INTENSIFICATION OF THE TRADITIONAL AGRICULTURAL SYSTEM IN PATAU, TAMBUNAN DISTRICT, SABAH, MALAYSIA

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1.Abstract

During a 10 day fieldtrip to the Patau village, Tambunan district, Sabah, Malaysia, we found that many of the farmers are in the early phase of intensification, using chemical inputs, irrigation and are beginning to abandon the traditional agricultural system of shifting cultivation, in favour of a system that is increasingly dependent on permanent cultivation. The motivations for this change, are mainly socio-economic, e.g. lack of labour, land or the wish to secure an adequate and steady supply of food. The role of agricultural agencies is also an important factor in this process. The constraints related to intensification are lack of appropriate advice and support from agricultural agencies and attacks by different types of insects and animals. The soil samples of upland fields did not indicate any changes in soil fertility between fallow and cultivated fields.

Keywords: Sabah, Shifting Cultivation, Intensification, Motivation, Soil, Soil Fertility

2. Introduction

A. Literature review and theoretical considerations

Intensification and commercialisation have been key avenues for agricultural development in Malaysia in general and Sabah in particular. Attempts have been made by different governmental agencies to commercialise and intensify agriculture in order to increase food production and improve the socio-economic conditions of smallholders. In spite of these efforts the income of small farmers in Sabah remains under the poverty line [Lim (1993), p. ix-x].

The underlying problems and motivations related to agricultural change and intensification are complex. Most theories link agricultural intensification to population growth. According to the theory of Ester Boserup, population growth results in a shrinking supply of land and other natural resources, which provide motivation to invent other means of utilizing the scarce resources or to invent substitutes for them. This leads to changes in the agricultural practise, which includes soil fertilisation, more thorough cultivation, labour saving, yield increasing technologies and land improving investments [Boserup (1981)].

The need to increase food production and at the same time conserve land to feed growing populations, have largely been achieved through the same process of agricultural modernization in much of the world and is based on positivist science, where scientists and planners identify problems and solutions, e.g. in relation to agriculture, and pass them on to the farmers. The

technologies and forms of intervention developed by scientists and planners aim at changing practices of rural people. Local needs, conditions and knowledge are seldom considered [Pretty (1995) p. 26-27]. Problems arise when the conditions, constraints and needs of small farmers are not considered in agricultural research and planning, which has been a problem in relation to smallholder farming systems in Sabah [Abdullah & Rejab (1993) p. 65]. This might be an important explanation why agricultural development has benefited small farmers less than others.

Definition of intensification

In our definition of intensification we mean a process; a process where the farmer either increases the inputs of labour or capital on his field, and/or where the farmer cultivates the land more intensively (area intensification), for example decreasing the fallow period in shifting cultivation. According to Mortimore the process of intensification normally has three appearances, and they are either implemented alone or together:

a. Increase in labour input per hectare,
b. The creation of landesque capital (e.g. in the form of soil/water conservation structures or irrigation systems) and
c. Changes in land management. These might include changes in: cultivation frequency (or fallow interval); the percentage of land cultivated; the farming technologies used; the crops selected; the ways in which crops and livestocks are integrated; and the management of rangeland and trees. [Mortimore (1995)].

The main objective for intensification is to increase the yield. This objective can also be reached by extensification, i.e. area expansion.

Definition of shifting cultivation.

Shifting Cultivation is the name that is used for agricultural systems that involve an alternation between cropping for a few years on selected and cleared plots and a lengthy period when the soil is rested. Cultivation consequently shifts within an area that otherwise is covered by natural vegetation [Ruthenberg (1971)]. During the fallow period the biomass is allowed to recover to a level at which it will, after clearance, permit a new harvest as good as previous ones. The sustainability of the system depends very much on the length of the fallow. But with increased population pressure, it seems that shifting cultivators respond with a shortening of the fallow, or

abandoning part of the shifting cultivation system, and create a mixed system with both shifting cultivation and a range of farmed fruit trees [Brookfield (1995) p. 115 +121].

A. Objectives and research questions

Objectives

Our main objective behind this study is to look at the dynamics related to intensification, i.e. what are the motivation factors behind the changes of the traditional agricultural system to that of a more intensified system. This should be seen in relation to the theory, which tries to explain population growth as an underlying factor. However, we are also interested in looking at the more direct factors and problems related to intensification. More specifically, we want to investigate how the intensification process is implemented in practice in our study area and to gain an understanding of the problems and constraints farmers are facing. In relation to this, an important aspect is to understand the way in which modern technologies, inputs and knowledge are transferred from the scientists/planners (i.e. agricultural agencies) to the farmers.

Research questions

Our initial research questions were:

1. Why do the farmers in Patau intensify their traditional agricultural system - what are the natural and social factors that motivate them?
2. Which consequences does the intensification have environmentally and socially?

Well knowing that these were broad research questions and that the situation in Patau might be different from what we imagined, we identified some indicators, which we wanted to look. Later on we changed our focus due to the fact that the intensification in Patau was at an earlier stage than we had expected. Our research questions, therefore, changed to focusing on the motivations and problems related to intensification. Our research questions are:

- ***What are the motivating factors for farmers in Patau to intensify their agricultural production?***

- ***What are the problems related to intensification of agriculture in Patau?***

D. Study area

The village of Patau

The village of Patau is consisting of three hamlets, Patau, Narayat and Katagayan. The reason that there are three hamlets is, according to a key informant, that some people wanted to move from Narayat, due to lack of space, and founded the hamlet Patau. Later this happened again, and Katagayan was on the map.

The largest part of the village (Patau and Katagayan) is situated in a flat valley bottom; Narayat is situated on a small-elongated ridge (100 - 150 m high) that divides the lowland around Patau. The lowland around Patau is primarily used for growing wet rice, and the Department of Irrigation and Drainage (DID) completed a major irrigation scheme in Patau in the beginning of 1999. In the vicinity of Patau there are large areas of steep upland, this upland is mainly used for shifting cultivation, and to a minor degree to cultivation of more permanent crops, for example coffee.

In the Patau area there is another small settlement called Mahua, which we will include when we mention Patau. Mahua is situated 6 km from Katagayan, and has a very different setting than the three other hamlets in the area, because Mahua is lying on a ridge, with only a few lowland fields surrounding it. The three hamlets and the settlement of Mahua (from here on the whole area is called Patau) has approximately 700+ inhabitants, most of them are born and raised in this area. Though many have lived outside the area for some time, either in bigger cities like Keningau, Kota Kinabalu or even further away on the mainland or abroad.

The primary source of income and occupation in the Patau area is agriculture. The single most important employer in Patau is the KMP Patau (Primary School Patau), but even though the teachers are employed they still practise farming part time. Although agricultural output is the main source for income, the cultivation of cash crops in Patau is minor. Only a small part of the agricultural products aren't consumed in the households, just the surplus is sold at the market.

In the past days Patau was a place where there were many Bobolian, the pagan priestesses of the Dusun, but nowadays, as the Bobolian either dies or convert to Christianity, there are supposedly only 1 or 2 Bobolian alive in Patau.

Power structures in Patau.

The village council

The village council (the JKKK) deals with economic and development issues. In Patau there are three village councils, each consisting of 11-12 members. There used to be just one council but

they divided into three because of the possibility for more funding and the population increase. The old unit still exist; there is a 16-17 persons coordination unit between the three JKKK. This unit is quite powerful, but not formally. All the members of the JKKK's are appointed by the government. The headmen of the villages are automatically member of the JKKK. Everything to and from the government goes through the District Officer (DO), who is the Sabah Government's representative in the Tambunan District. All decisions in the village are discussed in the JKKK, and a minute is send to the DO. The JKKK has three types of meetings, the annual meeting where all the villagers can come, urgent meetings where the villagers are invited sometimes and the running meetings just for the JKKK members. Everybody in the village can make proposals to the Village Council; they will discuss it, and if it is an important issue there will be a meeting with the villagers.

The Adat system

The adat is the traditional law, and is used for solving problems in the villages without involving the Sabah state authorities. The adat system consists of three layers; the headman of each village is the first instance, then the native chief for the Mukim level [1] (in the Patau case there are 7 villages in the Mukim.). And the top level is the Head of District Tambunan and the native court for the district. If problems are not solved at the top level, then the case goes to the District Officer, and the Sabah Laws are applied to solve the problem. The Adat is used on smaller cases like theft and some land tenure issues, and the punishment is always some economic compensation from the offender to the offended. This way nobody goes to jail, and no money is paid to someone outside the village. But on a crime like murder the Sabah Laws are applied.

3. Methodology

A. Social Science Methods

Our study of the farming system and intensification process in Patau village is to a large extent based on social science methods with a focus on qualitative methods. We have used methods such as structured surveys of farming households in the village, observations in the village and field walks, mapping and semi-structured interviews with key informants, farmers, and officials from different relevant government agencies in Tambunan District. In addition, we have been inspired by the Participatory Rural Appraisal approach (PRA) and gathered a group of farmers to

[1] Mukim, a Bahasa Maleyu word meaning: a subdivision of a district

do a participatory matrix scoring. In addition, natural science methods were applied by taking soil samples and taking measurements of upland plots and fallow areas. An account of these methods will be provided in the following chapter.

As mentioned earlier, we realized that the situation in Patau was somewhat different from what we had expected before leaving Denmark. Thus, we altered our research questions to focus on the motivations and problems related to intensification.

Indicators

Based on our initial information from the surveys and interviews we identified the following indicators;

- Current farming system (land use, ownership, crops, cultivation methods etc.).
- Farmers' access to inputs and indicators of intensification: use of pesticides, fertilizers, machinery, irrigation, new farming technology and methods (new varieties, use of intercropping), fallow periods, cropping frequency.
- Farmers' access to knowledge; degree of education and access to and use of extension services.
- Farmers' access to off- farm work
- Socio-economic indicators (income, subsistence production, access to credit, loans as well as labour and gender issues)
- Farmers' perceived problems related to farming and household situation.
- Farmers' future plans related to farming and household situation.

Based on these indicators and findings we wanted to assess the problems related to intensified production and the major reasons why farmers are intensifying their production.

Research questions in relation to our interviews

In our attempt to assess the degree of intensification in Patau we had to operationalize the term "intensification" in order for it to be understood by the farmers. We, therefore, used our definition of intensification as a way of identifying indicators of the intensification process. The indicators found to be operational were:

- Use of inputs (labour, pesticides, fertilisers and other chemical inputs, use of machinery and irrigation)
- Use of new varieties
- Changes in land use system: such as shortening of the fallow period, permanent cultivation etc.

