Abstract

At present Kpg. Puak, located in the State of Sarawak, is undergoing transformations due to the over all development in Malaysia. These changes have an affect on the livelihood strategies of the inhabitants. Both external and internal factors influence these changes.

One of the main factors is migration, since it creates new income possibilities as well as put constraint on the agricultural production due to lack of labour. Households in Kpg. Puak experiences migration at the same time as the education level is rising. This affects their farming practises. Instead of relying on subsistence farming alone farmers diversify their production, and livelihood strategies. These now also includes cultivation of cash crop and off farm labour.

The main farming practices are rice as subsistence crop and baby maize as cash crop. Due to previous governmental schemes, and soil quality in the area, chemical inputs are used. This can have an environmental affect on the water resources. Apart from the cultivated fields, the villagers also collect products from the forest, primarily for subsistence use at present time. Collection of birds nests have an importance both social and financially for some.

The villagers believe they own the land they use because they refer to the indigenous law system, adat, but the official land code makes land tenure insecure. The tenure insecurity can affect possible compensation for lost land. This is relevant due to road construction in the area. On the other hand, the new road intensifies the above mentioned development

Acknowledgements

This field-rapport is the result of a two-week stay in Kampung Puak. Our deepest thanks therefore go out to all the villagers. Their warm hospitality and willingness to participate in our survey was invaluable. Also special thanks to our guide during the stay, Mr. Salleh, whose knowledge about the community was a great help in conducting the investigations. And our interpreter, Ms Lucy for her help, patience and participitation in various field trips

Especially our Malaysian counterparts deserve huge thanks. Thanks to Hamden Mohammad, Khamri Katang, Cristopher George, Hamidah Ali, Ranum Bari and Syarifah Noorlia Wan Bujang. Thank you for your co-operation, assistance, understanding and patience.

We would like to thank our Malaysian supervisors for their help in the field and for their willingness to share their knowledge with us. But certainly also because of all their efforts in arranging the fieldtrip.

The supervisors back in Denmark, Ole Mertz, Andreas de Neergaard and Quintain Gausset also deserve to be mentioned. Thank you so much for taking the time to help us with processing data after our return to Denmark

Finally we would extend our thanks to our Danish supervisors in Malaysia, Kristine Juul and Rikke Folving for their guidance, and help throughout the entire field course. Not only academically but certainly also practically, i.e. changing airline tickets in every possible airport between Copenhagen and Kuching.

PREFACE

"*The Danish SLUSE (Sustainable Land Use and Natural Resource Management) program was created in 1997 as a response to a request from the Danish Ministry of Environment(DANCED) to educate candidates within environmental and international development studies with broader interdisciplinary qualifications."*

(Introduction from ILUNRM compendium)

As a part of obtaining the SLUSE certificate 2004/2005 we all followed the course Interdisciplinary Land Use and Natural Resource Management (ILUNRM). This compulsory interdisciplinary course, with a 3 weeks' field course, from 9th to 29th of January, brought the group to the Malaysian state of Sarawak, Borneo. In a small village in Sarawak we got the possibility both to observe and also be a part of the everyday life in the Kampung Puak (Kpg. Puak). Our original assignment for this report was to:

"*Evaluate the opportunities and constraints related to the past and present location of the Kpg. Puak in relation to adjacent resources. Explore possible impacts of external interventions such as mining and the proposed conservation plans on present and future land tenure security. Evaluate the potential implications of the new road on accessibility to land, labour and forests resources."*

(ILUNRM)

After our arrival adjustments had to be made.

1 THEMATIC CONTEXT

1.1 Malaysia – a country under development

The majority of the countries in Southeast Asia are, in their pursuit of becoming fully developed countries, undergoing significant rural changes. Changes in the rural areas that are economical, political as well as social, cultural, and environmental (Rigg, 2000).

The federation of Malaysia was formed in 1963, and consists of Peninsula Malaysia and the two Borneo states Sabah and Sarawak (Jomo et al, 2004). Since the early nineties, the government of Malaysia has implemented an overall economic transformation, called Vision 2020. Its goal is that Malaysia shall become a fully industrialized nation by the year 2020. The vision transforms the development focus from the primary to the secondary and tertiary sectors, but the primary sector still has a very important role in fulfilling this vision (Ibid).

The major cornerstone for the Malaysian economy has for many years been export of natural resources, such as tin, rubber, oil palm, petrol and timber. But this has since the second Malaysia Plan from 1971,been paralleled by an industrialization policy (Ibid). In this plan the manufacturing and processing of products should be the engine for the restructuring of the nation (Rasiah & Shari, 2001). All this resulted in a rapid manufacturing growth, which helped the Malaysians to gain access to the modern market and thus helped alleviate poverty. This has meant a rapid structural transformation of the Malaysian economy (Jomo et al, 2004).

Concerning agriculture, the government wants to transform this through its National Agricultural Policy. A major objective of this policy is income maximization and changing agriculture into a modernized and commercialized sector through technological and scientific development. This is an example of how the primary sector is transformed to economically support the development of the other sectors. Since the exploitation of timber resources and subsequent conversion to oil palm plantations of

state land gained momentum in the 1960s, shifting cultivation has been viewed as an obstacle to such development (Hansen & Mertz, 2003).

Indigenous strategies of use and management of tropical ecosystems have, for decades, been identified with shifting cultivation practices[1]. It has recurrently been described as a low productivity system, wasting natural resources and because of this shifting cultivators have been viewed upon as destroyers of tropical forests. But what might not have been considered previously is, that these land use strategies involves gathering, fishing, hunting and to different extents agro-forestry and forestry extraction, plantations, and cash crops (Toledo et al, 2003). The view on shifting cultivation was determined by the fact that scientists overlooked the diversity of indigenous practices and management and only focused on the agronomic centred approach not taking into account all the other activities mentioned above (Ibid). Even though shifting cultivation in Malaysia has been proven a more benign alternative, in terms of productive sustainability, than most other permanent farming systems in the tropics, the general view on this practice is still negative (Mertz et al, 2003). Shifting cultivation is still being practiced in Sarawak, and the farming practises are mixed, but still with a focus on subsistence farming (Jomo et al, 2004; Norwawi, 2002). This is in contrast to the federal and state levels desire for continuous cultivation. The government has implemented different agricultural schemes, which has meant that the farmers have converted fields to permanent cultivation. This has affected the livelihood strategies of the indigenous people of Sarawak.

> *"Farming, once a way of life, is now a livelihood, one occupation among others"*
>
> (Moerman in Rigg, 2000).

In other words, agriculture is not the only resource for a rural household anymore. This change in livelihood strategies is partly due to increased opportunities for off-farm labour and governmental focus on large-scale land development schemes, especially in areas with good infrastructure (Mertz et al, 2003). It is also partly due to an increase in the level of education in the population. In Malaysia it is compulsory to attend school

[1] Swidden-, slash and burn- , or nomadic practices

for 11 years. This development has lead to increased migration. Young people from rural areas leave the countryside and move to the cities. At the moment the percentage of urbanization in Malaysia is 59 (Kjeldsen, M. L & Phil, M, 2005). A consequence of this migration pattern is that elderly people in the rural villages are now struggling to maintain their farms due to lack of labour (Rigg, 2000).

Therefore it is essential to evaluate the different types of resources or 'capital' that the households in a village have access to. These assets provide an opportunity for different combinations of livelihood strategies. According to Scoones (1998) the concept 'capital' covers four different types: natural capital, economic capital, human capital and social capital[2]. These capitals must then be combined such as to create a sustainable livelihood. To have a sustainable livelihood means to be able to

> "*...cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, while not undermining the natural resource base.*"
>
> (Scoones, 1998).

1.2 Our assignment

This assignment is approached through an appraisal of the different livelihood strategies in the Kampung (Kpg.) Puak. Are their livelihood strategies sustainable or will they have to change within the near future? A short introduction to Kpg. Puak and its history is necessary to understand the developmental status of the village and the physical environment surrounding it. Hereafter the connection between the educational status of the villagers and migration patterns is analysed. Migration is seen as a way to create new livelihood strategies outside Kpg. Puak or as a way of diversifying sources of income to the household economy in the village. These strategies might be proven advantageous when change in land tenure occurs. Bau area is known for its gold resources and future gold mining interests in the area is a crucial issue for the people in Kpg. Puak. There is a conflict between the traditional indigenous adat law and the Land

[2] Natural capital refers to the natural resources. Economic capital refers to cash, savings and economic assets like infrastructure, technologies and equipment. Human capital includes the skills, knowledge, ability and capability of the household inhabitants of Poak. The social capital comprises the networks, social relations, associations etc. upon which people draw to pursue the livelihood strategies

Code in Sarawak. It is discussed how these discrepancies affect the villagers in Kpg. Puak as to land tenure security. Examples are drawn from the construction of a new road in the area. The natural resource base in the area is assessed through a combination of natural and social science. Focus is put on soil quality and how farmers adjust to overcome limitations and maximize production. Furthermore the management of drinking water resources is appraised especially in relation to the influence of farming. The use of non-timber forest products (NTFP) and wildlife from the forest are also a part of the natural capital available for the households. Here special emphasize is placed on the management system controlling bird nests collection as this is the main source of financial income from NTFP to the households in the village. All of these different opportunities and constraints play a part in the design of the different livelihood strategies of the inhabitants of Kpg. Puak

During the field course in Sarawak the assignment and objectives from our synopsis had to be adjusted to math with the synopsis of the Malaysian counterparts and the realities in Kpg. Puak.
First of all, the village had not been resettled. It was first inhabited in the 1850 by settlers from several different other areas. Secondly present gold mining activities in the vicinity of Puak community had no environmental influence due to its location downstream from the village. Last, it was learnt that the idea of a future conservation of one of the lime stone hills had been given up.
Adjusted assignment:

"*Evaluate the opportunities and constraints related to resource use in Kpg. Puak and how this has changed over time. Explore possible impacts of external interventions such as mining and construction of a new road on present and future land tenure security.*"

(Revised, Jan 2005)

2 METHODOLOGY

The diversity of aspects that influence different livelihood strategies meant that the collection of data took on a broad perspective. Also the circumstances under which the data was collected as well as the fact that the participants in the field study had different cultural and educational backgrounds played a part, e.g. in the interpretation of the data. This is even more evident when working in rural areas where even more misunderstandings might occur and when time constraints are an obstacle for in-depth data sampling and repetition. One way of diminishing these inaccuracies or even errors is by using "Methodological triangulation"[3] (Denscombe 1998 ; Murnaghan & Stochking 2001). During the data collection in Kpg. Puak the information found was backed up by different sources whenever it was possible. The different methods were qualitative as well as quantitative, and the final result is a combination of the different methods and data.

2.1 Participatory Rural Appraisal (PRA)

"PRA is an approach, not a method".

(Kelvin 2005, personal communication)

The PRA approach has advantages compared to and more traditional approaches such as the questionnaire survey. The information created through PRA activities is often stated in relative rather than absolute values and gives the possibility of comparison without having actual measurements (Chambers 1997). We found that the qualitative and the quantitative methods supplemented each other. PRA was used in the initial state of the investigation to provide general knowledge about the village, its geography and its problems. It provided preliminary information needed for the design of the household survey and the quantitative information from this survey was used to locate sources of information for further in depth studies. Most of the PRA activities carried out in Kpg. Puak were mapping or diagramming made by a group of the inhabitants. We observed that information was built up cumulatively and the participants crosschecked each other filling in gaps and adding detail to the maps and diagrams.

[3] Using and comparing data of several different approaches or sources in order to minimize inaccuracies

The initial activities carried out in Puak were transect walks through the village and the surrounding fields, the making of a village map, a time line and a problem ranking diagram. Later a pair wise ranking diagram was made. The idea of this activity was to understand which crops the farmers themselves perceived as the most important without setting a parameter such as economy or area. Finally, a seasonal calendar was initiated in order to show the seasonal distribution of work load in the agriculture.

2.2 Personal observation

> "*Observing directly (see for yourself): This can be the most effective if combined with self-critical awareness…..*"
>
> (Chambers, 1997)

Observations and comments from the different activities were written down in notebooks and these were later used to back up or to question information obtained from other sources. An example is the investigation of artificial inputs to agriculture where personal observations became crucial, as the farmers could not state the contents of mineral fertilizers, herbicides and insecticides used. Participation in different daily tasks also became a way to obtain information about the villagers' workloads. Activities such as harvesting, fishing and kitchen chores were effective ice-breakers making the people laugh at our clumsiness. Discussions about the importance and constraints of the different activities came naturally.

2.3 The use of an interpreter

Our interpreter was a young Bidayuh woman, Ms Lucy, who spoke English, Malay and Bidayuh fluently. She was a former SLUSE student and this proved to be an advantage but in some cases also a drawback. She had a good understanding of our assignment and she was aware of the fact that Danish culture is very different from the Bidayuh culture. Sometimes she told us that the question we were about to ask might be misunderstood and therefore offend the respondent. This was a major advantage since the villagers' acceptance of us was crucial for our gathering of information and our study.

Even though most of our experiences with our interpreter were good there were also some situations, which might have affected the reliability of our data. Being a former SLUSE student she would sometimes add details to the respondents answer.

The chemistry between the interpreter and the Danes turned out to be crucial for the data collection. Her attitude and body language could affect interviews and when she was tired or unmotivated translations became scares. We found that the atmosphere is very important when doing face-to-face interviews with people. One of our best interviews was very “unplanned” and took place while we sat talking with Ms. Lucy and later joined a group of villagers working outside their house. Due to the relaxed atmosphere we got a lot of useful information

Correct translations were essential especially in the household survey. A good example is that we discovered that the words “fallow” and “abandoned” are one and the same in Bidayuh. So whenever we have asked about anything related to fallow we couldn’t be sure whether the respondent thought of land that was not cultivated or land that would be cultivated again within a given range of years.

2.4 The use of a guide

On our arrival at the village we were assigned one of the inhabitants, who spoke English, as a guide. Mr. Salleh, guided us on walks in the jungle. When we wished to conduct certain interviews or a PRA exercise we explained to him what kind of persons, i.e. young men, farmers etc. we were interested in and then he invite the people he thought useful. He also came to interviews, would introduce us (in Bidayuh) and explain the purpose of our interview. Most of the time it appeared that he was merely observing but on occasions he would interfere (talking in Bidayuh to the respondent). We tried to explain to him that it was necessary that we got the answers from the respondent only, but it was also a matter of not disrespecting him. This might have affected the results gained from interviews. It was a good experience working with Mr. Salleh and he definitely was an important source of information constantly telling us about his village and its inhabitants.

2.5 Household survey

The household survey in Kpg. Puak is an example of the advantages of using results from preliminary qualitative methods to design a quantitative survey. Each household and the name of the household head were identified on a village map made by 40 villagers[4]. No secondary data or individual key informants could provide us with the precise number of households. A simple random sample of 50% of the households in the community with equal probability was chosen.

The questionnaire[5] was pre-tested, necessary adjustments were made and the research team carried out the survey with 40 households. The entire survey was controlled by use of a list with data on all households in the village.

Our Malaysian counterparts acted as interpreters since this would speed up the process markedly. To ensure all questions in the questionnaires were asked in the same way we translated the questionnaire from English into Malay and Bidayuh. However, we learnt from our Malay counterparts and Ms. Lucy that one couldn't always ask a straight question. This meant that the idea of asking exactly the same questions in every interview wasn't always possible. Most household interviews were carried out in Malay or Bidayuh, but a few were conducted in Mandarin and one was in English.

Apart form the direct quantitative information obtained from the household survey we also learnt which problems we should investigate with more in depth approaches and which persons it could be interesting to interview more thoroughly.

2.6 Interviews

Interviews in the form of key-informant, informal- and focus group interviews were used to obtain qualitative information. The main parts of the interviews were open-ended and semi-structured. The research objectives were used as interview guides[6] in preliminary interviews but as information accumulated more specific and relevant interview guides were made. The purpose was both explorative, to help us understand a

[4] Appendix A
[5] Appendix B
[6] Appendix D

specific situation or issue in order to define the context, and also to gather more basic information. We used key informants, both internal key informants i.e. the headman of Kpg. Puak concerning the rights to the bird nests, and external key informant i.e. the district officials such as the agricultural officer to obtain information on specific topics. Focus group interviews were used to obtain in-depth information on topics of interest that was revealed through preliminary qualitative methods and the household survey. The recording was done both by handwritten notes by the interviewer or an assistant and by tape recording

2.7 Natural resource survey

Results from PRA approaches, interviews and the quantitative household survey formed the basis for selection of sites and themes in a comprehensive survey of the natural resources base.

2.7.1 Soil analysis

To get an assessment of soil quality, samples were taken from specifically chosen fields and adjacent fallow areas. These were brought to Denmark and analysed for pH, Carbon-, Nitrogen-, Aluminium- contents and soil texture.[7]

2.7.2 Measurement of area and distance, slope and plant cover*:*

During farm visits it became clear that some farmers had to walk a long distance in difficult terrain to get to their fields. By use of GPS the walking paths from the farmers' houses to their fields were recorded.

GPS was also used to measure the areas of the two fields and due to differences in inclinations of slopes total surface areas were compared rather than planar area. The hill rice field was situated on irregular slopes and therefore measured by inclinometer whereas the slopes of the baby maize field were estimated.

The other method used was estimation of area by number of grains planted compared to distribution of grains on the field. This method has the advantage that the large areas of

[7] Appendix E

many farmers can be estimated from interviews. However, the surface area of one or two fields has to be known in order to adjust the equation used. This method was tried out in one field in Kpg. Puak, but as the surface area was not known at the time, this method did not find further use here. In future research this method could be useful if incorporated in the household survey.

Vegetation cover in fields was estimated by using "cover estimate by eye" method and used to understand the exposure of fields to erosion. Vegetation cover is defined as the area within a quadrate that is covered with the above ground parts of each species (Coker & Kent, 1992).

2.7.3 Water analysis

Indicators used for the quality assessment of the drinking water resource were among others nitrate, ammonia, phosphate and the total coliform count.[8] These were taken from three locations along the river and two from the pipe water system. Two of the locations in the river were sources of drinking water for the village and the third was affected by wastewater.

We also planned to test the water for traces of the toxic herbicide Paraquat, but this was not possible due to high testing costs (Sing, 2005, personal communication). Through village mapping, interview with a commuting mine worker and examination of topographic maps with Dr. Lau Sing (2005) it became clear that no goldmines are placed in the area of Kpg. Puak or the adjacent fields. The nearest goldmines were further downstream and therefore arsenic pollution was not a problem for the water resources in Kpg. Puak.

[8] Appendix F

3 RESULTS AND DISCUSSION

3.1 Introduction to Kpg. Puak

Kpg. Puak is located in Bau district in the state of Sarawak. The village is situated along a 2 km village road that starts at the main road to Krokong Gunung. From the junction the village road leads up and ends in a narrow valley between limestone hills. Houses are scattered along the road though the majority of them are clustered at the junction and at the end of the road. The villagers were asked to make a time line in order to have

Table 3.1 Community history

Year	Event	Order of remembrance
1957	The village is newly formed	6
1957	The village grew into 35 households	8
1965	Dirt road	1
1974	1st community hall	4
1977	Primary school	2
1977	Rubber project is given	7
1977	Piped water supply	9
1986	Paved road	3
2001	Present community hall	5
2005	Now t he village is growing to 60 Households	10
2005	Suddenly UNIMAS students came to Kpg. Puak	11
2005	Now we are still using generator, each household has its own	12

the major historical events clarified. The time line can be seen in Table 3,1. There might have been a bias since the participants were invited by our guide and the houses at the junction was not represented by any participants.

In the 1850s a few people left the village at Krokong Gunung and founded Puak due to an increasing lack of land. Another reason why they chose to settle further downhill was that times were becoming more peaceful – defence against other hostile villages was no longer needed. The status as a Kampung was not officially recognized until 1974. The village now include 72 households.

A dirt road was built through the community in 1965.The villagers now had easier access to Bau town including the market as well as educational facilities. Previously the villagers had to walk for hours to get to Bau town. In 1986 the road was paved. This further improved access for the upper part of the village.

In 1977 piped water was installed in almost every house. This meant that people saved the time other wise spent on getting water from the river. The majority of the houses in the upper end of Kpg. Puak are connected to one main pipe line leading water from a small dam further upstream the river Puak. The houses near the junction are connected to another pipe system and the houses in between have small private pipelines taking water from nearby streams on the hillsides. The household survey revealed that 98% of the households in Kpg. Puak have piped water supply. During the dry season from June to August 72 % of the households lack water from the pipes. Drinking water is then collected directly from the rivers. A facility such as pipe water is an example on a development project partly initiated by the villages' local council, the JKKKR.

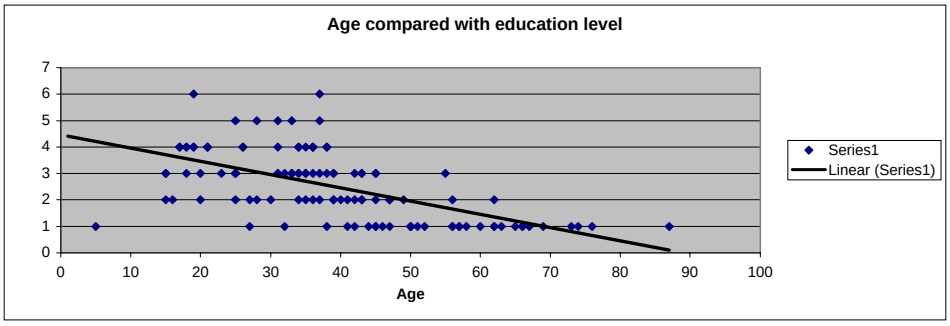
This council also takes care of the villagers' interests and arranges public events. The headman, Mr. Majin, is at the top of the hierarchical JKKKR. The headman is the link between the outside world and the village everything has to go through him. He decides on development plans, concerning the village and who are entitled to social welfare. This top down system can have an effect on the livelihoods of Kpg. Puak because it results in lack of communication between the levels. The lack of knowledge distribution between the levels is a general problem for systems in Malaysia. During our stay we only had the opportunity to visit the headman once. The headman was not present at any of the coordinating meetings. Instead the JKKKR was used as a source of information.

