Development and limitations of the livelihoods and natural resources in Gerigat, Sarawak, Malaysia

ILUNRM-Course

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Abstract

The investigation in Gerigat was led by research questions on the socio-economic activities of the village, interviews on the impact of socio-economic activities on the environment, and evaluation on the potential future socio-economic activities.

Therefore, the data collected in the field is as diverse as the number and the characteristics of activities in action in the village. The population has a seasonal life rhythm, which depends on some major locations, investors and actors. As soon as we arrived in the village, the waste management issue and sanitation seemed to be important. Indeed, the results from this investigation elaborates on one of the more important issue concerning the environmental sustainability of the community organisation.

The Field study revealed that the livelihood is rather independent compared to other communities which are more dependent on governmental schemes. However the survival and the development of Gerigat will have to deal with outside forces, according to the fact that their natural resources are limited. Furthermore, the location of the community is not favourable for further extension. The water boundaries limit the access even though infrastructure is implemented. Gerigat has several potentials for future development including tourism. If they learn how to embrace these future opportunities and adapt them to the environment issues, the village sustainability will be kept in the future.

Introduction

In the description of the SLUSE course it says that the central theme is to learn and use interdisciplinary methods and apply theoretical approaches. This description is indeed very accurate. Our different cultural backgrounds and educational training have been obvious from the beginning and the challenge has been to take the best from these trainings. There has been a significant focus on group dynamics and group work throughout the working process. We all started out having different ideas of what we wanted to investigate in the field, and slowly we found a common focus.

The process of finding common grounds has been very educational and a major challenge in the process was the cooperation with our Malaysian counterparts. Combining the thoughts of two groups to common research questions was a tough but giving task, as it forced everyone to reconsider your suggestions and to argue for them.

A big advantage when doing this kind of field trip is that you live at and with the people you do your research on; hence this is one of the objectives of the course. Unfortunately we lived in a beach resort at the village borderline, so we did not actually live with the locals, and had to either make appointments with people or actively seeking people. Spontaneous and often informative interviews or talks did not happen as we were more or less isolated from the locals.

The preliminary village description, although a sparse one, gave the impression that the village had a lot of problems and challenges which would be hard to overcome. Therefore, the biggest realization we did on arrival was that the village actually is a relatively well functioning village with job opportunities and reasonable levels of income. Furthermore, there seems to be some potential for future development in tourism activities and agriculture. This change in the perception of the village is explained continuously in the report.

There are water resources all around Gerigat in the shape of the sea and the river and practically all activities in Gerigat are to some degree dependent on this. This situation is interesting because dependence also means vulnerability. If the water resources are degraded in any way it will have consequences on the livelihoods, because these depend on available and useful water resources. That dilemma has been the overall focus in our research.

This report is the final product of group discussions, data gathering, literature research and lectures. The report does not give a complete picture of activities and opportunities in Gerigat, but is focusing on those issues that we believe influence the livelihoods the most.

Research questions

We chose to base our research on the following research questions:

- What are the socio-economic activities in Gerigat?
- What is the impact of socio-economic activities on the environment?
- What could the potential future socio-economic activities be?

These questions have been developed in cooperation with our Malaysian counterparts. In the framework of these questions we furthermore chose to focus on the following issues, which seem to be influencing the livelihoods in Gerigat the most:

- **Socio economics and human dynamics**
  - What interactions exist between villagers and between the village and external factors?
- **Agriculture**
  - What is the importance of agriculture in Gerigat?
  - Is the agricultural production sustainable?
- **Forest and mangrove**
  - What is the state of the current forest?
  - What is the interaction between the mangrove and the livelihoods in Gerigat?
- **Fishing and aquaculture**
  - What is the importance of aquaculture as a livelihood in Gerigat?
- **Waste management and sanitation**
  - What can be done to improve the waste disposal system and the sanitation?
  - Which factors does the waste influence?
- **Tourism in Gerigat**
  - Can the existing tourism industry be developed to create additional livelihoods?

The issues listed above all have the water resources as a common denominator, and hence the water resources act as the main thread throughout the entire report.

The report is outlined following the issues, and each chapter contains a description of the methodology, results and analysis of the current issue. The report will end with a discussion and conclusion including all the issues. The conclusion will fulfill the research questions and answer the sub-questions of each issue.

Background

Introduction

This first section is made based on information we obtained from a semi-structured interview with the headmen. The two men answered our questions about the general organization of the community, and the relation to its attached resources. Later we had another and more informal interview with the oldest man from the village, who gave us additional explanations about the present landscape composition, compared to the past.

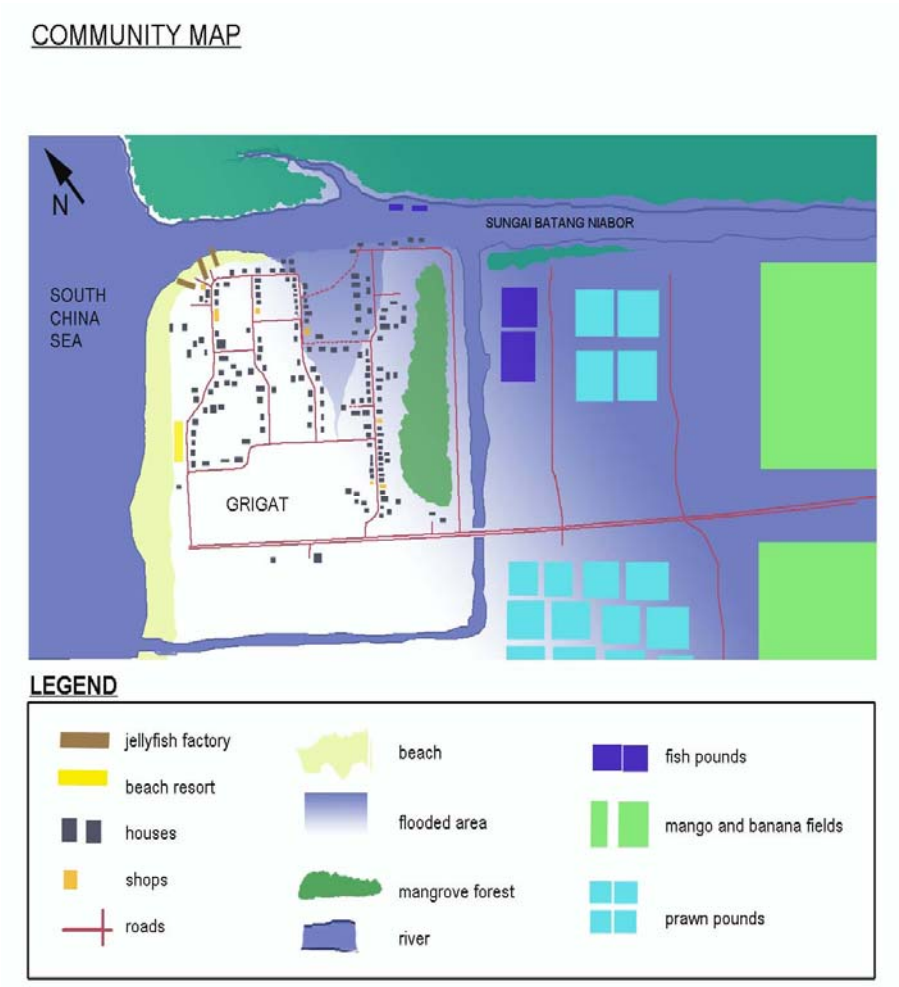


Figure 1 The community map and the village time line have also been made based on interviews and transect walks

Gerigat is a Malay village of about 1000 inhabitants, primarily Muslims and traditionally living from fishing and timber logging in the mangrove. A minority of Chinese people also lives there and 2 headmen are sharing the management of more than 170 households. A primary school, a kindergarten, 7 grocery shops, 2 mosques represent the villages facilities whereas 3 jelly

fish factories, a beach resort and mango cultivation constitute themajor local activities besides selling product from the sea or the mangrove. Aquaculture ponds also take place nearby the village but without involving anybody from Gerigat. major local activities besides selling product from the sea or the mangrove. Aquaculture ponds also take place nearby the village but without involving anybody from Gerigat.

1930-1960	fishermen from other villages fishing in this area started to built houses for seasonal stay
1964	17 fishermen houses were located in Gerigat
1970	M. Lau stared the jellyfish production and the beach resort
1974 -75	The temporary place was slowly becoming a permanent village
1996	Electricity supply
1997	Water supply
1998	The village is getting 2 headmen instead of one.
1999-2000	Road was constructed
2003	The fish catch start decreasing
2004	Mango plantation IADP scheme implemented
2005	Banana plantation IADP scheme implemented
2008	Retaining wall project is being implemented

Table 1 The village time line have also been made based on interviews of the headmen and old people

Geographical and history description

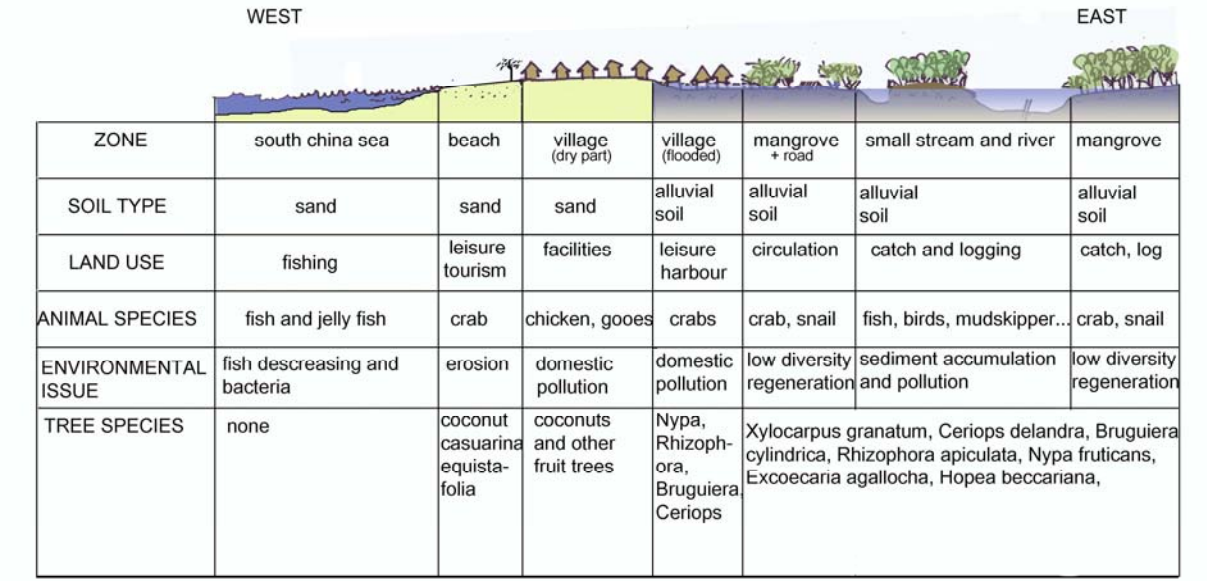
In the 1950s, Gerigat was a temporarily station for fishermen coming from Sessang, during the fishing season (April to July). In the 1960s they started to built houses on the present location of the Jellyfish factories (East). They were using the trees growing there. Since then, the erosion of the sand bank never stopped and caused several problems for the growing community. The beach is to some extent used for recreational activities by the locals and is appreciated by the resort customers. The sign indicating the village even says "Gerigat Beach"

Gerigat lies on the outermost delta of the Nyabor River, which is part of Rajang River Delta, with the South China Sea towards the west and the river delta towards north. Mangrove forests surround the village and grow on each river bank . There is a sandy beach right south of the river mouth which stretches approx. 2 km and is influenced by the silty sediment supply from the river. The tide was strong during the first days of March, because of the spring tide period.