We used these indicators to determine if there had been an intensification and to what extent. When asking farmers about intensification we did not use the term 'intensification,' instead we tried to address this issue by asking if they try to increase their production (how and why), the role of agricultural agencies, if they are growing any permanent or new crops, if they use pesticides and fertilizers, machinery, what their future plans are in farming and why.
In assessing the problems related to farming and intensification we asked the farmers open-ended questions to get them to identify the main problems. We also asked directly if such issues as labour and land access were potential problems and about the connection to agricultural agencies to get a broad picture of the more underlying problems. Our questions related to education, economic situation, and access to advice and inputs were ways of operationalising the research question regarding farmers' motivations for intensifying. We wanted to see if education, economic situation and access to extension officers and other agricultural services were motivations for farmers to intensify.

Selection of Key informants

We decided to select two key informants, who play an important role in the village life, such as a village headman or a teacher. Our two key informants were a teachers and a veterinarian, whom the SLUSE team had been in contact with prior to our arrival in Patau. Both informants were in the Local Farmers' Association (PPK) and therefore knew about farming.
Our selection of informants for the structured survey was done with the help of some young people in the village, who contacted the farmers. Our criteria were to get farmers that owned both upland and lowland plots, and that we wanted people from all areas of Patau. We conducted 14 structured surveys as well as 2 interviews based on our first semi-structured interview guide to test the interview guide. Since not all the informants from the surveys owned upland fields we decided to select the ones with upland fields for our semi-structured interviews; out of the 14 surveys we selected 5 farmers for further in-depth interviews as well as the 2 other farmers, which we had tested the interview guide on.

Before arriving in the village we had discussed how to select both female and male informants, since some of our literature on farming in Sabah indicated that both men and women do farming and especially stressed the importance of women in farming. We, therefore, wanted to make sure that we were able to speak to women as well as men. However, it turned out not to be a problem

and we ended up with 13 female and 6 male informants, due to the fact that nearly all women do farming and that some of the men are also involved with off-farm work.
In 4 instances we interviewed two people from the same household (mostly husband and wife). This was both to crosscheck the information, but also to hear different opinions. In one case we were not aware that the informants were related until later.

Household surveys and interview with key informants

A structured survey is a method of interviewing people to collect information in which a formal questionnaire is used to structure the interviews. The principal purposes of this method are to generate quantitative data and that the content of the interview is decided and standardized prior to when the survey begins [Casley & Kumar (1988) p.54-55]. However, our objective for using the structured survey method was not to get quantative data.
The purpose of the household survey was to collect some basic information about farmers' livelihood, farming system, degree of intensification, and problems related to farming (see appendix 1). Based on this information we wanted to identify 5-8 informants for in-depth semi-structured interviews. In addition, we hoped that the findings from the surveys as well as the semi-structured interviews with key informants and agricultural officials would provide us with useful information about the farming situation in Patau, based on which we could make revisions to the interview guide for the semi-structured interviews with farmers.

Implementation

In the first survey all five of the group members participated to enable us to discuss problems and our approach afterwards. Afterwards we discussed the interview and how to make sure that the following ones were strictly structured and short. The following surveys were therefore held in less than 30 minutes and based only on questions from our structured interview guide. We divided up into two groups with 2 and 3 in each group.
We also interviewed 3 different agricultural agencies with other groups of SLUSE students. Here we focused on getting an overall idea of the farming situation in the area as well as information about the work and the role of these agencies in relation to farmers' situation and problems. It was our intention to interview some of these agencies towards the end of our stay in Patau to crosscheck some of the information we got from the farmers. However, due to the lack of time at the end we were not able to do this.

Semi-structured, open-ended interviews

These types of interviews are the most structured form of qualitative interviews and tend to use open-ended questionnaires, which list the specific questions to be asked. In some ways semi-structured interviews are similar to structured interviews in that it reminds the interviewer what questions to ask; but it also differs greatly from the structured interviews in that the questions are open-ended, the informants are sought to express themselves fully, the sequence of questions are not predetermined, and additional questions can be asked.

Semi-structured interviews have a number of strength; the information obtained can answer specific questions in a project; the information obtained from various informants is comparable enough to determine the simple frequency of responses although the emphasis continues to be on the in-depth understanding provided by the informants; and finally, these types of interviews can be conducted more rapidly than other qualitative methods.

A major limitation of this method is that the interviewer might not pursue promising leads in effect conducting more of a structured interview, and also that the information gathered is very much dependent on the quality of the interview guide. [Casley & Kumar (1988) p.13-14]

We decided to use the semi-structured interview method, as it is a good way of getting qualitative data, while at the same time ensuring that we get specific information related to our research questions (see appendix 2 for details). In addition, the interview guides ensured some consistency and that specific questions got answered when we divided up into two groups.

Selection of informants

We selected our 7 households 2/ informants based on the criteria that they had to have upland fields as well as lowland, first of all, because the combination of the two systems is an important part of the farming system in Patau, but also in order to see if there had been any steps towards intensification of the upland plots. Five of the farmers interviewed were women and four were men. The interviews were conducted in two different settings; in four cases we did it in the farmers' homes and in three other cases we went to the farmers' fields to conduct the interviews here and in 2 cases also to take field measurements and soil samples.

In all cases we had the farmers draw a map of all their plots on a piece of paper in the beginning of the interview as a way of simplifying our questions and understanding the location, size, and

[2] As mentioned earlier we interviewed husband and wife (daughter in-law) in 4 cases; some times individually other times together.

number of plots. This was a very useful method of getting an overview of the situation. Interviewing people in the farm was a good way of getting some more detailed information and of actually being able to see what the informants were talking about. It also enabled us to ask some more detailed questions, which we otherwise would not have thought of. The other interviews conducted in the homes of the farmers had some other benefits, as the informants tended to be more relaxed and we could therefore continue the interviews for 2 1/2 - 3 hours.
Initially our goal was to conduct at least 10 semi-structured interviews. However, as our findings in each interview started to be the same with very few variations, we decided to stop and ended up with the total of 7 semi-structured interviews.

Implementation of the interviews

In the semi-structured interviews we also split up into two groups; one person was in charge of the questions, a second person assisted with the questions (and/or taking notes), and if there was a third person present this person would take notes.
In most of the interviews, our open-ended questions worked quite well as the farmers for the most part opened up and provided us with much interesting information. We partly used the interview guide with open-ended questions and partly added questions related to different topics. However, in retrospect there were still several interesting questions, which we never got in-depth with, because we rushed on to the next question in our interview guide - thereby many 'why's or explanatory questions were left out. We, therefore, tended not to make the interviews as semi-structured as we had intended and instead they were sometimes more structured.
The use of interpreters worked very well in all the interviews and we did not feel like we missed out on any important information, even though we cannot be certain of this. We tried to address the informants directly, i.e. looking at the person, however, this was not always successful and instead the interpreter often became the medium of both our questions and the farmer's answers. The interpreters were helpful in rephrasing the questions, if they were not clear to him or to the informant.
Overall the interview situation was comfortable and we were able to get the majority of our questions answered, even the more sensitive ones such as questions about gender issues, decision-making, money, wealth and future hopes. A few times the informants appeared a little shy or started to laugh (for example when asked who is the main decision-maker), but were always willing to answer the questions.

As a way of giving something back towards the end of the interview we asked the informants, if they had any questions for us, or any thoughts they wanted to share. This worked well as it enabled the informants to understand the reasons for our study and have us answer some of their questions. We were also interested in hearing about their concerns and expectations related to our study. Some asked us very specific questions about problems in their farming, which we were rather surprised about and unable to answer.

PRA - Participatory Matrix Scoring

Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA) are methods much used in development projects and research, and emphasize participatory methods and tools. These methods focus on learning from the local people themselves; that they present and own the outcomes and also learn themselves during the process. These methods have been referred to as data economising and data-optimising approaches. Different PRA techniques such as the participatory matrix scoring have been invented and tried out to investigate and analyse complex problems and often also possible solutions with local people. The basic idea is that the local people themselves define their problems, ideas and solution [Mikkelsen (1995) p.67-70].
We have used this method to get more in-depth information about the problems related to farming, which farmers in Patau face, and for the farmers to define these problems themselves. Due to our limited time we were not able to get these farmers to identify possible solutions.

Conducting the PRA

We invited about 4 of the farmers, which we had conducted the semi-structured interview with, to a meeting the last afternoon in Patau to do a participatory matrix scoring. Three other informants also showed up for the session. This was conducted in a community hall. We had made two charts prior to their arrival; one to relate different crops to different problems, which the farmers were to identify (see appendix 3), the other one to identify the benefits and importance of each of the crops to each other. However, the farmers identified double as many crops and problems as we had expected they would, and they spent much time discussing the crops and problems. As a result, the first matrix scoring took 2.5 hours at which time it was too late to do the last one. The matrix scoring was done with scores from 1-5, and therefore the crops were not ranked in relation to each other.
Upon completion of the PRA the chart used to identify the problems was left in the village for farmers to look at and hopefully use.

B. Natural Science Methods

Soil Sampling

Methods of sampling depend on the purpose for which the sample is required. In general there are two main types of sampling:

1. The pedological sampling of a soil profile horizon by horizon to characterise and classify the soil profile.

2. Taking samples from the surface layer, or from both the surface and deeper layers, of a field or area is considered fairly homogenous in order to make the analysis designed to indicate soil fertility, productivity and to lead to fertiliser recommendation [Ahn (1993)].

Our emphasis was on the second type of sampling, which we used to investigate our areas to see if there were differences or changes in the levels of nutrition between the cultivated land and the fallow land.

According to Ahn, the samples are taken to a standard depth, commonly 15 cm. It is important to have a sufficient number of core samples (20-40 core samples) to ensure that when mixed the samples approach the average of the field. The core samples are then thoroughly mixed to form a bulk sample, which is sub-sampled to give a final sample for analysis.

According to Landon, the core samples involve the collection and mixing of about five to six samples equal in weight, and after mixing to take one or two sub-samples for final analysis. Care should be taken, however, to avoid collecting sub-samples from locations having a different history of land use, different topography and recent fertiliser application [Landon (1996)]

Despite the interrelated pressures of time, costs, lack of proper tools and difficulties of the slippery slopes, we collected five samples in each part of the slopes (the upper part of the slope, the middle part of the slope, and lower part of the slope) in both farms and their fallows. Later we mixed the samples of each part of the slope and took 10 sub-samples for final laboratory analysis. These sub-samples were analysed for pH, CEC, available P, % N, % C, texture, Ca, Mg, K and Na in the Agriculture Research Centre, in Kuching, Sarawak, Malaysia.

4. Results and Discussion

A. The farming system in Patau village

As mentioned earlier, farming is the primary occupation in Patau and is therefore important for the livelihood of the majority of the population. Even though it is the primary activity for most

people, only a relatively small amount of the crops cultivated in the area are cash crops. The bulk of what is cultivated is primarily consumed in the village. However, is quite common for farmers to sell vegetables at the marked in Tambunan when they have a surplus, i.e. more than the family can consume.

