LIVELIHOOD STRATEGIES IN TRINGGUS

Report as Requirement for the Course Interdisciplinary Land Use and Natural Resources Management

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Group 1, Tringgus:
Dennis Hansen
Jannie Smerup Nielsen
Ahmed Nur Osman

Supervisors:
Kristine Juul
Rikke Folving

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Abstract

Livelihood strategies include many different aspects of people's daily lives. To obtain a broader understanding of the reasons behind peoples planning of their everyday lives, various factors of importance were examined. In this report the analytical framework was used to conduct a research in Kpg. Tringgus in Sarawak, Borneo. The focus of the field research was put on four main elements. Three of the elements, resource use and dependency, population movement, and land use and agricultural production, were used as subtitles to be able to answer the overall element, livelihood strategy. The livelihood resources (natural, economic, human and social capital) were analysed to see the villagers' pursuit of different livelihood strategies (agricultural intensification or extensification, livelihood diversification and population movement). The main findings are characterized with a short fallow period for the agricultural fields and shifting cultivation and pursuit of other forms of economic stability through commuting or more permanent movement. The conclusion of people's livelihood strategies in Tringgus, points on intensification of their agriculture and diversification of pursuits of better livelihoods through population movement.

Keywords: Livelihood strategies, resource use and dependency, population movement, land use and agricultural production.

Introduction

In the seas of South-East Asia the island of Borneo is to be found. Borneo is the third largest island in the world and cover about 746000 square kilometres. The inland of Borneo is mainly covered with hilly rainforests which biodiversity is ranging from a unique animal wildlife too a diverse tropical vegetation. The climate of Borneo is wet, warm and humid, where temperatures are on average between 25-35 degree Celsius and annual rainfall between 2500 mm and 5000 mm, with heavy rainfalls in the monsoonal periods (King, 1993).

In Malaysia shifting cultivation is still being practiced in many areas despite economic growth. The government has viewed shifting cultivation as an obstacle to economic growth and attempts have been made to promote more permanent cropping schemes such as pepper, rubber, cocoa and vegetables (Hansen and Mertz, 2003).

South East Asia is characterised as a region where farming is one of the main sources of income and occupation. Malaysia is no different and Borneo especially (Hansen and Mertz, 2003). Things are changing though. Studies have showed that rural livelihood diversification into non-farm activities to a great extend is taking place in the region (Rigg, 1998). This is confirmed by other studies conducted on Malaysian Borneo (see Hansen and Mertz).

Tringgus is located on the Sarawak Karan River in the South Western part of Sarawak about 10 km from the Malaysian-Indonesian border. Through time the village has been located several different places in areas near the border. The latest movement was in 1982, when the government resettled the village further down the mountains so it would be easier to reach for the administration. Today the village consists of about 130 households administered by two headmen. The inhabitants of Tringgus are all Bidayuh people and most of them are in various extend engaged in agriculture, mainly hill rice shifting cultivation, but also other kinds of crops. A big part of the agricultural production is for own consumption but they also sell some of their products on local markets. The government has made attempts to make the farmers involve themselves in small scale commercial farming e.g. pepper and rubber but this has never been successful. Factors such as natural terrain, suitability of soil and floods are limiting factors to the development of the agriculture.
In Tringgus, like in the rest of Malaysia and Borneo, changes are occurring in relation to livelihood strategies. A fairly big part of the inhabitants in Tringgus (around 40 percent) are involved in population movements (commuting and migration), mainly because they are engaged in off-farm work. This may imply changes in resource use and dependency e.g. less labour is available for farming and income level is rising.

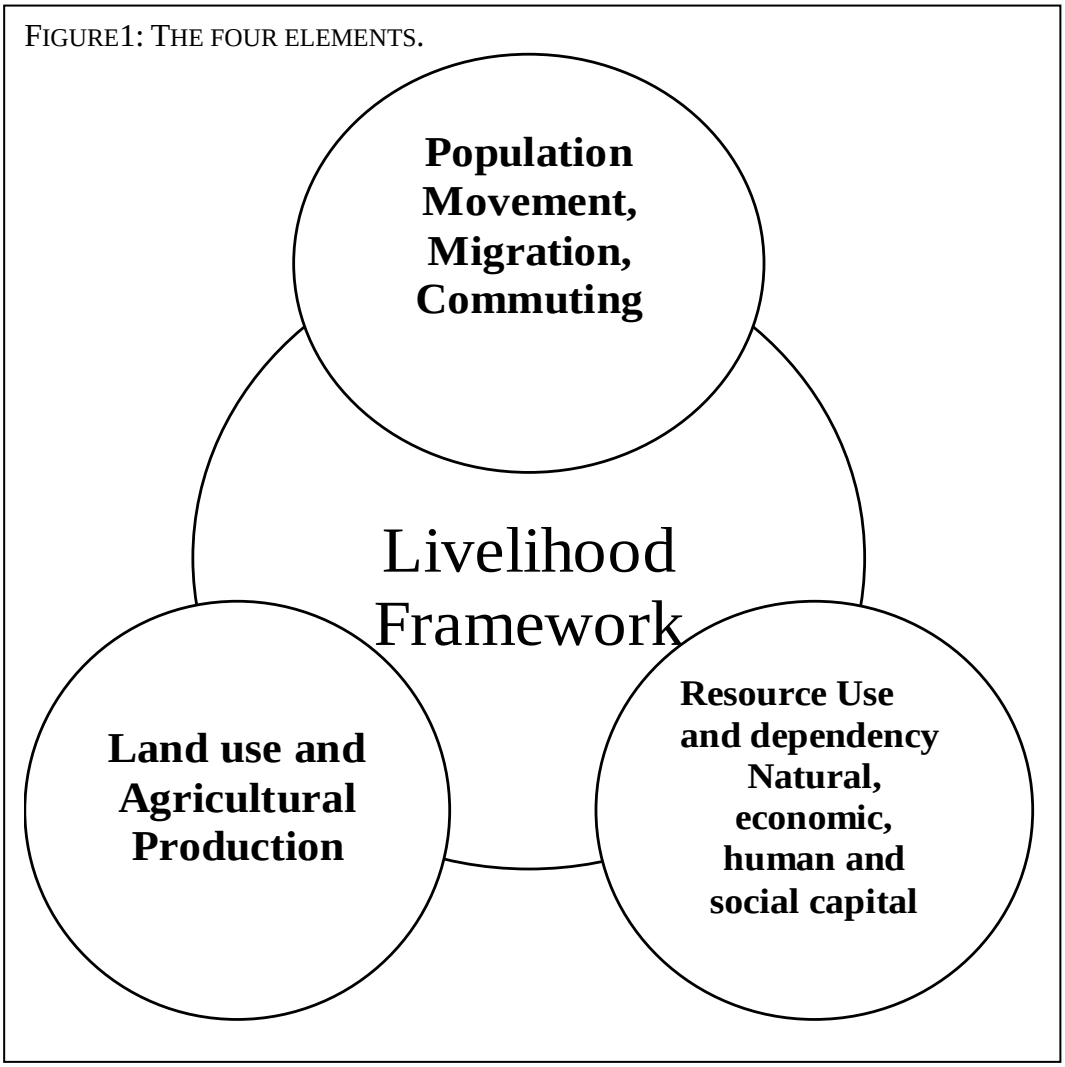
Overall task

Evaluate past, present and future effects of land use changes partly due to population movements/migration/commuting from Kpg. Tringgus on livelihood strategies, resource use/dependency and agricultural production. Assess the extent of tenure security of the Tringgus population and the impact of this on local investment strategies

The four elements

The overall task consists of different elements which are land use, population movement, livelihood strategies, resource use, agricultural production and tenure security. These elements affect each other in different ways. During discussions it became clear that the relationship between these were not likely causal. It seems that the different parts are connected in a more complex way.
To be able to understand the different elements and investigate them, the following figure 1 shows how we ended grouping them into more easily approached parts.

FIGURE1: THE FOUR ELEMENTS.



The IDS livelihood framework analysis (see later in this chapter) is the overall framework for analysis. The framework encompasses all the elements and is a way of understanding the complex relations between them.
One element has been changed after the field study. This was the element encompassing land use and tenure security. During the field study not enough evidence was found to prove that tenure security had any significant effect on the other elements in the framework. Furthermore it became clear that land use and agricultural production were closely related so the five elements were reduced to four.

Objectives and analysis strategy

Before the studies in field an investigation of all the elements were objectives in themselves. They still are but during discussions with the Malaysian students in the beginning of the field study, we ended up narrowing the focus down into three field study research objectives common and useful for all. The objectives agreed on are:

- To determine the factors that, influence the population movements in Tringgus.
- To determine the correlation between population movement patterns and agricultural activities.
- To identify the changes and consequences of population movement for the household.

The focus, of the above objectives, was on two of the previous five elements, agricultural production and population movement. This however does not mean that analyzing all the elements is not possible, because many of the methods used also implicit deals with resource use, land use and livelihood strategies. Equally all of it is still within the livelihood framework.
When analyzing and discussing the data collected during the field study the elements will form the structure. The data will be analyzed in three parts, in relation to resource use, in relation to land use and agricultural production and in relation to population movement. All the three parts will be analyzed and discussed in relation to the livelihood framework. Data will be presented when relevant, which means that the same data may be used more than once but be analyzed in relation to different elements.

Livelihood framework

The livelihood approach is a fairly new approach and encompasses many different objectives on an individual level, village level and on the broader socioeconomic structures of society. Due to the mosaic of different ways of approaching the framework it makes the definition, of what livelihood basically is, difficult. The definition used in this report will be that of the IDS team's presented by Ian Scoones:

"A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks maintain or enhance its capabilities and assets, while not undermining the natural resource base.", (Scoones, 1998).

Writings and research using the livelihood approach, livelihood strategies often are connected with the household. This will also be the scale of analysis in this report. There are some things though to be cautious about when doing that. The first thing is that sometimes the strategies of one person in the household are not the same as for the rest of the household. Jonathan Rigg points out this in his article from 1998, *"Rural-Urban interactions, agriculture and wealth"*.

The other thing to be cautious about is how to define a household. A household is most often referred to as a spatially defined unit. If then this spatially defined unit is

used as a unit of analysis then there is a danger, that it will fail to cover who are members of the household i.e. where the household begins and ends (Rigg, 1998). When using the household as a unit in the field study we defined it as the people who live under the same roof and sharing the same food but also include individuals who previously belonged to this household but are now living somewhere else, temporarily or permanently. We did this to be able to know the extent of population movement, which includes people who do not live in Tringgus anymore.

In relation to our assignment, Rigg has some interesting observations that are an inspiration to our study. The article focuses among other things on rural people's movements back and forth between villages and cities mainly to work. This he terms occupational diversity. Rigg explains that recent studies show that there are three main strategies behind occupational diversity and that these often are connected to wealth. For the poor rural people occupational diversity is a strategy of survival, for the middle income people it is a strategy for consolidation and for the rich rural people it is a strategy for further accumulation.

Rigg also discusses which effects this rural-urban interaction has on the agriculture. This is very relevant for our study that focuses on people's movements and land use changes. According to Rigg off-farm work has an important effect on agricultural methods and production. It has consequences for labour availability, for cultivation practices, for time available for farm work and for use of mechanic tools (Rigg, 1998). If changes have happened, it can be viewed as if changes have occurred in the household's livelihood strategies.

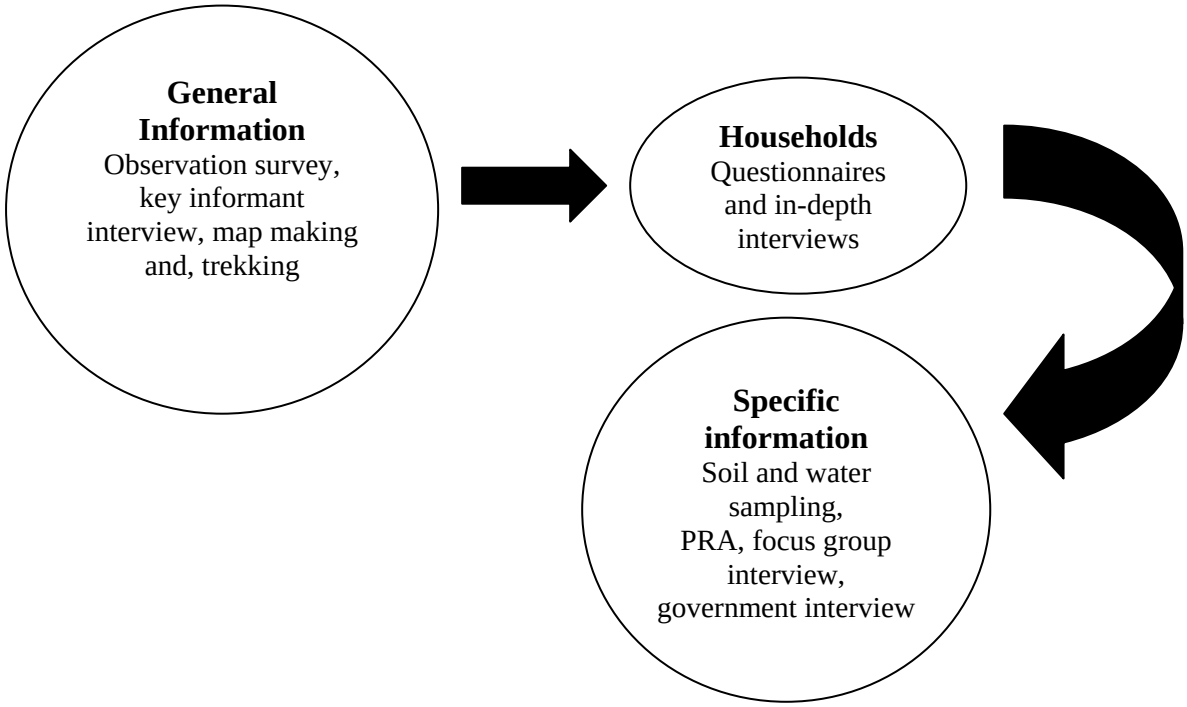
As described previously the livelihood approach will be used as an analytical framework. The analytical framework in this report is based on the sustainable rural livelihood framework presented by Ian Scoones (see appendix 4). The framework is used for analyzing sustainable livelihoods and this is done through five indicators; context, livelihood resources, institutions and organisations, livelihood strategies and sustainable livelihood outcomes. The livelihoods are achieved in different contexts through different strategies (agricultural intensification/extensification, livelihood diversification and migration). These strategies are achieved through access to a range of resources (capitals) and the livelihood outcomes are influenced by institutions and organisations (Scoones, 1998).

It will not be within the scope of this report to investigate every aspect described in this framework and focus will not be placed equally on every aspect. The focus will be especially on livelihood resources and livelihood strategies. By this we do not underestimate the importance of the other indicators; context and institutions and organisations, it was just not easy to cover all within our time limit. Because of this the main objective will not be to assess the sustainability of the livelihoods found in Tringgus. Instead the framework offers a possibility of understanding the complex relations between the different elements investigated in this report and a possibility to learn how they affect each other. This will be the main focus in this report.

Methodology and Discussion

This study covers a period of fourteen days, from 10th January to 24th January 2005. The group has assessed the research in three main ways (see figure 2) using primary data collection and secondary data collection to be able to collect information, describe and analyse the village livelihood strategies through our overall elements; population movement, land use and agricultural production and resource use. The first two weeks of this study was utilized to fraternize with the villagers by doing observation survey, key informant interviews, map-making, Participatory Rural Appraisal (PRA), household interviews (questionnaires) and also further in-depth interviews for either chosen or randomly selected households, soil sampling and water sampling. The secondary data collection it was gathered from interviews with the government agency, science literature and national institutions.
The following chapter is divided according to what kinds of information the different methods provide us with. These are general information on village level, information about individual households and information about more specific topics such as crops, labour allocation and water quality.

FIGURE 2: THE THREE MAIN WAYS OF INFORMATION COLLECTION.



Doing interdisciplinary research

The field course is interdisciplinary which contribute to a more holistic understanding of the complex relationships, which characterise the natural resource management and environmental field of study. As well as this gave us many new and good experiences it also proved to be a challenge both in relation to doing interdisciplinary research and in relation to the corporation with the Malaysian counterparts.
When doing interdisciplinary research within a limited timeframe it is necessary to make compromises but importantly to do it without reducing the validity and

reliability of the results. In the field study it was often not possible to make extensive and detailed studies of all the areas of interest. The most relevant issues had to be picked out and the most effective way of investigating them had to be decided. Both Malaysian and Danish students made these considerations before the field study and all though we had established a general consensus, about which areas was to be studied, disagreements showed up as we went along in the field study. We approached the issues as they showed up and tried to reach a common solution but a few times we did not succeed. This was especially an issue when we talked about which methods to conduct. The aquatic life survey for example was never really agreed upon but it turned out to provide some useful information.
The issue of people from different schools of science meeting (science and social science) also proved to be a challenge. Different opinions on the use of qualitative versus quantitative methods sometimes caused vivid discussions but never any hard feelings. A very big advantage, when working together with the Malaysian students, was that they had a lot of knowledge about local conditions. Many of them are working in government offices that are related to environmental and agricultural development. This was for example very useful when making decisions about relevant focus areas. In general the experience of working together across disciplines and across cultural barriers was a very valuable.

General Information methods

It was central to conduct both observation surveys/walks and key informant interview (Mikkelsen, 1995), with the intention of obtaining general information of the village and recent changes. The methods were conducted during the first days of the field study to provide us with basic knowledge of Tringgus.

Observation survey

The purpose of the observation surveys was to get a general overview of the village infrastructure, facilities and to make acquaintances with the inhabitants of Tringgus and their daily lives. These observation walks was initially planned as transect walks with selected households. But through discussions with our Malaysian counterparts and simply arriving there, it seemed logically that we had to make some simple observations of the area by our selves. Besides it appeared reasonable that this was one of the first methods conducted, so that overall knowledge could be generated.

Key informant interview

Moreover was the key informant interview important to obtain background knowledge of the village history, activities and the general trends in the village. In the synopsis prepared before the field study it was argued that the key informant interview was going to be used for selecting households for the questionnaire survey. During discussions with the Malaysian counterparts this aim was changed because of the bias that the headman

PICTURE 1: KEY INFORMANT INTERVIEW.

might represent. Carrying out the key informant interview (Picture 1) did not go as expected though. Headman Mr. Toe was invited but besides him 20 other people showed up. These were members of the village committee JKKK. This was of course a good opportunity to get a lot of information; however the situation was not what we had prepared for and therefore it was not taken fully advantage of. For example the villagers could have been divided into smaller groups this would have made it easier to involve everyone in the discussions. The interview went on for about 45 minutes and despite the unexpected situation, the information we were seeking, were more or less obtained.

Preliminary map

The information the two methods described above provided was needful for our preliminary map making (see appendix 5). Intentionally the map making was a procedure to be conducted together with a key informant person such as the headman. It was furthermore originally meant as an indication of wealth or social status of village households. But through discussion and also the already conducted interview with the key informant, we learned that the villagers were reluctant to talk about the social or economic status of different villagers. Therefore the procedure was changed to be a secondary data map, which was provided by a government institution in Bau. The basic information for the map making, such as the location of the infrastructure, houses and the boundaries for the three parts of Tringgus, was conducted through a walk around the village together with a JKKK member. The information that we now wanted from the map was an illustration of the position of the different parts of Tringgus (Nguan, Rotan and Bong) and the number of households. It was furthermore useful as a guiding map around the village.

Further general information was gathered to be able to produce a comprehensive description of the villagers' livelihood strategies. The methods used was seasonal calendar, preference matrix and problem ranking, these methods are also called participatory appraisal approaches (PRA's).