Water plays an important role in everyday life in Gerigat. Sea fishing and jelly fish production enrols a large part of the community, and the tide floods half of the village once a day.

Therefore, Gerigat developed like a typical Malays village, due to the traditional location nearby the sea and riversides. The houses are supported by piles, which prevent the houses from humidity, and a number of streets are reduced into wood jetties (see the map).

According to the oldest generation, Gerigat is located on a sandy Laguna, between the sea and the river, which is reduced in surface every year since the first house has been built there.



ZONE	south china sea	beach	village (dry part)	village (flooded)	mangrove + road	small stream and river	mangrove
SOIL TYPE	sand	sand	sand	alluvial soil	alluvial soil	alluvial soil	alluvial soil
LAND USE	fishing	leisure tourism	facilities	leisure harbour	circulation	catch and logging	catch, log
ANIMAL SPECIES	fish and jelly fish	crab	chicken, gooes	crabs	crab, snail	fish, birds, mudskipper...	crab, snail
ENVIRONMENTAL ISSUE	fish descreasing and bacteria	erosion	domestic pollution	domestic pollution	low diversity regeneration	sediment accumulation and pollution	low diversity regeneration
TREE SPECIES	none	coconut casuarina equista-folia	coconuts and other fruit trees	Nypa, Rhizoph-ora, Bruguiera, Ceriops	Xylocarpus granatum, Ceriops delandra, Bruguiera cylindrica, Rhizophora apiculata, Nypa fruticans, Excoecaria agallocha, Hopea beccariana,		

Figure 2 The transect walk is giving a picture of the community characteristic and the landscape composition. On 2 transect walks, only one is shown here because the information are nearly the same on both.

Village organisation

Since 1998, there are two districts in Gerigat for administration purposes. The population is increasing, in number of people per household and in number of households. At present, there are 80+ and 90+ households under the management of each headman.

Both of them have a committee with 12 members who are chosen by the villagers and divided into different bureaus for education, security, health, youth, religion, infrastructure, social, gender etc.

Activities

Gerigat's major socio-economical sustainability consists of the exploitation of natural resources. The easy access and the combination of diverse seasonal income sources make exploitation profitable.

Sea fishing consists of going every day to the sea, from 8AM to 4PM with handmade nets on engine boats. The fish is for own consumption and sale to buyers who give money, petrol, or housing in exchange.

The jellyfish catch is also a big part of the fishermen income when it is the season. These are processed into three factories which occasionally employ women and children for washing, salting and conditioning the jelly fishes.

The mangrove exploitation is a traditional practice. It consists of catching crabs and snails (Non Timber Forest Products, NTFP) and logging timber from the forest. It is an alternative for earning cash when the fish season is off.

The prawn farm is owned by an outsider from Sarikei/Sibu and is benefiting from the fresh water from the river. The land is rented from the villagers for a 15 years period and was formerly covered by mangrove.

The mango plantation has been established by the governement for developing commercial agriculture under The Rural Economic Development program (IADP). The plantation has just been established, so people just start to earn money from it.

The banana plantation is also an government program, exploited by people from Kabong.

Several grocery shops are spread out over the village. Often tended by women from upper class households. they are the only source of commercial products in the village.

The fish ponds are an individual initiative of Mr. Tiong, buyer, fish seller and owner of a shop and a jellyfish factory, supported by the state.

The beach resort is also an individual entrepreneurship that has been created by the Chinese Lau family in the 1970s. Mr. Lau also owns the two other jellyfish factories. He is welcoming visitors in a 100+ bed-chalet, most often during holidays, for short stays and for eating in the sea food restaurant.

Cattle: 5 persons are owning cattle in Gerigat, and these last are walking around all day. They are often found on the beach or gardens. We were told by the headmen that in the 1950s, there were about 100 cows in Gerigat while today there are only 22 left.

Socio-Economics and human dynamics

Introduction

In this part we aim to evaluate the dynamics of the socio-economic life in the village, and therefore a range of methods help us to demonstrate the significant tendencies. Our hypothesis in the synopsis was that the river should be a major resource for the livelihoods organisation, thus we wanted to look at the management of the natural resources. Our investigation in the field was observing the livelihood system by collecting data on each activity.

Methods

First we based our work on key informant interviews with the headmen, Mr. Lau, Mr. Tiong and the farmers we met in the mango plantation. The *15 semi structured interviews* and *26 preference rankings* were focused on the labour and the amount of income; this was completing the information from the previous interviews. These last methods allowed us to make graphics showing the preferred activities, in general, or concerning income, health, easy, labour, future security, tradition and government support.

The general preference ranking on activity (graphic 2) is showing a rank on the other way around compared to the others (table 3-9) because the method used for asking people about their preferred activity in general wasn't a ranking by putting a number, but by choosing the preferred activity between two activity. So the more they choose the same activity, the more this is considered popular (see appendix for the table)

Afterwards we made a *seasonal calendar* to present how the villagers are jumping from activity to activity throughout the year. This was based on the same 15 semi-structured interviews about income.

The resource flow map used below has been created after gathering information from the field, interviews, transect walks and observations. It enables us to locate the transactions from the direct resources to their destination, as well as the inputs from outside.

Finally, the *Venn diagram* shows the relationships between people and the diverse investments in community life. The purpose is to underline the flow of the resources (exploitation/sale) in relation with the different actors: labour, investors and suppliers from outside.

This permits us to identify the actors and factors influencing the socio-economic life of Gerigat, and the network around them.

Results

Assessment of the diversity of activities based on preference ranking and young people and workers interviews (see appendices)

Our first hypothesis about Gerigat's economy was totally turned around after investigating the field.

While we thought there were few opportunities and a great dependency on the outside investments, we realised that on one hand Gerigat is socio-economically rather independent thanks to the exploitation of their natural resources, and on the other hand the prawn farm or the mango scheme do not add anything or only a small part to the villagers' income.

According to the different graphics, mangrove exploitation and fishing is obviously the traditional activity in Gerigat and still the most popular among the workers. In the preference ranking about tradition villagers rank collection of NTFPs on the 3rd place and forest logging on the 4th place, after jellyfish production and fishing. In the income preference ranking, villagers rank forest logging and collection of NTFPs on the same level as fishing and working in the jellyfish factory. These are all the more preferred sources of income.

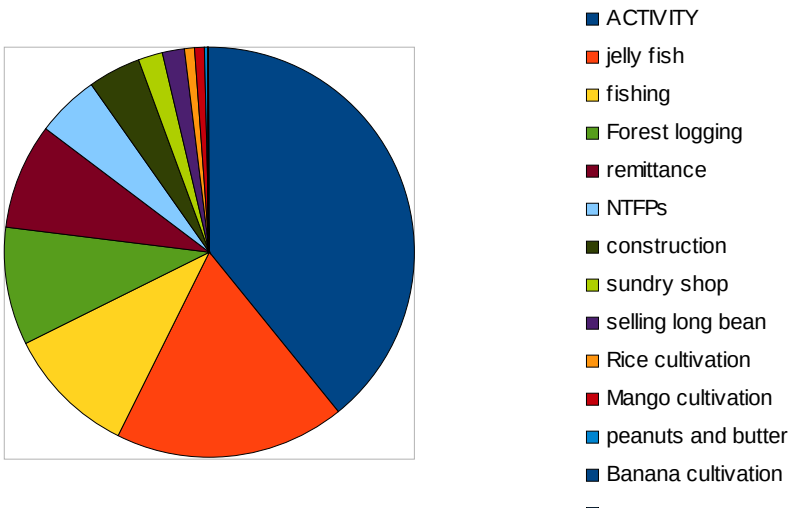
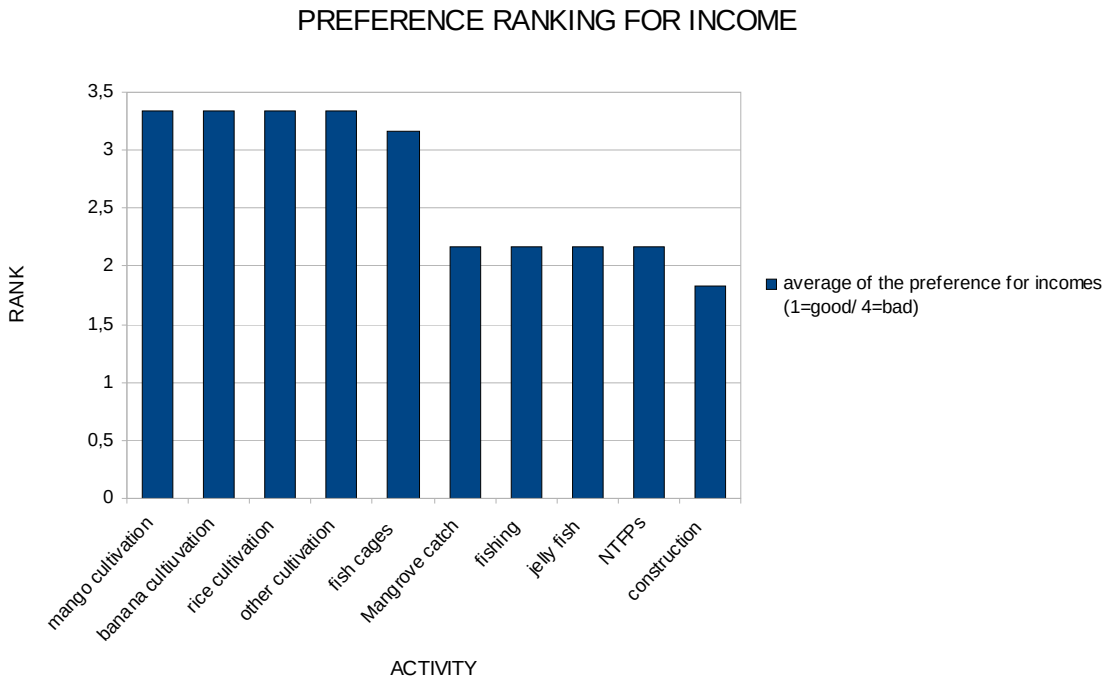


Figure 3 Distribution of income per month for each activity. See appendix for exact values.

Jelly fish is especially a valuable source of income; one fisherman can earn up to RM250 per catch. It is a short season and it varies from one day to another but it is well appreciated by the fishermen (see graphic 1 and the 15 workers interviews in appendix).

The exploitation of the mangrove is preferred because of its easy access, labour, health and income. It is also the only activity they really have during December and January (see seasonal calendar) and thus a good alternative for the low season. However, concerning future security

villagers are not so confident about relying on the mangrove (the forest logging comes on the 6th place, and collection of NTFPs comes last, graphic 7).



Figur 4 Preference ranking of the ACTIVITY according to the INCOME. The more income people think an activity is offering, the more close to 1 they rank it. The survey was filled up by 12 persons among the workers in the villages. See appendix for more preference rankings.

It also seems that the majority of the workers have 1 or 2 other seasonal jobs that can complement each other. The preference rankings 7 and 3 show that they wish to work with more secure and well paid jobs like construction, but the chance to get these jobs is very small.

For discussion about mangrove and agriculture see relevant chapters. In the *activities preference ranking* (graphic 2), many persons seem willing to cultivate rice even though it is not used in Gerigat (graphic 8). This could be understood as a desire to develop paddy fields in the area, but the terrain in Gerigat is not suitable for rice cultivation[1]. Moreover there is no project no existing scheme to support rice cultivation in Gerigat. The result about rice cultivation is thus conflicting and considered not relevant.