Apart from wet rice production in the lowland other common crops include: dry rice, cassava, sweet potato, ginger, tobacco, corn, sugar cane, cocoa and a number of vegetables (long bean, short bean, cucumber, pumpkin, chilli, cabbage and some local vegetables) as well as fruits (banana, pineapple, durian, jackfruit, rambutan, mango). These are mostly cultivated in the upland areas. Farmers in Patau usually grow a variety of these crops and a common combination is wet rice in the lowland plots and vegetables, dry rice and different types of fruits on upland plots.

Government subsidies and inputs

In an attempt to improve wet rice productivity and support farmers' livelihoods, the government provides subsidies through the Department of Agriculture by giving the farmers 100 RM/acre wet rice and fertilizer each growing season. Chemical fertilizers, pesticides, and herbicides were introduced to the area 5 to 6 years ago and now most farmers are using these inputs. In spite of the beneficial results, which were acknowledged by a number of farmers, a few farmers had reservations regarding the use of these products. A few of our informants mentioned some side-effects from using pesticides; small fish had been killed near the wet rice fields at one point and one farmer mentioned getting dizzy from applying chemicals in her plots. However, the use of chemical pest control such as insecticides and herbicides (even though not in a large amounts), has according to different informants, helped increase the yields substantially and reduce the crop damage. In addition, the recent construction of an irrigation system is also helping farmers to intensify the wet rice production.

Upland farming and shifting cultivation

The shifting cultivation system is still practiced in upland areas. The fallow period vary largely from farmer to farmer and from field to field. In general, the fallow period range from 2 to 3 years on the plots that are considered suitable for agriculture and close to the farmer's house. In other areas the fallow period can reach up to 9 -10 years. This seems to be in cases, where the land is very far from the farmer (as an example, one farmer had a plot 2.5 hours away), and when the farmer does not have enough time and labour to clear the land for new cultivation. Other factors

can be related to the fertility of the soil and topography, which may also have an impact on the fallow period. The soil analysis results show low fertility in the investigated upland fields.

Many crops grown in upland areas depend on the amount of rainfall and chemical inputs such as fertilizers, insecticides and herbicides are rarely applied here. The cultivation in these fields depends mainly on the fertility gained after the fallow period, hand weeding and to some extent on green manure or chicken manure. Dry rice is often inter-cropped[3] with other vegetables and fruits such as sweet potato, cucumber, cassava, maize, pineapple, rambutan etc.

Cash crops schemes

In recent years, there have been attempts by Department of Agriculture (DoA) and Korporasi Pembangunan Desa (KPD -rural development corporation) to discourage the farmers from practicing shifting cultivation and instead turn to more permanent cultivation. As a result farmers in Narayat (hamlet in Patau) have started a coffee scheme under the DoA. Some farmers have also planted rubber trees, although none of our informants were involved with this type of cash crop. Also, as an incentive for farmers to improve their production, KPD provides facilities for mushroom production (see chapter 4 e) and 8 farmers joined a mushroom project in 1990.

To provide good yield, coffee production requires intensive use of chemical fertilizers and insecticides to control especially ants, which can damage the plant. The application of fertilizers in the coffee fields is recommended by DoA staff and must be done 3 times a year. However, according to one informant he applies the whole amount once a year due to delays in getting fertilizes at the right times.

Mushrooms also need chemical sprays against snails and other insects, which must be applied periodically in all corners and holes of the mushroom house, where pests can hide.
Finally, many farmers in Patau are starting to plant permanent fruit trees in the upland fields such as: durian, rambutan, mango, jack fruit, which are less time- and labour consuming compared to other crops. Thus the practice of shifting cultivation seems to be declining.

[3] When using the term intercropping we use the term broadly to include the cultivation of different crops in the same field

Wet rice production might have primary importance due to the relatively higher yield compared with upland production: in terms of labour the upland requires twice a much labour as the lowland and gives only half the yield. However, cultivation of upland areas is also important for the farmers as it enables them to plant other crops than rice. Hence, most farmers have a combination of upland and lowland production.

Farm size

The lowland plots are generally smaller than the plots in the upland areas, but the yield is almost double per acre. As a result all the farmers we interviewed had lowland. The lowland plots have an average size of 2.5 acres (average of the 16 households interviewed). Most of our informants have just around or a little less than 2 acres, but one farmer owned up to 6 acres lowland. A few farmers have to rent lowland, if they are unable to obtain land otherwise. A few farmers had as little as 0.5 acres lowland. One reason for these small plots is the fact that children inherit land - and as the population grows the smaller are the plots, which are passed on to the children.

In the upland the size of the plots and the number of plots owned by each farmer vary greatly. Five of our 16 informants [4] did not own any upland plots at all. Of the 11 households that do own upland 6 of them said they had plots with a total size of less than 10 acres (most common was 2-4 acres). Another 5 households owned plots in the upland that exceeded 10 acres - with an average of 15 acres, although one household had more than 45 acres. In spite of the relatively large sizes of these upland plots more than half of them are not under current cultivation. According to the farmers the reasons for not cultivating all this land is either due to the long distance to the fields, health reasons, lack of time and labour. In addition, some of these areas are still used for shifting cultivation, which is why not all the land is under current cultivation.

When asking questions about farm size at different occasions or to two different members of the household, the answers were sometimes not quite compatible, which indicates some inaccuracy. A reason for this could be that farmers were not always remembering all their plots unless they were doing a mapping of all the plots. Some farmers might only have mentioned the plots they currently cultivate (and thereby leave out areas that are not cultivated), and others might have problems remembering the actual size of their plots (which might be why some plots were

[4] Included here are informants from both the survey and the semi-structured interviews since this was a question we asked both groups of informants.

extremely large). Finally, there was also some uncertainty in a few interviews whether or not the farmer actually had a title on his/her upland plots; two persons said they were still waiting for a title.

Socio- economic issues

The level of education tends to vary from farmer to farmer mostly depending on age. Most of the older farmers (age 60 and above) did not have any formal education, whereas most other farmers had some kind of education (form 3-5). The younger generation tend to have a longer education than the older generation and as a result, many of the young people have off-farm activities in the urban areas such as Kota Kinabalu, with timber companies, or as government workers in the area (e.g. as teachers). It is therefore not surprising that 9 out of the 16 farmers interviewed derived most of their income from off-farming activities [5] even though they themselves were full-time farmers. The other 7 farmers had farming as their primary source of income. These farmers sell their surplus of vegetables and fruits at the markets in Tambunan, which is their main source of income. This is for the most part done on an infrequent basis, e.g. when they have more vegetables than they can consume themselves. Hence, their income tends to vary. Only a few farmers go to the market on a regular basis.

Due to differences in sources of income, household size and composition expenditures and income tend to vary from household to household. Also, when it comes to household savings there are great variations between the different households [6], a few farmers do not have any savings, others have a few hundred ringgit saved up in the bank and one had up to RM1000. Most of these savings are planned to be used for unforeseen expenses, children's' school, and other necessities. However, a number of households also owned such items as televisions and telephones. Only two of the households had taken loans to improve their sources of income. These loans were not put directly into farming, instead they were used for such things as setting up a small shop in Patau, buying jars and other equipment for rice wine production, buying a rice processing machine, a chainsaw etc.

[5] Off-farming activities are activities not directly related to farming. This includes off-farm employment, temporary work, owning a store, getting money from children, and making and selling rice wine (since the rice usually bought from the market).

[6] We only asked these in-depth questions related to income, expenditure, savings and loans in our semi-structured interviews.

Most of the farmers without off-farm income mentioned that they have some difficulties getting enough money for the household (especially those households with many children), although they emphasized that they are better off now than 10 years ago. A common finding is also that most of the farmers are positive when asked about the future and that they hope to increase their income and farming situation by planting more permanent crops.

B. Natural problems in the agricultural production

The farmers in Patau identify many natural factors, which affect the agricultural production. Some of these factors can even interact with each other and enhance the negative effects. The type and intensity of infestation of these problems vary from place to place and from one ecology to the other. These problems can be grouped into types of pests (insects, rodents, birds, and other bigger mammals), which appear in both lowland and upland farming systems. Weeds are problems especially in uplands. Climatic problems, such as floods and droughts also affect the agricultural production in Patau. All these factors can cause fluctuating yields.
Our findings are based primarily on qualitative interviews and PRA with the farmers. Therefore, we were not able to establish the scientific names of insects, weeds and other pests, and include it in this study.

Insects

Insects can cause extensive damage to the rice crop in the field and during storage. The insect complex is enormous when viewed worldwide and is quite extensive when viewed locally [Hill and Waller (1988)]. Although we do not have a clear idea about the losses caused by insects, most of the informants agreed that insects reduce the yield substantially and their negative effects are clearly seen in the two types of cultivated rice as well as vegetables like long bean and cucumber (as mentioned in the PRA Matrix Scoring).
Insects can attack all parts of the rice plant in all stages of the growth. To cope with this problem, some of the farmers in Patau spray pesticides one to two times a year, and some of them spray only after the insects already have started to damage the crop. A list of the different insecticides and pesticides available in the DOA shop in Tambunan appears in appendix nr. 4.

Rodents

Rodents are pests mainly of stored products, which they eat and spoil with their excrements, but small rodents like rats and mice can also seriously damage the crop in the field. According to the

informants, these rodents cause considerable loss in rice plants and newly planted seeds, and can cause serious damage to many other crops such as: coffee, tobacco, mushroom, cassava, sweet potato, cucumber, pineapple, jackfruit, banana etc. In an attempt to limit the damage caused by rodents, the farmers use different methods; for instance in lowland fields, they put traditional traps in different places, where rats may enter to the fields. The farmers also increase the level of water to stop rats from reaching the rice plants and from time to time clear the vegetation around the fields, where the rats hide. But these methods are not fully effective in decreasing the losses caused by rats.

Birds and Mammals

Bird and mammal pests are less important than the types of pests already discussed, but can also cause sporadic and local problems [Cox and Atkin, 1979]. Birds, as confirmed by most farmers in Patau, are serious pests of both wet- and dry rice, banana, and cucumber. The large forest areas near the fields provide a stable habitat for different kinds of bird populations. To prevent the yield from loss, farmers use old control methods such as scarecrows. Even though not mentioned by the farmers, these methods seem to be ineffective as good prevention against birds.
Many crops are also threatened by other mammals such as deer and wild boar that attack wet- and dry rice, cassava, and sweet potato.

