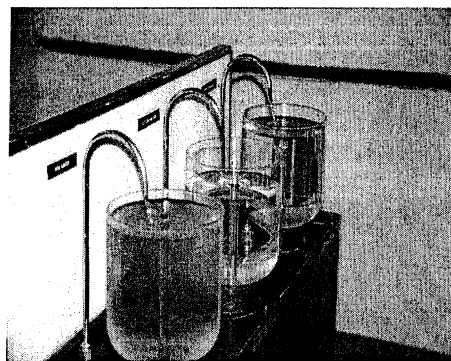


Water Resource Management in Niah River Catchment- Rumah Ranggong

**An interdisciplinary investigation of the relation between land use and
water quality**



**Supervisors: Assistant Professor Ole Mertz and Quentin Gausset
SLUSE 2000/2001**

by

Rasmus Hviid (Public administration, Roskilde University Centre)
Kewin Kamelarczyk (Forestry, The Royal Veterinary & Agricultural University)
Ditte Nielsen (Geography, Roskilde University Centre)

Foreword

This project is the result of a 3-week field trip to the Niah district, Sarawak, Malaysia from the 14th of October to the 5th of November 2000. The Danish participants of the field course were a part of the SLUSE program. The SLUSE program is an interdisciplinary field course on sustainable Land Use and Natural Resources Management. 4 Lectures and 12 master students from the University of Copenhagen, Royal veterinary and Agricultural University and Roskilde University Centre, as well as 5 Lectures and 24 master students from UNIMAS attended the Sarawak field trip 2000. The groups were divided into 4 subgroups dealing with water, agriculture, forestry and tourism, all with the common subject of land and resource use.

Abstract

The point of departure for this essay is decreased water quality in the Niah River, Sarawak. This subject is investigated in terms of its causes as well as its impacts. The collection and processing of primary data, social as well as natural scientific, make up the basis for our findings and conclusions. Within this framework of study, changed land use in the Niah catchment area is identified as the primary reason for the most serious factor of water pollution: - *a significant increase of the sediment level, caused mainly by soil erosion from oil palm plantations.* Furthermore, an increase of the flooding hazard is identified. The impact of this degradation is subsequently discussed in terms of changed livelihood strategies in a local Iban longhouse.

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1 Introduction

1.1 Introduction to Malaysia and Sarawak

Malaysia is a resource rich country in Asia (Picture 1) undergoing a rapid development phase (Vincent & Ali 1997, p. 1-3). The country's GDP was in 1970 about 20 billions MR¹, out of which 10 billion came from the primary sectors. In 1990, this number had increased exponentially to 80 billions MR, out of which only 20 billions came from the primary sectors². Malaysia was the world's largest producer of tin, tropical timber, natural rubber and palm oil in 70's and 80's, which places natural resources in a key role in the development of the country (Vincent & Ali 1997, p. 3 -10). As a result, heavy resource extraction has accumulated a lot of income to the Malaysian economy, mainly from the export profits (Cleary et.al. 1994, p. 99-100). Although the primary sectors part of the total GDP has decreased, there exist a very uneven distribution between the primary, secondary and tertiary sectors between Peninsular Malaysia and Malaysian Borneo. As a result, Sarawak is still very dependent on the natural resources like timber and palm oil. However, years with intensive logging activities have resulted in big part of the forest being more or less degraded or changed to other kind of land uses (King, V.C. 1993, p. 237-239). Large areas have been converted into palm oil plantations in Sarawak, maintaining Malaysia as the leading exporter of this product to the world market. Hence, palm oil represented over 1/3 of the total from the primary sector in 1990 compared to 1970, where palm oil only represented 5 % of the export (Vincent & Ali 1997, p. 17). The question in that case is, whether there exist any reason for being concerned about Malaysia's possible lack of awareness regarding sustainable development in this process of reaching a higher standard of living (Third world Quarterly, 19(4) p. 771-786). However, Malaysia is getting increasingly conscious about the environmental impact regarding the exploitation of its natural resources, and as seen in its development country context, it has a more developed environmental legislation than usual for developing countries (Vincent & Ali 1997, p. 23-26). One of the environmental problems attached to the drastically shift in the land use in Sarawak, is the impact on the watershed resources, primarily due to silt and soil erosion decreasing the water quality in the water sheds (Memon & Mohammed (1999), p. 90). Especially for the local inhabitants, untreated surface water from rivers has been essential as a resource for consumption and food gathering. This was also the case for Rumah Ranggong (will be referred to as Rh. Ranggong), a longhouse bordering up to the Niah River located in the Niah district, Sarawak (see section 1.4). As for this longhouse

¹ The Malaysian currency (the exchange rate in October 2000 was approximately 250 Dkr. for 100 Malaysian Ringgit).

as well as several others, the introduction of the logging industry and oil palm plantations in the area during the 60's, significantly changed the water quality in the river and hereby the villagers' use and utility of their primary water resource. Hence, this problem will be the core subject of this report.

1.2 Objectives

Our main objective is to investigate whether decreased water quality is a result of changed land use in the Niah River water catchment area. This includes an examination of magnitude and sources of pollution. Our second objective is to examine in which way the changed water quality has influenced human daily life / life quality in the Ranggong village. Finally, we will identify the legislative and institutional framework regarding decision-making and implementation of water management in Sarawak, in order to reach a better understanding of the institutional background and indirect causes of the pollution.

1.3 Project design

1. Introduction: Overall introduction to Malaysia and Sarawak and objectives of study.
2. Study area: Introduction to the Niah catchment area, its land use as well as the main characteristics of the villagers in Rh. Ranggong.
3. Methodology: Description of the methods used (natural and social scientific), including a short discussion of their utilization and their justification in the report as a whole.
4. Data processing: Presentation of the primary data collected in the field and secondary used.
5. Discussion: A discussion of the data in relation to the main objectives of the report.
6. Conclusion: A summarization of the finding in relation to our objectives.
7. Reflections: Some post rationalizing regarding the process and methodology and reflections upon the future of the study area.

1.4 Study area

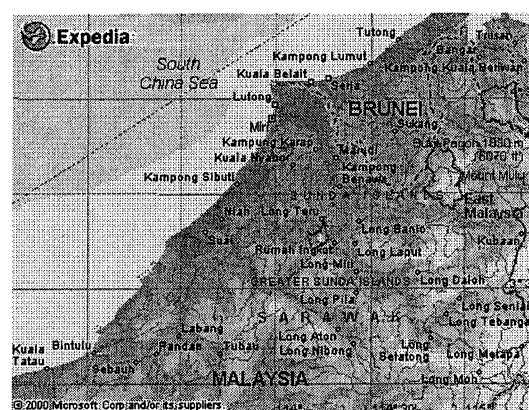
The land use in the Niah district area (picture 2) is presently dominated by agriculture. Hence, the district is primarily rural, besides the few urban areas, under which the city of Batu Niah is the densest one. These areas include oil palm plantations, subsistence and cash crop farming, and different qualities and stages of secondary forest, but also some few small patches of primary forest located mainly nearby streams possessed by the Iban long houses. The Iban controlled

² (1978 prices)

land areas are often entitled native customary land³ or native communal reserves⁴. Other land areas are typically state forest reserves, villages or plantations (*Customary land rights under the Sarawak Land Code*, 11/12 1997). Before the timber industry arrived to the area in the 60-70'es, the area was almost covered by primary forest, except for the areas surrounding the villages. Presently, the most dominating forms of land use are clearly oil palms plantations. Large companies typically run these plantations, but there are some small areas maintained by the natives as well. After the logging activities some 20-30 years ago, the timber companies typically sold their concessions⁵ to the plantation companies or continued using the areas for other purposes. These areas were almost without exception converted into oil palm plantations. The small-scale farming in the Niah district is primary run by the Iban native people (Agricultural extension office).



Picture 1. Sarawak State.



Picture 2. Location of Niah area.

Looking at the broader population facts, the composition of ethnic groups is as manifold as in the rest of Malaysia, including Malay, Chinese, Iban and Indian groups, under which the two first mentioned, are the most numerous (Vincent & Ali 1997, p. 7). The religion of the Iban is pagan (King, V. (1993) p. 31), although more and more are converted into Christianity while the Malays are Muslim⁶. The Ibans in the Niah district are primarily found in one of the many long houses located in the rural areas, often close to one of the many streams located in the district. Their main income generating activity is farming; subsistence farming as well as cash cropping (Agricultural extension office). Another important source of income is work in the timber and oil palm industry, often located far away from their native village (Headman of Rh. Rangong). Before fertilizer and pesticide became available, the Iban farming methods were based on

³ Land lawfully claimed by "natives" prior to 1.1. 1958.

⁴ State land declared by the minister for the use of any native community.

⁵ Time restricted land use rights.

⁶ As this is the state religion.

shifting cultivations⁷. The situation today is dominated by relatively modern methods, although the planting and application of chemicals still are done by hand. Furthermore, many of the cash cropping activities are included in a government subsidy scheme, which since the middle of the 80's have promoted cash crops grown by small-scale farmers, especially pepper and oil palm. The Malays are involved in some farming activities too, but they are mainly employed in the administrative sector, as well as in other urban activities, where they also live. Finally, a minority of Indonesian contract workers is employed in the oil palm plantations, where they approximately make up 80 % of the total workforce, as they are normally lower paid than the locals (Interview: Managers of oil palm plantations I & II).

The village of Rh. Ranggong was founded approximately about 1940. Since then, 4 longhouses have been built, due to the former ones were destroyed by flooding or in fires. Soon after the settlement of Rh. Ranggong, plots of land surrounding the village were allocated. Each family got the land they were able to clear. As the population in Rh. Ranggong increased the land had to be divided more formally⁸. The land shortage was furthermore due to logging and the establishment oil palm plantations around Rh. Ranggong (Group discussion: women).

Today the longhouse has 59 households and about 380 inhabitants. Most of the young people (18-35 years old) work away from the longhouse making the bulk of the adult inhabitants older than 35 (appendix A).

The longhouse started using electricity for the first time around 1980, using diesel driven generators. In 1986, a road was constructed to connect the longhouse with Batu Niah and other longhouses. The organization of the longhouse is as follows: Above all, there is the headman, who is considered to have the greatest knowledge about the traditional Iban laws and traditions. As a result, his decisions are often taken for valid. Besides that, the longhouse has a committee (JKKK or "council of village"), which contains of 11 members (primarily people who can write or have other practical abilities (speaks English etc.)). They are sometimes randomly chosen but can also be appointed. The son of the headman will inherit his position, but if he does not has a son, the position will be up to election (Interview: Headman of Rh. Ranggong). More than 50 percent of the adults have never attended school while 28 percent went to primary school. All children are attending school, either the local primary school or the secondary school in Batu Niah (which means that the only children living permanently in Rh. Ranggong are younger than 12 years old) (Appendix A). The main occupation of Rh. Ranggong is as mentioned farming.⁹

⁷ Burning and clearing land followed by fallow periods.

⁸ "From that tree to that tree".

⁹ Of the respondents 78 percent were farmers.

Hence, the main source of income is cash crops as pepper, paddy, fruits, oil palms etc., but money are also send home by younger men working outside the village area (Group discussion: women).

2 Methodology

As shown in info-box 1, we make use of a number of different methods to meet our objectives. In the following section, a short description of the different methods practiced as well as their actual utilization is presented. Finally, we discuss some practical as well as theoretically aspects of the methodology, which we consider as relevant when considering the process of data collection. We would initially like to stress, that we consider the validity and reliability of both the natural and social scientific data sets for being relatively low, primarily due the very short time in used the field, which restricted the quantity of water samples as well as interview to a minimum.

Info-box 1. Methods used.

Social scientific

Interviews, including

- Survey interviews (multiple choice)
- Semi-structured interviews
- Participatory methods, including
- Participatory mapping
- Participatory fieldwork (paddy planting)

Natural scientific methods

- Water sampling

Other

- Field observations
- Living on location
- Informal conversations

2.1 Social scientific methods

2.1.1 The Survey

With the purpose of identifying the impact of decreased water quality in the Niah River upon the villagers of Rh. Ranggong, as well as to reveal other aspects relevant to our objectives, we decided to carry out a survey (appendix A). The questions included in the interview-scheme had, with a few exceptions, directly or indirectly connection to our core objective, including water quality experiences, flooding experiences, farming practises and health related questions. We conducted in all 27 interviews¹⁰, which approximately corresponded to one person being interviewed from every second household¹¹. To prevent gender and age biases every second household was chosen¹². Then, the respondents were divided into nine categories, in which the

¹⁰ Of which we only use 24 as two are pilot study interviews and one is lost.

¹¹ There are 59 households in Rh. Ranggong.

¹² We chose the households with uneven numbers

criteria were age intervals and gender. The main purpose of that was to prevent the dominating population in the longhouse to be too over represented and thereby make a less representatively picture of the situation. The questions were mainly made as multiple choices, and they were hereby relatively close-ended, as they in this form would be more easily quantifiable later on. We made two pilot-studies of the first version of the survey to identify questions, which were irrelevant, confusing etc. These pilot-studies had a rather significant impact on the final interview scheme, as we encountered quite many problems. Primarily we had problems with open-ended questions and too many questions. The pilot interviews were simply too time consuming¹³. The questionnaire was corrected by deleting and reformulates questions and the questionnaire was specified more on water.

In relation to the actual utilization of this method, the following challenges were encountered: In spite of the pilot study, there were many examples of people not interpreting the questions in the way we expected them to. As a result, the respondents often came up with an answer not fitting into the closed-ended options, which made the data difficult to quantify¹⁴. Finally, it is important to stress that there at the best can be talked about trends or some possible impacts to the livelihood in Rh. Ranggong from the findings of the survey.

2.1.2 Semi-structured interviews

In addition to the survey, we conducted some 14 interviews throughout the field period, which included single respondent, key-person and group interviews (table 1). The main distinction between these interviews and the survey interviews scheme is, that they are based on a semi-structured interview-scheme and with a much greater extent involves the use of open-ended questions. The single respondent interviews were only conducted in Rh. Ranggong and are considered mainly as a supplement to the conclusions drawn by the survey. The key-person interviews play a key role, as they served as a source of specialised knowledge, gained from officials or the like. The group discussions and focus groups have the same function as the single respondent interviews, only with the additional aspect of being conducted group-wise. It should be noticed that the questions asked in these interviews often included the same questions as those that were used in the survey. The big difference was the omission of the multiple-choice method as well as the stringent order of the questions. Instead, the interview allowed the respondent(s) to answer as elaborating as he/she wanted. As a result of that, a discussion was established in which

¹³ Approx. two hours pr. interview

¹⁴ The answers were often a pragmatic "choice" taken for the respondent as the where only few answering options and no possibility of answering "don't know".

the respondent(s) was the one in charge of the conversation and thereby choosing the direction and (to some extent) the subjects of the interview. This secured a more in-depth understanding of the respondent's situation and opinions.

Table 1. Semi structured interviews conducted

Key person interviews:	Villagers / single respondent interviews:	Group discussions:
Second assistant at agricultural extension office in Batu Niah	Headman of Rh. Ranggong	Committee meeting
Health care center in Batu Niah – medic in charge	Changgai - businessman	Women – Focus group I
Manager of the water treatment plant in Batu Niah	Old man in room 32	Women – Focus group II
Manager of oil palm plantation I	Guides – river upstream trip	Women – Discussion
Manager of oil palm plantation II		
Manager of oil palm plantation III		
Manager of CPO mill (Crude Palm-oil mill)		

In relation to the actual utilization of this method, the following challenges were encountered: It should come as no a surprise, that the quantity of the semi-structured interviews is relatively low. With a higher quantity, we would have had the option to make some “quantification of qualitative data” and / or database processing, for the purpose of creating a more systematical picture of our “soft” data. The lack of time and the focus on the survey simply restricted us from doing so.

2.1.3 PRA (Participatory Rural Appraisal)

The semi-structured interviews were not our only choice of qualitative method, as we performed some participatory rural appraisal techniques as well. The main reason for the choice of using these methods was to gain in-depth insight of the villagers' local knowledge and livelihood in a participatory way. During the stay, two participatory methods were hereby performed:

Participatory mapping of the territory surrounding the Rh. Ranggong village.

The purpose of the participatory mapping was to get first-hand insight in the local geography, and to identify what the villagers actually prioritized as important factors in the mapping (crops, places etc.). Essentially, three men from the village were randomly chosen, and a map consisting of four A4 – pages were drawn. Challenges: As the mapping developed, it became more and more obvious, that one of the participating persons where in charge, and that he mainly decided what to draw. Also, there was a problem in the fact that the interpreter became very eager in helping, so there were some situations, where he took over and participated in the drawing. Finally we discovered that the paper format chosen was to small, which resulted in a less detailed map.¹⁵

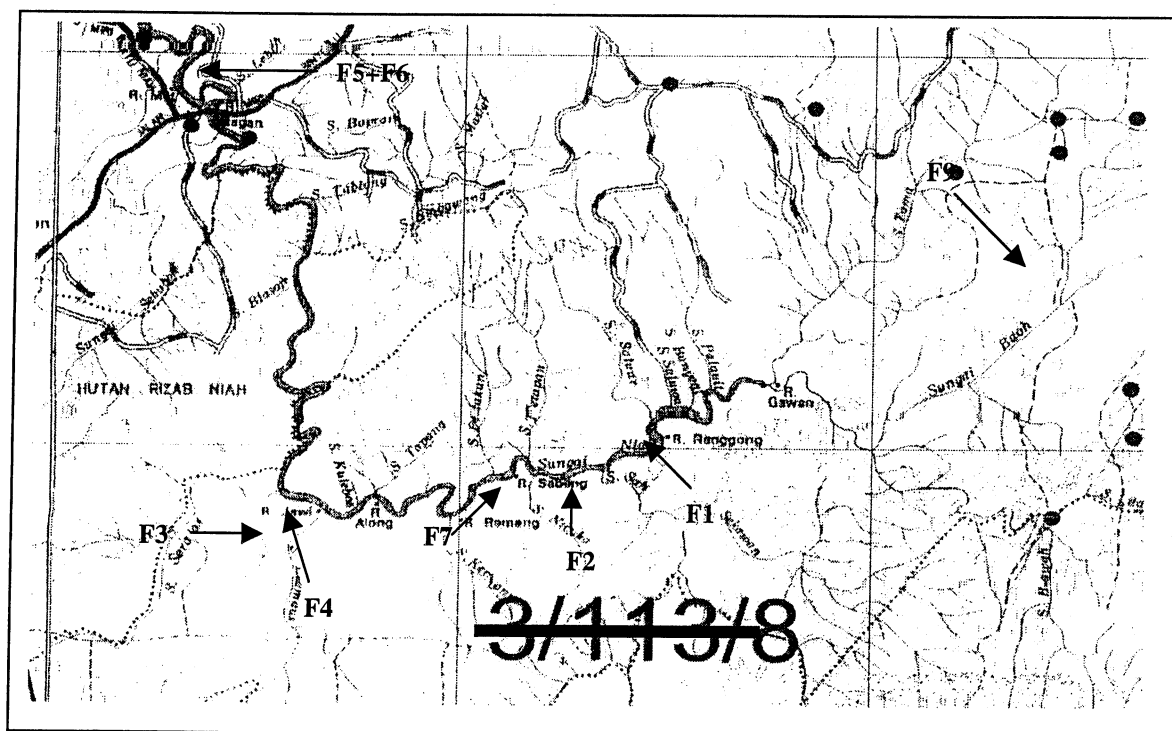
Participatory fieldwork (paddy-planting)

We had the chance to participate with the paddy planting in a nearby paddy field. The purpose of this séance was primarily to gain in-sight in the work conducted by a typical farmer, including the distribution of work among the family members. In an erosion perspective, this gave us valuable information about the crops grown on small-scale farming fields. The participatory field workmost valuable contribution though was the complicity obtained with the respondent. Challenges: The heat and the sun.