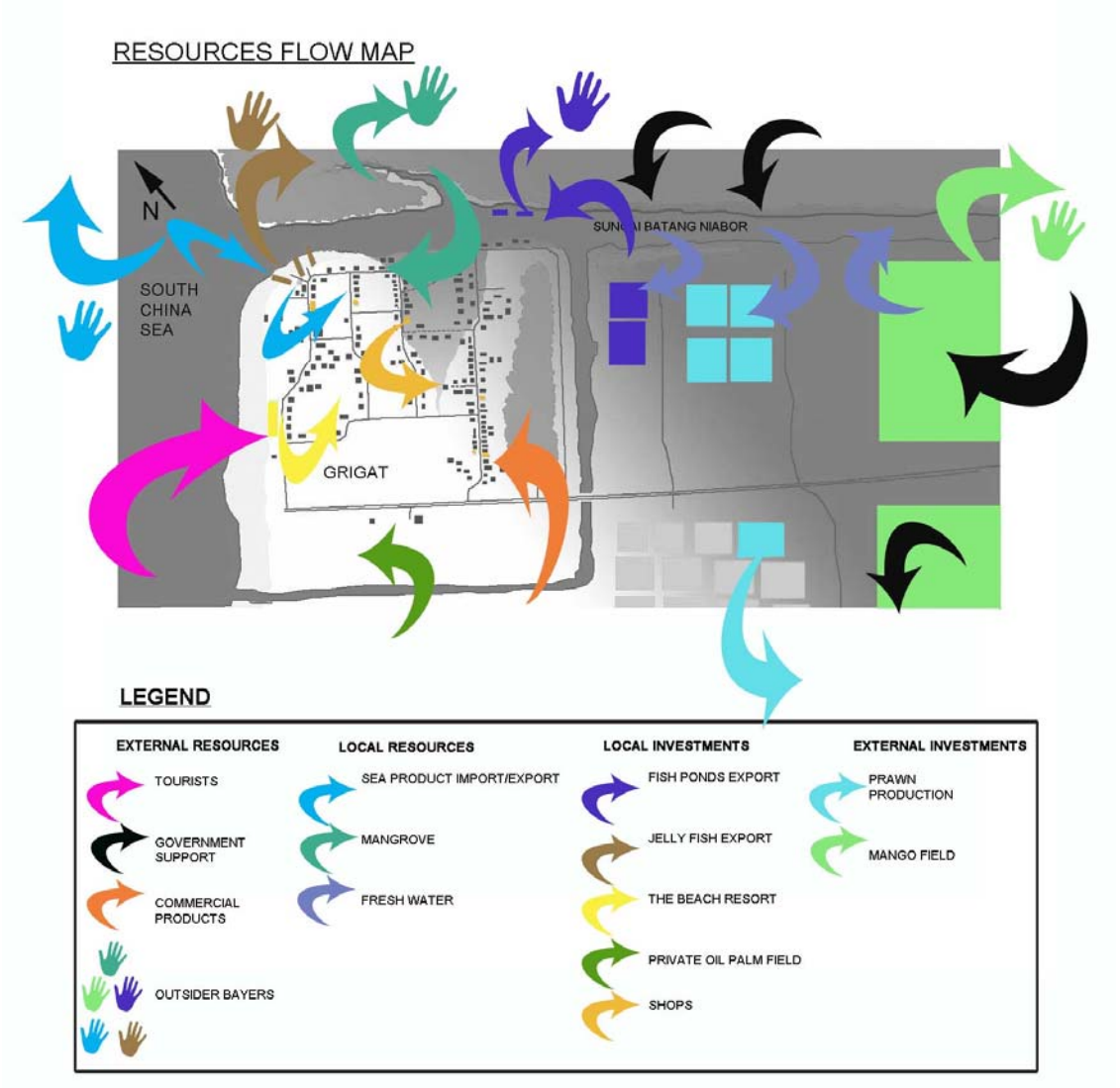
One of the headmen told us that until the recent implementation of the Mango commercial cultivation project, Gerigat has never been an agricultural village. The traditional preference ranking (graphic 8) confirms this. On the other hand, according to the oldest generation of the

1 The natural vegetation is mangrove, and cutting the trees and drain the land like it has been done in the mango fields will make the soil very acid.

villagers, before the erosion of the beach started in the 1960s, people were cultivating coconuts and water melons on the north-west side of the coast (presently face to the resort and close to the factories).

Resource Flow Map and the seasonal calender

The seasonal calendar shows that Gerigat's socio-economic system is characterised by a mixture of means of exploitation. There is a good spread of the resource spots over the overall community area and a balance between the different seasons they can work in. Indeed the year and the area seem to be always covered by one occupation or another. Though, the villagers can earn cash year-round. This make the village independent in the way people are controlling their sources of income.



Figur 5 The resource flow map show the flow with arrows, turned to the village when it is a village benefit, or toward aoutside when there is a selling. The colors design the diverse landuses. The hands represent the buyers.

On the other hand, not everybody is involved in every activity. People generally rely on a couple of them, like: fishing +mangrove catch, construction + fishing, mangrove exploitation + mango cultivation.

	fish	jelly fish	mangrove catch	forest logging	mango	banana	rice
january							
february							
march							
april							
may							
june							
july							
august							
septembre							
octobre							
novembre							
decembre							

Table 2 Seasonal calender based on the interviews with workers about their income and activities.

The interviews show that even when fishing is not the main activity, there is always a member of the family (uncle, father, cousin) who owns a boat and brings fish for the household self-consumption or asks for help to catch fish.

The resource flow map is showing key elements of the village system, the major inputs and outputs and flows within resources. It also gives a basis for reflection on the possible development of the socio-economic system. Factors are categorised whether there is investment or exploitation. Services, land type and implemented activities or products are distributed in the community area, which is the background of the map.

	Exploitation system or location	Inputs	Outputs for the village/villagers
1. Local investments	Beach resort	-Mr and Mrs Lau's labour -Private investments -Visitors	-Money from tourists consumption, -Village reputation
	Grocery shops	-Private investments in commercial products -Reduction of the living space for stocking the product -Labour	-Providing services -Availability of commercial products.
	Private oil palm plantation	-Fertilizers -Herbicides -Labour	-Direct income from sale oil -Not depending on joint venture
	Fish ponds/cages	-Labour and private investment from owner -Maintenance -Infrastructures -Government support (for fry)	-Income from export of the fish -Reputation for high quality product -Experiment on potential for development of more fish ponds in the villages.
	Jellyfish factories	-Infrastructure -Maintenance -Employees	-Create jobs in the village -Market for the fishermen -Reputation and income from export

2.External investments	Mango scheme	-Government support (fertilizer, herbicides, infrastructure) -Farming -Labour -Loss of mangrove	-Creation of jobs -Income from sale -Own consumption
	Prawn farm	-Investments from outside owners (from Sibu), -Land reduction in Gerigat	-Rent of the land from villagers
3. Local and direct resources	Sea	-Boat -Fish net -Fuel	-Fish, jelly fish -Food -Money -Seafood restaurant -Beach resort
	Mangrove forest	-Boats -Fuel -Tools for harvest	-NTFPs -Food -Income -Potential for adventure tourism (See tourism ch.)
	River	-Boats -Infrastructure for pumping -Cage/ponds	-Transport -Aquaculture
4. External and indirect resources	The buyers from other villages and Sibu, Sarikei etc	Availability of products (fish, jelly fish, NFTPs, timber)	-Market -Income
	Government support	-Loss of land	- Drained land - Save money -Implementation of suitable land for agriculture
	Tourist	-Services implementation	- Income
	Commercial product	-Investment (capital)	- Shopping (service)

Table 3 This table is based on the resource flow map analysing the system relative to the village benefits:

Analysis

We know that these statistics are not exhaustive and might show only partial results. Furthermore, most of the 26 interrogated for preference ranking persons didn't really choose their job. However regarding to the diversity in the activities they do, it was interesting to know opinions on the importance of each source of income. This provides a basis to evaluate the systems of exploitation and the organisation of the livelihoods.

The result from the investigation on the socio-economic system of Gerigat, shows us the complexity of the interaction under each resource, actor and investment. This understanding allows us to identify other potential investments in: agricultural schemes, developing the fish ponds production to eradicate the future lack of fish in the sea, developing micro-commerce to support the increasing tourism activity (see Chapter 8).

From this analysis, we can identify negative and positive aspects of an eventual development of outsiders projects in Gerigat. On one hand the villagers will have less control on their land and their livelihood, but on the other hand, they will get more regular cash income by getting salaries. In other words, the number of jobs might increase but the villagers independence will decrease. And finally, because the majority of mono-cultural plantation schemes are environmentally unsustainable, Gerigat will experience a degradation of the natural resources (see for example further analysis on the mango scheme and the impact of the river in the next chapter).

We realize after investigation that the river plays a less important role than the sea in the livelihood. The river is even a source of problems by bringing debris and garbage from upstream into the village and by flooding part of it every day at high tide.

Immigration and unemployment

Our hypothesis was that young people didn't want to live in Gerigat and therefore migrated towards the larger cities, see interview with young in appendix.
Looking at our answers in the table based the interview with young people (see appendix) it becomes clear that the level of education is rather high though only one informant had a specialised education besides secondary school. Three of the informants were still in school, two of them had a steady job but the rest was either unemployed or for most of the girls' part married.
Almost all of the informants have an idea on what they want to do but almost all of them don't do anything. So even though they had the basis to get a specialized education it seemed like this wasn't the reality.
This could be explained with them being between secondary school and a higher education, which only applies to one respondent.
Another explanation could be that if you have a higher education in Gerigat, you are forced to leave the village if you want a job in your field. The village itself simply doesn't offer any. A lot of the families we talked to had children studying or working in larger cities.

Venn diagram

It appears that besides the primary exploitation of natural resources, some key figures, not originally from the village, are running their own business in Gerigat with a demand for participation from the rest of the population. According to the categories established above for the resource flow map, these are local investors who play a role in the village livelihood.

They are buyers for fish, giving in exchange money, fuel or even house renting.
According to the Venn diagram, Mr. Lau and Mr. Tiong are keys resource persons on which others villagers depends for their livelihood; for example, the have created the jellyfish market. In the season Mr. Tiong daily received 200-300 jellyfish with he bought for 1 RM/jellyfish and sold after processing for 9000 RM/ton – 36000 RM/ton depending on the type of jellyfish. He didn't have any steady employed but hired people on a day to day basis. Mr. Tiong and Lau are aware of their influence or 'power' in the village. Mr. Lau is the only one able to attract tourists to Gerigat, and we learnt from him that it is only because of lack of time that he is not developing further this potential. Mr. Tiongs experiment with the fish ponds and cages are seen as a marginal investment. He actually experienced dead fishes in the pond but his ambition could engage others in the village in the future.

For further information on these keys informants see the portrait of Mr. Lau and interview with Mr. Tiong in appendix) and information on the resort in the tourism chapter. See also the aquaculture part.

Agriculture

Introduction

In our synopsis we wrote that we wanted to find out why the area under agriculture was decreasing. We wanted to look at three different issues: the potential pollution of the agricultural fields from the prawn ponds, the efficiency of the IADP program and the livelihoods strategies and preferences of the farmers.
However, when we visited the mango plantation we soon found out that the majority of villagers is participating in this scheme. Because of this we decided to find out how sustainable this mango plantation is and what amount of the household income comes from agricultural production.

Methods

We interviewed farmers (see appendix), did preference rankings (see appendix) and took soil samples. We took in total 30 soil samples in 3 different spots. We took 4 samples in the mango plantation, on 3 different depths: 0-15 cm, 15-30 cm and 30-45 cm. In the mangrove area next to the mango plantation we also took 4 samples on the same depths. In the village mangrove area we took in total 6 soil samples in 4 spots. We could get samples from different depths in only one spot.
Unfortunately we could not interview an IADP officer.

Results

Description 'Integrated Agricultural Development Program'

The Ministry of Agriculture started the Integrated Agricultural Development Program (IADP) in Kalaka-Saribas district in June 1986. Since then several programs have been installed, including the Gerigat mango plantation scheme (354 ha) and the Gerigat banana plantation scheme (46 ha). People from Gerigat participate in the mango scheme, but only people from Kabong participate in the banana scheme.