Trekking

In the hilly surroundings of Tringgus a trekking was planned. The idea with the trekking was to find a waterfall, which could function as a trekking point for future eco-tourist. The intention was to look into future possible diversified livelihood strategies, an extra income possibility for the inhabitants. The trek was measured in GPS, for the purpose of making a map overview of the trekking way and the distance to the water fall. The problem we experience during the trek was the difficulties in making GPS waypoints on the way due to dense vegetation cover (see appendix 6).

Households

This part was essential for the whole report due to the combination of quantitative and qualitative measures of our four elements.
The focus was on household level and we defined a household as the people who live under the same roof and share the same food but also include individuals who previously belonged to this household but are now living somewhere else, temporarily or permanently. We did this to be able to know the extent of population movement, which includes people who do not live in Tringgus anymore.

Questionnaire

The questionnaire survey was chosen as part of the methodology in the field study because it is a good way of collecting original data for describing a population that is too big to observe (Babbie, 2002). Through discussion with our counterparts the questionnaire was made (see appendix 7). The questionnaire consisted of the following themes; basic background, family profile (age, education, occupation), population movement, land use and limitations, market and household income. These themes were important to be able to construct a quantified estimation of relevant information about all our four elements.

The first part of our sampling strategy was systematic. Through calculation of how many households from each of Tringgus' three parts were to be interviewed to make it representative for the whole village. In all 36 households were to be selected. The households were thereafter randomly selected from a list of household heads (provided by the headman).

The questionnaire consisted of 26 closed-ended questions, which made it easier to process in the SPSS software program. Furthermore were it tested three times on our kitchen staff. Even though tested some of the questions created some problems which will be taken into consideration when using the results
The questionnaire survey more or less confirmed what we assumed e.g. about the villagers' involvement in population movements, agriculture and economic issues and was possible to use the information obtained in the questionnaire survey in other methods like the semi-structured interviews and the focus group interview.

Semi-structured in-depth interview

Following the questionnaire it was relevant to look further into the themes. The reasons for choosing a semi-structured in-depth interview (Gillham, 2000) were that we wanted to get in-depth information, than what a quantitative questionnaire could give us, about all the elements of our assignment. This we did by asking questions concerning land availability, soil fertility, income, aquatic life, marketing and perception of livelihood and movement. It was also the intention that the interviewed persons would be able to tell about their opinions and changes of the elements/livelihood strategies that might have taken place during the last years. After discussions with our Malaysian counterparts and reflections of the conducted questionnaires, some quantitative questions were added more specific issues (income and aquatic life).
Intentionally we wanted to select 5 households from the questionnaires, which would live up to our criteria's of different degree of population movement or wealth, but this

was changed through discussions concerning which kinds of information we wanted from the in-depth interviews (see appendix 8 for the questions asked and answers). Instead the sampling strategy was focused on random selection (but still chosen among the households which participated in the questionnaire). This turned out to create difficulties in drawing comparison between our questionnaire and this method. The selection of the households became a more general survey of in-depth information and not for specific households from a questionnaire. We also chose one person that we knew were not living in Tringgus on a daily basis, but who was commuting weekly to and from Kuching. This interview was decided due to the importance of talking to someone who is involved in population movement.

Overall the two different interviews were informative, sometimes affirmative. But there were some general difficulties connected to the interview processes and the persons being interviewed. These were related to income and problems in general, which they were not very willing to talk about, personal questions which related to family and language because some of the questions were not easy to translate. It was constructive and positive, for all the interviews that the interviews were created as semi-structured interviews, the interviewer experienced more flexibility and it made the atmosphere more relaxed between interviewer and interviewee.

Seasonal calendar

The only PRA we had planned in our synopsis was the seasonal calendar. The reasons for choosing this method were its ability to cover the villagers' livelihood strategies through their activity patterns. It can in addition also be an informative tool in identifying different contributions in terms of age which was of importance to us (Slocum *et al.*, 1995). The kind of information we wanted this method to provide us with, was the difference in activities between a young group (15-29) and an adult group (30-50) during a year (see picture 2).

PICTURE 2: THE TWO GROUPS.

The young group (students)

The adult group

The reason for choosing two groups was because the age difference might create different livelihood strategies in form of work, education, culture and traditions. We found it furthermore relevant to know the villagers' general activities throughout a year and the intensity of their work load.

In general the method was useful in telling us of the villagers' activities, both cultural and work wise, but also their opinion on the activities they found essential to spend their time on during a year, was valuable. We actually expected or hoped this method could provide us with information about the off-farm work periods. This did not happen to the extent we hopped for.

Preference matrix

Another of the PRA methods, the preference matrix (Selener *et al.*, 1999), was found to be a great tool for obtaining relevant information about the villagers' agricultural production and their reasons for growing several crops (see picture 3).The farmers' preferences were relevant for describing two of our main elements; Land Use and Agricultural Production and Resource Use and Dependency. What's more was the information's significance for analysing their livelihood strategies in terms of the two elements. Overall we obtained good information about the reasons for growing different kinds of crops. A problem though was that we did not get a complete understanding of every reason, so not all the information can be used in a later analysis.

PICTURE 3: PREFERENCE MATRIX.

Problem ranking

The third PRA method, the problem ranking (Selener *et al.*, 1999), was conducted to acquire important information of problems identified by the villagers. The reason for deciding upon this method was that it could give us a simple and concrete statement of the problems and at the same time in a ranked order. It was through discussion with our Malaysian counterparts that the ideas for conducting this PRA were rectified to be useful. The intention was then to assemble the villagers' (see picture 4) most central problem issues, which could be used as a comparison with our assignment. We expected some of the issues to be related to resource and dependency besides this problems related to land use and agriculture could also be interesting for us. Most of the problems were not related to this but this was also valuable information

PICTURE 4: PROBLEM RANKING.

Focus group

One of the last days of the field study, an unplanned focus group interview (Mikkelsen, 1995), with some young girls from the village was carried out. The girls all attain secondary school in Bau. The idea of making an interview with some of the young people in Tringgus had previously been discussed in our synopsis, but merely with farmers and not youngsters. Therefore the opportunity would be a good way of learning about their thoughts of the future, so this was to be the topic for the interview (see picture 5). Genuine discussions between the interviewed persons were not fully obtained due to the lack of planning and language barriers. Only two Danish students conducted the interview and the girls only knew little English. The situation taken into account the information gained from the focus group interview were moderate. The new knowledge was applicable for describing the youngster future livelihood strategies, and furthermore the reasons for movement.

PICTURE 5: FOCUS GROUP.

A generally good thing with the PRA methods were the possibility in gave the participants to sit and discuss together, without interference from us, except when they wanted it. Thereby it only became their opinion without our misguiding voices. Another advantage was that the participants had to be active, where they for example had to make a large scheme and work together. This appeared to create a stress-free environment and they relaxed more. To some extent it also strengthens the collaboration between us and the villagers, which might have been due the more relaxed atmosphere. They seemed more talkative after they participated. When reflecting on this it might have been a good idea to have conducted the PRA as one of the first methods to make the villagers feel more comfortable talking to us.

Government interview

Further general information was conducted through a semi-structured interview (Gillham, 2000) with the head of the Department of Agriculture in Bau. The motivation for this interview was to hear the government's plans with Tringgus and furthermore to learn of other agricultural policies related to the farmers in Tringgus such as subsidization and educational schemes (see appendix 9). This information was relevant to know due to the farmers' agricultural situation. Do they learn about farming from the official institutions and do the farmers' get subsidization, which thereby could be a reason for choosing certain crops. It was moreover the expectation to attain relevant information about the institutional and organisational structures of governmental offices due to the possible influence from official side on farmers.

Specific information

As mentioned in the introduction agricultural intensification is a part of livelihood strategies. Intensification usually brings about land degradation. Therefore, it was seen relevant to assess land degradation and water quality parameters that are related to soil erosion. This was done in order to find information regarding if the option of agricultural intensification was leading to soil depletion and erosion. Assessing land degradation is a complex undertaking and erosion research is a capital-intensive and time consuming exercise. It had been an option to create a baseline description from primary data gathered but due to limited time framework in this field study, precise assessment on soil erosion that leads to recommendations on certain preventive measures became impracticable. Here the attempt was to get general information on land quality. Factors that influence land degradation were observed from different angles thereby mixing some of quantitative approaches of natural sciences and as well as qualitative approaches of social sciences. As such, only limited actual soil and river water sampling were performed. These scientific data were incorporated with informal interviews with few farmers in the fields and PRA techniques exercised with the villagers. What was planned to be obtained was a cursory baseline and a general overview of the following:

Soil samples, Characteristics of sampled sites, Present land use, General topography, slope, soil depth and risk of erosion, Cropping and conservation practices, River water analysis (TSS and Turbidity)

Agronomic field observations related to cropping and use of soil conservation measures were also carried out. Turbidity and Total Solid Suspension of the river water were also tested to detect sediment flows into the river due to possible erosion hazards (see Water Quality Assessment).
Soil parameters in this study though are not sufficient enough for erosion assessment. Nutrients can be lost through myriads of ways. Therefore, parameters are useful just get information about the general fertility of the soil. Soil depth and infiltration rate which were more closely related to run-off erosion were not included in the study due to time limitation. However, soil depth was measured during the sample collection just as a rule of thump.

Soil Sample Site Selection

For soil-samples the parameters analyzed concerned the levels of nutrition for plant growth, physical characteristics of soil such as texture and structure. The attempt was illuminate whether certain farming patterns and changes were depleting the soil. As such, selection of 8 sample sites was based on land use to cover representative fields for different crops. An attempt was made to minimize the effect of variables other than land use. A land Class II with certain characteristics such as limitations and slope was selected according to Sarawak Land Capacity and Classification. It was assumed that soils of this class were the same level of quality before it was used or before the primary/secondary forest was cleared for cultivation. Any change in the quality of the soil was attributed to land uses. The table (see appendix 10) shows the general characteristics of sampled sites.
Apart from time limitations and pressures encountered during the field study, there have been also limitations and difficulties in sample site selection. This was mainly due to nature of the land. In general, cultivable land was too limited due to slope and

topography. Additionally due to time limitation in the field work it was difficult to find sufficient number of farmers, in time, to be interviewed

Soil Analysis and Equipments Used

Soil analysis is performed to determine the chemical and mineral composition of soil with respect to its ability to support vegetation and as guide to systematic classification of soils based on their physical and chemical properties. There are two kinds of soil test which explains as follow; Regular soil test where soil is analyzed for macro nutrients and micro nutrients (N, P, K, S, Ca, Mg and their concentration). In addition, electrical conductivity is measured to determine the level of soluble salts. Soil pH and a buffer pH are measured to determine a lime requirement. Complete soil test include the regular soil test plus the concentration of iron, copper, zinc and manganese. Boron level can be determined for an additional charge.
In this project, only regular soil tests were carried out to trace the fertility of the soil for small cultivation in Tringgus.

Water Quality Assessment Methods

The quality of water sample taken from four different location of Sg. Pedi river of Tringgus was assessed by in-situ measurement while some of the sample was grabbed for laboratory analysis. Water quality parameters and methods and equipments of analysis are briefly highlighted here.
The water sampling and *in-situ* testing exercise were conducted during the field trip. Grab samples were obtained, preserved for laboratory analysis on other relevant water quality parameters. The table 1 and appendix 16 briefly shows Surface Water Quality Parameters, units and methods used fro test and analysis.

TABLE 1: PARAMETERS, UNITS AND METHODS TO ANALYSE THE WATER SAMPLES.

	Parameter	**Unit**		**Method of Analysis**
1	pH	-	In-situ	YSI pH meter
2	DO	mg/l	In-situ	YSI-55 or Hydro lab Surveyor MK-II
3	BOD^5	mg/l	Lab	5 day analysis
4	TSS	mg/l	Lab	Lab analysis
5	Turbidity	NTU	In-situ	Hydro lab Surveyor MK-II
6	Nitrate-N	mg/l	Lab	HACH DR/4000 Method 2515, LR
7	Phosphate	mg/l	Lab	HACH DR/4000 Method 3025

Water quality parameters mentioned above are all related to and have effect on aquatic life in the river water. Any negative effect imposed on aquatic life by these water quality parameters will have impact on use of river water resources. Turbidity and Total Solid suspension, apart from their effects in aquatic life, are also indicators for sediment flow resulting from soil erosion into the river water. Therefore, their study is asset to get basic information on resources use in Tringgus.

Four sites were selected for water sampling based on the up and down stream, tributes and original gravity water supply. As river water is considered to be homogeneous, one sample was collected from each location. GPS was used to identify sampled points. Appendix 5 shows the points for the water samples.

River Water Quality

Available water quality data at national level was used to qualify river water in term community use and aquatic life. The results obtained from in situ and ex situ analysis were compared to National Water Quality Standards (NWQS) data, Class I and Class IIA.

All the parameters of water were related to the use of river water and their suitability to the aquatic life. Only two parameter parameters namely Turbidity and Total Solid Suspension are relation to soil erosion. Moreover, Turbidity measurement is based on the concept that the greater the amount of suspended material, the greater the light scattering and the higher the turbidity. The light-scattering particles may be both organic (e.g., algae and other plant or animal debris) or inorganic (e.g., fine silts or clays). Therefore, higher Turbidity of river water as evidence of erosion could be weak unless it is combined with other parameters of study. The rest of parameters may be helpful while discussing the use of water resources in the other parts of the report.

ANALYSIS AND DISCUSSION OF THE RESULTS

In this section of the report the results obtained through the use of different methods are presented, discussed and analysed in the light of the context described in the introduction section and questions raised in the synopsis (see appendix 17). The structure outlined in the introduction will be adopted. As such, there are three parts in this subsection namely resources use, land use and agricultural production, and population movement (migration and commuting).

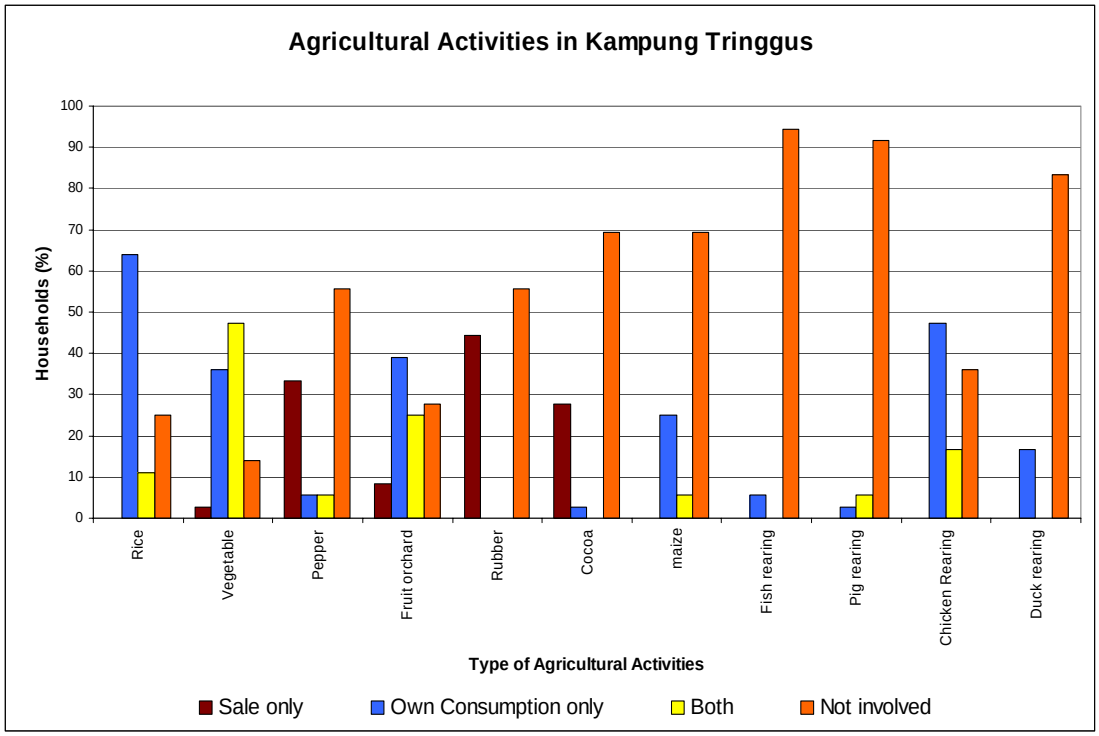
Resource use and dependency

Within the livelihood resources element of the analytical framework are natural, economic, human and social resources. In this subsection the use and dependency of these resources will be analysed and discussed.

Natural capital

Information regarding land resources and crops is covered in the land use and agricultural production part of this report. Here, dependency and use of agricultural products are discussed. The figure 3 shows different products, their dependency and use. Preference matrix (see appendix 11) and questionnaire also show similar results. Apart from crops some households also rear chicken, ducks and pigs. Very few depend on fishing. Households varied in production and use of different products.

FIGURE 3: AGRICULTURAL ACTIVITIES IN KPG. TRINGGUS MEASURED IN PERCENT AND WITH FOUR CATEGORIES; SALE, OWN CONSUMPTION, BOTH AND NOT INVOLVED.



As shown in figure 3, for instance, about 65% of households surveyed produced rice for own consumption while 25% are not rice producers at all. The rest are producing surplus for the market. The head of the Department of Agriculture, pointed out in the interview that farmers produce rice as a symbol of cultural heritage. Exercise of seasonal calendar (see appendix 12) with the villagers revealed that villagers also use timber as firewood or sell it in town and gather forest products such as leaves for house roofs (see picture 6). They also hunt wild animals, mostly pig and deer for direct household consumption and sometimes for selling when price is high.

PICTURE 6: LEAVES FOR HOUSE ROOFS.

It was observed, during the study, that the villagers depended on gravity feed water for drinking purpose while they used river water for cleaning purposes. Appendix 13 shows the results of water quality analysis. Water samples W1, W2 and W2, which are river water samples, indicated that river water is not fit for drinking due high level of TSS and turbidity (indicators of sediments and other suspensions in the water) and high levels of Fecal Cliform Content (FCC), which are harmful bacteria to human beings. The gravity feed water W1 which villagers use for drinking purpose require treatment according to National Water Quality Standards for Malaysia (NWQS).

Observation survey and in-depth interview with villagers revealed that fish was reduced in both population and size. River water analysis show that and Biochemical Oxygen Demand (BOD), Turbidity and Total Solid Suspension are significantly higher, above the normal range required. Such significance of these water quality parameters has negative impacts on aquatic life. The picture 7 shows different fish types and their respective local name and size. While collecting and taking the snaps fishermen informed that the types of fishes were plenty and number and large in size before 1995. This is also confirmed in the semi-structured interviews where respondents also stated that fish size and population is decreasing. This may be due to deterioration of quality of water. This

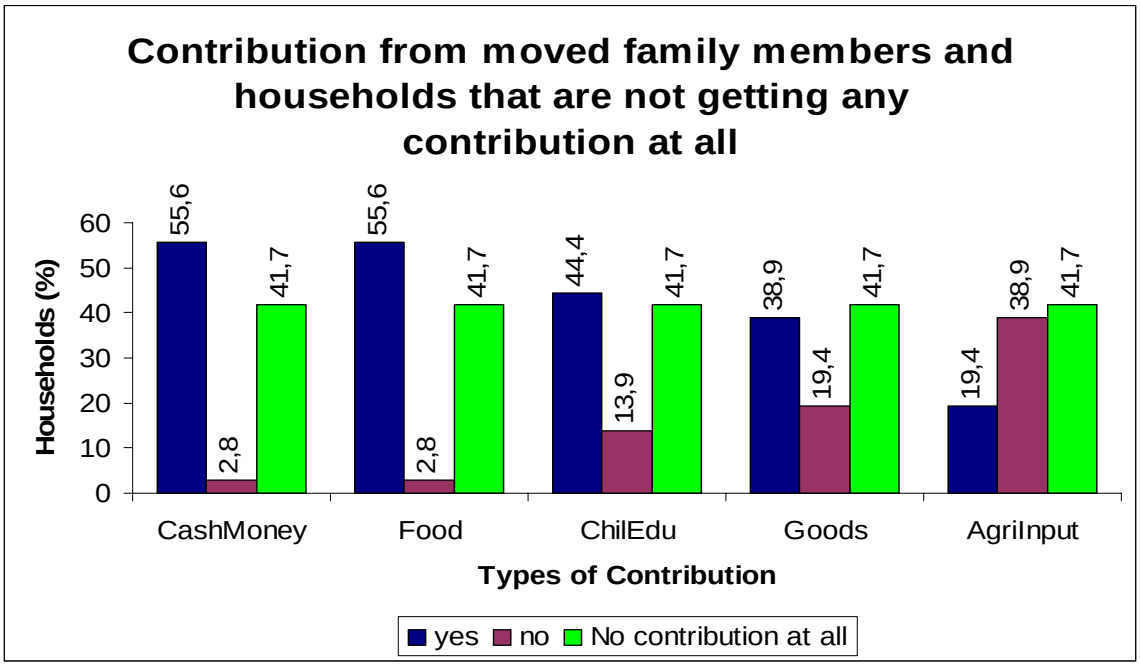
PICTURE 7: FISH TYPES.

may result in changes in the livelihood strategy to the few villagers who partially depended on fishing.

