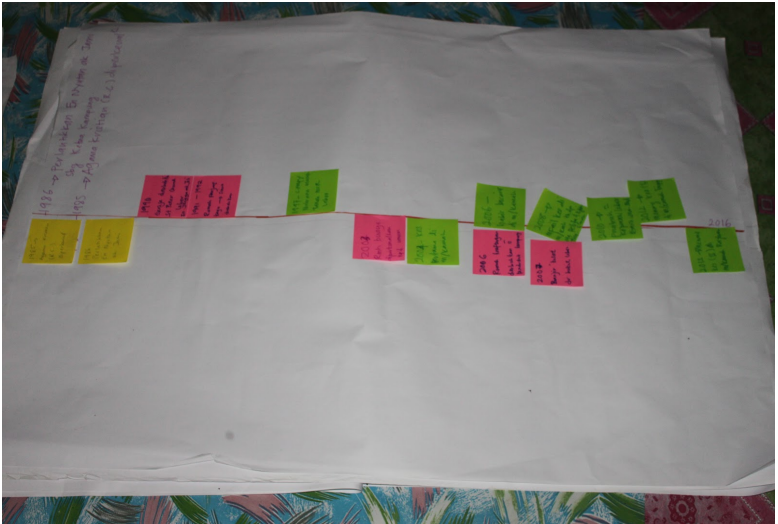


Environmental Impact	Ranking Score
Drought (Kemarau)	30
Heavy rain (ujan Lebat)	17
Higher temp. (Panas)	107
Erosion (Tanah runtuh)	0
Animals and insects (Jelut)	25
Fertilizers (Baja)	23
Burning (Nuru)	29
Logging (Balak)	29
Palm oil (Kelapa Sawit)	29
Cleaning of peatlands (Pengasiran tanah gambut)	29

Matrix-ranking

	padi	Gedeh	Lado	Semut	Kato	Sagur	Durian
Food Preference (Umai Pakai)		*			*	
Income (Pemisi)			**			
Labor Require- ment (Tenaga Kerja)						
Yield (Penguluh)	*					
Market Price (Rega Pasar)						
Ease of cultivation (Penyamaai penanam)						
Water require- ment (bumi ai)						

Timeline

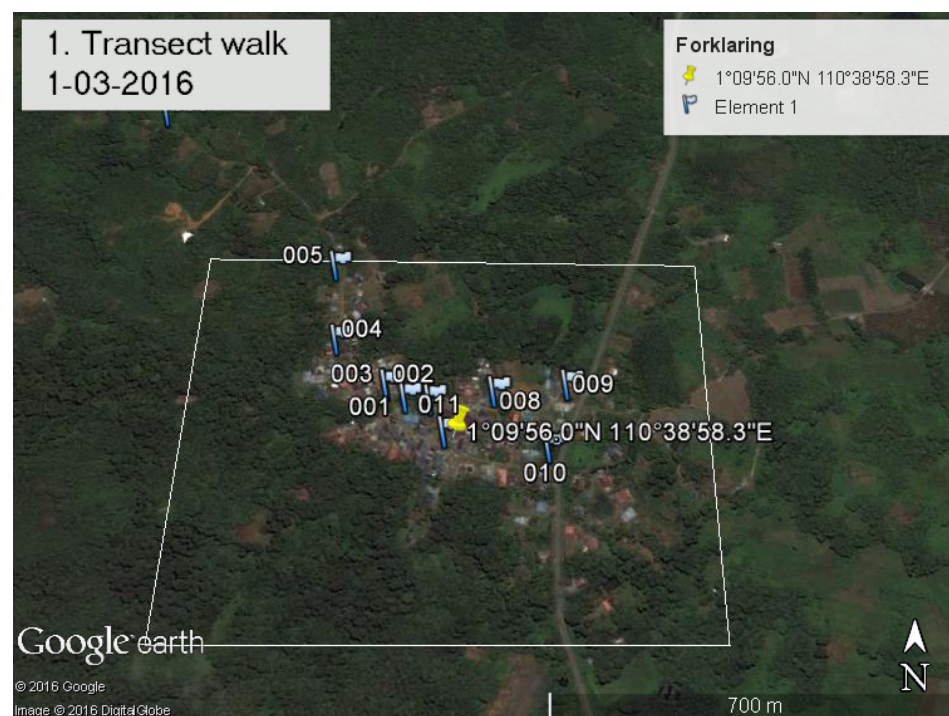


Mapping of past and present Lebor



Transect walk, walkabout, in situ interview

On our second day in Lebor, we went on a transect walk (Selener et al., 1999) with a farmer and the former headman. Here, zones, locations of houses, streams, roads, and cultivated or forest area near the village were marked on a GPS, and used through QGIS-programme for making a map of the village. The transect walk transformed on its way to a walkabout (Strang 2010), where the guides showed us their own cultivated lands, where they have their daily routines and interact with their surroundings. Here we conducted in situ interviews (Strang 2010) with them, and asked about legacy, family and farming. As our informants were familiar with the settings, it made the interviews more informal and relaxed. Also, the surroundings inspired our informants to talk and show us things in the nature, from which we got a knowledge about their relation with the environment.



Deep hanging out, informal conversation and participant observation”

During our field trip, we did some deep hanging out (Geertz, 1998) with the women who cooked for us, neighbors, the headman, at karaoke-sessions, welcome and farewell ceremony. Of this method, we created and developed relations with some of the villagers and could observe the social relations among them. We had informal conversations during deep hanging out, before and after conducting our social science methods and by meeting people in the street. Here, we got information under more informal settings, and the villagers got the chance to ask us questions. Also, we did participant observation through all our methods by interacting with our surroundings (Hume, Mulcock 2005).

Working, planning and sharing data

Before the field trip, we met in our 5-man group everyday and discussed, wrote and read together. We were in contact with our three Malaysian fellow students through

mail, where we exchanged research questions and reports. During our field trip, we took pictures and field notes whenever we got the chance to record our data. We had a common logbook, where we took turns in writing our plans and activities. We placed a calendar on the wall with post-its of activities and participants, to get a clearer overview. Some of our appointments were impulsive, which were tough for our interpreters. Nevertheless, they were always helpful when we needed them. We had morning and evening meetings altogether, where we discussed our findings and plans. After end field trip, we exchanged all our research data with our Malaysian students, and through Nvivo, we coded our data to get an overview of our data.

Social science Methods	Natural science Methods
Questionnaire (23) Narrative interviews (4) Semi-structured interviews (SSI) (3) Mixture of a narrative and a SSI-interview (7) In-situ interview (2) Participatory photography (2) Focus group interviews (2) PRA-sessions (4) Walkabouts (2) Nvivo Ongoing deep hanging out, participatory observation and informal conversation	Forest resource assessment (FRA) (2) Water-sampling (2) Transect walks with GPS (2) QGIS

Appendix 3 - Interview guide for a narrative approach

We have no standard guides for the narrative interviews, since many of the questions appeared along the process. Below we have come with some examples of questions that we asked during an interview with Jengga. These questions were generally in the back of our minds when conducting a narrative interview, and something that we used to open up the narratives.

- Can you tell us about yourself and your life?
- Can you tell us about life in Lebor?
- Can you tell us about the history of Lebor?
- What does the nature mean to you?
- How do you see the future for Lebor?

Appendix 4 – Questionnaire

Date:
Household:
GPS:
Location :

Section A: Demographic of respondent

1. Gender: Male ☐ Female ☐
2. Age: _____ years
3. Ethnicity: _____
4. Main Occupation: _____
5. Total members of people living in the household: _____
6. Numbers of years living in Lebor: _____
7. Highest level of Education: _____
8. Main source of income of the household: _____
9. Other sources of income (off-farm job, money from other family members, etc.):

Section B: Farming activities

10. How much land do you have in total (in acres)? _____
11. How did you get the land?
Bought _____
Inherited _____
Other, *please specify*: _____
12. What types of crops do you grow? Is it for subsistence or for sale (*specify for each crop*)?
a. _____ b. _____
c. _____ d. _____
e. _____ f. _____
13. Have you changed the crops you grow on your farm?

- 13a. If yes, what did you grow before? _____

14. Why did you change to the current crops?

15. Do you have any livestock? How much? _____

16. Who is responsible for:

- a. Harvesting
- b. Planting crops

17. Do you use fertilizer or pesticide in your crop field? ___ Yes ___ No

18. Have you received any financial support for your farming activities? ___ Yes ___ No

19. If yes, how often have you received support? _____

20. By whom? _____

C) Peatlands in Lebor

21. Is there areas of peatland on the land you own?

___ Yes, How much? _____

___ No

22. If yes, what do you use the peatlands for? _____

23. Why have you chosen this crop for peatland? _____

D) Environment

24. Have you perceived any changes in the *quality of water* in the river in the last 20 years?

Yes _____

No _____

25. Did you use to have any *animals* in Lebor that you don't have anymore?

Yes, Which? _____

No _____

26. Did you use to have any *trees and plants* in Lebor that you don't have anymore?

Yes, Which? _____

No _____

27. Have you perceived any changes in *rainfall pattern* in Lebor in the last 20 years?

Yes, What kind of? _____

No _____

28. Have you perceived any changes in *temperatures* in the last 20 years?

Yes, What kind of? _____

No _____

E) Tabung Haji plantation in Lebor

29. Has Tabung Haji converted any of your land into oil palm plantation?

30. Did your household use the area before the conversion?

Yes, How? _____

No, Why? _____

31. Were you consulted before oil palm plantation was introduced to Lebor?

Yes, How? _____

No _____

32. Are you involved in any way in Tabung Haji plantation in Lebor?

Yes, How? _____

No _____

33. Does involvement in the plantation generate income to your household?

_____ Yes

_____ No

Appendix 5 - Example of interview guide for a semi-structure interview

Below, an interview guide from a semi-structured interview with Mr. Ganggak, the former headman of Lebor. The interview was conducted on the second day of the fieldwork.