Weeds

Weeds are in general a difficult problem to consider in a brief review, because any plant that grow where it is not wanted qualifies as a weed, and often there is a little specificity between the weeds and the crops they invade [Buchholtz, 1967].
Weeds are undesirable for the following reasons: They compete with beneficial vegetation for space, water, nutrients, and they can create a fire hazard, some are toxic or cause allergic reactions in man and animals, some are parasites on economically important plants and many harbor injurious insects, plant pathogens and rodents. Conversely, the same plants that cause losses can also reduce soil erosion, add organic matter to the soil, fix nitrogen, and provide food and shelter for wildlife and other beneficial organisms [Cox and Atkin, 1979].
Weed competition is a major constraint to upland rice production in Patau. Current trends towards shorter fallow periods and more intensive use of upland soils might further aggravate weed problems. With limited use of herbicides and the difficulty adopting mechanical weeders, farmers rely largely on hand weeding one to two times a year. According to [Moody (1994)] this

method is considered slow, laborious, and lowly efficient because, many weeds are left in the field after weeding, and weeding is often done after the crop has been seriously damaged.
Due to lack of adequate machinery and due to the fact that rice is not planted in straight rows, manual weeding is still the only weed control method practiced in the lowland wet rice production. But according to the farmers, the infestation by weeds in these areas is not as serious as in the upland, mainly because many weeds cannot grow in such anaerobic conditions, which wet-rice tolerates well.

Climatic problems

The two climatic parameters affecting the agricultural production negatively in the village are floods and droughts. The area is subject to periodic droughts, which dramatically effects the yield completely.

The adoption of irrigation two years ago has reduced the effects of the drought in lowland fields, but all the upland areas are still under the influence of the possible droughts. Droughts can also generate the auto-ignition of fires that can destroy cultivated fields and forests. According to some farmers, the area 2 years ago faced a big fire, induced by a long drought [7], which destroyed many of trees. Floods, even though its negative impacts was not identified by the farmers in Patau, is still another climatic factor that can effect the yield, provoke serious soil erosion and land slide in steep slopes. In the flat fields where there is a poor drainage system, floods also may aggravate the problems and lead to the destruction of a big part of the rice fields.

Soil fertility

Soil fertility refers to the ability of the soil to supply nutrients needed by plants. According to Roder et al, it is one of the constraints to crop production in tropics in general and slash-and-burn systems in particular [Roder et al (1995)]. In respect to the PRA Matrix Scoring, it was found that soil fertility is a moderate problem in the farming system in Patau.

In this paragraph some parameters such as CEC, SOM, BS, N and P in relation soil fertility will be discussed. These parameters were found from soil analysis results shown in appendix 5. It will also briefly discuss the comparison between the soil analysis results in fallow and cultivated fields.

Cation exchange capacity (CEC) measurements are commonly made as part of the overall assessment of the potential fertility of a soil, and the CEC results can sometimes also be used as a

rough guide to the types of clay minerals present. In general, topsoil values for the CEC measured on the all soils may be summarised as shown in table 2.1. [Landon (1996)].

In connection to soil analysis results, CEC are between low and medium values in both farms and their fallow as shown in table 2.1. According to Landon, when the soils are dominated by kaolinite for their mineralogy, CEC will be under 10 [Landon (1996)]. But in our case CEC are more than 10 and maybe there are other minerals than kaolinite, which are dominating in these soils, such as 2:1 minerals (Illite).

Table 2.1

Rating	SOM	Phosphor	Nitrogen	CEC
Very high	> 4.5	> 45	> 1	> 40
High	3.5 - 4.5	25 - 45	0.5 - 1	25 - 40
Moderate high	2.5 - 3.5	15 - 25		
Medium	1.5 - 2.5	10 - 15	0.2 - 0.5	15 - 25
Moderate low	1.0 - 1.5	6 - 10		
Low	0.5 - 1.0	3 - 6	0.1 - 0.2	5 - 15
Very low	< 0.5	< 3	< 0.1	< 5

SOM: Soil Organic Matter (% carbon * 1,724) Standard rating.
Phosphor: Available Phosphor, (ppm of P) Standard rating.
Nitrogen: % Nitrogen of the soil, Standard rating
CEC: Cation exchange capacity (me / 100 g of soil), Standard rating
Source: Landon (1996) & USDA

The proportion of the CEC accounted for by exchangeable bases (Ca, Mg, K and Na) is also used as an indication of soil fertility. A general interpretation of %BS values is as follows: low < 20; medium 20 to 60; high > 60 [Landon (1996)]. In relation to soil analysis results, BS are low in most cases except the case AF2 (as shown in appendix 5), which was sampled under fallow on the middle part of the slope. In this case, maybe there was accumulated ash from the last burning, although there is no information about that in the interviews.

Both nitrogen and phosphor are the two most important plant nutrients and their deficiencies cause severe crop losses, and standard rating of N and P are shown in the tables below. Regarding the results of the soil analysis, N and P are low values in both farms and their fallows.

Soil organic matter is calculated using factor 1.724 x % C. This is often made as a measure of the quantity of organic matter in a soil, which in turn is taken as a crude measure of fertility status and standard rating of organic matter (shown in table 2.1.). In connection with the soil analysis

[7] It could have been El Ninõ that caused this drought

result, the SOM are the only parameters, which give high values in both farms and their fallows. This is due to forest vegetation, but the reason why plant residues do not contribute with other plant nutrients is not clear, maybe these plant residues contain lower values of plant nutrients than carbon.

In all the parameters there are no differences in relation to the position of the slope, although logically, the lower part of the slopes could be expected to deposit eroded material. An explanation could be that eroded materials are not deposited but washed away through the valley, due to the steepness also of the lower part of the slopes.

It is generally accepted that the practice of shifting cultivation with adequate fallow is based on processes of recycling nutrient through the soil and regenerating biomass [Brookfield (1995)]. After one to three years of cropping, the field is abandoned for 5-10 years to allow regrowth of the forest due to the decreasing soil fertility and other constraints.

However, according to Yiu-Liong et al, it was reported that there is no evidence of declining nutrient levels as being responsible for abandoning the fields after one year of cropping in Sarawak [Yiu-Liong et al (1989)]. Maybe there are other constraints such as increased weed competitions, increased pest and disease problems, which lead shifting cultivators to fallow the land.

The comparison between fallow and cultivated fields in our study was to establish any possible effect on the soil from agricultural intensification of upland fields in Patau. Based on soil analysis results, all the parameters do not show any differences in the comparison of fallow and cultivated fields. The lack of differences in our results could be due to the type of the soil, type of vegetation biomass, soil erosion, leaching, intensity of rainfall, degree of the slopiness and intensity of burning.

Burning has effects on soil fertility adding nutrients through the ash. But during the burning operation the soil temperature increases, and afterwards, more solar radiation fall on the bare soil surface. This results in higher soil (up to 150 °C) and air temperatures. This change of temperature regime causes changes in the biological activity in the soil and decreases decomposition and mineralization of organic matter [Andriesse (1989)].

The rainfall of Tambunan district is heavy and it is around 60 to 120 inches, it is distributed throughout the year and there is no dry season [Yong Leng, (1965)]. The intensity of the rainfall combined with the steepness of the slopes could cause some of the ashes to wash away, and later maybe erosion. This high rainfall could also lead to some leaching of replenished nutrients from

the clearing and burning in the shifting cultivation system, and later to be followed by a decrease in soil fertility as the soil analysis results show.

According to Yui-Liong et al, reported that most soils from uplands in Sarawak are highly leached and are derived from parent materials relatively low in weatherable minerals [Yui-Liong et al. (1989)]. These soils show some variations according to the texture, but in general they have low pH around 4-5, base saturation is less than10 %, cation exchange capacity is ranging from 16 to 24 me /100 g clay and the level of phosphor are low.
These soils are similar to the soils we have analysed, and the vegetation they support was adapted to this kind of low fertility soils, i.e. even the vegetation has very low content of nutrition or minerals. So after burning of this vegetation, the soils contribute with a very little amount of plant nutrients to the system, and this could be the reason we were unable to see any difference between fallow area and cultivated fields.

C. Labour issues and constraints

In Patau farm work is based on family labour, i.e. labour is primarily derived from members within the household.[8] The number of household members involved in farming depends on the availability of off-farm work and the size and composition of the household. In households with one person involved with off-farm work the spouse (mostly the wife) is in charge of farming activities. In some of households the husband works as teachers in Patau, or has other kinds of permanent or temporary work outside the village. In households that rely primarily on farming for their livelihood, responsibilities related to farm work are often shared equally between the husband and wife; in some cases older children are also involved.

In terms of gender, both men and women are involved with farming. In some households there is no division of labour and the responsibility and tasks are shared equally. In a few households the men answered that they are the primary decision-maker, however, in most households the husband and wife either share the responsibility and decision making equally or they have separate responsibilities. In some households (but not all) men are in charge of more heavy work and the women of the lighter work. This is either based on the different tasks, but in some cases it

[8] The term "household" is used to indicate a unit of people that live in the same house and eat together. Our interviews indicate a tendency that the primary farm work is organized within the household and not so much within the family as an extended unit of kinship.

is also based on the different crops; in one household for instance the husband was in charge of the coffee production, and in another household it was the production of teakwood. In both cases wives were in charge of the wet rice production. In addition, in the two households who were/had been involved with mushroom production it was the men's sole responsibility. These findings could indicate that men in some cases are the primary responsible for the production of cash crops or new crops, however, the findings are still too varied to make any conclusion in this regard.

When asked about labour problems most farmers did not identify this to be a problem for them. The primary reason for this is, that most of the labour intensive tasks are handled in cooperation between farmers, i.e. most farmers are organised in large working groups, or 'gotong-royong'. This type of group work is widely practiced in Patau and enables farmers to overcome labour shortages. There are up to 20 farmers in a group and the groups are not always fixed, but can change from year to year. The group usually consists of farmers nearby and neighbours. The main reason for working in groups is to speed up the work (and to have a party after the harvest/workday).
The groups work like this: if farmer A helps farmer B, B must help him/her as well. It is in other words a labour exchange; 1 day of work in exchange for 1 day of work. It is also possible in some groups to pay in terms of yield or in money (RM 10 for a 1/2 day work). It doesn't matter what the job is, because it is up to the farmer to decide what kind of work he/she needs done by the group. Labour demands are highest during clearing, planting and harvesting times, but even though all farmers need to harvest at the same time, it is according to the farmers not a problem to get the work done in the groups.

Apart from dealing with labour problems through these groups, a few farmers also mentioned that they sometimes hire labour. This, however, was not widely practiced among our informants. The few farmers that did hire labour were women, who were full-time farmers, lacked access to labour and had a source of off-farm income (to pay the hired labour). Other informants, in fact, mentioned that they sometimes get hired as farm labour. So even though renting labour was not a common practice amongst our informants it does exist and is a way for farmers engaged in off-farm activities to handle labour requirements in farming.