3.2 Migration – result of new possibilities

The migration in Kpg. Puak is mainly influenced by a wish for a steady and higher cash income as well as the fact that people are getting a higher education than previously. Twenty percent of the houses in the village were abandoned and 36 % of the households had experienced members migrating. During a focus group interview with 5 unmarried young men (18-28) from the village all of them agreed that working in the field is physically hard and time consuming. They all also agreed that the major reason for them not wanting to work in the fields is that there is no guarantee of a steady cash income due to the changing crop prices. Two of them were already working outside the village and commuting to work every day.

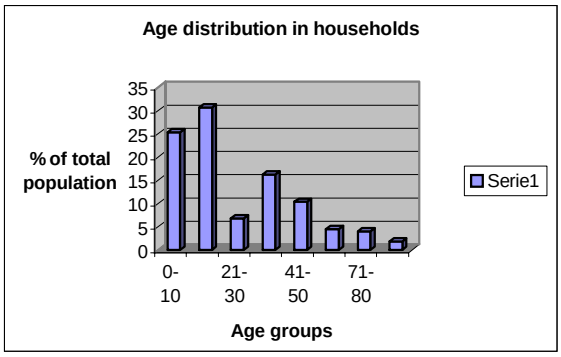
The inhabitants of Kpg. Puak are also getting a better education. Figure 3.1 shows how education levels of the villagers are distributed in relation to age. The highest level of education is seen among villagers ageing from 15 – 40. The level of education declines with increasing age. This corresponds with the time line that reveals that the primary school in the village was built in 1977.

Figure 3.1



In an interview with the headmistress of a secondary school near Bau, she explained that there was an increasing tendency for the students to continue their education in the bigger cities where they might settle permanently. This is experienced all over the state (Hansen and Mertz, 2003; R. Soda, 2001).

Figur 3.2



However we learned through various interviews and informal talks that most of the people that migrate return to the village at some stage to “retire” which implies that the village is not likely to change in the near future. Figure 3.2 shows the age distribution in households and that up to 56 % of the population is under the age of 20. Seven percent of the population are within the age group 21-30. This coincides well with our theory that the young people (excluding the 56 % that still attend school) seek job opportunities outside Kpg. Puak. A reason why the next age group (31-40) is twice as large as the previous could be that people return to the village or it could be that the school have given people the possibility to go on with further education outside the village.

Migration is not a new trend since it has been a tradition among the Dayak (the indigenous of Borneo) villagers that the males once in their life leave the village for a period and work outside. This shows that cultural traditions also play a part (Mertz & Hansen, 2003) and that migration is not solely due to better-paid jobs and a higher education level.

Improvement of the village’s infrastructure with piped water, electricity, public houses (community hall, cultural house) along with a new road, all contribute in making the village a more desirable place to live. Some of these projects have already been implemented in the village. Migration diversifies income possibilities but at the same it alienates the younger generations from their families’ land.

3.3 Land tenure security

Land tenure security is an important aspect in the livelihood strategies of the inhabitants in Kpg. Puak since it can have a great effect on how a farmer chooses to cultivate his fields. If there is an uncertainty in the ownership of the land a farmer might be reluctant to cultivate certain types of crops. A farmer without secure tenure will most likely choose crops with a short period of growth, and which require less time between planting and the output (Bruce, 1989). A crucial question is: can outside interventions affect land tenure security in Kpg. Puak?

The Dayaks of Sarawak, which includes the inhabitants of Kpg. Puak, have practised and still is, the customary law, also called adat. This is a form of informal governance with out written documents, and is under custodianship of the village headman. The adat has been the important instrument in maintaining law and order. According to the system, the rights of land are first defined by who first cultivates land[9](Ngidang, 2003). From interviews is was revealed that the inhabitants of Kpg. Puak originally obtained their land this way. Natural landmarks, such as rivers, durian trees and bamboo are used as boundaries between the different plots of land. According to the adat law this land is then passed on to the descendents through generations (Ibid.).

Meanwhile Sarawak state believes that traditional land tenure is an obstacle to development, and instead they have tried to provide individual title to land through legislation (Cramb & Wills, 1990). The diversion of land into these groups has caused some problems between the government and the indigenous people. The main tension point concerns the definition of Native Customary Rights (NCR). The Adat defines NCR as rights to ownership of land, whereas Sarawak Land Code defines NCR as right to use of the land, but not own land (Ngidang, 2003). This difference in understanding of title to land can also be seen in the villagers of Kpg. Puaks own understanding of their land status. According to the household survey it was established that 90 % of the villagers claim to own the land they use, but at the same time 82 % say that the land status is NCR. According to the Land Code (1999) land has to be measured and claimed to get NCR-status. As it is now the government has not declared any of the land around Kpg. Puak NCR land, they regard all the land as State land (Malong, R. 2005, pers. com.). This coincides with villagers' statements that so far no government officials have been out to survey their land. Even if NCR is claimed, the villagers of Kpg. Puak do not legally own their land, they only have rights to use it. However, this does not have an affect on the livelihood strategies in Kpg. Puak at present day, because the villagers believe they own their land.

[9] Ngidang writes about how the adat fungtions amongs Ibans, but in this thesis we belive it also refires to the Bidayuhs of Sarawak.

One reason why the government might not have surveyed the land or got it titled yet, is if the area holds an interest for them. During our research we learned that a mining company has a mining certificate on all the land surrounding Kpg. Puak. The result from the household survey was that 90 % of the villagers did not know about this. The contract gives the company permission to investigate the area for minerals. If they locate such resources in the area, this lease gives them permission to extract it from the ground. The lease will rule out any rights the inhabitants in Kpg. Puak have to their land. One of our Malaysian counterparts works for a company and can verify that gold has been found in the area. If future mining activities are initiated in the area the villagers' land tenure is not secured.

A project that has already affected 48 % of the villagers is the construction of a new road that runs parallel with the village road[10] since some of their farmland has been absorbed. When the government plan to take over land being used they first have to give a notice. in e.g. the newspapers. This leaves the farmer with 60 days to claim compensation (Land Code, 1999). After this is done the government will then send someone out to evaluate the land and compensate accordingly. A problem is that many of the inhabitants of Kpg. Puak do not know the land code in all its detail, maybe because of the top down system.

Outside interventions can affect land tenure security in Kpg. Puak. This is supported by the two examples where land can be taken from the villagers without their consensus. However there is a difference in who in the village is effected most by the insecurity of the land tenure. Household economies that mainly depend on farming are more vulnerable to outside interventions than those sustained by more diversified livelihood strategies.

3.4 Opportunities and constraints for the farmers

The traditional farming practice of Kpg. Puak is shifting cultivation. The main differences between farmers are seen in how they prioritize cash crops compared to

[10] Appendix C

subsistence crops and how long the fallow period is. From the household survey it was found that 75 % of the households[11] in Kpg. Puak are involved in agricultural activities. However, only 37% of the inhabitants consider farming as their main occupation. The farmers claim that farming activities do not generate a steady cash income, and the contribution of crop production to the household economy varies.

The length of the fallow period is the main factor influencing the sustainability of shifting cultivation systems (Nair, 1993). However, the system in Kpg. Puak was also provided with inputs in terms of fertilizer and herbicides to the production of both cash crops and crops for own consumption.

Shifting cultivation requires large areas of land and the distance to and topography around the fields is a constraint for farming. This was mentioned both by the farmers but also by the middleman buying baby maize from them. He said that one of the reasons why Kpg. Puak produced less that other villages was the distance to their fields. We went with one of the farmers through the jungle and to his hill rice field. The walk was about 1 hour and the walking path was steep and slippery. Furthermore streams and other obstacles had to be crossed to reach the field.

3.4.1 Farm products

Over the last decades different cash crops have been introduced to the farmers in Kpg. Puak such as rubber (1978), cacao (1985) and pepper (1996) and most recently baby maize (2000). Rubber, cacao and pepper have been introduced on governmental schemes and at the same time the use of fertilizer and herbicides was introduced. Baby maize was initiated without any subsidies. Most of the fields visited had many different kinds of crops. The farmers appear to favour a diverse crop production even though it is on a small scale. To have a production like that makes sense if the farmer and family are to live off the production. From the PRA diagram pair wise ranking and through various interviews it was found that the three most important crops in Kpg. Puak were hill rice, pepper and baby maize.

[11] Appendix C

Hill rice

Hill rice is grown by 80% of the farmers in Kpg. Puak according to the household survey and the area of hill rice production has not changed markedly over the past 15 years. Several farmers stated that hill rice is the only crop with a spirit and that it is a part of most local meals. Therefore rice is treated with great respect and as a consequence hill rice is only grown for own consumption and never sold at the market. This way hill rice differs from all other crops as it does not bring in any financial capital to the household economy. Hill rice is left standing on the field and harvested in small portions when food is needed. The farmers told us that sometimes when a large field is to be sown (especially with rice) a group of villagers would get together and help each other with the sowing. It is a so-called work-party "gutong…" and it is also a tradition to build houses and clear forest this way. When the first rice is harvested there is a celebration "Pesta gausai dayak". All this shows that households depending on hill rice production make use of their social capital for production. The production of hill rice is a survival from traditional subsistence farming.

Pepper

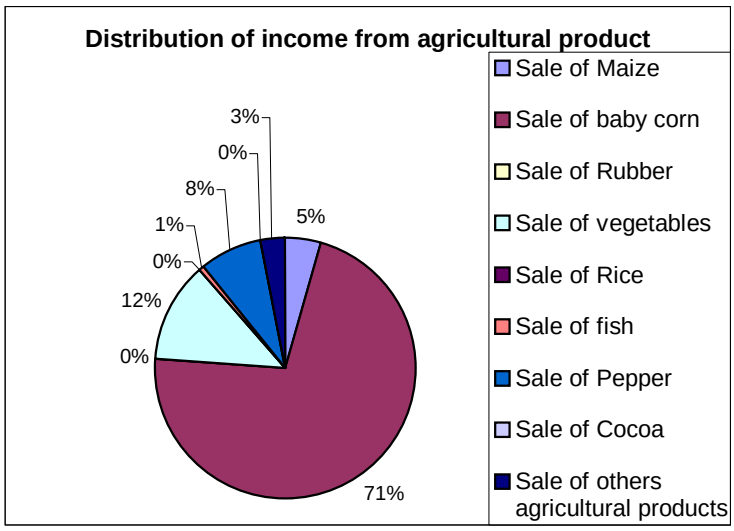
The farmers we interviewed told us that the production of pepper has been much larger that it is today. The area grown with pepper has decreased 40% over the last 15 years according to the household survey, but numerous abandoned pepper fields could indicate that productive pepper area is even further decreased. Eight percent of the income from agricultural products is from pepper. The change in production can be due to decreasing pepper prices, but while out in the field we also saw signs of a fungus on pepper plants. The farmers told us that the pepper was "sick". An agricultural extensionist from Kuching explained that the fungus was probably *Fusarium wilt*. The pepper plant will either not bear fruits at all or the fruits will be very small and not of any use. There were a few productive pepper fields higher up the mountain but the majority of the pepper fields around Kpg. Puak were abandoned. When visiting some of the farmers they stored 50 kg bags of peppercorns in the hope that prices would rise.

Baby maize

At the moment baby maize is the main cash crop produced in Kpg. Puak. This area has increased 37% over the past six years and today baby maize constitutes 71 % of the

financial income from farming activities. (Figure 3.3). The production of baby maize was initiated because there was a demand from buyers in Kuching. There is a middleman that buys the baby maize from the farmers in Kpg. Puak and from four other villages in the area. During the interview he told us that he sells to four fixed buyers. The farmers are not paid in advance. They get paid after the middleman has sold the baby maize in Kuching. The middleman claimed that he charges 12% of the money from the sale but this information was not confirmed by other sources. In the beginning of the baby maize production the farmers did not have to process the maize before selling to the middleman. Today they must cut of the leaves and pack them the in small plastic backs which they sell at approximately 6,5 MYR/kg. The unprocessed baby maize was sold at approximately 2,5 MYR/kg before and by observations and measurement the extra labour need is estimated to 1 man-hour/kg. This processing has therefore increased slightly but also increased the labour significantly.

Figure 3.3



3.4.2 Soil quality

Soil is one of the natural resources used when doing agricultural activities. There are several indicators that when combined characterize the soil quality. We decided to measure some of the indicators such pH, C/N and texture. These measurements were made on a hill rice field and a baby maize field since they represent both subsistence farming and cash crop production.

pH and Aluminum

The purpose of measuring pH was to understand if the farmers get the optimal effect of their fertilizer or if the nutrients might be fixed in the soil or leached, thereby becoming unavailable for plant uptake. The optimum pH for plants is e around 6-7. During the field survey the pH values found are between 3,90 and 4,39, which indicates that the soil is acidic. The low pH values are constraints to both the rice production (IRRI, 2005) and also to the production of baby maize (CIMMYT, 2004). It should be noted that genetically improved cultivars of both rice and maize might be able to produce better on soils with high acidity than cultivars that have not been genetically improved. The use of improved cultivars opens up for increased production in the future.

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Aluminium is a heavy metal that releases from soil minerals to the soil solution under acidic conditions and it was therefore decided to look at the content of aluminium in the given soils.

There are two main problems with having aluminium in the soil firstly that it fixates plant nutrients, especially the macronutrient phosphorus and secondly it is toxic to the plants. The toxic actions of aluminium are primarily root-related (Marschner, 2002).

The values found during the field survey are relatively high (0,0296 – 0,0520 mmol Al/g soil). These values are toxic for most crops and also for hill rice and baby maize and there will be fixation within the soil of plant nutrients (Chapman 1966; Marschner, 2002). The measured Al contents might not be a severe problem for the rice production but it will lower the production (IRRI, 2005). Maize cultivated on soils with a pH below 5 and where aluminium is present results in a reduced yield (Lindon & Barreiro, 2002).

3.4.3 Soil Organic Matter

The content of soil organic matter (SOM) is an indicator of how well the soil sustains agricultural production. Organic matter has many physical and chemical characteristics that are important within the soil. Among others, organic matter is binding and stors important plant nutrients and it also increases the water holding capacity of the soil (Plaster, 1997). Organic matter is important both for the development and the stability of the aggregates in the soil.

…Soils with high SOM concentrations are more productive
than soils with low SOM concentrations;…

(Mcdonagh et al, 2001)

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One method to quantify the amount of soil organic matter within a given soil is to make a determination of total C and total N in the soil. The C/N ratio is an estimate of the availability of soil organic matter as a source of plant nutrients through decomposition and mineralization (Woomer et al,1994).

SOM causes nutrient retention that prevents leaching. Another important characteristic of SOM in relation to the fields around Kpg.Puak is that it detoxifies the soil. Soil organic compounds react with phytotoxic[12] chemicals and reduce their negative effects on the plants. An example is the residual substances from roots and microorganisms that bind and complex toxic cat ions like Al and Fe. This is especially an important feature in the fields around Kpg. Puak since Al contents are very high (Woomer et al.1994).

Carbon content was measured from the soil samples and it was found that carbon content increases down the slopes of cultivated land. This is evident in the baby maize field whereas it is less significant for the hill rice. The effect of the slopes could not be seen in the results from the fallows areas. There are large differences within the C-contents from the baby maize field. The down hill result was even higher than the average values in the fallow. The soil samples taken down hill were significantly darker than soil from other samples. This is a clear sign that the soil was water logged. Water logging impedes decomposition leading to high C/N ratios. This might explain that the carbon content down hill was higher than the reference area in the fallow.

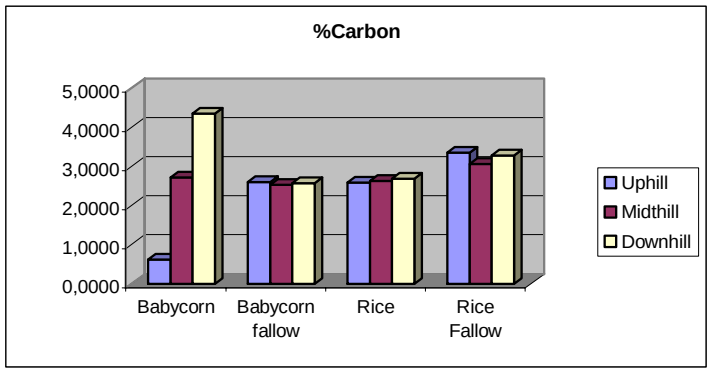
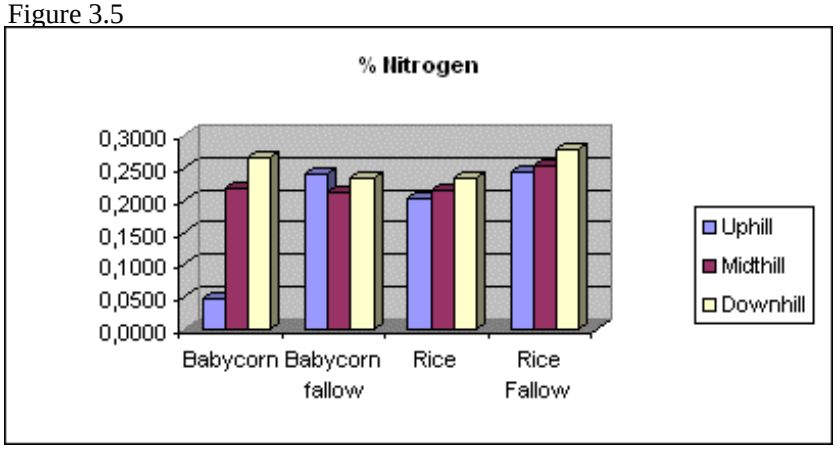


Figure 3.4

[12] Toxic to plants

The C- content uphill was less than 25% of the average values in the fallow (figure 3.4). What can be derived from these results is that soil organic carbon is lost from the baby maize field. One explanation to this could be that soil organic carbon is lost with run off. This tendency was expected as the storage of soil C in crop rotation systems are often only 50% of soil C stored in the natural system (Woomer et. al 1994). Nitrogen sustains this tendency as percentage in the soil increases down the slope. This is also more significant in the baby maize field than in the rice field. (figure 3.5)

Figure 3.5



A number of factors leading to erosion were observed at the site. The plant cover in the baby maize field was 5 – 10 % whereas the cover in the rice field was estimated to be 50- 75 %. An abundant vegetation cover prevents rain splash erosion and thus reduces surface crusting and run-off intensity (Morgan, 1995). The gradient of the baby maize field was estimated to be 7 -25 degrees. The gradients of the hill rice field were even steeper ranging from 20-40%. In theory an increasing gradient of slope increases the velocity of runoff leading to erosion of topsoil, but this was not confirmed in our results. We observed that the topsoil was compacted and this observation was confirmed by the analysis of soil texture. However, signs of erosion are not seen in the results from the texture analysis[13]. The clay content in the baby maize field was on average 22%. The compacted layer decreases the infiltration rate and thereby increases runoff (Morgan,

[13] Appendix E

1995). The slope and the high amounts of rainfall are both factors that contribute to the risk of erosion.

The farmers knew about erosion but did not consider it as a problem. They told us that they avoided using fertilizer at the peak of the monsoon that occurs in the last week of December and the two first weeks of January. Erosion controlling measures such as terraces were not observed in the fields. The farmers explained that these practices are too labour demanding and that it was not their tradition. "*We are shifting cultivators - this is our tradition"* (Miss Joas, 2005, personal communication). Our impression from talking with the farmers is that there is no immediate land shortage. One farmer stated that he had so much fallow land that clearing the oldest and largest trees demanded more hours of work than he could allocate.

The C/N ratios in the soil from both fields are within the range of 10 – 17 with an average of 12,5. We had expected this to be higher due to low pH and continuous cropping. The C/N ratios show that there is a fast release of plant available nutrients but also a high risk of N –leaching. The plant cover estimations show that the plant density and abundance in the baby maize field are scarce and it is therefore not likely that the plants can take up the nitrogen accordingly. Furthermore the owners of the baby maize field annually apply approximately 34 kg pure N * $acre^{-1}$.[14] The samples were taken in January where the monthly precipitation is the highest of the year As N is highly susceptible to leaching and the plants in the baby maize field cannot uptake much of the N available, it is likely that most N is lost from the soil and some is incorporated in the SOM. The SOM thereby functions as a buffer that takes up the mineral N and releases it continuously.

The continuous cultivation of baby maize fields might cause reduction of SOM. The productivity of the soil declines in accordance with decrease in SOM. The buffer effect in relation to nutrients and water is reduced and soils get more susceptible to erosion which speeds up C-loss further. The decline in productivity can be replaced by

[14] 286 Kg fertilizer * 12% N * $acre^{-1}$ * $year^{-1}$

increasing application of mineral fertilizer, it is a downward spiral with progressively increasing expenses.