1. When did the transition from peatlands to palm oil plantation take place?
2. How big is the affected area?
3. What did you use the peatlands for before?
4. What happened when the palm oil plantation got implemented / how?
5. Did they get permission, and from who?
6. How was it in the beginning with implementation of the plantation?
7. Did Lebor benefit, who and how?
8. What has the plantation meant for Lebor?
9. If you still had access to the area (or if you win the case), what would you do with the land?
10. How will you distribute (share) it?
11. Do the villagers engage in joint-ventures with Tabung Haji? Why and how?
12. How many from Lebor are involved in joint-ventures?
13. How has the plantation affected the social relations in Lebor?
14. How has the environment been affected by the large-scale plantations?
15. What does the environment mean to the villagers?
16. Have there been any changes in general in the environment?
17. Have you noticed any differences in: rain patterns, floods, droughts, biodiversity loss?
18. Why do you think these changes have occurred?

Appendix 6 - Forest Resource Assessment and biodiversity methodology

In order to estimate the above-ground biomass (AGB), we measured three plots (20mx20m) in the forest on a mountain close to the village. These sites were chosen by our local guide and resource person, one plot estimated as noticeably logged and two others less disturbed. The actual time of logging was unknown, but our resource person estimated the area had been logged several times within the last decades. For measuring trunk diameter (DBH), we used the same approach as in Chave et al. (2005). Trees with a diameter of 5cm or above were measured, adding these to allometric equation used in Kenzo et al. (2014) to calculate the AGB. This formula uses data from local trees, which is why it was chosen. Lastly, all tree species were identified with the help of our local guide and resource person.

The used allometric equation:

$$BA = 0.7857 \times DBH^2$$

$$\text{Stem dry biomass (Ws)} = 0.0822 \times DBH^{2.48}$$

$$\text{Branch dry biomass (Wb)} = 0.0124 \times DBH^{2.48}$$

$$\text{Leaf dry biomass (Wl)} = 0.0442 \times DBH^{1.67}$$

$$AGB = Ws + Wb + Wl$$

$$DBH = \text{trunk diameter at breast height (130 cm)}$$

The carbon concentration of our sample is calculated assuming carbon content of 47 percent as in jungle rubber samples (meaning mixed rubber garden and secondary forest) used in Kotowska et al., 2015, calculated from Table 3. This same percentage was used for calculating carbon content of reference article by Kenzo et al. (2014) in our analysis.

Oil palm

Two plots (20mx20m) were measured at a young small-scale oil palm plantation on mineral soil. Relying on data on trunk height at different ages in Henson and Dolmat (2003:Figure 6), the trees are estimated to be 5-8 years old. Frond bases of the palms had been removed as a management practice. The area was flat and locally the soil was considered fertile.

The forest plots mostly contain dicotyledons trees and the oil palms are monocotyledon plants. This is why we cannot use the same allometric equation as for the forest plot, and instead we use the one from Khalid et al. (1999) designed for oil palms.

To find the biomass of the oil palms, we measured the height of the palms from the start of the leaves to the ground. Using destructive sampling, Khalid et al.(1999) find a weight-height correlation of

$$W = 725 + 197H$$

where W means the total fresh weight in kg and H the height in cm. The resulting wet weight was multiplied by dry weight/wet weight ratio acquired from Khalid et al. (1999) to calculate the AGB. Khalid et al. measures with destructive method the dry weight/wet weight ratio of oil three palm trees without frond bases. We calculated the

average of these ratios (=0,225), which we then used to calculate the dry weight of our sample trees.

The carbon concentrations of oil palms in the analysis are calculated using 42 percent from Kotowska et al., 2015, calculated from Table 3. This same percentage was used for calculating carbon content of reference article by Khalid et al. (1999) for our analysis.

Biodiversity

Most of the density data is in stems per ha. We calculated stems per ha for both the oil palm plantation and the secondary forest using this formula:

$$\text{Stems per ha} = n \times (10,000 \text{ m}^2 / \text{total plot size (m}^2\text{)})$$

We used non-logged wet evergreen forest to compare our data with. It has some of the same species as our forest has and is described as a forest with a heavy rainfall level. There is a lack of comparable data, because estimating species per ha is a very challenging. The closest we could find is from Nakagawa et al. (2013). They have studied the trees of tropical forest in Sarawak. Therefore we will expect a similarity in the forest they have investigated and the one we have investigated. They have investigated fallow forest, which is one type of disturbed secondary forest, as our forest plots are. We measured trees with a trunk size of DBH ≥ 5 but in the comparison we use the same trunk diameter size (DBH ≥ 10) as in the reference article. There is a difference in size from our measured plot and the plot size presented in Nakagawa et al. (2013). Our plot size is 0,12 ha and the plot size in the literature is 0,1 ha. This means our result has an upward bias.

Appendix 7 - Water sampling methodology

- Water temperature
- PH
- Salinity
- Conductivity
- TDS
- Dissolved oxygen (DO)
- Nutrients (nitrate and nitrite, ammonia nitrogen and phosphate)
- Chemical oxygen demand (COD)
- Total suspended solids (TSS)
- Faecal coliform count (FCC)
- total coliform count (TFC)

Station No	GPS Coordinates	Location	Reason
1	N 01° 09'54.8" E 110° 38' 4.1"	The sampling location is the upstream of the village river and where the gravity feed system was located	To investigate if the river is still polluted after the logging
2	N 01° 12' 9.039" E 110° 39' 51.559"	This sampling location was located at the oil palm plantation area	To investigate if the river is polluted by the oil palm plantation

Appendix 8 - Results from water sampling

Parameter s	ST 1 N 01° 09'54.8" E 110° 38' 4.1" (Gravity feed System- Sg Lebor)	River Classificati on	ST 2 N 01° 12' 9.04" E 110° 39'51.6" (Oil Palm area)	River Classificati on
Temperatu re	24.8°C	-	27.3°C	-
pH	7.44±0.05	I	5.10±0.14	III
Salinity	0.01 ppt (1%)	IIA	0.04 ppt (4%)	III
Conductivi ty (ms/m)	0.023 ±0.017 (23 µs/cm)	I	0.093±0.0 01 (93 µs/cm)	I
TDS (mg/L)	21.45	I	56.7±2.63	I
DO	9.75±0.11	I	6.31±0.05	II
Nitrite (NO ₂ ⁻) (mg/L)	0.006±0.005	I	(<0.350) limit	III
Nitrate (NO ₃ ⁻) (mg/L)	0.03±0.03	IIB	(<0.50) limit	III
Ammonia Nitrogen (NH ₃ -N) (mg/L)	0.14±0.03	II	0.41±0.01	III
Phosphate (PO ₄ ³⁻) (mg/L)	0.18	IIA/IIB	0.375±0.0 1	V
COD (mg/L)	21.5±0.71	IIA/IIB	155±5.66	V

TSS (mg/L)	8	I	260±11.3 1	IV
FCC	500MPN/100 ml	IIB	Not detected	-
TFC	5,000 MPN/100ml	IIB	7,500	III

The water in station 1 is in the river class II. (for recreation)

Water Supply II - Conventional treatment.

Fishery II - Sensitive aquatic species.

Class IIB - Recreational use body contact.

Therefore, it is advisable to boil the water first before every consumption.

The water in station 2 is in the river class III. (for plantation)

Water Supply III - Extensive treatment required.

Fishery III - Common, of economic value and tolerant species; livestock drinking.

The river was located near the oil palm plantation, and the high value of nitrite, nitrate, ammonia and Phosphate indicates the presence of fertilizers in the water sample. Therefore, extensive treatment of the water is needed to prevent any effect on other subsidiaries river human health and the environment. Phosphate level from station I exceeds the number for polluted rivers. Many causes can affect the high number such as animal faeces, minerals from the mountain, pepper fields that were spotted in the area as well as other factors.

Nitrate and nitrite concentration in the water from the oil palm plantation was too high to measure. Because of this, we do not know the exact concentration of these two parameters. We can still use these results to give us a minimum concentration. At the lab we were told that we could not do anymore to get any measurements. However, when asking about the maximum number the device could detect, we were told that we needed to dilute the sample in order to measure the contents. We went back with new water samples a few days later, but due to heavy rains the previous day, the water was to disrupted, and we were not able to get any numbers.

Appendix 9 - Results from FRA and biodiversity

Here, we will outline the multiple sources of bias that can have affected our results in regards to carbon stored in above-ground biomass.

Biomass

Firstly, the choice of allometric equations is a very probable source of bias. We had several equations to choose from for forest plots, and they gave us very different results, ranging from 108,138 Mg/ha to 181,28 Mg/ha. We chose the one used in Kenzo et al. (2014) because he uses local trees in his calculation. That equation does not involve measuring heights, which means less data is gathered on site and more gained through equations. This also gives us bias, whose direction we do not know. For oil palms, we used an equation created by Khalid et al. (1999). The equation is made by measuring destructively biomass of four oil palms to derive dry weight/wet weight ratio, which we then used. This article was suggested by our resource person.

Secondly, our samples are very small. This may bias results upwards or downwards. Morel et al. (2011) concludes that plots of 1 ha are more reliable than smaller plots. Especially forest plots can vary tremendously in tree composition, whereas oil palm plantations of same age are supposed to resemble each other more. When sample size is large, some errors due to variance between individual plots could be smoothened out.

Thirdly, the choice of forest plots was not in our hands but we were guided by a local FRA expert from UNIMAS and a knowledgeable villager. They were responsible of finding plots that would result in a representative sample of forests in Lebor, taking into consideration the intensity of logging activities and its effect on the overall status of forests in Lebor. As we do not know the area, we cannot judge if this task succeeded.

Fourthly, the forest plots were on a slope, which reduces the spherical area. This means the trees receive less light than in flat areas, which can bias the biomass downwards. Perhaps the literature we compare our results with is measured on flatter plots. Indeed, our result was lower than in our reference articles, although spherical bias was very unlikely enough for creating this difference.