Labour constraints related to intensified agriculture in the future

Even though many farmers said that they were able to overcome problems related to labour, some farmers have large upland fields that are uncultivated. We shall elaborate on land issues in the following section. When asked why this land is not cultivated these farmers often answered that it was due to lack of time, which could indicate that there are some labour problems in the current system and this problem is likely to be a constraint to a more intensified production in the future. When we asked farmers about labour in relation to increased production, a number of farmers did in fact say that shortage of labour would probably become a problem in the future. In addition, the switch to permanent and less labour demanding fruit trees could be a conscious attempt by farmers to reduce labour demands in their future productions. One of the underlying problems, expressed by two of our key informants and in informal conversations with some youth, is the fact that the young people are getting educated and are therefore less likely to stay in the village after they finish their education. As a result, the amount of available labour in Patau would be reduced. Our interviews, however, also show that many people do return to Patau to do farming, even though they have an education and have had off-farm employment in the urban areas. One of the groups in Tikolod village has similar findings [pers.comm.].

D. Land tenure, access to land and other issues in Patau.

All the informants had ownership to land in Patau, however, a few farmers were renting lowland to supplement their production. Getting titles to new land close to Patau is virtually impossible and the nearest available land is 17 km. from Patau. In spite of this, some farmers are still applying for new land but have been waiting to get titles on the land for up to 10 years. According to one informant it is possible to buy new land, but it is rather expensive for a smallholder: 1 acre of upland costs RM 3000, and 1 acre of lowland goes for RM 10.000.

When looking at land problems in Patau more thoroughly a rather complex picture emerges: On one hand there is not enough land for farmers to extensify, and especially in the lowland there are some signs that increased population is leading to decreasing plot sizes, when larger plots are divided among many children: On the other hand there are large uncultivated plots in the upland that farmers for various reasons are not cultivating.

Lowland plots are the most difficult type of land to obtain. However, even though lowland plots are difficult to attain the land needed to satisfy a family's subsistence needs of rice is relatively

small: One acre of lowland is enough to provide rice for a family of less than 10 people. Especially in the hamlet of Patau (which is the largest of Patau's 3 hamlets) located right by the main road and in the lowland area, 3 informants either own just 0.5 acres lowland or expressed concerns about the growing population, which leads to land being divided among more people. The parents of a woman had owned 5 acres of lowland, but when they passed it on to their 5 children she only ended up with 0.5 acres.[9] But as mentioned earlier, it is common to have less than 2 acres of lowland, but only a few farmers, like the woman mentioned, own as little as 0.5 acres.

As an exception, two of the elderly men we interviewed owned up to 4 acres of lowland, of which only half is cultivated by them. It seems plausible that they keep this land to pass on to their children or grandchildren, since apparently land is a scarce resource. A few of the farmers with only 0.5 or 1 acre lowland were renting land from other farmers as a way of solving the problem of limited access to lowland.

Vincent and Ali, who relate this process to the customary Adat system, where property is divided equally among sons and daughters, also describe this process of subdivision of land, and subsequently fragmentation. The constant subdivision of land resulting in a fragmentation can eventually make the land held by each heir too small to provide the sole source of household income or subsistence [Amriah Buang (1988) in Vincent and Ali (1997), p.171].

In the upland areas issues and problems related to land are somewhat different. Of the 11 households that own upland 5 of them owned plots in the upland that exceeds 10 acres. Some of these farmers, as well as the farmers with less land, have areas that are left uncultivated. The most extreme example was a family who said they had 4 upland plots, with a total acreage of 44, which were uncultivated. There are a number of possible reasons why these areas are not being cultivated. First of all, in some cases the reason for leaving land uncultivated could be due to the practice of shifting cultivation, which demands access to large areas of land. Secondly, not all the farmers hold titles to this land (some are still waiting for their title), which might cause them not to spend time cultivating the plots. Finally, a number of farmers mentioned distance to the plots and time to be important reasons for not cultivating the land.

[9] It seemed that the parents must have kept some of the land themselves and passed the rest on to their adult children and in-laws.

It is important to see the issue of land use in Patau not only in the context of access to land but also in relation to labour. Access to labour is an important prerequisite for cultivation of land and as mentioned in the previous chapter there are problems related to labour in Patau, although often defined by farmers as a time constraints. Studies related to this issue from other areas in Malaysia suggest that the steady outflow of rural youths [10] is causing a lack of labour and an aging of the farm population. As a result taking land out of production could be a response by farmers to the diminishing household labour pool and their advancing age. [Vincent and Ali (1997) p. 160]
In Patau, however, this seems more complex as such. We have seen signs of two contradictory trends. Some informants say that the population has increased, thus increasing the demand for land, but there also seems to be a tendency that the young generation is moving away and therefore the amount of available labour is decreasing. We have no detailed data related to Patau's demographic situation that confirm either population growth or migration from the village, only trends from other areas of Sabah/Malaysia. Therefore, our conclusion and explanation of the trends mentioned by our informants is only a hypothesis. An explanation could be that the population in Patau has increased in the past (say a generation back) and thereby increased the number of households in the village. This has lead to a greater demand on land and subdivision of smaller plots. At the moment and in the years to come it is, however, likely that the children are getting educated and seeking off-farm work. This would explain why the farmers have less time to cultivate some of the upland areas, as it is mostly just the husband and wife that do the farming and not so much the children. It is not unlikely, though, that some of the children return to the village eventually to do farming.

E. Agricultural agencies in Tambunan District - the gap between agencies and farmers

The majority of farmers in Patau have some connection to the Department of Agriculture as they receive subsidies for ploughing and fertilisers for their wet rice fields. Some farmers are also in different ways involved with either the PPK (Local Farmers Association) or the KPD. Our interviews, however, indicate that the majority of farmers either do not get any advice from these agencies at all or only very infrequently, or that they are not fully satisfied with the advice and services they receive.

[10] But as we mentioned earlier many of them come back to the village again.

The Department of Agriculture and extension services

The Department of Agriculture's role in terms of the smallholders in the district is to support the farmers with subsidies and assist them in intensifying their production. Farmers in Patau receive direct subsidies for wet rice production as well as fertilizers, and the coffee growers are receiving subsidies for opening up new land as well as subsidies on inputs for coffee production.

The DoA has especially focused on getting farmers to intensify their wet rice production. An important step in Patau was the introduction of the irrigation system, which will help farmers to ensure crops against droughts. The DoA has also tried to introduce farmers to double cropping (2 harvests per year) by introducing a new rice variety that only takes 3 months to grow and gives higher yields. The rationale behind such attempts is to get more farmers to sell their rice. These efforts have been combined with pricing incentives to increase production. The price on rice is kept high through subsidies. A semi-governmental body the National Padi & Rice Board control the rice market in Malaysia, i.e. the pricing of rice and import/export. [Vincent & Ali (1997) p.171.] The price for rice is fixed at RM 49.70 per 100 kg. On top of that farmers receive a subsidy equalling half of the RM 49.70 that brings the real price the farmers receive for 100 kg rice to RM 74.55.

In spite of this support none of our informants (16 households including those surveyed) sell their wet rice. The wet rice production is solely for subsistence consumption. Even the rice wine produced in the village for selling is not based on the local rice. Several farmers pointed out that the reason for this is that farmers want to secure enough local rice for their own consumption, because there is a preference to eat rice, which they have cultivated themselves.

The introduction of new rice varieties has up until now also not been successful. Only one of the 16 households interviewed uses the 3-month variety and only on a plot designated as a demonstration plot under the DoA. The second plot owned by the household is cultivated with the local 6-month variety. About 4 farmers did in fact try cultivating the new variety in 1998, but failed due to drought, as the irrigation system was not working successfully at that time. Even now that the irrigation system is effective some farmers are still reluctant to change. The DoA now tries to introduce a system where farmers can grow both the 6-month variety (for own consumption) and the 3-month variety (for selling) all in one year. Apart from the insecurity farmers associate with the new 3 month variety, it also does not meet farmers' needs such as being easy to harvest and capable of storing. Furthermore, labour constraints would be another barrier.

To solve problems with labour, the DoA is trying to introduce the use of machinery, such as a mechanical ploughs, in wet rice production. According to one informant, farmers are interested but the rather expensive cost of this machinery (RM. 18.000) is a significant barrier.

Extension system

To implement some of these new technologies and farming practices in the villages the DoA in Tambunan District has an extension system with 8-9 extension staff. Each of them is in charge of extension work in about 10 villages. The extension staff does training on new technology, timing and application of fertilizers, and advice on pesticide use (including safety).

According to the DoA in Tambunan, the extension officer goes to the village to inform the farmers about these matters every two weeks. This is done through communication between the extension officers and a target group of farmers in each village with whom the extension officers works and gives information regarding subsidies and recent research etc. It is then the job of the target group to disseminate this information to friends and other farmers.

The problem in Patau is that most of the farmers we interviewed are not in contact with an extension officer or that the information is not passed on. None of the informants mentioned that there is an extension officer visiting Patau on a frequent basis. In fact, one informant informed us that the Department of Agriculture holds one annual meeting in Patau to give farmers subsidies and advice. On the other hand, a few farmers said that they sometimes contact the DoA in Tambunan themselves for advice and that they are overall satisfied with the Department's services. However, several other farmers said they were not receiving advice from DoA at all (4 out of the 7 semi-structured interviews) [11] and two farmers expressed wishes for frequent visits by the extension officers, more advice and that the Department knew more about the very specific problems farmers are facing.

The Korporasi Pembangunan Desa (KPD) - Rural Development Corporation - and its involvement in Patau.

KPD is a government-funded state government agency under the Department of Agriculture. A large part of KPD's work is focused on contract farming projects within different crops primarily upland crops. In Patau the KPD has been involved with the aforementioned mushroom project and a passion fruit project (which failed probably due to drought). KPD projects are set up by a

[11] One of these receives advice from the KPD instead due to his previous involvement with KPD's mushroom project.

minimum of 5 farmers in each village. The idea behind this system is that these groups of farmers eventually establish a cooperative and work together on marketing the products.

KPD's role is to provide technical advice, loans for inputs, processing facilities and to purchase the crops. In return the farmers have to provide their labour. In the case of the mushroom project the farmers are obliged to pay the KPD 2/3 of their income from the mushrooms to repay the loan. KPD's goal is to increase farmers' production of cash crops and to have "modern and self-reliant farmers."[12]

KPD's efforts in Patau do not seem to have been very successful due to the fact that only one farmer is currently involved with the mushroom project. Since the project was initiated in 1990 seven farmers have abandoned the project. The remaining farmer pointed out that it is first of all time-consuming work, does not provide very good returns (even though the returns are much higher and more stable than e.g. selling vegetables) and then the fact that the roof for the mushroom house needs replacement after a few years, thus requiring new investments by the farmers. One other farmer is still in contact with the KPD due to his prior involvement in the mushroom project and the KPD is advising him about other crops such as fruit trees.