There is a possibility that continuous cropping of baby maize in the fields of Kpg. Puak might degrade the soils. However, when asked how long many years more they had planned to grow baby maize on the particular field, the farmer replied:

> "*We will grow maize until the soil gets too tired and the plant will not grow anymore. Then we will clear a new area and start again*".

This means that over a longer period of time baby maize production can still be classified as shifting cultivation. The cropping periods and the amounts of inputs to this system are increased but the practice is still within the same system. Sustainability of this system depends on the availability of large areas and thus of tenure security.

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Inputs to agriculture

3.4.4 Measurement of area

For comparison of inputs to different fields the areas of the fields were measured. GPS measurement and registration of inclinations were compared with results from estimation of area by rice grains.

The results from the GIS measurement of planar area (flat projection) and the surface area (3D) are presented in table 3.2. Procedures, calculations and more contour maps are presented in appendix G. The contour maps in appendix G show that the rice field is placed on more precipitous slopes than the baby maize field.

	Baby maize field	Rice field
Total planar area	0,55	0,92
Total surface area	0,58	0,99

Table 3.2

From the findings presented in table 3.3 the area of the rice field was found to be 2,7 ha[15]. This does not coincide well with the area found by GPS. The uncertainty of the GPS was from 4-30 m at each point taken, but the reason for the difference in area is

[15] Calculations are presented in appendix K

most likely the uncertainty in the G factor: number of grains per plant hole. The owner of the rice field might sow 7 rice grains in each hole as stated, but a “Gutong” of 40 villagers sowed the field.

Table 3.3

D : density (rice plants/ m^2)	9	Plants /m^2
G : average number of grains per hole	7	Grains
R : number of rice per 100g	3865	Grains
C : total weight of rice in can	10,85	Kg
N : number of rice cans used	4	Cans

It was found that the Gutong actually planted 19 grains per hole on average.
If a more comprehensive survey is to be conducted where areas of larger rice fields in remote areas are to be estimated, then this method might prove useful. The advantage of this compared to the estimation from yield harvested is that it can refer to a field with standing rice.

3.4.5 Inputs to the fields

Inputs to the different fields were assessed through interviews with the farmers. Farmers are aware of current prices on agricultural inputs. They know how many bags and cans they apply but not the exact amount in the different bags and cans. We measured the content of Paraquat cans and Kenn tech cans found in the fields. The results seen in table 3.4 presents our findings.

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Table 3.4

Product	Quantity	Prize (MYR)	Prize per unit
Paraquat	1 l	18	18,0
	3,5 l	40	11,4
Kenn tech*/ Kenn up	0,5 l	18	
	1,5 l	40	26,7
* *The active ingredient in Ken-tech is also Paraquat*			

These are the only pesticides used. The baby maize farmer chose to buy larger quantities of pesticides at lower prices though large sums of money are to be paid in one go. The rice farmer bought smaller quantities, had lower expenses at a time, but had to pay a higher price total. He could have saved up to 45 MYR per year or approximately 1/3 of his total expenses to pesticides for hill rice by buying larger amounts. It is possible that this shows a livelihood more based on subsistence farming where income is only generated in smaller portions. The hill rice farmer did not grow baby maize at the time of investigation and no signs of a commuting strategy were seen in his home. The information from the farmer was combined with the surface area of the fields and the result is inputs per hectare (table 3.5). When determining the amount of chemical inputs used per harvest large differences are not seen. Hill rice is harvested once annually whereas baby maize is harvested 3-4 times within a year. This means that the baby maize field gets approximately 4 times the amount of inputs per year compared to the hill rice. This can become an environmental problem where erosion or leaching occurs. Price per harvest of hill rice compared to baby maize is similar. Baby maize creates a cash income whereas hill rice does not. This means that the hill rice farmers need to finance his buying of inputs from other sources. We were told that another possibility for the farmer growing cash crops is that he is able to hire paid labour.

Table 3.5

Annual inputs to agriculture			
	Baby maize field	**Rice field**	
Fertilizer	690	202	Kg/Ha
Kentech / Kenn up	10,3	2,0	l/Ha
Paraquat	18,1	4,0	l/Ha
Insecticides	< 0,1	< 0,1	l/Ha

3.4.6 Management of the drinking water resources in relation to farming

The inlet to the main pipe water system was placed in the limestone hills. No fields were seen in the upper catchment area of the watershed and a LANSAT satellite map from 2000 sustained this observation. Therefore no contamination from fields is expected. All water samples taken from the five locations show that the water has a good quality compared with the national threshold values for untreated drinking water (Table 3.6).

Table 3.6

	Up Stream	Middle Stream	Down Stream	Pipe water (Community Hall)	Pipe water (At Puak junction)	**Acceptable Value**
pH, *(in-situ, 14.1.05)*	8.0	7.6	7.5	8.0	7.9	**5.5 - 9.0 ***
Nitrate, mg/L	0.15	0.22	0.18	0.18	0.26	**10 ***
Ammonia, mg/L	0.06	0.02	0.02	0.01	0.04	**1.5 ***
Phosphate, mg/L	0.10	0.11	0.07	0.08	0.09	**0,15 ****
Total Coliform Count, CFV/100ml	592	-	810	304	320	**5000 ***
*(Ministry of Health Malaysia 2000) ** (GEUS 1998)						

Nitrogen from cropped areas can affect the quality of the river water middle stream due to run off and leaching. This was not seen in the water results, but the hypotheses of increased values of nitrate cannot be entirely rejected. The water samples were taken in the rainiest month of the year (MMS, 2002) and farmers have stated that they stop all applications of fertilizer and herbicides from December to February due to the heavy rains. To obtain reliable results, water samples are to be taken from the river in the months June - August where the people collect their drinking water from the river.

The water samples were not probed for the herbicide Paraquat or other traces of toxic chemicals used for crop production. Several Paraquat-, ken-tech- and insecticide cans were found lying in riverbanks up stream from the main dry season collection site.

Similar observations were made less that 50m upstream a small private pipe water inlet. Recently a man in the village died after drinking Paraquat, which was mistaken for drinking water. This is an example of the way toxic chemicals are handled by farmers in Kpg. Puak making it a potential risk for the health of the inhabitants. Fatal poisonings by small amounts of Paraquat have been reported among farmers and their families (Hogstedt et al,1997; Wesseling et al, 2001). The increasing use of Paraquat for baby maize production is a potential health risk for the inhabitants. If crop production in the village is intensified further there is a need for training and awareness rising about the treatment of chemical inputs to agriculture.

3.4.7 Implications for the farmers

The soil as a resource for farming can put limits to crop production. The soils are susceptible to soil erosion but farmers prevent this by avoiding tillage and leaving the crop residues on the field. No advanced erosion control measures like terraces are used and this might be because most farmers have access to the land needed. The sustainability is sustained by shifting cultivation practices combined with inputs. If land tenure changes meaning that the farmers get less land, then further agricultural intensification might be needed. Intensification will require both labour and financial capital. Another constraint to crop production is the distances to some of the fields. But maybe fields close to roads could be cultivated for more intensive cash crop production. Also the lack of knowledge on how to handle chemical presents a health risks.

New possibilities that lead to migration open up for other income sources than farming. This cause lack of labour in agriculture and subsistence farmers must diversify their income possibilities. Similarly to the majority of farmers in tropical humid areas around the world (Toledo et al. 2003), the farmers in Kpg. Puak are immersed in a dual economy. Every now and then they produce crops for the market and buy goods using cash, yet at the same time, they produce basic crops for their own consumption. As a result, they are obliged to adopt a strategy that encompasses their dual role as subsistence and market producers. Therefore, the main objective of the farmers' strategy is to maximize the diversity and the number of available options, in order to guarantee its subsistence and to minimize the risks. There was a large diversity of crops grown

both within the fields and in the villagers' home gardens. If one crop failed they had the possibility of eating something else. This way continuous availability of natural capital is secured. This is a contrast to the livelihood strategies where security is found through financial capital.

3.5 Forest produce and Wild life

The natural resources in the forests of Sarawak has been of both culturally and traditionally importance to the indigenous people for many years. It has mostly been subsistence hunting and collecting, but also for commercial trade (Rahman et al, 2003). This is also the case for Kpg. Puak. The forests surrounding the village have a rich diversity of planted and naturally occurring plants. Through transect walks in the forests and interviews we were introduced to various forest products, some of which are used for building materials, consumption and medicinal purposes. The household survey showed that approximately 50% of the villagers collect jungle products either for own consumption or selling[16]. There is also a relatively large share (27%) of the villagers that only buy jungle products and not collect any. The products and wildlife are sold at markets in Bau as well as traded among the villagers i.e. our cook bought herbs from her neighbour and paid in cash. Furthermore a 200 kg wild boar was shot and sold in the village at approximately12 MYR pr. kg of meat. Wild life is a resource that can be utilized by the entire community, but the total income from each kill only benefits the household of the hunter. This way the management of this resource makes it susceptible to overexploitation as described in the theory tragedy of the commons (Hardin 1968). This coincides with interviews stating that there has been a decrease in wildlife during the last 10 years. The respondents state that development of more effective methods and tools is a reason for this.

The fact that commonly owned natural recourses are traded for money within households in the community illustrates that financial capital is gaining ground in Kpg. Puak. These are examples of subsistence way of living developing into more capitalistic based livelihood strategies. However it should be mentioned that forests products are

[16] Appendix C

not a steady cash income securing the households economy - it is an opportunity for the villager to earn some extra money, and at the same time maintain there traditional way of life.

The resources of the forest are a part of the livelihoods of Kpg. Puak.
The use of fallow and secondary forest cannot only maintain a sustainable agricultural system, but also the resources from the surrounding forest have a chance to regenerate secondary forests (Christensen, 2003). Therefore changes in farming systems from subsistence to more cash crops, as well as the development in the area i.e. a new road, logging activities and gold mining can affect the resources of the forest.

3.5.1 Bird nest collection

In the vicinity of Kpg. Puak there are some caves were swift lets nests. Collection of birds nests can have an economical importance since there is a marked for selling dried nests. From the survey we learned that, the collection of bird nests play a part in the different livelihoods in Kpg. Puak.

The villagers of Kpg. Puak harvest the nests in Gunung Cawa cave in the limestone hills. According to Mr. Jenang, chairman of the bird nests committee, the collection of nests in these caves goes back to the 1950s but it is believed that there was no specific owner at that time. After an accident, where about 30 people died, it was thought that evil spirits haunted the caves, and all activities ended. In the mid 70s, the headman of Kpg. Puak, Mr. Majim, rediscovered the caves and got a personal licence that he held until 1995 where he stopped due to illness. Instead Kpg. Puak and 3 nearby villages began to cooperate in the collection, and in 2000 the 4 villages received a shared permission and the Central Bird Nests Committee (CBC) was formed to control the collection in Gunung Cawa. (Jenang 2005 personal communication; Majim 2005, personal communication). The forest department requires a secure management system that divides the resource equally between the CBC members of the 4 villages and at the same time gives the swift lets population the possibility of reaching a sustainable level.

Once a month the nests are harvested and the villages take turns so that each village

harvests twice a year. The remaining 4 months are left for the birds to breed. The cave is divided into different areas and the harvest is controlled so that there always are some areas in a resting period.

Throughout the history of nest collection in Sarawak theft has been a problem, (Gausset, 2004). To avoid theft from Gunung Cawa it is guarded 24 hours a day all year round by 4 guards. All expenses including the guards' salaries are taken from the earnings of each harvest. A list of all expenses from the harvest in January 2005 is shown in Appendix H.

There are indications that the rules within the management system are followed up by sanctions from the committee. A participant did not fulfil all the obligations connected to the collection and during the distribution of earnings from the harvest it was observed that part of his share went into the mutual fund instead. This shows that the system is respected and thereby protecting the resource. In Kpg. Puak there are at the moment 69 CBC members, which means that 90% household benefits from the harvests.

Each harvest is around 11 kg and is sorted in the different quality categories. The villagers can earn 2.225 RM/kg for their best quality of nests. The participating households each earn around 262 RM pr. harvests. The importance on the household economy varies. The income from the nests has only major importance for 8% of the households. Here they count for more than 15% of their total income. On average it is only 2% of the financial income that originates from bird nests collection[17]. This coincides with information gained from interviews.

Apart from the economic aspect the nests also have a social importance for the community. A given amount of the earnings goes to a fund governed by the CBC. This fund pays for different activities in Kpg. Puak, such as the organization of social gatherings at the Community hall or the Cultural house. Some of the earning also pays for traditional costumes for the young people so that they are kept aware of their cultural heritage. An indication of a social awareness within the community was also

[17] Appendix C

seen when a misfortunate widow with four children received 262 RM though she did not participate in the harvest, which is normally a requirement.

To sum up, the collective collection of nests is a relatively new aspect in the livelihood strategies of Kpg. Puak, both from an economical and social viewpoint. Now the system is sustainable due to rules and regulations, but this can be challenged by the over-all development of the area, i.e. the possibility of gold mining.

A project under progress is the refining of birds' nests, which could come to play as a more important role in the future. Now the villagers sell the birds nests to a middleman who then refines them. But the CBC is trying to obtain a sales permit, so they can start doing it themselves. This would mean that the people involved in the collection could earn more

3.6 The new road – constraint or opportunity?

In 2003 the building of a new state road began. This road passes through Kpg. Puak, and is scheduled to be completed in 2005. One of the reasons a new road is being build is to increase trade in the area. The road is going to connect otherwise scattered villages with each other, and the State hopes it will open up for more agricultural and economic growth for the villages (Interview with Mr. Kong Bee Hon).

> *"An alternative development strategy, which would address the needs of the majority of people living in rural areas, is to provide road access and encourage the rural population to develop in situ. Rural roads are seen as having potential to ease the problem of remoteness and to facilitate rural development."*
>
> *(YB GOLONG, 2003)*

From the household survey it was clear that the increased accessibility to town is a main reason that 87% of the villagers looks forward to the road. But the villagers also expect to be able to sell their agricultural and forest products at the roadside. This can intensify the development from subsistence to cash crop, and involve the beforehand mainly subsistence non-timber forest products in a more financial matter.

The road also opens up for even more diversified income strategies in other, since wage

labour opportunities in the urban areas is brought closer. As it is now, some villagers commute between work and Kpg. Puak. This trend could increase due to the new road. The easier access to education and work opportunities could such intensify the migration pattern, but there is also a possibility for people to return to the village and commute to the urban areas (Yb Golong, 2003).

The new road can also have a social impact on the households of Kpg. Puak. The road could intensify inter-village contact (Yb Golong, 2003), which was a hope among the villagers. They hoped that neighbouring villages would send their children to the primary school Kpg. Puak. This again can help the issue concerning lack of labour in the agricultural area because of increased interaction between the villages.

The new road does not only open up for new opportunities, but also clarifies some constraints. About 43% of the villagers are directly affected by the construction of the road.[18] They all expected to be paid compensation for their loss of land, but this compensation had yet to be paid. This could be because of the lack of tenure security as mentioned before. According to Ngidang (2003) there has been a tendency for the diversification between NCL and State land to not be clarified before projects were implemented. Therefore it is a possibility that the affected farmers have to cope with loss of land and lack of compensation.

Another aspect is that the road can intensify a tendency in the village. As it was observed through a problem ranking exercise and the household survey, electricity is debated among some of the villagers and the primary wish is electricity supply for the entire village. At present only houses near the junction have electricity. The rest of the village relies on generators that are only used in the evenings. At the same time the households near the junction were less involved in farming activities, and more in waged labour. This division between the two parts of Kpg. Puak will be more elucidated due to the fact that the road passes directly in between the two areas.

[18] Appendix C

4 CONCLUSION

People of different origin founded Puak approximately 150 years ago. Since then external interventions e.g. governmental schemes for crops, construction of the school and the road have influenced the livelihood strategies in the village. New possibilities of income have developed and the more traditional income sources such as agriculture, hunting and gathering have adjusted accordingly. The traditional farming system is shifting cultivation. In the past most households lived entirely by subsistence farming. Today households engaged in farming activities have chosen a combination of income opportunities. Two of the alternatives are off-farm labour outside the village and production of cash crop. The villagers in Puak have incorporated both possibilities in their life. Compared with livelihoods based on the natural capital this diversification might prove to be a more secure livelihood strategy because future land tenure is susceptible to changes.

The far distance to the fields and the sloping topography were found to be constraint to the crop production. Despite this the farmers are managing considerably well still sustaining subsistence and a cash crop production. Hill rice is the most important crop for consumption whereas baby maize is the most income-generating crop. Some households make use of social networks for hill rice production and other labour demanding activities. It can be concluded that the soil of the two field investigated both are very acidic and have aluminum contamination. This will give a reduced yield from the hill rice and baby maize production.

From the water analysis it can be concluded that there is not serious problems with the water from the river. But there are indications of leaching and run off from the agriculture so in the future they must be aware. This can cause a problem in the future.

The villagers in Puak believe they hold NCR to their land but the government claims the land as state land. This has implications both for the present and the future. At present the villagers use their land as they find optimal, this includes growing valuable trees that are long-term investments and also natural boundary marks and collection of non-timber forest products. If the tenure-ship is uncertain their land use patterns will change.

Secondly the fact that the land is state land sets a question mark to whether the villagers will be paid compensation if the land they use is claimed to mining or other external activities such as the new road.

A connection between education and the rate of migration was found in Puak. The higher level of education and the possibility of better-paid jobs outside village leave behind shortage of labour in the village to agricultural activities among others. The new road will open up the possibility for people to commute. All this implies that the households of Kpg. Puak in the future will be more closely connected to, and affected by the over all development of Malaysia.

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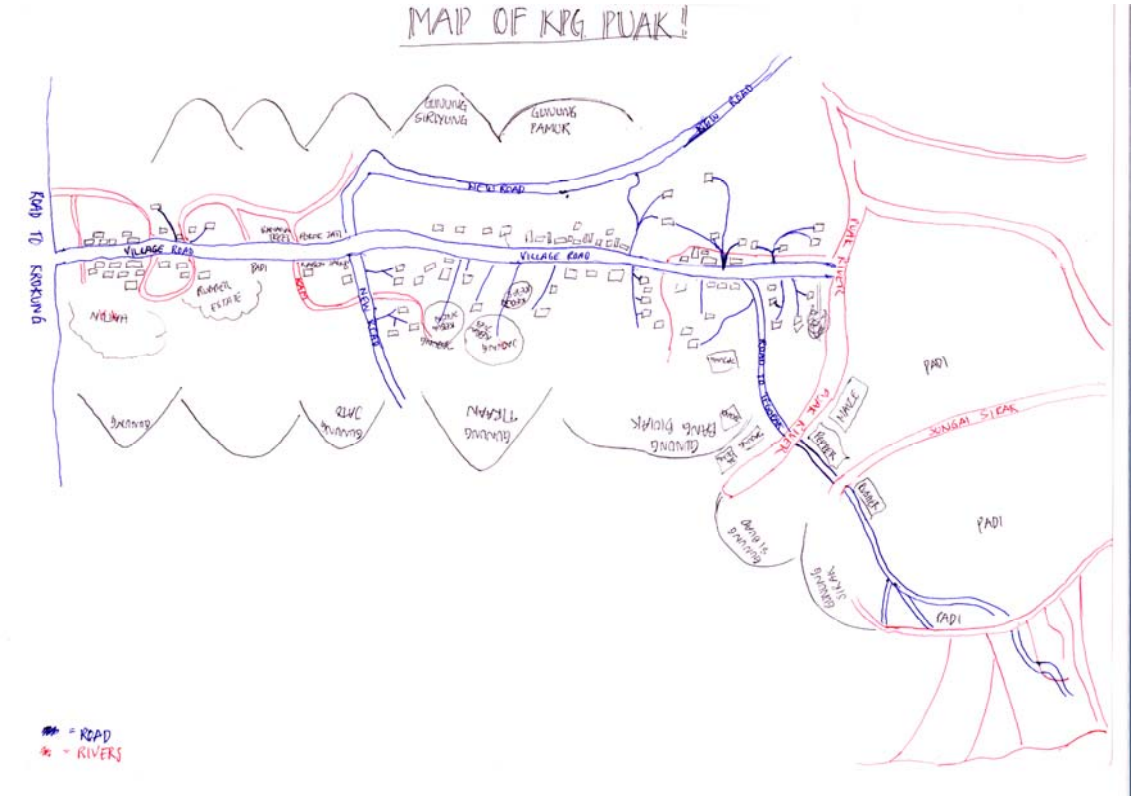
6 APPENDIX

- **Appendix A: PRA diagrams and maps**
- **Appendix B: Questionnaire**
- **Appendix C: Selected results from household survey**
- **Appendix D: Interview guides**
- **Appendix E: Soil analysis**
- **Appendix F: Water analysis**
- **Appendix G: GPS measurements and maps**
- **Appendix H: Distribution of profit from birds' nests collection**
- **Appendix I: Work schedule**
- **Appendix J: Synopsis**
- **Appendix K: Calculations**

Appendix A: PRA diagrams and maps

Appendix A.1: Village map



Appendix A.2

PRA exercise: Pair wise ranking of farm products
Which of these products are most important in kpg. Puak?