Economic capital

The villagers were reluctant to talk about their economic status, particularly income or cash. When it comes to talking about expenditures, they were quite open. However, the contributions from family members, who migrated or commuted, played a large role for the different households' livelihood. Results from questionnaires show, where figure 4 that more than 50 % of all households surveyed got different kinds of contributions from moved members. These contributions can be cash, food, and educational items for the children, other goods and agricultural inputs. The main

FIGURE 4: CONTRIBUTION AND NO CONTRIBUTION FROM MOVED HOUSEHOLD MEMBERS.



contributions were cash and food, where 55,6 % of the households asked said that they received cash and food, where only 2,8 % received contributions other than cash and food. A very small amount of these contributions (20 %) are invested in agriculture. This dependency on contributions from commuting or moved household members is an indicator of low income status. The indication was confirmed in the problem ranking (see appendix 14). Variation in income level could be visible in village housing which differed in building material. Some households were obviously owned by well-to-do-people in terms of income while others were built with bamboo and other forest products. When the headman was asked who is rich, the answer was that those who possess concrete houses and vehicles are rich. People who have cars were few.

The infrastructure and facilities (see appendix 5) in Tringgus consisted of the village public buildings such as the church, kindergarten, primary school, community hall and flying doctor clinic. A tarred road was running between Nguan and Rotan parts of the village (the black thick line on the map layout) while the road that leads outside Tringgus was a gravel road. The village electricity was supplied from a generator

provided by the government. This generator was switched off most of the time except four hours a day in the evening. The findings from the problem ranking and the questionnaire survey revealed that the villagers see the facilities and infrastructure as the main village problems. Electricity supply, for instance, was ranked as number one in the problem ranking exercise. This problem could be a reason behind young people's willingness to move to areas where electricity is constant. In addition, this lack of electricity power creates difficulties in storing food for even shorter periods of time. Transportation was also mentioned as a large problem especially transportation for agricultural products.

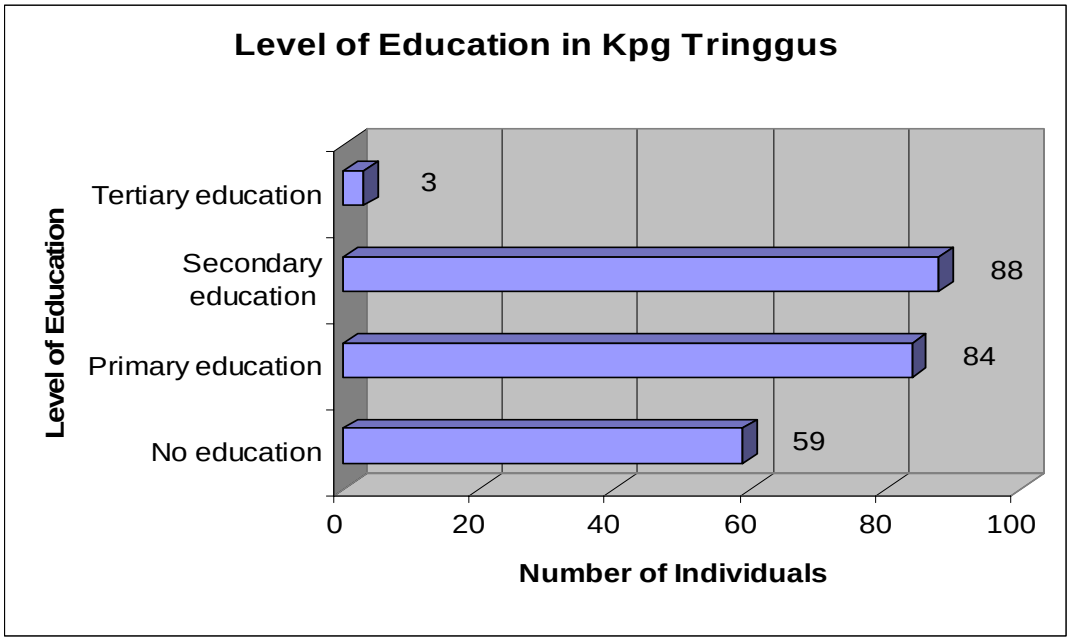
The production equipments and technologies used in pursuit of their livelihood strategies were mainly traditional tools for the agricultural production. These tools were according to the questionnaire survey and the observation survey, for example handcrafted tools (see picture 8), which were used for drying different crops, and bags for carrying seeds and knifes or machetes. Some modern tools where used such as plastic containers for distributing herbicides or other chemicals. The seasonal calendar also showed that the villagers have an annual period *'Tanjuk'* where they are making platforms for processing paddies and drying processes as seen on the picture. Other techniques and equipments were used for fishing (see appendix 15). These ways of fishing has changed in the last 10 years, where the fishing equipments used 10 years ago were rod line or bare hands. But now the techniques and equipments have been altered dramatically, explosives have been introduced, but also more efficient fishing ways and tools such as fishing nets and guns. These new ways and tools may eventually have changed the fish population due to over fishing and efficiency, which thereby change the livelihood of the fishermen/women to focus on other areas of income.

PICTURE 8: HANDCRAFTED TOOLS.

Human capital

The findings from the 36 household questionnaires (see figure 5 on next page) showed the human educational resource level to be mainly in the middle and lower parts of education. This means that the household members in general have either secondary or primary or no education level at all, and that a very little fraction of the members of the households has a higher level of education.

FIGURE 5: EDUCATIONAL LEVEL IN TRINGGUS.



The relationship between education level, age and population movements is discussed in population movement section of this report. This indicates that different levels of education generate different pursuits of livelihood strategies, where some want to farm the land others want to work in other areas. This is exactly what the seasonal calendar (see appendix 12) for the young group indicates when it shows that the young people throughout a year are working in off-farm areas such as assistants in shops or assistants in mechanical shops, even if this mainly is done in their school holidays. Furthermore it can also be said that a higher education may open doors to other jobs than farming.

Social capital

The dependency on the social networks (see appendix 11 and 12) seems to function, when the community works together in harvesting their fields. Besides this the villagers also work together in clearing the road paths to their fields and furthermore repair the water pipes three times a year and other activities. This labour sharing network is called *'Gotong-Royong'* and is a traditional term for coordinating the working together for example when they have to do harvesting, cleaning, preparing and repairing of farm areas and infrastructure in the village.

Another social resource is the young generation as the seasonal calendar showed. There seemed to be connections between elderly generations work habits and the young people's help with farm workload (seen from the young generation viewpoint). But as an elderly farmer said, "*Most youngsters are not interested in agricultural works. The impact is that farmers have to practice 'shared labour'. Therefore it has resulted in less concentration of manpower in own farm"*, so the reasons for sharing the labour could be seen as allocation of the young generation in educational institutions or their reluctance to participate in farming activities. The connections between the generations or their social relations seem to be changing, which is indicated by contributions send to household families, the young people's desire for a

future outside Tringgus and this groups' aversion against working in traditional working areas such as farming.

Although generational relations are changing, the villagers are trying to conserve their cultural heritage and traditional ways through their local competitions and festivals. Their local festival, also called *'Gawai Dayak'*, is a traditional Bidayuh harvest festival in June, where they celebrate and gives thanks to gods and spirits for the bounty of the land. All generations participate both in the preparations and the festival itself. Besides this arrangement they also have local football, where the football competitions are divided into female and male groups, *'Takraw'* (a football game mixed with volleyball, no hands) and river rafting competitions. These arrangements are both cultural and traditional related but at the same time they also make the social relations, networks stronger.

Part conclusion

The inhabitants of Tringgus are very much dependent on their natural resources through different agricultural activities, but at the same time the cultural and traditional way of living also plays a large role in choosing their agricultural strategy. Many of the villagers are dependent on the contributions from moved or commuting family members. The situation without contributions may not be life threatening, but their function as extra 'income' upholds a certain living standard. In general the extra income also supports the children's education and it seems as if the support of children's education is a strategy where the purpose is an investment in their old age through the future perspectives of family members that send contributions. The tendency points in the direction, where the children will either commute or move, which is indicated by the lower education the higher tendency to stay and the higher education the higher tendency to move. Through the social networks and relations the villagers have managed to maintain their agricultural activities through labour sharing, but also uphold a connection to the younger generation through traditional and cultural festivals and competitions. The livelihood strategies of the villagers is a mixed strategy of sustaining a certain way of living and trying to manage the younger generations need to try other ways of living.

Land Use and Agricultural Production

Although the contribution of the agriculture sector to the national economy has declined in recent years, and is gradually being overtaken by the industries sector, its role is still important in terms of food security, import substitution, reduction of a massive food import bill, and as a resources supplement to industry-based development. In fact, agriculture remains the largest single user of the country's land (Bakar, 2003). To preserve the status quo of the productivity of agricultural land a lot of efforts should be exerted to wisely manage forests and land under cultivation. Improper use of the land brings about rapid depletion of the suitable agricultural land and becomes a hindrance to sustainable production and use of land. This part of the study investigated the impact of different land uses on the productivity of agricultural land in Tringgus. Different methods were used to investigate the likelihood of erosion occurrence in the area under the study. These methods include questionnaires, interviews, PRA approaches, agronomic field observation, soil and river water quality analysis and use of available secondary data related to physical environmental factors

such as soil, relief and climate. Results obtained through these methods are cited below.

The available literature on land tenure in Malaysia reveals that land tenure in all Tringgus area comes under Native Customary Right (NCR) land. This information was later confirmed in the questionnaire survey and key informant interview which added that all villagers are small holders usually cultivating 4-5 acres and some of them have land of similar size outside Tringgus, under the same status (NCR). *"That is, land is not held under title but subject to Native Customary Rights"* (Cramb *et al*, 1990:352). So far as land use is concerned, it was observed that the land use around Tringgus can be divided into six main categories, namely; secondary forest, fruit trees, intercropped field crops, vegetables, spices (pepper) and land left for fallow. Primary forests are quite distant from Tringgus and are of little use due to the distance and natural terrains. Roots and tubers are also seen such as cassava and ginger though not plenty.

Secondary Forest

The secondary forest around Tringgus is mainly dominated Macaranga species, bamboo and pioneer species such as ferns. These secondary forests are usually located on steep slopes above 30 degree. Soil surface is usually covered by pioneer species and thus sheath erosion is quite minimized.

Fruit Trees

Large tree fruits mostly available in Tringgus are Durio, Langsium domesticum, Artocarpus elaticus, Cocoa, Rambutan (Nephelium lappaceum L.), Tampoi (Baccaurea angulata), jackfruit and Dabai (a native fruit of Sarawak harvested by local natives and sold it in the local market). Traditionally, the farmers in the area plant their fruit trees in the forest without clearing the primary forest. After full growth of fruit tree plantations, they start clearing some of forest tree plants near their fruit trees for space. Owing to this practice, the foresters in the area consider fruit fields in Tringgus as secondary forest.

There are also small fruits such as pineapple, papaya, and banana. There are no mono-cropped fruit fields in Tringgus. Most of these fruit tree species are usually intercropped. The slopes of the fruit fields are usually gentle not more than 20 degree. Besides the shadow of big trees, the soil surface is covered with pioneer species.

Filed Crops

Agronomic observations reveal that the main field crop grown in Tringgus is hill paddy rice usually intercropped with one or more of miscellaneous crops such as maize, cassava, banana and papaya. These intercrops are usually grown on gentle as well as steep slopes with poor canopy density. Soil is usually prone to sheath erosion during the rainfall. Very short fallow period is practiced but common and specific conservation measures such as rotations, cover crops, appropriate fertilizer applications, mulching, contouring, terracing, construction of silt ponds, and diversion drains are not in practice in field crops in Tringgus. The semi-structured interviews with villagers and key informant interview with the headman indicated that farmers believe that their land is fertile. They are not aware if land degradation result from their farming practices. This result is contradicting with the results from problem

ranking. Here, farmers complained that their land is not suitable for farming due to slopes and rocks and they revealed that they sensed low fertility in terms of low yields. It required investigation but it could be due to farmer difference in terms of what they grow and their experience.

Land having slopes of more than 20 degree is not recommended for field crops such as paddy rice. According to interview with the head of Department of Agriculture in Bau district, there is no way to improve paddy rice production in Tringgus due to the nature of land and its poor fertility. Farmers in Tringgus are growing hill rice for their traditional needs. The head of the department said that Bidayuh people relish their own traditional rice variety. Moreover, according to the preference matrix farmers' preference for paddy rice it is due to low capital input and labour input requirement, storage for future uses as food and fodder, and for family heritage (see appendix 11).

Vegetable Fields

There are two types of vegetables grown in Tringgus; namely fruit vegetables such as green beans and leafy vegetables such as kankong, called in English as swamp cabbage or water spinach although it is not really cabbage or spinach it is ubiquitous plant in Tringgus that grows everywhere, cultivated and uncultivated. These vegetables are usually grown in low land with shallow water table that are prone to flooding and in household gardens. Erosion hazard is eminent during high rainfall intensity and when the soil is bare before the full cover of vegetation is reached. On the basis of farmers' preference these vegetable are grown for household consumption, leisure time activity, family heritage, low capital and labour input, additional cash income.

Spices (Pepper)

Pepper berries grow on vines trained around hardwood posts (see picture 9). The glossy-leaved pepper plants, marching in regularly spaced rows up the hills are a very common sight in Sarawak. The bare soil in the inter-row space on steep slopes is visible from far distance hills and low lands around Tringgus. Taking these sights into account one can speculate the eminence of run-off erosion when the rainfall is its highest intensity. Lack of soil conservation practices pours oil into the flame. Farmers also revealed during the preference matrix exercise that they perceived low fertility in pepper fields, thus, requiring more fertilizer application. Despite the fact that the general appearance of pepper fields in Tringgus do not conform the measures of conservation agronomy, the Department of Agriculture in district recommended pepper for Tringgus. Perhaps there were other conservation packages

PICTURE 9: PEPPER FARM.

and fertilizer applications associated with the recommendations. Otherwise, these recommendations will end to failure. Farmers also prefer pepper to generate additional cash income. It can also be stored for profitable future market demands.

Fallow Land

Shifting cultivation is common practice in Tringgus. It is observed in that the fallow period is shorter usually 2-3 years with rare cases of six years. The land surrounding the villages is dominated by complex natural terrain with steep slope more than 30 degree. Secondary forests are usually located in this terrain. Although people of Tringgus have abundant land mainly primary and secondary forest with steep slopes, cultivable flat and gentle slopes land is limited and farmers practice recurrent shifting cultivation with short fallow periods. The soils of recently abandoned fallow land are bare and prone to erosion before it is fully covered by pioneer species. Shorter fallow time also worsens erosion hazards. Long existing fallow fields are usually covered by macaranga, bamboo, grasses and weeds.

Other Indicators for Eminent Erosion

Apart from improper use of land, lack of conservation measures, steep terrains and high rainfall intensity other indicators of erosion hazards are investigated in study. During the field work river water samples were collected to assess Total Solid Suspension (TSS) and Turbidity which are indicators of siltation of river water resulting from soil erosion. Soil samples were also taken to determine depletion of soil due to improper land uses. Results obtained in-situ and laboratory analysis are cited below.

River Water Analysis

Turbidity

A water quality measure that is related to suspended sediment is turbidity. This quantifies the degree to which light travelling through water is scattered by the suspended particles present. The greater amount of suspended material, the greater the light scattering and the higher the turbidity. The light-scattering particles may be both organic (e.g., algae and other plant or animal debris) or inorganic (e.g., fine silts or clays). Turbidity is measured in a special type of light meter, and is generally expressed in Nephelometric Turbidity Units (NTU).

Turbidity of river (Sg. Pedi) water was significantly higher in all the three samples taken from the river water. It was higher than the normal range of both Class I and Class II Malaysia's National Water Quality Standards (Appendix 13).

Total Solid Suspension (TSS)

Suspended solid levels in water are indicative of the presence of inorganic or organic particles or immiscible liquids. These materials are common constituents of water due to the erosive action of water flowing over soil surfaces and may include silt, clay, plant fibres and other organic materials.

Results of Total Solid Suspension are in agreement with that of Turbidity indicating flow of sediment into the river.

Land degradation

Before answering questions in the synopsis it is crucial to divide the land uses described above into categories based on vegetative cover and how soil surface is bare and more or less disturbed or its exposure to the risk of erosion. Accordingly, land uses in Tringgus can be divided into two categories;

1. Forest, fruit trees and fallow fields
2. Vegetable, hill paddy rice and pepper fields

Forest, fruit trees and fallow fields

In general, and as detailed above, this category was comparably less exposed to erosion risk because the soil surface was covered most of the time. Their highest exposure to erosion risk was when primary forests were first cleared for cultivation and before its re-growth to secondary one. Similarly, fruit fields might have been exposed to erosion risk, to some extend, at the time of clearing the original flora. Although fruit farmers in Tringgus cut the forest trees after their fruit trees reach full growth into big trees any disturbance of the soil during cutting of trees may bring about erosion risk when rainfall is its highest intensity. The same is true with fallow land left bare when the soil is already exhausted followed by erosive power of rainfall which then accelerated by slope. The shorter fallow periods usually 2-3 years can also be a hindrance to improving the productivity of the soil (see below). However, at the time of the field study the soil surface of these fields were protected by vegetative cover as mentioned in the results. Any exposure to erosion risk could have occurred in the past.

Vegetable, paddy rice and pepper fields

In this category, soil is more disturbed as it is involved in tillage seed bed preparation, in addition to the slope, as compared to the category discussed above. In vegetable (see picture 10) and paddy fields, soil surfaces are usually exposed in the period between harvesting and planting. Vegetables are usually sown in rows 20-30 cm apart on low land gardens that are prone to floods. Soils in the inter-row space are usually exposed. Coincidence of hill paddy fields with low canopy density and high rainfall intensity is common in Tringgus. More critical and deteriorating situation was observed in pepper field. Moreover, soil conservation measure is not in practice and public awareness on erosion risk is lacking.

PICTURE 10: VEGETABLE GARDEN.

River Water Quality and Soil Fertility

As detailed above, turbidity and total solid suspension of river water were significantly higher indicating that there is undermining run-off erosion. These sediments can be from both logging of forests and other cultivated fields. So far as the soil analysis is concerned, the laboratory results from Kuching are still awaited. Otherwise it could show how the soil is exhausted or not by different land uses.

Agricultural Intensification in Tringgus

As outlined by Ian Scoones (1998), within the sustainable livelihoods framework, three broad clusters of livelihood strategies are identified. These are: agricultural intensification/extensification, livelihood diversification and migration. In this subsection of the Discussion of Results, agricultural intensification in the study area will be discussed in relation to the results obtained. Agricultural intensification has been defined as 'increased average inputs of labour or capital on a smallholding, either cultivated land alone, or on cultivated and grazing land, for the purpose of increasing the value of output per hectare' (Carswell, 1997).