More than 100 families are participating in the mango scheme and each family owns around 3-5 acres of land (approx. 1,2-2,0 ha). The fruits are used both for domestic consumption and for selling on markets in e.g. Sarikei. The planting density for the first 3 years is 100 trees per acre.

Income/preference ranking

The 5 different agricultural sources of income (selling long bean, rice cultivation, peanuts & butter, mango cultivation and banana cultivation) take the last 5 places in the income ranking.

Preference ranking	**Mango**	**Rice**	**Banana**	**Other**
Income	Bad	Bad	Bad	Bad
Health	9th place	6th place	8th place	7th place
Labor	10th place	8th place	9th place	7th place
Easy	10th place	8th place	9th place	7th place
Future security	5th place	2nd place	3rd place	4th place
Tradition	7th place	5th place	6th place	10th place
Government support	3rd place	1st place	2nd place	4th place

Table 4 Preference rankings of villagers for agricultural production

Sample	EC in soil solution	pH	Potassium	Phosphorus (µg P g-1 soil)
Mango S1 L1 + L2	0,58	3.8	Low	0,48
Mango S2 L1 + L2	0,58	3.8	Low-Medium	0,64
Mango S3 L1 + L2	0,58	3.9	Medium	0,64
Mango S4 L1 + L2	0,76	3.7	Low	0
Mango S1+2 L3	0,72	4.7		0,72
Mango S1+2 L3	1,08	4.6		0,72
Forest S1 L1 + L2	21,24	6.3	Medium	0,12
Forest S2 L1 + L2	24,37	6.2	Medium	1,12
Forest S3 L1 + L2	20,45	5.8	Low	1,12
Forest S4 L1 + L2	21,02	5.1	Low	1,12
Forest S 1+2 L3	28,91	6.7		0,88

Forest S 3+4 L3	28,26	6.6		0,88

Table 5 Test results from soil samples from the mango plantation and mangrove forest. L 1 = 0-15 cm, L2 = 15-30 cm and L3 =30-45 cm.

An adult tree can yield approximately 20 kg of fruits per harvest, and there are 2 harvests per year. During the first years the planting density is 100 trees per acre. The average price is 6 RM per kilo. This means that theoretically a farmer with 3 acres (300 trees) could get an income of 36000 RM per year. But the yields of mango trees can vary a lot per year.

Until the trees were 2,5 years old (in August 2007) the flowers were cut off to promote vegetative growth. The trees started producing in August. The farmers also told us that the plantation uses many inputs during the first years, and some farmers quit the program.

Only sample 1 and 4 in L1+L2 of the mango plantation had a low to medium Nitrogen content. This is probably due to the use of fertilizers in the plantation.

The soil in the mango plantation area is considered salt-free. The soils in the mangrove forest and village mangrove area are strongly saline.

The pH in the mango plantation is very low, this might influence nutrient availability and create risks of Al, Fe and Mn toxicity. The pH is probably this low because Rhizophora, one of the main species, forms fibrous muds. These fibrous muds accumulate oxidisable sulphur. *(Hesse, 1961)* The potassium levels are low, which means the soil has a low fertility.

The levels of available phosphate in the mango plantation are very low. This is also influenced by the low pH, which immobilizes phosphate in the soil. The low pH also negatively influences root growth and function, which makes it more difficult for the roots to take up nutrients. (Rowell, 1994)

The other negative effect of a low soil pH are decreased amounts of exchangeable Ca^{2+} and Mg^{2+}, the amount of Al^{3+} increases, toxic elements like aluminum and manganese become more soluble.

Samples	**% Nitrogen**	**% Carbon**	**C:N ratio**
Mango S1 L1&2	0,1664	1,976	11,875
Mango S2 L1&2	0,3037	4,527	14,90616
Mango S3 L1&2	0,171	2,251	13,16374
Mango S4 L1&2	0,2758	4,385	15,8992
Mango S1&2 L3	0,254	4,35	17,12598
Mango S3&4 L3	0,2155	0,5084	2,359165
Forest S1 L1&2	0,1664	2,51	15,08413
Forest S2 L1&2	0,171	2,32	13,56725
Forest S3 L1&2	0,1953	2,997	15,34562
Forest S4 L1&2	0,175	2,617	14,95429

Forest S1&2 L3	0,199	3,218	16,17085
Forest S3&4 L3	0,1987	3,994	20,10065

Table 6 The organic matter content in the mango and mangrove forest soils

We also analyzed the organic matter contents of the soils and calculated the C:N ratio. In both the mango plantation and the mangrove the C:N ratio is high. In the mangrove this is probably because the natural vegetation is more or less intact, which means all the litter goes back into the soil. Also the anaerobe conditions in the soil here slow down decomposition.

In the mango field the low pH reduces the activity of soil organisms and thus leads to an accumulation of organic matter. The reduced activity of soil organisms also leads to reduced mineralization and a lower availability of N, P and S. (Rowell, 1994) The normal range of pH for mango cultivation is between 5.5 and 7.5. (Samson, 1986)

Analysis

Although rice cultivation is seen as a secure source of income and the government support is apparently good, villagers don't like to engage in it, because of the high labor input, low income and health risks. Striking is that they see rice cultivation as more secure, while hardly anyone is involved in it, especially compared to mango cultivation. Agricultural production is not a traditional source of income and except for the mango scheme, few villagers engage in it.

Although it seems like the mango trees are growing well, the soil samples draw a different picture. The fertility of the soil is extremely low and more importantly, the pH is very low. This can cause severe problems in cultivation. This means a substantial amount of fertilizers has to be applied. The fact that the villagers are also advised to use many pesticides, growth regulators and herbicides is also not very beneficial for the environment. These chemical products will probably also contaminate the river through leaching into the drainage channels. Overall it does not seem that the mango plantation is an environmental sustainable source of income.

The plantation has a potential of providing a substantial income, but until now it does not add much to the total income.

In the next couple of years the 300.000 trees in the plantation will start producing fully. There are no provisions for the sale or export of all those mangoes, which could flood the local market.

Forest resources

Introduction

In our synopsis we wrote that we wanted to find out which influence the mangrove had on the livelihoods. Our hypothesis was that the mangrove area was severely degraded and thus had no ecotourism potential and did not offer enough coastal protection.

Methods

In order to find out about this, we conducted a forest inventory in 5 plots, got preference rankings on sources of income, and interviewed the headmen, Mr. Lau and some fishermen. The tourism potential is discussed in chapter…

The forest inventory was conducted in 5 plots: 2 plots on the other side of the river, 2 plots on the village side of the river near the prawn farms, and 1 plot in the forest within the village boundaries. The plots were 10 x 10 m. Within each plot, the abundance, circumference and species of trees was recorded. The species and abundance of saplings was also recorded.

Results

Importance of forest resources for livelihoods

Out of 13 sources of income, forest logging is on the 4th place income-wise, with 750 RM per month. The collection of Non Timber Forest Products (NTFPs) like snails, fruits and crabs is on the 5th place, with 621 RM per month. Only jellyfish and fishing are more important sources of income.

Preference ranking	**Forest logging**	**Collection of NTFPs**
General	9th place	10th place
Income	Good	Good
Health	1st place	2nd place
Labour	1st place	2nd place
Easy	2nd place	1st place
Future security	6th place	10th place
Tradition	4th place	3rd place
Government support	8th place	7th place

Table 7 Income and preference rankings for forest logging and collection of NTFPs

State of the forest resources

According to the headmen, the forest area is decreasing due to coastal erosion and logging activities. But also the conversion of mangrove into prawn farms and the establishment of the mango plantation in a former mangrove area reduce the area under forest.

Before they used to cut only the big trees, but now they also cut the smaller trees. They mostly get timber from the forest area on the other side of the river, quite far from the village. The timber is sold as construction material. They used to produce charcoal as well, but don't use it anymore. The leaves of the Nypa palm are used for roofing, and the core and fruits can be eaten. Other products from the forest are crabs and snails. According to the headmen, these are still in full supply. The headmen also told us that the species in the forest are changing, especially on the other side (not village side) of the river. The water brings seeds from other species like Tengar Tikus (*Ceriops delandra*), Berus (*Bruguiera cylindrica*) en Nyireh batu (*Xylocarpus granatum*).

Bakau (*Rhizophora spp*) and Berus (*Bruguiera cylindrica*) are the species used for timber.

Forest inventory

We found 9 different species: *Xylocarpus granatum, Ceriops delandra, Bruguiera cylindrica, Rhizophora apiculata, Nypa fruticans, Excoecaria agallocha, Hopea beccariana, Heritiera globasa* and *Croton tiglium*. These are all true mangrove species, except for *Hopea beccariana* and *Croton tiglium*. Of the species *Heritiera globosa* and *Croton tiglium* only saplings were encountered.

PLOT 1	**Abundance/plot**	**Basal area/ha**	**Saplings/plot**	**Soil type upper layer**	**Comment**
Rhizophora apiculata	10	12,53	7	Alluvial soil	
Bruguiera cylindrica	2	11,92	65		
Xylocarpus granatum			1		
PLOT2					
Xylocarpus granatum	4	9,19	0	Sandy soil	
Hopea beccariana	1	0,97	6		
Bruguiera gymnorrhiza	1	0,08	0		
Croton tiglium			1		
Heritiera globasa			5		
Rhizophora			2		

apiculata					
Nypa fruticans	24		0		
PLOT 3					
Bruguiera cylindrica	3	0,51	0	Sandy soil	Traces of previous burning
Hopea beccariana	12	2,17	2		
Excoecaria agallocha	9	20,37	0		
Nypa fruticans	35		3		
Xylocarpus granatum			2		
PLOT 4					
Xylocarpus granatum	16	15,14	3	Alluvial soil	
Excoecaria agallocha			11		
Bruguiera cylindrica			2		
PLOT 5					
Rhizophora apiculata	13	6,56	35	Alluvial soil	Past logging traces
Bruguiera cylindrica	7	3,59	0		
Ceriops delandra	6	0,83	165		
Xylocarpus granatum			4		

Table 8 Abundance, basal area (m^2/ha) and sapling abundance per species in the 5 plots.

In order to find out if the basal area and biodiversity of the Gerigat mangrove is low, we will compare these data with those of the (near virgin) Sematan mangrove area which is a national park. Ashton & Macintosh conducted a forest inventory here in 2000. The shown figures are averages of in total 9 plots in 2 different places.

Trees	S1	S2	G1 (other side of river)	G2 (village side of river)	G3 (village mangrove)
Abundance	20,6	31,5	21	37,5	26
Basal area (m^2/ha)	36,15	28,51	17,35	19,095	10,98
Species	4,8	6,25	3	2	3
Saplings					
Abundance	48	43,25	43,5	11,5	204

Species	4,6	6,25	2	3,5	3

Table 9 Comparison between average abundance, basal area and species of trees and saplings in Sematan forest area (S1 & S2) and Gerigat (G1, G2 and G3). (Ashton & Macintosh, 2000)

If we compare the tree abundance of Sematan with Gerigat, there does not seem to be a big difference between the two. All samples have averages between 20 and 38. However, the basal area in Sematan is higher than in Gerigat. Both averages of Sematan are above 25 m^2/ha, while the three averages of Gerigat are below 20 m^2/ha. Especially the forest near the village has a very low basal area. Also the number of species is quite different, the averages of Sematan are around 5-6 species per plot, but in Gerigat the averages are 2-3 species per plot.

The saplings abundance of the other side of the river plots is comparable to those in the Sematan area. But the abundance of saplings on the village side of the river is very low, while the saplings abundance of the village forest is very high.

The number of sapling species is between 2 and 4 in Gerigat, while it is around 4-6 in Sematan.