	Nenas	**Lada**	**Jagung**	**Timun**	**Halia**	**Tapioca**	**Durian**	**Koko**	**Tebu**	**Chili**	**Kacang**	**Padi**	**Batik**	**Pisang**	**Rambutan**	**Butan**
Nenas		la	ja	ti	ha	ta	du	ko	te	ch	ne	pa	ba	pi	ra	bu
Lada			ja	la	la	la	du	la/ko	la	la/ch	la	la/pa	la	la	la/ra	la
Jagung				ja	ja	ja	ja	ja	ja	ja	ja	ja	ja	ja	ja	ja
Timun					ti/ha	ti/ba	du	ko	ti	ci	ti/ka	ti/pa	ti	ti	ti	ti
Halia						ha	du	ko	ha	ha/ch	ha	pa	ha	ha	ha	ha
Tapioca							du	ko	ta/te	ch	ka	pa	ba	pi	ra	bu
Durian								du	du	du	du	pa	du	du	du	du
Koko									ko	ko	ko	pa	ko	ko	ko	ko
Tebu										ch	te	pa	ba	pi	ra	ko
Chili											ch	pa	ch	ch	ch	ch
Kacang												pa	ka	ka	ra	bu
Padi													pa	pa	pa	pa
Batik														pi	ra	bu
Pisang															pi	bu
Rambutan																bu
Butan																

Procedure:

Half of the group participated in this exercise. The farmers were asked to draw all the most important agricultural products in Kpg. Puak and ad the name of the product.

priority		Product	Score
	1	**Jagung**	14.5
	2	**Padi**	13.5
	3	**Durian**	13
	4	**Koko**	11.5
	5	**Lada**	11
	6	**Chili**	10
	7	**Halia**	9
	8	**Timun**	8
	9	**Butan**	7
	10	**Rambutan**	5.5
	11	**Pisang**	5
	12	**Kacang**	3.5
	13	**Batik**	3
	14	**Tebu**	2
	15	**Nenas**	1
	16	**Tapioca**	1

Appendix A.3.

PRA exercise: Problem ranking

Priority	Score	Problem
1	28	Electricity
2	11	Connection road from highway into kpg Puak not made yet
3	9	Bridges in bad condition
4	4	The main road is not good
5	0	Sudden flooding
6	0	Lack of pipe water during dry season - have to go to the river for water.

Appendix B: Questionnaire

SURVEY QUESTIONNAIRE

"THE CHANGES OF LAND USE PATTERNS IN KPG PUAK"

BAU DISTRICT

Interviewer: _____ House Number: _____ Date: _____

A. PERSONAL DATA OF RESPONDENT

1. Race :

_____

2. Age :

_____

3. Gender :

_____

4. Main occupation / role in household :

_____

5. Period of residence :

_____

6. Religion :

_____

B. HOUSEHOLD PROFILE

Fill in the table below based on instruction in 7 and 8.

7. No. and age of members of household* including the respondent: _____

8. Employment status of household members :

1 = Not yet attending school 2 = Schooling 3 = Left school but unemployed 4 = own / family farm
5 = Gov't servant 6 = Private firm 7 = factory worker 8 = Odd job labourer 9 = Timber camp worker 10 = Bird's nest collector 11 = Others

Household member's education level including the respondent's.

1 = Never attended school 2 = Primary 6 3 = Form 3 4 = Form 5 5 = Form 6 6 = Completed Diploma 7 = Completed Degree 8 = Others.

Household member Relationship with head of household		Gender M / F 8(a)	Age 8(b)	Education Level 8(c)	Main Occupation 8(d)	Second Occupation 8(e)
Respondent						
2						
3						
4						
5						
6						
7						
8						
9						
10						

** Include those who are working outside and return during the weekend.*

9. Is your household's average monthly food consumption self-produced or do you buy them? (**tick where appropriate).

Product Consumed	Self produced	Buy	Sell	Remarks
Rice				
Vegetables				
Fruits				
Chicken				
Meat				
Fish				
Egg				
Salted egg				
Milk				
Salted Fish				
Canned food				
Spices				
Salt				
Sugar				
Coffee / Tea				
Edible jungle product				
Wild life meat				
Others Specify : ……..				

10. What are your household's sources of monthly income?

Household source of income	Income (RM)	% Income*
Sale of agriculture produce (please specify)		
Maize		
Baby corn		
Rubber		
Vegetables		
Rice		
Fish		
Pepper		
Cocoa		
Others		
Sale of livestock products (please specify)		
Chicken		
Pigs		
Duck/Goose		
Eggs		
Others		
Sale of gathered jungle produce		
Animals (hunting)		
Vegetables and Fruits		
Food herbs and spices		
Pepper posts		
Bamboo		
Rattan		
Ornamental plants		
Others		
Own business (shop, transportation, etc)		
Wage / salary		
Remittances from family members elsewhere		
Others (please specify)		
Total	RM	100%

*To be used by interviewer

11. What is your household's average monthly expenditure? Estimate RM _____

D. SOCIOECONOMIC INDICATORS

12. Type of house the household live in (**tick where appropriate).(From interviewer's observation)

Wooden	Brick	Mixed

13. Does your household have access to the following utilities and social facilities? (**tick where appropriate).

Utility / Facility	Yes	No
Electricity supply (SESCO or Generator set)*		
Piped water supply		
Transportation		
Flush toilet		

14. Do you use the community hall?

Yes ☐ No ☐

15. Have you ever experienced lack of water supply?

Yes ☐ No ☐

If yes, where do you get your water supply during this period?

☐ Water T☐ ☐ Others (Specify) _____

(If you are using the river water, where? _____)

Do you boil water before you drink?

☐ Yes☐ No

16. Is there an electricity supply (SESCO) to your house?

Yes ☐ How much did you pay ? RM _____

No ☐ How much are you willing to pay? RM _____

JOB PREFERENCES

Please tick (√) in the appropriate column. Agree (1), Disagree (2).

Perception	1	2
	Agree	Disagree
17. I prefer to farm my own land		
18. I prefer to work outside of the village. Specify:……		

MIGRATION PATTERNS

19. How many members have left the household and live outside Kpg. Puak?

Male:…….. Female :……

20. Why have they left the Kpg. Puak?

Male ……

Female ……..

21. Do you expect them to come back and stay in the village?

Y ☐ ☐ :

G. LAND OWNERSHIP AND USE

22. Do you own any land?

Y ☐ ☐ :

If "yes" , what is the status of your land?

……..

23. How many acres do you have before the village road was built? _____ acres.

24. How did you obtain the land?

Self ☐ ☐ ited ☐ B ☐

Given

25. Is there any land leasing in this area for gold mining?

☐ ☐ No

26. If `Yes' , in your opinion, is your land affected by this lease?

Y ☐ ☐ No

27. How many acres of your land are used for:

Use	Before	After
	Size of land	Size of Land
Rice		
Maize		
Baby Corn		

Pepper		
Rubber		
Fruit orchard		
Fish Ponds		
Other crops		
Rent to others		

* Before/ after the village road was constructed

28. How any acres of land was cultivated before the village road was built and after is was completed?

Before …….. After ……

29. How many acres of land is fallow ?

Before :…… After : ……

30. How long is the fallow period ?
Before…….. After……

31. Have you abandoned any land/fields?
Before:……. After:……..

32. Has your living standard improved since the village road was built?

Y☐ ☐ :

If 'Yes' why?

……

If 'No' why?

……

33. Do you think that you will benefit from the new road?

Y☐ ☐ :

If 'Yes' why?

……

If 'No' why?

……

34. Is your land affected by the construction of the new road?

Yes : ☐ No : ☐

If 'Yes", have you receive any compensation?

Yes : ☐ No : ☐

35. Other comments and observations by interviewer:

……
..

……
……..

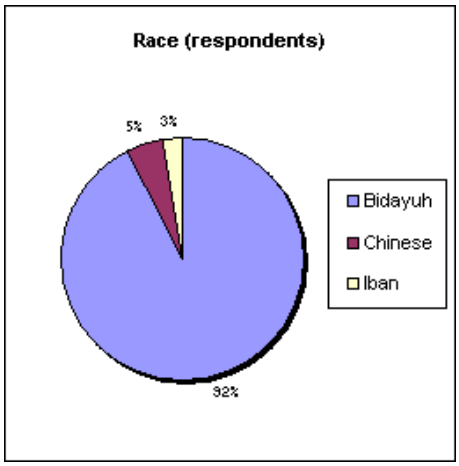
……
……

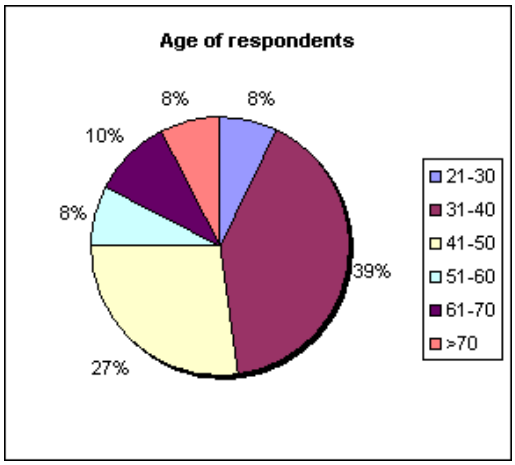
……
……

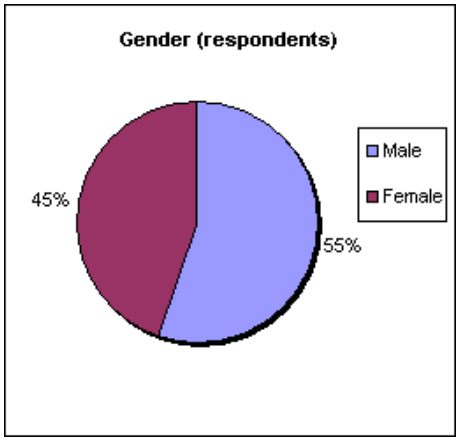
" THANK YOU FOR YOUR CO OPERATION "

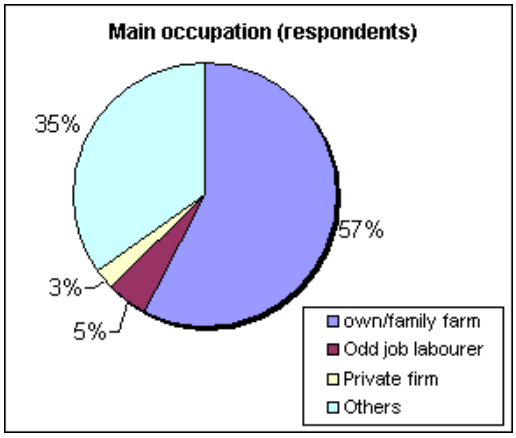
Appendix C - Selected results from the household survey

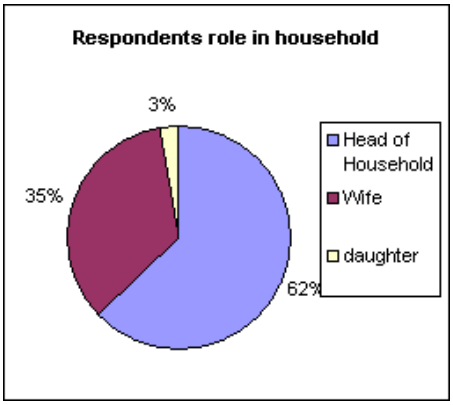
General information about the respondent

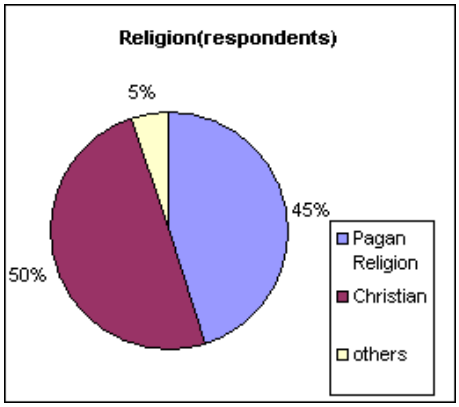




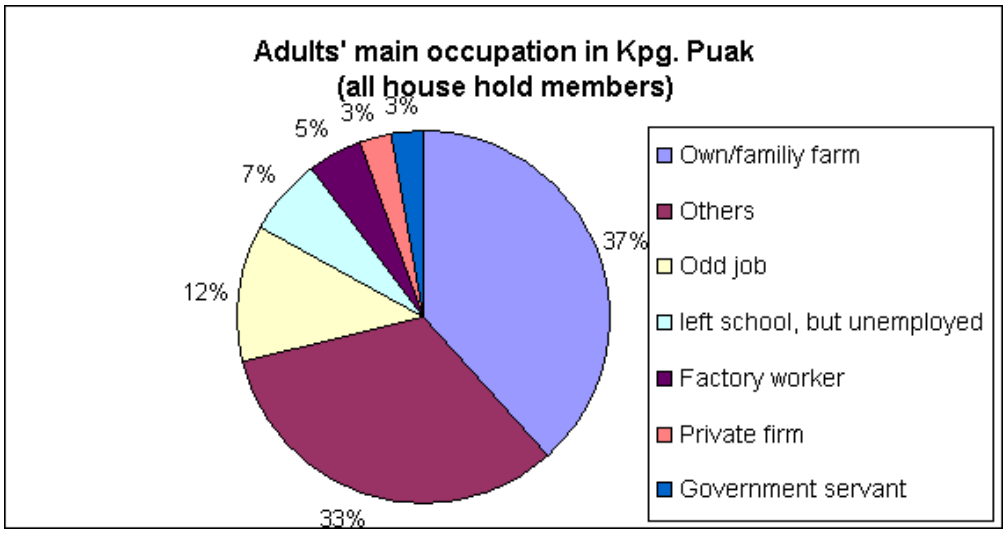


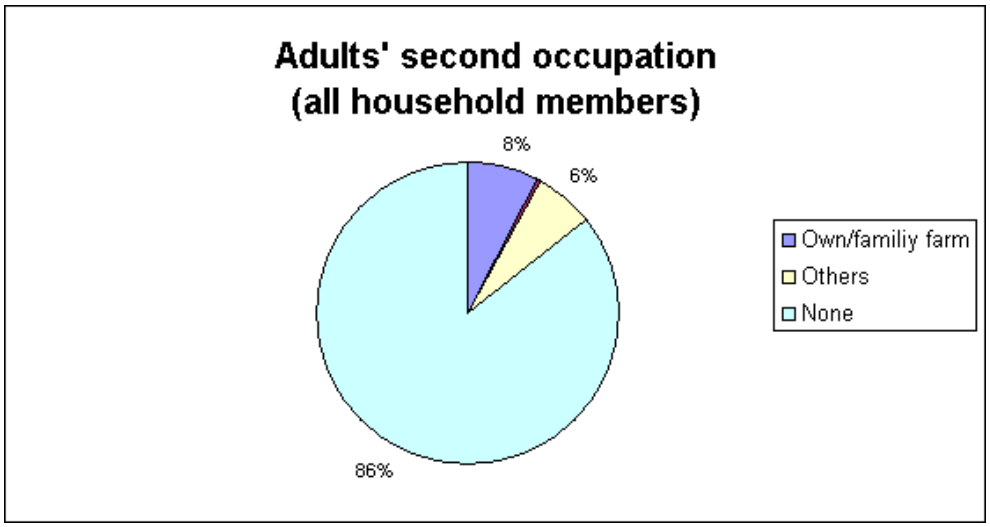




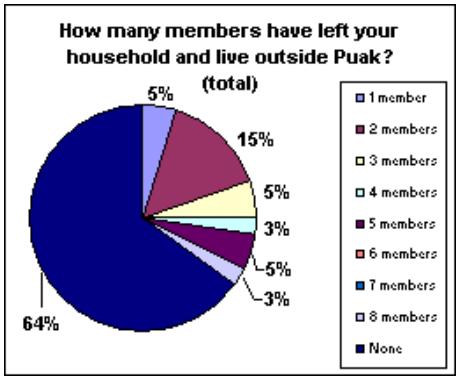


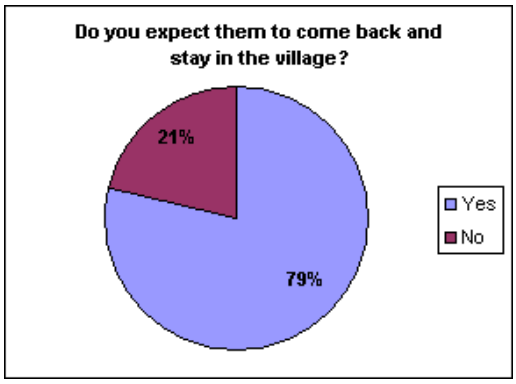
Householdmembers main and second occupation