Although land tenure system in the study area gives lot of opportunity in terms of possessing land and there is no land shortage for general uses but availability of cultivable land or land suitable for crops such as paddy, vegetables and pepper is extremely limited due to the natural terrain. Farmers confirmed that in the problem ranking (Appendix 14). The shorter fallow period usually 2-3 years in the study area is a good indicator for the existence of land shortage. "*The less available land is per capita, the more intensively it must be used"* (Netting, 1993:264). "*Agricultural intensification can be measured by the increased inputs per unit of land, by the frequency of cultivation (reduced fallow), or by total factor productivity (TFP)", (*Carswell, 1997:4). The main input used for agricultural intensification was seen to be labour input. Hiring labour is not common in Tringgus but rather social resources are used and that is labour sharing network locally known as 'Gotong-Royong' (see resources use)

Data on population growth and land use change in the study area before and after Bidayuh people settled in Tringgus was not available but it can be predicted that some changes might have happened. Population density in relation to available cultivable land might have also resulted in shorter fallows. Nevertheless, shortening of fellow or intensification of agriculture and resulting land degradation are main issues in Malaysia. "*In the early years, shifting cultivation was regarded as relatively sustainable, due to a long fallow period of often more than 20 years. However, recently, with increased population pressures, the shifting cycle has shortened from 20 years to 15 years to less than three years, thereby reducing a fallow time which worsens erosion and accelerates river siltation",* (Bakar, 2003:233).

The present land use highlighted under "Land Use and Agricultural Production" which is intensification of agriculture sought as livelihood strategy by the villagers seems to be deteriorating the soil resource if conservation measures are not adopted. If this kind of land use is prolonged agricultural production would not only be reduced to a level that farmers would not be able to produce the least surplus for market but to a level that it could not cover the household direct consumption.

Part conclusion

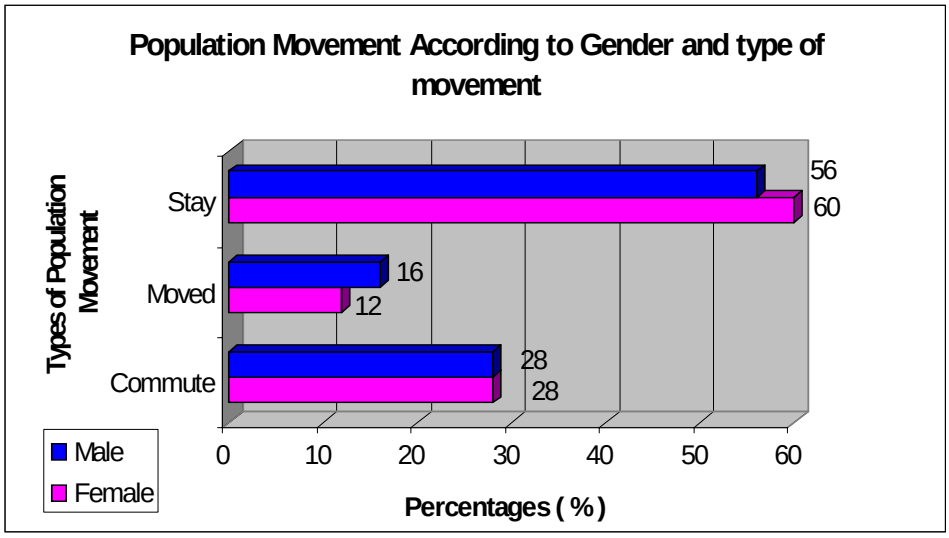
As mentioned in the results, a large part of agricultural production gained from hill paddy and vegetable goes to direct household consumption while pepper is mostly sold. Due the shortages in cultivable land and needs of food for household consumption people have to shorten fallow period and intensively use land. For intensification to occur an increased demand for output is usually necessary. If this intensification continues without soil conservation measures and restoration of soil fertility, as the situation of Tringgus, the sustainability of agricultural production dependency will be dim. In other word, if this option of agricultural intensification as a livelihood strategy fails then people will have to resort to other strategies such as livelihood diversification and migration (see below).

Population movement

One of the 4 elements that form the assignment is population movement, which is the focus of the following section. In the livelihood framework migration and livelihood diversification (in this report referred to as population movement) can be part of a household's livelihood strategy. In Tringgus our field study showed that population movements are part of many households' livelihood strategies. The first part of this analysis of population movements in Tringgus will present the general trend of population movement in Tringgus. The second part is an analysis of what factors effect the population movements in Tringgus and population movement in relation to livelihood strategies.

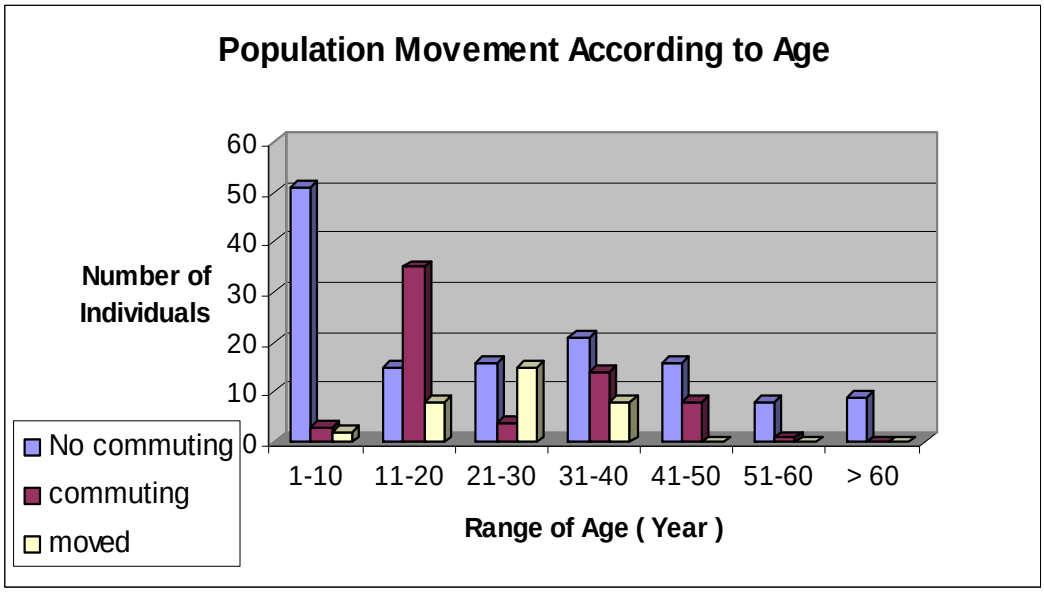
The questionnaire survey shows that a significant number of people (both male and female) in Tringgus (around 40 %) are involved in some kind of population movement and the difference between females and males are not very big. 28 % of the males and equally 28 % of females from the household sample commute. These numbers represent the total number of people, from the village, which commute daily, weekly and monthly. 16 % of the males and 12 % of the females in the household sample have migrated. A large number of people though stay in Tringgus, 60 % of the females and 56 % of the males, but note that these numbers represent all ages (see figure 6).

FIGURE 6: POPULATION MOVEMENT ACCORDING TO GENDER AND TYPE OF MOVEMENT.



When investigating further who is engaged in some kind of movement it becomes evident that this must effect most households. The questionnaire shows that a large number of the members from the household sample who are not engaged in population movement are children from the age of one to ten and older people from the age of 41 and above. It also shows that the high numbers of people commuting mainly are young people at the age of 11 to 20. The reason behind this is probably that the secondary school is a boarding school and is located close to Bau. The people from the sample who have migrated are mainly young and middle-aged adults, i.e. the group of people from the age of 11 to 40 (see figure 7). The people who are involved in population movements are thus mostly people of the working age, which is why population movement has an effect on the households.

FIGURE 7: DIFFERENT TYPES FOR POPULATION MOVEMENT ACCORDING TO AGE.



The questionnaire survey also showed more about which kind of people that are engaged in population movement by combining educational background and population movement (see figure 5). This reveals that in general it is people who completed at least primary school and especially those who have completed secondary school who migrate or commute.

It is evident that a significant part of the young and younger adults in Tringgus are involved in some kind of population movement. Livelihood diversification and migration is a way of coping when other options (such as agricultural intensification) fail to provide a livelihood. In fact the questionnaire showed that many households encourage members to take off-farm work. The first objective made during the field course deals with the question of which factors influence the population movements, therefore several of the methods carried out implicit and explicit deals with this question.

When asked in the semi structured interviews, the villagers all agree that they engage in off-farm work outside Tringgus because they want more income and more regular income than the agricultural activities can give them. Some engage in off-farm work when no farming activities are taking place, others abandoned agriculture completely.

The questionnaire showed that 64 % of the children of the household sample abandoned agriculture. One of the respondents from the semi-structured interview had abandoned farming. He works in Bau repairing electronic devices. He commutes every day and therefore he has no time to do agricultural activities. Others again do both agriculture and off-farm work at the same time. The interview with the Tringgus villager now living in Kuching showed that he works in a printer shop in Kuching in the weekdays and go back to Tringgus in the weekend to grow ginger which he sells on markets. The questionnaire also shows that in many households some members are engaged in off-farm work (often the oldest of the children) while others are still cultivating the land. The members who are engaged in off-farm work often contribute to the household consumption (see Resource section).

Several factors we will argue influence the population movement in Tringgus. The above shows that some experience that agricultural activities often are not enough to sustain the livelihood they wish. The interview with the head of Department of Agricultural for example indicated that paddy rice farming in Tringgus cannot be improved and that rubber production has been neglected. From the preference matrix it is also clear that there are not many preferences for growing commercial crops like pepper and rubber (see appendix 11). The questionnaire shows that they do sell other agricultural products (see figure 3) but this seems only to be at part of the villagers' livelihood diversification.
Another factor also related to agricultural production is evidence of land degradation (see Land Use section). Short fallow periods in Tringgus indicate that agricultural intensification is taking place in Tringgus. The intensification can cause land degradation. Furthermore the intensification indicates that there is a shortage of suitable land for agriculture. This can affect the villagers' ability to produce enough agricultural products, whether for sale or own consumption, to sustain the family livelihood. The agricultural intensification is a way of trying to provide a livelihood. If this strategy fails it will be necessary for the villagers to diversify their livelihoods by for example finding off-farm work, commute or migrate. Another way of coping with failure in agriculture or other parts of the villagers' livelihoods could be to seek other possibilities such as tourism. In the village surrounding areas, about 6 km in a straight line, one waterfall are situated (see appendix 6). Through arranging trekking to for example tourists, the villagers can vary their income possibilities and thereby diversify their livelihood strategy.

Another factor influencing population movement is education. There is a primary school in Tringgus and many young people attend secondary school in Bau. The questionnaire survey shows that 84 of the 234 members of the household sample finished primary school and 88 finished secondary school. The respondents from the semi-structured interviews indicated that especially the young do not have interest in agricultural activities and that they would rather engage in off-farm work. The focus group interview confirms this. The girls in the group all wished to engage in off-farm work after they finish their education. Most of them dreamed of becoming teachers one dreamed of being a lawyer and one dreamed of being a stewardess. The seasonal calendar that the young made showed that they do help with agricultural activities sometimes but it also revealed that in school holidays they engage in off-farm work outside Tringgus (see appendix 12). It is off course not only young students who wish to engage themselves in off-farm work or move away. As mentioned in the beginning

of this section the questionnaire showed that there is a correlation between who is involved in population movements and the level of education these people have.

Problems in the village related to facilities, seems to be another factor affecting the population movement. The problem ranking showed that of the 13 problems listed half of them are related to facilities in the village (see appendix 14). Not all can be said to directly influence population movement but especially electricity which is ranked as the biggest problem may have an effect. Electric supply is unstable and is only available in the evening, unless you buy your own generator. The young especially feels this is a problem along with the lack of telecommunication. The focus group interview confirms this. The girls from the interview said that they would like to live in Tringgus and commute to work, but as long as facilities like these are missing they would rather live in a bigger city like Bau. These facilities are not of a life sustaining character but they are an important part of the villagers' (maybe especially the young) wellbeing and therefore they are a factor affecting population movements.
The facilities may not only be constraining for the villagers so that they wish to move away, they can also positively affect population movements, especially commuting. Such a facility is the gravel road to Tringgus which was constructed in 1995. Before that the only way to get to e.g. Bau was by boat and that could take a day and during heavy rain it was not possible at all. Now that the road is there it opens up new possibilities. One of the respondents form the semi structured interview said that he commute daily using his motorcycle as transportation, another respondent said that her husband also commute every day. Through our observations we also saw that few people even own cars and it is likely that they commute to some extent. Through informal talks we learned that some of them work on construction sites outside Tringgus and that they do not commute daily all year round. Not all off course have their own transportation but the village has an unlicensed minibus which takes the villagers to and from Tringgus. The opportunity to especially commute has become bigger along with the new road.

Part conclusion

A fairly big part of the villagers in Tringgus, mainly young and young adults, are involved in some kind of population movement and especially those who have completed some level of education. This population movement is a part of the villagers' and households' livelihood strategy. When the agricultural production is no longer enough to provide the livelihood they want, livelihood diversification and migration becomes a way of coping with this. The fact that the young educate themselves is also a factor influencing the population movement. They would prefer to find an off-farm job rather than be involved in agriculture and by educating themselves they become more acquainted with the outside world and they have a better opportunity to find other jobs. The village facilities also seem to have an effect on the population movement. Lack of facilities such as stabile electricity supply and telecommunication make the villagers want to leave Tringgus or earn money to compensate for the lack of facilities by buying e.g. a generator. The newly constructed road also opens up new opportunities to find work outside Tringgus and still live in Tringgus.
These changing livelihood strategies are not only affected by the described factors they themselves also effect the life in Tringgus. Especially the distribution of labour is changing in favour of off-farm work leaving the agriculture with a shortage of labour

which can lead to changes in land use for example the described agricultural intensification which among other things is affected by availability of labour.

Conclusion

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We have drawn from published materials in our curriculum and other literatures. We have moreover drawn information from the villagers' in Kpg. Tringgus and their surroundings.

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APPENDIX 1: TIME SCHEDULE OF FIELDWORK FOR JANNIE

Date	Activity
9th of January	Delayed arriving in Kuching
10th of January	-Discussion about how to join our synopsis -planning next days work
11th of January	-Observation survey -key informant interview with headman (and representatives from local JKKK committee) -Preparation of presentation in Bau
12th of January	-Presentation in Bau -Discussion of comments on presentation
13th of January	-Discussion and designing questionnaire -Testing questionnaire on 4 persons (in small groups) -Discussing objectives and methods.
14th of January	-Discussing questionnaire and sampling strategy -Second test of questionnaire -Performing questionnaire interviews divided in groups of two -One group plans PRA methods
15th of January	-Finishing questionnaire interviews -PRA with villagers (not performed) -Discussion on work progress
16th of January	-Going to church -PRA with villagers -Evaluation of the PRA
17th of January	-Looking through results of PRA -Planning semi structured interview -Briefing on work progress
18th of January	-Soil sampling -Evaluating PRA -Preparing questions for head of Agricultural department
19th of January	-Doing semi structured interviews -One group preparing questions for Head of Agricultural office -Discussion of work process
20th of January	-Interview with Head of Agricultural office -Preparing presentation for 23rd -Focus group interview
21st of January	-Preparing presentation for 23 rd
22nd of January	-Villagers giving farewell party -Finishing presentation for 23 rd
23rd of January	-Leaving Kpg. Tringgus -Presentation at UNIMAS training centre, Bau -Farewell party in Puak and Skibang
24th of January	-Leaving for Kuching -Farewell party for teachers, Malaysian and Danish students
25th of January	-Visiting Chinese vegetable farm -Farewell party at Doctor Siti's house
26th of January	-Visiting Bidayuh villages and hot spring
27th of January	-Trying to arrange meeting with Agricultural department in Kuching
28th of January	-Interview with commuting Kpg. Tringgus villager -Kpg. Tringgus farewell dinner
29th of January	-Leaving Malaysia

APPENDIX 2: TIME SCHEDULE OF FIELDWORK FOR AHMED

Date	Activity
9th of January	Delayed arriving in Kuching
10th of January	-Discussion about how to join our synopsis -planning next days work
11th of January	-Observation walk -picking out soil sampling spots -Key informant interview with headman (and representatives from local JKKK committee) -Preparation of presentation in Bau
12th of January	-Presentation in Bau -Discussion of comments on presentation
13th of January	-Discussion and designing questionnaire -Testing questionnaire on 4 persons (in small groups) -Discussing objectives and methods
14th of January	-Discussing questionnaire and sampling strategy -Second test of questionnaire -Performing questionnaire interviews divided in groups of two -One group discusses soil sampling
15th of January	-Finishing questionnaire interviews -Taking water samples -Analysing water samples *in situ*
16th of January	-PRA with villagers -Evaluation of the PRA
17th of January	-One group looking through results of PRA -Briefing on work progress
18th of January	-Doing semi structured interviews -Soil sampling -Evaluating PRA
19th of January	-Preparing questions for Head of Agricultural office -One group going through the semi structured interviews
20th of January	-Interview with Head of Agricultural office -Preparing presentation for 23rd -Focus group interview
21st of January	-Trekking to old Kpg. Tringgus and waterfall
22nd of January	-Villagers giving farewell party -Finishing presentation for 23 rd
23rd of January	-Leaving Kpg. Tringgus -Presentation at UNIMAS training centre, Bau -Farewell party in Puak and Skibang
24th of January	-Taking present to the headmen in Kpg. Tringgus -Leaving for Kuching -Farewell party for teachers, Malaysian and Danish students
25th of January	-Visiting Chinese vegetable farm -Farewell party at Doctor Siti's house
26th of January	-Visiting Bidayuh villages and hot spring
27th of January	-Trying to arrange meeting with Agricultural department in Kuching
28th of January	-Interview with commuting Kpg. Tringgus villager -Kpg. Tringgus farewell dinner
29th of January	-Leaving Malaysia

APPENDIX 3: TIME SCHEDULE OF FIELDWORK FOR DENNIS

Date	Activity
9th of January	Delayed arriving in Kuching
10th of January	-Discussion about how to join our synopsis -planning next days work
11th of January	-Observation walk -picking out water sampling spots -Key informant interview with headman (and representatives from local JKKK committee) -Preparation of presentation in Bau
12th of January	-Presentation in Bau -Discussion of comments on presentation
13th of January	-Discussion and designing questionnaire -Testing questionnaire on 4 persons (in small groups) -Village mapping based on existing map -Discussing questionnaire
14th of January	-Discussing questionnaire and sampling strategy -Second test of questionnaire -Performing questionnaire interviews divided in groups of two
15th of January	-Finishing questionnaire interviews -PRA with villagers (not performed) -Briefing on work progress
16th of January	-Going to church -PRA with villagers -Evaluation of the PRA
17th of January	-Looking through results of questionnaire -Planning semi structured interview -Briefing on work progress
18th of January	-Soil sampling -Evaluating PRA and preparing questions for head of Agricultural department
19th of January	-Doing semi structured interviews -One group preparing questions for Head of Agricultural office
20th of January	-Interview with Head of Agricultural office -Preparing presentation for 23rd
21st of January	-Trekking to old Kpg. Tringgus and waterfall -Preparing presentation for 23 rd
22nd of January	-Villagers giving farewell party -Finishing presentation for 23 rd
23rd of January	-Leaving Kpg. Tringgus -Presentation at UNIMAS training centre, Bau -Farewell party in Puak and Skibang
24th of January	-Taking present to the headmen in Kpg. Tringgus -Leaving for Kuching -Farewell party for teachers, Malaysian and Danish students
25th of January	-Visiting Chinese vegetable farm -Farewell party at Doctor Siti's house
26th of January	-Visiting Bidayuh villages and hot spring
27th of January	-Trying to arrange meeting with Agricultural department in Kuching
28th of January	-Interview with commuting Kpg. Tringgus villager -Kpg. Tringgus farewell dinner
29th of January	-Leaving Malaysia