Pertubuhan Peladang Kawasan (PPK) - Local Farmers' Association.

PPK is a government agency under the Malaysian Farmers Association. The agency's main objective is to increase farmers' income and in their work towards this goal, the PPK often cooperate with JKKK (the village councils).

The membership cost is a subscription fee of RM 1 per year, and there are no conditions such as ownership to land or level of income. PPK's biggest project in Tambunan district at the moment is 5 large chicken rearing farms. The chickens are sold at the markets and the organic manure from the chickens is sold to farmers. There are no chicken farms in Patau yet.

The regular process for starting a project is that a farmer applies for funding through the PPK, who provide a guarantee for the farmer. The sources of funding are the government, banking facilities and the organization's members. The project is evaluated before it is started. First of all, the product has to be marketable and the applicant's household economic conditions have to be good, to ensure that the loans can be repaid. Secondly, the village has to be consulted to assess if

[12] Interview with KPD Tambunan District, Sabah 21/10 1999.

it is acceptable by the rest of the village that the project is placed there. It normally takes at least 3 months for this process to be completed and for the project to be implemented.

Apart from assisting farmers in setting up projects, the PPK is also looking into suitable cash crops due to the decrease in shifting cultivation, and are promoting such cash crops as maize, tobacco, coffee, ginger, and yam.

The organization helps its members to apply for land through political pressure. Finally, PPK encourages its members to use pesticides and fertilizers and advice them about protection in the handling of chemicals. The PPK also sells chemicals, although these are slightly more expensive than from ordinary shops and markets.

At the moment there are no projects in Patau due to the fact that none of PPK's members in Patau have applied for projects. However, the Patau section is the biggest in the district and at the moment the Board of Directors are in the starting phase of planning a chicken farm in Patau [13].

In the semi-structured interviews with 7 different households there were 2 farmers/households that were members of the PPK, one of which had started a small shop for selling food through a loan from the PPK. This shows that PPK also provides loans to other and smaller activities than agricultural projects. These loans, however, are not considered as projects by the PPK, but just loans. PPK's projects are usually larger in scale and focus on agricultural related activities. Other farmers we talked to did not seem to know much about PPK or be interested in the organisation, even though this organisation unlike the KPD and DoA has local representatives in the village.

Analysis of the problems related to agricultural agencies work

To sum up, it seems clear that all 3 agencies have the goal of increasing the amount of cash crops and intensifying the production in the villages. There have been some successes in relation to the agencies' objectives, such as decreasing the use of shifting cultivation, which has been discouraged by the Malaysian government and the DoA in the district. There is, for instance, a ban on open burning of land and rather heavy fines [14]. In addition, the turn to more permanent crops such as coffee and fruit trees has also been an important goal by the DoA and KPD. Especially the farmers involved with coffee production have made the decision to do so based on advice from the DoA. However, the success of these schemes is yet to be seen.

[13] Interview with PPK, Tambunan District 21/10 1999.
[14] This could also be because of the very big forest fires 1997–'98.

Farmers are generally not lacking assistance - they can receive both subsidies and advice from a number of different sources such as the ones mentioned above. The problems seems to be both the quality of assistance and advice as well as the way it is implemented. Furthermore, another important problem is the lack of comprehensive coordination of the assistance to the farmers, which was pointed out by an informant from one of the agricultural agencies. There are a number of agencies and governmental ministries working on issues related to farming (e.g. the Ministry of Agriculture, Ministry of Rural Development and Ministry of Land and Regional Development) [Vincent & Ali (1997) p. 155], but they are not working together to coordinate their efforts. As a result the individual projects and types of assistance are not known to all farmers, which might be a reason for their limited effect.

In a number of other aspects, it is evident that there is a gap between agricultural agencies and farmers. The first problem is that the agencies are not reaching out to all farmers either due to insufficient resources (e.g. not enough extension officers 'in the field'), or due to the fact that farmers do not feel that the agencies can assist them. This leads us to the second problem, namely the problem of knowledge and technology being developed from the top and transferred to the farmers, who for a number of reasons are not able to implement or use this knowledge. There are several examples of this in Patau such as problems adapting the new rice variety, machinery and even to apply fertilisers properly.[15]

Having said this, it is also important to emphasize the important role of the agricultural agencies in developing the farming system and increasing farmer's incomes. One farmer, in fact, said that he was waiting to hear from the DoA about how to improve his production. Even though farmers try to get the best yield out of their production it seems quite evident that they are relying on the advice from the agricultural agencies, when trying to increase and intensify their production methods.

5. Conclusion and Perspectives

A. Methods

Overall the field process and methods used worked quite well, especially the project design, identification of informants and the interviews. The surveys were a good way of getting the broad information we needed and identifying informants for the semi-structured interviews. The semi-structured interviews also worked well and we got a lot of useful information. One of the

[15] A number of farmers mentioned that they don't use fertiliser as prescribed by the DoA either none at all or only once per year.

problems with the semi-structured interviews was that we did not get in-depth with several interesting questions, because we tended to make the interviews more structured in some cases and less semi-structured. Therefore, we missed out on important clues and questions.

The PRA/matrix scoring also worked well, because farmers could discuss their problems together, thereby giving us a broader picture of the problems farmers face. It also gave us a good impression of the variety of crops grown by farmers. A limitation was that the scoring did not give us any indication of the most prevalent problems. In addition, the activity was conducted in Dusun and only summarized briefly afterwards due to the lack of time. It was in other words difficult for us to get any specific information about the concerns and points made during the PRA.

We didn't use as much time on the soil sampling as we had planed. When we arrived in Patau we put our emphasis on the interviews, because we wanted to get some knowledge about the agricultural system and the area, before we decided where to do our soil sampling. But when we started, all participated, and tried the different aspects related to doing soil sampling in the field. On top of that, it worked out that we first got our results 3 weeks after we were back home, and by then our soil samples and calculations did not show what we had expected, this has made it difficult to integrate in our other findings.

Also group process worked quite well; we all got a chance to participate in the various interviews as well as the soil sampling; in the social science methods the responsibilities were shared so we all got a chance to interview and take notes, which has been beneficial for all of us. Our interdisciplinary work also worked well, because we were able to supplement each other well in various aspects related to methods and knowledge of social and natural aspects of farming (e.g. in interview situations.) One minor problem was that we all have had different ways of taking note and writing summaries. Therefore, the summaries tend to be quite varied; some are more in-depth than others, which gives a lot of inconsistency and it has been quite difficult to work with during the report writing process.

In terms of our finding there are a number of specific issues, which we were not able to determine through our interviews and also some inconsistencies in the way we asked the questions and conducted the interviews. Some of the specific findings, which we were not able to get good and

consistent information on, were issues such as education, ownership to land, establishment of historical changes and fallow periods in the shifting cultivation system, but also information about types of weeds, insects and pests.
Information about changes in crops, size of land, and fallow periods over time was very difficult to obtain, primarily because farmers' recollection of farming practices 10 years ago or more was quite poor, but also because we had difficulties asking questions regarding fallow periods consistently and in a way the farmers could relate to. In some cases we were able to get the information and in other cases we weren't. One of the problems was to ask farmers these questions away from the actual fields, where they had no frame of reference. It was somewhat easier to ask the questions in the field, where the farmer could be more precise and we could see the fallow area with our own eyes.

Overall though, we have been able to conduct a number of good interviews and get good qualitative information. We can, therefore, make some broad conclusions about the farming system and intensification process in Patau although not all our findings are conclusive.

B. Motivations and problems related to intensification

A common finding is that farmers are intensifying their production by using capital inputs such as pesticides, herbicides, and fertilisers as well as irrigation, but also that farmers are abandoning the system of shifting cultivation and are turning towards permanent crops such as fruit trees and coffee. Of the seven people we conducted semi-structured interviews with 6 of them have planted fruit trees in the upland (especially durian and rambutan) or mentioned this as their future plan. Three of the 7 informants were involved with the coffee scheme under the Department of Agriculture, and 2 wanted to increase their production of ginger.

Farmers' motivations for intensifying their production

There are different reasons why farmers intensify. For some the objective is to increase their income by growing new crops and for others it is also important that these crops (especially the fruit trees) are less labour intensive and time consuming to cultivate. Shifting cultivation is considered to be labour intensive but is still practiced (although on the decline). However, this type of system enables farmers to cultivate generally low fertile uplands with a variety of crops, which are important for their subsistence life-style and culture.

The turn towards more permanent production of either coffee and fruit trees are long-term investments for the farmers to ensure a steady yield and/or income in the future. In addition, a few farmers are cultivating ginger and plan to do more ginger production, which is a crop that provides good yields, grows fast and can stay in the ground for up to 1 1/2 years. Since prices on ginger fluctuate, it allows farmers to sell when prices are most profitable.
The switch to more permanent crops is, therefore, based on the objective to cultivate crops that are less time consuming, can ensure farmers a steady yield, and last but not least have the potential of increasing their income long-term.

The Department of Agriculture, and to some extent also the KPD, have been a direct motivation factor in some farmers' decision to grow new crops. This has especially been the case for farmers involved with the coffee scheme. All the farmers answered that their main reason for doing coffee was due to advice and assistance from the Department of Agriculture. Their long-term objective is to make money from the coffee. The DoA has also tried to introduce new high yielding rice varieties and machinery to the farmers in Patau. But for various reasons farmers are reluctant to use this new technology. The underlying reason seems to be concerns related to securing a steady yield, and in the case of machinery (mechanical ploughs) they are difficult to use and very expensive. Since rice is the primary subsistence crop and main staple for farmers in Patau the majority of farmers can't afford to take any risks. The findings by Abdullah and Rejab show some common characteristics between farmers in Patau and the general situation of smallholders in Sabah. According to Abdullah and Rejab, the driving forces behind the evolvement of the smallholder farming system are farmers' attempts to minimise and spread risks and to ensure that the basic food needs of the family are met [Abdullah & Rejab (1993), 5].

Findings in relation to theoretical issues

Although we were not able to obtain any solid data from Patau, there are some signs that the population might have increased and therefore could have lead to intensified cultivation of the lowland areas and now also some upland plots. Since data from Sabah in general show a growth rate in the population of 4%,[16] it is likely that the population in Patau has also increased. Current land access problems in Patau may, therefore, be related to population growth and could be motivating more and more farmers to do permanent cultivation of the upland areas. As stated in

[16] Economic Intelligence Unit (EIU): 1999. And in 1991 the growth rate was 5.7% [Khoo (1995) in Vincent and Ali (1997), p. 6]

the beginning of this report, Boserup's theory focuses on the connection between population growth and shrinking supply of land as motivations for intensified agriculture. Population growth and scarcity of land could play an indirect role in the intensification process in Patau, however, our findings suggest that there are several other and more direct factors, which are also important in the intensification process. As stated earlier our findings emphasize the importance of government policies, e.g. provision of subsidies and inputs through agencies like the Department of Agriculture, as important factors leading to intensified land use. Since subsidy policies are focused on certain cash crops and private land ownership are a prerequisite for subsidies, government policies can also be an important motivation factor. Last but not least farmers' personal livelihood strategies and needs for cash are also important motivation factors to intensify production.