Our wish to compare the forest plot to the oil palm plantation is the most critical part of the analysis, giving rise to numerous errors. To see how much of the above-ground carbon stock is lost when transitioning to oil palm, the oil palm plots should have resembled the forest before conversion. This is probably not the case in this sample. The forest plots were on slope on a soil that was considered “good” according to the guide, and the soil at the oil palm plantation was flat, also considered “good” soil according to one villager. In lack of actual soil sampling, we cannot see how they differ and thus how they would affect tree growth. The soil at the oil palm plantation was more moist, which could mean it would have different tree species than in the forest plots, thus resulting in different biomass.

Moreover, we tried to link our result in the conversion at Tabung Haji plantation, which is located on peatlands. We did not have reference literature on how peat soil affects tree growth, so we cannot say if the carbon drop follows the same pattern as in mineral soils where our measurements were done. Perhaps peat swamp is challenging soil type for many tree species, giving low biomass for forest, and favorable for oil palms, giving

higher biomass for oil palm. In this case, the drop would be lower. In the lack of literature, we did not take this into discussion in our analysis. This is why our reflection on the effects of Tabung Haji are based both on many possible methodological biases as well as many assumptions.

Lastly, as a technical bias we might have measured smaller or bigger area than 20mx20m in the forest plots, as measuring was extremely challenging in steep slopes and dense vegetation, although we were assisted by a very experienced resource person. We also may have held the measuring tape systematically wrong, which we however do not believe, as we were supervised by our assistants.

Below is the results from our plots

Tre e no	Local Name	Scientific name	DBH (cm)	BA	Ws	Wb	WI	AGB
1	Kumpang	<i>Knema sp</i>	36,25	1032,46	605,28	91,31	17,76	714,35
2	Ipoh	<i>Antiaris toxicaria</i>	6,8	36,33	9,54	1,44	1,09	12,06
3	Kumpang	<i>Knema sp</i>	37,5	1104,89	658,37	99,32	18,8	776,48
4	Mebulan Bukit	<i>Blumeodendro sp</i>	42,2	1399,21	882,36	133,11	22,89	1038,36
5	Ubah	<i>syzygium havilandii</i>	8,6	58,11	17,08	2,58	1,61	21,26
6	Ipoh	<i>Antiaris toxicaria</i>	16,8	221,76	89,87	13,56	4,92	108,35
7	Durian	<i>durio zibethanus</i>	41,5	1353,17	846,51	127,70	22,26	996,47
8	ubah	<i>syzygium sp</i>	6,9	37,41	9,89	1,49	1,11	12,49
9	Langsat Kera	<i>Dacryodes sp</i>	11,6	105,72	35,87	5,41	2,65	43,93
10	Entimau	<i>Ficus gecharis</i>	5,3	22,07	5,14	0,78	0,72	6,63
11	Benua	<i>Macaranag triloda</i>	13,2	136,90	49,42	7,45	3,29	60,16

12	Meranti	<i>Shorea platyclados</i>	6,1	29,24	7,29	1,10	0,91	9,29
13	Purang	<i>Makaranga caladifolia</i>	14,4	162,92	61,32	9,25	3,8	74,37
14	Entimau	<i>Ficus geocharis</i>	5,7	25,53	6,16	0,93	0,81	7,9
15	Medang	<i>Litsea gracilipes</i>	40,6	1295,12	801,71	120,94	21,46	944,11
16	Temesih	<i>Antidesma coiaceum</i>	21,5	363,19	165,70	25,00	7,42	198,12
17	Temesih	<i>Antidesma coiaceum</i>	18,6	271,82	115,68	17,45	5,83	138,96
18	Temesih	<i>Antidesma coiaceum</i>	19,4	295,71	128,42	19,37	6,25	154,04
19	Baru Balit	<i>Brownlowia spp</i>	9,1	65,06	19,65	2,96	1,77	24,38
20	Baru Balit	<i>Brownlowia spp</i>	6,4	32,18	8,21	1,24	0,98	10,43
21	Baru Balit	<i>Brownlowia spp</i>	9,7	73,93	23,02	3,47	1,96	28,46
22	Baru Balit	<i>Brownlowia spp</i>	11,3	100,33	33,61	5,07	2,54	41,22
23	Baru Balit	<i>Brownlowia spp</i>	8	50,28	14,27	2,15	1,42	17,85
24	Temesih	<i>Antidesma coiaceum</i>	21	346,49	156,31	23,58	7,14	187,02
25	Temesih	<i>Antidesma coiaceum</i>	16	201,14	79,63	12,01	4,53	96,18
26	Temesih	<i>Antidesma coiaceum</i>	16,5	213,91	85,95	12,97	4,77	103,68
27	Temesih	<i>Antidesma coiaceum</i>	8,5	56,77	16,59	2,50	1,58	20,67
28	Temesih	<i>Antidesma coiaceum</i>	22	380,28	175,42	26,46	7,71	209,6

29	Temesih	<i>Antidesma coiaceum</i>	14,2	158,43	59,23	8,94	3,71	71,88
30	Temesih	<i>Antidesma coiaceum</i>	14	154,00	57,18	8,63	3,63	69,44
31	Temesih	<i>Antidesma coiaceum</i>	9,4	69,42	21,29	3,21	1,86	26,37
32	Rambutan Hutan	<i>Nephelium rambutan-ake</i>	7	38,50	10,25	1,55	1,14	12,94
33	selukai	<i>Polyathia spp</i>	5	19,64	4,45	0,67	0,65	5,77
34	Temesih	<i>Antidesma coiaceum</i>	9	63,64	19,12	2,88	1,73	23,73
35	Temesih	<i>Antidesma coiaceum</i>	22	380,28	175,42	26,46	7,71	209,6
36	Temesih	<i>Antidesma coiaceum</i>	10	78,57	24,82	3,74	2,07	30,64
37	Temesih	<i>Antidesma coiaceum</i>	18	254,57	106,65	16,09	5,52	128,25
38	Temesih	<i>Antidesma coiaceum</i>	6	28,29	6,99	1,05	0,88	8,93
39	Temesih	<i>Antidesma coiaceum</i>	24	452,56	217,67	32,84	8,92	259,42
40	Baru	<i>Tilia sp</i>	5	19,64	4,45	0,67	0,65	5,77
41	Baru	<i>Tilia sp</i>	6	28,29	6,99	1,05	0,88	8,93
42	Temesih	<i>Antidesma coiaceum</i>	12	113,14	39,02	5,89	2,8	47,7
43	Mebulan	<i>Endospermum diadenum</i>	24	452,56	217,67	32,84	8,92	259,42
44	Songoh	<i>Elaeocarpus nitidus</i>	28	615,99	319,02	48,13	11,54	378,69
45	Meranti	<i>Shorea pubistyla</i>	33	855,63	479,50	72,33	15,18	567,01
46	Ubah	<i>Syzygium zeylanica</i>	16	201,14	79,63	12,01	4,53	96,18

47	Benuak	<i>Makaranga caladifolia</i>	10	78,57	24,82	3,74	2,07	30,64
48	Ubah	<i>Syzygium zeylanica</i>	13	132,78	47,58	7,18	3,2	57,97
49	Ubah	<i>Syzygium zeylanica</i>	27,5	594,19	305,08	46,02	11,2	362,3
50	Kemayau	<i>Santiria sp</i>	8,5	56,77	16,59	2,50	1,58	20,67
51	Baru Bukit	Brownlowia spp	5,1	20,44	4,67	0,71	0,67	6,05
52	Kayu Asam	<i>Aporosa sp</i>	7	38,50	10,25	1,55	1,14	12,94
53	Benua	<i>Makaranga caladifolia</i>	8,5	56,77	16,59	2,50	1,58	20,67
54	Upih	<i>Parishia insignis</i>	65	3319,58	2575,71	388,55	47,1	3011,36
55	Baru Bukit	Brownlowia spp	7	38,50	10,25	1,55	1,14	12,94
56	Engkala	<i>Litsea gracilipes</i>	7,5	44,20	12,16	1,83	1,28	15,28
57	Lengkan	<i>Litsea garciae</i>	8,5	56,77	16,59	2,50	1,58	20,67
58	Pelai	<i>Astonia beccari</i>	55	2376,74	1702,05	256,76	35,63	1994,43
59	Benua	Makaranga caladifolia	9,5	70,91	21,86	3,30	1,9	27,05
60	ara	Ficus alata	7,5	44,20	12,16	1,83	1,28	15,28
61	Towi	<i>Mollatus sp</i>	16	201,14	79,63	12,01	4,53	96,18
62	kumpang malam	<i>Myristica sp</i>	13,5	143,19	52,25	7,88	3,41	63,55
63	kumpang merah	<i>Knema sp</i>	10,5	86,62	28,02	4,23	2,24	34,49
64	midung	<i>Alangium havilandii</i>	20	314,28	138,49	20,89	6,58	165,96

65	Towi	<i>Mollatus sp</i>	10,5	86,62	28,02	4,23	2,24	34,49
66	medang putih	<i>Cryptocarya enervis</i>	16	201,14	79,63	12,01	4,53	96,18
67	nyatuh	<i>Palaquium sp</i>	6	28,29	6,99	1,05	0,88	8,93
68	tampoi hutan	<i>Baccaurea sp</i>	5	19,64	4,45	0,67	0,65	5,77
69	perupok	<i>Lophopetalum sp</i>	23	415,64	195,87	29,55	8,31	233,72
70	ubah sirih	<i>Kibessia coriacea</i>	8	50,28	14,27	2,15	1,42	17,85
71	ubah sirih	<i>Kibessia coriacea</i>	20	314,28	138,49	20,89	6,58	165,96
72	medang kuning	<i>Phoebe opaca</i>	29	660,77	348,03	52,50	12,24	412,77
73	kelampai	<i>Elateriospermum tapos</i>	10	78,57	24,82	3,74	2,07	30,64
74	bawang hutan	<i>Scorodacarpus borneensis</i>	14	154,00	57,18	8,63	3,63	69,44
75	pelai	<i>Alstonia beccari</i>	24	452,56	217,67	32,84	8,92	259,42
76	medang	<i>Litsea sp</i>	38,4	1158,56	698,25	105,33	19,55	823,14
77	medang keladi	<i>Cryptocarya impressa</i>	9	63,64	19,12	2,88	1,73	23,73
78	medang keladi	<i>Cryptocarya impressa</i>	6,1	29,24	7,29	1,10	0,91	9,29
79	Kedondong hutan	<i>Canarium sp</i>	6	28,29	6,99	1,05	0,88	8,93
80	kumpang	<i>Horsfieldia crassifolia</i>	36,25	1032,46	605,28	91,31	17,76	714,35
81	entimau	<i>Ficus gecharis</i>	9,3	67,96	20,74	3,13	1,83	25,69
82	ubah bukit	<i>Syzygium arcuatinervia</i>	63,7	3188,13	2449,84	369,56	45,53	2864,94