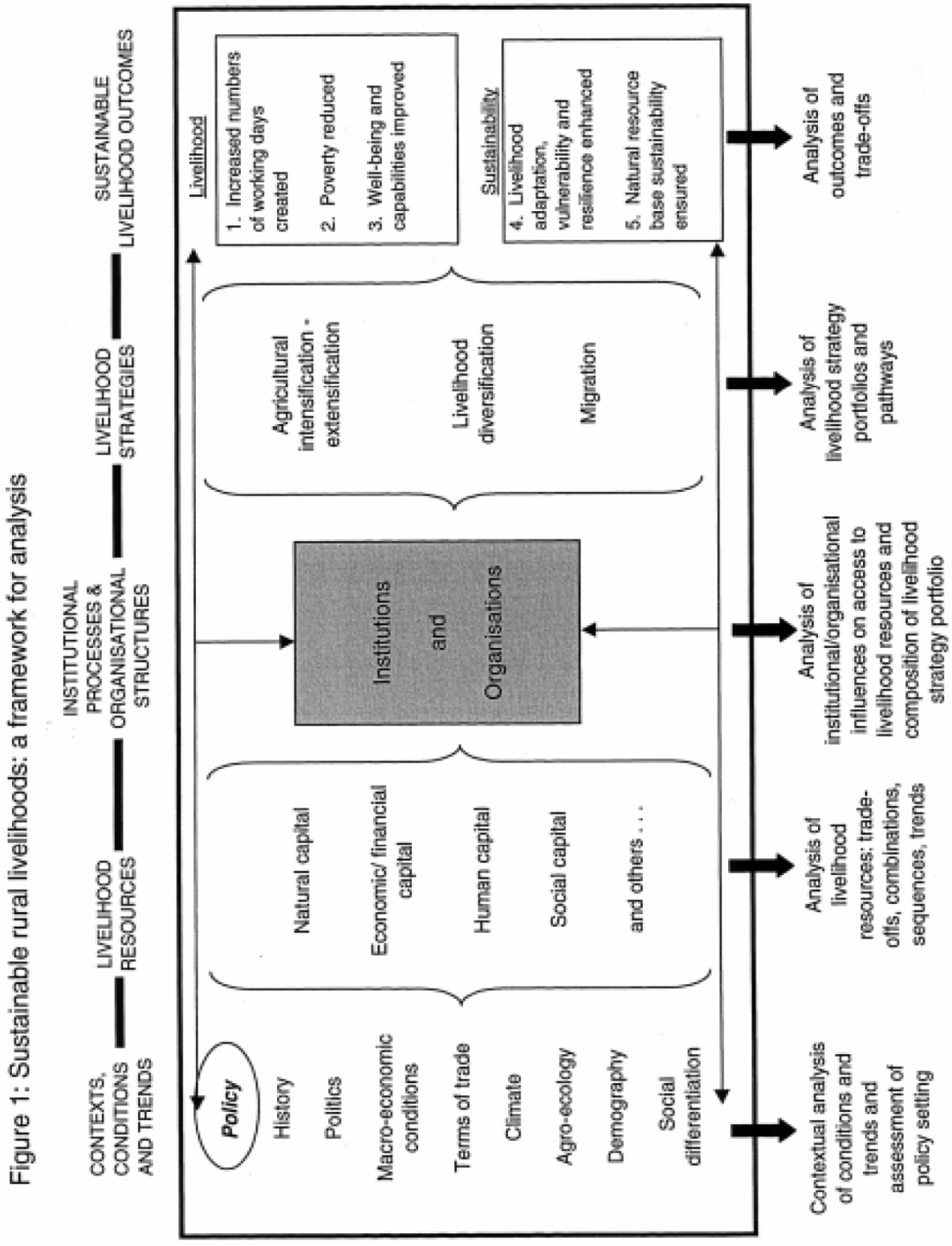
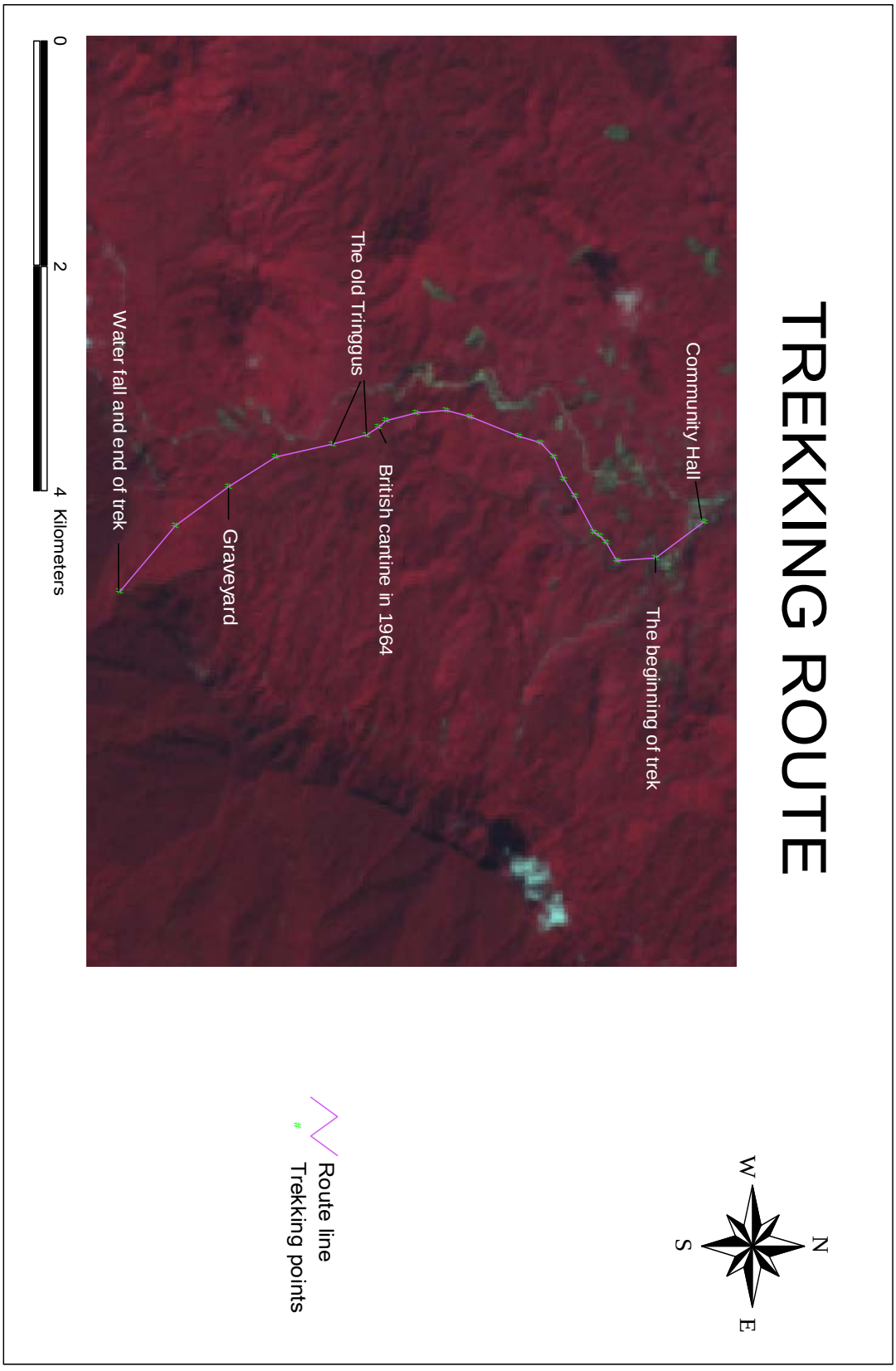


Figure 1: Sustainable rural livelihoods: a framework for analysis
CONTEXTS, CONDITIONS AND TRENDS
LIVELIHOOD RESOURCES
INSTITUTIONAL PROCESSES & ORGANISATIONAL STRUCTURES
LIVELIHOOD STRATEGIES
SUSTAINABLE LIVELIHOOD OUTCOMES
Policy
History
Politics
Macro-economic conditions
Terms of trade
Climate
Agro-ecology
Demography
Social differentiation
Natural capital
Economic/ financial capital
Human capital
Social capital
and others . . .
Institutions and Organisations
Agricultural intensification - extensification
Livelihood diversification
Migration
Livelihood
1. Increased numbers of working days created
2. Poverty reduced
3. Well-being and capabilities improved
Sustainability
4. Livelihood adaptation, vulnerability and resilience enhanced
5. Natural resource base sustainability ensured
Contextual analysis of conditions and trends and assessment of policy setting
Analysis of livelihood resources: trade-offs, combinations, sequences, trends
Analysis of institutional/organisational influences on access to livelihood resources and composition of livelihood strategy portfolio
Analysis of livelihood strategy portfolios and pathways
Analysis of outcomes and trade-offs

APPENDIX 5: LAYOUT MAP OF TRINGGUS JANUARY 2005.

APPENDIX 6: TREKKING ROUTE.



APPENDIX 7: QUESTIONNAIRE, HOUSEHOLD SURVEY.

Interviewer: _____ Number: _____

A. BASIC BACKGROUND

1. Name of Village (which part) : _____

2. Period of residence : _____

B. FAMILY PROFILE

3. What are the household details in terms of gender, age, marital status, level of education?

   * M – male, F - female

Members	**Gender (M / F)**	**Age**	**Race**	**Marital status**	**Level of education**
Father (Husband)	M			Married	
Mother (Wife)	F			Married	
1st Child					
2nd Child					
3rd Child					
4th Child					
5th Child					
6th Child					
7th Child					
8th Child					
9th Child					
10th Child					
11th child					
Others(specify)					

4. Who in the household are still staying in the village and what is their occupation, which type and where? In term of (G – government servant, P – private sector, SE –self- employed, O - others).

Members	**Categories of Occupation (G / P / SE / O)**	**Type of job**	**Location**

5. Who in the household are commuting and their occupation (G – government servant, P – private sector, SE –self- employed, O - others) and where?

Members	Categories of Occupation (G / P / SE / O)	Type of job	Location

6. Who in the household had moved to other places and what is their occupation, which type of job, where and when? In term of (G – government servant, P – private sector, SE –self- employed, O - others)

Members	Categories of Occupation (G / P / SE / O)	Type of job	Location	Year of moving

C. POPULATION MOVEMENT

7. How frequent are the household members commuting and any of them abandoned the agriculture activities here in Kampong Tringgus?

Members	How frequent of commuting (daily, weekly, monthly)	Abandoned / still doing the agriculture activities

8. Did the household encourage any of the household members to take a job outside Tringgus?

Yes: _____ No: _____

9. Do the household members that moved or is commuting from Tringgus bring any impact to your

(I) Labour use in farming the field?
Yes: _____ No:_____

(ii) Labour use in other than agricultural activities?
Yes : _____ No : _____

(iii) Other impacts?
Yes: _____ No: _____

If yes, please specify_____

10. Are the household members that moved or are commuting contributing to the family?

Yes : _____ No : _____

11. If yes, what type of contribution, is it ?

Type of contribution	**Please tick**
Cash money	
Food	
Children education	
Things for the home (TV, fridge, cooker)	
Agricultural inputs	
Others (please specify)	

12. Is it easy to get work in other jobs than agriculture within Kampong Tringgus?

Yes: _____ No: _____

13. Is it easy to get work in other jobs than agriculture outside Kampong Tringgus?

Yes: _____ No: _____

14. Is there any of the household member plan to move out?

Yes: _____ No: _____

D. LAND USE AND LIMITATION.

15. Do the household own any land in Kampong Tringgus and its status?
Yes : _____ No: _____

16. Do the household own any land outside Kampong Tringgus?
Yes : _____ No: _____

17. If yes, please state the status of the household's land and its location?
Status :_____ Location : _____

18. How many cultivated field do the household have?
_____ Size :_____

19. How many fallow fields do the household have?
_____ Size :_____

20. What is the household agricultural product used for (sale or own consumption or both) and degree of importance, (high, medium, low) ?

Agricultural product	**Purpose**		**Degree of importance (High, medium, low)**	
	Sale	**Own Consumption**	**Sale**	**Own Consumption**
Dry land hill rice				
Wet rice				
Vegetables				
Pepper				
Oil palm				
Coconut				
Fruit orchard				
Rubber				
Cocoa				
Maize / corn				
Fish pond				
Rear pig				
Rear chicken				
Others (Please specify)				

21. Do the household use the following items in their agricultural production and how often (never, seldom, always)?

Items	**How often (never, seldom, always)**
Pesticides	
Herbicides	
Fertilizers	
Animal feeds	
Organic waste (animal manure)	
Traditional tools (paring, knife)	
Machinery (pump)	
Others : (please specify)	

E. MARKET

Skip, this section if the agricultural products only for own consumption. Refer to question **20.**

22. Where do the household sell your products ?

Place	**Please tick**
In the village	
Shop in the nearby bazaar (Pangkalan Tebang)	
Road side stalls	
Farmers' Organization	
Government Agencies	
Middleman who comes to the village	
Other villages	
Others (please specify)	

23. Do the household members have any problems selling their agricultural products?

Yes :_____ No :_____

24. If yes, is it due to? Please rank the major expenditure according to range of 1-5, (e.g.: 1–Highest).

Problems	**Rank (1 – 5)**
Accessibility (roads, etc)	
No buyers for products (No demand)	
Distance (To far)	
Price (To low)	
Transportation	

F. HOUSEHOLD INCOME

25. What are the household's income sources and the degree of importance to the household (high, medium, low, none)?

Household source of income	**Degree of importance (High, medium, low, none)**
Sale of cash crops	
Sale of fruit crops	
Sale of Livestock	
Sale of Fish products	
Sale of gathered forest products	
Services of transportation	
Off farm wage / salary	
Remittances from family members elsewhere	
Others (Please specify)	

26. Which of the following items is the expenditure of the household? Please rank the major expenditure according to range of 1-6, (e.g.: 1–Highest).

Items	**Rank (1 – 6)**
Food	
Children's education (fees, bus, books and etc)	
Clothing	
Utility bills (electricity, gas, taxes and etc)	
Motorcycle / car / boat /own generator (instalment, fuel)	
Agricultural investment (fertilizer, animal feed,	

APPENDIX 8: SEMI-STRUCTURED IN-DEPTH INTERVIEW, QUESTIONS AND ANSWERS.

1. **Could you please explain to us if there is a problem with suitable land for agriculture?**

- land limitation/ availability
- productivity/ soil depth/ drainage
- floods
- yield
- slope
- intensity of farming (fertilizer, labour, income)

Answer:
From questionnaires 4*: (The interviewer wife sometimes talks about the farm of her parents, the household is selected due to: recently married, young couple from different households in Tringgus, the father is commuting by motorcycle, they grow vegetables for household consumption using part of parents fields)*
Land is suitable for agriculture but to her land is limited, because they don't have land on their own. They use a part of parents land for vegetables, for household consumption. Some places are not fertile because of rocks and there is erosion near the church. Floods usually happen near the bridge (Nguan). Yields of paddy hill rice are better where there the slopes are not steep. They use fertilizer when government subsidizes it. They don't hire any labour because their land is so small. Income from the farm can sustain half of the year so the rest of the year should be complemented with off-farm jobs.
From questionnaire 8: *(Selected basically because he is a farmer and has plenty of land to farm. But level of income is low and the yield from the field is also low). No problem with land limitation. There are ample of land available. They need fertilizer to increase the productivity. The yield is average but worsen by years. No flood but high degree of slope. They use labour intensive and input is important to the land.*
From questionnaire 24*: (Moved to kpg Bong in 1982 with his parents and siblings. He inhereted the landl he owns now from his grandfather who cleared and cultivated new land in Tringgus in 1986 along with many newcomers. He is not cultivating his land today but has some fruittrees for own consumption. In 2000 he started working as a technician in Bau repairing electronic devices but he has been doing off-farm work since 1987.He is working temporarily and whenever peoples needs his service he will go to Kuching as well. He abandoned farming after growing pepper and hill rice partly because the return of pepper cultivation was very small and partly because he has no time to farm his land when working in Bau.)*
Land is suitable for agriculture but his fields are small and scattered all over the village. If he had bigger fields he might want to cultivate it. His fields next to the waterfall are very fertile. His fields are very steep and big rocks lies besides the field.
Further in-depth 1(randomly selected): *Have enough land . Only plant pepper and vegetables for own consumption plus hunting. There is a price problem with pepper once you received 18 RM per Kg now it is 3 RM. The slope of the field affects the productivity and there had never been any floods in the fields. Lower yield because of lower selling prices and at the same time they cannot afford to buy fertilizer. Intensity in terms of labour use is spent more time in cultivating the land due to that they changed from hill rice to pepper and also that their children moved away.*

Further in-depth 2(randomly selected): *(Have three children schooling and are farmers and sometimes off-farm work, but only when they don't have any farming activities). Productivity is reduced in term of yield due to the soil's fertility (continued planting of crops lead to low soil fertility). The crops, especially pepper, needs fertilizer input. Can not plant other cash crops due to the slope of their fields.*

2. **What are the impacts of population change (movement) on farming intensity?**

- labour use in the farm
- interest in farming activity
- Labour allocation (do you hire labour, which do you hired, do you work as hired labour in others farm, and is it negative or positive….)