Problems related to intensification in Patau

Our findings have showed that there are a number of problems farmers face in their attempts to intensify their production ranging from natural problems, to issues related to land and labour and access to agricultural advice. The natural problems and labour shortages illustrated earlier can be limiting factors in farmers' attempts to intensify and increase yields. However, an even bigger barrier to improved production and livelihoods seems to be the access to appropriate knowledge and technologies. In this regard, agricultural agencies in the district play a central role, but also the agricultural research and development (R&D) conducted at state and national level seems to have an impact.

The underlying problems in this respect should be seen in the broader context of the top-down modernist approach to agricultural research and development (R&D) and planning, which is still the prevailing approach in Malaysia and other countries [Abdullah & Rejab:1993,p.65]. Technologies are developed in research stations by scientists, who assume these technologies will work elsewhere. They are then passed down to farmers by different agencies and extension officers with the expectation of positive benefits. Central to this process of modernization of agriculture is the assumption that technologies are universal - that is, that technologies can exist independently of social context; as well as the notion that new technologies are better than local knowledge and old technologies and thus represent 'progress.' [Pretty (1995) page 27].

The key to this problem is the fact that scientists in research stations have quite different conditions than small farmers, because they have access to all the necessary inputs at all the appropriate times. When farmers try new technologies they rarely do as well as researchers [Pretty: 1995, p. 48-49]. There has been a great bias toward resource-rich farmers, plantation agriculture and export crops such as oil palm, cocoa and rubber in Sabah's agricultural research and development (and in Malaysia in general). As a result, smallholders have not adequately benefited from the agricultural research and development, as it has not been specific enough for their needs. Hence, new technologies are often rejected by small farmers, due to the fact that they are considered risky by the farmers, do not fit diverse environments or farmers aspiration, or because farmers lack adequate inputs or suitable markets [Abdullah & Rejab (1993) p. 65]. The bottom line is that the needs and conditions of small farmers are seldom considered by researchers and governmental agencies. In Patau, for example, farmers have rejected the introduction of mechanical ploughing and new high yield rice varieties because these new technologies are too expensive and not suitable for the farmers' needs and a complex environment (e.g. mechanical ploughs for wet paddy production is difficult to use as the mud is too deep).

Therefore, there is a great need for research and extension services to be more participatory and based on farmers' specific needs. By adopting participatory methods in the development and implementation process new technology and methods could become more relevant to farmers' specific needs and conditions and thus be more easily accepted by the small farmers. Thus, agricultural agencies play an important role in the future; also in terms of providing information about methods, which focus on sustainable practices such as biological pest controls (Integrated Pest Management), soil erosion prevention and soil conservation methods (Integrated Plant Nutrition Management). This, however, requires more resources and different working methods and research.

C. Future perspectives

Due to the factors discussed earlier such as population growth and land shortages it seems that further intensification is inevitable in Patau. The success and sustainability of this intensification will largely depend on future cultivation practices, better cooperation between farmers and agricultural agencies and the development and implementation of biological pest control methods and resource- and soil conserving practices as well as limited use of chemicals, especially in the cultivation of wet rice, coffee and other crops, where chemicals are currently applied. The current

trend towards fruit tree cultivation in upland areas can be seen as beneficial for the Crocker Range National Park, because it will create a forest-like environment at the fringe of the national park, which could become a buffer zone. These fruit trees can also mitigate soil erosion. However, with the reduced practice of shifting cultivation many cultural aspects of farming will disappear and unless this new practice of permanent upland cultivation is done cautiously, adverse environmental impacts are likely to overshadow the positive imprint of the current tendency.

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8. List of Abbreviations

Abbreviation	Bahasa Melayu	English
C		Carbon
Ca		Calcium
CEC		Cation Exchange Capacity
DID		Department of Irrigation and Draining
DO		District Officer
DOA		Department of Agriculture
JKKK	Jawatankuasa Kemaijuan Keselmalematan Kampung	Village Council
K		Potassium
KPD	Korporasi Pembangunan Desa	Rural Development Corporation
N		Nitrogen
Na		Sodium
Mg		Manganese
P		Phosphor
PPK	Pertubuhan Pelada Kawasan	Local farmers association
RM	Ringgit Malaysia	Malaysian Currency
SOM		Soil Organic Matter

9. APPENDICES

9. Appendices

Appendix 1

Structured Survey of Patau households.

1. Household composition: number of family members year round?
   - number of family members working outside of Patau?

2. Main source of income? Percentage On farm or Off farm activities?

3. Farm area? Number of fields?

4. Ownership of land: owner or renter?

5. Number of years in Patau?

6. Location of fields (Percentage: lowland or upland)?

7. Subsistence or cash crops?

8. Crops grown:
   - types
   - varieties (indigenous, HYV etc.),

9. Cropping practice:
   - shifting cultivation
   - permanent
   - both

10. Use of inputs:
   - pesticides?
   - fertilizers?
   - irrigation?
   - machinery?

11. Use of conservation methods:
   - intercropping/rotation cropping
   - agroforestry
   - organic manure
   - soil erosion methods
   -

12. Connection to agricultural organizations?

13. Main problems related to farming:
   - pests, weeds etc.
   - decreasing yields
   - lack of labor
   - lack of water
   - Poor soil
   - erosion
   - other

14. Farm labour: family or hired?

15. Main farmer in the household? Primary responsible for agriculture?

Appendix 2

Semistructured interview guide: farmer informants (First Edition)

• 1. Basic Information

A. Name and gender:
B. Household composition:
C. Landownership: owner or renter:
D. Off-farm activities:

• **2. Current farming practices and degree of intensification.**

Can you tell us about how and what you farm?
How long have you been in the area?

- Size of land and Number of fields
- Location: upland, lowland or both.
- Farming practices: permanent (no fallow), some fallow, shifting cultivation.
- What crops are grown and where? (indigenous, exotic, HYV). Reasons for growing these crops.

In what ways do you try to increase your production/yields?

A. *Use of inputs:*
How do you control pests, weeds etc. on your plots?
- Use of fertilizers, pesticides, herbizides, HYV: reasons, problems and benefits. what kinds (the names)?
- Water use: irrigation or not: problems and benefits.
- machinery?

B. *Use of labor:*
How do you get labor on your farm?
- Farm labour: family or hired. If family, who and what responsibilities.
- Has labor needs increased or remained the same within the past 5-10 years.
- Do you rent labor or do it all yourself/within the family?
- Are there any problems getting labour? what?

C. *Areal intensification:*
- Are all plots in use? if not, why aren't they being used?
- Do you use fallow? How long? Has this decreased, increased or remained the same in the past10 years?

D. *Areal Extensification:*
- Have you aquired more land in the past 5-10 years? how and why?

E. *Soil conservation methods:*
- Practice of intercropping or rotation cropping?
- use of organic manure
- **soil erosion methods (types)**
- agroforestry

F.*Use of knowledge:*
- where do you get advice on farming issues/practices? (other farmers?)
- Have you been in contact with extention officers? For what and how often?

G. *Use of agricultural/farmers organizations:*
- Do you have any contact with KPD, LFA or FAMA and why?

H.*Access to capital:*

- Have you taken any loans or credits to help you improve you farming production?
  if yes, why? has this been easy? How?
  if no, why not?

• 3. Motivations factors for intensifying agricultural production.

What are the main changes in your production over the 10 years?

Have you increased you production in the past 5, 10, 15 years?
- how? and how much?
- what were the main reasons for this?

A. *Access to inputs:*
- Have you received credits/loans from KPD or other sources?

- What have been the results of using e.g. pesticides, fertilizers, herbizides or improved crop varieties (machinery or irrigation) on your production?

- How do you get these inputs? Are their any problems using them?

- Do you use any new crops? why? Problems and benefits?

B.*Access to knowledge/advice:*
- Have agricultural extension officers given you advide on how toincrease your production?
- how does this match your own farming practices?
- were you able to follow their advide? why/why not?

C. *Market access:*
- How and where are your crops sold?
- Has this become easier in the past 5-10 years, if yes why? (Distance to market and way of transport)

- Has the prices you get for your crops changes in the past 10 years?
How?

D.*Income and access to off-farm work:*
- Where does your household earn money from? mostly farm work or off-farm?
- Has your income changed in the past 5-10 years (more or less money)? How?
if involved in off-farm work has the money earned here been used for improving the agricultural production?

E. *Access to land:*
- Have you aquired more land in the past 5-10 years? how and why?

• 4. Consequences of intensification.

Environmental consequences:
A Do you have problems with soil erosion on your fields?

B. Do you have to use more fertilizers, pesticides etc. to get the same yields as when you first started using them?

C. Do you have problems with pests or weeds on your plots - even where you use pesicides? What weeds/plants? Is this a problem with certain crops/on certain plots?

D. Do you have any problems with the (new) crops that you didn't have before? If yes, what are these problems?

E. Biggest problems and benefits compared to situation 10 years ago?

Socio-economic consequences:

A. Has there been any changes in your income from farming activities in the past 5-10 years? (increased or decreased). What are the reasons for this?

B. Has there been any changes in the amount of labour needed to grow the crops? what?
- Do you need more labor to keep up the production?
- How do you get more labour?
- Has this created problems in your family/with your wife or husband? (Is there too little time to do other things, i.e. caring for children, cooking, getting firewoods etc.?)

C.Is some land left uncultivated, and why?

Final questions:
A. What are your biggest problems in the farm and in the household now compared to 10 years ago?

B. What are the biggest benefits of your current farming practice and household situation compared with how it was 10 years ago?

C. What are you plans for the future in terms of farming and off-farm work?

Interview guide semi-structured interviews with farmers - 2.ed.I

Current farmings pratices / degree of intensification.

1. Do you have any education ?
2. Have long have you praticed agriculture ?
3. Can you tell us about your farm ?

Draw a map of our farm

- Crops / Acres
- Permanent cultivation
- Location upland / lowland
- Time of cultivation versus fallow
- When do you plant and when do you harvest
- Are some areas not in use
- How long have you had the land (upland / lowland)
- How did you get the land

1. Do you wish to have more land ?
2. Do you use communal land ?

3. How do you control pests (weeds - etc.) on you farm ?
   - How much ?
   - What kind ?
   - From where do you get it ?