83	temesih	<i>Antidesma coiaceum</i>	9,5	70,91	21,86	3,30	1,9	27,05
84	pudu	<i>Artocarpus kummis</i>	6,3	31,18	7,89	1,19	0,96	10,04
85	ubah bukit	<i>Syzygium arcuatinervia</i>	48	1810,25	1214,37	183,19	28,39	1425,9 4
86	repai	<i>Dendrocrocnid e elliptica</i>	12,4	120,81	42,32	6,38	2,96	51,67
87	baru bukit	<i>Brownlowia spp</i>	12,1	115,03	39,83	6,01	2,84	48,68
88	lingsat kera	<i>Canarium sp</i>	15,5	188,76	73,60	11,10	4,3	89
89	Lingsat kera	<i>Canarium sp</i>	8,2	52,83	15,18	2,29	1,48	18,95
90	rapai bulan	<i>Dendrocrocnid e sp</i>	8,5	56,77	16,59	2,50	1,58	20,67
91	lingsat kera	<i>Canarium sp</i>	6,3	31,18	7,89	1,19	0,96	10,04
92	entimau	<i>Ficus geocharis</i>	6,3	31,18	7,89	1,19	0,96	10,04
	Total:	Species:47	151 1	31669,3 2	18402,72 83	2776,08 07	574,3 8	21753, 2

Biodiversity

Including trees of DBH <5 and herbs would most likely draw our result upwards at the forest plots. Still, the loss of tree biodiversity is evident when a forest is converted into a mono-cultural oil palm plantation, as at the latter only one tree species is found.

As we did not have entomologists and zoologists in our team, we were not able to measure biodiversity of animals and insects during our Forest Resource Assessment. Therefore, the analysis of biodiversity loss in this regard will be based only on the perceptions of the villagers.

Appendix 10 - Description of informants

Throughout our field study in Lebor we conducted several methods with different informants from both groups (A and B) in order to gather our data. In the following section our informants referenced in the report will be presented and elaborated on. We named them with letters to secure their anonymity and to let the reader know which group they belong to. This list will of course not be publicly available.

Informants from the A-group:

<u>A1</u>	The current official headman of Lebor, Mr. Nelson, elected in October 2015. He is retired, but previously a secondary level teacher in general skills that included a subject related to agricultural knowledge and practices. He participated in a semi-structured interview and the environmental ranking with men from the A group.
<u>A2</u>	Marida is a farmer and ex-military man. He is the second person in the court case against Tabung Haji, changed from B to A a few years ago. He participated in a questionnaire and a narrative interview.
<u>A3</u>	Gunau is a farmer and was our guide on the forest walk and participated in the PRA-session, the environmental ranking with men from the A group and in a narrative interview.
<u>A4</u>	An older man we did participatory photographing with (Photographer nr 1)
<u>A5</u>	Patricia is one of our younger informants. She has learned about climate change in school. Daughter in law of the former headman. She participated in the environmental ranking with the women.
<u>A6</u>	An older man we did participatory photographing with (Photographer nr 2)
<u>A7</u>	Natin is one of the cooks who has some farming activities, but her husband has a well paid job. She participated in the environmental ranking with the women.
<u>A8</u>	A8 refers to the former Penghulu, an overall headman for Lebor and neighboring communities from 1973-1978. He participated in the questionnaires, PRA-session, environmental ranking with men from the A group and a narrative interview.
<u>A9</u>	Philip is an older gentleman and a retired teacher, he lives alone in Lebor, his children and grandchildren lives in Kuala Lumpur and the US. Phillip participated in the questionnaires and in a semi-structured interview.
<u>A10</u>	Nicha is 53 year old woman from Lebor. She is a farmer and participated in the questionnaires and the focus group.
<u>A11</u>	Mr. Ganggak ak Guma is the former headman of Lebor (before Mr. Nilson). Mr.

	Ganggak is a farmer and owns the palm oil plantation where we conducted one of the FRA's. Mr. Ganggak assisted us on a walkabout the second day in Lebor and participated in a semi-structured interview, the PRA-session with the A group and the Environmental ranking with men from the A group.
<u>A12</u>	Old woman, participating in a questionnaire.
<u>A13</u>	Nwyangan is a farmer. He assisted us on the walkabout the first day in Lebor and participated in the focus group and the PRA-session with the A group.
<u>A*</u>	Environmental ranking with women from the A group.

Informants from the B-group

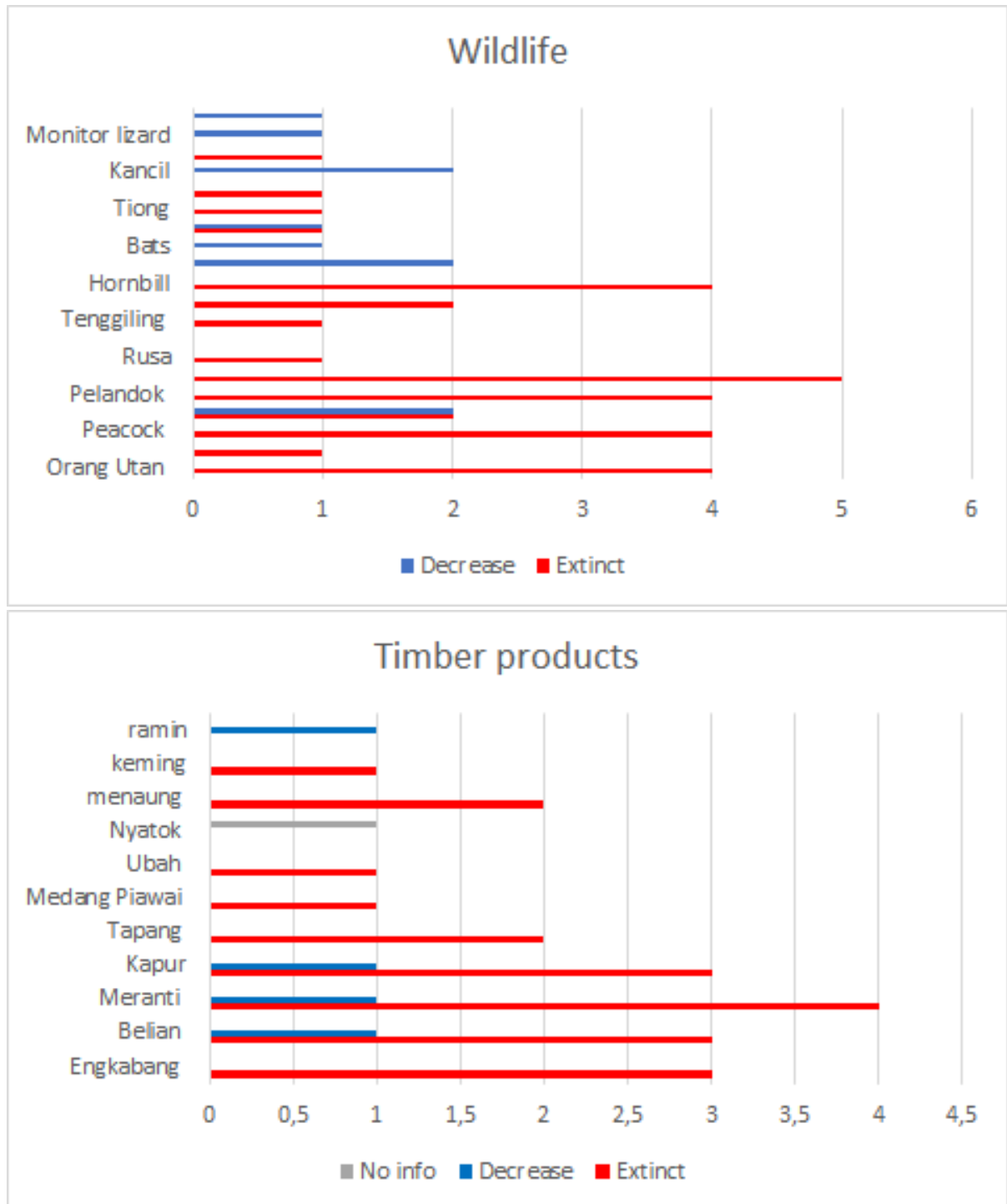
<u>B1</u>	The unofficial Headman of the B-group, Jengga Jeli, is a farmer and quite active in the court case. He provided us with documents from the ongoing court case. Jengga participated in the PRA-session and in a narrative interview.
<u>B2</u>	The former former headman, Mr. Nyutan, referred to as Hero by members of the B group. Headman from 1986 to 2002. Before this, he was a chairman of the teacher-parent association. Now he is a farmer and lives in a longhouse with his family. When he became headman he continued development projects. After 5 years of the court case, he stopped as a headman - the conflict between the villagers gave him "a headache". Nyantan participated in the PRA-session and a narrative interview.
<u>B3</u>	Bilbiana, 37 years old and has led the court case against FELCRA, that has taken land in another part of Lebor than Tabung Haji. They lost the case. Bilbiana participated in the PRA-session and in a narrative interview.
<u>B4</u>	Kanyang is a farmer, that had his land taken from the D.D. Plantations Company. He then ruined their machines, so the company sued him, and the court case is still running. He participated in a narrative interview.
<u>B5</u>	Uri is an elder woman who participated in the questionnaire.
<u>B6</u>	An old man, farmer, helped blocking the way for Tabung Haji's machines, removed the sticks that the company had put up. Participated in a questionnaire.