Answer:
From questionnaires 4: *They don't own land and have no interest in farming. Husband left farming and is commuting. The parents don't hire any labour either.*
From questionnaire 8: *They faced the difficulties of labour shortage which resulted almost impossible for commercial cultivation. Most youngsters are not interested in agricultural works. The impact is they have to practice 'shared labour'. It is therefore resulted less concentration of manpower in own farm.*
From questionnaire 24: *He abandoned farming because he only has time for doing his off-farm work. He earns more money from doing off-farm work so that he can build the house, by a motorcycle and get a likens to drive it.*
Further in-depth1(randomly selected): *The children are not interested in farming, they just want to look and this is due to they better education and higher income. They only do farming and don't hire any labour. Did timber logging from 1994-1999 combined with farming but is only doing farming now.*
Further in-depth 2(randomly selected): *Interest in farming activity decreased due to other job oppunities in town, especially among the youngster, and furthermore are the unstable market prices affecting the income of farmers.*

3. **Could you tell us about the fertility of your land?**

- How do you perceive fertility

Answer:
From questionnaires 4: *Fertility is perceived as – soil is soft and black in colour.*
Questionnaire 8: It is poor due to problem of soil erosion. They need to buy more fertilizer each season of plantation.
Further in-depth1(randomly selected): *The soil is fertile when it has a certain colours and also because they grew hill rice with a higher yield.*
Further in-depth 2(randomly selected): *Not very sure, but in term of productivity can the soil fertility be known.*

4. **Do you think your land is fertile and why?**

Answer:
From questionnaires 4: *She thinks 'her' land because they can grow vegetables.*
From questionnaire 8: *It is less fertile because yield is decreasing each year.*

From questionnaire 24: *He perceives his land as fertile. He thinks that it might be suitable for growing vegetables and pepper and hill rice. It is not suitable for having a fishpond even though he would like to have one.*
Further in-depth1(randomly selected): *The same as in question 3. Pepper needs fertilizer to bloom but the soil good.*
Further in-depth 2(randomly selected): *Yes productivity is satisfactory.*

5. **Do you think that your agricultural products have changed over the years from when you moved to this village and until now?**

    1. Pattern of cropping: own self, other family member help, "Gotong-Royong" culture, seasonal hired labour
    - Decrease and increase in yields
    - Probing with many crops…

Answer:
From questionnaires 4: *We never changed our pattern of cropping, no change in the yield, always the same. They always grow vegetables.*
From questionnaire 8: *Yes. Drastically. More labour fewer yields. Family type of farming. Practice 'shared labour' culture.*
From questionnaire 24: *He started growing pepper because he could obtain subsidies from the government but because the return of pepper cultivation was very small he started growing hill rice. Because he has no time to farm his land when working in Bau he abandoned farming completely.*
Further in-depth1(randomly selected): *They never change their pattern. First they grew hill rice in old Tringgus and now they are growing pepper. Has also tried rubber, cocoa, and many others.*
Further in-depth 2(randomly selected): *Pattern of cropping is done by their own selves and by the Gotong-Royong culture. There is a decrease in the yields or productivity of hill rice and pepper farming.*

6. **What is the difference in the use of fertilizers and chemicals now, compared with 20 years and 10 years ago?**

Answer:
From questionnaire 4: *20 years back they didn't need to use fertilizer and other chemicals, but now they use it.*
From questionnaire 8: *Now more fertilizer and chemical are used. Crop is dependent on more chemical input whereby the past was not at all.*
From questionnaire 24: *He used fertilizer for his pepper vine but did not use for his hill rice because he thinks it will accumulate in the paddy and that this is unhealthy.*
Further in-depth 1(randomly selected): *20 and 10 years ago they were subsidized with fertilizer and chemicals from government. The government provided every thing and told them to focus on agriculture. Now they have to buy everything.*
Further in-depth 2(randomly selected): *20 years ago they never used fertilizer, 10 years ago where fertilizer sometimes provided, but it depended on the subsidy. Now they need more fertilizer for their pepper farming which they buy themselves.*

7. **Do you need to invest more to gain the same yield now compared with 20 years, 10 years ago and now?**

Answer:
From questionnaires 4: *They need to invest more to sustain the same yield as in the past.*
From questionnaire 8: *Yes. More input on fertilizer.*
Further in-depth1(randomly selected): *They rarely use fertilizer because it is too expensive and not subsidized.*
Further in-depth 2(randomly selected): *Yes, need to buy fertilizer and chemicals for their farms.*

8. **Do you have any problem in soil erosion in your land and why?**

Answer:
From questionnaires 4: *No erosion problem in our land.*
From questionnaire 8: *Yes. Slope and heavy rain fall disturbed my agricultural products.*
From questionnaire 24: *He did not mention soil erosion but he mentioned that his fields are very steep and that one of the fields is located close to a waterfall*
Further in-depth1(randomly selected): *No problem with soil erosion and have never experienced such problem. Don't know how to handle such a problem.*
Further in-depth 2(randomly selected): *Yes, due to heavy rainfall, but only limited to pepper production because they cut the grass around the pepper plants.*

9. **If you have a land and have no fertility problem, then why is there a need for commuting/off-farm works?**

- Why, when, where, who and how

Answer:
From questionnaires 4: *My hushed is interest in more income, than farming gives, he has his motorcycle and can easily reach his workplace.*
From questionnaire 8: *My son and son in law have to work out side village to seek for better income. Forced to travel back weekly.*
From questionnaire 24: *He earns more money from off-farm work and he likes repairing things. He would like to cultivate his land but he wants to grow crops that grow fast so that he can earn money fast but he did not think about which kind of crop this could be.*
Further in-depth 2(randomly selected): *To earn extra income for the family to buy food and other needs when there are no farming activities taking place.*

10. **What do you see as alternative in improving your farming practice?**

Answer:
From questionnaires 4: *No alternatives. Improving farming practices know to us unless we make hit and trial.*
From questionnaire 8: *No others but to put in more fertilizer.*
Further in-depth 1(randomly selected): *No alternatives and do not think about it.*
Further in-depth 2(randomly selected): *Apply or put in more fertilizers.*

11. **What do you see as an alternative to farming?**

Answer:
From questionnaires 4: *Off-farm job is the alternative.*
From questionnaire 8: *Fishing and seeking jungle produce; timber, bamboo and hard wood for building material.*
Further in-depth 1(randomly selected): *No plan to do other activities than farming.*
Further in-depth 2(randomly selected): *Look for other jobs outside Tringgus.*

12. **Which work is most dominant off-farming and farming compared to income level and why?**

Answer:
From questionnaires 4: *Off-farm job is the most dominant; the job is giving more than farming.*
From questionnaire 8: *Level force. Especially in construction site outside village is more attractive as no bond with employer; possible to earn incomes during the period of waiting for paddy ripen.*
Further in-depth 2(randomly selected): *No answer.*

13. **Do you have any difficulties in supporting your family in terms of income?**

- What is the average family monthly income?
- What is the households' yearly income?

Answer:
From questionnaires 4: *Monthly average income: 950 RM. Yearly incomes: 11400 RM*
From questionnaire 8: *RM 250/ month. RM 3000/ year.*
Further in-depth1(randomly selected): *No problems with supporting family. No fixed monthly income. Yearly income 2000-3000 RM but only estimates.*
Further in-depth 2(randomly selected): *Not enough to support family. Monthly income 300 RM, yearly 3600 RM.*

14. **What is the average monthly expenditure of the household on the following items**

(a) Food -
_____
(b) Children's Education
_____
(c) Transport
_____
(d) Utility bills
_____
(e) Loan repayment
_____
(f) Fuel
_____
(g) Others
_____

Answer:
From questionnaires 4: *a: 100 b: 0 c: 10 d: 30 e: 200 f: 120 others: 100*
From questionnaires 8: a*: RM 120 b: RM 50 c: RM 50 d: RM 12 e: 0 f: RM100*
Further in-depth1(randomly selected): *a: 200 b: 0 c: 24 d: 16 efg: 0*
Further in-depth 2(randomly selected): *a: 200 b: 800 c: 16 d: 11 efg: 0*

15. **What are your households' sources of monthly income?**

(a) sale of agriculture produce -
_____
(b) sale of livestock
_____
(c) sale of fish
_____
(d) sale of gathered forest produce
_____
(e) own business
_____
(f) salary (off-farm work)
_____
(g) remittances from other family members
_____

Answer:
From questionnaires 4: *All zero except f: 950*
From questionnaires 8: *a: RM300 b: RM 20 c: 0 d: RM 120 e: 0 f: RM 300 g: 0*
Further in-depth1(randomly selected): *a: Pepper and vegetables=? bc: 0 e: wild bore 12 RM per Kg. 1 bore = 40-60 Kg e: 100 RM f:0 g: 200-300 RM trice a year.*
Further in-depth 2(randomly selected): *a: 200 bcde:0 f: 100 (estimate) g: 0*

Aquatic Survey

16. **In your opinion, do think that fish population here has changed and why?**

- Decrease and increase in yields

Answer:
From questionnaires 4: *Fish yields has changed and decreased, a fish called Bahan which is 60 centimetre has disappeared*
Questionnaire 8: *Yes. It is due to the factors such as non-stop catching, using explosive material (small dynamite), more demand as population increased and no extra money to buy fish from wet market.*
From questionnaire 24: *yes the yields have decreased since the 1980s. Before it was possible to catch 5- 10 fish in to hours when putting out a net, but today it might not even be possible to catch one fish in 24 hours. In his opinion the population changed because people from other villages came to Tringgus and used bombs for catching fish and also because of the forest loggin near old Tringgus → a lot of soil will wash into the river.*
Further in-depth 1(randomly selected):

The fish population has decreased due to over consumption and poor water quality, the water has got more polluted because of waste from the village.
Further in-depth 2(randomly selected): *Yes there is a decrease in yields due to logging activities.*

17. **What types of aquatic life can be caught 10 years, 5 years and now?**

Answer:
From questionnaires 4:

Type of life			***Weight (Kg)***	***Weight (Kg)***	***Weight (Kg)***
10	***5***	***Now***	***10 years ago***	***5 years ago***	***Now***
Galeng	*Galeng*	***Dont know for all the rest***			
Pahat	*Pahat*				
Pait	*Pait*				
Bakuk	*Bakuk*				
Papak	*Papak*				
Riat	*Riat*				
Tapel	*Tapel*				
Ramatn	*Ramatn*				

From questionnaire 8:

Type of life			***Weight (Kg)***	***Weight (Kg)***	***Weight (Kg)***
10	***5***	***Now***	***10 years ago***	***5 years ago***	***Now***
Gereng	*Gereng*	*Gereng*	*5 - 10*	*3 - 5*	*1 – 2*
Dungan	*Dungan*	*Dungan*	*3 - 4*	*2*	*1*
Baung	*Baung*	*Baung*			
		Pais			
		Keli			
		Pahat			
		Seluang			
		Robert			

Further in-depth1(randomly selected):

Type of life			***Weight (Kg)***	***Weight (Kg)***	***Weight (Kg)***
10	***5***	***Now***	***10 years ago***	***5 years ago***	***Now***
Gereng	***The same as year 10 for the rest***		*2 to 5*	*0 to 5*	*< 5*
Pahat			*0 to 3*	*0 to 1*	*< 1*
Dungan			*1 to 5*	*0 to 5*	*< 5*
Seluarg			*0 to 1*	*0 to 1*	*0 to 1*
Paeis			*0 to 3*	*0 to 1*	*< 1*
Tegur			*0 to 1*	*< 1*	*<1*

Further in-depth 2(randomly selected):

Type of life			***Weight (Kg)***	***Weight (Kg)***	***Weight (Kg)***
10	***5***	***Now***	***10 years ago***	***5 years ago***	***Now***
Pait	***The same for the following years***		*2*	*< 2*	*< 1*
Gereng			*2*	*< 2*	*< 1*
Pahat			*4*	*< 2*	*< 1*
Seluang			*1*	*< 1*	*< 1*
Tegur			*1*	*< 1*	*< 1*
Dungan			*2*	*< 1*	*< 1*

18. **Method used to catch aquatic life 10 years, 5 years ago and now?**

Answer:

From questionnaires 4:

10 years ago	***5 years ago***	***Now***
Bubu	*Bubu*	*Poisonous plant*
Fishing rode	*Fishing rode*	*Big fish Talupoya from duriyan plant mixed with small pieces of bread put in the fish pat.*
	Fishing net	

From questionnaire 8:

10 years ago	***5 years ago***	***Now***
Bubu	*Bubu*	*Shoot*
Rod and line	*Jala*	*Explosion material*
	Fishing Net	*Jala*
		Fishing Net

Further in-depth1(randomly selected):

10 years ago	***5 years ago***	***Now***
Jala (netting)	*The same as in year 10 for the rest*	
Senapang kien (fish gun)		
Juü (bubu) ruse		
Jaring (netting)		
Minuk (normal fishing)		

Further in-depth 2(randomly selected):

10 years ago	***5 years ago***	***Now***
Fishing net	***The same as 10 years for year 5 and now***	
Fishing hock/rode		

19. ***Time spend to catch the fish 10 years, 5 years ago and now?***

Answer:

From questionnaires 4:

10 years		***5 years***		***Now***	
Time	***Weight (Kg)***	***Time***	***Weight (Kg)***	***Time***	***Weight (Kg)***
1 hour	*60 fishes*	*1 hour*	*30 fished*	*1 hour*	*No*
4 hour		*4 hour*		*4 hour*	*No*
8 hour		*8 hour*		*8 hour*	*No*

From questionnaire 8: *could not answer.*

Further in-depth 1 (randomly selected):

10 years		***5 years***		***Now***	
Time	***Weight (Kg)***	***Time***	***Weight (Kg)***	***Time***	***Weight (Kg)***
1 hour	*3*	*1 hour*	*1*	*1 hour*	*0*
4 hour	*12*	*4 hour*	*4*	*4 hour*	*2*
8 hour	*24*	*8 hour*	*8*	*8 hour*	*4*

Further in-depth 2(randomly selected):

10 years		***5 years***		***Now***	
Time	***Weight (Kg)***	***Time***	***Weight (Kg)***	***Time***	***Weight (Kg)***
1 hour	*2*	*1 hour*	*1,5*	*1 hour*	*0,5*
4 hour	*4*	*4 hour*	*3*	*4 hour*	*2*
8 hour	*12*	*8 hour*	*8*	*8 hour*	*4*

Marketing

20. **What is the main problem in marketing your agriculture products and why?**

- Infrastructure, roads, transportation possibilities
- Marketing facilities
- Incentive to sell and produce (contract farming????)

Answer:

From questionnaires 4: *Dont sell only household consumption*

From questionnaire 8: *Infrastructure: gravel road. Transportation : Have to reserve RM 8 for 'van sapu' and RM 10 for meal.*

From questionnaire 24: *does not sell only own consumption (fruits) because he does want to compete with other villagers that have no other income.*

Further in-depth 1(randomly selected): *The main problem is the price because it fluctuate.*

Transport is difficult because of poor road and van transportation is difficult because it is shared

With other villagers. They have incentives to sell it to market agencies.

Further in-depth 2(randomly selected): *No problem because he sell the agricultural products to FAMA (Federal Agricultural Marketing Agency).*

21. **When you sell your agricultural products, which is not used for consumption, are you able to sell all of it or not?**

- What is the reason?

Answer:

From questionnaires 4: *Dont sell only household consumption*
From questionnaire 8: *No. Can't compete with other sellers.*
Further in-depth 1(randomly selected): *No problem selling pepper.*
Further in-depth 2(randomly selected): *Yes sell to FAMA*

Perception

22. **Are you satisfied with the present livelihood in the village and why?**

- Our living standard is much better now if compared to five years ago: Income, facilities, education, better opportunities, trend, and agriculture.
- Are the households capable to overcome hard times such as: Have people moved due to diseases, natural disaster?
- Future livelihood, staying or moving

Answer:
From questionnaires 4: *For them, life standard is better because they build their own house in their mother land, they have no reason for moving out.*
From questionnaire 8: *Yes. No problem. Mobile clinic available. Staying (no choice if no further development).*
From questionnaire 24: *Did not answer this question directly but said that he did not want to move away because it is cheaper to live in a village than in a city and in the village he has more space. He also likes that he can walk around the village and talk to the people he meets because he knows them. If he lived in the city he would stay home most of the time.*
Further in-depth 1(randomly selected): *The living standard and income are more or less the same.*
Want to stay and take care of the land.
Further in-depth 2(randomly selected): *Much better living standard than for 5 years ago due to higher income, facilities and assistants from FAMA to market their products. No problem with disease and natural disaster. What to stay here in Tringgus and hope for more development.*

23. **In your opinion, what are the factors of movement to other places and why?**

- Income, facilities, education, better opportunities, trend, agriculture.

Answer:
From questionnaires 4: *Marriage, easier to go to work, they can afford to buy house in towns, to further education.*
From questionnaire 8: *Better income. Better facilities: electricity, water, shopping centre. Better opportunity: hoping for better income, choose able. Trend: like to try and to gain diverse experience. Perception: agriculture is only for old man and people do not have academic qualification.*
From questionnaire 24: *he thinks that the young wants to move from Tringgus because they go to school other places. This means that they are not home when parents are doing farming and them they will not learn how to farm. This is why they would rather find some work they know how to do.*

Further in-depth 1(randomly selected): *People move because they have income difficulties and getting jobs with higher income. They, specially the young, only want facilities such as electricity and entertainment. It is also due to a higher education level and furthermore is a trend among the youngsters.*

Further in-depth 2(randomly selected): *Income is a factor for moving because the salary is higher away from Tringgus. Furthermore the facilities are better and better opportunities to get a job. The modern life stile and many entertainment facilities is also a factor. There is a limit to cash crops it is only pepper which can be cultivated on his fields.*

APPENDIX 9: QUESTIONS FOR THE HEAD OF DEPARTMENT OF AGRICULTURE.

1. What is the main function of Department of Agriculture?
2. What is the overall crop system in Bau District, the last 10 years and the present?
3. Does the department give any subsidy?
4. What types of subsidies are provided?
5. Is there any agriculture subsidy scheme available in Tringgus?
6. When did the subsidy scheme started or commenced?
7. What are the types of crop planted under the scheme?
8. Do you involve the farmers in planning and in implementation?
9. Is there any assistance in marketing the agricultural products by the department?
10. Is there any future planning in developing the agricultural sector in Tringgus?

APPENDIX 10: CHARACTERISTICS OF SOIL SAMPLE SITES.

Sample Number	Description	Vegetation
Sample 1	• Fruits tree areas • Located on the flat shoulder of the land • Soil floor have been cleared • Approximately about 10 m from the small stream • Soil depth approximately 15 cm with A-horizon is about 7 – 10 cm	• Cocoa • Langsium domesticum • Durio spp. • Eugenia spp. • Shorea microphylla • Banana • Dabai • Artocarpus Elaticus • Ficus spp. • Terentang • Creeper • Fern • Keladi • Alloid
Sample 2	• Fruits tree areas • Located on the ridge top on the dryer side of the land • Soil floor slightly cleared and some area covered with grass and weeds • Less undergrowth • Have been cultivated for the last 6 years • Soil depth is approximately 100 cm	• Durio spp. • Cempedak • Asam • Rambutan • Tampoi • Palm spp. • Langsium domesticum • Alstonia spp. • Bamboo
Sample 3	• Land cultivated with paddy hill rice • Located on the ridge top • Intercropping planted • A-horizon about 5 cm	• Hill Paddy • Labu • Kuchai • Tapoica • Banana
Sample 4	• Land cultivated with hill padi rice • Located on the side slope • Planted with intercropping • Soil depth approximately 15 cm with A-horizon is about 3 –5 cm	• padi • Banana • Tapoica
Sample 5	• Land left fallow about 2 years • Located on the ridge top on the dryer side of the land • Soil floor covered with grasses and weeds with pioneer species such as macaranga and bamboo	• Macaranga • Bamboo • Grasses • Weed
Sample 6	• Located on the abandoned pepper garden • Slope slightly gentle • Soil floor covered with weeds and grasses	• Abandoned pepper • Macaranga

	• Well aggregate • Good drainage • Soil surface have been eroded through time • Yellow, Sandy soil	
Sample 7 (Control)	• Samples fall on the Secondary Forest • Located on the steep slopes • Soil floor full with undergrowth • Dominated with pioneer species	• Macaranga • Pioneer species
Sample 8	• Located on the vegetable garden • Low laying area • Mostly covered with weeds and grasses • Shallow A-horizon approximately 3-5cm • Shallow water table • Flood prone area	• Abandoned vegetable garden • Kangkong

APPENDIX 11: PREFERENCE MATRIX.

No	Crops Purpose	Hill Rice	Pepper	Fruits	Leafy Vegetables	Cocoa	Rubber	Fruiting Vegetables	Corn
1	Own Consumption	5	2	5	5	1	-	5	3
2	Family Heritage	5	-	4	-	-	-	4	5
3	Part Time (Leisure Time)	-	2	-	4	2	1	3	2
4	Sale (Additional of Cash Income)	3	2	1	-	1	-	-	-
5	Labour Wage (from other people's farm)	3	2	1	-	1	-	-	-
6	Labour Not Needed (own family and household)	5	5	5	5	5	5	5	5
7	Working Together Culture (Gotong-Royong)	5	1	3	2	2	1	1	1
8	Low Capital (Traditional Methods)	5	3	4	4	2	1	5	5
9	Storage (animal feed and cash crops)	5	2	-	-	-	-	-	5
10	Fertile Land (Less usage of fertilizer)	5	3	5	5	5	5	5	5
	Total	**46**	**22**	**28**	**25**	**19**	**13**	**28**	**31**

APPENDIX 12: SEASONAL CALENDARS. **For the adult villagers 30-50 years**

MONTH **ACTIVITIES**	**JAN**	**FEB**	**MARTS**	**APRIL**	**MAY**	**JUNE**	**JULY**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**
Gotong-Royong (Clearing the road path to the farm land.)	5											
Tanjuk (Making platform)		5										
Harvesting paddy			5	2								
Making kitchens in the village				5						2		
Preparation for Gawai Dayak					3							5
Gotong-Royong repair the water supply pipes			4		4						4	
Takraw competition							2	4				3
Gotong-Royong in the church			2			2		5			3	3
Gotong-Royong activities		2					3		5			3
Football competition for the female												5
Rela activities		2		2		2		2		4		2
Annual general meeting for the village	5											
Total	**10**	**9**	**11**	**9**	**7**	**4**	**5**	**11**	**5**	**6**	**7**	**21**

1) **'Rela'** = Village security team.
2) **'Takraw'** = local game.
3) **'Gawai Dayak'** = Local festival activities.
4) **'Tanjuk'** = A platform normally used for processing paddy and drying process.