Finally, we consider the fact that living **on** location, and thereby developing several personal contacts, and more in-depth in-sight in the realities, livelihood strategies and customs as a powerful way to identify and understand a local-specific problem. It would have been more difficult to create a loose and safe atmosphere during the interviews and the surveys, if the time had only been spent on location in the daily hours and only in work situations. A relationship of trust with the community and thereby with our respondents was hereby build. Hence, one negative impact is that the objectiveness might have been coloured by the villager's view of the situation in Rh. Ranggong. These aspects of the research have a high priority in reflecting upon the results extracted from the primary data.

¹⁵ Unfortunately this map is no longer available (along with other field trip documents such as our time planning) as a thief recognized its high value.

2.2 Natural scientific methods



Picture 3. Niah River and sample point (F1 to F7 and F9), (Source: the Malaysian counterpart).

2.2.1 Water samples

In order to classify the water quality and the impact of the land use on in the Niah River catchment area, ten water samples were conducted at ten different locations. Only one sample was taken at each location. Two samples should have been taken at each site to obtain statistic valid data (Neumann 1997, p. 138) but this was not done due to limited time for analysis¹⁶. Furthermore the seasonal deviation should be known or at least the difference between rainy and dry season. Several parameters were measured. Focus was put on the most crucial although other parameters could have been included. Following parameters were determined *in situ*: temperature, dissolved oxygen (DO), conductivity, pH, turbidity and the depth of the stream. A Hydrolab^{®17} was used for this. Furthermore, water samples were taken to get the following parameters, which had to be determined by the use of field laboratory: biochemical oxygen demand (BOD)¹⁸, chemical oxygen demand (COD)¹⁹, total suspended solid (determined at

¹⁶ Aggravate by the time consuming field hydro lab, that did not work that well in the field.

¹⁷ Hydrolab® is an electronic device, able to measure the above-mentioned parameters by lowering it directly into the river.

¹⁸ BOD is an indicator of organic pollution.

UNIMAS after our return to Kutching), ammonical nitrogen, phosphate, nitrate, total coliform²⁰ and E. coli²¹. The Malaysian counterpart carried out these analyses. All the above-mentioned parameters are included in the “Proposed Interim National Water Quality Standards for Malaysia” made by DOE, 1993 (Menon & Mohamed, 1999, p.137), which will be used as point of departure when examining the level of decreased water quality.

To relate the findings with the land use we chose to allocate the measuring points in a way that the different points would represent different land use practices and other activities existing in the catchment area (Picture 3):

Point 1: Sungai Niah. Sample taken at Rh. Ranggong. The results would show us the existing quality of the water used by the inhabitants of the longhouse. Large-scale oil palm plantations mainly occupy the land upstream (appendix D). The proportion of small plot farming by local farmers is minimal, as only one longhouse besides Rh. Ranggong exists up river.

Point 2: Sungai Sah. This river has a large catchment area south of S. Niah mainly occupied by large areas of oil palm plantations (appendix D).

Point 3: Sungai Lamaus. Smaller river than Sungai Sah but also with a catchment area mainly occupied by oil palm plantations (appendix D).

Point 4: Sungai Niah. Sample taken at the longhouse Rumah Ampau approximately 10 kilometers down river from Rh. Ranggong. Due to the existence of several longhouses upriver from this point an accumulated impact of human activity (sewage, human or/and animal faeces, laundry, bathing etc.) on the water quality could be expected. Unfortunately the bacteria tests (which could have indicated this impact) did not succeed here as the field lab broke down.

Point 5: Water intake point at the water treatment plant. Sample taken to partly to test the possible impact of the treatment plant (result has to be studied in relation with point 6) but also to test the downriver water quality.

Point 6: After the treatment plant. Sample taken to check a possible impact of the treatment plant (result has to be studied in relation with point 6).

Point 7: Sungai Nibuka. Small stream with a catchment area only occupied by small-scale farming which also includes patches of secondary forest. Originally the intention was to use a stream with pristine forest as catchment area as reference. Unfortunately no such is left in the Niah catchment area so we had to change our approach. We decided to use Sungai Nibuka as reference as it is the least disturbed stream in the proximity to Rh. Ranggong. The other streams used for sampling are all affected by the impact of oil palm plantations.

¹⁹ COD is an indicator of chemical or inorganic pollution.

²⁰ The total coliform count indicates if the water contains pathogenic organisms.

²¹ E.coli count is an indicator of sewage contamination.

Point 8: Sungai Sakacoh (small stream). Sample taken inside oil palm plantation-I²² to investigate the water quality inside the oilpalm plantation and the effect of lacking riparian zones. BOD and COD were not measured here, as the hydro lab was with another group.

Point 9: Sungai Baoh (one of the main rivers forming Sungai Niah). Sample taken inside oil palm plantation-II for the investigation of water quality upriver of Sungai Niah. BOD and COD were not measured here.

Point 10: Drainage inside the oil palm plantation-I. Original a small stream but siltation was removed by machinery and the run of it straightened. BOD and COD were not measured here.

Besides the above ten sample points with several parameters measured two locations were chosen exclusively for bacterial analysis: Forest Research Station (located on the Miri-Bintulu highway) and Rh. Ngelayang (longhouse located few kilometres upriver from Rh. Ranggong).

2.2.2 Field observation

To obtain the needed data and knowledge concerning agricultural management practices several field trips were carried out. Together with the oil palm plantation (and CPO-mill) managers we were showed around inside the plantations (and CPO-mill) to get an idea of the practices used. Not only did we get their “story” but we did also make our own observations (measurements of riparian zones, erosion potential, infrastructure etc.). Furthermore, several visits were paid in the fields of the local farmers to get an idea of their agricultural practices.

2.3 Intercultural teamwork

The physical separation between the team members affected the initial phase of the teamwork, especially communication. Despite the availability of the technical features necessary for communicating across distance (videoconference and net-chatting once a week) we experienced some difficulties. We discovered that certain topics were difficult to touch upon while chatting. This can among other things be explained as a matter of trust, which cannot easily be gained without face-to-face interaction.

Another factor affecting the group work was the physical separation of the group in the initial phase and the fact that part of the group was closer to the research area than others. This had both positive and negative implications. The positive implication was the possibility to dig out information that the group otherwise would be restricted from and moreover a knowledge on the Malaysian society. The negative implication was that it did create an unequal relationship

²² The number is a pseudonym for a specific company which name cannot be published.

between the two parts of the team as one part had more easily access to information than others. Another aspect that did influence the process all along, was different opinions about what the task consisted of. This is partly due to different way UNIMAS and SLUSE-DK did approach the proposed study themes. The latter saw it as a point of departure for narrowing down the focus. This resulted in different focuses: a narrow and a broad, which among other things lead to a misunderstandings between the students. Furthermore a discussion evolved regarding opinions of how “good research” should be conducted. Roughly, this discussion can be reduced to a difference between a mainly positivistic approach and a mainly critical-rational one. Finally another aspect can have affected our work, namely our own “ethnocentric” values which might have hindered us in perceiving the problem and conducting our research in any other way than we did. All things considered, the diverse team was a resource in clarifying different aspect of the problems researched. However some problems were faced in the process.

2.4 Working with an interpreter

As all the qualitative data more or less had to be collected with the use of an interpreter, it can be rewarding to reflect upon this kind of work. First of all working with the interpreter allowed us to have verbal contact with people that we otherwise would have been more or less prevented from communicating with. Also, the interpreter explained actions, notions and behaviour patterns etc. to the Danish part of the team and thereby helping us to work better in the context of the host culture. Nevertheless working with an interpreter also involved some problematic aspects. First of all, the interpreter simplified or even oversimplified matters in order to ease communication and the intercultural meeting. As a result, the interpreter did not translate everything but just summarizing the points he believed to be important. This has doubtfully had an impact on our understanding of the topic being researched, as this selective way of transmitting the information, whether or not deliberate, contains a risk of biasing the information. Secondly, the interpreter, not due to personal attributes but his/her function, sometimes discomforted the relation between the respondents and the interviewer, due to the indirect conversation creating a distance. This problem was also one the group had to face as some respondents complained about not being able to speak to us directly. We therefore did not obtain the candour of the respondent that we otherwise might have had, and thereby possibly missing out relevant information.

It is also worth mentioning that interviewing becomes more time-consuming and maybe even boring for both parties as it becomes difficult to develop a conversation or discussion. This became very apparent and influential when we tried to create a focus group discussion, where

one methodical point was to create a discussion between the respondents. Either no discussion developed or we did not understand the discussion going on as the interpreter only could translate a certain amount of statements at the time.²³ The interpreter could also create a distance between the interviewer and the respondents due to his/her personal attributes. The fact that the interpreter was male, is important to have in mind, especially regarding the possible distance to our female respondents. Moreover our interpreter had a tendency of having some pre-defined biases concerning the women's role in society. Last but not least, working with an interpreter also affected the way the interviews were conducted. For example, we tended to formulate our questions as simply as possible, due to the fact that the respondents as well as the interpreter did not understand them otherwise. This resulted in a tendency of asking leading questions, such as "Is it good or bad?" instead of asking for the respondent's opinion about a certain subject. This is definitely something the researcher has to be very conscious about, but as we discovered it is much easier said than done. All in all, working with an interpreter can be a very influential factor when collecting data, which can be both rewarding as well as problematic.

3 Data

In this section the result of our fieldwork will be introduced. Firstly, the results regarding the water samples will be presented. Secondly, we present the results regarding the impact of decreased water quality. Thirdly, we shortly focus on the land use of the area, including the oil palm plantations and the small-scale farming, as these present the dominant land occupier of the area. Finally, we introduce the legislative and institutional framework, which will be based on secondary literature collected in Malaysia. The results in the water and land use sections are mainly based on interviews, field observations and water tests.

3.1 Water samples

The water quality data obtained during the field trip is showed in table 2. Examining the results it must be kept in mind as mentioned that the samples in each spot where only conducted once. As a consequence, we cannot check whether a variation in the samples is due to a variation in the water or a bad measurement.

²³ We are aware of that recording the discussion could have solved some of these problems if we afterward get a transcript. This method is however very resource consuming and a tape recorder can also create a distance between the interviewer and the respondents.

Table 2. Water quality indicators measured during the field trip. For comparison: the “*Proposed Interim National Water Quality Standards for Malaysia*” (DOE, 1993) are included.

Parameter	Water Sampling Points						
	F1	F2	F3	F4	F5	F6	F7
	R.Ranggong	S.Sah	S.Lamaus	R.Ampau	Water Intake Point	After Treatment Plant	S.Nibuka
Time	0840 hrs	0950 hrs	1035 hrs	1100 hrs	1145 hrs	1155 hrs	1615 hrs
Date	19-okt-00	19-okt-00	19-okt-00	19-okt-00	22-okt-00	22-okt-00	22-okt-00
Weather Condition	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny
Remarks	Heavy rain the night before				Heavy rain the night before and at 0900 hrs for 1 hr		
Water condition (current/level)	Fast/high	Fast/high	Slow/high	Fast/high	Fast/high	Fast/high	Fast/low
	In-situ Testing						
Temperature, °C	26,01	26,13	26,05	26,24	26,75	26,74	26,24
Dissolve oxygen, mg/l	6,51	5,86	5,39	5,93	5,6	5,94	4,41
Depth, m	2,8	1,7	1,4	5,3	3,8	3	0,1
Conductivity, $\mu\text{S}/\text{ms}$	48,8	54	47,3	50,8	54,6	54,8	31,9
PH value	7,18	6,96	6,81	7	6,19	6,77	7,14
Turbidity, NTU	256	195	195	231	113	111	32,5
	Physical/Chemical testing						
BOD, mg/l	0,68	1,3	1,81	1,95	0,54	1,15	0,64
COD, mg/l	24	19	16	20	12	11	20
TSS, mg/l	139,5	90,5	52	93	53	61,5	34,5
Ammonical nitrogen, mg/l	0,094	0,059	0,063	0,033	0,035	0,141	0,248
Phosphate, mg/l	0,104	0,403	0,089	0,068	0,052	0,096	0,105
Nitrate, mg/l	0,2	0,3	0,1	0,2	0,3	0,2	0
	Bacteriological Analysis						
Total coliform count, MPN/100ml*	>2400				>2400		
Total E.coli count, MPN/100ml	278				221		

* MPN = Most Probable Number

Proposed Interim National Water Quality Standards for Malaysia (DOE, 1993). (Source: Memon & Mohamed, 1999). (See appendix D).

Table 2 (continued)

Parameter	Water sampling points			Water Quality Standards #		
	F8	F9	F10	Class I	Class II	Class III
	Drain (PI-I)	S.Baoh (PI-II)	S.Sakacoh (PI-I)			
Time						
Date	23-okt-00	23-okt-00	23-okt-00			
Weather Condition	Sunny	Sunny	Sunny			
Remarks	Heavy rain the night before					
Water condition (current/level)						
In-situ testing						
Temperature, o C	28,98	28,57	28,5			
Dissolve oxygen, mg/l	4,18	4,46	3,48	7	5,0 - 7,0	3,0-5,0
Depth, m	-	-	-			
Conductivity, uS@ms	126,8	53,7	55,9			
PH value	6,74	6,97	7,28	6,5 - 8,5	6,0 - 9,0	5,0-9,0
Turbidity, NTU	256	86,1	170	20	100	
Physical/Chemical testing						
BOD, mg/l				1	3	6
COD, mg/l	7	11	7	10	30	60
TSS, mg/l	129,5	46	90	25	50	150
Ammonical nitrogen, mg/l	0,134	0,131	0,097	0,1	0,3	0,9
Phosphate, mg/l	1,587	2,878	0,077	0,2	0,2	
Nitrate, mg/l				7	7	
Bacteriological Analysis						
Total coliform count, MPN/100ml*				100	1000	5000
Total E.coli count, MPN/100ml				10	200	500

* MPN = Most Probable Number

Proposed Interim National Water Quality Standards for Malaysia (DOE, 1993). (Source: Memon & Mohamed, 1999). (See appendix D)

In addition to the above presented results two bacterial analysis were conducted:

Forest Research Station: Total Coliform: >2400 MPN/100ml, E.coli: 542 MPN/100ml

Ruhmah Ngelayang: Total Coliform:>2400 MPN/100ml, E.coli: >2400MPN/100ml

Generally the samples show no alerting thresholds regarding water classification if classifying by the National Water Quality Standards for Malaysia. An exception is the value of Suspended Solid found at F1 (Rh. Ranggong) and at F8 (drain in Plantation I). The former reaches 139,5 mg/L and the latter 129,5 mg/L. Both values are near the lower threshold for Class III (150 mg/l) in the National Water Quality Standards for Malaysia²⁴. While no other parameters analysed indicate any pollution of the river water, the river as a whole must be regarded as Class II what is also the classification made by A.Memod & M.Muhammed for Niah River in 1995 (A.Memod & M.Muhammed, 1999, p. 94).

Of the samples taken in Niah River the lowest level of SS is found upriver (sampling point F9 in Baoh River). When Niah River reaches F1 (Rh. Ranggong) the level of SS has increased dramatically but decreases again further down river. Finally the level of SS increases slightly again after the treatment plant. In the tributaries of S. Niah and smaller streams in the catchment the highest level was found in the drain inside Plantation-I and the lowest in S. Nibuka.

Regarding the Biochemical oxygen demand (BOD) the level is relatively low in at F1 (Rh. Ranggong) but increases moving further downstream topping at F4 (Rumah Ampau). The tributaries all show high values except from the small stream S. Nibuka.

Regarding the level of nitrate only small variations are found. Those variations might be stochastic. Furthermore the level found are not unusual. On the contrary huge variations is found regarding the levels of Phosphate, with an interval ranging from 2,878 mg/l at point F9 (S. Baoh in Plantation II) to 0,052 mg/l at F5 (water intake point). The noticeable higher values found in F8 and F9 could indicate some incorrectness of the results. This cannot be checked as we as mentioned only have a single sample for each spot.

3.2 Perception on water quality: the habitants of Rh. Ranggong

In the following section we will present, the data regarding water quality extracted from the conducted survey in Rh. Ranggong (appendix A) as well as the semi- structured interviews²⁵, will be presented. The numbers in the brackets refers to the room number of the respondent.

3.2.1 Description of the present water quality

As shown in Figure 1, the color and the presence of toxic substances are the factors, which most frequently are chosen as being in the category “worst condition” by the villagers. This is closely followed by taste and smell of the water. The problem with soil erosion is further underlined as

²⁴ This means that the water is still suitable for drinking but not considered as good quality water (Appendix D).

²⁵ Committee meeting, Extension of survey with room number 15, 19, 37, river trip guides, focus group discussion I & II, Headman, Healthcare centre, Changgai and Women's group discussion.

23 out of 24 (or 95%) confirm, that they have experienced problems with increased sedimentation. In question C12 (appendix A) soil erosion should therefore be stressed as a major problem in the eyes of the villagers.

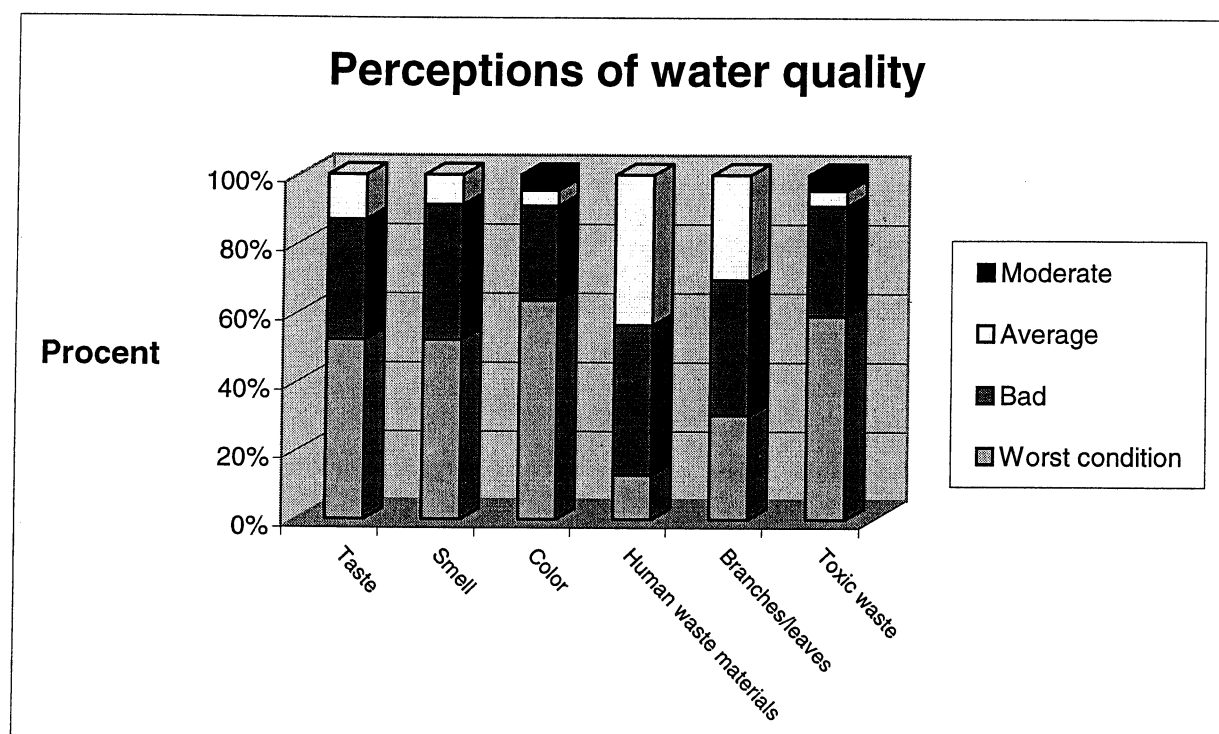


Figure 1. Condition of water quality in the Niah River by categories

Several statements in the semi-structured interviews support these identified trends: Committee, 15,32, 37, River trip, Focus group II, Women's group discussion. However, some divergences exist among the respondents regarding whether or not a change of the width and depth of the river has actually occurred (Headman, River trip, Focus group II).