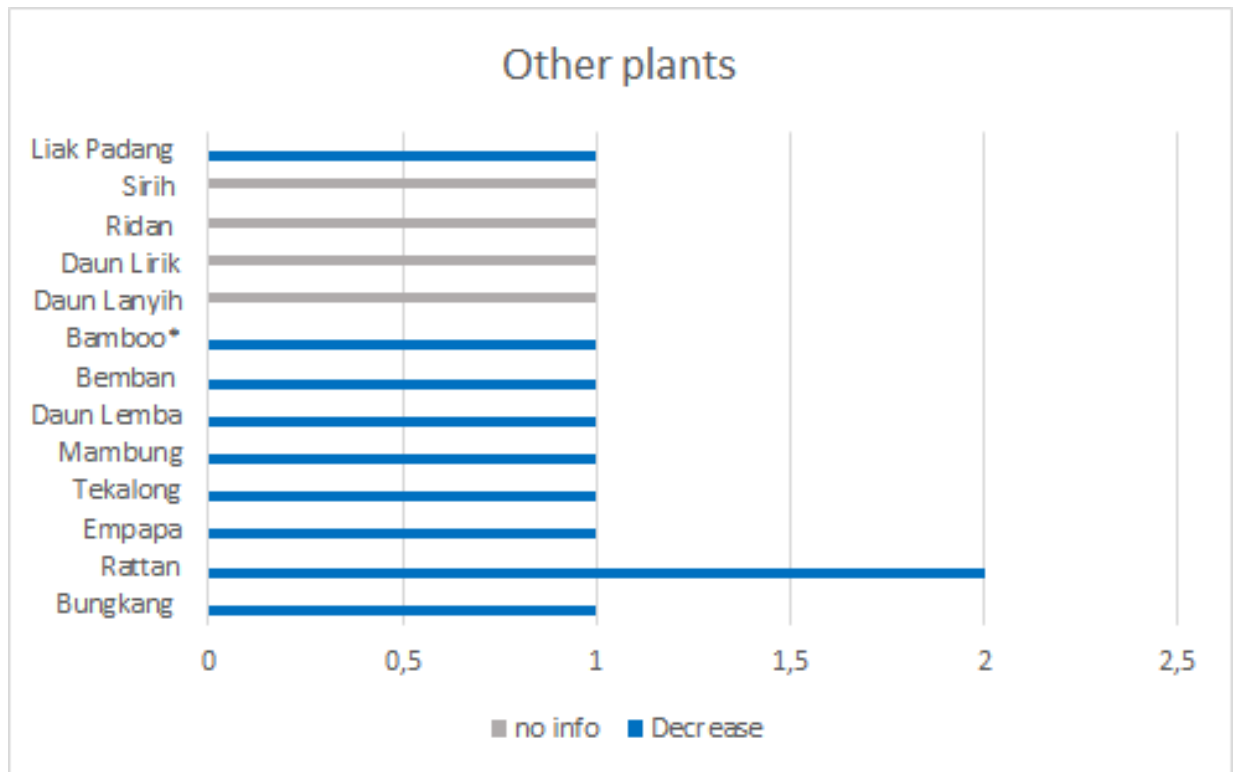
Informants from no or unknown group

Youths - from focus group interview. Four girls aged 18-23 and two men aged 20 and 30.

Appendix 11 - Figures of perceived decline and extinction of wildlife and plants in Lebor

The following data is from the questionnaires where we asked the informants about decline and extinction of wildlife and plants. When asking about wildlife 9 out 23 mentioned specific species (see below), as well as when asking about trees. Four out of 23 mentioned plants (other than trees) in their responses.

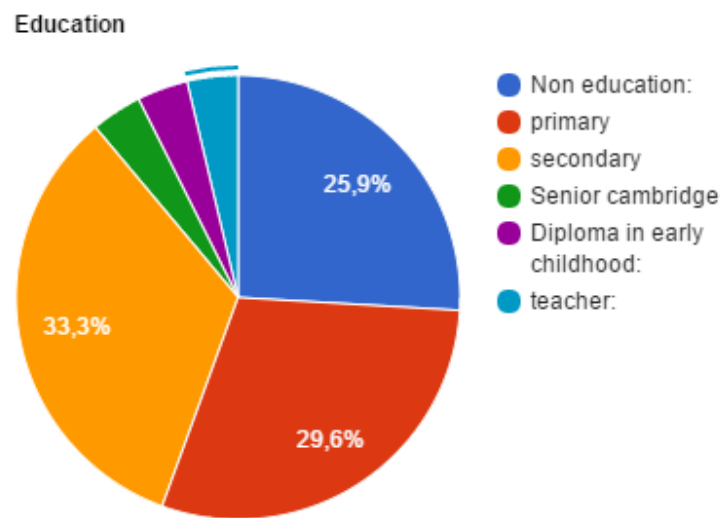




* Bamboo consist of these 6 species:

1. Amat
2. Munti
3. Payan
4. Pering
5. Bekuan
6. Bala

Appendix 12: Graph over education level in Lebor



Senior Cambridge is another name for secondary level education that is a requirement for entering university in the British school system.

Appendix 13 - Numbers and graphs on data from the questionnaire

Zones of Kpg. Lebor



Zones

- Zone 1: Ibul
- Zone 2: Al Lebang
- Zone 3: Dara Bagai
- Zone 4: Pian Garong

Zone nr. 5 only consist of 2 house and is placed south of Lebor

Location	Gender F/M	Age	Ethnicity	Main occupation	Total member of people living in the household	Number of years living in Lebor	Highest level of education	Main source of income of the household	Other sources of income	How much land do you have in total (in acres)?
zone 1:	Male:	average	Iban Remun:	Farmer:	average	Born in lebor:	Non education:	Farmer:	Money from family members	1 plot:
	9	58,272727	19	18	4,636363636		21	7	16	10
zone 2:	Female	Max age:	Iban:	Shop:	Max household:	Moved to Lebor:	primary	Shop:	Part-time work	2 plots:
	5	14	85	4	1,10(2 in city)		2	8	2	5
zone 3:		Min. age		Teacher:	Min. Household		secondary	pension:	Selling farming products or food	3 plots:
	4	38		2		1		9	1	7
zone 4:				Housewife:			Senior cambridge	Salary:	Government help for housing	4 plots:
	3			1				1	3	1
zone 5:				Retired:			Diploma in early childhood:	contract worker:	Shopkeeping	5 plots:
	2			1				1	1	1
							teacher:		No other source of income:	6 plots:
								1		5
										Acres <20
										Acres >20
										Acres >20

How did you get the land?	What types of crops do you grow? Is it for subsistence or for sale? Specify for each crop 1?	Have you changed the crops you grow on your farm?	If yes, what did you grow before?	Why did you change to the current crops?	Do you have any livestock? How much?	Who is responsible for a. Harvesting b. Planting crops?	Do you use fertilizer or pesticide in your crop field?	Have you received any financial support (Seeds, fertilizer, pesticides and money) for your	If yes, how often have you received support?
inherited:	pepper	yes:	pepper	Income:	chicken:	Him/herself	yes:	yes:	once a year
21	8	13	3	7	9	4	14	8	5
Through marriage	oil palm	no	oil palm	Workload:	Duck:	Both:	no	no	once every 3. year
2	4	9	1	3	8	15	8	14	2
bought	rubber		rubber	Crop rotation for soil quality:	Goose:	Hired:	pesticides:		only once
5	14		4	1	1	3	3		2
Both inherited and bought	paddi		paddi	More yield:	no	Other family	Fertilizer		
5	13		6	1	10	4	7		
	vegies		vegies	Crops was attacked by squirrels	Pigs		organic		
	6		3	1	1		4		
	fruits		fruits						
	13		2						
	cocoa		cocoa						
	1		3						
	durian		durian						
	6		2						

By whom?	Is there areas of peatland on the land you own?	If yes, what do you use the peatlands for?	Why have you chosen this crop for peatland?	Have you perceived any changes in the quality of water in the river in the last 20 years? Which?	Did you use to have any animals in Lebor that you don't have anymore? Which?	Did you use to have any trees and plants in Lebor that you don't have anymore? Which?	Have you perceived any changes in rainfall pattern in Lebor in the last 20 years? What?	Have you perceived any changes in temperatures in the last 20 years? What kind of?	Has Tabung Haji converted any of your land into oil palm plantation?
RISDA	yes:	Land taken:	suitable:	yes:	yes:	yes:	yes:	yes:	yes:
2	9	2	7	19	17	20	14	18	9
MPOS	no	oil palm	To show that it is my land	no	no	no	no	no	no
2	14	3	1	4	1	2	6	4	6
government:		rubber	suitable for rubber	Polluted by logging	not sure	not sure	not sure	not sure	
4		4	3	9	4	1	3	1	
family:		rice	suitable for paddi	heavy rain worsens the quality					
1		4	3	7					
		Fallow	suitable for oil palm						
		2	1						
			it was empty						
			1						

Did your household use the area before the conversion? If not, why?	Were you consulted before oil palm plantation was introduced to Lebor? How?	Are you involved in any way in Tabung Haji plantation in Lebor? How?	Does involvement in the plantation generate income to your household?	Notes	A/B if known
Coconut	yes:	yes:	yes:		A:
1	4	1	0		16
Sago	no	no	no		B:
1	19	18	2		7
rubber					
4					
paddi					
9					
bamban					
2					
fruits					
0					
cocoa					
0					
durian					
0					

Transition from peatland to palm oil production in Lebor



**Thematic course: Interdisciplinary Land Use and Natural Resource Management
(ILUNRM/SLUSE)
26th February 2016
2596 words**

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Introduction to the study

Global demand for palm oil has led to an increase in palm oil plantations worldwide – mostly in the global south. Malaysia is no exception and is one of the world's largest palm oil producers (Lim & Biswas, 2015). The expansion in palm oil plantations has led to great debate with proponents arguing palm oil as an alternative to fossil fuels and that the development will create economic growth and jobs for local communities in the affected areas. Opponents argue that the development leads to negative consequences for the environment and livelihoods.