For the young villagers 15-29

MONTH ACTIVITIES	JAN	FEB	MARTS	APRIL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
1)Buying educational tools and sending kids to school	5		2			3						2
2)Preparing equipment for harvesting		5										
3)Dinner occasion – bless the students before going to school						3					2	
4)Fishing and hunting	3				3						2	
5)Village meeting	5					3						5
6)Farming and planting activities	2	5	2	2	2	2	2	2	2	2	2	3
7)Bidayuh Gawai Dayak festival	3			3		5		3				4
8)Go to fruit orchard	3		2								3	4
9)Cutting timber	3		2								2	
10)Gotong Royong in the village	5			5		5				4		5
11)Selling agricultural products in town (Bau) and other places	5	5	1		1	3	1	1	1	1	1	3
12)The youngster working in town	4	1	1	1	1	1	1	1	1	1	4	3
13)Agricultural activities	1	1	4	1	1	1	1	1	1	1	1	1
14)Playing traditional games (Torque)		2			2				5			5
15)Football and Takraw competition	4					5						5
Total	**44**	**19**	**14**	**12**	**10**	**31**	**5**	**8**	**10**	**9**	**17**	**40**

a) **'Gotong Royong'** = the whole village come together to do cleaning or other activities in the village or church.
b) **'Takraw'** = Local game.

APPENDIX 13: WATER RESULTS.

Parameter		Unit	W1	W2	W3	W4	NWQS	
							Class I	Class IIA
1	pH	-	**7.56**	**7.65**	**7.56**	**8.32**	**6.5-8.5**	**6-9**
2	Temperature	ºC	**24.11**	**24.15**	**24.19**	**24.19**	**Normal**	**Normal**
3	Conductivity	µ	**14.67**	**14.4**	**14.8**	**13.4**	**1000**	**1000**
4	Dissolved Oxygen (DO)	mg/L	**6.7**	**6.6**	**6.7**	**5.2**	**7**	**5-7**
5	Turbidity	NTU	**63.7**	**65.0**	**62.6**	**32.7**	**5**	**50**
6	Total Suspended Solid (TSS)	mg/L	**77.5**	**76.0**	**67.5**	**31.0**	**25**	**50**
7	Biochemical Oxygen Demand (BOD5)	mg/L	**5.6**	**4.4**	**6.6**	**4.1**	**1**	**3**
8	Chemical Oxygen Demand (COD)	mg/L	**25.65**	**17.7**	**18.15**	**20.35**	**10**	**25**
9	Ammonical Nitrogen	mg/L	**0.000**	**0.013**	**0.077**	**0.000**	**0.1**	**0.3**
10	Nitrate Nitrogen	mg/L	**0.045**	**0.035**	**0.045**	**0.030**	**NA**	**NA**
11	Phosphate	mg/L	**0.179**	**0.196**	**0.179**	**0.342**	**NA**	**NA**
12	Total Coliform Content (TCC)	CFU/100ml	**60**	**186**	**60**	**100**	**100**	**500**
13	Fecal Coliform Content (FCC)	CFU/100ml	**170**	**120**	**16**	**112**	**10**	**100**

Class I Conservation of natural environment (pristine environment)
Water supply I – practically no treatment necessary (except by disinfection or boiling only).
Fishery I – very sensitive aquatic species

Class IIA Water supply II – conventional treatment required
Fishery II – sensitive aquatic species

APPENDIX 14: PROBLEM RANKING.

1. Electric supply: The only source for the electric supply for the village is a generator provided by the government but it is not sufficient because it is not available all the time. The generator is operated from 6:00 O'clock to 10:00 O'clock in the evening.
2. Garbage/waste disposal: The village has no well planned garbage and waste disposal system. This creates problem because some people use the river and everywhere to dispose their waste and garbage.
3. Blocked water pipe: Water pipes are originated from gravity feed water supply in Kpg. Tringgus. The participants stated that the water pipes are usually blocked during the rainy season and the villagers seek directly to river water for drinking purpose.
4. Forest logging (illegal): Outsiders intrude into village forest and perform illegal logging. In this way a lot of land is cleared.
5. Teenager problems (smoking/drinking): The elders are overwhelmed by teenagers who indulge themselves into excessive drinking and smoking that may create domestic problems.
6. Infrastructure (Roads and Bridges): The villagers pointed out that there are no roads and bridges towards the fields and cemetery. They usually cross the river by foot but in the rainy days people who go to their field or cemetery in the morning when there are no rains cannot come back home through crossing the river at the evening when it is raining because of the high water level of the river. They have to wait till the next day when the water level lowers down.
7. No cooperation among villagers: There are many problems that individuals cannot solve. There is no communal coherence in this regard. Everybody has to solve his own problem individually and common problems remain unsolved.
8. Misuse of funds: The villagers believe that funds allocated for the village development are misused or diverted to other unnecessary work.
9. Facilities (Community hall/football field): The community hall is not well structured to hold that name due to poor performance stage, toilet and lack of kitchen. The existing football field is not sufficient and well developed.
10. School dropouts (due to low income): Teenagers leave schools earlier before they complete it. These school dropouts are becoming common and happen in almost every household due to low income of the household. To cope with that problem teenagers resort to look for jobs in nearby towns
11. No suitable land for agriculture: The village lands are not suitable for agriculture due too rocks, stones and steep slopes. The land is not also fertile because yields are very low.
12. Telecommunication: There are no telephone lines in the village. Even mobile cells do not work here due to the remoteness of satellites.
13. Public transportation: There's no public transport system designed by the government. The only means of transport for the villagers is "Van Sapu", unlicensed private van that occasionally wipes out people from the road sides to transport them from the villages to Bau and vice versa. In addition to "Van Sapu" there are fewer well-to-do people who use their own cars and bikes to reach elsewhere.

APPENDIX 15: FISH EQUIPMENT.

Name of fish		1995			2005		
Local	**Scientific**	**Catching method**	**No. of catch/hr**	**Size (in)**	**Catching method**	**No. of catch/hr**	**Size (in)**
Gereng (Semah)		Cage trap, Rod & Line	> 7	> 15”	Cage trap, Rod & Line, Cast net, Fish net, Fish gun, Dynamite,	< 2	< 12”
Dungan (Sebarau)		Cage trap, Rod & Line	> 7	> 15”	Cage trap, Rod & Line, Cast net, Fish net, Fish gun, Dynamite,	< 2	< 12”
Menjang (Baung)		Cage trap, Bare hands, Rod & Line	> 5	> 8”	Cage trap, Rod & Line, Cast net, Fish net, Fish gun, Dynamite,	< 2	< 6”
Pais, Pahat (Barb)		Cage trap, Bare hands, Rod & Line	> 25	> 5”	Cage trap, Rod & Line, Cast net, Dynamite,	< 20	< 5”
Robert		Cage trap, Bare hands, Rod & Line	> 25	> 5”	Cage trap, Rod & Line, Cast net, Dynamite,	< 20	< 5”
Sluang		Cage trap, Rod & Line	> 25	> 5”	Cage trap, Rod & Line, Cast net, Dynamite,	< 20	< 5”
Shiren (Kilan)		Cage trap, Bare hands, Rod & Line	>10	> 15”	Cage trap, Rod & Line, Cast net, Dynamite,	< 3	< 7”

APPENDIX 16: SURFACE WATER QUALITY PARAMETERS.

The significance of water quality parameters studied during the field trip in Tringgus Sg. Pedi River is briefly highlighted as follows.

- ***pH***

  pH is a measure of acidity/alkalinity. The neutral pH is 7. There are certain levels in both extremes pH in which biological processes are adversely affected.

- ***Dissolved Oxygen (DO)***

  Dissolved Oxygen measures the amount of oxygen dissolved in water. DO level partly depend on the physical, chemical and biological activities in the water, which may produce or deplete the DO. It is increased by the agitation of the water surface.

- ***Oxygen Demand***

  Oxygen demand measures the amount of oxygen required to oxidize organic matter. It is an indirect measure of the amount of organic impurities present in a water sample. Oxygen demand is an important consideration because it can deplete the available oxygen in a water body, thus harming the aquatic life. It is commonly estimated by Biochemical Oxygen Demand (BOD). BOD is a measure of oxygen utilized during a specified incubation period and temperature for the biochemical degradation of organic matter present in the water. BOD_5 (BOD for a 5-day incubation period) at 20°C is measured for the samples.

- ***Total Suspended Solid (TSS)***

  Suspended solid levels in water are indicative of the presence of inorganic or organic particles or immiscible liquids. These materials are common constituents of water due to the erosive action of water flowing over soil surfaces and may include silt, clay, plant fibres and other organic materials. When sediment settles out it can severely alter aquatic communities. Sediment may clog and damage fish gills, suffocate eggs and aquatic insect larvae on the bottom, and fill in the spaces between gravel where fish lay eggs. Suspended silt and sediment interfere with aquatic plant growth by reducing water clarity. Similarly they can impair recreational activities and aesthetic enjoyment by altering the appearance of the water.

- ***Turbidity***

  A water quality measure that is related to suspended sediment is turbidity. This quantifies the degree to which light travelling through water is scattered by the suspended particles present. The greater amount of suspended material the greater light scattering and the higher turbidity. The light-scattering particles may be both organic (e.g., algae and other plant or animal debris) or inorganic (e.g., fine silts or clays). High turbidity affects the aesthetic appeal

of waters, and in the case of recreational areas may obscure hazards for swimmers and boaters. Its environmental effects are essentially the same as those for suspended sediment: reduction in light penetration reduces plant growth, which in turn reduces the food source for invertebrates and ultimately fish. If turbidity is largely caused by organic particles, their microbial breakdown can lead to oxygen depletion, the stimulation of algal growth, and the other adverse effects associated with nutrient enrichment. Turbidity is measured in a special type of light meter, and is generally expressed in Nephelometric Turbidity Units (NTU). An NTU less than 25 is considered acceptable for aquatic life, but the appearance of the water is affected at much lower values than this. (Environment Canterbury, 2005).

- ***Temperature***

  Temperature is a fundamental factor in water quality, and the temperature exerts an enormous influence over aquatic organisms. If the overall temperature of an aquatic system is altered, a shift in community composition can be expected. Higher temperatures can also compound low dissolved oxygen concentrations in lakes and closed river mouths, by encouraging the decomposition of organic material, and reducing the oxygen-carrying capacity of the water.

- ***Nitrate Nitrogen (NO_3^--N)***

  Ammoniacal nitrogen is finally oxidized to form nitrates under aerobic condition. Nitrate poisoning in infant animals, including humans, can cause serious problems and even death. A limit of 10 mg/l (as nitrogen) has been imposed on drinking water to prevent *methemoglobinemia* in infants. In surface water, its presence is usually indicative of runaway nitrate fertilizer.

- ***Phosphate (PO_4^{3-})***

  Phosphorus occurs in natural and wastewater almost solely as phosphates. It occurs in solution, in particles or detritus, or in the bodies of aquatic organisms. Organic phosphate is formed primarily via biological processes. Phosphorus is essential for the growth of organisms and can be the nutrient that limits the primary productivity of a body of water. Phosphorus is also commonly used in plantation as supplementary plant nutrients and thus an important parameter to monitor.

APPENDIX 17: FINAL SYNOPSIS IN SLUSE 2004, GROUP 1, TRINGGUS.

LAND USE CHANGES AND LIVELIHOOD STRATEGIES IN TRINGGUS

Synopsis of Report as Partial Requirement for the Course
Interdisciplinary Land Use and Natural Resources Management

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Tringgus Group:

Dennis Hansen
Jannie Smerup Nielsen
Ahmed Nur Osman

Supervisors:

Kristine Juul
Rikke L. Folving

Introduction

In the seas of South-East Asia the island of Borneo is to be found. Borneo is the third largest island in the world and cover about 746000 square kilometres. The inland of Borneo is mainly covered with hilly rainforests which biodiversity is ranging from a unique animal wildlife too a diverse tropical vegetation. The climate of Borneo is wet, warm and humid, where temperatures are on average between 25-35 degree Celsius and annual rainfall between 2500 mm and 5000 mm, with heavy rainfalls in the monsoonal periods (King, 1993).

Borneo is divided into three areas. One part of the island belongs to the Federation of Malaysia, another part is Indonesian and the third is a little kingdom called Brunei. The history of Borneo is influence by different nations, for example the European colonial period, where the British rulers had occupied Borneo, but also Japan occupied the island during the Second World War. The island was seen as having a central position in the Asian region, where Borneo played a large role in the mercantile trade. Migration from other parts of Asia has also played a large role in shaping the societies of Borneo, for example did Chinese immigrants, in the end of the eighteenth century, move to Borneo to do gold mining in the western parts of the island.

The population of Borneo is as diverse as the animal and plant wildlife. The inhabitants of Borneo is ranging from different indigenous, tribes, for example Bidayuh, too Indonesian, Malaysian, Chinese and people from other parts of Asia and the world. Today it is the Chinese that are dominant in both Malaysian and Indonesian Borneo as well as in Brunei. This shows how the different nation’s occupation of Borneo and the immigration has been the main factor in shaping the culture and traditions of the people of Borneo and made it a multiethnic society of the world today (King, 1993).

In the Malaysian part of Borneo the areas where the majority of people live are; in the region of Sarawak and the region of Sabah, in and around the state capital Kuching, in the second largest city, Sidu, and in Bintulu and Miri, which are near the border to Brunei. Kuching is the administrative, industrial and commercial centre of Sarawak.

In the western part of Sarawak and close to the large rivers it is subsistence farming that broadly describe the economic situation of people living in villages (Airriess, 2000). It is in the Sarawak region that our field research is located in a village named Tringgus.

People in Tringgus are subsistence farmers cultivating hill rice and maize for own consumption as well as some vegetable gardens. Lately, rubber extraction has been taken up again due to rising prices. Many of the villagers have odd jobs in Bau or Kuching, some are government servants. Those working outside Tringgus, some commute on daily basis and others have permanent residence in Kuching. Tringgus village was settled by Bidayuh in early 1970s and 1980s by government insentience.

Our overall task

Evaluate past, present and future effects of land use changes partly due to population movements/migration/commuting from Kpg. Tringgus on livelihood strategies, resource use/dependency and agricultural production. Assess the extent of tenure security of the Tringgus population and the impact of this on local investment strategies.

The five elements

A way the overall task can be understood is that Tringgus has experienced growing population movements, migration and commuting. This then following led to land use changes which may have had some effects on livelihood strategies, resource use/dependency and the agricultural production. During discussions, of the overall task, it became clear that it is not necessarily only land use changes that affect livelihood strategies, resource use and agricultural production, but that it might also works the other way around. Changes in livelihood strategies, resource use and agricultural production due to population movements may also have affected the land use. Seen this way, maybe the things that are going on should not be understood as a causal relationship, where population movements lead to land use changes, which again leads to changes in livelihood strategies, resources use and agricultural production. It seems that the different parts are connected in a more complex way.

This is the assumption we start out with and the task will be approached with this in mind.

There are five main elements to look into (see the scheme below) when approaching the task and these elements form our objectives which are:

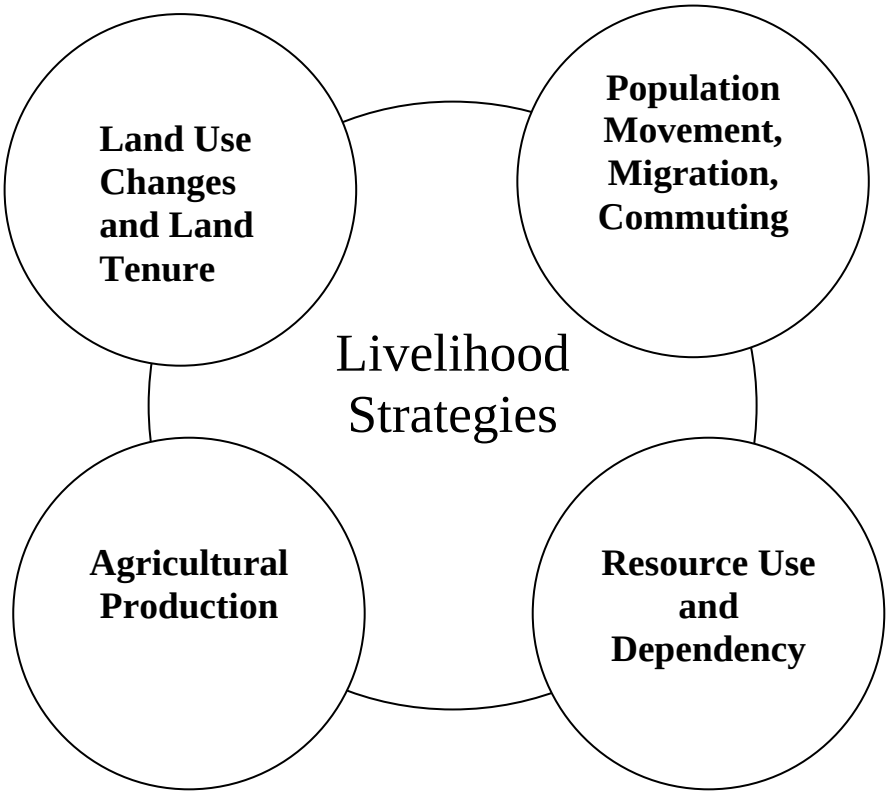

Figure 1: The five main elements.

To look more into the changes that have been taking place in Tringgus a Livelihood approach will be used as the optics through which the five elements can be seen. It is the assessment that a Livelihood approach will encompass all the elements and that it will be helpful in understanding the complex connections between them. The livelihood approach will further be explained in the next paragraph.
The evaluation of the five elements is broken up into smaller parts which more easily can be approached. Because each element encompasses many different aspects a selection is made and those that seem most relevant to the assignment are chosen.

Population movements, migration and commuting

The first objective is to get an overview of the extent of the population movements and also to investigate what kinds of movements is taking place (or have been taking place) in Tringgus. Because Tringgus was resettled about 30 years ago the concentration will be on the last 20 to 30 years, when the population movements and the land use changes are evaluated. Main focus will be on the present though, since the narrow time frame of the fieldwork is a limitation.

To look deeper into population movements the fourth question in the proposed tasks can be useful as a guideline: *"Evaluate changes in land use practices in relation to availability of land and labour. Assess the impact of recent trends of off-farm work within and outside the village. And evaluate changes in allocation of manpower to various economic activities."*

There are three sub questions in the proposed task which are interlinked and deal with the same topic; labour/manpower and the use of it and what it contributes to the village. The three buss-words are: land and labour, off-farm work, allocation of manpower.
Overall the questions (see annex 1) have to do with the employment, of the people living in the village, in different working areas and the change of this through a period of time and the effect of this on the village (more specifically, land use).

Land use (changes) and land tenure

The second objective is to try to get an overview of what kinds of land use has been taking place during the last years in Tringgus, if any, and to what extent they have been taking place. An important part of this will also be to find out why possible changes have been taking place. This will be an important part of evaluating the effects of population movements.
In the approach to land use will also be evaluation of the land tenure in Tringgus. This is because it is expected to have an influence on the way the people in the village use the land and in this way the land tenure is an issue closely integrated in the livelihood approach.