4. How do you feel about using them ?
   - Problems
   - Benefits
   - Effectiveness

   Do you have to use more to get the same result as you first got when you started using them ? (problems even when using pesticides ?) (what crops ?)

5. Do you use any new crops ? - What ?
   - Where did you here about them ? -
     Problems / Benefits

Historical perspective.

1. What did you grow 10 years ago ?
2. How was the fallow period ?
3. Did you use pesticides / fertilizer etc. ?
4. What are the main changes between now and 10 years ago ?

Intensification.

1. Why do you grow the crops you do now ?
   Motivations - Problems - Benefits
2. Has the agricultural department, KPD, etc. told you about these crops/helped you with the start of the production ?
3. Why has the fallow period decreased / or why is you production more permanent now than 10 years ago ?
   Problems / Benefits
4. Do you try to increase you production (specify area : upland / lowland)
5. How about you income ?

Connection to Government agencies

1. Do you recieve subsidies ?
   From where ?
   Why ?
2. Are you involved with any govenrment schemes ?
   Why ?
   Problems / Benefits
3. Do you get any advice for D.o.A, KPD, PPK ?
   Have you heard of them ?
   Why donÕt you use them ?
4. Have they given you any advice on how to increase production ?
5. Where you able to follow their advice ?
   How ? - Why not ?
6. How often do you talk to them ?
   Where ?
7. Do you get any advice from anywhere else (other farmers)
8. What do you want from an agency ?

Labour issues

1. How do you get labour on the farm ?
   Who ? How often ?
   Responsibilities ?
2. Do you sometimes rent labour ?
   When ? Why ?
3. How does the group labour work ?
   How is it organized ?
   Hof ften do you use this kind of labour ?
4. Do you have problems with labour ?
   Why ? When ?
5. Whould you grow more if you had more labour ?
   Which ?
6. Has there been any changes in the amount of labour needed to cultvate the land +
   What ?
7. Has there been any changes in the kind of labour needed to cultvate the land +
   What ?

Land issues

1. Has there been any changes in the amount of land you cultivatet in the past 10 years ?
   Why ? Why not ?
2. Have you brought more land / Are you applieng for more land ?
3. The application process ?
   Do you grow before tha application is given ?
4. Is there any upland area that you cultivate permanently ?

Why do you do that ?
Labour? Increased production? Lack of land?

5. Do you practise intercropping?
   Why?
   Where did you hear about this system?
   Problems / Benefits?

Market and Household economic issues

1. How much of your income is from farming / off-farm work?
2. How much do you spend monthly?
3. Do you save some money?
   Estimate? For what?
4. Have you taken any loans / credits to improve farming practises?
5. Do you have to buy any food?
   And what kind?
6. Where / How do you sell your crops?
   Any crops sold through DoA, KPD, PPK or FAMA ?
   How much do you make (e.g. when you go to the marked ?)
7. How do you consider you self in terms of wealth ?
   And what is wealth in your opinion ?
   How do you see yourself ? - Compared to the other people in the village ?
8. Have you increased you income in the past 10 years ?
   What are the reasons ? - Changes in prices ?
9. Do you consider yourself better now then 10 years ago ?

Final questions

1. What would you like to grow in the future ?
   Why ?
2. How do you see yourself and your family's life in 10 years ?
3. What are the biggest problems, you face in your farm ?
   How ? Why ?
4. What are the positive changes ?

Do you have any comments / questions to us?

Appendix 3

Problems with increased production related to Crops.

Matrix scoring made in Balaraya - Kampung Narayat - date: 28-10 - duration 2.5 hours
Participants: Mrs Hasnah Kunsalam - Mrs Queen, Mr. Tajin Kodiong, Isa Adon, Mary Kassim, Esther "Okum" and Alice "Sandou"
Interpreters: Yuri & Johnny

	Weeds	Cater-pillar	Rodents	Drough t	Rain	Birds	Insects	Soil fertility	Distan-ce	Machi-nery	Labour require-ments	Lack of land	Wild boar	Deer	Fire
Wet rice	2	5	5	5	3	5	5	3	2	5	5	3	-	4	-
Dry rice	4	2	5	5	2	5	5	3	5	4	4	2	-	4	1
Coffee	5	5	-	5	-	-	2	3	5	4	4	3	-	-	5
Durian	2	4	3	5	-	-	-	3	5	4	4	3	-	-	5
Cassava	2	1	5	3	-	1	-	-	2	2	3	-	5	5	3
"Tankran"	5	1	5	5	3	-	3	3	3	2	3	-	-	-	-
Long bean	1	2	3	4	3	-	-	3	2	1	2	-	-	-	-
Mushroom	-	2	-	4	-	-	-	-	-	3	5	-	-	-	-
Pineapple	1	-	5	2	-	-	-	-	2	2	3	-	-	-	2
Sw.potato	2	5	5	3	-	-	-	3	4	1	3	-	5	4	1
Jackfruit	1	5	3	1	-	-	-	-	1	1	1	-	-	-	-
Cucumber	2	4	2	5	-	-	4	4	5	1	3	-	-	-	-
Chili	4	-	-	4	-	4	-	2	1	1	2	-	-	-	-
Tobaco	5	5	-	3	3	-	-	5	5	1	5	-	-	-	-
"Brinjal"	1	1	-	2	1	-	-	2	1	1	2	-	-	-	-
Ginger	1	-	-	2	1	-	-	4	5	1	4	2	-	-	-
Banana	1	-	2	1	-	3	-	1	1	2	2	5	-	-	1

Minimal problems gives score 1 - Maximum problems gives score 5
(not any problem related to increased production with crop at al, gives score: -)

Malaisia 1995-00

last

insecticides

Class	Name	Use
1	Thiodan	uplands
2	Termitox 500 EC	uplands (to control ants)
	kendan	uplands
	Bena 555	lowlands
3	CH Maxion 1000E	upland/lowlands
	CH Malaxion 570E	upland/lowlands
	Metasan 50	upland/lowlands (for snails)

Table 2

Pesticides

Class	Name	Use
1	-	-
2	Victor 300	upland/lowlands (for wet rice 20-30g/acre/year, for palm oil 30gs/tree.
	Mesurol 50WP	prevent wet rice from birds
	ACM Diazinon 60 EC	upland/lowlands
	White oil	upland/lowlands
3	Decis	vegt., fruits/uplands
	Thuricide HP	veget., palm oil
	Cold Coin Malathion	upland/lowlands

Table 3

c) Herbicides

class	Name	Use
1	CP-Paraquat Dichloride	Applied in uplands and lowlands but only when the case is severe and the done urgently
	Paraquat Extra 25,6	
	Cropaquat	
	CSH-Paraquat	
	Terquat	
	Gramaxone PP 910	
2.	CH Amine 5	for wet and dry rice
	2.4-D dimethylamine	weeds as: E. crusgalli, M.vaginalis, Scirpus grossus, Passiflora foetida and Borneria laifolda
	Keris 2.4-D isopropylamine	
3	Newahtox 2.4-D	for upland and lowland
	Sindax	weeds
	Garlon 250	

According to the man responsible in DOA chemicals shop, the diffirence between the three chemical classes cited above, is the intensity and speed of action which are respectively high, medium and low in the classes 1, 2 and 3.

Source: Interview with agricultural chemicals shop seller.

under DOA, Tambunan market, Tambunan district, Sabah, Malyasia.

Table 4
Fertilizers

Name	Use
Selama 8-8-6	
Bicomine	wet and dry rice, vegt., and fruits
Soto-no 101	
NPK Blue (subur)	
NPK yellow	
Deliver	
HI-PK	vegt., fruits and flowers
HI-NK	
Ferti 47	flowers only
J:H 47	encourages root growth in fruit trees

Appendix 5

Land Measuring

The area of the two farms and their fallows were measured by using GPS, measuring tape, compass and clinometer. The areas of both farms and their fallows are:

Mary Kassim's Farm = 3.768,6 m^2
Fallow = 1.899,9 m^2
Alice Nagan's Farm = 642,0 m^2
Fallow = 229,5 m^2

Mary Kassim's Farm

Table1: Laboratory analysis of farming area

	pH	Ca	Mg	K	Na	CEC	Av.P	%N	%C	%Sand	%Clay	%Silt
A1	4.4	0,5	0,5	0,5	0,06	21	16	0,2	2,4	34	41	25
A2	4,3	0,3	0,3	0,3	0,07	20	6	0,2	2,2	41	37	22
A3	4,8	1,1	1,9	0,7	0,05	17	6	0,2	1,9	24	46	31

A1 from the upper part of the field, A2 is from the middle part and A3 is from bottom part

Table 2: Calculated Parameters

	% BS	% SOM	C/N
A1	7,56	4,09	12,47
A2	4,76	3,76	13,69
A3	22,02	3,31	11,29

Table 3: Laboratory analysis of Fallow area

	pH	Ca	Mg	K	Na	CEC	Av.P	%N	%C	%Sand	%Clay	%Silt
AF 1	4,2	0,2	0,1	0,3	0,06	22	5	0,2	2,7	26	47	27
AF 2	5,6	4,5	5,5	0,8	0,06	20	5	0,2	2,0	34	34	31
AF 3	4,4	0,4	0,3	0,4	0,06	17	4	0,1	1,7	45	34	21

AF1 from the upper part of the fallow, AF2 is from the middle part and AF3 is from bottom part

Table 4: Calculated Parameters

	% BS	% SOM	C/N
AF1	3,19	4,71	14,37
AF2	53,58	3,41	11
AF3	5,94	2,88	12,85

Alice Nagan's farm

Table 5: Laboratory analysis of farming area

	pH	Ca	Mg	K	Na	CEC	Av.P	%N	%C	%Sand	%Clay	%Silt
B1	4,6	0,3	0,1	0,2	0,05	15	5	0,09	1,6	60	26	15
B2	4,2	0,2	0,2	0,3	0,04	16	6	0,13	2,2	56	28	15

B1 from the upper part of the field, B2 is from the middle part and B3 is from bottom part

Table 6: Calculated Parameters

	% BS	% SOM	C/N
B1	5,15	2,81	18,11
B2	3,97	3,86	17,23

Table 7: Laboratory analysis of Fallow area

	pH	Ca	Mg	K	Na	CEC	Av.P	%N	%C	%Sand	%Clay	%Silt
BF 1	4,8	0,8	0,4	0,4	0,04	13	5	0,1	1,6	63	22	14
BF 2	4,8	0,5	0,6	0,4	0,03	14	5	0,1	1,7	58	27	16

BF1 from the upper part of the fallow, BF2 is from the middle part and BF3 is from bottom part

Table 8: Calculated Parameters

	% BS	% SOM	C/N
BF1	12,6	2,81	16,3
BF2	11,17	2,9	14