The Sarawak region in Malaysian Borneo hosts many large-scale plantations and the same goes for the small village Kampung Lebor located 75 km southeast of Kuching. Former peat areas have now been converted to large-scale palm oil plantations, which have both environmental and socio-economic impacts on the area, as the peat area used to be the village's community forest, but also because of the fact that peat serves as a carbon sink (Osaki & Tsuji, 2016). According to established literature on climate change and peatlands, the transition from peatland to palm oil plantations aggravates global warming with significant consequences. A study conducted by Danielsen et al. (2008), reports carbon emissions of biofuel production in forested areas. The findings reveal that it would take between 75 to 93 years for the carbon saved by using biofuels to compensate for the now deforested area. However, if the area used for biofuel production was previously peatland, it would take at least 600 years to restore the carbon balance. Seeing that palm oil production is used for biofuels, these numbers become quite essential for arguing that palm oil production affects climate change. This leads us to our research objective and research question.

Research objective

Our aim is to investigate economic, social and environmental impacts in the transition from peatlands to large-scale oil palm plantations in Kampung Lebor, and how the villagers perceive this transition in land use. Secondly, we seek to analyze how the transition of peatland areas to palm oil plantations in Lebor relate to global discourses of climate change, and how this coheres with local perceptions of climate change.

Research question

What socio-economic and environmental impacts has the transition from peatland to large-scale oil palm plantations in Lebor had for its villagers, and how do they perceive this transition?

Sub-research questions

- 1) How have the land use practices in Lebor changed along with the large-scale oil palm plantations?
- 2) Can there be observed any changes in biodiversity and water resources that could be linked to recent land use changes, which?
- 3) How has the transition affected the livelihood of the villagers?
- 4) How can you characterize the different stakeholders' involvement in the transition from peatland to palm oil, and what is their stance on climate change?

The following four sections give a more detailed description of how we plan to carry out the research questions including methodological and theoretical considerations we have had so far.

Sub-question 1

The aim of the first question is to gain an understanding of how and to what extent the peatlands in Lebor have been transformed into oil palm plantations. According to Miettinen and Liew (2010), only ten percent of the area that used to be primary peatland forests in 1990 remains, whilst the rest has been converted to agricultural or forestry use, a large part of this being oil palm plantations.

The primary data will be collected through transect walks, GPS measurements, questionnaires and PRA methods such as participatory mapping of past and present land use. Hopefully, the data can be inserted into QGIS, that can give some illustrative maps of the usage of land. While doing transect walks, we wish to do in situ interviews about indigenous resource management and local knowledge systems relating to both agricultural and general resource management.

We know that peatlands used to be considered wasteland in the 1970's and 80's, but we would like to get an understanding of how the villagers of Lebor have perceived and utilized peatlands through history. Have peatlands had any significant importance for the Lebor community back in time, and if so, what have the impacts been due to the transition to palm oil? We also wish to unveil the villagers' considerations of the future use of current peatlands. These questions will be investigated whilst facilitating community mapping exercises.

Furthermore, it is also planned to interview 'experts' such as scientists specializing in land use and peatland and people from the Malaysian Peatland Society.

Sub-question 2

In this chapter we will look at what kinds of impacts oil palms on peatland have on biodiversity and the quality of water in the rivers close to Lebor. Wilcove et al. (2013) argue that forest conversion to oil palm plantation has resulted in "tremendous biodiversity loss" in Southeast Asia, both in terms of vegetation and animal species. Here we will assess the biodiversity of insects in sample plots in the oil palm plantations, which we will compare to reference sites both at the marginal zone of the plantations and in primary peatland forest. The reason for choosing insects instead of vegetation is that this kind of change in biodiversity is less apparent, whereas the vegetation loss is obvious when converting forest to monoculture. Other methods used will be interviews, transect walks, and PRA methods, like natural resources matrix, in order to collect villagers' own perceptions of changes in biodiversity. We will also give some of our key informants a camera, and ask them to take pictures of places that have changed. These photos can then be used in the interviews with them afterwards.

Another impact on the biodiversity can come from fragmentation of the usable habitats, due to land use changes. If the habitats gets too small to sustain different populations of the species, they might extinct from the areas. If there are pathways between the habitat fragments, the populations can travel to the other habitats and interact with other population of the same species. This is called forming meta-population and raise the population's chance of survival. To estimate this, we will use Google Earth/QGIS and GPS observations.

Palm oil plantations have been suggested to cause significant water pollution in nearby water resources in Southeast Asia (CIFOR, 2009; Yon, Aik Pang, 2015). Also the villagers of Lebor suspect that the oil palm plantations upstream have led to pollution of the water in the Lebor and Tampoi rivers. We will investigate this by taking water samples of the rivers. At this moment we are still unclear on what to measure, since we are limited in our expertise. A logical link between oil palm plantations and pollution would come from intensive fertilization at the plantations, which often results in nutrient runoff, thereby polluting water resources. By detecting for instance excessive nitrogen contents in the rivers may not prove that the pollutants come from the oil palm plantations, but whether the river is polluted or not. In addition to these measurements, we will also examine the

villagers perceptions of the quality of water and its possible changes through the above mentioned qualitative methods.

Furthermore, we wish to do Forest Resource Assessment in order to assess the changes in the forest biomass as a result of the transition to palm oil plantations. The expansion of palm oil plantations has led to degradation of forests in Lebor, which is not only affecting biodiversity but also greenhouse gas fluxes. The amount of biomass can serve as an indicator of the ability of the forest to absorb carbon dioxide. (Roy et al. 2002.) We will assess the change in biomass when a peatland forest is converted into oil palm plantation by comparing sample plots from both sites.

Sub-question 3

The intention with this question is to investigate if the transitions to palm oil plantations has had social and economic impacts on the villagers in Lebor. We wish to find out if the livelihoods in Lebor have changed, the main focus being on sources of income, local knowledge, social dynamics and interdependence among the villagers.

- Some of the farmers in the area are included in the large-scale palm oil plantation through joint ventures. Cramb (2013) remarks that these schemes have not lived up to expectations in terms of income generation. We wish to investigate what results they have had in Lebor, and discover the motivations to participate or stay outside these schemes. We will here rely both on semi-structured interviews with perhaps community leaders, and leaders of different stances in the community, and participatory workshops/focus group interviews. In the beginning of the field work, we will also distribute a questionnaire to collect baseline information on household incomes.
- An increasing percentage of land in Sarawak is being used for large-scale oil palm production, combined with population growth. Since the availability of land is more scarce, villagers, especially the youth, migrate to the urban areas to find alternative income opportunities (Cramb 2013, p. 142) We are interested in how this affects the community's social bonds and identity. This, we will investigate through semi-structured interviews and deep hanging out method.
- Moreover, we seek to understand the villagers' (changed) perception of nature and land. The community forest is, with the initiatives of the oil palm production, vanishing. Also, the Lebor river has possibly been polluted due to the oil palm plantation nearby. It is from that river the village has got its name. We seek to investigate what impacts these aspects have had on the villagers feeling of connection with the area, assuming that the Lebor engage emotional and memorial with their natural environment (Young and Pang 2015, p. 20). We will use participatory photography method, giving some informants a camera and ask them to take photos of natural environments that has a personal importance to them. Afterwards, we will conduct informal interviews where we talk about the photos. This method has been used to give opportunities to the informants to represent and express themselves, and give rise to a dialogue with them on the topic in question (Bleiker, 2007). Of this we might get information about histories, environmental changes, values, knowledge or/and traditions of the village. We will also do transect walks and conduct informal interviews in situ. Furthermore, we will do cultural mapping, where we ask for names and meanings of the land. By this we might get an idea of what happens to a specific cultural place and name, when the land transforms.

Sub-question 4

Through this question, we wish to understand the processes and driving forces behind the transition. Who are the different stakeholders and how their opinions have influenced the expansion palm oil plantations? For instance, the transition may have been driven by “external” actors, but there might also be actors within the village who have facilitated the process. We will investigate this by conducting participatory stakeholder analysis, where different actors and their impacts on the process are identified. Due to the assumed sensitivity of this issue, we will complement this with individual semi-structured and informal interviews with relevant respondents. In addition, we have contacted local Malaysian Peatland Society to have an interview on this matter, acknowledging that expert interviews may contain biases.

With point of departure in established literature and discourses on climate change, we work from the premise that the transition from peatlands to palm oil plantations has an enormous impact on climate change due to peatlands’ role as a carbon sink (see e.g. Hansen et al., 2014; Miettinen, Liew, 2010; Wetlands international, 2011). On the international level, mitigating climate change is one of the dominant arguments against the palm oil industry. We are interested in uncovering if any considerations on global warming are present in Lebor. Do the villagers, or other stakeholders we may interview, identify concerns of climatic changes, and what reasons they give for them? Particularly, we wish to see if the villagers acknowledge relations of climate change and peatland conversion to oil palm plantations. Ideas of climatic changes will be awaited to appear in our data collection without asking directly. This data will then be related to literature review on climate change considerations internationally, to find out how these two levels cohere with each other.

Analytical framework

As an analytical framework, we have chosen the *narrative* approach. A narrative analytical framework is meant to give researchers an idea of how their informants make sense of their world, which can reveal more general patterns and relations on a macro-level (Riesmann 2007). We believe this framework to be suitable when investigating the locals’ perceptions of the changes in their livelihoods and in the environment, and also in analyzing their understanding and possible concerns of climate change. By conducting a mixture between informal and topic-focused interviews (Casley and Cumar 1988), we might get a deeper understanding of the informant’s perspective, or narrative, and at the same time be controlling the topics discussed. The topics should be broad and the questions should be relatively open-ended, since the interviewer has to give the narrator the space for telling what is of most importance. Of this method, we can observe what is highlighted and what is downplayed, what is included or excluded in the story. We will note down what terms they use regarding nature, oil palm investors, etc. We might then get an idea of by whom or what these narratives are influenced: e.g. internal/external actors, international environmental NGO’s, and the Malaysian state. We are aware of that capturing elaborate narratives will be challenging with a translator, so we will discuss our aim well with the translators before conducting any interview.