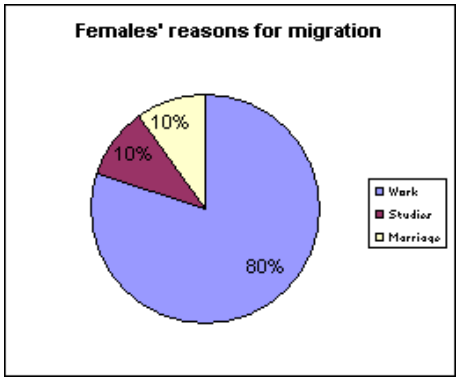


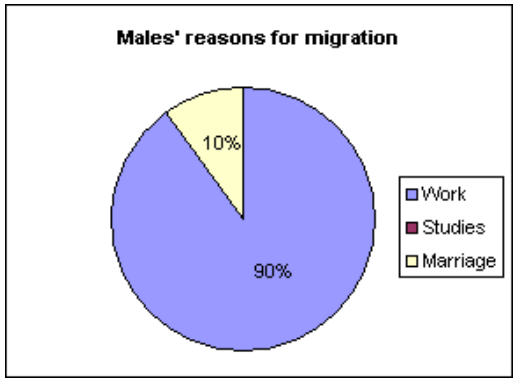


Magration patterns and the reasons stated by respondend

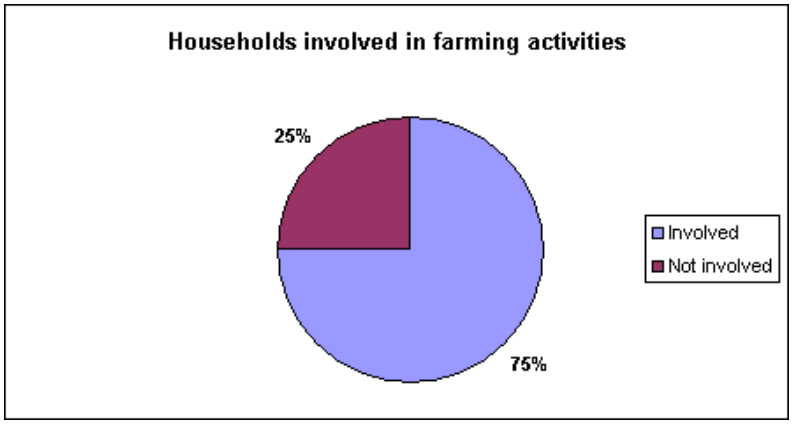


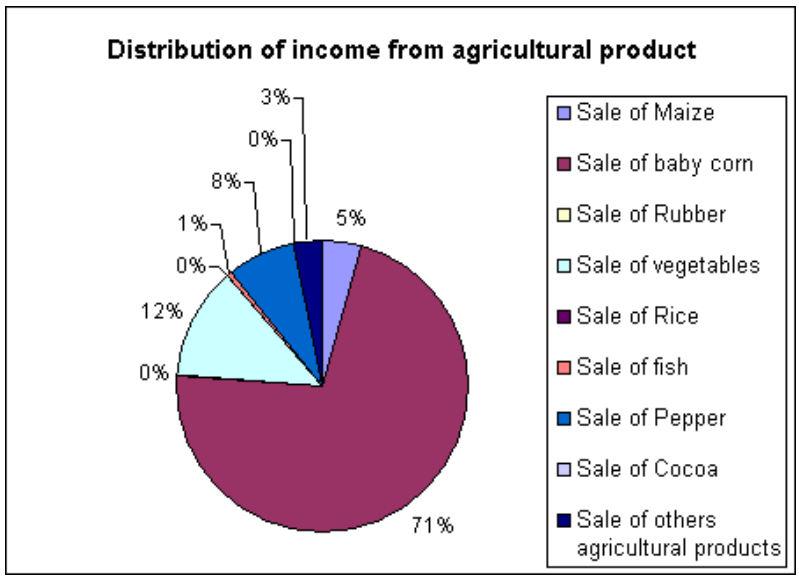




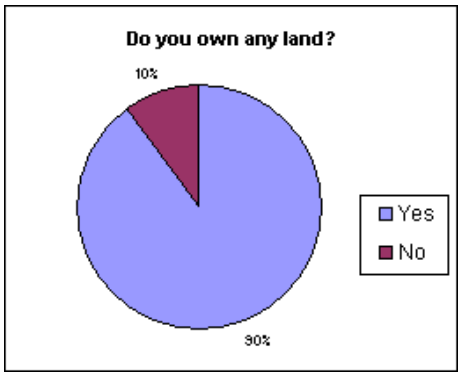


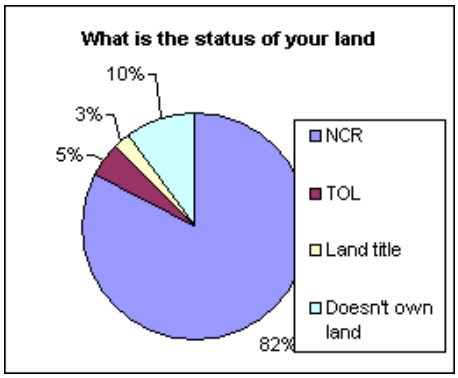
Farming activities

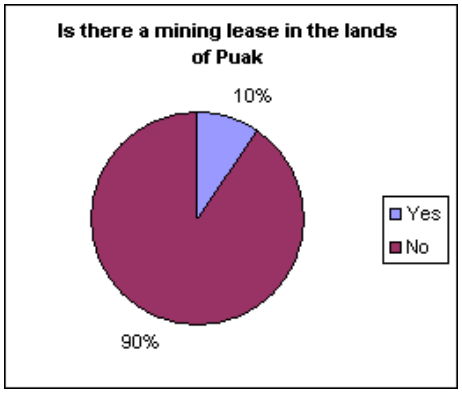


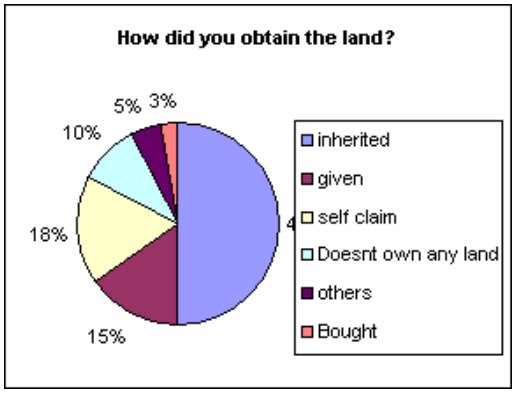


Villagers perception of land tenure

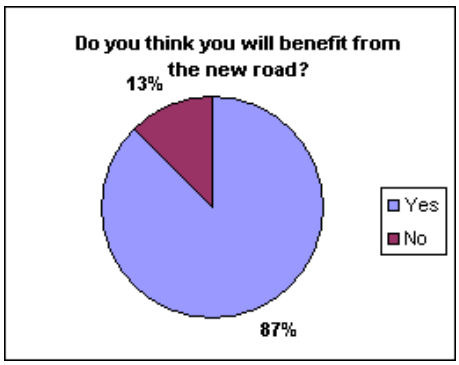


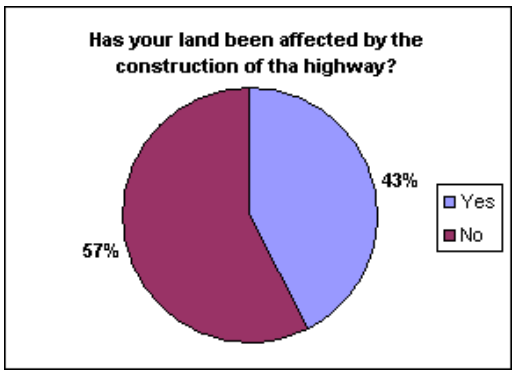


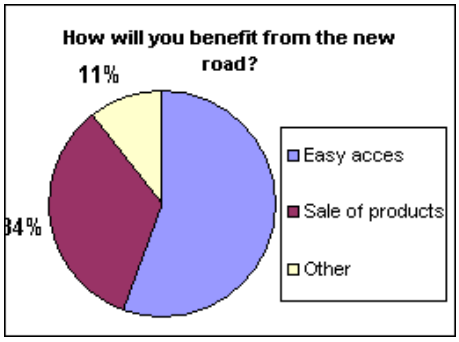




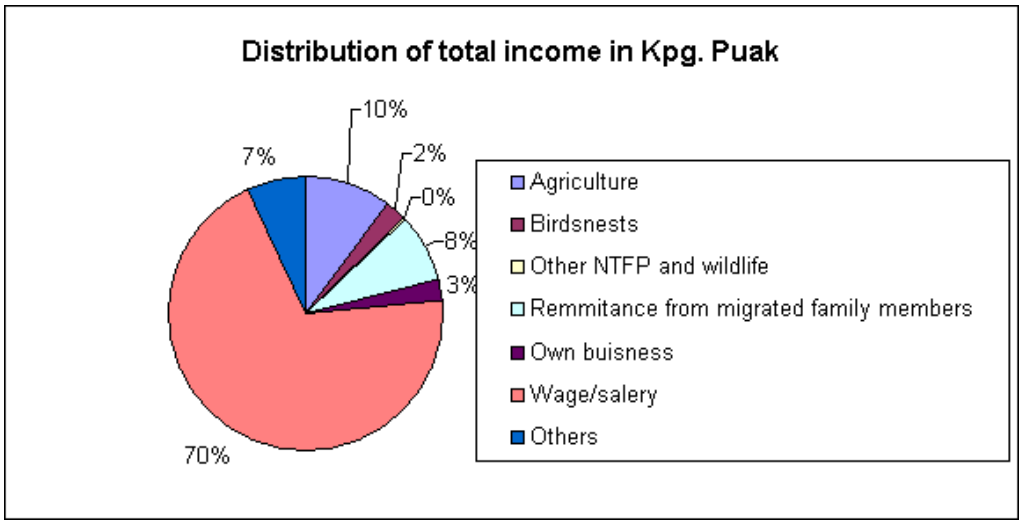
Villagers view on implications of the new road

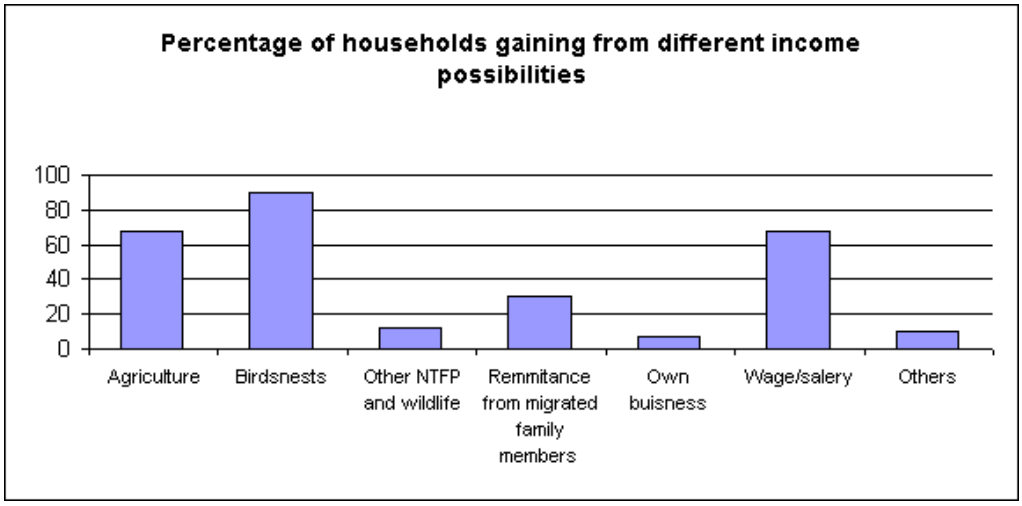


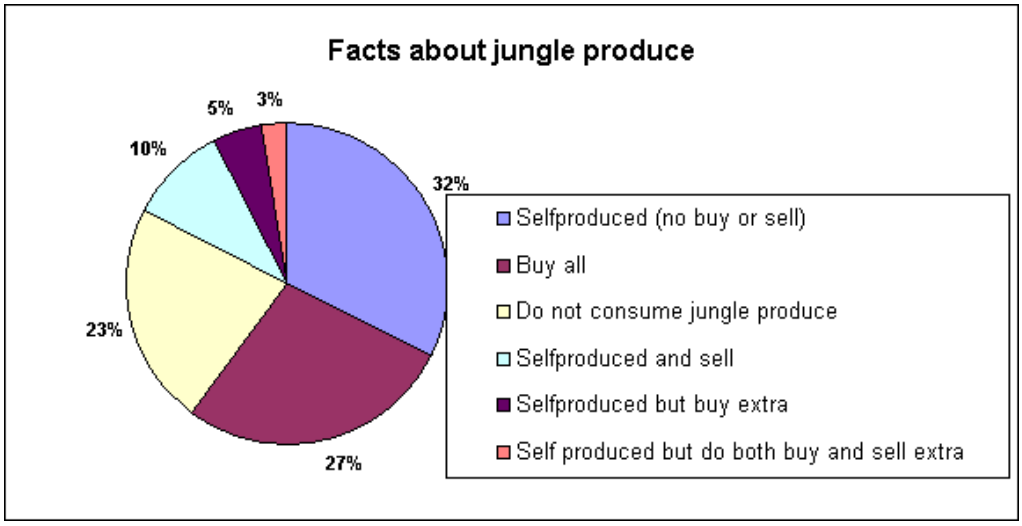


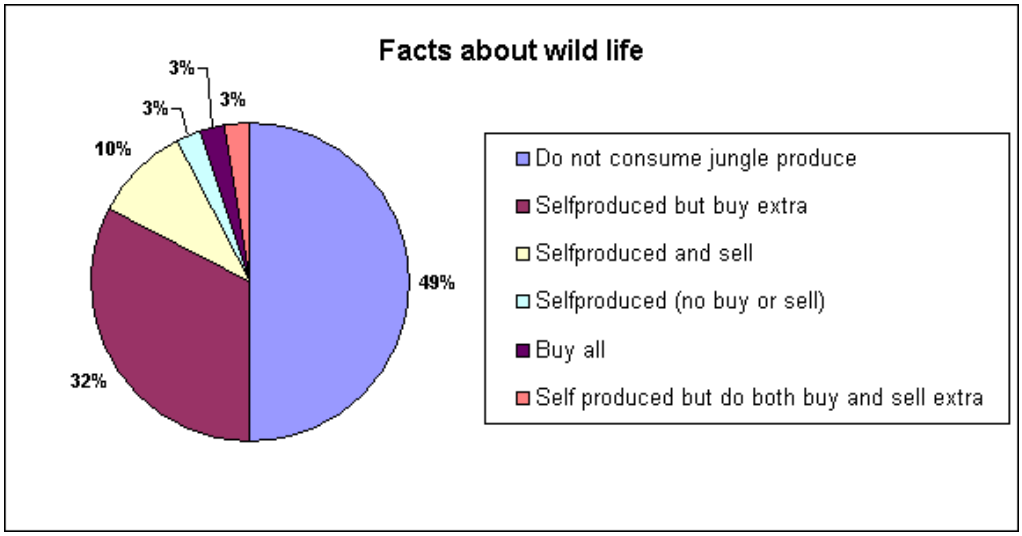


Total finansial importance of different sources of income



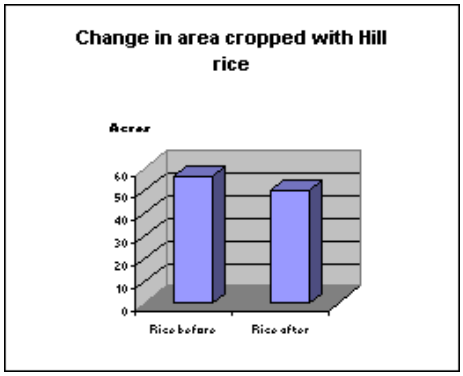


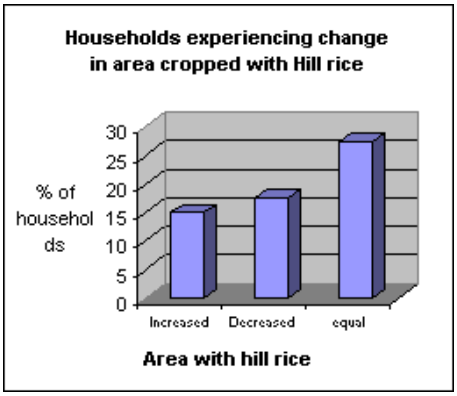

Facts about jungle produce
5%
3%
10%
32%
23%
27%
Selfproduced (no buy or sell)
Buy all
Do not consume jungle produce
Selfproduced and sell
Selfproduced but buy extra
Self produced but do both buy and sell extra

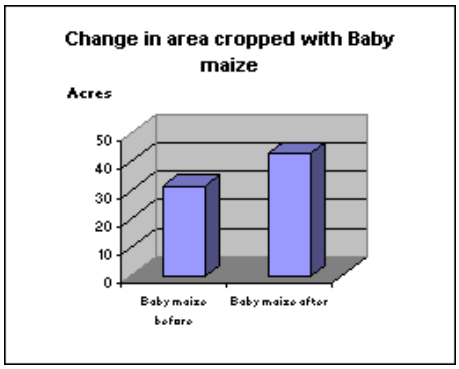

Facts about wild life
3%
3%
3%
10%
49%
32%
Do not consume jungle produce
Selfproduced but buy extra
Selfproduced and sell
Selfproduced (no buy or sell)
Buy all
Self produced but do both buy and sell extra

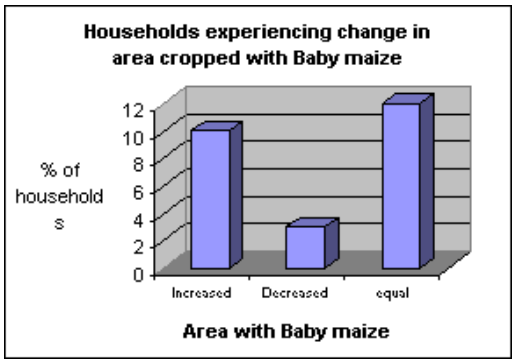
Changes in areas cropped with hill rice and baby maize from before 1986* until today.

* (the village road was paved)



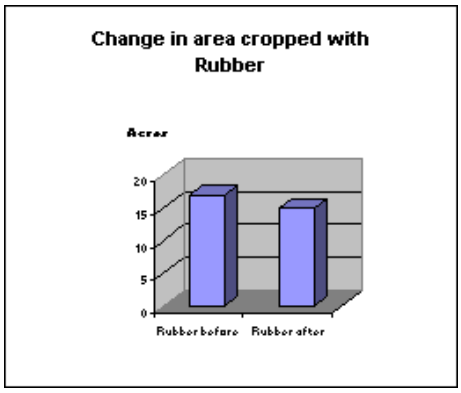


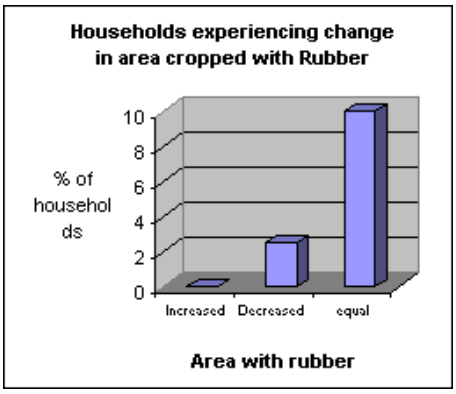


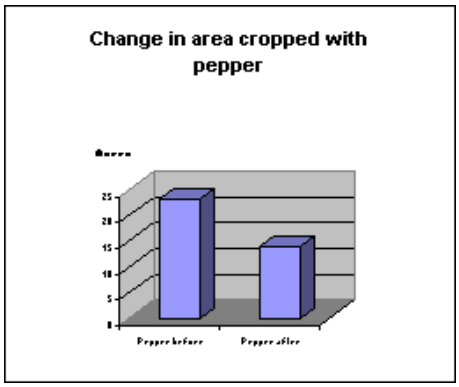


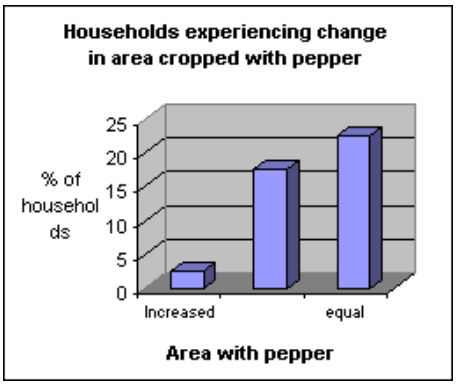
Changes in areas cropped with Rubber and Pepper from before 1986* until today.

* (the village road was paved)









Appendix D: Interview guides

Appendix D.1: Focus group interviews

1. LAND TENURE

Have you apply for title for your land? No why, Yes Why?
How do you determine/claim boundaries between your land
How long have you or your family own these land
Do you have land (NCR) outside this village Yes, how do you acquire these land
Do you aware of your right under the law (Land Code)?
Do you know if your house has been surveyed? Yes, No
How would you feel if your land is taken for mining activities
Do you know the procedure for claiming the compensation? If yes, please describe the procedure.

2. AGRICULTURE ACTIVITIES

What type of crops as far as you remember first planted in this village.
What type of crops are you cultivating now?
Have the government ever encourage you to plant certain crop If Yes what type of crops?
Are you still cultivating this crop Yes, No
If No why?
Are you practicing shifting (sweden) cultivation Yes How No
Are you practicing inter-cropping Yes, How?
Do you use any pesticides/ herbicides? If yes what type, where do you get it.
Has the government provide you with any pesticides/herbicides.
Is baby corn is a major source of income in this village Yes Why No why
How frequent do you plant/harvest baby corn
Does the government provide you with the fertilizer Yes is it enough No how do you get it
Is the government still providing fertilizer Yes, No how do you get it, how much
How do you market your farming products? Yourself, middlemen, If myself, middleman why?
Have you abandoned your land/ crops? Why?

3. DEVELOPMENT PROJECT

What type of development projects have been implemented in this village (Electricity, treated\ water supply)
What is the priority of the development projects that peoples need here?
If you says (eg. Electricity,..) why?

4. MIGRATION

As a youth, do you find any difficulty to get any job/work in this kpg?
What is the educational level you have and your parents (father & mother) have?
Are you planning to work outside or migrate from kpg. Puak? If yes, Why?
If you work outside Puak, where do you work? What do you do?
As parents, what do you feel about the migration of your children to elsewhere? Do you expect them to come back? For what?

5. LIVELIHOOD

Are you a full time farmer? Yes, No .What else do you do?
How do you see the future of Kpg. Puak? Same as now or more shops etc.
How important is the Non Timber Forest Product and wildlife in your life?
Please list out the NTFP that you collect.
Compare to the past, did you find any different in the amount and types of NTFP collected in Kpg. Puak.

Appendix D.2: Hill rice farmer

1) How do you cultivate hill rice?
- How long is the growing season?
- How are they planted?
    - Who plants them (wife, friends)?
    - How many hours/days do you spent on planting the rice?
- Where do you get the rice plant that you sow from (from a nursery field or..?)
- Do you ever water them in the dry period?
- Do you weed your field?
    - Who is responsible for weeding?
    - How many hours/days do you spent on weeding rice?

- Do you spray during the growing season?
    - What do you spray for?
    - How many hours/days do you spent on spaying?
- Do you get any help to harvest your rice?
    What kind of remunerations do the helpers get?
    How many hours/days do you spent on harvesting?

2)Would you increase the amount of hill rice produced if you could get extra help to the production?
- Has lack of labor caused you to change your agricultural practice regarding hill rice? (Use of herbicides, moved fields)

3) What happens to your field after the hill rice is harvested?
- The field is burned off (why is it burned off)
- A new crop is grown (for how many years are crops grown)
- The field is left fallow (how many years)

4) How do you store the rice after harvest?
- What are the problems faced when storing rice?

5) Is the hill rice produced by you consumed by your household?

6) Do you exchange some of the hill rice for other goods?

7) Have you ever sold hill rice? - Why and to whom?

8) What are the characteristics of a good hill rice field?

9) Around Kpg. Puak are there any areas that are very good for hill rice? (Does the farmer have any hill rice fields that are not producing as well as expected) Why and are the fields in use at the present?

Appendix D.3: Baby Maize farmer:

History of babycorn production in kpg.	How did it start, who was the first to grow it, what was the prize in the beginning,
Farming techniques:	When how many times per year how to do how many hours of work constraints
- soil preparation (herbicides)	
- planting	
- treatment (herbicides,pesticides, fertilizer)	
- harvest	
- Processing and storage	
- resting period	
Yields, sale	How many bags/kg of bc from the field (each field), who buys, contract or random selling. Prize now Differencies
Perception of erosion and conservation measures	

Appendix D. 4: Baby maize buyer, Mr. Jehit:

- *Who do you buy from?*
- *What kinds of crops do you buy?*
- In the beginning the farmers did not have to clean up the crops and put them in bags – how come they must do it now?
- Past:
- Present:
- Are they any changes in the amount you buy (i.e. Seasonal etc)?
- Do you sell to any specific?
- Are any of the farmers that sell to you on "contract farming"?
- How often do you buy baby corn from Kpg. Puak?
- Are you employed by the government, the village or…?
- How are the prices on baby corn right now and what share does each part get?
- Do you know if the farmers in Kpg. Puak are on any governmental scheme regarding baby corn?
- Is baby corn a vulnerable crop (to pests etc.)*?*
- How is the demand for baby corn at the moment*?*
- How is the production of baby corn in Kpg. Puak?

Appendix E: Soil Analysis

Soil samples from Malaysia were taken to Denmark for further analysis in the lab. The soil was taken from four different locations:1) a sloping paddy field 2) the sloping fallow area (secondary forest) next to it 3) a sloping field with baby maize 4) the sloping fallow area (secondary forest) alongside. In this way nine soil samples (3 uphill, 3 midhill and 3 downhill) were taken from each of the four locations a total of 36 soil collections. The three collections from each level were subsequently mixed and from each of these twelve samples 200 grams of soil were analysed. By having soil from both cultivated and fallow fields it could be ascertained whether there were any differences in terms of soil pH, carbon and nitrogen content and aluminum content, both within the fields and their neighboring fallow fields. A comparison was also made between the paddy and the baby maize field.