Analysis

The mangrove plays a reasonably big part in the livelihood of the villagers of Gerigat. They get quite some income from it, they prefer it above other sources of income concerning health, labor and availability, but they don't think they will be able to rely on it in the future. This probably means that they know the resource is degrading. Another contradictory thing is that in the general preference ranking they seem to prefer agricultural production above mangrove exploitation.
According to the headmen, fishing and mangrove logging are attractive sources of income for people from outside, and the main reasons why they want to live in Gerigat.

The abundance of trees in Gerigat is comparable to the abundance of the Sematan forest area. However, there are less different species and also the basal area is lower than in Sematan. The regeneration seems to be 'normal' in Gerigat, but also here the number of species is limited.

One of the striking things is that there are often saplings in the plots of species of which there are no adult trees in the plot. This could explain the claim of the villagers that there are new species in the mangrove. Most of the true mangrove species have seeds that float, and are dispersed in this way. Plot 2 and 3 have both a low number of saplings, both these plots are near the river and thus flooded frequently. Apparently seeds are removed from the area but not many are deposited there. Another explanation could be that due to logging there are less adult and seed producing trees, and thus less seeds and less regeneration.

There seems to be a lot of logging, and because logging is illegal people do not take care of the resource. The coast line changed a lot during the past 50 years. The degraded mangrove does

not offer enough protection against the eroding forces of the sea. This is already obvious on the other side of the river, where the mangrove meets the sea, the mangrove is losing terrain.

Aquaculture and Fishing

Introduction

As mentioned in the introduction, the water bound activities playes a large role in the maintenance of livelihood in Gerigat.

When we left Denmark we didn't know how big a role the fishing played in terms of sustaining the livelihood. But we had the hypothesis that especially the prawn farm was contributing to the pollution by letting out excessive amounts of nutrients and maybe antibiotics to the river. In addition to that we also thought that it only contributed with limited resources in terms of labour, self sufficiency and income.

In the attempt to elucidate the environmental impact of the socio-economic activities we did some investigations on water related activities. The importance of the aquaculture and fishing concerning livelihood is mentioned in 'Socio-economics'.

Methods

We interviewed the manager of the prawn farm, the owner of the fish ponds/cages and one of the jellyfish factories and random fishermen and took water samples from various places around the village.

Fortunately we got appointments with the key informants early in the process. As soon as Sunday we visited the prawn ponds and the following Tuesday we went to the fish cages and the jellyfish factory. We went as a group with our interpreter and did semi-structured interviews. Normally one or two of us were in charge of the interview and the rest of us added questions when we had the need.

We took four water samples, two from sites around the city, one from the nearby prawn ponds and one from the nearby fish pond. The two sites in the city were at the mouth of the river (estuary) and at the pier – see sample map in appendix. These sites were chosen to illustrate the water quality at the beach and clarify whether or not you could swim in the water and to illustrate the cities impact on the water quality. The ponds were located upstream compared to the city – see sample map - and the water analysis from the ponds showed us both the situation in the ponds and gave us an indication of the water quality upstream.

Results

Interview with manager of prawn farm

The farm is owned by an entrepreneur from outside Gerigat and the land is rented from the villagers of Gerigat. Initially the agreement was for the farm to hire workers from Gerigat but because of poor salary and odd working hours the villagers don't want to work there and the

farm only has employees from the Philippines know. In addition to that the farm sells all of the prawns to Sibu or Kuching and thus the farm doesn't add to the livelihood of Gerigat concerning work or food supply.

Turning the attention to the environment, the prawn farm has, according to the manager, very strict control with the water quality in the ponds and there is a legislation concerning the water they let out from the ponds.

[2]Parameters such as pH, salinity and nutrient levels are controlled at a weekly basis and the water has to be settled in a sedimentation pond for at least 72 hours before being let back to the river.

Because they export to Europe they can't use antibiotics and therefore this wasn't an issue in relation to the environment. To prevent diseases in the water they instead added a bio culture that enhanced the "good bacteria" and in that way kept a healthy environment. Also the Phytoplankton was given additional nutrients and therefore had good life condition.

Jellyfish factory and fish cages

When we arrived to Gerigat we didn't know there was a processing of jellyfish and neither a company of fish cages. We therefore didn't have any perception on whether they were polluting or contributing towards the livelihood.

Through our interview with Mr. Tiong we discovered that the fish cages were a relatively new project – only a few years old and still in the experimenting stage. It is governmental supported and engages Mr. Tiong himself and his 3 sons. He has problems in keeping his sons interested and for most of the time it was only Mr. Tiong himself taking care of the fishes.

The project consists of a pond with fry and proximately 30 cages with fish divided on 3 stations in the river. The fry were kept in the pond until they reached a size of ½ kg and not until then moved to the cages in the river and thus Mr. Tiong tried to improve the number of survivors. The pond with the fry was smaller than the ponds for the prawns and not artificially oxidized. It was in theory a closed system but linked with the Nyabor River through a small canal.[3]

The project was very small scaled and was not at this point of great value for Gerigat concerning neither food supply nor employment.

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[2] http://www.did.sarawak.gov.my/urban/html/wasterwater.htm

[3] (Europe has strict regulations on import of food – see http://ec.europa.eu/food/international/trade/im_cond_fish_en.pdf)

Looking at the potential impact the production could have on the environment the first thing to come into mind is the lack of control. Mr. Tiong claimed that he checked pH and salinity but besides that there were no records of wastewater control. The feeding consisted of by-catch and happened on an unsteady basis depending on his ability to get the fodder. Mr. Tiong also told us that he had experienced dead fishes occasionally but couldn't explain why.

Water samples

We took all of our water samples the same day. The analysis was partly carried out by us self and partly with the assistance from the Malaysian technicians. All of the samples were compared with the Interim National water Quality standards for Malaysia (INWCS)

G1 is the sample from the river mouth,
G2 is the sample from the pier,
G3 is the sample from the prawn pond,
G4 is the sample from the fish pond

Station	**Biological Oxygen Demand (mg/l)**	**Chemical Oxygen Demand (mg/l)**	**Nitrate (mg/l)**	**Ammonia (mg/l)**	**Phosphorus (mg/l)**	**Totale Colony Count**	**Feacal Colony Count**
G1		37	0.07	5.96	0.05	TNTC	36
G2		44	0.08	4.6	0.14	TNTC	51
G3		54	0.04	2.82	0.33	TNTC	-
G4		<0	0.01	0.84	0.96	TNTC	-

Table 10 Water sample results from tests conducted in the laboratory.

Station	Temp (°C)	Conduc-tivity ms/cm	TDS (total dissolved solids) (mg/L)	Salinity (PSU)	PH	DO (dissolved oxygen) (mg/L)	Oxidation reducing Potential (Current) (mV)	turbidity (nephel-ometric turbidity units)	Chloride (mg/L)
G1	27,93	45,3	29,44	29,24	7,57	5,27	26	166	9,4
	27,93	45,31	29,45	29,24	7,76	5,47	11	170	9,1
	27,97	45,31	29,45	29,25	7,83	5,45	-4	154,3	9,1
G2	28,04	44,03	28,6	28,3	7,88	4,82	-25,6	240,4	12
	27,72	43,35	28,12	27,7	7,77	4,85	-19,6	206,1	11,1
	27,97	43,68	28,35	28,07	7,81	4,86	-18,5	196,4	9,8
	27,55	43,12	28,03	27,69	7,7	-	20,1	208	9,1
G3	28,39	24,57	15,97	14,86	3,12	8	-27	21,9	22,5

	28,33	24,55	15,9	14,85	3,33	8,02	-20,4	21,7	22,4
G4	28,39	9,654	6,273	5,39	8,13	6,2	-24,8	12,5	5,1
	28,47	9,816	6,38	5,49	7,9	6,25	-13,5	33	5,4

Table 11 Water sample results from test carried out by the Malaysian technicians.

Prawn pond

Our water samples showed that the content of nutrients (nitrate and Ammonia) was very low. This was probably a result of the bio culture (plankton uses the nutrient) but also the fact that the prawns were fed after food intake. Before every feeding certain places in the pond were examined for leftovers. If there was a lot of food left – the prawns were fed less – and vice versa. The Phosphorus though was a bit high and could be a result of the discharge from the prawns.

These data surprised us in the terms of low nutrients and no antibiotic but was a clear result of the extensive control there was from the governmental side.

Chloride is used in the process of reducing nitrite and could explain the higher levels.

According to the manager the salinity should be around 25ppd – however, it varies between 12 and 33.In our result the salinity was a bit low (around 14). This though could be a result of the rainy season and is not therefore seen as an ongoing problem.

A result which stood out was the low pH (3,12-3,33). It is not unlikely – but it seems strange that the pH was *that* low since a pH value below 4 usually kills most species. One explanation could be that since the system was closed the amount of decaying organic waste materials builds up and cause the pH to drop. Because it was very close to harvesting season and hence the water in the pond had been there for some months this is not unthinkable at all.

The Fish cages

The result of the water samples from the fish pond varies from the prawn farm in most areas. If we look at the DO it is lower and more levelled with the river water. This clearly shows the lack of artificially oxidation as used in the prawn farm.

If we compare the results from the prawn farm and the fish pond, we see that the fish pond differs in the way that levels of ammonia and nitrate is lower, conductivity is lower, the TDS is lower, the pH is higher and the turbidity is lower. All this indicates that this production system is far less intensive than the prawn farm. There is less waste products from the feeding and the fishes cossing the value to differ. The Phosphorus is very high though and could be the result of the feeding with dead fishes. A high value of phosphorus is the main stimulant for algae bloom – and could therefore create a potential problem with low DO. (Brown, 1993)

In relation to the environment the results for nutrient would be the ones to focus on but because the production was so small scaled there is no real thread to environment.

A figure to focus on is the one for salinity/conductivity. This is very low compared with the fact that the fishes in the pond are saltwater fish and are going to be moved to the river when they reach a certain size. This could explain the dead fishes Mr. Tiong experienced.

The city

In general we found that the two samples from the city belong to class IIB-III (INWCS) depending on what parameter you focus on. In general the amount of nutrients was low and the turbidity number high. The salinity was rather high compared to that of drinking water. But all in all the data was very normal for river water in the coastal zone and with humus disposal from the nearby peat soil.

One thing that came as a minor surprise was that we found excessive amounts of coliforme bacteria and large amounts of faecal bacteria in both the samples. We did not detect any of these in the two samples upstream in the ponds and we therefore conclude that the bacteria come from the city. We did some research on the sanitary system in Gerigat which could give some explanations for this. The water samples from the city more thoroughly explained in "waste management and sanitation".

Waste management and sanitation

Waste management and the sanitation condition are not mentioned in the synopsis as issues we would look at, but existence of problems with waste disposal and sanitation became apparent the moment we arrived. As this situation is affecting several issues in the village we chose to investigate the situation closer.

Methods

We included questions about waste and sanitation in the interview to the headmen to obtain knowledge about whether it is considered a problem and if so, what they plan to do about it.

Furthermore, we executed soil and water samples in and around the village. The water samples relevant for this issue were taken at the river mouth. The samples should ideally have been taken from the middle of the river, because the water is most well-mixed here, but our samples were taken at the river bank at low depth because of practical reasons.

Soil samples were taken in the city mangrove at low tide. These samples should tell whether the soil is polluted by detergents, and hence whether detergents are leached into the river and sea affecting life in the water and in the mangrove. We managed to take 4 samples within a short distance, but only in one sample we managed to get to the level of level 2 and 3 (each level is 15 cm deep). The soil samples are considered representative for the soil at the city mangrove because the area is not that big (see map) and because the tide water will disperse the pollutants more or less evenly on the area.

Results

Waste management

It is very obvious that the waste disposal system is not adequate to meet the needs of the village. Almost everywhere you go in the village you find domestic waste as plastic bags, wrappings and other things which should be disposed of.