We also consider using fragments of the Sustainable Livelihoods Framework, since it might be helpful when investigating narratives. The dimensions that might be of use in our analysis are physical capital (access to information) and social capital (social relations). We might also include other aspects of this framework, according to the data we get.

Finding relevant informants

We will start our field work with a questionnaire to collect some baseline information on household characteristics and income-generation activities in the village. As we can only include a fraction of the households in this survey, it is important to choose carefully the respondents. Our plan is to walk around the village with our local guide, as widely as possible, to get an overview of the infrastructure and the location of households. This helps us stratify the village into sections, e.g. according to how close or far they are from the main road. After this, we can do a random sampling by choosing respondents from each section of the village.

In our PRA sessions and focus group interviews, we will have separate meetings for farmers in and outside joint venture schemes. We hope to find some of these participants from our questionnaire respondents, and some with the help of our guide and other locals through snowball sampling. When investigating socio-economic impacts, we consider having a focus group discussion for only women. They have supposedly different tasks and roles in the household, which is why they may have very different perceptions than men.

For individual interviews and participatory photography, we possibly use some participants from our group sessions, and perhaps do snowball sampling to identify some new respondents.

Planned collaboration with counterparts

The research questions as well as plans of our methods have been identified by us, and our Malaysian counterparts are informed by the preliminary study design. However, our research objectives will be discussed with them before embarking on the actual field work. We will welcome inputs from our Malaysian colleagues, especially acknowledging their assumedly better understanding of local conditions.

As our academic background is mainly in social sciences, the Malaysian students will be of great help with the natural sciences methods. We hope they can lead the water sampling and biodiversity assessment methods, whereas we have prior experience in interviews and participatory workshops. We will begin and end each day on field with discussions on the practicalities and aim of each method, as well as their outcome. Through continuous sharing of our ideas and experiences we aim at equal partnership with our Malaysian counterparts, where we can both teach each others on areas we are strong at.

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Appendix

1. Timetable
2. Datamatrix
3. Mindmap
4. Natural Science methods
5. Interviewguides
6. Questionnaire

Note to appendix: All interviews, questionnaire and methods are unfinished, in working process, and will probably be changed when we are in the field.

1. Timetable

[illegible]

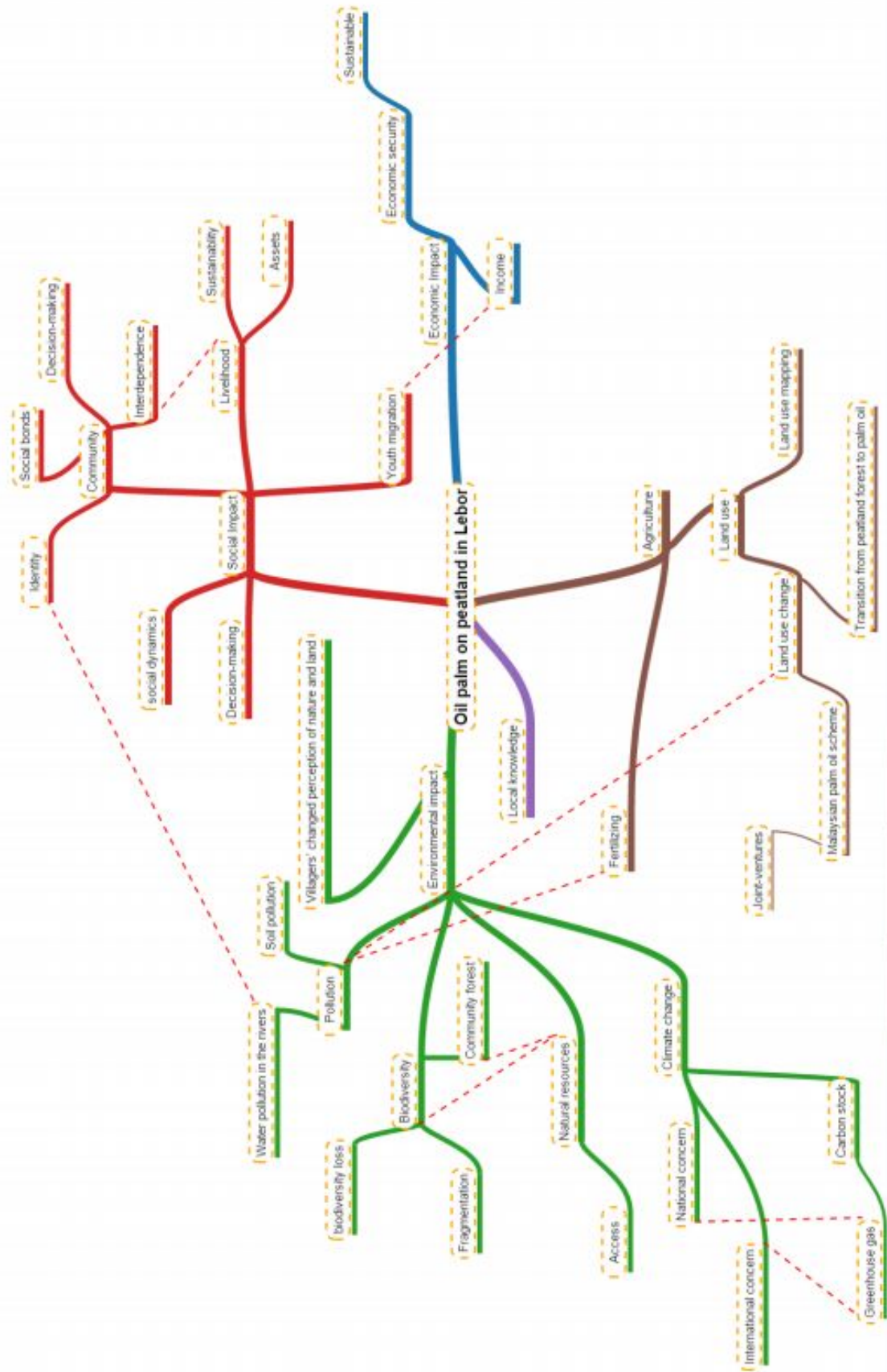
2. Data Matrix

	Sub-questions	Method/activities	Informants	Critical assumptions	Materials required
<p>What socio-economic and environmental impacts has the transition from peatland to large-scale oil palm plantations in Lebor had for its villagers, and how do they perceive this transition?</p>	How have the land use practices in Lebor changed along with the large-scale oil palm plantations?	Walkabouts; participatory land use mapping; GPS and QGIS mapping system; informal discussions	village headman; farmers in and outside joint-ventures; diverse villagers	Identifying villagers who remember recent land use changes in Lebor and who are knowledgeable of peatland conversions to palm oil plantations. Access to oil palm plantations, peatland forests and cultivated areas for transect walks and walkabouts. Satellite connection for GPS mapping. Active participation of villagers in land use mapping exercise.	Paper, markers, GPS, computer, printed maps
	Can there be observed any changes in biodiversity and water resources that could be linked to recent land use changes, which?	Biodiversity assessment; natural habitat fragmentation assessment; water quality measurement; participatory natural resources matrix; participatory photography; informal discussions	farmers in and outside joint-ventures; diverse villagers	Finding appropriate sites and reference sites for measuring biodiversity and water pollution, and gaining access to them. Sufficient knowledge of local vegetation to conduct biodiversity assessment. Active participation of villagers to PRA workshops. Forest Resource Assessment in order to assess the changes in forest biomass.	Soil sampling kit, printed schemes, water sampling kit, Forest Resource Assessment kit
	How has the transition affected the livelihood of the villagers?	cultural mapping; participatory community timeline; participatory photography; semi-structured interviews; informal discussions	farmers in and outside joint-ventures; diverse villagers	Active participation of villagers to PRA workshops.	Paper, markers, camera
	How can you characterize the different stakeholders' involvement in the transition from peatland to palm oil, and what is their stance on climate change?	Participatory stakeholder analysis; semi-structured interviews; informal discussions; greenhouse gas samples; informal discussions (do we have something else?)	farmers in and outside joint-ventures; diverse villagers	Informants who remember the beginning of joint ventures and their willingness to discuss the issue. Finding intact peatland forests for greenhouse gas measurement and access to them, and to oil palm plantations.	Paper, markers

3. Mindmap

17/2/2016

Mindmaps - Mind Map Maker



4. Natural Science methods

Method for terrestrial invertebrate sampling

1. Make a lot of traps(minimum 10-15)
2. Put minimum 5 traps in the oil plantages and in the forest
3. Collect insects in 1-2 days interval
4. Take pictures of the insects on a white paper
5. Look at different families
6. Investigate the diversity of the different habitats
- 7.



Observation of land use, deforestation and fragmentation

1. Use QGIS/Google earth to give us a bigger picture of the surrounding
2. Use GPS to identify the areas seen on the map
3. Categorize the areas in different crop/habitat types
4. Look at the size of the natural/semi natural habitats
5. Look at the distance between the habitats
6. Identify pathways if any between the habitats
7. Find out if the habitats can sustain meta-population of chosen species
8. Look at the areas there have been cultivated and how much is back

5. Interviewguides

INTERVIEWGUIDE Joint venture participants		Interviewer: Observer: Date: Recording number:
THEME	QUESTION	NOTES
Introduction	<ul style="list-style-type: none"> - We are 5 students from Denmark that are investigating palm oil plantations impacts on the Lebor villagers regarding livelihood strategies, economy and social relations - We are really thankful that you will participate in our interview. It is of great value to us. - The interview will take approximately 30 minutes, according to how much you like to tell - You only have to answer the questions, you feel comfortable answering, and if there is something you do not want to talk about, please let us know. - The interview will of course be anonymous, and only be read by ourselves and our teacher. - Is it okay, we record the interview, so we remember can use it in our work afterwards? <p>Do you have any questions before we start the interview?</p>	
Demographic questions	<ul style="list-style-type: none"> - How old are you? 	