3.2.2 Causes of decreased water quality:

According to the survey findings, oil palm plantations are believed to be the main factor regarding the decreased water quality, followed by logging activities²⁶. The respondents additionally explain that the increased erosion is a consequence of the logging of the forest as well as the establishment of roads²⁷, as it has left the soil is much more exposed to erosion (Headman, Committee, Focus group I.). Another factor of water pollution is the tuba²⁸ practice.

²⁶ In a ranking of the factors which are assumed influencing the water quality, 17 out of 24 possible (or 71%) select oil palm plantations in the category "the most influential". 8 out 24 possible or (34%) select logging activities as "the most influential category", and 12 out of 24 (or 50%) as the "the second most influential category".

²⁷ The construction phase (while bulldozing) are especially stressed as causing erosion (Committee meeting).

²⁸ Tuba is fishing with the use of chemicals.

20 out of 24 (or 83%) think tuba practice harms the water quality. Tuba is blamed for causing the bad smell of the river, and is according to the villagers mainly practiced by the workers in the logging and plantation camps upstream. However, the problems related to tuba problems have decreased as the villagers have complained to the plantation managers stressing that the tuba practice is illegal (Committee, Focus group I).

3.2.3 Seasonal variation and changed land use

Additionally, the villagers express aspects regarding the river quality that could be linked to seasonal variations rather than changes of the land use in the area. Nevertheless, the later cannot be excluded totally. Hence, the survey shows some interesting features regarding especially the flooding hazard. 67% of the respondents think the flooding has become more frequent now compared to before the logging and plantations²⁹. Regarding the duration of the flooding, the majority answered the duration is less than one week. However, 11 out of 17 (or 65%) stated, that in the past the flooding lasted for 2-3 days, but presently the flooding last around 5-6 days. Flooding has a range of impacts on the daily life of the habitants in Rh. Ranggong (Women's group discussion). Its most severe impact is the loss of agricultural yield destined for own food consumption as well as the general inconvenience in the unavailability of food³⁰. Secondly place is the income loss from cash crops (17 out of 24 or 71%). The semi-structured interviews further elaborate this aspect:

- Agriculture is affected due to the sediments on the leaves of paddy plants (Committee).
- The farmers are hindered from working in their field, as the roads are inaccessible (15, 37, Women's group discussion). Moreover the villagers are prevented from going to town and do business (Changgai).
- Animal husbandry³¹ is also effected as one respondent stated that it is problematic during the flooding as all the animals³² has to be captured and caged (19).
- Bathing becomes difficult after heavy rain, as the river current is too strong and the river water contains more sediment (19, focus group I).
- One respondent indicated that there is an increase in waterborne diseases as diarrhoea after a flooding (37), but according to the survey only 5 out of 24 (or 21%) thinks health is a major side effect.

²⁹ 17 out of 24 answered, that flooding before occurred twice a year. In addition, 16 out of 24 indicates the flooding hazard has increased to 3-4 times a year.

³⁰ For both factors, all the respondents (24 out of 24) chose them as having "impact on their daily life"

³¹ Mainly pigs and poultry are kept inn Rh. Ranggong. (own observation)

³² Mainly poultry as the pigs are cage all the time (own observation)

As for explanations to the increased flooding hazard, the top score in the survey to explaining the causes to increased flooding is “sediments altering the river” (16 out of 24 or 67%)³³. Similar explanations are also identified in the semi-structured interviews (15,19). One additional explanation is expressed in the women’s group discussion, as they blame the drainage systems in the oil palm plantations to cause the flooding.

Dry season

All the respondents in the survey confirm, that they experience water shortage during the dry season, which makes the water shortage the most severe impact of the dry season. This aspect is also confirmed by the semi-structured interviews (15). According to a single respondent, the problem is not a new one, as it was as severe before (32). The villagers deal with the water shortage by buying water at the Ngu Junction. In acute situations, water is delivered from the government (Women’s group discussion). Generally there is more inconvenience connected with the dry season: The water level is too low for bathing and washing and becomes very muddy, and irrigation is impossible (15, Women’s group discussion).

3.2.4 Consequences

The decreased water quality has some direct consequences, which primarily are expressed in the semi-structured interviews:

Firstly, there has been a decline in the fish stock according to our respondents from Rumahh Ranggong. Dead fish are sometimes found floating in the river (especially in the dry season) (Focus group II). Some respondents perceive the decline as an overall decline (32) others as an overall decline in the fish stock as well as an extinction of certain fish species (Focus group discussion I). Furthermore, tuba is a large part of the explanation regarding the decline in fish stock (Committee, Focus group discussion I, 32, Women’s group discussion). Another explanation is over fishing due to a bigger population (32). Nevertheless the shortcoming of fish in Niah has permitted the villagers to sell their fish as a market has emerged. The decreased river water quality does also affect the way caught fish is treated. The fish are sometimes so dirty³⁴ that villagers have to keep them for a few days in water to clean them and snails presently have to be rinsed twice to clean the sand out (Focus group discussion I).

Secondly some respondents (32, 37) express an increase of waterborne diseases despite the overall health improvement. (Group discussion women). In relation to this, one respondent stated

³³ Natural occurrence (10/24 or 42%), change in land use (13/24 or 54%) and the monsoon (10/24 or 42%) were also believed to cause flooding. None believe that the tide has an impact on the flooding. *Please notice, that the respondents could choose more than one factor in this question.*

that the river had become to polluted for bathing for an old family member as the person had sensitive skin (15). The villagers believe that the increase in waterborne diseases is a result of an increase of chemicals in the water (37). Nevertheless there are different opinions regarding whether the decreased water quality affects the level of waterborne diseases. The health care centre and the headman point out a decrease in waterborne diseases. The health care centre believes the decrease in diseases is due to the health awareness programmes.

3.2.5 Changed habits as a consequence of the river water quality:

The main impact on the livelihood is the total stop of using the river as a resource for drinking water, as all the respondents have changed from river to rainwater. All respondents confirm, that they boil their drinking water (Survey question C10, appendix A, data processing), which is considered very time consuming (Committee, 19, Women's group discussion). 7 out of 24 (or 29%) additionally filter their water³⁵. Regarding the shift from river water to rain water, two explanations are presented. Firstly, the shift is explained as a consequence of the decreased river water quality (37). Secondly another explanation for the shift of water source is the supply of the water containers from the government (15). The survey revealed some further trends regarding the decreased water quality:

When comparing the present situation with the past, all respondents still wash their clothes in the river as before, but additional eight now use rainwater as a supplement³⁶.

As for bathing, this is still largely done in the river (19 out of 21 or 90%), but additional eight (out of 24) state that they now also use rainwater for this activity. This means, that two respondents exclusively use rainwater for bathing.

There are apparently no changes regarding irrigation with water from the river, which still is the main source.

The biggest change in the inhabitants habits and the river is found when studying the rivers role for infrastructure. Presently, only 3 out of 21 (or 14%) respondents consider the river as an important mean of infrastructure. Before the establishment of the road, this was the primary option of transportation (15).

Finally, the survey looked into the preferences of water source in terms of different uses (Survey part C, appendix A). If possible, all respondents would use rainwater for drinking, washing and bathing, and only use the river water for irrigation. Furthermore, 20 out of 24 (or 83%)

³⁴ Told by their smell

³⁵ The price of one water filter is 100-150 MR (19).

³⁶ This is possible, due to the respondents possibility of choosing more than one box

respondents would pay for treated water (four respondents did not know whether they would pay or not). A demand for treated water is additionally expressed several times in the semi-structured interviews, which makes it a high priority in the wishes for the village's future (Committee, Focus group discussion II, Headman).

3.3 Land use

Even though a lot of information regarding land uses practices was gathered, the focus of this section is on the aspects affecting the water quality: soil exposure, fertilization, palm-oil manufacture, pesticides etc. Both in the context of oil palm plantations, as these are the main occupier of land but also in the context of small-scale farming practiced by the local inhabitants.

3.3.1 Oil palm plantations

In all we visited four oil palm plantations with areas ranging from 4400 ha to 10000 ha and with varying proportion of immature (1- 3 years) and mature palms (older then 3 years). The observed management schemes practiced only altered marginally in the four plantations. The aspects described below were investigated both through own observations but also through informative interviews with the managers of Plantation-I, II and III (will be referred to as manager-I, II, III) and the manager of CPO mill at Plantation-I.

Planting practices: Depending on the topography, the density of palms is 135 palms/ha (in flat areas) to 146 palms/ha (in steep areas), which means 8 to 9 meters in distance between the palms. For erosion prevention and for better accessibility terracing is practiced. Heavy machinery is used in this process and the result is terraces with a width of approximately 3,5 meters and totally exposed soil. The observed typography of the plantations varied a lot ranging from totally flat areas to slopes exceeding 30 % in steepness. In the case of Plantation-III the EIA Approval for explanation of EIA see section 3.4) suggests that steep slopes exceeding 30 degree (app. 66%) should be left uncultivated (e.g. forest maintained). This limitation was only practiced in plantation-III. (Own observation)

Cover crops: Even though it is not directly affecting the yield the managers are aware of erosion problems. Massive landslides have occurred (manager-I) and during the first one and a half year of rotation erosion along rivers and drainage is commune (manager-II). For preventing erosion



Picture 4. Cover crop of Leucaena

and as natural fertilization cover crop is planted (cover crops are compulsory for the approval of the EIA report). It is usually planted before the palms and will within the first year give a total cover of the ground. A mix of three species of legumes is used: *Puraria javanica*, *Ceatrosema pebesea*, *Colopogonium mucunoide*. When the palm reaches a certain size the cover crop will be shadowed to death. After 25-30 years the palms will be cut and replaced by new ones. In Plantation II which is relatively young (manager II) we observed the cover crops covering approximately 90% of area cultivated (picture 4) leaving the remaining 10% bare.

Riparian zones: The EIA carried out by the plantations include a section describing the "Protection of river bank erosion" where direct guidelines are given for the width of natural buffer zones. Even though all the plantations planted after 1994 have carried out EIA reports, we observed streams and rivers in all the plantations with insufficient width or lack of buffer zone. Most parts of Plantation-I were planted before 1994, which means that no EIA has been carried out (e.g. no buffer zones). Further more are plantations developing new areas smaller than 500 ha not forced to carry out EIA. This can lead to areas without mitigating measures for environmental impacts (including buffer zones), which was actually observed in Plantation-I (Picture 5 and 6). The water quality of the river and the compliance with the EIA is monitored by the NREB.



Picture 5. Riparian zone observed in Plantation-II at Baoh River.



Picture 6. Lack of Riparian zone observed in Plantation-I. The newly developed area was below 500 ha and therefore excluded from EIA

Depending on the amount of fertilizer as mature and 1,25 – 4,5 kg/year as applications/year. More over ashes generated from the nutshells in the oil production is applied, as they are alkaline. The latter is only the case when a CPO mill is situated in connection with the plantation (Plantation I and Plantation III). Another natural fertilizer is as mentioned the legumes, which in practice is capable of reducing the use of fertilizer with 20 %.

Herbicides are only used in circles around the palms (radius 2 meter) and during harvest along the lines palm for better access. The brands used contains following active ingredients: Paraquat Dichloride, Glyphosate Isopropylamine and Glufosinate-ammonium.

Generally very small amounts of pesticides are used. In Plantation III alternative methods to the chemical are practiced: light traps, collection of insects and biological pesticides.

Sewage: The manager of the CPO mill at plantation-I told us that 18-ton of sewage is discharged every day from the production of palm oil. Years ago this amount of sewage used to have huge impact on water quality in Malaysia (Vicentt & Ali 1997, p.328-329) but today the DOE³⁷ mitigates the pollution with strict control (for the explanation of DOE see section 3.4). In Plantation-I water samples are taken 4 times a year. Before reaching the river the sewage has to pass 6 ponds: a suspension pond, an anaerobic pond, aerobic pond, an algae pond and a fishpond. The threshold for BOD is 100 ppm.

Other aspects: The infrastructure inside the plantations is well established. For the extraction of harvest the formation of access roads is necessary but unfortunately this all in all causes exposure of large areas of bare soil. As roads generally are unpaved and not only restricted to the flat areas but also are situated on slopes erosion potential is created.

Another aspect crucial in the context of erosion is the drainage practices. According to the manager-II this cultivation improvement is carried out in the lower parts of the areas. For soil loss prevention cover crop is planted along the drain. Though the manager-I told us they had stopped the practice in his plantation due to siltation problems we did here observe drainage systems (water sample taken).

3.3.2 Small-scale farming

The local farmers cultivate a wide range of crops. Some are mainly substantial: swamp and hill paddy (rice), vegetables and fruits while others are mainly cash crops: pepper, oil palms and specific species of swamp paddy (Table 3). In the last 20 years, permanent farming and short fallow periods has been the primary practice, compared to the former with extensive shifting cultivation with slashing and burning as well as long fallow periods. (Interview: Old man in room 32) In defiance of the new cultivation methods facilitated by the introduction of fertilizer, fallow periods are still practiced in the paddy cultivation. The present fallow period is on average 5 years dependent on the type of paddy. Hill paddy fields shift every year but return to the same

³⁷ In the issues of sewage and water pollution it is the DOE who is responsible.

field after 5 years. For wet paddy the same field is used for 2 years (Interview: Old man in room 32). Regarding use of chemicals the villagers have received instructions in the application and use of fertilizer, herbicide and pesticide from the agricultural extension office. The education is part of an agricultural subsidy program also carried out by the Agricultural Extension Office. Besides this education the merchandisers selling pesticides from time to time provide help in reading the labels. (Group discussion: women) The subsidy program mentioned support pepper, oil palm and fruit orchard cultivation. It provides the farmers involved with a free quantity of fertilizers, pesticides and, under some circumstances, seedlings as well (Group discussion: women). Further more it subsidies cover crop (legumes) and gives recommendations of terracing on steep slopes in the cultivation of oil palms. Unfortunately the farmers do not normally grow cover crops, as the removal of cover crop from the palms is too labor intensive (Interview: manager-I). Further more it is believed by the farmers that the cover crop absorbs the fertilizer and in that way steals it from the palms. (Interview: Old man in room 32). During our field observations no terracing was observed in the oil palm plots.

According to the respondent the farmers operate with a riparian zone of approximately 10-15 meters of wild vegetation at plots, which border on to riverbanks or streams.

Table 3. Crops cultivated in the area of Rh. Rangong and their cultivation and main purposes.

Type	Gestation, years	Rotation, years	Cultivar	Capital input	Fertilizer input	Labor input	Economic orientation
Oil palm plantation	2,5 - 3,0	25 - 30	Mono culture	Intensive	High	Low	Export oriented
Hill paddy field	1	3,0 - 5,0	Multi species	Low	Moderate	Moderate	Subsistence
Swamp paddy field	1	Non	Multi species	Low	Moderate	Moderate	Cash and subsistence
Pepper farm	4	20	Mono culture	Moderate	High	High	Cash
Fruit orchard	5,0 - 7,0	Non	Multi species	Moderate	Moderate	Moderate	Cash and subsistence
Oil palm small holding	2,5 - 3,0	25 - 30	Mono culture	Moderate	High	Low	Cash
Vegetable farm	1,0 - 4,0	Non	Multi species	Low	Moderate	High	Cash and subsistence

3.4 Secondary data - Environmental Legislation and Institutions

Besides the direct noticeable problems regarding water quality investigated in the Niah area, we see the national policy and legislation as an important aspect as well, as we consider them to be one of the possible implicit reasons for some of the identified problems. In the following, the different laws and institutions regarding water resource management will therefore be described.

This should help us to explain causalities and (dis-) connections existing within the legislative and institutional framework regarding water quality problems in Sarawak.

3.4.1 Allocation of power, federal and state authorities

Sarawak is a state in the Federation of Malaysia. As a result, both federal and state agencies have influence on the actual natural resource management in the country. Therefore it is also important to identify the allocation of legislative power between state and federal government. The ninth schedule of the federal constitution contains hereby three lists: List I (Federal List), List II (State List) and List III (Concurrent List). Administration of the main part of the natural resources, including land, onshore minerals, agriculture and forests are included in the State List. The agencies in the environmental and natural resource sector are as mentioned a mix of federal and state agencies but in the case of the Sarawak and Sabah, the state agencies here are dominating. As a result, some federal water legislation does not extend to Sarawak since these matters are in the State or Concurrent List (Memon & Mohamed (2000), p. 19). In spite of this, the existence of two parallel legislations on the same environmental issues, as well as the fact that the number of laws counts relatively many³⁸, often result in overlap of state and federal agencies tasks and duties, which has an impact on the transparency of the overall legislation (Ib Larsen, DANCED, unpublished report, 2000). However, Memon and Mohamed state that in the case of water resource management in Sarawak, the responsibility “*is very much a state mater, with only marginal involvement by the Federal government*” (Memon & Mohamed (2000), p. 19). Furthermore, there quantity of institutions on this area is quite comprehensive, which we will try do demonstrate below. A main remark concerning this aspect of our problem is that there may be basis for identifying some accountability problems as well as divergent policy practices regarding the existing water quality management in Sarawak. Firstly, this has an impact to our understanding of the more implicit explanations for the change in water quality. Secondly, it partially answers the question why the existing legislation might not work fully optimal. If we hereby look at the different agencies and authorities involved with water quality, the following influence:

3.4.2 Federal authorities

³⁸ **Main:** The State Natural Resources and Environment Ordinance (NREO). The Federal Environment Quality Act (EQA), and Regulations, rules, and by-laws based upon this legislation. **Other laws:** The Federal Constitution, The State Constitution, The State Local Authorities Ordinance (LAO), The State Sarawak River Ordinance (SRO), The State Water Ordinance (WO), The State Protection of Public Health Ordinance (PHO), The State Land Code Ordinance (LO), The State Land Use (Prescribed Activities) Ordinance (LUO), The State Forest Ordinance (FO) (Ib Larsen, DANCED, unpublished report, 2000); (Memon & Mohamed (2000) p. 106).