Analysis of texture

An analysis of soil that measures the mechanical composition in regards to clay, silt, fine sand and coarse sand. The separation of the fractions occurs by sedimentation and sifting. In general the primary particles are concentrated in soil aggregates that must be mechanical separated by the use of detergent. For the measurement of silt and clay the hydrometer method is used. This method is based on a measurement of the density of the soil solution after different times of respite. The density will decrease with decreasing concentration and it is measured by extracting (with a pipette) the same amount of the soil solution after 3 minutes and again after 4 hours. The extracted water is then put in aluminum trays (that have been weighted and given a number) and heated in an oven until the water has evaporated. After the evaporation of the water the tray are weighted again and the weight of the soil are found. The calculations were made in excel.

Measurement of soil pH

20 grams of soil from each of the 12 locations were mixed de-mineralized water and after 20 minutes of respite the pH was measured by an electronical pH-meter.

Measurement of aluminum

To determine the amount of exchangeable Aluminum we made solutions of soil from each of the 12 locations and mixed them with 1M KCl. For the further determination we used a Merch Microquant Aluminum Test Kit.

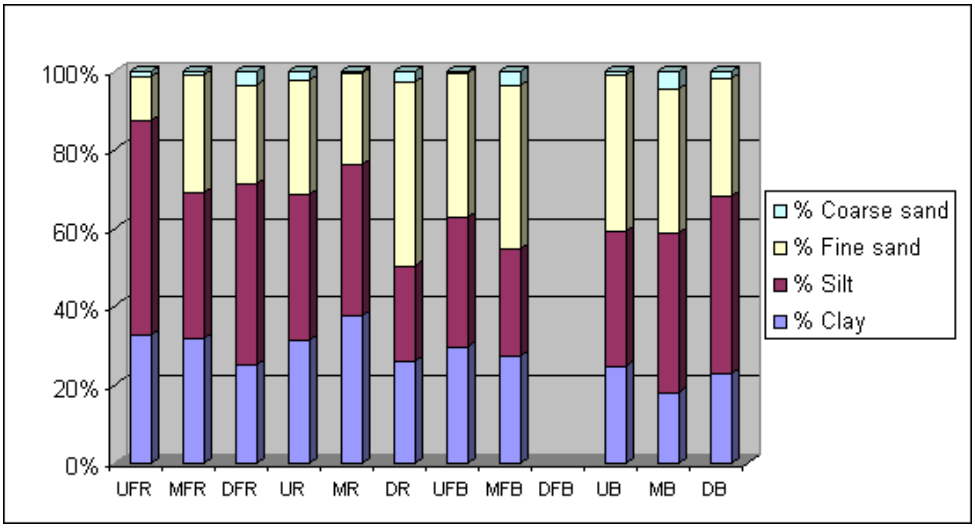
Measurement of C and N

To determine total C and N in the soil an Elemental analyzer coupled to a mass spectrometer (Anca20-20, Europe scientific, UK) was used

Soil analysis

Texture

		% Clay	% Silt	% Fine sand	% Coarse sand	Description
1	**UFR**	32,9	54,5	11,1	1,5	Silty clay loam
2	**MFR**	32,0	37,2	29,8	1,0	Clay loam
3	**DFR**	25,1	46,1	25,4	3,4	Loam
4	**UR**	31,2	37,4	29,1	2,3	Clay Loam
5	**MR**	37,8	38,6	23,2	0,4	Clay Lloam
6	**DR**	26,1	24,4	46,8	2,8	Sandy clay loam
7	**UFB**	29,8	33,1	36,6	0,5	Clay loam
8	**MFB**	27,2	27,5	41,7	3,5	Clay loam/ (Loam)
9	**DFB**					
10	**UB**	24,9	34,2	40,1	0,8	Loam
11	**MB**	18,1	40,7	36,9	4,3	Loam
12	**DB**	22,8	45,2	30,2	1,8	Loam

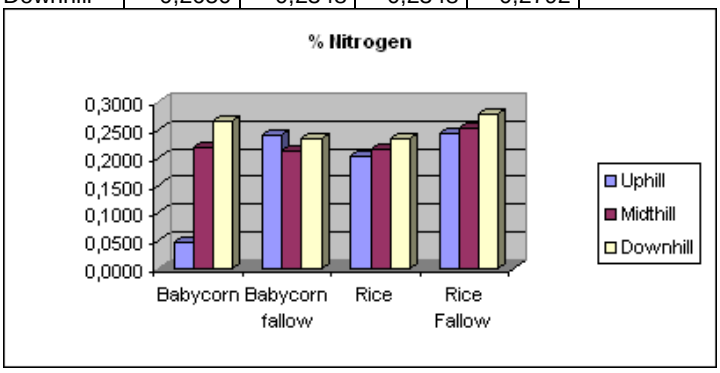


1	Uphill	Fallow	Rice
2	Midhill	Fallow	Rice
3	Downhill	Fallow	Rice
4	Uphill		Rice
5	Midhill		Rice
6	Downhill		Rice
7	Uphill	Fallow	Baby maize
8	Midhill	Fallow	Baby maize
9	Downhill	Fallow	Baby maize
10	Uphill		Baby maize
11	Midhill		Baby maize
12	Downhill		Baby maize

Particle size	
Clay	< 0,002 mm
Silt	0,002 - 0,02 mm
Fine sand	0,02 - 0,2 mm
Coarse sand	0,2 - 2,0 mm

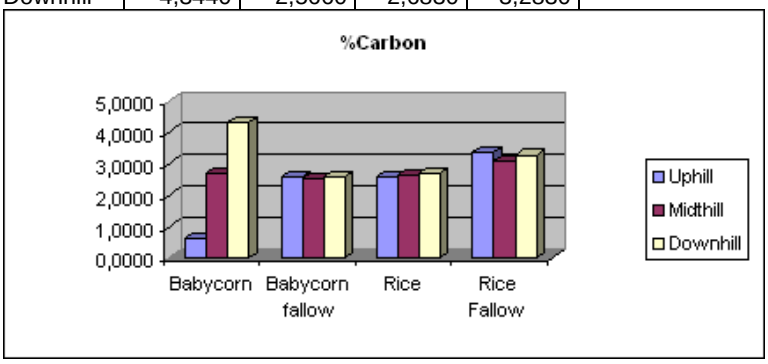
% Nitrogen

	Babycorn	Babycorn fallow	Rice	Rice Fallow
Uphill	0,0482	0,2401	0,2036	0,2442
Midthill	0,2176	0,2121	0,2163	0,2515
Downhill	0,2650	0,2348	0,2348	0,2792



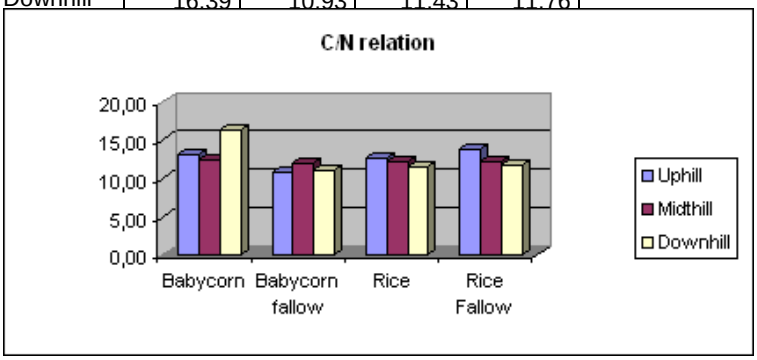
% Carbon

	Babycorn	Babycorn fallow	Rice	Rice Fallow
Uphill	0,6282	2,6010	2,5890	3,3530
Midthill	2,7130	2,5250	2,6240	3,0700
Downhill	4,3440	2,5660	2,6830	3,2830



C/N relation

	Babycorn	Babycorn fallow	Rice	Rice Fallow
Uphill	13,03	10,83	12,72	13,73
Midthill	12,47	11,90	12,13	12,21
Downhill	16,39	10,93	11,43	11,76



Aluminium

	mg Al/L	mmol Al/L	µmol Al/g jord
1	**0,20**	**7,40**	**0,0296**
2	**0,20**	**7,40**	**0,0296**
3	**0,20**	**7,40**	**0,0296**
4	**0,35**	**13,00**	**0,0520**
5	**0,35**	**13,00**	**0,0520**
6	**0,20**	**7,40**	**0,0296**
7	**0,20**	**7,40**	**0,0296**
8	**0,20**	**7,40**	**0,0296**
9	**0,20**	**7,40**	**0,0296**
10	**0,20**	**7,40**	**0,0296**
11	**0,20**	**7,40**	**0,0296**
12	**0,20**	**7,40**	**0,0296**

1	Uphill	Fallow	Rice
2	Midhill	Fallow	Rice
3	Downhill	Fallow	Rice
4	Uphill		Rice
5	Midhill		Rice
6	Downhill		Rice
7	Uphill	Fallow	Baby maize
8	Midhill	Fallow	Baby maize
9	Downhill	Fallow	Baby maize
10	Uphill		Baby maize
11	Midhill		Baby maize
12	Downhill		Baby maize

PH				
	Rice field	Fallow next to rice field	Baby maize	Fallow next to Baby maize
Uphill	3,90	3,90	4,14	4,20
Midhill	4,00	3,92	4,11	4,21
Downhill	4,10	4,22	4,11	4,39

Appendix F: Water analysis

Kampung Puak, Bau	Up Stream	Middle Stream	Down Stream	Pipe water (Community Hall)	Pipe water (At Puak junction)	**Acceptable Value*
Temperature, *(in-situ, 14.1.05)*	24.4	25.3	25.2	25.7	25.4	-
pH, *(in-situ, 14.1.05)*	8.0	7.6	7.5	8.0	7.9	*5.5-9.0*
Conductivity, *(in-situ, 14.1.05)*	17.9	22.2	14.3	19.3	19.1	-
Turbidity (NTU), *(in-situ, 14.1.05)*	14	25	40	8.2	8.9	*1000*
True colour	0.0	0.0	0.05	0.0	0.0	*300*
Apparent colour	0.1	0.4	0.9	0.2	0.3	-
Salinity (ppt), *(in-situ, 14.1.05)*	0.0	0.0	0.0	0.0	0.0	-
Dissolved oxygen (mg/L), *(in-situ, 14.1.05)*	6.3	6.13	6.17	6.3	6.0	-
Biochemical Oxygen Demand, mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	*6*
Chemical Oxygen Demand, mg/L	25	30	28	28	36	*10*
Nitrate, mg/L	0.15	0.22	0.18	0.18	0.26	*10*
Ammonia, mg/L	0.06	0.02	0.02	0.01	0.04	*1.5*
Phosphate, mg/L	0.10	0.11	0.07	0.08	0.09	-
Total Coliform Count, CFV/100ml	592	322	810	304	320	5000
Faecal Coliform Count, CFV/100ml	340	400	500	136	208	-

**Recommended Raw Water Quality Criteria*, extracted from National Standard for Drinking Water Quality,
Engineering Services Division, Ministry of Health Malaysia, December 2000

In order to assess the drinking water resources in Kpg. Puak, water samples from five locations were taken and analysed. Three of the samples were taken at different locations in Puak river: upstream, midstream and downstream. The sites were chosen for the following reasons: 1) Upstream because the water for the pipes is diverted from here 2) Midstream because during periods of drought the villagers collect water at this site 3)Downstream as this is where the outlet for wastewater is.
The last two samples were taken from piped water in the Community hall and from a house at the junction The quality of the water was analysed to see if it was contaminated and thus detrimental to the health of the inhabitants.

Appendix G: Maps and GPS measurement

SURFER REPORT – Baby maize field

VOLUME COMPUTATIONS

UPPER SURFACE

Grid File:	**I:\klaus\cornout.grd**
Grid size as read:	**100 cols by 79 rows**
Delta X:	**1.18181818182**
Delta Y:	**1.19230769231**
X-Range:	**404452 to 404569**
Y-Range:	**149383 to 149476**
Z-Range:	**74.0197728355 to 99.7042502065**

LOWER SURFACE

Level Surface defined by Z = 0

VOLUMES

Approximated Volume by	
Trapezoidal Rule:	**511054.221597**
Simpson's Rule:	**511273.14441**
Simpson's 3/8 Rule:	**511719.878291**

CUT & FILL VOLUMES

Positive Volume [Cut]:	**511054.221597**
Negative Volume [Fill]:	**0**
Cut minus Fill:	**511054.221597**

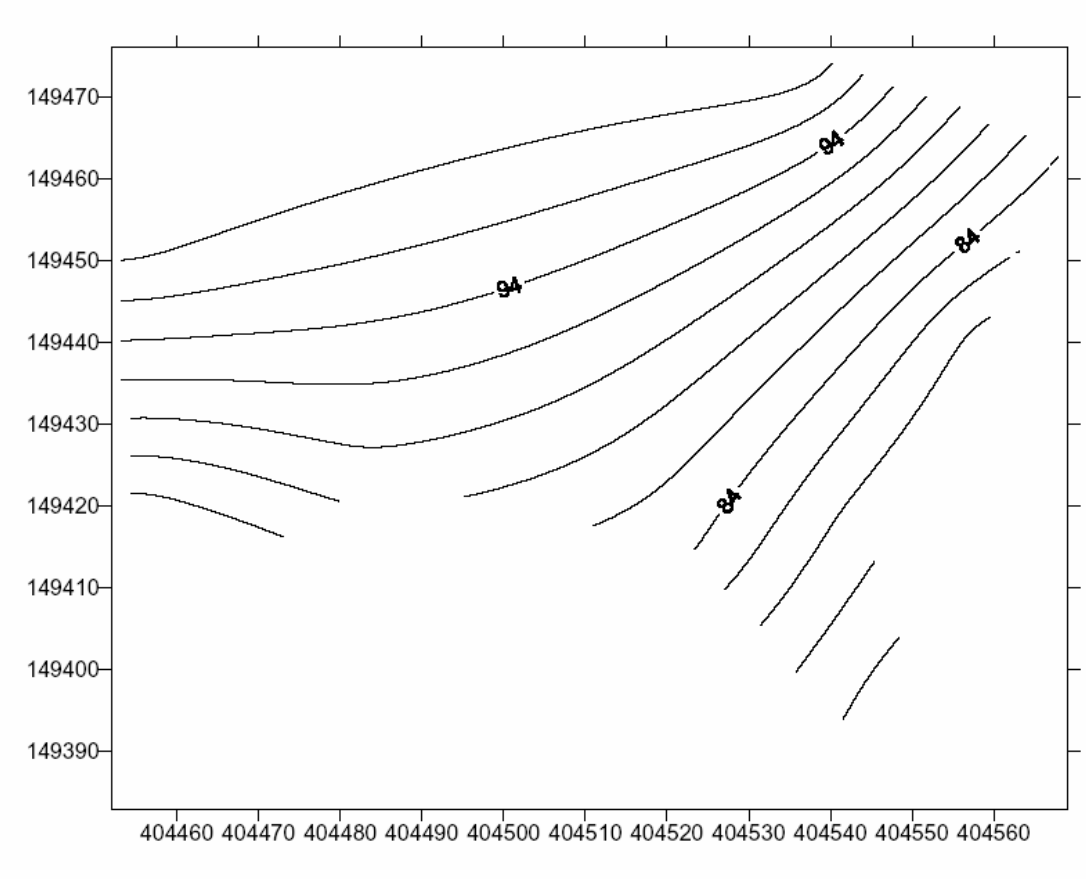
AREAS

Positive Planar Area	
(Upper above Lower):	**5467.27272727**
Negative Planar Area	
(Lower above Upper):	**0**
Blanked Planar Area:	**5413.72727273**
Total Planar Area:	**10881**
Positive Surface Area	
(Upper above Lower):	**5773.98219463**
Negative Surface Area	
(Lower above Upper):	**0**

X	Y	Z
0404452	0149455	100
0404454	0149417	84,76821129
0404468	0149411	84,76821129
0404483	0149423	89,91283578
0404523	0149414	84,87866878
0404550	0149383	74,60635507
0404552	0149395	74,60635507
0404544	0149418	79,81399083
0404559	0149440	79,81399083
0404569	0149464	84,8873169
0404537	0149476	100,1141379
0404452	0149455	100

UTM
WGS 84

Contour map of baby corn field



SURFER REPORT –Hill rice field

VOLUME COMPUTATIONS

UPPER SURFACE

Grid File:	**I:\klaus\rice2out.grd**
Grid size as read:	**72 cols by 100 rows**
Delta X:	**1.45070422535**
Delta Y:	**1.45454545455**
X-Range:	**405408 to 405511**
Y-Range:	**147888 to 148032**
Z-Range:	**85.0285202313 to 115.904106461**

LOWER SURFACE

Level Surface defined by Z = 0

VOLUMES

Approximated Volume by	
Trapezoidal Rule:	**971432.323552**
Simpson's Rule:	**972537.776052**
Simpson's 3/8 Rule:	**972126.293953**

CUT & FILL VOLUMES

Positive Volume [Cut]:	**971432.323552**
Negative Volume [Fill]:	**0**
Cut minus Fill:	**971432.323552**

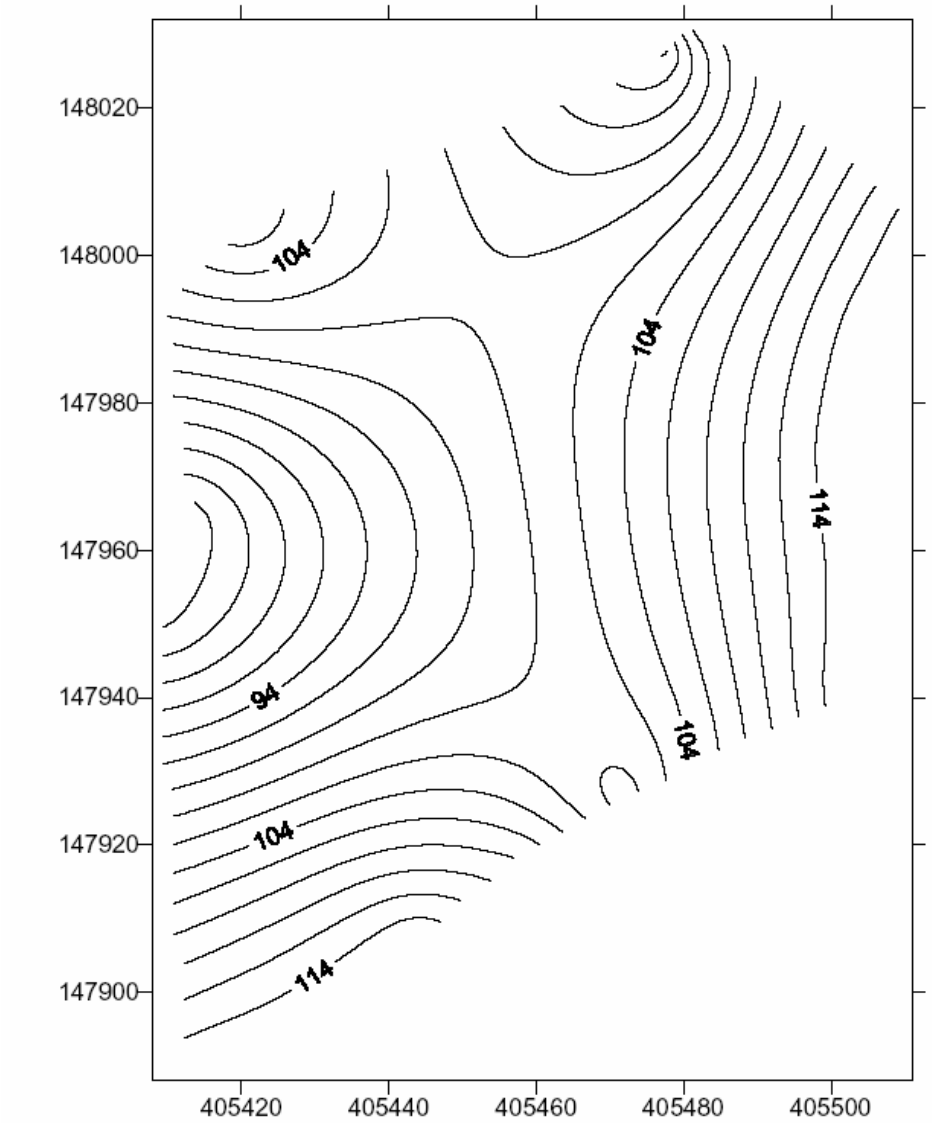
AREAS

Positive Planar Area (Upper above Lower):	**9164.23047375**
Negative Planar Area (Lower above Upper):	**0**
Blanked Planar Area:	**5667.76952625**
Total Planar Area:	**14832**
Positive Surface Area (Upper above Lower):	**9890.59535975**
Negative Surface Area (Lower above Upper):	**0**

X	Y	Z
0405482	0148032	100
0405511	0148005	115,3545614
0405506	0147990	116,75438
0405503	0147974	116,75438
0405503	0147940	116,75438
0405472	0147926	99,43051474
0405458	0147918	108,7566679
0405444	0147907	116,4339486
0405412	0147888	116,4339486
0405408	0147951	85,70679552
0405413	0147965	85,70679552
0405409	0147992	100,8948635
0405420	0148005	108,8687245
0405474	0148025	93,434851
0405477	0148028	91,82262205
0405482	0148032	100