There exists a waste management system in the village consisting of 20 garbage bins supplied by the municipal council. The bins are emptied 2-3 times a week, but this is clearly not adequate. A no-waste campaign was launched many years back in an attempt to limit the disposal of waste on the ground, but that had very little effect. The headmen are aware of the problem, but need some initiative and capital to make people realize the problem.

The soil samples taken in the city mangrove showed high levels of phosphate, which indicates that there is a high release of detergents from the domestic household in the mangrove. The relatively high pH-values are related to the high phosphate-levels.

	Sample	Sample	Sample	Sample
Level	pH=6,8 P =4,8	pH=6,6 P =1,76	pH=6,9 P =2,40	pH=6,7 P =1,76
Level	*n.a.*	*n.a.*	pH=*n.a.* P =1,80	*n.a.*
Level	*n.a.*	*n.a.*	pH=6,1 P =0,88	*n.a.*

Table 12 Results from soil samples shown according to the different depths. Each level is 15 cm deep.

Sanitation

There is public supply of water to Gerigat. The water intake is in Sungai Licok and Sebelak, from here it is pumped into a reservoir in Licok, elevated to tanks in Nyabor and Kabong and then distributed to the villages in the Saratok District, which Gerigat is a part of.

All waste water from domestic households ends up in sieving septic tanks of plastic and concrete. The water sieves through the sandy underground and ends either up in the groundwater or in the river or sea. Sometimes a septic tank is filled up which creates problems with bad smell, and this situation is of course dissatisfying for the villagers.

Station	Location	FCC			TCC	
		# colonies	CFU	INWQS	# colonies	INWQS
G1	River mouth	36	720	IIB	TNTC	III
G2	Fishing pier	51	255	IIA	TNTC	III

Table 13 Water samples analysis result. Calculations of CFU can be seen in appendix. **FCC**: Feacal Colonies Count. **CFU**: Colony Forming Units. **TCC**: Total Colony Count. **TNTC**: The number is too high to count. **INWQS**: Interim National Water Quality Standards for Malaysia.

The water samples show high values of CFU (Colony Forming Units) and TCC (Total Colonies Count) at both locations. According to the Interim National Water Quality Standards for Malaysia (INWQS, see appendix) this places the CFU in G1 in category IIB, which is described as water you can use for recreational purposes, but conventional treatment is required. G2 is placed in category IIA. The counts of TCC in both samples are so high that it can't be counted, and could be placed anywhere from category III and up.

Analysis

The levels of phosphorous in the city mangrove soil samples is not the most interesting aspect, as is the fact that the high levels in the soil means a release of detergents to the river and to the sea. Especially the mangrove areas along the river and sea are vulnerable to even

small changes in the chemical balance, and the phosphorous pollution is therefore crucial in preserving the mangrove habitats.

It is not a clear trend in the soil samples, but it seems that the phosphate level, and to a less pronounced degree the pH-values, decrease with depth, see table 12. The point of release is above ground and it is therefore natural that the levels will decrease with depth due to the limited infiltration capabilities of the soil.

Even though the values of CFU is placed in the relatively safe category IIA and IIB this doesn't mean that it is safe to swim in the water. You can't avoid having some intake of water through your mouth when you swim, and even small amounts of bacteria will have an effect on your system. Furthermore, most other measurements are placed in category III or higher and hence indicate that the general content of bacteria and human waste is high.

The sanitary and waste disposal systems in Gerigat need to be changed in order to decrease the release of detergents, and to clean up the city. It is positive that there exists a waste disposal system already, and it is obviously a matter of funds if this system should be expanded. More important than funds is the mentality of the villagers. As it is now, people do not think about what it means to dispose the waste in the backyard or on the street. People should be made aware of the consequences of this disposal of waste, both for the surrounding environment but also for the local environment, hygiene and appearance.

The sanitary system like toilet drains, waste pipes and septic tanks should be expanded in capacity. Again, it is positive that there already exists a system, which mainly requires additional funds to expand. The combination of sieving septic tanks and easy infiltrated soil is unfortunate, because the waste water easily will disperse to the local as well as the surrounding environment.

Tourism in Gerigat

In the synopsis of this field work we put up 4 questions about tourism in Gerigat. The answers to the questions were supposed to clarify

- the degree of tourism in Gerigat
- the potential income of a tourism industry
- the impact on the surrounding environment
- the economic potential of developing tourism in Gerigat

Even though the answers ideally would be given in qualitative information, it has in practice been very difficult to achieve this information. First of all, the tourism in Gerigat is not managed as an industry and there exist therefore no records or statistics of any kind. Secondly, even if there did exist records and statistics of tourism in the village, it is difficult to define what tourism actually is.

Our main preliminary hypothesis was that the beach would be the main attraction in Gerigat. This was based on the location of the village at the mouth of the river Nyabor and at the South China Sea. It was also based on the existence of the beach resort, which we assumed meant that people came there for the beach. Secondly, we believed that activities as mangrove excursions and river safaris would be potential attractions.

Methods

In order to investigate these hypothesises we conducted interviews with the headmen and with the owner of the beach resort, Mr. Lau. These interviews mostly provided qualitative information, but also quantitative information was obtained this way.

We also conducted 39 questionnaires to random selected people in Sibu, which is a town located approx. 150 km from Gerigat and has a Chinese dominated population of 230.000. The city was chosen for questionnaires because of the ideal distance it has for day or weekend trips, the Chinese dominance in the population and as a representative city for larger cities in Sarawak. We did not expect anyone knowing Gerigat or at least not the resort, since it is such a small and isolated area – it is not a place you pass when going elsewhere. It should be noted that a statistical base of 39 samples is not ideal, and all conclusions drawn from this must hence be critically looked upon.

Furthermore, we wanted to assess the beach as a tourist attraction. This is described in the synopsis as taking sediment samples, estimate climatic and wave conditions and look at sediment dynamics in the near shore and in the river. Upon arrival, though, we realised that the beach is not suited for swimming and that people are not coming for swimming.

Therefore we focused on the potential for adventure tourism by going to the mangrove across the river and by going up the small river going north-west. These trips should tell us whether it is attractive for tourists.

Results

Adventure activities around Gerigat

The beach resort owner can arrange adventure trips as river safaris and mangrove hiking with a local guide (usually one of the village youngsters) in a fishing boat, but Mr. Lau told us that visitors are reluctant to do this, as there are too many mosquitoes in the mangrove area.

The mangrove just opposite the river has been logged for many years, but it has still preserved the impression of a mangrove forest. Tourists interested in seeing pristine nature would enjoy going here looking for Nypa-fruit, crabs and snails, which is still there, and walking in the muddy terrain. There were a lot of mosquitoes around, but this can for some tourists be seen as a part of the experience.

A river safari up the smaller river takes you into a mangrove area almost without human influence. There is fishing nets and boats going there for timber, crabs and snails but the riverbank doesn´t seem influenced by these activities. The full trip to the beginning of the river would take you 2 hours, and is therefore suitable for a daytrip going up and down the river.

This kind of tourism directed towards a rather small group of tourists, which is confirmed by the 8% of local people travelling having the purpose of hiking and travelling. National and international tourist would have a bigger interest in adventure tourism than local tourists.

Beach resort

The “Gerigat Seafood Resort” is located at the edge of Gerigat just at the coastline and is owned by a local Chinese businessman, Mr. Lau. At the high tide line in front of the resort there is a wooden coastal protection, which presently seems to be degraded by undermining. The resort is mainly visited by tourists from larger cities in other parts of Sarawak. According to Mr. Lau the most common visitors are church groups for bible study, students and families. During our stay in the resort, we observed that the majority of the visitors were Chinese, which is supported by the questionnaires. Of the people who know Gerigat, all 3 Chinese people know the resort, while only 2 out of 13 people with other ethnical background know the resort. The resort is open in public holidays, weekends and when people call in advance and book dinner or rooms, and there are about 50 guests in the resort during the major public holidays, but the capacity is over 100 beds. Mr. Lau points out two reasons for people staying and dining in the resort; the good seafood and the fresh sea breeze. Assuming that “enjoying the sea breeze” and “beach” in question 8c in the questionnaire is the same, this statement is accurate, see figure 6. During our stay we saw families take a stroll on the exposed beach at

the time before sunset, and we saw them having dinner at the resort afterwards. This seems to be a common way of visit. The general trend in the questionnaires is that almost half of the people travelling have the purpose of visiting friends or families (44 %), the purpose of dining (10%) and other purposes (31 %).

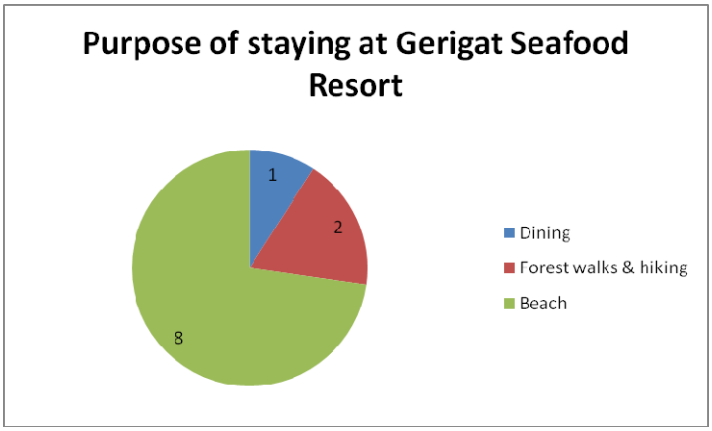

Figure 6 Pie chart showing why visitor´s main reason to come

The villagers and headmen in Gerigat support the resort and benefit from tourists buying fish, fruits and crabs, but the local willingness to work with tourism is limited because of the seasonal fluctuations in the demand for workers. Mr. Lau believes that the number of tourists would increase if he advertised for the resort and if the locals perceived tourism as a livelihood instead of additional income.

The headmen see the opportunities in receiving more tourists by gaining more jobs and income, but also expressed their concern about having strangers in village, which could disturb the way of life that the villagers are used to.

The main road coming from Sarikei and Roban was constructed in 1996 and is in good condition; hence the accessibility to the village is good. The village can offer shops with groceries, and small food stands selling snacks. Furthermore, you can buy fresh caught fish directly from the fishermen or from Mr. Lau. The village has a problem with disposal of domestic waste, and that affects the impression of the village a tourist would get.

There is a combination of a large tidal range and a low beach gradient means that the water reaches the coastal protection at high tides. The upper part of the beach is exposed around neap tides, but the sand is still saturated by seawater which is not suitable for a recreational beach. The high sediment concentration makes the water unattractive just by appearance. The water samples taken near the beach have shown that the water has high levels of total coliforme and faecal coliforme unit numbers. See the chapter about waste management.

Discussion

The basic foundation for a successful recreational beach is determined by some rather simple factors. When beaches lack success or lose popularity it is often related to loss of beach width, erosion or degradation of the surrounding environment (infrastructure, population pressure etc.). As described in *Results* the beach in Gerigat has very unsuitable conditions for beach recreation. We therefore conclude that the beach is not attractive as a place to swim. It is rather the *location* of the resort at the coast which is attractive.

Our analysis has shown adventure tourism as a bigger potential for tourism development than beach tourism. There are examples from other villages in Malaysia which have developed a tourism industry based on the available natural resources. The kampong Annah Rais located 1 hour from Kuching has developed itself as an attraction, where you can sleep in a longhouse and do trekking in the jungle. Inhabitants in Annah Rais have hereby created a whole new source of income, and improved their livelihoods. Gerigat does not have the same cultural attraction value as Annah Rais, but has indeed some nature in the surroundings which can attract adventurous tourists.

We located one travel agency based in Sarikei, which arranges 2 day-trips to Gerigat from Sibu with one day-accommodation at the Gerigat Seafood Resort. The program contains among other visits to the jelly fish-factory, river cruise to the mangrove, to the fish ponds and "...delicious local seafood meal cooked by the resort owner" (see appendix). In other words, the program is a mix of adventure- and ecotourism activities. Unfortunately we gained no information about visitors of this program.