The Federal Department of Environment (DOE): The increased awareness of environmental issues that emerged during the 1970's and especially after the United Nations Conference on the Environment, held in Stockholm 1972, affected the political and political framework in Malaysia. The *Third Malaysia Plan* (1976-1980) stated that: "*environmental improvement and protection will receive the full attention of the government in the planning and implementation of programmes.*" (Vincent & Rozali, 1997, p.23)

Among others DOE was formed as a result of this conference, as well as in connection with and for the enforcement of the EQA in 1974 (EQA was the first legislation in the developing world regarding environmental issues) (Sekitar A.J., (1996), p. 26). It is situated under the Ministry of Environment and affects all federal environmental matters. Even though Sarawak Government has formed the NREO (see below) covering some of the same issues as EQA, DOE is operating in the state as well. It is responsible of water pollution regulation, EIA approval (see Info-box 2) and monitoring the environmental management (Memon & Mohamed (2000), p. 107-109).

Info-Box 2

EIA is a shorting of Environmental Impact Assessment. NREO (1994) empowers the NREB to order the owner of land who wants to undertake activities having impact on the environment and natural resources to carry out an EIA study. Before 1994 this was not statutory. The report shall contain, inter alia:

- The potential impact of the activities on the environment and on the sustainable utilisation; and
- The measures being preventive, mitigating or abatement to be taken for the protection and enhancement of the environment.

In the case of agriculture development the requirement for EIA is:

- Development of estates or plantations of an area exceeding 500 hectares (from land under secondary or primary forest or involving the resettlement of more than 100 families or involving modification in the use of the land.
- Conversion of mangrove swamps into agricultural estates having area exceeding 50 hectares (Natural Resources and Environment Board, 1995, Guidelines for preliminary EIA for agricultural development.)

3.4.3 State authorities

The State Natural Resources and Environment Board (NREB): The Natural Resources and Environmental Ordinance (NREO) came into force the 1st of February 1994. For the enforcement of this Ordinance, which includes the management of natural resources enumerated in the State List, and to make the environmental protection more effective, the state has established the NREB. The board is attached to the Ministry of Environment and Public Health (MOEPH). As for the DOE the tasks of the NREB is regulation and EIA approval though in the case of Sarawak the latter has the widest mandate. Further more NREB has, together with the Sarawak

Rivers Board and the Water Resource Council³⁹ been created in a response to the problem of inadequate and fragmented jurisdiction for managing water and related resources (Memon & Mohamed (2000), p. 109; Larsen, I. DANCED, unpublished report, (2000)).

Furthermore, following agencies have in someway responsibility for water management in Sarawak: State Water Authorities, Land and Survey Department, Department of Irrigation and Drainage (DID), Medical Department, Agriculture Department, Sarawak Tourism Board, Forest Department, Geological Survey Department, Marine Department, Public Works Department (JKR) and the Local government (Memon & Mohamed (2000), p. 108).

4 Discussion

In order to comply with our objectives this section will try to combine the different findings presented in the Data section. The different aspects will be divided into three parts.

4.1 Land use and water quality

The most striking results regarding the water samples were the level and variation of Suspended Solid content in the catchment area. As for the social scientific data, the inhabitants of Rh. Rangong confirm that there has been an increase of sediment in the river water. Taken the coherence of sediment content of the water and the soil loss from the surrounding area into account some interesting conclusions can be discussed. The lowest level found in Niah River was far upstream. Even though the surrounding area at this point (F9) mainly was used for young plantations (young versus old plantations, see below) the impact of these was relatively low due to the location of the sample point near the source of the river. As we move downstream the impact of the plantations accumulate, apparently due to the plantations occupation of the surrounding areas. Some of the tributaries confluencing Niah River upriver from Rh. Rangong originate from Plantation-I. Due to the age of the plantation no EIA is carried out here, which means that no environmental mitigation has been enforced. Furthermore the observation of draining systems, new-planted areas without riparian zones (area below 100 ha) and old palms

³⁹ *Water Resource Council*: Also established under the Water Ordinance 1994. As mentioned its function is among others to increase integration in planning and management of water resources. Further more all project proposals and plans related to the use of water resource in river catchment's area must be submitted to this council (Memon & Mohamed (2000), p. 33). *Sarawak River Board (SRB)*: Although the Board according to its Ordinance (Sarawak River Ordinance) is a "multi purpose river basin planning, regulatory and service delivery agency" its role in practice is only to regulate river traffic on the designated rivers and providing navigation and passenger terminal facilities. Its environmental functions are secondary while other agencies share the same environmental roles (Memon & Mohamed (2000), p. 109)

without cover crop (due to the shadow effect) emphasise the erosion potential in this estate. This fact could be a part of the explanation for the relative high value of suspended soil found in Rh. Ranggong. The lower values found further downriver must be due to the confluence of the large tributaries (e.g. S.Sah and S.Lamaus) which have a lower content of sediment. Furthermore the result from S. Nibuka (F7) indicates that streams mainly passing through areas occupied by small-scale farming are less subjected to soil loss than streams with a catchment area occupied by oil palm plantations. As a lot of farming is practiced along Niah River downstream from Rh. Ranggong, the soil loss into the river will be less pronounced in area with this kind of land use.

The different level of soil loss from plantations and small-scale farming mainly derives from the following deviations in land use: small-scale farmers generally only clear small areas compared to plantations, not only seen in a geographical large scale but also considering the single plots. Furthermore, no large areas are cleared at the same time meaning that no large surfaces are exposed to erosion.

Even though terracing is not practiced in the small-scale farming it does not seem to affect the erosion in a negative direction. The soil exposure subsequent terrace building probably increases the erosion more than the lack of it. Concerning erosion the most vulnerable stage in the establishment of a plantation is in the first two years. Terraces are being built and the soil left uncovered. Therefore young plantations are those areas that primarily contributing most to soil loss. In the long term though, terracing probably mitigate the erosion. Another major difference between the two types of land use is the quantity of roads. Only small paths exist between the plots in the small-scale farming in contrary to the plantations where a huge web of roads is enhancing the exposure of bare soil.

The organic pollution, measured by BOD, is altering among the samples point but never exceeds the lower threshold for class II (as it was the case for suspended solid). Never the less it is worth noticing that the highest values of BOD are found at the same points as the lowest suspended solid. One source of organic pollution is loss of organic matter from the upper soil layers. Newly cleared areas are under the right circumstances initially subjected to this type of erosion. Subsequently the soil erosion begins. The high BOD values found in S.Sah and S.Lamaus might indicate erosion in some recently cleared areas somewhere in these catchment areas.

Another potential source of organic pollution is the CPO mill. Unfortunately no water sample was taken at the point of discharge but considering the low levels discovered downriver it is tempting to believe that the treatment plant at the CPO mill actually is doing its duty (keeping

the BOD below 100 ppm required by the DOE). This assumption is also confirmed by the development of BOD load in Malaysia during the last 25 years. In 1975 the BOD load discharged by CPO mills was equivalent to the BOD load in the raw sewage of 12 million people. In 1985 population-equivalent BOD load fell to only 80 thousand people, which is more than hundredfold reduction. (Vincent & Ali, 1997, p.320).

An important issue regarding water quality is bacterial contamination. The source of several diseases is bacterial related (e.g. diaries and cholera). In order to estimate the impact of the human usage of the river (sewage, bathing, etc.) the E.coli bacterial content was measured. The accuracy of the results is uncertain, but it implies some level of contamination, classifying the water somewhere between Class II and Class III. In Rh. Ranggong and at the treatment plant the level is just above the threshold of Class II, but if we move further downriver to the Forest Research Station, where the population density is higher, the level of E. coli exceeds the lower threshold of Class III.

4.2 Livelihood strategies

At this point it should come as no surprise that the loss of sediment as well as the emission of toxic substances (tuba practises, pesticides) into the Niah River, has had several impacts on the livelihood strategies of Rh. Ranggong. The question, which is up to discussion, is the actual magnitude of the impact. That includes the villager's experience of the pollution as being more or less influential to their daily habits, and thereby has changed their livelihood strategies. Finally, an overall consideration of the general development of welfare in the village should be taken into account. These features are important to stress, as they are essential in the overall discussion of how severe the pollution should be considered. Roughly, according to our findings, three aspects should be taken into account regarding the changed livelihood strategies in Rh. Ranggong:

A severe increase of sediment in the river water, as well as an, by the inhabitants, assumed toxic contamination of the water: As identified several times in the data set, a too high value of sediment in the Niah River has restricted the villagers from using it for drinking and cooking, as it due to the changed colour, taste and smell is unsuitable for these purposes. Furthermore, the villagers mistrust the water, due to an assumption of toxic substances coming from tuba practises and chemicals utilized in the oil palm estates. This is also blamed to cause skin deceases, which had changed some of the villager's bathing habits. In a situation where no other alternative source of drinking water exists, this impact would bee even severe. However, rainwater collected

in tanks provided from the government has minimized some of the problems, but not eliminated them, as there still exist a water shortage problem during the dry season (the government provides some amount of water in acute situations). This problem is two-fold, as the quality of the river water decreases even more in this period making the river to a non-existing alternative to rain water in almost every sense. Even in a situation where the dry season is not taken into account, no doubt exists that if treated water was available for the inhabitants this would be preferred, even though they would have to pay for it. The time consuming process of the boiling and filtering of the rainwater, which also includes the costs of buying gas and water filters creates this demand.

Another side effect of decreased water quality is the decline in the fish stocks, which could be a result of the tuba practice, the very high value of sediment in the dry season, or simply over fishing. Finally, the laundry has been influenced in a negative way, due the colouring effect of the sediment. The existence of a problem deriving from decreased water quality is therefore not to question, as this is stressed by the enhanced time consumption, water shortage problems in the dry season, problems regarding the quality of the fish stock, as well as the colouring effect on clothes.

An increase of the flooding hazard:

Flooding, although only occurring periodically, has a major impact on the livelihood of Ranggong. There exist some uncertainty whether it is natural occurring or human caused factors that cause flooding. However, two aspects will be mentioned regarding flooding of the studied area. Firstly, the hazard has apparently increased, and secondly, the period with flooding has increased compared to the past (approximately from 2-3 days to 5-6 days). As already illustrated in the data set, the impact of this factor includes the collection of animal husbandry in cages, the children not attending school, the decrease of the paddy yield and inconvenience of being isolated. This increase has occurred parallel to the increase of sediment, so there is some support behind the assumption, that the increasing hazard in some way is connected with the changed land use in the area. An explanation could be the missing "swamp-effect" following the conversion of natural forest. Another explanation could be an increase in the amount of rain during the rainy season, caused by global warming, changed local climate due to the removal of forests or just natural occurring fluctuations. Assuming that the changed land use is the primary reason, this aspect is worth to stress, although it does not directly affect the overall daily habits of the villagers in Rh. Ranggong. When considering the increased flooding hazard it is also important to take into account that the villager at present are more oriented towards the outside

world due the changed livelihood strategies, e.g. the importance of cash cropping and thus the need to go to the market and sell their products.

Shift in demand and increased welfare:

As a final remark, some few aspects regarding the overall development in the village should be considered. The grade of the impact could otherwise be overestimated, especially taking the overall development of Rh. Ranggong into account. Firstly, there has been a shift in demand for river products. Mainly as a result of the new established road, fish and other food products are now possible to buy from the mobile traders or at the Ngu Junction. This, combined with the agricultural subsidy program, the extended cultivation of cash crops, as well as fertilizer and pesticides becoming available, has decreased the dependency of the river as a resource for food. Secondly, there is some evidence for concluding that health programs and the health centre in Batu Niah has had a positive impact on the health level in the village, although the river water is being accused of carrying more deceases. Thirdly, the general economic development in the area has created jobs for especially the younger men of the village. Some of the money earned are send back to the respective families, and hereby increasing the welfare in general.

4.3 Aspects of the legal and institutional framework

If only the direct causes of the increased level of sediment in the Niah River as well as the other pollution factors are taken into account, it is relatively easy to point out the first-to-hand solutions, which among others include wider riparian zones, more extended use of cover crops, decreased soil exposure during rainy season, etc. However, we have seen that some legislation exists regarding the mitigation of environmental degradation. The enforcement is apparently not working effectively, since the riparian zones as well as cover crops often are used in a scale that does not live up to the demands described in the legislation. Why is that so? A sufficient answer on that question would require more in-depth studies in the practices of the enforcement of environmental laws and institutions in Sarawak. However, according to our scarce empirical knowledge about this area of study, there seems to exist quite a comprehensive number of official apartments and boards coming from *both* federal and state authorities. Apparently these authorities do not always collaborate in an effective way. Also, some accountability problems are properly occurring as well, since the functions and goals of the different authorities occasionally seems to overlap or are less stringent defined.

5 Conclusion

Changed land use in the Niah district has had few but major impacts on the water quality in the Niah River, Sarawak. The major source of contamination is by sediments eroded into the main stream as well as its tributaries, mainly from areas occupied by oil palm plantations. Another, although not natural scientific determined, source of pollution is the tuba practices as well as other toxic substances led out or leached into the streams. The magnitude of the pollution has been measured using two indicators: Firstly, "The proposed Interim National Water Quality Standards for Malaysia" (DOE, 1993) was the point of departure in using the natural scientific data to classify the water quality. By this the water quality is found to be somewhere between class "II" and "III", which means that for consumption mechanical and/or chemical treatment is required. Secondly, we have shown that in Rh. Ranggong the inhabitant have stopped consuming the river water. Combining these two, it is clear that there has been a noticeable degradation of the water quality in the Niah River, which is due to changed land use. A further examination of the actual impact of this environmental degradation on the livelihood in Rh. Ranggong has revealed a high level of complexity. This is first of all due to the fact, that the overall development regarding transportation, education, economy as well as health generally has increased, but also because the problem regarding water supply during the dry season is not new. However, taking the increased flooding hazard, longer flooding period, the necessity for boiling of drinking water and the periodically lower paddy yield due to sedimentation into account, the impact of decreased water quality must be stressed as an actual problem. Finally, the partly illustration of the legislative and institutional framework regarding environmental concerns in Sarawak, has provided us with reasons for assuming the existence of some accountability as well as collaboration divergences. This hypothesis could serve as possible answer to the sometime ineffective enforcement of the environmental legislation identified primarily in the surrounding oil palm plantation areas.

6 Further perspectives

The future of Niah catchment area:

Even though the inhabitants of Rh. Ranggong are aware of the impact of plantation establishment this does not seem to hinder their wish of having their own plantation. The government has already approved the conversion of 2504 ha of their NCR (Native Communal Reserve) into oil palm plantation. This project will be carried out in a joint venture between the state, the longhouse and a private company. Another 1000 ha have been approved for forest reserve with the purpose of eco tourism (Changgai). In Rh. Ranggong prevails an optimism

regarding the future environmental situation, as they believe that the environment quality will improve in the near future. This they believe will be a consequence of the logging has now stopped and so have the large conversions of oil palm plantations. In contrary the plantation managers does not consider the development of new plantations as reached its end. Any expansion possibility will be made use of. Even though an assumption could be that the existence of plantations at the present will reduce the future impact as the most severe interventions all ready have been carried out (e.g. terracing, clear cutting), and the riparian zones all ready are developed.

Looking at the small-scale farming there exists among the local farmers a wish of better infrastructure within the agricultural areas. If roads are constructed it will with out doubt enhance the soil loss in the farming areas as the soil is exposed.

Methodological reflections:

This project and its findings are primarily shaped by its methods and the primary data collected in the field. First of all, the fieldwork was placed in its early phase of the project, and as a result there was a time lack in the preparation of the research questions and the generation of knowledge about the field trip area. This has had both positive and negative impacts. As for the positive aspects, the fieldwork was conducted relatively open minded vis-à-vis the researched problem. But the focus of the whole project would eventually have been more specific on the essentials, if we have had more time in the planning phase. This is reflected in the survey as well as in the interviews as there were examples of asking less relevant questions as well as overseeing other essential ones. Thus, more time in the initial phased might have resulted in a relatively better planned project.

The focus of the fieldwork was the decreased river quality in the perspective of changed land use in the area. As shown, sediment pollution plays a major role regarding the decreased water quality, and consequently erosion is an important factor, which makes it a very relevant object of study. A way of estimating erosion is to use USLE (Universal Soil Loss Equation). If we could find a difference in erosion between the different cultivation types and relate these findings with the one from the water samples a pattern might appear (i.e. in areas with large erosion the rivers nearby would probably have a high content of suspended solid). If the task had been to compare different fields (with factor values measurable and specific for the exact field) the USLE would be applicable. In our case where the comparison of erosion potential of different cultivation types is the objective the equation does seem rather useless. The explanation is, that the factors regarding slope gradient, slope length and soil erodibility vary within one type of cultivation type

(e.g. slope gradient differs among the paddy fields). The only factors that will be approximately invariable within the specific cultivation type are the crop management factor and the conservation practices factor (e.g. generally within an young oil palm plantation the ground will be covered by leguminous cover crop).

For this reason we chose not to use the USLE but instead only stick to our subjective observations of crop management and erosion preventing actions when estimating erosion potential of the different cultivation types. Besides this we experienced, when we initially tried to use the USLE in the field, the measurements as very time consuming and the result rather inaccurate, the latter because of the subjective estimations of some of the factors.

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Appendix A: the survey

Data processing of the survey questions regarding water

(Based on 24 surveys interviews one disappeared one blank 2 pilot)

Water supply* '	Source of water			
	Before		After	
	River	Rain	River	Rain
Drinking & cooking	18	4		21
Washing cloths/dishes	21		21	8
Irrigation (agr. use)	17	2	17	2
Bathing	21		19	8
Transportation	21	x	3	x

Water supply II**	Preferred source of water			
	Before		After	
	River	Rain	River	Rain
Drinking & cooking	14	2		16
Washing cloths/dishes	15	1		16
Irrigation (agr. use)	14	1	9	6
Bathing	15	1		16
Transportation		X		X

* Because of a fault in some of the prints of the questionnaire we had to leave out three of the surveys interviews, furthermore the answers reflects the bad design of the the answer possibilities box. It is to complex, the trends showed in the answer are however interesting.

** When asking about preferred source of water additional 5 respondents did not answer the questions.

NB: The respondent could click in more than one box.

	Yes	No
Do you boil the water?	24	
Do you filter the water?	7	17
Would you pay for water?	20	

Water quality	the worst	worse	Average	Moderate	The best
Taste	12	8	3		
Smell	12	9	2		
Color	14	6	1	1	
Human waste materials	3	10	10		
Branches/leaves	7	9	7		
Toxic waste	13	7	1	1	

No answer

4(Before/after)

18

1

4

1

1

2

1

1

2

Do you experience any problems w.:	Yes	No
Increased sediments?		23
Increased flooding?		24

How long is the flooding period?	Before	After
less than one week	21	17*
About two weeks		7
Almost one month	1	
More than one month	1	

*11 of these respondents answered also less than one week to duration of the flooding, however the stated that before the flooding just lasted a few days presently 4-5 days

How frequent is the flood hazard?	Before	After
About once week		
Once a month	2	1
At least twice a year	17	6
Other specify	4	16*

* 13/16 elaborates this answer saying 3-4 times a year, 1/16 thinks flooding occur 6 times a year

Do you experience water shortage problems in dry Season?
Do you think the tuba practice can decrease the water quality?