UTM
WGS 84

Contour map of Hill rice field

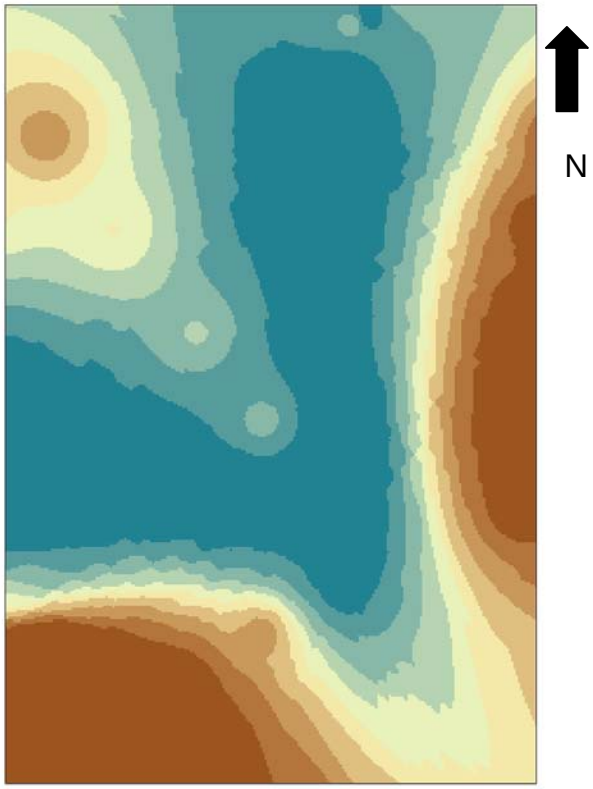


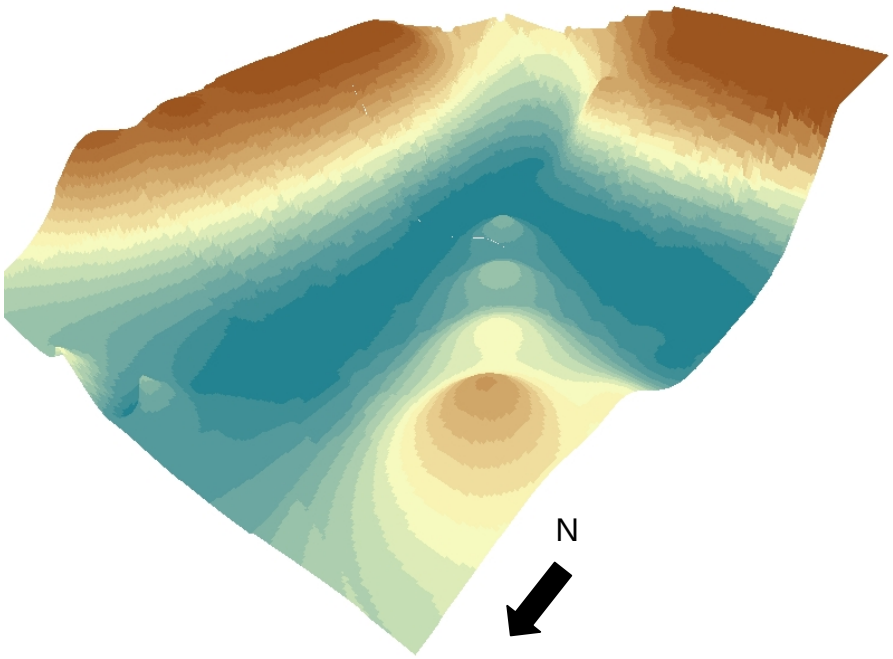
Slopes visualized by topographic maps

Rice field

Extrapolation made by Inverse distance weighting (IDW) in 3D analyst (ArcGis)

Inaccuracies are seen due to missing wave points in the center of slopes.





Appendix H: Distribution of profit from birds' nests collection

Prize for the nests:
1st grade: 2.225 RM/kg
2nd grade: 1.112 RM/kg

Bird nest collection:
1st grade: 10, 52 kg
2nd grade: 0,16 kg

Total pay: 23.462,5 RM

Distribution of profit:

Total:	2342, 50 RM
Expenditures	-5323, 30 RM
For distribution	18139, 20 RM
For each household	262, 88 RM

Expenditures:

Watchers salary (4 persons):	3.000
Christmas holidays allowance:	80
Mr. Saban was bidden by a centipede (hospital bill)	38
Fare for lorry	30
Climber/carpenter 19 pers. 80 RM /pers.	1.520
Community service/ work	40
AJK, committee 4 persons	200
Food	279.3
Total expenditures according to the committee	5.323,3

Remarks:

- Only men go to Gunung Cawa.
- The poor lonely woman received full share of the money though she could not sent a representative to the mountain.
- One man only received 222 Rm because he did not participate in the mountain clearing activity.
- The Chinese buyer: Mr. Alvin Chong
  Phone: 082 – 577753
  Sunway service & supplies co.
  www.diamondenergywater.com

- He was joined by an observer: Local Bidayuh Mr. Ranyaw Ak Pitol (Andrew)

Appendix I: Work schedule

Tilde	Morning	Afternoon	Evening
10-01-2005	Arrival at Bau training center	Arrival at Kpg. Puak Transect walk with guide	
11-01-2005	Bau	Group meeting Preliminary interview with mr. siot and the medicine man	Meeting with headman Preparing synopsis
12-01-2005	Synopsis presentation in Bau	Bau	Group meeting
13-01-2005	Group meeting	Preparing questionnaire	Pre-testing questionnaire
14-01-2005	Water sampling	Water sampling	Questionnaire
15-01-2005	Kuching	Kuching	Kuching
16-01-2005	Kuching	Kuching	Kuching
17-01-2005	Kuching	Field visit to baby corn field Visit to Tringus	Observing PRA
18-01-2005	Preparing interview with farmer Field visit – collection of fruit, and chillies -fishing in the pond	Preparing interview with farmer Visiting farmers house - pepper storage	
19-01-2005	Soil samples and interview hill rice field	Soil samples and interview hill rice field	Bau
20-01-2005	Soil samples Baby maize field nr. one. unknown farmer	Soil samples baby maize GPS baby maize	Focus group interview
21-01-2005	Processing information	Interview with middleman	Processing information
22-01-2005	Visit to Skibang	Visit to Wind cave	Preparing Presentation
23-01-2005	Preparing presentation	Preparing presentation	Preparing presentation
24-01-2005	Presentation at Bau training center	Farewell party in Kpg. Puak	Farewell party in Kpg. Puak

Laboratory at KVL

Date	4-02-2005	7-02-2005	8-02-2005	9-02-2005	10-02-2005	11-02-2005
Hours	4	8.5	6	6	9.5	5

Louise	Morning	Afternoon	Evening
10-01-2005	Arrival at Bau training center	Arrival at Kpg. Puak Transect walk with guide	
11-01-2005	Bau	Group meeting	Meeting with JKKK members Preparing synopsis
12-01-2005	Synopsis presentation in Bau	Bau	Group meeting
13-01-2005	Group meeting	Informal conservation at the junction	Village mapping
14-01-2005	Water sampling	Water sampling	Preparing questionnaire
15-01-2005	Observational walk on new road	Questionnaire	Questionnaire
16-01-2005	Visit to Sirikin market	Bird nest collection day	Socialising with villagers
17-01-2005	Interview with external key informants	Interview with external key informants Visit to Tringus	Observing PRA
18-01-2005	GPS (new road)	GPS (various points)	
19-01-2005	Interview with external key informants	Interview with external key informants	Bau
20-01-2005		GPS (village road)	Focus group interview
21-01-2005	Processing information	Processing information	Processing information
22-01-2005	Visit to Skibang	Visit to Wind cave	Preparing presentation
23-01-2005	Preparing presentation	Preparing presentation	Preparing presentation
24-01-2005	Presentation at Bau training center	Farewell party in Kpg. Puak	Farewell party in Kpg. Puak

Klaus	Morning	Afternoon	Evening
10-01-2005	Arrival at Bau training center	Arrival at Kpg. Puak Transect walk with guide	
11-01-2005	Transect walk to fields	Group meeting Preliminary interview with mr. siot and the medicine man	Meeting with headman Facilitating problem ranking exercise
12-01-2005	Synopsis presentation in Bau	Bau	Group meeting
13-01-2005	Group meeting	Informal conservations at the junction	Village mapping
14-01-2005	Water sampling	Water sampling	Preparing questionnaire
15-01-2005	Observational walk on new road	Questionnaire	Questionnaire
16-01-2005	Visit to Sirikin market	Bird nest collection day	
17-01-2005		Field visit to baby corn field Visit to Tringus	Time line and - Pair wise ranking
18-01-2005	GPS (new road) Field visit – collection of fruit, and chillies -fishing in the pond	Preparing interview with farmer	
19-01-2005	Soil samples and interview hill rice field)	Soil samples and interview hill rice field)	Bau
20-01-2005	Soil samples Baby maize field nr. one. unknown farmer	Soil samples baby maize GPS baby maize	Focus group interview Data collection for establishment of rice equation
21-01-2005	Processing information	Processing of baby maize – informal interview????	Processing of information
22-01-2005	Preparing presentation	Preparing presentation Assessment of herbicides use in baby maize field	Preparing presentation
23-01-2005	Preparing presentation	Preparing presentation	Preparing presentation
24-01-2005	Presentation at Bau training center	GPS measurement in hill rice field	Farewell party in Kpg. Puak

Laboratory at KVL

Date	4-02-2005	7-02-2005	8-02-2005	9-02-2005	10-02-2005	11-02-2005
Hours	4	11	6	7.5	5	4

Oliver	Morning	Afternoon	Evening
10-01-2005	Arrival at Bau training center	Arrival at Kpg. Puak Transect walk with guide	
11-01-2005	Transect walk to fields	Group meeting Preliminary interview with mr. siot and the medicine man	Interview JKKK members Preparing synopsis presentation
12-01-2005	Synopsis presentation in Bau	Bau	Group meeting
13-01-2005	Group meeting	Preparing presentation	Pre-testing questionnaire
14-01-2005	Water sampling	Water sampling	Questionnaire
15-01-2005	Questionnaire	Questionnaire	Questionnaire
16-01-2005	Processing information	Bird nest collection meeting	Socialising with villagers
17-01-2005	Processing information	Informal interview with villagers Preparing PRA-exercise	PRA exercise: Seasonal calendar and time line
18-01-2005	Interview with external key informants	Interview with external key informants	
19-01-2005	Interviews with external key informants	Interview with external key informants	Interview with villager
20-01-2005	Processing information	Processing information - preparing focus group interview	Focus group interview
21-01-2005	Informal interview with villager	Interview with middleman	Preparing presentation
22-01-2005	Visit to Skibang	Visit to Wind cave	Preparing presentation
23-01-2005	Preparing presentation	Preparing presentation	Preparing presentation
24-01-2005	Presentation at Bau training center	Farewell party in Kpg. Puak	Farewell party in Kpg. Puak

Appendix J: Synopsis

SLUSE 2004-2005
ILUNRM COURSE
Interdisciplinary Land Use and Natural
Resource Management

The Royal Veterinary and Agricultural University, Roskilde University Center
and the University of Copenhagen

External factors' influence on livelihood strategies in Kpg. Poak
-past and present

Synopsis for field trip to Kpg. Poak, Sarawak State, Malaysia

Written by:
Klaus Dons, KVL – AD04034
Oliver Grubb Hoffmeyer, RUC
Tilde Hellsten, KVL –AD04003
Louise Ann Nordtorp Jørgensen, KU

Supervisors:
Kristine Juul, RUC
Rikke Folving, KU

December 2004

Introduction

In connection with the SLUSE project 2004/2005 we have been assigned with the village Kampong Poak (Kpg. Poak) as the field site of our study. Kpg. Poak is located near the town of Bau in the state of Sarawak, Borneo. The village is lies in a valley between limestone hills. It consist of 55 households including one headman Mr. Maging anak Pitol. The village was relocated in the 1950s from Krokong Gunung to its present location where it was officially recognized in 1974 (ILURNM, 2004).

www.mmaj.go.jp/mmaj_e/project/asia/sarawak**.html**

Thematic context

One of the great influences on Kpg. Poak is its resettlement. This major upheaval must have had a great impact on the daily livelihood strategies of the community. The new location may have given new opportunities and constraints different from those in the old village, which is something one has to take into ones considerations. But also the development in the society as a hole is an important factor to keep in mind.

Since the early nineties, the government of Malaysia has implemented an overall economic transformation, also called Vision 2020. Its goal is that Malaysia should become a fully industrialized nation by 2020 (Jomo et al, 2004). The vision transforms the development focus from the primary to the secondary and tertiary sectors, but the primary sector still has a very important role in fulfilling this vision (Yaik, 2002).

Concerning the agriculture, the government wants to transform it through its National Agricultural Policy. A major objective of this policy is income maximization and turning agriculture into a modernized and commercialized sector through technological and scientific development. Since the exploitation of timber resources and subsequent conversion to oil palm plantations of state land areas gained momentum in the 1960s, shifting cultivation has been viewed as an obstacle to development (Hansen & Mertz, 2003). In Sarawak, shifting cultivation is still being practised, and the farming practises are mixed, cultivating both cash crop and subsistence crop (Jomo et al, 2004) (Norwawi, 2002).

In general shifting cultivation is seen as a waste of natural resources, inherently primitive, and known for having relatively low output per unit area (Magid & Mertz, 2003). But in this context it is important to note that very little research has been devoted to agronomic improvement of crop production in the system, mainly because the system has been considered inherently primitive even anti-developmental.

As mentioned before, the primary sector is still important in Malaysia. This does not only concern the agricultural sector but also the mining sector. Most of the limestone hills in the area of our field site, Kpg. Poak are leased by mining companies (Noweg et al, 2004). The mining is therefore also important for Kpg. Poak, as there is a goldmine

in its vicinity. Different aspects of this can have an influence on Kpg Poak. Mainly it can have a positive affect on the economy but there are also negative effects such as the release of arsenic from the ground. Focus has especially been on the lake Tasik Biru in the Bau area. It turns out that the lake after extensive gold mining in the beginning of the 1990's has been contaminated with arsenic residues and now presents a health risk for the families living around the lake. Symptoms of arsenic pollution have been reported (Unknown, 1999b). The indigenous news site, Rengah Sarawak describes the situation in details. Here it is stated that Tasik Biru used to be a community owned lake. As gold was discovered the lake was turned into the private property of a sole prospector legally authorized by the State Government. The lake was emptied, gold was extracted and the site was left for natural refilling by rainwater (Unknown 1999a). Since Tasik Biru is located less than 10 km from Poak it is possible that these two places are hydraulically connected within the same watershed. Therefore there might be a risk of arsenic contamination in the area of Poak.

Non-timber forest products (NTFP) such as plant and animal resources that are extracted by the villagers are also important. These resources can be used for both subsistence and commercial purposes (Burger, 1991). As it is now one of the most important income sources are the valuable edible birds' nests to which Poak holds a license to harvest. They share this right to the Gunug Kawa cave with four neighbouring villages. Once every three months they are allowed to go into the cave and collect the nests (ILUNRM 2004).

When it comes to collection of birds nests there are lot of things to take into consideration. Especially when it comes to who gains from the enterprise. In his article from 2004 Quentin Gausset wrights about the management of the Niah cave in Sarawak. His article focuses on the socio-economic cause of the decline in eligible birds' nests that can be harvested. In the 1980´s the prices for bird's nests increased which lead to illegal harvesting outside the season and without permission from the owners of the cave. Now most owners lease their caves. Most leasers are also traders in nests and sublet their share of the cave to others who either work there themselves or hire workers. Again there are the government agents who try to make sure that the no

overexploitations takes place. In short a lot of players (owners, leaser etc) are involved in the game!

The limestone forests and hills are one of the state's most valuable cultural heritage, and therefore a proper protection and management of the area may be necessary to ensure sustainability of its biodiversity and possible future tourism income (Noweg, 2004). The prospect of a future reserve in the Kpg. Poak area can therefore have an impact on the villagers' daily life. Use of NTFP such as bird nests might be limited or prohibited and the villagers might no longer be able to depend on these activities as a source of income. Also here, indigenous resource use and income strategies are highly dependent on government decisions. A lot of this comes down to the tenure aspect, and uncertainty of land tenure security is a problem for Kpg. Poak that needs looking into. Firstly, the villagers claim NCR[19] to areas that are leased to a mining company by the government. Secondly, the village was not officially recognized before 1974 though villagers claim that the relocation took place in the 1950's. In order to claim NCR a village must be officially connected with an area at least since 1952 (ILUNRM, 2004).

The over-all economic development has not only had an effect on Kpg. Poaks use of natural resources. Last year the work of a new road leading to Kuching was commenced. This can influence the social aspect of the livelihood of Kpg. Poak. As it is now, a lot of the young people (mostly men) work in Kuching (and other cities) and send money home to their wives and relatives that still live in Poak (ILURNM, 2004). The road could among other things amplify this migration tendency to include their wives leaving only the older generation behind to maintain the different households farming activities (Patterson, 1984).

To sum up, a lot of external factors, such as government policies, mining companies and reservation plans have great impacts on the livelihood of Kpg. Poak. Therefore the approach to the assignment will be the external factors impact on the livelihoods strategies in Kpg. Poak.

[19] NCR: Native Customary Rights

Assignment

Evaluate the opportunities and constraints related to the past and present location of the Kpg. Poak in relation to adjacent resources. Explore possible impacts of external interventions such as mining and the proposed conservation plans on present and future land tenure security. Evaluate the potential implications of the new road on accessibility to land, labour and forests resources.

Objectives

- Appraisal of the physical and human environment of Kpg. Poak including mapping of existing key natural resources, demographic data, and village mapping along with accessibility to farmer's fields.
- Evaluation of past and present allocation of manpower in relation to land and resource use. Assessment of various income activities for different members of households (including impact of off-farm work within and outside Kpg. Poak).
- Evaluation of reasons for relocation of village.
- Appraisal of agricultural intensification.
- Appraisal of land tenure relationships and security (including government's lease of land to mining companies).
- Evaluation of economic and environmental effects of past gold mining along with the possible introduced health risk of the inhabitants due to arsenic pollution
- Assessment of changes in utilization of non-timber products (including the economic sustainability of collection of birds' nests) and animal resources of the limestone forest.
- Assessment of villagers' expectations concerning government propels of future activities in the area:

  i future conservation plans

  ii. New main road - see also appendix 1

Sustainable livelihood strategies

We have chosen a so-called rural livelihood approach for this report. The aim of this approach is to keep the focus on the rural people and their perception of the surrounding world by studying their livelihoods, and what strategies they implement to facilitate sustainability. To have a sustainable livelihood means to be able to "*...cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, while not undermining the natural resource base.*"(Scoones, 1998:5). In short, a livelihood comprises all the activities, assets and capabilities needed for maintaining a living standard.

In a livelihood approach it is essential to evaluate the different types of resources or 'capital' that the households in Kpg. Poak have access to. These assets provide an opportunity for different combinations of livelihood strategies (Scoones, 1998). According to Scoones, the concept 'capital' covers four different types; natural capital, economic capital, human capital and social capital[20]. The people of Kpg. Poak must then combine these different capitals to create a sustainable livelihood (Scoones, 1998).

As it is shown in the following figure, the livelihood strategies can be analyzed through a given context, e.g. policy setting, politics, history or socio-economic conditions: internal and external conditions (Scoones, 1998).

[20] Natural capital refers to the natural resources. Economic capital refers to cash, savings and economic assets like infrastructure, technologies and equipment. Human capital includes the skills, knowledge, ability and capability of the household inhabitants of Poak. The social capital comprises the networks, social relations, associations etc. upon which people draw to pursue the livelihood strategies

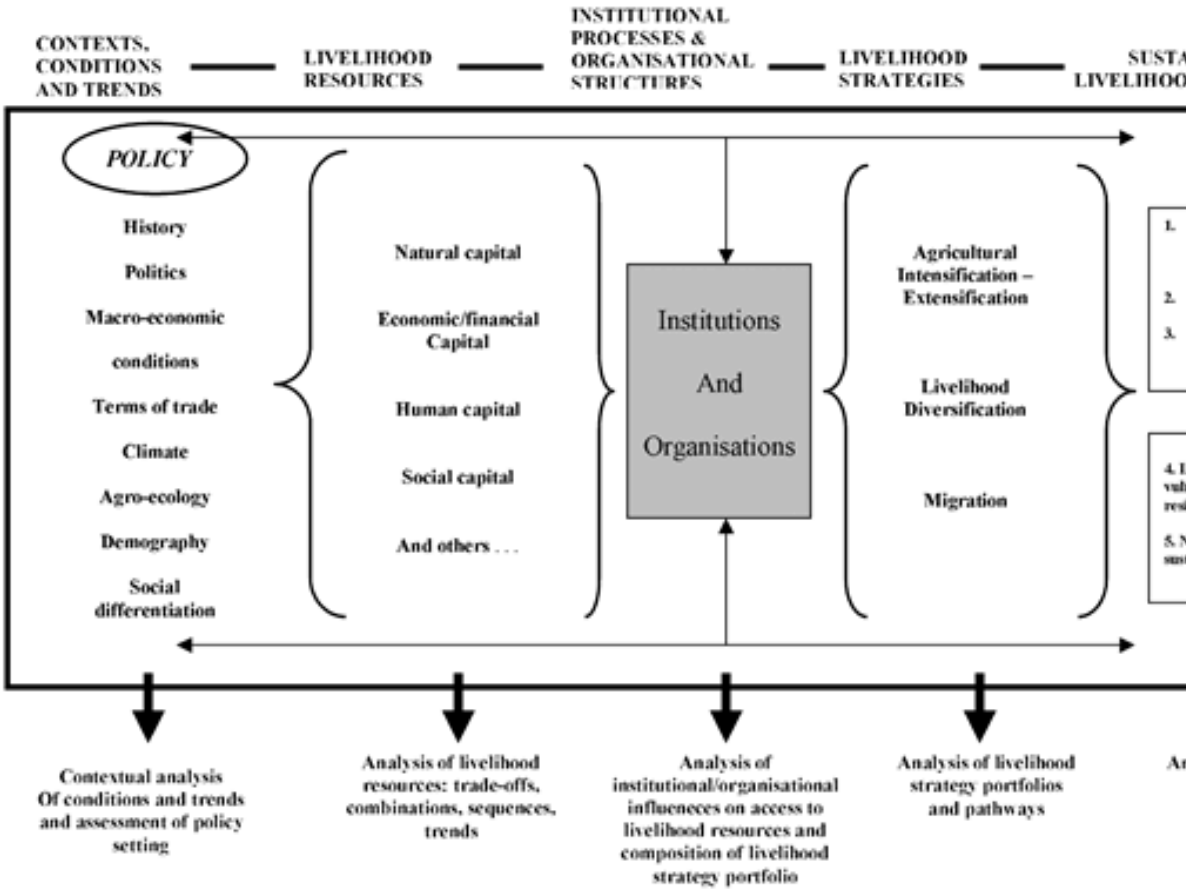


Figure 1 (Scoones, 1998: 4)

By using this analytical framework, it is possible to evaluate the complex and diverse livelihoods of the households in Kpg. Poak. What kind of livelihood strategies are used; agricultural intensification/extensification, migration or diversification.