By land tenure is meant "the set of rights which a person or some private or public entity holds in land or trees" (Bruce, 1989: 1). The access to different kinds of resources, or capital is according to Ellis (2000) modified among other things, by land tenure. In this way land tenure has an effect on the livelihood strategies of a household. At the same time land tenure affects the conservation and use of land. If the household owns land under insecure circumstances it is likely that it will not initiate long term projects on the land or invest a lot of capital in the agriculture production (Bruce, 1989: 1).

In Tringgus the land was earlier cultivated by inhabitants from neighbouring village and they claim to be the rightful owners of the land, this may create an insecure situation for the people in Tringgus that cultivate land. If this is the case it is imaginable that a person may not be interested in conserving the soil or buy machines for cultivating the field. This may have an effect on these people's livelihood strategies.

Livelihood strategies

As said earlier the livelihood approach will be the overall analytical frame. This means that the four other elements can be understood as part of a household's livelihood strategies, they will therefore be part of assessing this element. Of course other livelihood strategies that might be relevant to answer the overall task will also be looked into. These other (parts of the) livelihood strategies might include things like, remedies (transportation and production), and administrative factors (decision making - who and why, tax, public funding, relation to the government etc.)

Resource use/dependency

To evaluate the resource use/dependency the third proposed task will be good as a starting point, *"Asses household past and present land and resource use, including changes in access to land and resources."*

"Resources" though is a very broad concept. Therefore the point of reference will be the assets taken from Ellis' framework for Livelihoods analysis. These assets are natural capital, physical capital, human capital, financial capital and social capital where the first three will be the focus in evaluating resource use/dependency. Resources may not easily be translated into capital but in this assignment where

livelihood is the analytical framework it seems very relevant to bring in the concept used by others writing about livelihood. It also helps operationalize the concept resources, which is otherwise very broad.

Agricultural production

The agricultural production is of course directly affected by land use changes and vice versa. It is also very much affected by availability of man power (connected to population movements), livelihood strategies and resource use/dependency (maybe these factors are also affected by the agricultural production). Another important factor to look into is the impact of the agricultural production and land use changes on the physical environment in Tringgus. To evaluate the agricultural production, the following questions written in annex 1 will be relevant to work with.
To look deeper into physical effects we will focus on soil erosion risk.
Soil erosion is regarded as the major and most widespread form of soil degradation, and as such, poses severe limitations to sustainable agricultural land use. Soil can be eroded away by wind and water. In Tringgus, where land use change and population dynamics is observed, and also steep slopes are cultivated, there might be erosion risk that need assessment. Scientists have developed different methods of assessing soil erosion. The most popular methods are Universal Soil Loss Equation and (USLE), its derivative, CORINE Soil Erosion Risk Assessment. These two methods are based on calculations of soil parameters, metrological data and vegetative cover of the soil.
These methods are very comprehensive though which is why we will turn to a more qualitative approach (see the methods section).

Livelihood and livelihood strategies

The livelihood approach is a fairly new approach and encompasses many different objectives on a village level and on the broader socioeconomic structures of society. Due to the mosaic of different ways of approaching the framework it makes the definition, of what livelihood basically is, difficult. We will use Ian Scoones definition livelihood:
“A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable

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

Writings and research using the livelihood approach, livelihood strategies often are connected with the household. There are some things though to be cautious about when doing that. The first thing is that sometimes the strategies of one person in the household are not the same as for the rest of the household. Jonathan Rigg points out this in his article from 1998, "Rural-Urban interactions, agriculture and wealth". Here for example he refers to studies that show that young daughters of factory workers in Java are increasingly independent and refuse to live according to their parents will (Rigg, 1998: 505).

The other thing to be cautious about is how to define a household. A household is most often referred to as a spatially defined unit. If then this spatially defined unit is used as a unit of analysis then there is a danger, that it will fail to cover who are members of the household i.e. where the household begins and ends (Rigg, 1998: 500).

In relation to our assignment, Rigg has some interesting observations that are an inspiration to our study. The article focuses among other things on rural people's movements back and forth between villages and cities mainly to work. This is also termed occupational diversity. Rigg explains that recent studies show that there are three main strategies behind occupational diversity and that these often are connected to wealth. For the poor rural people occupational diversity is a strategy of survival, for the middle income people it is a strategy for consolidation and for the rich rural people it is a strategy for further accumulation.

Rigg also discusses which effects this rural-urban interaction has on the agriculture. This is very relevant for our study that focuses on people's movements and the following land use changes. According to Rigg off-farm work has an important effect on agricultural methods and production. It has consequences for labour availability, for cultivation practices, for time available for farm work and for use of mechanic tools (Rigg, 1998: 508-512). These consequences are more or less also what we expect to find when we come to Tringgus. If changes has happened it can be viewed as if there has been changes in the household's livelihood strategies and the livelihood approach will then help us understand what changes happen and why they happen.

As described previously the livelihood approach will be used as an analytical framework. The analytical framework in this synopsis is based on Ellis' framework for micro policy analysis of rural livelihoods (See annex 5). The idea is that the household platform is based on different assets and the access to these assets is modified by various factors. Important to analyse the livelihood is also the context in which the unit of analysis is situated. All these things are part of the forming of various livelihood strategies. These livelihood strategies are composed of different activities which affect the livelihood security and the sustainability.

To investigate every aspect described in this framework will not be the objective of this assignment, but the way of understanding livelihoods are very relevant to our work.

Methods

We will assess the assignment in three main ways, by dividing our methods into three targeting groups(see the figure below). The first targeting group is the two headmen in Tringgus, the second is a representative fraction of the households and the third is the selection of some few households which will be targeted as our focus group (see annex 2 for the time frame). The methods used in our livelihood approach are; participatory appraisal approaches such as transect walks, seasonal calendar and mapping, furthermore we will use quantified questionnaires and qualified semi-structured interviews and analysing soil erosion.

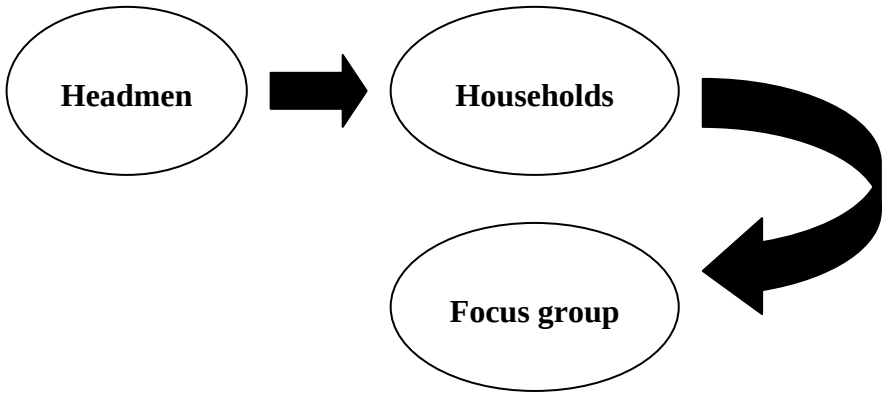

Figure 2: The three targeting groups.

Headmen

A useful method relevant to our proposed tasks is participatory rural appraisal (PRA). Before we conduct interviews and questionnaires we have to have overall information about the village. As such, we will prepare participatory social and resource mapping. In social mapping, we will find information about household characteristics and locations. On the other hand, resource mapping will furnish us with the information about villagers in relation to resources and resource use. Taking our limited time framework into account, we will perform all these strenuous tasks by selecting the first targeting group by which we think has a preconceived insight about the area under our study. These maps will also help us make transect walks with the focus group and then finally decide households for questionnaires. We foresee that village

leaders are the most relevant groups to be first contacted pending what proposals will given by our Malaysian counterparts.

Social mapping

Social mapping shows people, social groups, health and other household characteristics, leading on to identification of key informants, and then to discussions with them and analysis by them. In participatory social mapping, local people show the location of household. With an informed (knowledgeable) group or person, a participatory census (social mapping) of a small village has been conducted in less than an hour, and then other information added by "interview the map". A participatory map leads to planning transect walks in which villagers who made the map act as guides for outsiders. The transects in turn lead to the identification and discussion of problems and opportunities, which then lead to listing and ranking options or "best bets". In participatory resource mapping, local people present their view of their natural resources. (Chambers, 1997)

Households

There are approximately 80 households in Tringgus, where the households are divided into two parts, one with 10 households and one with 70 households. A fraction of both parts of the village will function as a sample of the whole population (the 80 households). The sample chosen has to be a representative and stratified selection of the total population. These two factors will be present due to the two headmen's help in giving an overview of the village. When the households have been selected they will be stratified with focus on the household's welfare/wellbeing and on the social mapping conducted by the headmen. The village will then be categorized and further divided in relation to certain criteria. These criteria have not been decided yet, but it could be wealth, migration and commuting.

Questionnaire

The stratified households will be asked questions relevant for analysing the five elements and the assignment (Ideas for questions see annex 1). The questions will be put forward through a quantifying questionnaire and be asked personally to each household, both the female and male head of household (the wife and husband). This is done due to the fact that both female and male head of household has different work

areas which therefore recurrently can give them varying parameters and opinions about the five elements. Furthermore the questionnaire will be designed in a way so it will not be offensive or confusing and it will also have to be tested on for example a control group, to see if any parts of the questionnaire are misguiding. (Oppenheim, 2000)

Focus group

To get insight into the household's livelihoods and livelihood strategies in the few days we have at our disposal, we have chosen to select a few household which we will investigate more thorough. We do not know yet how many households we will select but we talked about selecting three or maybe six. The thought behind this is to select households that represent the extremities of the criteria we choose and one or two households that represent the average of the criteria. As mentioned the criteria could be wealth or migration (or both). This means that we will select a household where no members are involved in populations movements, a household where many (needs to be defined) members are involved in population movements and a household where members represent the average of population movements. The procedure will be the same if we choose wealth as the criteria. We are aware though that whatever we choose we have to be careful to remember to define the criteria well. By selecting households that represent the extremities and the average we will argue that we get a representative selection of households.

The methods we will be using to get the information we need about the households to approach the assignment, will be semi structural qualitative interviews, transect walks, seasonal calendars and soil risk analysis. In addition we will use relevant maps (ex. Soil maps and rain fall maps) and pursue relevant information from government offices in Kuching. The following will be a short introduction to each method and a discussion of what kinds of information we expect to achieve.

Semi structured qualitative interview

By doing qualitative interviews it is our goal to get more in-depth information about all the elements of our assignment i.e. population movements, livelihood strategies, resource use and agricultural production (See annex 4). We also hope that the interviewed persons will be able to tell us about changes in the elements/livelihood

strategies that might have taken place during the last years. The interview should also give us an opportunity to get the interview person's opinions about the changes that may be taking place i.e. ask them why they think changes are taking place and what consequences they think this have had or will have. Maybe the interview person will make us see connections we did not think about, or make us revise our assumptions.

Transect walk

Like with the headman we would like to make some transect walking with members of the selected households. On the walk we would like to go to all the areas owned or used by the household. This could be the fields they cultivate or that lies fallow, the woods, if they use it in some way. If they have a garden where they grow vegetables we will go there or if they own or use other areas for other purposes we will also go there.

This method we assume will provide information about some of the household's livelihood strategies, for example if they grow vegetables, or cultivate fields. It will also give an opportunity to talk about land use changes. In all the places we go there will be an opportunity to ask if any changes in use has happened. Finally we assume that it will be possible to get information about use of resources. For example if the household own some machines for cultivation of land or they use irrigation for their fields.

With this method there will be an opportunity to involve the household more in the investigation which hopefully will provide information that the interview may not.

Seasonal calendar

The seasonal calendar can be made for many purposes. With this method we would like to get information about the household's use of human resources which we assume will be dependent on population movements. We would like to know for what actions the household uses human resources and when. By doing this we hope to see whether population movements have changed the use of human resources and if this has changed anything in livelihood strategies, resource use and agricultural production.

Soil risk analysis

Qualitative Assessment of Soil erosion Risk:

A way assessing soil erosion risk is to qualitatively investigate without going deep into complex calculations of soil, topography and meteorological parameters. That is qualitative assessment of soil erosion risk that involves:

1. Existence of sedimentation blocks of water ways
2. Uncovered field (vegetative)
3. Steep slope
4. Conservation measures
5. Perception of farmers to erosion.

In Tringgus, field qualitative assessments, transect walks; interview and interviews will be used to assess erosion risk. This qualitative assessment may pave the way to detailed research on soil erosion

Land tenure

The way to assess the land tenure and the various effects is not an easy task. There may be more than one type of land tenure system in Tringgus, which is why it is, as John W. Bruce puts it, important to work from behaviour to tenure which means that it is not wise to start asking the questions like 'who owns the land'. Rather it is better to start asking questions about how the land is used. This way it may be easier to understand the land tenure system(s). This is why we will integrate the questions on land tenure in some of the other methods being used i.e. transect walks and interviews. We will be asking both the headmen and the selected households, questions about land tenure. This way hopefully, it will be easier to avoid biases from either the headmen or the households. In Kuching we will also try to get second hand data on the land tenure systems.

Collaboration with the Malaysian students

The collaboration with the Malaysian students will be an important part of the whole assignment, both before, during and after the fieldtrip. Before the fieldtrip the contact to the Malaysian students has been through the internet, writing emails. Both parts have explained what objectives will be pursued and what methods will be used.

When arriving in Kuching, it is our plan to meet with our counterparts and discuss what we will do and when. The methods will be of interest for both parts which gives us an opportunity to perform them together. The questionnaire is an example of this, where it will possible to integrate questions of interest for both parts in one questionnaire. This will save us time and create opportunities for fruitful discussions. As far as possible we will aim at participating in all the methods being performed. This will help us use the experiences and results of all methods in the final report which is an important goal for us. The contact between us and our counterparts will be maintained when coming home so that questions can find answers and discussions will continue to contribute to a better understanding.

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Annex 1: Outlines of Useful Questions

Population Movement/migration/commuting

- What are the needs for/availability of labour other than household members-present, past?
- What kinds of work do inhabitants have other than farming or dependency on natural resources (forest products?)
- Where they are working and with which skill they are performing their tasks?
- When did they start their work other than farming or dependency on natural resources (forest products?)
- Which work is most important or dominant?
- What are magnitudes of dependency on farm/forest products and that of other work in terms of income? Which one they most depend on?
- Which crop they used to grow in past and present, and if there is difference what was the reason for that change of land use?
- What is the House-field distance (time)?

Livelihood Strategies

- How does the villager come from Kpg. Tringgus to another village, is it bye car, moppets, walking, hiking or another form of transportation?
- Is the village dependent on the inhabitant working in other villages/towns?
- Which kind of remedies does the villages inhabitants have and use for their agricultural production?
- Does the village have enough manpower to sustain a self-sufficient food production and is it necessary?
- What was the past and what are the present and the future strategies for their agricultural production, and employment in other work areas?
- In which work areas are the village inhabitants employed, past and present?

Agricultural Production

- What is the impact of demographic change on intensification of farming and expansion of land under cultivation?
- What impacts have the remittances from commuting members of households and those permanently working outside on farming intensification and expansion of land under cultivation?
- What impact has the expansion of land under cultivation and clearing of forests on degradation of land?
- What is the impact of new settlements on land productivity?
- What changes have occurred in land productivity since 1970 when first Bidayuh farmers moved into the area?

Resources Use

- Human resources: To assess this it will be relevant to find out who in the families do what, in relation to land use, and when. What do men, women and children do? Do they have different tasks and do they vary during the year? Have the different tasks changed during the past years? If yes, why?
- Natural resources: To assess this we could be asking questions like, what natural resources do they use in relation to land use? This question could focus on land ownership, use of the forest (ex. Rubber trees, fruit trees, trees for building fences around crop fields), and use of water resources (ex. in relation to growing rice). Has the use of natural resources changed during the past years? (Has it been affected by land use changes or has it affected land use?)
- Use of resources that are not natural, like machines, fertilizers and so on. In relation to this we could focus on do the farmers use any resources that are not natural? If yes which and has the use changed during the past years? Why has it changed? (Has the land use had an effect or has it affected land use?)

Annex 2: Tentative time schedule

Date	Activity	Performers
6-8th of October	Internship at Sømilestationen	All
20th of October	Discussion of our preparations	All
3rd of November	Making the synopsis	All
10th of November	Making the synopsis	All
17th of November	Submission of draft synopsis	All
24th of November	Discussion of draft synopsis	All
1st of December	Making the synopsis	All
10th of December	Handing in the synopsis before 1400 hours	All
9th of January	Discussion with the Malaysian group	All
10th of January	Interview, transect, mapping with Tringgus' two headmen	All
11th of January	Household questionnaires	All
15th of January	Few households, transect, seasonal calendar, interview and analysis soil erosion	All
29th of January	Leaving Tringgus	All

Annex 3: Logical Framework Appraisal (LFA)

Project Elements	Indicators	Assumptions
Development Objectives:		
Immediate Objectives: • To evaluate past, present and future effects of land use changes in Kpg. Tringgus.	• Reports approved and accepted by course responsible	• Report submitted on or before the deadline.
Outputs: 1. a) Give us an overview over the village. b) Enhance our knowledge about the five elements in a more thoroughly and in-depth way. 2. Inform us about the reel stratification of the village and the inhabitant's livelihood strategies. 3. a) Give us an overview over the village through social mapping and transect walk. b) Enhance our knowledge on the livelihood strategies through transect walk and seasonal calendar. 4. Give us an interdisciplinary approach which will improve the knowledge our different methods.	• Receive enough of questionnaires. • Interview and consultation held. - Headman 1 - Headman 2 - Focus group - Kristine and Rikke • Discussion about the project and methods used with the Malaysian students.	• We can receive feedback from questionnaires. • People are willing to be interviewed and are reliable source of information. • The participatory approach will be successfully. • Discussion with the Malaysian students will be effective and efficient.
Activities: o Communications (emailing & letters), Group meetings & discussion, Writing the synopsis & report, Reading & research (I.T) o Interview (1) - Headmen (a) - Focus group (b) o Questionnaires (2) - Selected households o Participatory Appraisal methods (3) - Headmen (a) - Focus group (b) o Consultation with the Malaysian students (4)	Inputs: o Materials for Reading and Research activities. o Research Equipments (computer, printers, meeting rooms, paper, internet) o Funds for travels and site visits. o Funds for materials etc.	Preconditions: o Material and Equipments for Reading and Research is available. o Key persons will cooperate on the interview and questionnaire process. o Everybody in the group will work on their respective assignments. o Availability of funds.

Annex 4: Interview guide for the 3 – 6 selected households

We seek in-depth information about all the elements of our assignment i.e. population movements, livelihood strategies, resource use and agricultural production. We also hope that the interviewed persons will be able to tell us about changes in the elements/livelihood strategies that might have taken place during the last years. The interview should also give us an opportunity to get the interview person's opinions about the changes that may be taking place i.e. ask them why they think changes are taking place and what consequences they think this have had or will have.

Population Movement

- The dependency on non-farm work through migration or commutation (can they sustain their lives without).
- Has non-farm work given the family anything (materials, money, leisure time etc.) or has it taken away anything away (tradition, family is fractioned)

Resource Use

- Has the use of manpower changed (work in the fields – more or less work hours)
- Hiring of manpower to cultivate or other.
- Is there more money to buy food, TV etc?

Agricultural Production

- What is the production primarily used for (consumption or selling)
- If the harvest goes wrong, what is than the alternatives?

Livelihood strategy

- What is the strategy for the future, work in non-farm, farm or other
- Does the family want to leave the village

Land use changes and land tenure

- Their opinion about the changes for example the new road
- Their opinion about villagers whom are taking work away from the village.
- Their opinion about non-farm work is it good or bad for the community.

- Which effect has it had on the agricultural crop choice at the farm land which has unspecified ownership?