Yes	No
24	
20	4

What do you think are the causes of flooding? **	
Sediment altering the river size	16
Monsoon season	10
Tidal effect	0
Natural occurrence	13
Change in land use	10

**Please notice respondent could click more than one box

Do the flood impact you daily life?	*
Lost of agr. Food production	24
Lost of income from agr. Products	17
Health problems	5
Inconvenience of getting food	24

* One respondent added a category more difficulties w. transportation

Please rank the activities below according to their impact on the water quality.					
	1*	2	3	4	5
Oil palm plantation	17	5			
Trad. Farming		1	1		
Logging	8	12			
Pepper farming		2			
Other			7**		

*1 for most important and so forth

** Infrastructure was mentioned four times, development once and no specified twice.

200 - 300 pm

1

SURVEY OF RUMAH RANGGONG COMMUNITIES TOWARDS THEIR DEPENDENCE AND AWARENESS ON NIAH RIVER CATHCEMENT

Respondent Code:.....9.....Name: Christina (wife).....(Optional)

PART A : DEMOGRAPHIC INFORMATION

Please tick (✓) the appropriate box

1. Gender

Male ☐

Female



2. Age: 52 year

3. Year of schooling: 4 year

4. Occupation: i) Bee hune / House wife (main)

ii) (others)

iii) (others)

5. Total household income per month: RM 800

6. Percentage/proportion of income above derived from farming/agriculture (including form their children): RM.....

7. How many family members live in the household: 5 persons

PART B : DEPENDENCE ON THE NATURAL RESOURCE FOUND WITHIN THE CATCHMENT AREA

Please tick (✓) the appropriate box

8. Is there any decline in availability of the jungle product/forest produce after the oil palm plantation establishment? If the rank is between 2-5 please answer question number 8b.

1	2	3	4	5
NIL	LITTLE	MODERATE	A LOT	TOTALLY ZERO
	✓			

8b. Are your daily diet changes with the consequences of the jungle product declining?

YES

☐

NO

☒

9. Do you depend on the jungle product? If NO go to question number 9b.

YES

☐

NO

☒

9b. Where do you get the supply?

	Jungle product	Ngu junction	Forest	Traders	Other I/house	Others place
1	Wild vegetable					✓
2	Birds				✓	
3	Animals			✓	✓	

Farm

4	Fruits					✓
5	Fire wood		✓			
6	Building materials		✓			✓
7	Medicine plants	—	—	—	—	—

PART C: WATER SUPPLY BEFORE/AFTER THE OIL PALM PLANTATION (OP)

Please tick (✓) the appropriate box (Ri=River water/Rn=Rain water)

Use of water supply	Sources		Preference of water source			
	Before	After	Before		After	
	Ri Ri Rn	Ri Ri Rn	Ri Ri Rn	Ri Ri Rn	Ri Ri Rn	Ri Ri Rn
Drinking & cooking	✓	✓	✓			✓
Washing (cloth/dishes)	✓	✓	✓			✓
Irrigation (agri use)	✓	✓	✓		✓	✓
Bathing	✓	✓	✓			✓
Transportation	✓					

10. Do you boil the water?

YES

NO

☒
☐

10b. Do you filter the water?

YES

NO

☐
☒

11. How much would you pay for treated water from the government?

RM. 10/- /per month

PART D: PERCEPTION ON WATER POLLUTION (NIAH RIVER)

Please circle the scale that provided below according to your perception of the water after the oil palm plantation (1= the worse condition and 5 = the best condition). Please tick (✓) the appropriate box

Scale	1	2			5
Water quality	The worse	Worse	Averages	Moderate	The best
Taste	✓				
Smells/odors	✓				
color	✓				
Waste material(human)		✓			
Branches/log/leaves			✓		
Toxic waste		✓			

12. Do you experience any problems with increased sediments in the water?

YES

NO

☒
☐

13. Do you experience any problems with increased flooding?

YES

NO

☒
☐

14. When is the most heavy flood event that you have ever been encountered within your lifetime (senior respondent)?

In the year 1960s	
In 1970s-1980s	
Recently <i>99</i>	<input checked="" type="checkbox"/>
Others	

15. Usually how long is the period?

	Before OP	After OP
Less than one week	<i>2</i> <input checked="" type="checkbox"/>	<i>4</i> <input checked="" type="checkbox"/>
About two week		
Almost one month		
More than one month (specify the duration of flood)		

16. How frequent is the flood hazard?

	Before OP	After OP
About one week		
Once a month		
At least twice a year	<input checked="" type="checkbox"/>	
Others <i>4</i>		<input checked="" type="checkbox"/>

17. Usually when is the period of raining season?

September to December	<input checked="" type="checkbox"/>
December to March	
Others	

18. In your opinion, what do you think are the causes of flooding?

Sediment altering river size	
Monsoon season	<input checked="" type="checkbox"/>
Tidal effect	
Natural occurrence	
Change in land use	<input checked="" type="checkbox"/>

19. Did the flood cause any impact to daily life?

Lost of agricultural products that are needed of source of food	<input checked="" type="checkbox"/>
Lost of source of income from selling agricultural product	
Health problems (specify)	
Inconvenience of getting food	<input checked="" type="checkbox"/>

20. Do you face water shortage problem (lack of river water and rain water) in dry/drought season?

YES

NO

☒
☐

21. When is the period of drought season? Specify the month of facing this problem?

July - August

22. Do you think 'tuba' practices can decrease the water quality?

YES

NO

☒
☐

23. What are the activities that have caused the changing of water quality? (please rank according to the most impacted land use activities)

Oil palm plantation	1
Traditional farming/cultivation	
Logging	2
Pepper farm	
Other	

PART E: LAND USE

24. How many plots do you have?

	Before OP	After OP
Traditional farming	5	3
Permanent farming		

25. How long is the fallow period?

3 Month/years

26. Amount of chemical use per unit/plots?

Pesticide: 4 gallons per plot

Fertilizer: 9 sacks per plot

$$9 \times 50 = 450 \text{ kg.}$$

27. Agriculture practice management?

- Irrigation

YES

NO

☐
☒

- Cover crops

YES

NO

☐
☒

- Riparian zone

YES

NO

☒
☐

- Natural fertilizer

YES

NO

☐
☒

PART F: HEALTH PROBLEM

28. Frequency of visiting the clinic center (a year), according to the disease.

Disease	Respondent	Wife/husband	Child	Parent in law
Cholera	—	—	—	—
Diarrhea/typhoid	—	—	—	—
Food poisoning	—	—	—	—
Skin disease	—	✓	✓	—
Malaria	—	—	—	—
Dysentery	—	—	—	—

29. Form the list of the diseases below please rank according to the major diseases. Before / After the OP

Diseases	Cholera	Diarrhea/typhoid	Food poisoning	Skin Disease	Malaria	Other	
Rank	1	2	5	4	3	—	

PART G: THE POTENTIAL OPPORTUNITIES AND THREATS OF MARKET FORCES ON THEIR LIVELIHOOD

30. Have you ever thought of attract tourists to the area?

YES

☒

NO

☐

31. Do you or any in your family work in the company oil palm plantation?

YES

☒

NO

☐

32. Do you or any in your family work in the private (own) oil palm plantation?

YES

☐

NO

☒

33. How important is the possibility to find job in the oil palm plantation

Very important	Important	Not important
✓		

Distribution of Respondents by Gender, Age, Educational Level, Occupation, Income Category and Member of Household.

Variables	Frequency (N=28)	Percentage (%)
Gender		
Male	14	50
Female	14	50
Age Group (years)		
20 to 24	1	3.6
25 to 29	2	7.2
30 to 34	1	3.6
35 to 39	4	14.4
40 to 44	8	28.8
45 to 49	0	0
50 to 54	4	14.4
55 to 59	2	7.2
60 to 64	2	7.2
65 and above	4	14.4
Mean = 47.64		
Education Level		
Never attended school	16	57.1
Primary school	8	28.6
Secondary school	4	14.3
Collage or University	0	0
Mean = 2.18		
Occupation		
Farmers	22	78.6
Non-farmers	6	21.4
Income Category		
<i>1) Total Income (RM)</i>		
0 to 100	4	14.3
101 to 200	4	14.3
201 to 400	5	17.9
401 to 600	10	35.7
601 to 800	2	7.1
801 to 1000	1	3.6
1001 to 1200	0	0
1201 to 1400	2	7.1
Mean = 467.14		
<i>2) Agriculture Income (RM)</i>		
0 to 100	5	17.9
101 to 200	6	21.4
201 to 400	5	17.9
401 to 600	6	21.4
601 to 800	0	0
801 to 1000	2	7.1
1001 to 1200	0	0
1201 to 1400	0	0
Mean = 286.79		
Family Members		
2 to 4	13	46.4
5 to 7	14	50
8 to 10	1	3.6
Mean = 4.43		

Appendix B: Semi-structured interviews

Interview with headman of village

Respondent: headman of Rh. Ranggong

History of the village;

Government land was given to the villagers in 1940. The house that we were presently visiting is not the original one. As cause of fires and flooding, this is the 4'th longhouse build since the foundation of the village. The founders came from Sri Aman (district 2).

Main events;

The villagers stopped using river water in 1980('s), due to the increased activity in the logging and oil palm plantation industry. Since then, rainwater has been collected from the roof in containers (1 container per family) provided from the government, for the purpose of cooking and drinking water.

The longhouse has been using electricity from generators in around 20 years +. The first one was provided by the government, but it broke down a few times, and could only provide electricity to a few apartments (the headman etc.). Presently, all families share some common generators, and have all aces to electricity (usually, the generators operate between 7 and 10 p.m.)

Organisation of longhouse;

Firstly, there is the headman. He does not formally have any veto-right, but due to his great knowledge regarding traditional law and Iban traditions he/his decisions is rarely questioned. He seek advices from the Council of village (committee) = contains of 11 people (some years ago the were only 7). The members of the committee is randomly selected others are appointed.

The headman of Rh. Ranggong replaced his father when he died. In case the headman does not have a son or otherwise not acceptable the position is up to election.

Future:

The longhouse plans a joint venture with the state and a company for 60 years. The government will gain 10%, the company 60% and the longhouse 30%. After 60 years the agreement is up for renegotiation but the government can decide to take over land.

Others plans includes infrastructure, power provided from SESCO, and treated water from a water treatment plant. They asked for the water supply 5 years ago and the government has approved this wish, but has not give any specific time frame.

Facilities:

The Rh. Ranggong has one primary school (7-14). The government subsidizes the pepper and oil palm plantation. Furthermore the government (health dept.) has provided a toilet and a water tank (blue). Finally the government support roof materials.

The rest of the longhouse(s) has been build by own initiative and resources.

Sources of income:

Cash crops, (pepper, paddy, fruits, rubber etc) Another important source of income is the cash money send home by mostly male family members working in the timber industry.(All family members come home for the traditional Iban festivities Gawai Dayak)

Water quality:

The problem is due to the plantation activities, as the clear the forest and the bare ground erodes when raining. He (unlike the others) thinks the river have not change in color, depth and wide. Further he sees no increase in waterborne diseases

Changgai number 27.

Respondent Changgai

Profile

Age 36 and 11 years (form 5) of school. All in all there is 6 people in the house hold (2 children). His income is based on the work as contractor/subcontracter in the oilpalm plantations and business. Very secondary he sometimes helps his father with the farming. Further more he has a small plot of oilpalms next to the longhouse, but he hire people for the harvesting. (very reluctant to answer what his income and occupation was). Lowest income is RM 1000 per month. His earning on the oilpalms is very low. The oilpalmmill only pay him RM 100/ton FFB. The prise used to be RM 300-400/ton.

Future plans for the area of Rumah Ranggong:

the village committee has applied for NCR on 6000 ha. This is all state land (Pemakai menoa) (land for usage) but the longhouse is allowed to use it for: food gathering, hunting, fishing and farming. At present 3929 ha has been approved as NCR by the government. The use of this area can be divided into tree: 2504 ha for oilpalm plantation in joint venture with the private plantations, approx. 1000 Ha for communal forest reserve (eco-tourism) for the longhouses Rh. Ranggong (600 ha) and Rh. Nyelayang (400 ha) and the rest for agriculture.

Interview with old man in room 32.

Age 72 years old.

How big are you income?

Income 200-300, but respondent says that he do not depend on much on money as the grow most of their own food. They mainly buy sugar, salt, coffee & tea.

Are you still depending on jungle products?

The lack of jungle area mainly results in a decline of animals for hunting specially pigs, building materials. Now they have to buy these items. The vegetable and fruits that they before collected in the jungle they now plant in there farming areas.

Do you thing the decline in the forest areas is good or bad?

It is bad not be able to hunt anymore.

Do you think life is better or worse now?

All basic needs can be meet as they can be bought in Batu Niah, the junction, traders or others.

Do you think you are wealthier now than before?

Don't really know, before no one had cars or motorboats in the longhouse.

How did the river use to look like and how did you use the river?

Before the water was clean, no sediments in the water. One could see fish move. The current was faster. Furthermore there was less branches and. The decreased water quality is due to logging and plantations.

What is your perception of logging and plantations? What do they mean to you. Before/after?

Before transport was difficult as the current was less strong as the river was blocked by branches and logging.

Was there less fish before?

Before there where lots of fish in the river. The decline in fish is due to the workers in the logging camps and plantations as they use tuba. The decline is furthermore due to a bigger population and thereby over fishing.

Are there any special kinds of fishes extinct?

Before there was many fish, but now the fish population has declined, but it's still possible to find all kinds of fish the number has just declined.

Is there a bigger lack of water now in the dry season compared to before?

Same

Did you collect rainwater before the government provided the water containers?

Before the river water was still save to use.

Have you experienced an increase or decrease in water born diseases?

Long time ago before the logging and plantation there was not many diseases came from the water. Now more diseases come from the water.

Why?

This is due to pesticides is washed into the river by the rain.

THE RESPONDENT COMPALINS AT THIS STAGE OF THE INTERVIEW THAT IT HAS TO BE DONE THROUG AN INTERPRET.

What kind of waterborne diseases are found?

Typical it's skin diseases

Do you experience problems with cholera & mosquitoes?

Mosquitoes born diseases increased. The respondent has no statistic but indicate that more people die at present.

Which groups are affected?

Before mostly old persons but now all groups are affected (also babies)

Is it a problem that the river has changed color?

No not really

Is there any change in the agricultural practices?

Before a lot of trees, villagers used slash and burn practice to fertilize land. Now when the land need fertilizer chemical are added.

How long is the fallow period?

Five years depend on paddy type. Hill rice fields move every year and come back to initial field after Five years. Wet rice grow two years in the same field

What is the best agricultural practice regarding yield permanent farming or slash and burn?

Same

Did anybody teach you how to use the chemicals?

Yes the agricultural dept. They came to the long house and told us what to use and treat specific kind of disease and how much to use.

What about subsidize?

Yes its possible to get subsidizes for 2-3 years but you have to fill out an application form and send to headquarters. They decide.

Do you just get fertilizer, pesticides, herbicide or also plants?

Gets money to buy chemicals, specially for pepper. But they can also get some from other longhouses.

Do the government tells you what chemicals to use?

Yes, often they tell them what to use sometimes they get the products from the government.

What brands do you use and how much?

Chicken head, bridge

The respondent uses approx. five gallons of pesticides a year but the number is not fix. Furthermore he use approx. ten bags of fertilizer (50kg = 3kg as 16 kg = 1kg). However this is sometimes not enough. The respondent have one plot oil palm 2 plots pepper and 3 plots of paddy (1 wet, 2 hill)

Do you apply the fertilizer/pesticides? Directly on the ground or do you dig it down in the ground?

Pepper and oil palm the pesticide are applied around the tree on the ground. A different procedure applies for paddy.

What season?

Season do not influence when the respondent apply chemicals, but he states that best result is obtained when sunny and rain in the evening.

How do you apply pesticides do you spray all over or just the plant?

No cover crops are used as they can affect the pepper and compete for fertilizer and nutrients. However ladyfingers and other plants are planted between the pepper plants or oil palm.

Do you use any protection when spraying?

No, the respondent knows how to apply take into account the wind etc. Maybe others do use protection.

Extension of survey with the household 15

Dependency on forest products

Question 8: Due to logging, oil palm plantations there is no more forest.

Question 8B: The diet has changed as the forest is too far away. They can still get the forest products (vegetables, birds, animals and fruits) but have to buy them in various places. Regarding firewood they use less as they now use gas (shift in demand) but if they need any they get it from their own farmland. Medicine they do not use plants but go to pharmacist.

The river

Before the river was important for transportation but in 1986 a road was constructed.

Before used less rain water as no containers. The water quality has overall decrease as the water is less clear, more branches etc. are found. This is due to logging and plantations. Another source of the bad water quality is the tuba practice used by the workers upstream in the logging camps or plantations.

Especially the habitants perceive the problems in dry season and after heavy rain. When flooding the habitants of the long house are blocked at the house as road inaccessible. Furthermore they can not go to their fields. The flooding is caused by low land level. Before 10-20 years ago the flooding was not a problem.

During dry season there is not enough rainwater in the tanks, so the habitants have to use river water, but the water level in the river is low so the water very muddy. No irrigation possible when dry season.

Tuba decreases the water quality as it causes diseases. This is specially a problem during dry season as they use the river water for drinking.

Land use

Question 23: Clear land erodes after rain and brings sediments into the river.

Respondent irrigates but has no drainage.

Have 4 plots of pepper, 1 oil palm, 2 rice and grow also in between corn, onions, cucumber etc.

Health

The respondent's father cannot go into river as he has fragile skin and gets diseases from the water.

Extension of survey with the household 19

Dependency on forest products

Not many forest products are found anymore. This is due to logging and plantations. This has specially led to change in the availability of animalistic products. Fruits they can also get from the other long houses. The respondents don't have knowledge about medicine plants so go to pharmacy in town if in need.

Water

Before the river water was safe to drink without boiling it.

Sometimes the respondent does not like to take bath in the river as the current is too strong.

A waterfilter cost 100+. The respondent would be willing to pay for water if the long house decided to buy if there came a possibility for doing so.

Regarding the changes in the smell and color of the river the respondent believes it's due to oil palm plantations and logging. The increase in branches and leaves in the river is due to flooding. The respondent sometimes observes fuel and oil in the water and believes it's due to tractors.

Increased sediments in the water is due to flooding and oil palm plantations and logging.

Problems as an effects of flooding is that all animals have to be caught and put into a cage during the flooding. The river currents get too strong for bathing. Furthermore transportation becomes difficult due to flooding. Respondents see the flooding only as a consequence of rain.

In dry season the low water level sometimes is a problem as not possible to take baths.

Furthermore the river water is used for drinking in the dry season, but the respondent does not see this as a huge problem as the water is clearer in the dry season. (This is conflicting with other respondents statements about the river in the dry season)

Tuba is bad as it can give diseases and a lot of fish dies, moreover the water smells bad and it's not good to bath or wash cloth in the river.

The decreased water quality also reduces the quality of the water for irrigation. This is not only true for Niah but also other smaller rivers

Extension of survey with the household 37

Dependency on forest products

The respondent use rubber tree as firewood

Water

Use the river water in the dry season and its pumped up with help from the generator. Uses the rainwater more extensively now as they have the water containers.

For irrigation the water of Sah river a smaller stream is used.

The river is now used less for transportation as they have a road now. Before they could only go to town by river a 3 hours journey, and only possible in the rainy season.

Water filter cost 700+

The respondent would only be willing to pay for treated water for cooking and drinking.

The water quality has worsen regarding smell, taste and color. Toxic in the water comes from the logging and plantation upstream

Flooding is bad as the road to the fields is blocked. Furthermore an increase in health problems (stomachache and fever) after a flooding.

The inconvenience of the dry season is that obligee to drink the river water and the water level is too low for bathing.

Tuba is bad as causes skin diseases and its is specially bad during the dry season as they have to drink the river water and this is not possible if tuba.