As we see it, there are several factors you should consider when developing a tourism industry, see table 14.

Factors to consider in developing tourism	**Improved coastal protection and infrastructure**	**Facilities and waste management**	**Investment in the resort**
Description	The existing coastal protection is not adequate to prevent the erosion, but strengthened protection is on the way. The last part of the road to the resort is in very bad condition, and the wooden bridges in the city mangrove are in poor condition.	Additional facilities could be craft shops, internet and restaurant. There is a problem with waste disposal in the village, which should be solved.	The resort would need a makeover to make it more attractive and to raise standards, especially for international tourists.
Requirements for improvement	Capital	Capital	Capital
	Policy making	Policy making	Private initiative

Factors to consider in developing tourism	Advertising for the area, activities and the resort	Local willingness	Environmental sustainability
Description	Presently no advertisement. Advertising would increase the awareness of the resort and improve the image.	The locals need to see tourism as a way of income, and hence prioritize this in the same level as fishing and logging. Training is needed into guiding, language and other skills related to tourism.	Creating a balance between preserving environment and improving livelihood
Requirements for improvement	Capital	Training and awareness	Training and awareness
	Image	Stable work	Limitations of tourism

Table 14 Factors to consider when developing the tourism industry in Gerigat

A very important factor for developing tourism is the willingness of the locals for developing and working with tourism. The headmen noted that the villagers were reluctant to work in the industry because it is season dependent and thereby not stable work. That is true, but fishing or agriculture are also dependent on the season, and as the tourist industry would become more developed the variation in work needed would be less pronounced. This comes down to that the villagers, including the headmen, should see the development of a tourist industry as a great opportunity for improving their livelihoods.

Discussion

The first information obtained from the headmen was that the population has been increasing since the founding of the village. The indigenous inhabitants of the village have managed to create a relatively safe community, which attracts people from other villages. Fishing and the exploitation of the mangrove constitute easy accessible money income and independency which are valued among newcomers.

Although Gerigat benefits from the immigrants this results in a growing pressure on the natural resources and in general on the community. To some extent, the rapid development of the village can inhibit further development. At some point Gerigat has to relate to external forces. From our information we learned that the fishermen are competing with an increasing number of dragging boats, which results in a decreasing number fish for the local fishermen. Despite this the number of fishermen is increasing.

We can also conclude that the mango plantation is not an environmentally sustainable source of income, due to pollution of chemicals and the fact that the soil seems very unsuitable for agricultural production. Another aspect is the sale of mangoes. In a couple of years the trees will start producing fully and apparently there is no common arrangement to market these mangoes.

In general the available natural resources are very vulnerable to change in the physical environment. Besides the intensified fishing the mangrove suffers from excessive exploitation as well. The low regeneration of the mangrove and the presence of illegal timber logging results in erosion and limits the availability of products provided by the mangrove.

Erosion is also a problem in other areas than the mangrove. In an attempt to prevent future flooding the village has received a grant for constructing a sea wall and is applying for a grant to establish an external tidal sluice. Furthermore, according to the headmen, during high tide the river brings in debris and garbage from upstream, which makes the waste problem discussed in an earlier chapter even more pronounced.

The pollution from the village onto the surrounding environment is substantial. The waste bins are not sufficient in numbers and due to the high infiltration capacity of the sandy soil the septic tanks also pollutes the environment.

An alternative source of income could be tourism. There seems to be tourism potential in the village, but people don't seem to be very interested in it at the moment. They are afraid that their daily life will be affected if more tourists are coming to the village. Major investments have to be made in both the attitude of the villagers (eg. concerning waste management) and in infrastructure in order to accommodate more tourists.

The economic capital of the village is placed in very few hands. The major businesses in the village are owned by two men meaning that they are a link in many transactions between fishermen, villagers and outside buyers. In other words, they have a big influence on the local market as to what is being traded, prices and buyers.

While we were conducting interviews, we found out that there is a division in the village. It seems that part of the village (closest to the main road) is better off in terms of income. These people's opinion about the village is also more positive; they see it as safe and harmonic. In the area closest to the pier there appears to be a problem with drinking and fighting.

In order to find out about the youth migration from the village we conducted questionnaires with youngsters aged 18-25. Unfortunately we did not find out how many percent from the youngsters migrate because we choose this age-group according to our western standards. We might have seen a different tendency if we would have concentrated on the age group of 14-20.
In the interviewed age group people are already settled in Gerigat. The majority of these youngsters don't have a job and the older generation thinks they are lazy.

Overall it seems that the villagers of Gerigat will meet some severe challenges in the coming years. They will have to change their way of living and have to find other sources of income.

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Appendix

Semi - structured interview for the young People of Gerigat (16-25 years old)

14-15-16 of March

What is your name?

How old are you?

Is your Family from Gerigat?

What is your study level?

Do you work? Where?

What do you do in your spare time?

What do you want to work with? Where? Why?

What do you not want to work with?

Where would you like to live?

Do you know any relatives or friends living in a bigger city?

What is the best thing(s) about Gerigat?

What is the bad thing(s) about Gerigat?

Semi - structured interview to the Headmen, 10th of March

For the headmen

- Are the villagers interested in environmental protection? (concerning pollution)
- Who owns the oil palm plantation? Who works in it? How big is it? Any importance for the village?
- Did the amount and type of products from the mangrove change compared to 20 years ago?
- Did the biodiversity and area of mangrove change compared to 20 years ago?
- Are many youths migrating from the village?
- Is there any garbage collection system?
- Where does the waste water go?
- What are the current and future investments that the village do?
- Is there any community project?

→ ask them to draw a map of the village

Appendix

Interview to the headman and farmers in the mango fields:

- The plantation is 3 years old
- IADP= the agricultural development program, which is providing technical advices and support, fertilisers, pesticides, seedlings, tools, are building the infrastructures and the drainage and have cleared the former mangrove to be able to plant trees there.
- 1 family owns around 3-5 acres
- More than 100 families are cultivating here.
- The government own and give the land for mango production for 60 years, it has now been leased for 10 years (temporary occupation land lease/licence)
- The land was mangrove before the plantation was established
- It is both for domestic consumption and for commercial purpose (market in eg. Sarikei)
- 1 tree gives 80 fruits per harvest
- 4 fruits =1 kg (20kg per tree)
- Average prize is 6 RM per kg
- The land is peat swamp because of the former mangrove. It uses to have a river system in the place and the villagers used to get food supply from the mangrove
- They are not irrigating (the rain is enough for this specie of tree) but preventing the fields against the sea tide.
- They have holes in ground for collecting rain water, and manually transfer it to the trees
- It is semi mechanical control by a slues system and gates in canals they close by high tide and open to drain water from the rain.
- There is no water coming from the river to the field.
- There is water well (hole digs into the soil) to supply water for preparing products for spraying on trees.
- This is a monoculture field, with only one species of tree.
- The kind of pesticides used here are to prevent against undesirable weeds and to protect the flower against pests (insects). They use also use products to induce flowering,
- IADP says there are the farmers are supposed to use 2 kg of fertilizer on each tree
- 50 kg fertilizer cost 150 RM
- Sticks are used for to bare the fruits.
- There are 2 harvests per years. The trees are flowering in March, and the next harvest will be in June
- They keep records of the yields for the agricultural department
- Banana commercial plantations are taking place besides the mango fields.
- Some are mixed crop (banana, papaya, coconuts and sugar cans)

Interview of Mamajam (farmer and fisherman):

- 3000 kg a year, this year is good!
- He use 2 kg of fertiliser per crop cycle
- 50 kg of fertiliser cost 150 ringgits.
- The mango plantation is not taking him a full time work
- He is helped by his 3 sons
- He has fish cages and work in the jellyfish factory
- He has 10 acres and 3 plots
- The plantation ask for a very high maintenance on the first years
- Some people give up because it is tiring

Interview to the prawn farm local manager

- Harvest 2 times a year, there is 4 pounds on this sides and 4 workers while on the other sides, a second managers is running 17 ponds and 10 workers.
- Feeding = 5 times a day. The schedule is 7/11/14/18/23
- The prawns are eating proteins from Taiwan; it is fish oil and plants proteins, mil…
- The feeding is categorized into 4 categories. The manager take samples every week to see the prawn's biomass evolution to know which categorize to use (size).
- The system is a close one; they use bacteria to clean the pounds after the harvests.
- They dry the pounds after harvest and then pomp again to refill it.
- They sell the harvest to Sarikei and Sibu for export.
- 6 to 10 tonnes per harvest.
- Pumping out takes 2 to 3 days
- They prefer maintaining the level of COD and BOD below the required level.
- They acclimatised-for the temperature- takes 1-2 hours
- The density average is 50000/ha
- The labour is working on 2 ponds each
- The water is clean due to added bacteria
- When harvesting, the water is let out to the sedimentation pond. If the government fishing department approves the water quality, the water can continue directly to the river. If not, the water shall stay in the sedimentation pond for 3-7 days.

Appendix

Informal interview to ISMAEL, Fisherman:

He was standing front of its house and we were talking together on the street side.

The owner of the chalet where he is living is also the person who he is selling his fish.

If the catch is good, (100 to 200 pieces per day), he is also some of it somewhere else (Sibu or Sarikei).

He is fishing both in the sea and in the river.

He is catching crabs in the mangrove, when it is not the good season for fishing.

The amount of fishes cached has decreasing the last 5 years.

The cause of this decrease is that strollers (big fish boats grabbing everything) are fishing in the Gerigat area; they are from other villages and from Sarikei.

The size of Ismael's net is 3 X 7 inches.

Almost everybody in the village get incomes from the sea.

Informal interview to one of the Headmen:

He stopped in the street when seeing us, he was by bike and we talked together in the middle of the street.

He is responsible for 80 houses in the villages while we evaluate there is about 150 houses and 1000+ persons in Gerigat. A second headman is taking care of the other 70 households.

The mains activities in Gerigats are:

Farming

Fishing

Jelly fish processing

Oil palm production

IADP program and support from the government

We learn from him that the owner of the prawn farm is from Sarikei and is renting fields from the villagers.

There was mangrove at the place where the prawn farm is now.

The resort owner is also owning the jelly fish factory, the sundry shop he is selling petrol to the fisherman and buying there catches, and running the Beach resort

<u>According to another fisherman met in the village, fishing consists in:</u>

Put cages in the river, put nets in the sea and the river, going to fish by boats or from the village when the tides is low (children's activities)…

<u>Other knowledge, about the infrastructures:</u>

One of the main roads in the village is maintained by a private company, that the government has been committing to build it (the road).

Appendix

Interview with Mr. Tiong

Fish cages

- Project started in 2004

- A government (department of marine and fishery) supported business.

- 1000 fry is given the first year from the government and so are the other materials like cages etc.

- He has about 30 cages distributed on 3 stations. He started with about 50 but a storm destroyed 40% of them.

- He started with the fry directly in the river. But because he had problems with high numbers of death among the fry he now (this is the first year) tries with the fry in the ponds until they are about ½ kilos (0,4-0,6 kg) and then moves them to the sea cages.

- The fish eat around 100 kg feed a day. They are feed with pelletized feed when they are small – and with dead fish or chops of fish when they get bigger.

- He harvest around September before the weather becomes too bad he doesn't know how many tons but in a good year he have harvested 5 ton.

- He gets approximately 7 RM a kilo...

- He has plans to build a boat bridge and a house near by the ponds so he can survey the ponds and the cages 24/7 – he has problems with people steeling them.

- He sells them in Kuching

- He has planted around 1,000 mangrove trees to prevent the erosion

We had the feeling that Mr. Tiong didn't tell the whole truth and there for did a follow up interview with Mr. Lau about the fish cage project.

The project is governmental supported but you have to be 5 persons in collaboration and take course in the fish production to get the support.