	<ul style="list-style-type: none"> - For how long have you lived on this farm? - How many live on this farm? Who? - For how long have you been part of the joint venture schemes? - What did you do for a living before joining the scheme? 	
Motivation	<ul style="list-style-type: none"> - Can you explain about what joint venture schemes is about? - What were the motivations for joining the joint venture schemes? Who's decision was it to be a part of it? Was it a discussion in the family? Did all agree? 	
Experience	<ul style="list-style-type: none"> - Has the participation lived up to your expectations? Are you happy about being a part of the schemes, why/why not? Do you agree in your family that it was the right decision? 	
Profit	<ul style="list-style-type: none"> - How has the participation changed your economy? In what way? - Who pays you for leasing your land? - How much are you paid, how often are you paid, in what form are you paid (money, crops etc.)? - What do you do for a living now? - Are there other income in your household? 	

Procedure	<ul style="list-style-type: none"> - Can you explain about the procedure: if I wanted to be a part of the joint venture scheme, who should I contact? What should I do? 	
Future	<ul style="list-style-type: none"> - would you like to continue with the schemes in the future? - if not: what would you do instead? 	

INTERVIEW GUIDE Palm oil smallholders		Interviewer: Observer: Date: Recording number:
THEME	QUESTION	NOTES
Introduction	<ul style="list-style-type: none"> - We are 5 students from Denmark that are investigating palm oil plantations impacts on the Lebor villagers regarding livelihood strategies, economy and social relations - We are really thankful that you will participate in our interview. It is of great value to us. - The interview will take approximately 30 minutes, according to how much you like to tell - You only have to answer the questions, you feel comfortable answering, and if there is something you do not want to talk about, please let us know. 	

	<ul style="list-style-type: none"> - The interview will of course be anonymous, and only be read by ourselves and our teacher. - Is it okay, we record the interview, so we remember can use it in our work afterwards? - Do you have any questions before we start the interview? 	
Demographic questions	<ul style="list-style-type: none"> - How old are you? - For how long have you lived on this farm? - How many live on this farm? Who? 	
Cultivation	<ul style="list-style-type: none"> - How big is your palm oil plantation? - How many years have you been cultivated palm oil? - Why did you start to grow palm oil? Whose decision was it to grow palm oil? Were you inspired of neighbors, family members, friends? - What did you cultivate before? - Do you cultivate other crops, which? - Why do you compliment this/these crops with palm oil production? 	
Production	<ul style="list-style-type: none"> - Has your production of palm oil increased, decreased or is it stable? - Is there a seasonal difference in the production or is the production size the same all year? 	

Workload	<ul style="list-style-type: none"> - Will you consider yourself as a full-time or part-time farmer? - Do your family members help you with the cultivation of palm oil? Who? How do they help? - Who (else) help you with the palm oil production? What do they help with? 	
Profit	<ul style="list-style-type: none"> - Where/to who do you sell the palm oil fruits? - Do you consider your palm oil production as profitable? Why/ why not? - How much do you gain from the palm oil fruits pr. month? - Has the profit increased/decreased, why do you think that is? 	
Joint-venture	<ul style="list-style-type: none"> - Do you know about the joint-ventures schemes? - Have any one you know become a part of the joint-venture scheme? Have you heard if their experience with the scheme have been good or bad? What have you heard? - Why do you grow your own palm oil instead of being a part of the joint-venture schemes? - Has it been a discussion in your family whether to be a part of the joint venture or not? Were there any disagreement about being a part of the schemes? 	
Outside of Malaysian Palm Oil Board and joint-venture	Can you find a receiver to take your crops?	

	<p>What are your take on the Malaysian Palm Oil Board(MPOB)?</p> <p>What do you think about that MPOB will suspension of the licence of farmes outside the scheme?</p> <p>What is your take on the High Court desission?</p> <p>Do the government only promoted oil palm through MPOB or do they also help farmers outside of MPOB?</p> <p>Are the natives overlook in the oil palm schemes?</p>	
Kpg Lebor B	<p>What is the idea with Kpg Lebor B?</p> <p>Is it true you use less to no fertilizer on your palm oil plantages?</p> <p>How big a part of your village is a part of Kpg Lebor B?</p> <p>How big a part of your village is a part of MPOB?</p>	

INTERVIEW GUIDE Headman: KK Baran Ramai Contact: +6019 838 3191		Interviewer: Observer: Date: Recording number:
THEME	QUESTION	NOTES

Presentation	<p>Thank you for having us in your village Lebor. We are very happy to be here. We are a group of students from Denmark and we are doing an interdisciplinary course.</p>	Be careful not to reveal our research aim.
Headman of Lebor	<p>Can you please tell us a little bit about yourself?</p> <p>How long have you been the headman of Lebor[1] ?</p> <p>What are your duties as a headman?</p>	
Lebor	<p>Can you tell us about the history of Lebor?</p> <p>More or less how many people live in Lebor?</p> <p>What are the main economic activities?</p> <p>What is the demographic constellation (gender, youth, ethnicity, occupation)?</p> <p>How much migration is Lebor experiencing?</p>	
Transition to palm oil plantation	<p>When did the transition from community forest (peat land) happen?</p> <p>How was it before the transition?</p> <p>What has the transition meant for Lebor?</p> <p>What have been the environmental differences since the transition?</p> <p>What have been the socio-economic differences since the transition in terms of income and livelihood?</p>	Don't be too critical toward the palm oil plantations.
The palm oil plantation	How many hectares in Lebor is occupied by palm oil plantation?	

	<p>How much dialog do you have with the owners of the plantation?</p> <p>Are people happy with the plantation?</p>	
Joint venture	<p>How many from Lebor are involved in joint ventures with the large-scale plantation?</p> <p>How many from Lebor are not involved in joint venture schemes, but still grows palm oil?</p> <p>What does joint ventures mean for the farmers income and livelihood?</p>	
Nature	<p>What does the nature mean for you?</p> <p>What does the nature mean for the village and the villagers?</p> <p>What do you use the surrounding forests and rivers for?</p> <p>Have there been any changes in the nature (biodiversity loss, floats etc.)?</p>	<p>Somehow investigate if there has been fatal environmental degradation without mentioning climate change.</p>
The villagers	<p>We are interested in speaking to small-scale farmer who are involved in the joint venture schemes and farmers who are not.</p> <p>Do you have an idea on who we can speak to?</p>	
Ending	<p>Thank you so much for your time and your hospitality. We are so excited to be here and are looking forward to exploring your village.</p>	

INTERVIEW GUIDE Informant from ‘Tropical Peat Research Laboratory Unit		Interviewer: Observer: Date: Recording number:
THEME	QUESTION	NOTES

<p>Introduction</p>	<p>Thank you for your time. We are a group of students from the University of Copenhagen and we are doing an interdisciplinary course. We wish to investigate the environmental and socio-economics impacts of transition from peat lands to agriculture (palm oil) and would therefore like to interview you.</p> <ul style="list-style-type: none"> - We are really thankful that you will participate in our interview. It is of great value to us. - The interview will take approximately 30 minutes, according to how much you like to tell - You only have to answer the questions, you feel comfortable answering, and if there is something you do not want to talk about, please let us know. - The interview will of course be anonymous, and only be read by ourselves and our teacher. - Is it okay, we record the interview, so we remember can use it in our work afterwards? - Do you have any questions before we start the interview? 	
<p>Presentation of informant</p>	<p>Can you please tell us a little bit about yourself?</p>	

	<p>What is your academic background?</p> <p>What is your occupation?</p> <p>What does your job consist of?</p>	
Tropical Peat Research Laboratory Unit	<p>What is the purpose of the Tropical Peat Research Unit?</p> <p>What do you do?</p> <p>What is your vision?</p> <p>Why is there a need for your unit?</p>	
Peat lands	<p>Can you please tell us a little bit about the peat areas in Sarawak (how many hectares? What is their purpose?)?</p> <p>What is your attitude towards the transition from peat lands to agriculture?</p> <p>How many hectares has been transitioned to agriculture (palm oil)?</p> <p>What are the pros and cons regarding this transition?</p>	
GHG emissions	How do you relate to the fact that peat lands serve as a carbon sink, and that it mitigates emissions?	Important to be very neutral.
The Malaysian Government	What is the Malaysian governments attitude and visions on peat lands (and the transition to agriculture) and	

	how does that coherence with your unit?	
Agriculture / (palm oil plantations)	<p>What has the transition from peat lands to agriculture meant for the economic development in Sarawak (and Malaysia)?</p> <p>What has the transition meant for the populations livelihoods?</p> <p>What has the transition meant for the environment (deforestation, degradation, biodiversity loss)?</p> <p>How have you included many of the indigenous inhabitants of Sarawak's connection to the forests?</p>	
Ending	Thank you so much for you time.	

B) Land use:

_____ Palm Oil
_____ Livestock rearing

Other, what? _____

15. Have you changed the way you use your land?

If yes: How did you use your land before?

Why did you change your way of using your land?

To get better income _____

Because the production was easier _____

Other reasons _____

16. What is the size of your land? _____

17. If you use the land for different purposes please specify size for each:

18. How did you get the land: _____ Inherited
_____ Bought
_____ Others: _____

19. Is there areas of peatland on the land you own? _____ Yes
_____ No

If yes, what do you use the peatlands for?

20. Has the government or private companies leased part of your land? _____ Yes
_____ No

If yes, please answer the following section C, otherwise go to D.

C) Government and/or private involvement in land use

21. Which actor has leased your land? _____ Government
_____ Private company
_____ Other

22. How much land has been leased? _____

23. What do they use the land for? _____

24. Is any of the leased land peatland? _____

If yes, what do they use it for? _____

25. Have you been given any compensation? _____ Yes

_____ No

If yes please describe:

D) Palm oil in Lebor

26. Have you been consulted before palm oil was introduced to Lebor? _____ Yes

_____ No

If yes,

how? _____

27. Have you benefited from the palm oil? _____ Yes

_____ No

If yes, in which

ways? _____

28. Has Lebor changed since palm oil production began? _____ Yes

_____ No

If yes, how? _____