Future

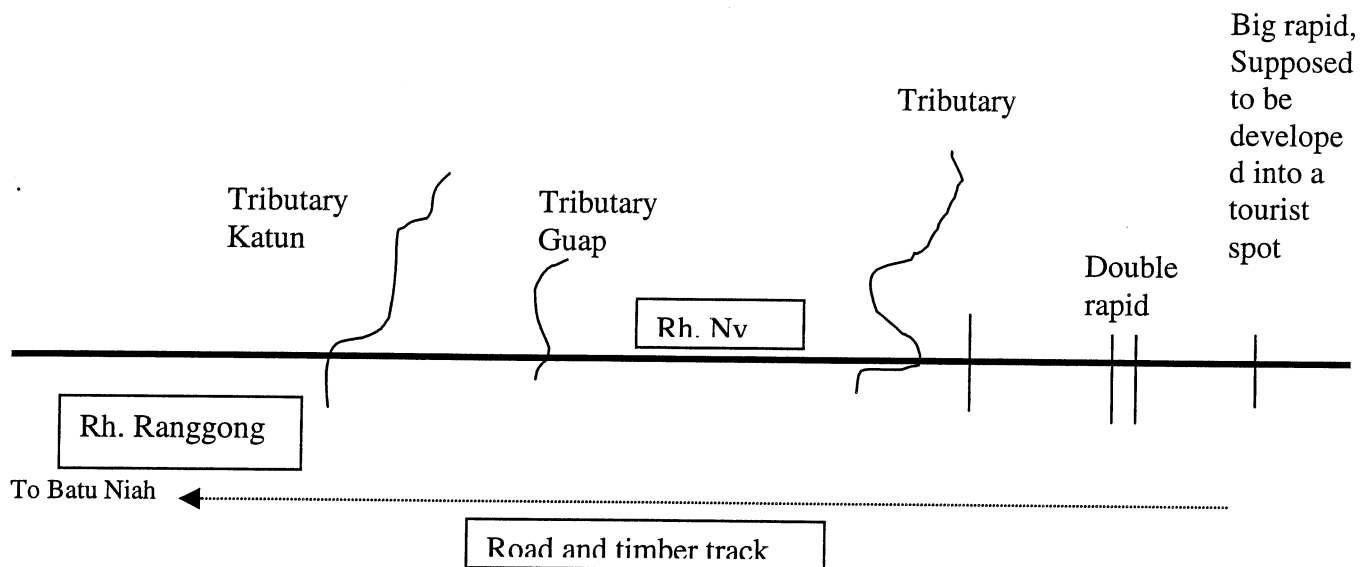
If the small rapid is developed into a tourist spot the government will make a small dam and lead water to the long house.

Many of the family members works for plantation eg. The son in law as tractor driver – making terraces. The possibility of working in plantations is important as possible find work when less busy in own fields and they can learn new agricultural practice by working in plantations.

Work age starts at 15-18 years if school is not continued.

River trip upstream to a waterfall

Respondents the two guides (Second day of our stay in Rh. Ranggong day)



It is difficult to define exactly which areas belonging to Rh. Nyeiayang and which belonging to Rh. Nyeiayang. Most of the left side belongs to Rh. Nyeiayang and the right side to Rh. Ranggong

Land use:

After Rh. Nyeiayang no plantation only small scale farming and community forest.

Left side:

Plantation areas (500 trees) near the Rh Nyeiayang, except from a 100 m buffer zone used for small-scale farming.

Right side:

Timber road, the NCR land supposed to be turned into plantation. Now used for small-scale farming & forest reserve.

Observations:

only a very narrow buffer zone, less than the 50 m the legislation prescribes. (approx. 20- 30 m). We see clear signs of erosion along the riverbank. Along the river is very dense vegetation, except in the plantation areas.

The river:

According to our guide the river was just a small stream with clear water 20 years ago. Now the stream is much wider and the water is brown.

When the water level is high, more snakes is found in the river.

Obs: The stones of the waterfall was covered by a thin layer of sediments

History:

Rh. Ranggong was in the past split up into two longhouses (Rh Dawi) as Rh. Ranggong grew to big. This means that the Rh. Dawi longhouse, down stream, is the same family.

The standard of living is the same between Rh. Nyeiayang and Rh. Ranggong.

Source of income:/ Plantations

Most people work in the oil palm plantations.

On the right side of Niah river, going upstream, the present forest area/ small scale farming area¹ is planed to be turned into a oil palm plantation.- a joint venture between the government, Rh. Ranggong and a plantation company. Even

¹ Small-scale farming include mainly paddy (wet and hill), corn, and pepper.

though the locals know the plantations are problematic for the environment, they proceed with the plans to build the oil palm plantation on their NCR land. This is partly due to the fact that they believe if they do not do so the government would take back their land. When we asked if they would prefer another land use on their NCR land they answered there is not such thing as if when we deal with the government. Later on, one respondent said that the perspective of oil palm plantation on the NCR land was sad. The land is very suitable for plantation

Future plans:

The area with the big rapid is supposed to be turned into a tourist area, with a chalet. This project is in cooperation with Rh. Nyeiayang.

Committee meeting

Respondents 11 members of the committee

Headman: long time ago the water was clear and drinkable without boiling and more fishes. Now the water is dirty (the colour) and there has been a decline in fish stock. This is due to logging and oil palm plantations. The workers used tuba, especially the road workers.

The people interviewed are aware of the forest as a watershed. Because the forest now is gone the flooding is more frequent, but the level lower (compared to 20 years ago). The worst flooding occurred in 1960 where the house was over flooded. Headman also argued that the removed tree cover makes the rain flow directly into the river while it used to be stopped. The soil is now without any protection and is totally exposed. Further more the bulldozing of the roads leads to erosion.

They believe the buffer zones will help cleaning the water but it has only been practised for 2 years until now. The temperature has risen due to declined forest area, which has changed the microclimate.

How have these changes affected the livelihood in Rh Ranggong?

- Not possible to drink water without boiling.
- Especially during the dry season the rainwater is not available. If water is brought to the longhouse they are forced to use the river water.
- Skin diseases but only sometimes. Especially after dry season.
- The flooding effects the agriculture because of the layer of sediments left on the leaves of the oilpalms and padi.

Ask scientists to check water quality and create a solution.

Have you ever ask the government for a solution of the flooding problem?

Not yet a treatment, but they believe that if emergency the government will help.

Has the JKKK approached the authorities with the water problems?

Never but planning to do so.

The JKKK has 4-5 years ago applied for a treatment plant, but still without any respond. Few years ago officials from Miri came to check water in the area and the effect of oil palm and look after a spot for making water treatment plant in support for the old one in Niah. But found no spot.

The government does not do anything about there problems even though they are aware of them.

The government doesn't really care about there problems with the water/river.

Did you ever get the results of the water tests?

No never even if 4 or 5 tests have been carried out.

You say that oil palm pollute the water, why do you then plan to make a plantation?

Firstly to get a profit, second to develop own land and finally to get closer to the government.

Do you think the plan of making tourism development can succeed even though oil palm plantations mainly occupy the area?

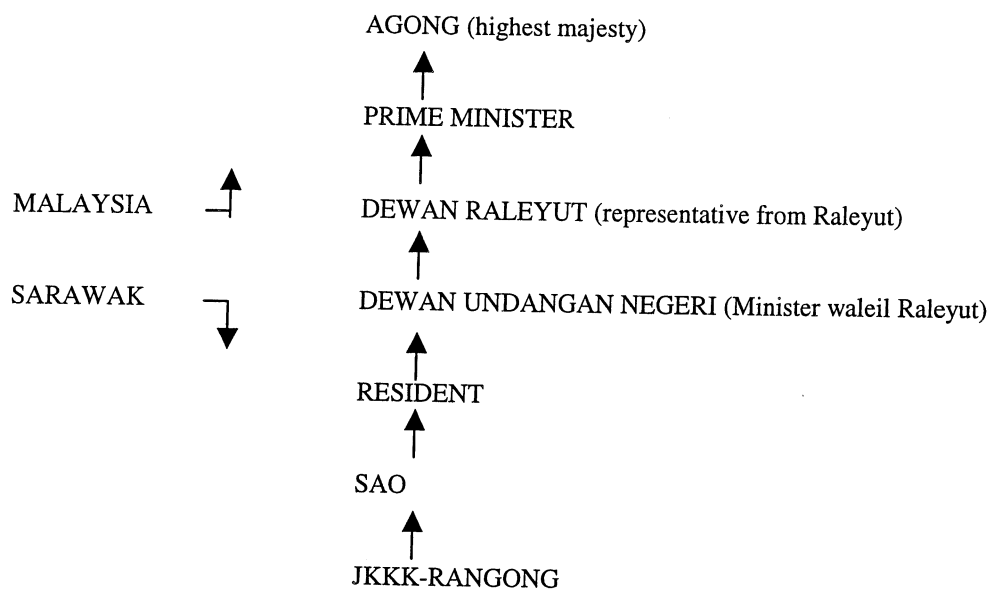
Before the possibilities where better (cleaner water, more forest). This might result in a declined interest.

If you want anything from the government what is then the procedure?

First committee meet and discuss. Then they gather the whole longhouse to discuss the issue. Finally they send an official letter (never a face to face meeting) to the government. The only way for the community to change something is to apply again and again until they succeed.

Ones a month (? Has to be confirmed) some members from JKKK have a meeting with the SAO (Sarawak administrative officer) in Miri where problems are discussed. SAO often promises to help verbally but never written. Once in a while a governmental representative is visiting the longhouse. (SAO - forest dep. or welfare/health dep.). At this meeting new policies are explained (last time the new concept of NCR-policy was presented).

Only during the election time do parliament members visit the longhouse. This means one time in the last 5 years. JKKK meetings with the government and in the longhouse is just concerning Rh Ranggong and do not network with other longhouses.



Group discussion – women

23/10 – 00 / 2:00 PM, duration: 1 ½ hour

Respondents:

Sindah Anah August, born 1951

Linah Anah Ringka, born 1931

Ganda Anah Ringka, born 1948

Context:

The interview was performed in the Ranggong longhouse the terrace, which we considered as a “neutral” place for the discussion. The respondents were told, that they didn’t have to come up with one answer. They were allowed to disagree if they couldn’t reach consensus. The communication went primarily through the interpreter, Dennis.

Remarks:

During the interview, we observed, that the respondents had difficulties in communicating their disagreements, as they almost always came up with one common answer. This problem was more stressed through the interpreters missing abilities to interpret the whole discussion leading to the answer.

Interview:

How many years have you attended school?

(Counts for all respondents): None, they never attended school

What is your occupation?

They were all occupied with farming. Also, they considered themselves as housewives.

What is your approximate income?

The respondents remarked that they grew their own crops and vegetables for consume/living, and that they weren’t into the specific income of the household.

Which changes in the river have you experienced during your lifetime in Ranggong?

They agreed on, that the river had changed from very clear (you could see the bottom of the river) to very brownish. Also, they had observed, that the stream was running slower now compared to before.

How often does flooding occur?

After a quite long discussion, the respondents said, that the water level came all the way up to the veranda approximately 3 times a year (which they considered as a flooding). They also said, that the flooding hazard was increased now compared to before.

What is the cause of the increased flooding hazard?

The respondents weren’t quite sure about this question. After having talking a while about the subject, they stressed that a possible reason could be the increased use of drainage systems in the oil palm plantations. These drains lead the water into the side and main rivers and thereby caused the flooding in the rainy season.

What are your observations regarding the quantity of fish in the Niah river?

They agreed on, that they had experienced a decreasing quantity of fish in the Niah river. Probably caused by population growth in the area and because of more chemicals in the river.

What is the cause of more chemicals in the river?

The respondents weren’t sure about that too, but they remarked, that the Indonesian workers in the oil palm plantations still used tuba practises (poisoning). They stressed, that they sometimes observed a special species of crap fleeing to the river shore, and that this phenomenon probably was a result of these practises.

What do you think is the solution to this?

The respondents remarked, that the plantations should stop using drainage systems. They had already tried to complain to the plantations and to the ministry about it, but they didn’t retrieve any response.

What did you exactly want from the ministry?

They complained to the ministry about the “no-response” action from the oil palm plantations.

What things are now impossible due to the decreased water quality?

The respondents asked quickly, that they couldn’t use the river for water consume anymore. Instead, they substituted it with collected rainwater. Sometimes in the dry season, they experienced a lack of rainwater. They borrowed or bought the water in these situations, which they clearly found inconvenient, as they had to walk or drive to the junction, which was quite far away.

Are there only problems with water in the dry season?

The lack of water in the dry season sometimes affects the pepper plants, as they cannot irrigate them. The main problem in the rainy season is still the flooding hazard, as they were “trapped” in the longhouse and couldn’t go anywhere or work in the field.

Is it really a problem that you cannot consume the river water anymore?

The respondents answered yes, especially during the dry seasons. It was time consuming to boil the rainwater. They finally stopped consuming water from the river approximately 5-6 years ago.

Which crops do you grow?

After discussing the subject they came up with (in that priority), paddy, corn, cucumber, varying kinds of pumpkins, “ling kau” and “bou sut”.

How many plots do your respectively households have?

(The respondents were quite embarrassed having to answer this question. We don’t know whether this was a cause of simply not knowing it or just common humility regarding the other respondents).

They owned 3, 3+ and 4+ plots (+ means “a little more than”). The last one (4+), was one of the first families to arrive and participating in building the first longhouse in Ranggong. In the beginning, the land was simply allocated by clearing as much land as possible. Thereby, the strongest family achieved the biggest land area. Both men and women helped clearing the land. Originally, they were 8 families under the Japanese occupation of Sarawak. As the time passed by, the population grew in the longhouse, and they had to divide the land more formally among the families.

Who are growing the fields?

The respondents answered, that the work was divided equally between men and women.

Are you still clearing forest to expand the crop area?

No, they couldn’t due to the oil palm plantations. Also, they had to practise more permanent farming on the existing fields instead of the earlier use of long fallow periods. The use of fertilizer prevented the plots from being exhausted.

Which kind of fertilizer do you use?

They primarily used “Uria” for the paddy fields. The quantity depended on the size, but one of the women used 3 bags a year (the one with 4 + plots), and the two others used 2 bags a year for their paddy fields.

Which kinds of pesticide do you use?

They used “Ramason”, “Paraquat”, “Cepat” and “Embam” for the paddy fields. They didn’t know the name for the pesticide used in the pepper – fields, but it killed the ants and other kinds of bugs (insecticide).

Did you receive any education / instruction in the use of pesticides / fertilizer.

The respondents answered, that they achieved some education from the merchandisers. Also they found that this sufficient enough, as they could read more instructions regarding use on the labels. As for fertilizer, they had received some instructions from some people from the agricultural extension office. These people frequently visited the longhouse as part of the agricultural subsidy program. If they wanted to be a part of the program, and thereby achieve a quantity of free bags of fertilizer a year from the government, they had to make an application.

Which programs are available under the agricultural extension office?

Under the pepper-scheme, they could get fertilizer, some pesticides and the seedlings. For the oil palm-scheme, they could get 3 bags of “chickenbrand” (each 50 kilograms) per year for 1000 trees. The fertilizer was applied around the

tree three times a year (one of the women had actually some oil palm trees, but didn't mention it under the question regarding which crops they grew).

Do you use any kind of protection regarding the application of chemicals?

None of the respondents used it regularly, but they washed their hands after use!!!

Do you use chemicals on plots near any riversides?

They did, but only on paddy fields

Do you grow the paddy right up to the river shores?

No, operated with a buffer zone on approximately 10-15 (they couldn't give an exactly measure, but they mentioned the distance from the hens houses to the riverside, which we valued to be about 10 – 15 meters).

Finally, have you experienced any health problems regarding the river water?

The respondents stressed, that that hadn't experience any problems until now, as they had learned to treat it with boiling, although they did feel, that the frequency of water born deceases had increased. This was only but an observation, since the general health level also had increased, due to the nearby health clinic.

Focus Group Discussion I

Respondents 2 Groups of men and women from Rh. Ranggong (18 & 19 October 2000)

- Understand and document the awareness of the human communities living within and surrounding the Niah River Catchment with respect to their:

➤ Dependence on the natural resources found within the catchment area.

Jungle Products (wild vegetables)

List down the wild vegetable that can be found in the forest (before plantation).

- | | | |
|---------------------------------|--|-----------------------------------|
| - sabong leaves | | (<i>Gnetum gnemon</i>) |
| - sepang leaves | | |
| - sindu leaves | | |
| - bunggang leaves | | (<i>Eugenia spp</i>) |
| - miding/lemiding/rambai (fern) | (<i>Stenochlaena palustris</i>) | |
| - paku kubuk/ubau | (fern) | (<i>Nephrolepis acutifolia</i>) |
| - paku ikan | | |
| - paku payak | | |
| - paku engkeruak | | (<i>Helminthostachys spp</i>) |
| - kepayang fruit | | (<i>Pangium edule</i>) |
| - empang fruit | | |
| - maram fruit | | (<i>Eleodora conferta</i>) |
| - tubu/rebung (bamboo shoot) | (<i>Bambusa spp</i>) | |
| - upa lalis (palmae) | (<i>Plectocomiopsis geminiflora</i>) | |
| - upa pantu (palmae) | | |
| - upa jelayan (palmae) | | |
| - kulat buah | (mushroom) | (<i>Hygrophorus puniceus</i>) |
| - kulat muyuon | | |
| - kulat kasut | | |
| - kulat kerang | | |

1. Do you face any problem with the amount of these wild vegetable? (before and after the oil palm plantation)
 - no problem - before oil palm plantation, villagers are freely to go into the forest to collect the wild vegetables. The amount of wild vegetable is enough for the villagers since we (villagers) only collect for their daily food supply and not for markets.
 - after the logging and oil palm scheme, we faced a problems due to the lost of forest. That means, our food supply (wild vegetables) is decreasing and now it is impossible for us to get the wild vegetables from the forest.
2. If yes, what are the factors that cause you the problems to collect this wild vegetable?
 - the logging activities - clear the forests area.
 - the oil palm plantation - after the logging activities. Land that supposed to be left for forest was cleared and planted with oil palm.
 - increased in village population - demand for wild vegetables is increased.
 - decreased of land size due to the plantation means that villagers starts to cultivate their old land. So, decreased in land left for fallow period - no more secondary forest - no more source to collect wild vegetables.
3. If no, why do you think so?
 - before logging activities and oil palm plantation, we do not faced any problems due to the decreasing in amount of wild vegetables. Before these activities started in our area, we have a lots of land that being left for fallow period eventhough the population started to increased. Some of our land was left for fallow period for more than 10 years. That's mean, in our land we still can get these wild vegetables and it is enough for us.
4. If yes, list down the wild vegetable that hardly/cannot be found in the forest anymore.
 - sepang leaves
 - sindu leaves
5. If no, list down the wild vegetable that still can be found in the forest.