Specific Methods

In the following, methods useful in assessing the different tasks and objectives in Poak are listed. Methodological triangulation is used to compare the information/results from the different methods. We must make sure that we in our research don't expose the villagers in any way that might have consequential effect after we leave the study site. What is also very important in this whole process is that we will get the overall tasks and goals for the two groups (Malaysian and Danish students) to coincide

Questionnaire

This is a useful tool for getting an overview of the present situation in Kpg. Poak. It can help in the situations where we need to evaluate opinions and phenomena in the village. For example, it can show a possible correlation between different social or physical categories e.g. off-farm income compared to agricultural activities in the household and Kpg. Poak. The questionnaire can help us describe the people of Poak and their livelihood strategies in terms of quantitative data and proportions (Babbie, 2002).

Due to lack of time we won't have time to interview all households in the village. The responded to this interview survey will be the head of households (HH) – both because we need to be able to compare between the different households but also as a show of respect to the HH. Apart from gathering information, the questionnaire can guide us in the selection of households and individuals for further in-depth analyse.

A preliminary draft of the questionnaire can be found in appendix 2, but of course the final questionnaire can only be implemented after we have met with our counterparts in Malaysia, and some tests have been done.

Semi-structured interview

Throughout all the stages of this study we will locate and carry out interviews with different individuals and groups who can provide us with specific knowledge. The interviews will range from informal conversations to in-depth semi-structured interviews using probes and prompts[21]. All types of interviews will primarily contain open-ended questions in order to uncover unexpected information.

The interviews with key informants will provide us with general and specific information on Kpg. Poak. Interviews with the headman and a few individuals will give us in-depth information on specific subjects but these interview might also provide us

[21] In this connection *probes* are used as additional questions that go deeper into the subject and are most often improvised, as they have to respond directly to the answers *Prompts* are understood as single words thrown in whenever the interviewee looses track or dries up in the middle of the answer. It is often recommended that questions in semi-structured interview guides are written as single key words. (Gillham, 2000).

with information about the daily routines that might not be obvious for us e.g. the decision making within the family, the anthropological aspects etc. These "finer details" will help us understand the different household livelihood strategies better. In depth interviews are to be held with a few chosen households were different members are interviewed to get a picture of social structures within the households and also the different power relation between households.

See appendix 3 for a potential interview guide with key informants.

Focus group

Topics for focus group interview are based on what has been found out during previous interviews. If there is a specific topic that receives a lot of attention it could be interesting to gather some villagers and observe them. This is due to the understanding of the process rather than the result, *"the focus group interview is, indeed, an interview, not a problem solving session"* (Mikkelsen 1995:104). We hereby hope to see if there is a hierarchy within the focus group and if this also is reflected outside the group – in the daily life of the village.

Informal conversation

Interacting with the community is important to gain information on the village that can't be obtained by using the traditionally scientific approach. A way to do this could be participating in the daily life routines in the village. By using this method one might gain insight in the culture and the traditions that have important influence on the daily life of the community – an influence that other vice could be overlooked in analyzing the raw data. To keep track of this information we will note it down afterwards.

Participatory Rural Appraisal (PRA)

PRA methods can be used while we are in Kpg. Poak since the villagers have knowledge that we would like them to share. The villagers know the conditions of the area and can point out important issues unseen to us.

Transect walks

To get an understanding of the farmer's everyday routine it would be helpful to have a transect walk with a farmer. This would help both in order to understand the distance "village to field" in time but also to see if the information gained from interview coincide with reality. During the walk a cross-sectional map is made of the area and the given cropping system and the different crops are described.

Mapping

Mapping is important because these techniques shift the focus from verbal to visual communication.

Villagers will make maps of the community and existing key natural resources or power structures affecting their life.

Ranking

Ranking is a participatory approach. This activity allows us to understand the relative importance of different topic such as e.g. NTFP, crops… to the people of Poak. The results are quantitative and can be treated statistically in order to draw general conclusions about the entire community.

Field Experiments

Soil fertility assessment

Soil samples will be analyzed for their content of soil organic matter (SOM). Our goal is to determine whether erosion is occurring in Poak and at what scale. The soil samples will be derived from 3 different locations around Poak; a sloping hill rice field, a sloping pepper field and from a sloping non-cultivated area (e.g. forest). The result will enable us to determine whether the hill rice – and pepper production is sustainable and do not deplete SOM. The soil from the non-cultivated area is used as reference. Furthermore we will measure the run-off from the same 3 locations. We will combine the run-off data with infiltration measurements and texture analysis.

Water analysis

Water samples will be collected from an area affected by the gold mining and compared to the samples obtained from the drinking water source. In these samples we are looking for arsenic. We will also take samples from Tasik Biru to use as a point of reference.
See appendix 4

Global Positioning System (GPS):

GPS is useful for measuring sizes, locations and distances relevant for Kpg. Poak and our research. This can be used to follow up on the information all-ready gained.

Time Schedule

We have made a rough schedule for how we see ourselves distributing our time. But this is as mentioned very rough – once we meet up with our counterparts a more final time schedule will be made.

Preliminary phase: first visit to Kpg. Poak. 1-2 days
Preparation/alteration phase: final adjustments of research methods in Bau. 1 day
Questionnaire phase: overview of the village 1-2 days
Interview phase: semi-structured interviews. Continuous
Field experiment phase: conducting filed experiments. 2-3 days
Follow-up interview phase: clarify discrepancies that might have surfaced. 1-2 days

See appendix 5

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Appendix 1

A short overview of the objectives, the purpose and the methodology

Objectives	**Purpose of objectives**	**Methodology**
Appraisal of physical and human environment of Kpg. Poak.	To get an overview of Kpg. Poak. - How does the daily life proceed in the village?	- Various PRA methods (transect walk, village mapping, ranking...) - semi-structured interview with key informants (e.g. headman) - questionnaire - informal interview - demographic data - GPS/GIS
Evaluation of past and present allocation of manpower in relation to land and resource use - assessment of various income activities.	To get a picture of what development has taken place in the village as to what work the inhabitants carry out- has there been an allocation from farming activities towards jobs in the city? What effect has this had on the household income? Has family patterns changed?	- PRA (transect walks) - semi-structured interviewing key informants (old and new generation) - household interviewing
Evaluate relocation of village	To find out why the village was relocated - government decision? Due to environmental factors? What are the consequences following the relocation. What effect has it had for the villagers?	- semi- structured interview with key informants (people who remember the old village) - official records -GPS/GIS
Appraisal of agricultural intensification	To see if there's has been a development through time in how farming activities has taken place - what consequences the intensification might have for the future?	-semi- structured interview - PRA (transect walks) - soil fertility assessment - GPS/GIS

Appraisal of land tenure relationships and security	To be able to understand the possible conflict between Poak and the government that might surface if future conservation plans etc are carried out.	- Semi- structured interview with key informants (headman, government official...) - official records
Evaluation of economic and environmental effects of past gold mining - including potential health risk	To see if the goldmine has had any influence on the village as to people getting work in the mine or having to give up farmland for mining company. Also if the presence of the mine has had any detrimental effects to the health of the inhabitants.	- Semi- structured interview with key informants (headman, villager, doctor, government official...) - water analysis (arsenic contamination) - soil analysis - PRA (transect walk)
Assessment of utilization of non-timber forests products and animal resources of the limestone forests	To get an impression of how much the village uses available resources in the area-what they gain from it, both commercial and personal!	- PRA (transect walk, ranking) - semi- structured interview with key informants (e.g. cave owners in relations to bird nests harvesting) - Household interviews (men, women...)
Assessment of villager's expectation concerning: i future conservation plan ii new main road	To gain knowledge about how the villagers fell about external interventions that might influence accessibility and use to/of the resources they now use - NTFP and fields.	- Semi-structured interview with key informants (headman, farmers...) - questionnaire

Appendix 2: Questionnaire (Draft)

Interview no._____ Date: _____

Location: _____

Household number: _____

Interviewer: _____

Interviewee: _____ Age: _____

Household stratification					
Members	Gender	Age	Level of education	Relation to Head of HH	Marital status
1 (Head of HH)					
2					
3					
4					
5					
6					

Contribution to household				
Members	Main Occupation	Last Occupation	Contribution to HH money income	Contribution to HH subsistence
1				
2				
3				
4				
5				
6				

Migration Patterns

Why did the village resettle in Kpg. Poak?

When did the HH settle down in Kpg. Poak?

How many members of HH work outside Kpg. Poak?
Male: _____
Female: _____

How many members of HH live outside Kpg. Poak?
Male: _____
Female: _____

Past (Before 1995)

Agricultural activities						
Crop /livestock (Listed after importance	Field size	Distance from Poak	Influence on cash income	Influence on Subsidence income	Use of Pesticides	Use of fertilizer

Present (1995-)

Agricultural activities						
Crop /livestock (Listed after importance	Field size	Distance from Poak	Influence on cash income	Influence on Subsidence income	Use of Pesticides	Use of fertilizer

How many parcels do your HH cultivate?

How many Parcels are in fallow?

Past (Before 1995)

Farming activities							
Crop:	Shifting cultivation	Manure	Fertilizer	Pesticide	Income	Subsistence	
1							
2							
3							
4							
5							
6							

Present (1995-)

Farming activities							
Crop:	Shifting cultivation	Manure	Fertilizer	Pesticide	Income	Subsistence	
1							
2							
3							
4							
5							
6							

Past (before 1995)

Non-timber forest products			
Use	Importance	Cash income	Subsistence income
Hunting			
Fishing			
Vegetables/fruit			
Wood			
Birds nests			
Other (specify)			

Present (1995-)

Non-timber forest products			
Use	Importance	Cash income	Subsistence income
Hunting			
Fishing			
Vegetables/fruit			
Wood			
Birds nests			
Other (specify)			

Water use			
Main Needs	Importance	Main Source	
Watering			
Drinking			
Household			
Livestock			
Bathing			
Other (specify)			

Has the goldmine affected your household?

- Has anyone worked there?
- Has it affected your field size?
- Has it affected the quality of your field?

Do you think a reopening of the goldmine affect you and your household?

- How?
- Why?

Appendix 3: Interview guide

Interview guide for semi-structured interviews with potential key informants

The Headman of Kpg. Poak, Mr. Maging anak Pitol.
Interview themes:

- History of Poak
- Demographic data on Poak (number of households, Number of inhabitants, male/female, old/young, and children.)
- Power relations within the households
- Key natural resources: crops, cropping systems, use of NTFP, water supply, hunting
- Governmental dividends
- Official laws and regulations
- Local rules and management systems
- Land tenure relations
- Other potential key informants

Reflections:
A logical first step of the study in Poak is to meet with the headman to obtain general information about key natural resources, demographic data and changes in allocation of manpower. We hope to be able to bring an aerial photograph of the village and have him point out areas as the interview proceeds. Other important facts that might be provided here is ownership of the land that the village use and also if there is any land near the old village Krokong Gunung they still use and if they own it. We will also ask if they receive any dividends and if there are any restrictions (i.e. governmental) on the use of land. The headman might also be able to tell about the laws and legislations concerning the use of natural resources in the area around Poak and how he and the village are informed about this.

A transect walk through the village and surrounding area with the headman is an important initial activity. It gives us an overall impression of the place and is a more informal setting for the interview where certain otherwise forgotten information might spring to mind. The most important objective of an initial transect walk is that we might be introduced to some of the inhabitants of Poak, for example other potential key informants. In some rural areas where foreigners are seldom seen it is crucial to be properly introduced by locally known and respected persons (Nielsen, 2003 personal comment.). We should be aware of the headman's position and popularity in the village before letting him introduce us. We could maybe loose the confidence of the people if we are too closely attached to someone they dislike.

This initial interview is aimed at being a natural informal conversation between the Headman and us. It is important that we make it possible to return for another perhaps

more specific interview later in the process. Most of the data collected in this initial interview is to be used for the further investigations.

Hydrologist at UNIMAS, Dr Lau seng

Interview themes:

- The history of Tasik Biru
- His research results
- Indicators of arsenic pollution in Tasik Biru
- Environmental implications
- Watershed connections in the Bau area

Reflections:

Dr Lau Seng is a professor at the Faculty of Resource and Science Technology, UNIMAS and has made a specific research project about arsenic compounds in the lake Tasik Biru in Bau. The title of the project is: *The speciation of arsenis compounds in Tasik Biru, Bau, Sarawak: its Environmental Implications*. An interview with Lau Seng could provide us with specific knowledge about indicators of arsenic pollution and its impacts on environment and people.

A doctor in Bau District Hospital

Interview themes:

- Specific symptoms of arsenic contamination in Bau
- Number of people affected
- How serious is the problem?
- Which areas do contaminated people come from?
- Have there been symptoms among people from Poak or the vicinity?

Reflection:

Other key informants might be employees at Sarawak General Hospital or Federal Health Ministry officials in the Medical Department, Sarawak.
From the story about Tasik Biru we know that local people have contacted Bau District Hospital and Sarawak General Hospital with injuries probably caused by arsenic pollution. We hope to get information about local symptoms on arsenic contamination and geographical locations of the incidents. The most important information obtained from this interview is if it can be confirmed or rejected that People from Poak have ever had these symptoms. The kind of information we seek is likely to be classified in some way and we will address potential key informants as informal as possible. We will not take notes of the conversations and we will be sure to explain our motivation for addressing them - that we are students trying methods in a field course

An agricultural extension worker or agricultural adviser

Interview themes:

- Guide lines for agricultural productions
- What has changed over time

- Specific yields from each crop
- Economic input to agriculture
- Dividends

Reflection:

(This could be in Poak, Bau or Kuching. It is not certain if such a person is connected to Poak).

If we are so lucky that there is an extension officer in the area that have worked in Poak – then it would very interesting to ask the farmers what guidelines they have got from the extensionist and these guidelines might have changed their agricultural production and indirectly changed the lives for the farmers.

Farmers in Poak

Interview themes:

- Which crop systems
- Inputs and outputs
- Distance to different types of fields
- Distribution of workload between household members
- Which pesticides, amounts and application periods
- Time spends on different activities in the field.
- perception of advantages and disadvantages of Pepper production versus Hill rice farming

Reflection:

Preferably it should be farmers that cultivate both hill rice and pepper plantations. The information we hope to get is if the farmers conception of whether the distance to the fields are an obstacle or not. In relation to this it is also interesting to ask about changes in:

Agricultural system
Types of persons doing farm work (age and sex)
Choice of crops
Use of chemical inputs – are they fertilizing their hill rice
Allocation of manpower

It is also important to understand if farmers are advised or supported in their agricultural production. If there is an agricultural extensionist related to Poak and how farmers perceive the implications this might have had for their agricultural production. Another important issue in these interviews is official subsidies. What kind of subsidies do farmers receive and are they related to specific crops, cropping systems or areas? As stated in the thematic context we expect that subsidies are related to intensively grown cash crops such as peppers. It is also expected that there is a negative correlation between of farm activities and time spent on shifting cultivation.

The eldest in the village

Interview themes:

- Agricultural systems in Krokong Gunung (KG)

- Use of NTFP and wild animals in KG
- Reasons for relocating the village
- Demographic data from KG compared to Poak today (number of households, Number of inhabitants, male/female, old/young, children.)
- Advantages and disadvantages of living in KG compared to Poak.

Reflection:

These should be men and women, preferably previous farmers or forest users. These key informants are important, as they are our only direct source of information about the time before and during the relocation of the village. All the present indicators on natural resource use such as agricultural systems, NTFP use etc. are to be compared with the information obtained in these interviews. Therefore much effort should be placed specifically on these interviews. If it is possible the data obtained will be followed up by personal observations on the old village area together with remote sensing indirect information from church books etc.

One of the inhabitants in Poak, with special knowledge on utilization of non-timber forest products (NTFP) and animal resources of the limestone forest.

Interview themes:

- Location of the different NTFP (Rattan, honey, bamboo, etc.)
- Which species of wild animals are hunted and what are the uses (consumption/sale)
- Change in game species and amounts (results from hunting)
- Tenure and management systems (local regulations)
- Constraints concerning extraction of NTFP and hunting
- Change in use of NTFP and hunting from KG to Poak
- Amounts for consumption and sale

Reflection:

This should especially be a person in charge or involved in birds nest collecting. Through this interview we wish to understand how the utilization of NFTP has developed over time. We expect that a use of a wide range of different forest products mainly for consumption within the household has changed into the extraction of a few products. Through this interview it should be assessed if a decline in the availability of each product has happened. The ecological and economic sustainability of these activities are to be assessed. The mayor NTFP in Poak are expected to be Birds nests, Rattan, Bamboo pods, Bamboo sticks, wild native vegetables, Insects, Honey (Jong, 2000), (Burgers, 1991) and (ILUNRM, 2004). We expect to find that off- farm activities and agricultural intensification are connected with the following factors in NTFP utilization:

- a narrowing of the diversity in NTFP used.
- an increase in the utilization of a few valuable products for commercial use.
- less NTFPs for private consumption within the household.

One person who has worked in the gold mines near Kpg. Poak

Interview themes:

- Locations of mines
- Location of mining waste
- Earning per workday
- Number of workers when the activity was at its highest.
- Number of workers from Poak
- Infrastructural benefits from mining (e.g. roads)
- Other benefits from mining such as sales of agricultural products to the mining industry
- Resource use in the mining (water, timber, gravel, food etc.)

Reflection:

It is not certain if there is such a person in Poak.
For the evaluation of the economic impact of past gold mining on Poak a former employee in the mines is expected to be the best informant. Other information such as deposit of mine waste and general procedures during the past mining activities might also give us a picture of the environmental impacts. Especially we need this information to proceed with water and soil sampling when probing for arsenic pollution.

Appendix 4: Common arsenic compounds

Name	Chemical formula
INORGANIC	
Trivalent	
Arsentrioxide	As_2O_3
Potassium arsenitt	$NaAsO_2$
Kaliumarsenitt	$KAsO_2$
Arsentrichloride	$AsCl_3$
Pentavalent	
Arsenpentoxide	As_2O_5
Arsenic acid	H_3AsO_4
Lead arsenate	$PbHAsO_4$
Calcium arsenate	$Ca_3(AsO_4)_2$
ORGANIC	
Trivalent	
Arsfenamin (Salvarsan) *	$(OH)_2(NH_2AsC6H_3)_2$
Arsenobetain *	$(CH_3)_3As^+CH_2COOH$
Arsenokolin *	$(CH_3)_3As^+CH_2CH_2OH$
Monometylarsenacid	$CH_3As(OH)_2$
Dimetylarsenacid (DMA)	$(CH_3)_2AsOH$
Pentavalent	
Arsanilacid	$NH_2C_6H_4$-$AsO(OH)_2$
Monometylarsenacid (MMA)	$CH_3AsO(OH)_2$
Dimetylarsenacid (DMA)	$(CH_3)_2AsOOH$
* *Name in Norwegian*	

Table 1: Common arsenic compounds (Modified after Olsen & Mørland 2004).

Appendix 5: Time schedule

Preliminary phase: This phase is where we visit Kpg. Poak for the first time. Here we will like to get an overview over the village and the surrounding area by conducting semi-structured interview and transect walks with headman. 1-2 days

Preparation/alteration phase: Where we return to Bau and make the final preparations including alterations needed for the return to Kpg. Poak.

Questionnaire phase: This is the first phase after we return to Kpg. Poak. We will here like to get different household to answer some questionnaires. These will give us an idea who we should interview and in what relation. 1-2 days.

Interview phase: Here we will conduct semi-structured interviews to gain information that is needed to analyse our different objectives. We might also be able to use the villager's local knowledge to help us in where we should conduct our field experiments. The interviews will take place over the most of our stay in Kpg. Poak.

Field experiments phase: Here we will conduct our soil and water analysis plus make the GPS measurements. 2-3 days

Follow-up interview phase: This phase might not be necessary but in case we under our field experiments or transect walks get some results that might not coincide with previous gained information. 1-2 days