- before logging and oil palm plantation we can found all types of wild vegetables but now we hardly to find any.
6. *Is there any changes in the amount or availability of the wild vegetables in the forest?*
- yes - especially after the logging and oil palm plantation. Before that we can get our daily supply from the forest. However after these activities, we have to go into the deep forest (if there any forest left- it will be far from our longhouses) to find two types of wild vegetable namely daun sindu and daun sepang because these two vegetables cannot grows in our garden.
7. *If the amount of the wild vegetable is decreasing, how do you faced this problems?*
- from our garden/temudok - we planted some of the vegetables
 - stop being eating/consumed it (sindu and sepang leaves)
 - buy it from Ngu Junction
8. *List down the name of the vegetables that can be found at your garden/farm/temudok.*
- | | | |
|---------------------------------|----------|--|
| - sabong leaves | | |
| - bungkal leaves | | (<i>Gnetum gnemon</i>) |
| - tubu/rebung (bamboo shoot) | | (<i>Eugenia spp</i>) |
| - upa lalis | (palmae) | (<i>Bambusa spp</i>) |
| - upa pantu | (palmae) | (<i>Plectocomiopsis geminiflora</i>) |
| - upa jelayan | (palmae) | (<i>Eugeissona utilis</i>) |
| - kulat buah | | (mushroom) (<i>Hygrophorus puniceus</i>) |
| - kulat muyuon | | |
| - kulat kasut | | |
| - kulat kerang | | |
| - miding/lemiding/rambai (fern) | | (<i>Stenochlaena palustris</i>) |
| - paku kubuk/uban | | (fern) (<i>Nephrolepis acutifolia</i>) |
| - paku ikan | | |
| - paku payak | | |
| - paku engkeruak | | (<i>Helminthostachys spp</i>) |
| - kepayang fruit | | (<i>Pangium edule</i>) |
| - empaong fruit | | |
| - maram fruit | | (<i>Eleodora conferta</i>) |
9. *Please notify, your reasons for planting this vegetables.*
- since we cannot find it in the forest anymore.
 - easier for us to get the food supply in the same land where we plant other crops.
 - it is cheaper for us to get it from our garden instead of buying it from Ngu Junction.
 - more healthy - free from overused of chemicals (pesticides & fertilizers)
10. *Do you use any pesticides and fertilizers to plant these vegetables?*
- no - these jungle produce can live without proper care.
11. *Do you received any subsidy from any agencies to plant these vegetables?*
- no - not for wild vegetables because they can survive without chemicals.
 - yes - for other vegetables - agricultural department - we have a vegetables projects - each households have the same amount of subsidy and size of plots.
 - agricultural department supply fertilizer (5 kg per year per households), seeds (provided once only - 1 kg per households), and pesticides (provided once only - 2 litre per households).
12. *What type of fertilizers and pesticides that was used for your vegetable garden?*
- fertilizers (Chicken Brand and Urea)
 - pesticides (Bridge Brand)
13. *Have you sells your vegetables from your garden? How much do you earn from selling these vegetables? (per month)*
- yes - for two of the respondents. They usually sell it at Ngu Junction every weekends - around RM 100-RM 200 per month - not much because competitions with other sellers (Bugis)

- no - for few of the respondents. The vegetable is for their own consumption.
14. Where do you get these vegetables if you do not plant it in your garden?
- buy it at Ngu Junction.
 - collect it at our temudok.
15. Why don't you plant these vegetables at your own farm?
- because I can get it from the village vegetables project. In this project we can plant it in the land that belongs to all villagers. So, instead of using my land to plant these vegetables, I can use my land to plant other crops either for cash or for our own consumption.

River Products

1. List down the fish that usually can be found/catch from the river (before plantation).

- tengadak	
- sayan	(<i>Leptobarbus hosii</i>)
- betutu	
- bantak/pait	(<i>Osteochilus spp</i>)
- baung	(<i>Mystus spp</i>)
- boeng	(<i>Cyclocheilichthys apogon</i>)
- kachong	(<i>Puntius bramoides</i>)
- belau	
- mengalan	(<i>Puntius bulu</i>)
- ensluai	
- debulai	
- snakehead fish	
- catfish	
- kulong	(<i>Lobocheilus bo</i>)
- semah	(<i>Tor duoronensis</i>)
- runtuk	
- adong	(<i>Hampala macrolepidota</i>)
2. List down other river product that can be found/catch from the river.
 - prawn/shrimp (udang galah, udang rangkang)
 - tortoise (kura umang, kura jaong & lelabi)
 - small crabs (geramak, geramak melai)
 - river snails (tekuyong binduk, tekuyong pulas, kupap)
3. Do you sell the river produces? (before and after plantation)
 - before plantation, we seldom sell the river produces because it was enough for all of us in the longhouse. And everybody in the longhouse can catch the same fish from the river, so no point for us to sell it. Even we can preserved the extra fishes so it will long lasting.
 - by this time, sometimes we sell the fishes among the villagers especially if we can catch more than we need for consumes. Not all villagers can catch the fish in a big amount. Young people these days do not willing to catch the fishes because the yields is declining and no time since they are working at other places (Miri or Bintulu). These new generation rather buy if from the markets. The villagers that was left in the longhouse really depends on the river to catch the fish and other river produces.
4. Is there any changes in the amount or availability of the river produces?
 - there is no changes in case of availability before the land/forests was opened and cleared for logging and oil palm plantation.
 - however after the forest was cleared and changes in water quality (muddy) the amount of the river produces. The amount of fishes is decreased especially for few types of fishes. Before the plantation starts at the upstreams of the rapids area, we usually can catch a lots of prawns and river snails. The availability of prawns, river snails and small crabs are also decreased and it is hardly to find it anymore.
5. Do you find any difficulties in finding these river produces? (before and after oil palm).

- no problem before logging and oil palm plantation. We can catch these river produce and sometimes we can sell it or preserved it. The amount of the river produce is a lot and we do not have to buy it from other places.
- after these activities, we cannot simply put our fish trap because sometimes we cannot catch any. The amount of fish that we catch is decreasing and we cannot sell it among the villagers or we cannot preserved it - not enough.
- sometimes we can see dead fish floating, especially during the drought season.
- the fish that we catch sometimes smells like a soils. We have to keep these fish for a few days before we can eat them. By doing these, we assumes that all dirts from that fish thrown out after they digest it. While by eating these river snails, we have to wash it twice because the contains of mud and sands.

6. If yes, list down the fishes and other river product that cannot / hardly to find by this time.

- semah (*Tor duoronensis*)
- mengalan (*Puntius bulu*)
- tengadak
- kachong (*Puntius bramoides*)
- udang galah (prawn)
- udang ribut (shrimp)
- tortoise (kura jaong)
- small crab (geramak)

7. If no, list down the fishes and other river product that still can be found from the river (according to the respondents the amount is decreased).

- sayan (*Leptobarbus hosii*)
- adong (*Hampala macrolepidota*)
- bantak (*Osteochilus spp*)
- betutu
- bantak/pait (*Osteochilus spp*)
- baung (*Mystus spp*)
- boeng (*Cyclocheilichthys apogon*)
- belau
- ensluai
- debulai
- snakehead fish
- catfish/keli
- kulong (*Lobocheilus bo*)
- runtuk
- river snails
- tortoise (lelabi & kura umang)

8. If yes, what are the factors that cause these problems?

- trees in the forest area can grab and reduce the soil from erosion. After logging and plantation, many trees was cut down. During the raining season, the soil erosion will pollutes the river and the water becomes muddy. So, the river produce which is sensitive to the changes in the environment can not survive.
- the process of river sedimentation also one of the factors that can reduces the amount of river produces. The habitat especially for the prawns, river snails and fishes was disturbed because of soil erosion - so they can not reproduce as usual.
- the amount of fishes also decreased because of the use of pesticides and fertilizers at the plantation.
- the amount of river produces also decreased because of the increased of human population along the Niah river - competitions.
- during drought season, the dead fish also can be found when 'nubai' practices was done. Usually this practices was done by outsiders (workers at oil palm plantation - Bugis).

9. If the amount and the availability of the river produces is decreased, where do you find these produces in order to replace it?

- from other tributaries
- buy from other villagers that sell the river produces
- buy at Ngu Junction
- stop from eating it

10. *Do you have any idea in order to solve the decreasing of the river produces?*

- in focus group discussion for a group of women - they suggest that the plantation should reduce the amount of chemicals. The nubai practices should be stopped. The length of riparian zones should be added to prevent from soil erosion.
- in focus group discussion for a group of men - they suggest that the plantation also should reduce the intake of chemicals and if possible the plantation can use the biological methods to control the pests. The plantation also should plant the cover crops to reduces the erosion and length of riparian/buffer zones should be added. The management and plan should be done according to the real plan which was approved by the government - the terracing process, riparian zones and pesticides.
- these men fgd - also suggest that penalty should be implement to the peoples that applies the nubai practices. The government (Agric. Depart) should help and support the villagers to starts the fish pond and prawn project because instead for their own consumption, they also can get benefits by selling it at Ngu Junction to earn cash.

Jungle Products (wild animals)

3 *List down the wild animals that can be found in the forest (before plantation).*

- keruak (birds)
- sengayan (birds)
- bidan (birds)
- ruai (birds)
- kechiang (birds)
- deer
- mousedeer
- wildboar
- monkeys
- wak-wak (lemur)
- tenggiling (reptile)
- ular sawa (python)

2 *Do you sell the wild animals that you catch? (before and after plantation)*

- before it was protected, we usually can sell this meat at other longhouses or at Ngu Junction.
- after the plantation scheme, we cannot sell it because we also hardly to find these animals and it was wrong to sell these animals or it's meat.

3 *Is there any changes in the amount or availability of the wild animals in the forest?*

- yes - before this we can sell the meat or we can preserved it for our own use. However now, we cannot sell it because for our consumption also not enough. Besides that since it was protected under wild animals protection ordinance.

4 *If the amount of the wild animals is decreasing, how do you faced this problems?*

- stop from hunting and consume these meat.
- consume other meats - chicken, pork etc.
- preserved the meat if we buy it from the traders.

5 *Do you face any problem with the amount of these wild animals? (before and after the oil palm plantation).*

- no - before oil palm plantation - we can get these wild animals without any difficulties. Usually after hunting, we usually can find at least one animals and the worse case is a bird.
- yes - after the plantation - we hardly to find these animals. We have to hunt in a big group so that we can split into few group in order to get more animals. We notice that the amount of these wild animals is declining because it is hardly for us to get any animals after goes for a hunting.

7 If yes, list down the wild animals that cannot/hardly be found in the forest anymore.

- ruai (birds)
- bidan (birds)
- deer
- wildboar
- wak-wak (lemur)
- tenggiling
- python

8 If no, list down the wild animals that still can be found in the forest.

- keruak (birds)
- sengayan (birds)
- kechiang (birds)
- mousedeer
- monkeys

8 If yes, what are the factors that cause you the problems to hunt these wild animals?

- no more forest due to cleared and open land for logging and plantation.
- the sound of heavy machines (logging) scares the animals.
- human encroachment scares the forest spirit's - so the animals cannot survive without these spirits
- many people hunt for the same animals - competitions.
- not enough food in the jungle for these animals.
- the animals might infected by diseases cause by human encroachment (dirty water and pesticides).
- no security for animals - under pressure so less reproduction.

9. If no, why do you think so?

- because we still can hunt these animals. The only problems is the availability of these animals is decreased.

10. Do you have any idea in order to solve the decreasing of the wild animals?

- gazatte the forest reserve so that these animals can live and breed.
- penalise the sellers of these meat because they don't hunt for their own consumption but for cash.

Jungle Products (building materials)

1. List down the building materials that can be found in the forest (before plantation).

- belian
- meranti
- kruing
- bamboo (payan)
- mengkuang leaves
- kerupok tikai
- rattans
- nipah leaves

2. Do you face any problem with the amount of these building materials? (before and after the oil palm plantation).

- yes - the building materials is declining in number especially after the logging activity and oil palm scheme starts. Now it is hard for us to cut and collect those species since there is no more left in the forest.
- no

3. If yes, list down the building materials that cannot/hardly be found in the forest anymore.

- belian
- meranti
- keruing

4. *If no, list down the building materials that still can be found in the forest.*
 - maybe mengkuang leaves, nipah leaves, kerupok tikai and rattans.
5. *If yes, what are the factors that cause the problems to collect these building materials?*
 - logging activities and oil palm plantation cut and cleared a big area. There is no more forest left behind.
 - the forest is being replace by the oil palm plantation.
 - population in Niah area is increased - competition for land so many forest is being cut down and cleared.
 - the trees cannot grow well because the changes of environment - weather is getting warmer.
 - many land was being declared as reserved forest, so we cannot simply enter the forest to cut down the valueable trees for building materials.
6. *If no, why do you think so?*
 - since our longhouse is complete so we don't really need these building materials anymore. If we want to renovate or do maintenance unto our house, I could rather just buy the plank or wood.
 - some of these building materials can be found/planted in our farm.
7. *Is there any changes in the amount or availability of the building materials in the forest?*
 - yes - especially after the forest areas and our temudok (left land for fallow period) areas was cleared for plantation. The decreasing of the availability complies to most all of the building materials. But, for certain materials (rattan, mengkuang leaves, nipah leaves and kerupok tikai) still can be found in our temudok.
8. *If the amount of the building materials is decreasing, how do you faced this problems?*
 - buy it from hardware shops, sawmills or orther villagers who's selling these materials.
 - try to plant these materials (rattans, mengkuang leaves, nipah leaves and kerupok tikai) in our garden.
 - stop from using it.
9. *Do you sell these building materials (before and after plantation)? If yes, how much do you earn from selling these products?*
 - we never sell building materials (hardwood) that was taken from the forest. Nevertheless, few ladies in this longhouse do selling handicrafts made from bamboo, rattan and those leaves.
 - there is no record on how much they earned by selling this jungle products - side income only.
10. *Do you have any plan in order to solve the decreasing of these building materials?*
 - try to plant it in our garden.
 - no idea.

Focus Group Discussion II

Respondents 2 Groups of men and women from Rh. Ranggal (27 & 30 October 2000)

TASK B:

- Understand and document the awareness of the human communities living within and surrounding the Niah River Catchment with respect to their:
 - Dependence on the natural resources found within the catchment area.
 - The communities understanding and commitment to sustainable use of natural resources.
 - Their perception to water pollution.
 - The potential opportunities or threats of market forces (e.g. tourism on their livelihood).

Questions (open ended-questions)

1. List down the wild vegetables that you usually eaten?
2. Which part of the vegetable that you can eat?
3. How do you prepare these vegetable?

Name of Wild Vegetables	Parts of Vegetables	How to Prepare
Sabong	young leaves, matured fruits	boiled, fried with other vegetables or in a soup & kernels made into cracker
Sepang	young leaves	fried with 'sambal belacan' or other vegetables
Sindu	young leaves, nuts	for flavouring food
Bungkang	young leaves	used as an ingredient in meat, chicken or fish cooked in bamboo joint over woodfire (pansoh)
Empaong	Fruits	vegetable prepared in 'ulam' style
Kepayang	young leaves, fruits, kernals	fried, as an ingredient in cooking & young leaves used in preparation 'kasam' (preserved meat)
Upa Pantu	heart of pantu	boiled (cooked plain)
Upa Lalis	heart of rattan	boiled, fried with 'sambal belacan'
Umbut Nibong	heart of the trunk	boiled, fried with 'sambal belacan'
Kulat Buah	(mushroom)	fried with other vegetables or with anchovy
Kulat Kasut	(mushroom)	fried with other vegetables or with anchovy
Kulat Muyuong	(mushroom)	fried with other vegetables or with anchovy
Kulat Kerang	(mushroom)	fried with other vegetables or with anchovy
Paku Ikan	young curled leaf stalks & young leaves	fried with anchovy, 'sambal belacan' or in 'ulam'
Paku Engkeruak	young curled leaf stalks & young leaves	fried with anchovy, 'sambal belacan' or in 'ulam'
Paku Kubuk	young curled leaf stalks & young leaves	fried with anchovy, 'sambal belacan' or in 'ulam'
Lemiding	young curled leaf stalks & young leaves	fried with anchovy, 'sambal belacan' or in 'ulam'

4. Are you still depend on jungle produce? Why?
 - yes, but we don't go to the forest to collect it because we can plant or found it in our farm or in our temudok. So, we don't consider these vegetables as jungle produce anymore.
5. Do these jungle produce (wild vegetables found in forest) is declining? Why?
 - yes, of course. Because there is no more forest can be found in this area. The forest was cleared for logging and taken over by oil palm plantation. The riparian zones only left less than 1 rantai (5-10 metre) from river banks. There is no possibilities for these vegetables to grows in such small area.
6. If yes, how do you faced this declining?
 - plant it in our farms or go to our temudok to find it.
 - stop from consuming it.
7. Do you face other problems regarding to the jungle produces?
 - yes - river products especially fishes (tengadak, enseluai and bantak)

8. *Is there other causes that affect your dependence to the jungle produces?*
 - the weather is warmer than before, so some of the vegetables (mushrooms and ferns) cannot grows as usual.
 - no more trees - no habitat for small animals and insects that usually help during the process of pollination - especially to produce wild fruits.
 - Competition between wild vegetables (hardly to find) and vegetables that planted in our farm (easy to get especially in large amount).
9. *What are the problems regarding to the water in this area?*
 - the water is turbid and muddy (especially after heavy rain).
 - oil and grease from oil palm plantation (machines, bulldozers etc).
 - chemicals (pesticides and fertilizers) contaminate the water.
 - dead fish - floating especially during drought season.
 - waste materials - pollutes the water.
10. *What are the causes of those problems?*
 - no proper management in the plantation while doing the terracing, irrigation, no cover crops, no mulching practices and the short length of riparian/buffer zones. The new plantation expose the soil to erosion.
 - the use of the pesticides and fertilizers especially for the new palm oil.
 - 'nubai' practices especially by the plantation workers (Bugis).
 - workers in plantation do not take care of their hygiene and they pollutes the water by throwing rubbish and domestic wastes into river.
11. *In your opinion, what can you do to reduce those problems and why?*
 - increased the length of riparian zones so that the chemicals and muds from soil erosion especially after heavy rain were trapped in this area before flows into the river.
 - take a serious action againts people who practised the 'nubai' practice.
 - warns the Bugis and ask the manager to control the oil spill. Try to reduce the intake of Bugis and increase the salary so that the locals will work in the plantation-because locals will not pollutes the river water since they used it.
 - ask the oli palm management to provides water tank for every households since their activities pollutes the river water. So that, the oil palm manager will know that they are polluting the river and cause the villagers in a miserable lifes.
12. *What do you think if government/agencies supply the treated water from treatment plant to this area?*
 - good idea-since the river was polluted & so that we can consumes a clean and treated water.
 - good idea-but I think it will take a long time to receive the treated water because our area is too far and it will be very costly. I think the agencies and governement should take other action/plan in order to provide the clean and well-managed water for the villagers along the river.
 - excellent idea-so that no more water borne diseases.
 - this kind of project should be done before since we asked for it many times.
13. *How much you willing to pay (per month) to consume this treated water?*
 - depends on our consumptions. During school, public holidays and festive season (Gawai and Christmas)- our water consumption usually double since our childrens and relatives are back. So, to reduce the bills we will use treated water only for cooking and washing the dishes. While we still can take a bath and do our laundry at the river.
 - we willing to pay around RM 5.00 - RM 12.00 a month.
14. *If you received the treated water, are you still dependent on the river water for your daily use?*
 - depend on the situation - when our childrens and relatives is here, we depend on river to take a bath and do laundry but not for cooking. Once a while we might take a bath in the river since we do it before we were supplied by treated water.
 - on the ordinary days, we might not depends on river to take a bath and do laundry since it was polluted. But we still depends on the river for other uses (irrigation, river produces).
15. *Do you have any suggestion (instead from treatment plant) in order to get the water supply? Please notify what are the suggestions.*

- the government should identify a strategic location to be gazetted as water catchment and build some small dams to collect water and pumped to our longhouses.
- the government should co-operate with the longhouses to identify the best location, management, sponsors and other because participation from the villagers is very important. So that we can participate and at least know what is happening around us (development).
- if the treated water project and gravity water fed is not implemented in our longhouse, government/agencies should provide us with more water tank for each of the households to collect the rain water.

16. (If respondents mention about the Gravity Water-Fed). Where do you suggest the best location for this project and why?

- the Temengung and officers from water treatment plant Miri have visited the rapids area before. They pronounce that there will be a location to build a small dam to collect a water and pumped to our longhouse.
- the best location for this project is at the upstream of the rapids area-because the land at the downstream of the rapids was cleared and planted with oil palm. So the water is not suitable for drinking and washing-because the contains of pesticides and fertilizers.

17. Who should start and maintain this project?

- the Jabatan Kerja Raya (JKR) since they have the Waterboard Department.
- the Jabatan Kesihatan (Health Department) so that they will always check the water quality.
- the village committee members from the longhouses along the Niah River cooperation with the government agencies and locals authority.

18. Do you think the villagers have their role to play in this project?

- yes especially dealing with the maintaining and the preparation of the project. We can help by giving the idea or keep the river is clean.
- we can help by make sure that the catchment area was not enchroached by anybody.
- if the project was approved, we can learn from the agencies/govt/local authority on how to handle the village water gravity-fed.

19. Why do you apply the fallow period (litan temudok) in your farming system?

- to maintain the fertility of the soil - burning - provide ash - natural fertilizers
- so that our yield will increase
- sometimes our farm was attacked by diseases - so by fallow period the diseases cannot be found in our farm.
- because we have other field/land to be cleared and planted.
- so that, we can get the wild vegetable especially when our farm was left for fallow period.

20. What are the crops planted in your farm?

- wet paddy, hill paddy, vegetables, spices, fruit trees, pepper, oil palm etc

21. Why do you choose to plant a mix-crops in your farm?

- because of our land - the hilly area are suitable for hill paddy, pepper & fruit trees, the wet area are suitable for wet paddy and peat area are suitable for oil palm etc.
- easy to get food supply from the same place where we can plant fro cash crops.
- utilise the land more efficiently because our land size is getting less/smaller.
- if we only plant one species, the yield will declining and we are in trouble especially during the diseases attack or price fluctuation.

22. Do you use any chemicals (pesticides and fertilizers) in your farming system (now and 15-20 years ago) and why?

- previous - no chemicals because cannot afford and our land is more fertile because of matured fallow period (10-14 years).
- present - most all of the farmers in this area are using the chemicals in order to increase the yields.

23. List down the brand's name for each fertilizers and pesticides that you use.

Crops	Pesticides Brand	Fertilizers Brand
Hill Paddy	Gromoxone, 'Empangau' Brand,	Baja Urea, Chicken Brand

	'Tengkorak' Brand	
Wet Paddy	Gromoxone	Baja Urea, Chicken Brand
Pepper	Gromoxone, Spark, Paraquat, Basta 15	Chicken Brand, Bridge Brand, Baja Urea
Oil Palm	Gromoxone, Harras, Round-Up, E-Commect	Baja Urea, Chicken Brand, Bridge Brand, 'MOP', 15-15 Brand
Fruits	Paraquat, Spark, 'Empangau' Brand, 'Tudan' Brand, 'Tengkorak' Brand	Bridge Brand
Vegetables	'Empangau' Brand	Chicken Brand, Baja Urea

24. Have you use the manure fertilizers before? Why?

- yes - only suitable for vegetables. We never try it on other crops because nobody ever try it before.

25. Are you still using this manure? Why?

- no - because this natural fertilizers is expensive and it is not worth for us. (RM 15 for less than 10kg).
- no - because some farmers informed me that the manure (guano) not suitable for all crops.

26. Compare to 15-20 years ago, does there any changes (landuse) in this area? Please specify. What are the factors?

- yes there are changes and the main are factors: logging, oil palm, pop. growth-distribution of land for the children & competing for landuse (development vs farming).

Before Oil Palm	After Oil Palm
The size of our land is big	The size is reduce/declining
Soil in our land is much fertile	Less fertile
Fallow period is longer (8-12 years)	Fallow period is shortened (3-5 years)
We can consume a lot of wild vegetables	Less/hardly to find wild vegetables
Land usually belongs to the villagers	Land was shared (joint venture)-govt., agencies etc
Less soil erosion especially at the river bank	More erosion and pollutes the river

27. Do oil palm plantation affect you and your family? Why?

- yes - our family member is working in the plantation-monthly income.
- yes - not all villagers are working at the plantation because the owner of the plantation prefer to take Bugis as their labours. Bugis maybe throwing their domestic wastes into the river.
- yes - in terms of the water quality which is declining (maybe)-health problems.
- yes - fish are found dead-maybe because of chemical, oil, grease etc.
- yes - our jungle products is declining/hardly to find by this time.
- yes - more river sedimentation because of erosion at the river bank.
- yes - flooding event more frequent (3-4x/year) due to sedimentation, no cover crops, the water level during flooding is high (no formal records), the period for the flood to stop is longer (3-4 days).
- yes - a big differences in water level especially between drought and rainy season
- the climate is getting warmer because no more shades provided by trees.

28. Are there any members in your family working in the oil palm plantation (scheme)?

- yes - some of the interviewees
- no - some of the interviewees

29. Do you think it is important to find a job in the oil palm plantation? Why?

- yes - because we can get monthly income. We can work at our own farm during the weekends and during the weekdays our parents/relatives will take care of our children. So it is important for us to winf a job in the plantation.
- no - difficult to find a job, since they prefer the Bugis. They don't care the amount of salary they can earn.
- no - because most of our children are working at other places (Miri, Bintulu, Johore, Kuching and Brunei) and they can get better income then working in the plantation.
- no - because we are too old and we cannot work hard with heavy tasks in the plantation.
- no - because nobody will take care of my family. We have our own farms/fields.

30. Have you ever been to the rapids (giam)?

- some says yes (5 - 17 years ago) and some says never.

31. *Is there any changes within 15-20 years in the rapids area?*
- yes - especially the water quality (getting muddy).
 - yes - the sedimentation increased and it is difficult for us to use our boat-sometimes we have to push & pull our boats.
 - yes - the declining of udang galah (prawns) and fishes.
 - yes - the landuse is changing from forest (temudok) into big plantation area.
 - yes - the water flows is increasing because the old logs is underneath the water.
 - yes - eventhough we never been there but our relatives, family members and friends informed us about the changes in that area.
32. *Is there any potential for the rapids to attract tourist/visitors? Why?*
- no - because the area is not like previous (clean etc), and no road access.
 - yes - eventhough the plantation is around. They may be can start a agro-tourism instead of eco-tourism alone.
33. *If there is an attraction in the rapids area, do you have any future plan to that area? What is your plan (if any) and why?*
- build chalet/log cabin for visitors to spend their nights to enjoy the nature.
 - provide food stall to attract the visitors to come.
 - provide boat and guiding services with the villagers from Rh. Nyelayang.
34. *What are the possible effect would be happens to you and your family if rapids can attract tourists/visitors?*
- depends on programs provided by the government and the local peoples.
 - maybe we will working a small family business (chalet, food stall, guiding and boat services).
 - provide employment especially for the villagers.
35. *Is there any possibilities for the rapids area to attract the tourists/visitors now and within year to come? Why?*
- not sure because there is no more natural forest.
 - no - the river was polluted.
 - no - since that do not have any road access, clean water supply and electrickt supply.
 - yes - the rapids can attract the tourist because of the 7 beautiful rapids and the plantation also can be one of the attraction - agro-tourism.
 - yes - the oil palm near (upstream) to the rapids area is matured, so it will be less in erosion and chemical use.
36. *If you are given a chance to promote the rapids, what would you do? Why?*
- make a suggestion to our Village Committee Member.
 - let the Committee suggest to District Office (local authority) and Ministry of Tourism especially to Sarawak Tourism Board.
 - Promotion especially to the students - so that they will vists on school holidays or weekend.
 - informed to the journalis/reporter about the rapids.
 - make a brochure which contain about the rapids, person to contact, facilities provided (boat,guiding, etc) and the price. Send this brochure at the airports, craftshops, hotels, Niah National Parks Office etc.

Timprest Oil Palm plantation

Respondent: Manager Jeffery Leong, agronomist.

History and background:

Number of employees: 63 check rollers (mainly locals their work consist of offices work, tractor driving), 151 contractors (mainly Indonesians, manual work, harvesting, application of herbicides and fertilizer, and manual weed control). They workers live in the plantation.

Area: 3459 Ha mature oil palm, 2365 Ha immature oil palm.

Plantation established in 1995, first planting found place in March same year. The plantation reached its present stat in 1997. However damages deflected to the palms due to animals (Porky pine) created a need for continuously planting of new palms.

Example of salary cost for manual wheat control.: 25 RM pr Ha contract 8 and check rollers 17RM

Does the plantation use cover crops?

The plantation is enforced to use cover crops since they have to follow the EIA- report written before the planting. During the creation of the plantation, the area was burned, and cover crops (2-3 species of legumes) where planted on non-terrace areas before the palms. In the cases, where terraces where needed, the cover was planted afterwards. It takes about one year for the crop to cover the ground, and it serves as soil preparation, keeping down other species and as a natural fertilizer. However, pesticides are used 2 m diameter around each palm to prevent any natural growth.

Future plans

They plan to expand the plantation in the next two years with 1000 Ha. However this will not be burn as the previously planted areas due to new and stricter regulation. Therefore the trees will be logged with chainsaw a left to degrade as natural fertilizer.

Perception of future demands

Recently there has been an over supply of palm oil, this is mainly due to more intense competition from US Soya been production which is reflected in the price of palm oil 750 RM pr. Ton. The respondent however believes that the marked will recover.

Sources of water

Water not used for consumption as drinking water is pumped from Tamar river. Water for drinking is rainwater collected in tanks.

Every three-month water samples are send to CEM Science to be tested as prescribed in EIA report. The practical enforcement of the EIA report goes through the DOE & NRIB, This is done twice a year and includes a check of the buffer zones.

Last water quality test showed a lack of oxygen but no pollution due to chemicals

The respondent confirmed that sediment in rivers was an increasing problem.

Palm Intensity

135 palm pr. Ha in flat areas and 146 palms pr Ha in contour areas. Distance between two terraces is 9-10m but depend on slop degree, the width of terrace 3,5 m. Topography of the Timpres area vary from very steep to very gentle.

Use of chemicals in the palm production

Amount of fertilizer used depend of the age of the palm.

Mature palms receive a total amount of 9kg. Divided into 4 times a year. Immature palms applied fertilizer 4 times a year but the total amount applied is 1, 25 to 4,5 kg pr. palm.

Pesticides are not used in the palm production.

Herbicides (GLV system mix) applied in a 2 m. diameter from the palm and its is sprayed manually. Unmature palm every 45-60 days 1,4 litres pr palm. Each application. The respondent confirms that there are guidelines for both fertilizer and herbicides. (Quantity, application protection? choice of brand)

Drainage System

Drainage system exist in lowland areas this is a requirement from the EIA report. Cover crops where planted near this drainage in the plantation initial state to stop the erosion.

Harvest

Every palm is ideal to visit three times a month but due to lack of man power each palm is only visited twice a month. The maturing time for oil palm s are two years.

Yield 3years old palm gives 7 tons pr. Ha, 7 years old palms give 18 tons pr. Ha 10-25 years old palms gives 25-27 tons pr year. After 25 years palms are replaced because of the increased difficulties in harvesting the fruits. However oil palm can be up to 25 years old.

Timpres also buy local small holders oil palm fruits.

Erosion was worst in the first 1 1/2 year and was worst regarding the rivers and the drainage.
Erosion is not problem for the plantation yields

Why planting oil palm

The planting of oil palm in the area has to be seen in the alternative in the region -Pepper-. Pepper is labour intensive and this labour is not present, this is further underscored by the fact the pepper is only harvest once a year. Moreover the pepper plant is more fragile and is more prone to catch diseases, furthermore uses a lot of fertilizer and insecticide.

The oil palm is when harvested transported to a mill.

Waste and bi-product from the oil palm production=s : Ashes generated from the nutshells is used as natural fertilizer it=s alkaline Ph value from 8-9.

When burning the shells the energy is used to produce electricity.

Oil palms are self-pollination so no hormones are used.

Own observations:

Check on buffer zone 30 meters on one side and nil on the other side of the river (6-10m)

The road was crossing the Tamaha River, during the water sampling a tractor passed by causing a massive sediment loss to the river.

Timpres area was quit well grow regarding cover crops approx. 90%.

BHB SB Oil Palm Plantation

Respondent: Master Degree holder in plantation R. Sumugann.

The plantation

The plantation is part of Arstal Group. The first planting was in 1983-1988, which makes the majority of the palm mature (except for in the newly developed areas). The plantation total area is 4399,5 Ha. The BHB plantation seeks to further expand this area but faces problems of NCR land.

The market

The demand of oil is generally increasing due to population increase but some problems exist due to competition from Soya beans. Further the important market in India and Pakistan is not as good buyers anymore. This is according to the respondent due to their large military expends.

Production system

The mill produces 30- 40 tons pr. hours.

Plant densities

Oil palms are planted in triangles and the distances between each palm are 28-29 feet.

Terracing & contour planting

Terrace is 26 feet between terrace and 14 feet deep. Slopes less than 20% is ideal for oil palm because less erosion than steeper slopes. IN this plantation slopes average is 30% and some places in Sarawak the Slopes gets up to 40%.

Cover crop is only planted in new areas and is planted in the area between each tree.

9 kg of fertilizer pr. Ha cover crops. The cover crops are of various species with a average duration of 6 years. The cover crops not only prevent erosion but are also natural fertilizer.

Use of chemicals

Fertilizer: total amount 8-11,5 kg pr palm divided into 6 applications pr. year. The amount of fertilizer use depends on various factors such as workers salary, soil quality, and plant growth.

Herbicide : 3 litre pr Ha a year in a radius of 2 meter from the palm. Brand used is Gramaxone, Glyphospat and Ally. Guidelines for application of herbicides include gloves & masques and acknowledge of the official guidelines for amount and use of herbicides.

Enforcement of environmental legislation

DOE & NREB come regularly they always show up when a change in the area is reported. There is no EIA report because of the age of the plantation.

Employment

20% are locals check rollers and 80% foreign contract workers.

Erosion

There is a problem with massive landslides, therefore steep slops are not sprayed the keep the spare vegetation.

Waste materials

Ashes only used for pit-soil to add alkaline to increase Ph. Some waste is also sold to other company

Water

Water for consumption as drinking is taken from the river is treated (chlorified?). The respondent expresses that there is no problems with sediments in the water anymore

No drainage in the plantation

Buffer zones are 40m on each riverbank and 20 m of banks of streams.

SELANGOR. Wawasan oil palm industries.

We only have the area information and field observation. No interviews were made.
Total area: around 5000 ha, within 5 years (1995-2000).

Detailed area description:

Phase 1: October 1994

Total: 992 ha

Plantable: 853 ha

Unplantable: 139 ha

Phase 2: April 1995

Total: 984 ha

Plantable : 886 ha

Unplantable: 98 ha

Phase 3: May 1997

Total: 1005 ha

Plantable : 905 ha

Unplantable: 100 ha

Phase 4: September 1997

Total: 735 ha

Plantable : 514 ha

Unplantable: 221 ha

Phase 5: September 1997

Total: 1059 ha (704 ha cleared)

Plantable : 517 ha

Unplantable: 542 ha

Plantation located within the catchment of Sg Luai (Northern boundary) and Sg Bawa(western boundary).
To date they have been harvesting the FFB for the last 2,5 years.

Environmental monitoring is done by the NREB 3 times a year. Water quality is done through 4 sampling points within their plantation area.

Field observation: at smaller streams no buffer zones/riparian reserves are observed. Cover crops were observed at the terraces but at the newly planted areas the cover was still sparse.

Generally the topography was relatively steep some times exceeding 25 degrees.

Health Care Centre

Respondent: a medical assistant.

Setting:

The medical assistant we interviewed was a bit late for the appointment. The atmosphere in the interview was good; the respondent spoke a little English. In the center we met four employees in all, 2 nurses and 2 medical assistants. In front of the center there was a queue, so we did not want to take up the assistant time for too long.

Do the health care center experience an increase or decrease in waterborne diseases?

The overall picture is that the waterborne diseases² in the area are declining. However Niah area sometimes experience outbreaks. For example: Cholera in 1997 and typhus in 1996. According to the health Clinic these outbreaks were not due to conditions in the area, the source of infection came from Miri. Furthermore 2000 has until now showed a decline in Malaria but 3 years ago the clinic experienced an increase. Nevertheless during the dry season where people might be forced to drink water from the river, the clinic experiences an increase in some waterborne diseases specially diarrhea and dysentery.

What is the cause of the decline in waterborne diseases?

According to Health Clinic the decline in the waterborne diseases is due to the health awareness programs. These programs consist in going out to the different longhouses (once every two months) and promote hygiene and also telling people to boil the water before consumption and cook the food. The government's health department are also the institution that have provides rainwater tanks and toilets.

What is the biggest health problem in Rh. Ranggong?

The clinic sees the Tub practice as the biggest threat to health coming from the river. And lastly according to the clinic the major health problem in Rh. Ranggong is headache.

² The waterborne disease mentioned by the clinic was cholera, typhus, diarrhea, typhoid, dysentery, elephant leg and malaria, the two latter due to the mosquitoes.

Niah Subis Water Treatment plant

Respondent: Waterplant manager Mr. Dunstan Igap

History

1980: Built (owned by Sarawak Land Development Board/SLDB)= government agency 1983: operated/launched: now under JKR (public work department), under state government

Purposes

Supply water to Oil palm mill (in the beginning) now, 99% supply for domestic consumption and 1% supply for commercial uses

Management

Directly under JKR and water quality analysis is carried out in the Chemistry Lab in Bintulu the result are reported into Miri office 9 attendants (24 hours shift)

Distributions

10 longhouse have not been received water supply until now 2020, minister planned to supply water to everyone but in reality, the water treatment plant is small and might not be possible to do so. They did dig ground water (aquifer) but insufficient

Problems

The cost of maintenance is increased because of the models spare part is out of order. Price of chemicals is high. The value of RM is decreasing because of economic down time in 1997. The cost of power supply increase and the selling price of water have not changed much and the treatment plant need a lot of subsidiary from government.

Flooding Occurrence

The water treatment did not have any record on the level of the flooding event. However, Mr. Dunstan Igap mentions that they start to take the level for the previous 5 years. All information about the water level was send to Miri Water Board. He concludes that for this previous five years, the flooding is more frequent and the level is higher than before. The highest water level is 29 ft (after heavy rain in the raining season). The highest water level during the normal day is 12-13 ft. In the drought season, the water level is 5-7 ft. The latest big flood is on 1998 (once) and 2000 (three times)

Warning System

They have the toxication warning system but it is not working for this 4 years. The cost of maintenance is expensive. By now they have to do it by manual (take and do water analysis on the contain of toxic in the water everyday). All the data about this water analysis was send to Bintulu and Miri. He also claim that the toxication in the Niah river also can be noticed when they can see the fishes are floating (seldom happens). The warning system regarding the water level also has to be done manually. The workers have to control the water intake and 24 hours observation is needed.