As far as Mr. Lau knows Mr. Tiong runs the production by him self and the other persons in the project is only there pro forma.

They started with 25 cages but have less now because of the storm.

It's only Mr. Lau who shows an interested in this project and the reason for that is that you only get money once a year when you harvest. Most of the people in the village don't like that idea.

If the fish are large approx. 2 kg you can get 16 RM/fish. But if the fish are small 0,8-1 kg. you only gets 14 RM/fish.

Jellyfish

- Owned and operated by a family (Muhammad Tiong)
- during peak season, 200-300 of jellyfish caught every day
- 2 types of jellyfish caught (ordinary and the red colour)
- Amount of catch is about 13 tons (ordinary) and 0.5 tons (red jellyfish) per year
- Workers employed on ad-hoc basis, no full time worker
- They are paid at RM1.50 per hours
- Buyers from Kuching and exported to Japan and Korea
- Sold at RM9,000 per ton and red jellyfish at RM36.00 per kg
- Waste water from the process of the jellyfish is discharge into the river.
- processed with salt and potassium aluminum for about a week
- He pays 1 RM/ jellyfish to the fishermen

Appendix

Interview with the prawn farm manager

Visiting Prawn Pond on 9 Mac 2008

The project started in 1998

It is owned by an entrepreneur outside Gerigat – the company is called CCK

The land is rented from the villagers of Gerigat on a 15 years basis.

The villagers receive 1000 RM/acre per 5 year

Before, it was a mangrove state land, later it was given to the village (lease title)

In the agreement stated that they should employ local workers

Initially people from Kpg Gerigat worked at the pond but due to low pay (RM300-RM400 per month) and odd working hours, they are no longer interested

There are 4 ponds the size raging from ½-1 acre

It's a closed system. The water is pumped in from the lake when the fry are bought and pumped out when they harvest.

The water stays in the sediment pond for at least 72 hours waiting for the COD and BOD to level.

pH, nitrite and nitrate are controlled once a week.

The prawns has the best conditions in a salinity at 25 ppd but it varies from 12-33.

The pH should be around 7 – 9

The hatchery is in Kuching and they sow twice a year.

Density is 15-20/cm2 = approx.150.000 prawns/hk

The fry is harvested after 4-5 month when they have reached about 30 grams = 6-10 ton/hk. The density is a factor in the matter of size. The lower the density is – the bigger the size of each individual prawn.

In the rainy season the density is lower because of the changed livelihood for the prawns.

4 workers take care of the 7 ponds – they are all fro the Philippines.

The prawns are fed 5 times a day at 7 - 10 - 14 -18 and 23. The prawns are fed with pelleteret feed made from protein and oil mainly from fish.

They don't have problems with disease and never treat the prawns. Because they ad a bio culture to the water to advance the good bacteria and the phytoplankton. The bio culture helps in maintaining a good water quality and the prawns eat the phytoplankton as an additional "snack".

The prawns is sold to Sarikei and Sibu and then exported to the western world.

Every time after harvesting, the water is retained in the sedimentation pond for at least 72 hours before it can discharge into the river.

The pond is leaving dry for 1-2 months and sprayed with CaCO3

Appendix

Portrait of Mr. Lau

Mr. Lau is a local entrepreneur and owns several undertakings in Gerigat. His family came to the area in the 1930´s where his parents opened a small shop, which still is the main grocery shop in the village. The shop is run by his brother and two employees, but is a major part of Mr. Lau´s income.

The major buisness is the jellyfish production which was started in 1970. The fishermen are selling him their catch during the season (March to May) directly to his two factories at the beach. The jellyfish income generates an income on RM30.000 a year.

The Gerigat Seafood Resort is also owned by Mr. Lau and he seems to really enjoy this enterprise as he is cooking and serving guests himself. His wife is helping him out but there are no employees. Next to the resort there is a small garden, where he grows coconuts, nurses chickens and grows plants used for cooking.

Besides his businesses, Mr. Lau owns a bird nest house, in which bird nests for export is produced. The production of bird nests started out as a business, but is now more like a hobby – there has been no income the last 7 years.

If you stay in Gerigat you can´t help notice the presence of Mr. Lau, and he is even mentioned in a program for a trip to Gerigat. He has a very big charisma, and it seems like he knows everybody in the village. He also seems to have gained a lot of respect from the villagers, probably partly because so many depend on his undertakings.

Appendix

2 Days 1 Night Gerigat Fantastic Fish Village Tour - program

Day 1

Depart from Sibu to Gerigat (2.5 Hours by Road).

Half-way visit pepper farm, dragon fruit farm and Sebangkoi Orchard Farm.

Lunch at Sebangkoi Country Resort.

Arrive Gerigat Beach, check-in Gerigat Seafood Resort.

Visit local Jelly Fish Processing Factory.

Enjoy outboard river cruise for viewing the mangrove area and local Malay Fish Village.

Enjoy the greatest sunset view.

Enjoy delicious local seafood meal cooked by Resort owner.

Night activities like barbeque and Camp fire.

Day 2

Breakfast, enjoy the sunrise view.

Proceed for activities like fishing the prawn and crab or sailing.

Visit the Local Fish pond.

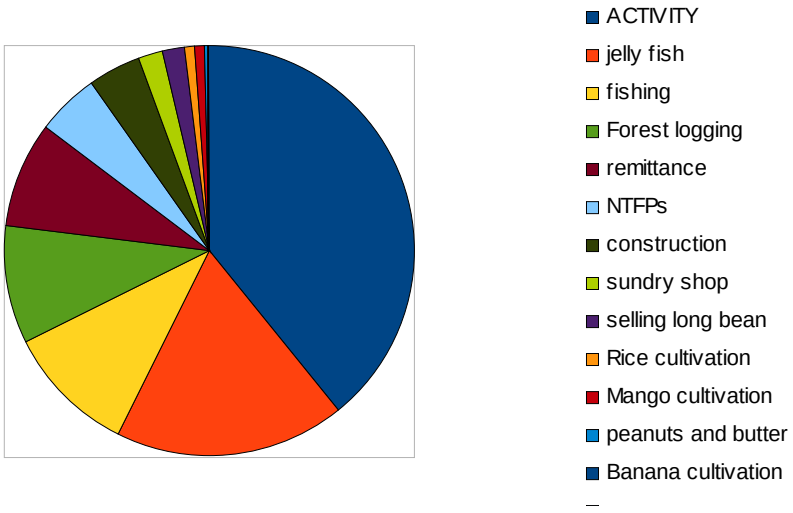
Check-out and return back to Sibu.

Half-way visit Sebangkoi Deer Farm.

Visit local fruit farm before arrival Sibu.

Appendix

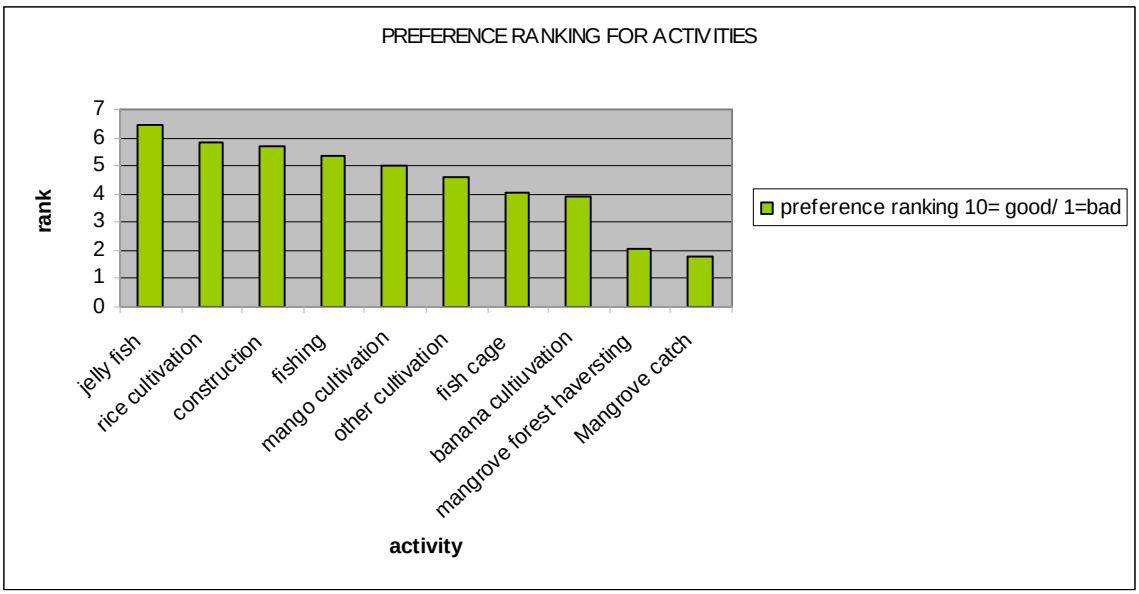
1. INCOME PER MONTH FOR EACH ACTIVITY



ACTIVITY	average of cash incomes a month
jelly fish	2900
fishing	1325
Forest logging	750
remittance	700
NTFPs	621
construction	366
sundry shop	300
selling long bean	150
Rice cultivation	120
Mango cultivation	60
peanuts and butter	60
Banana cultivation	30

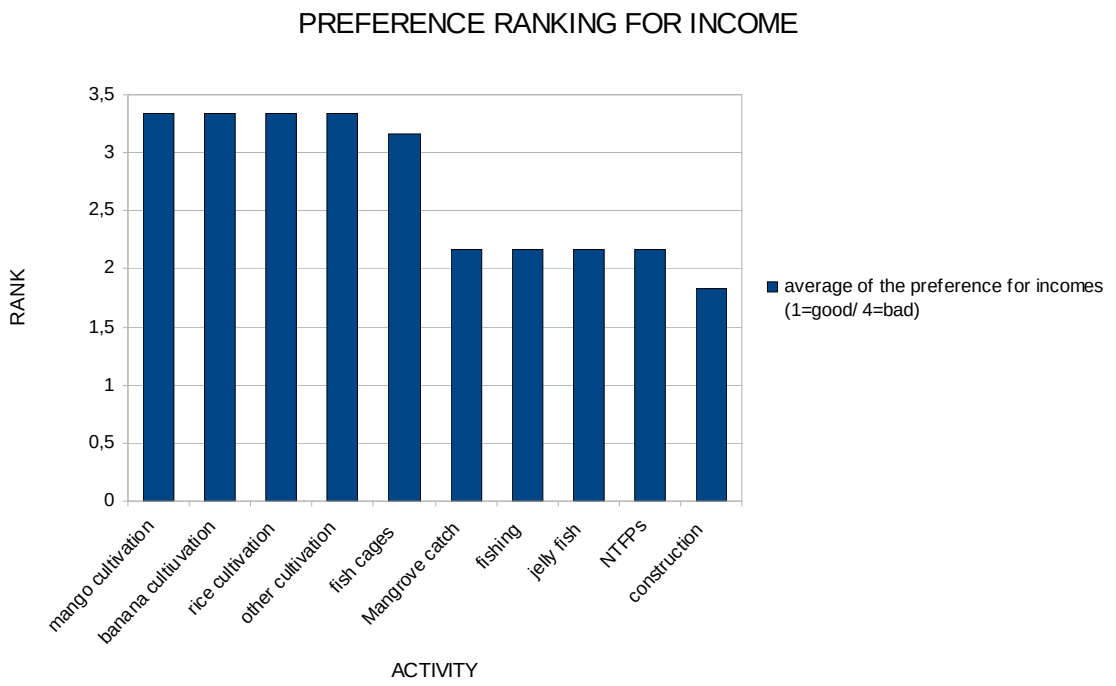
Pie showing the diversity of the activities and their importance according to the cash income people earn from each of them in a month. The survey was filled up by 15 persons among the workers in the village.

2. ACTIVITY PREFEENCE RANKING



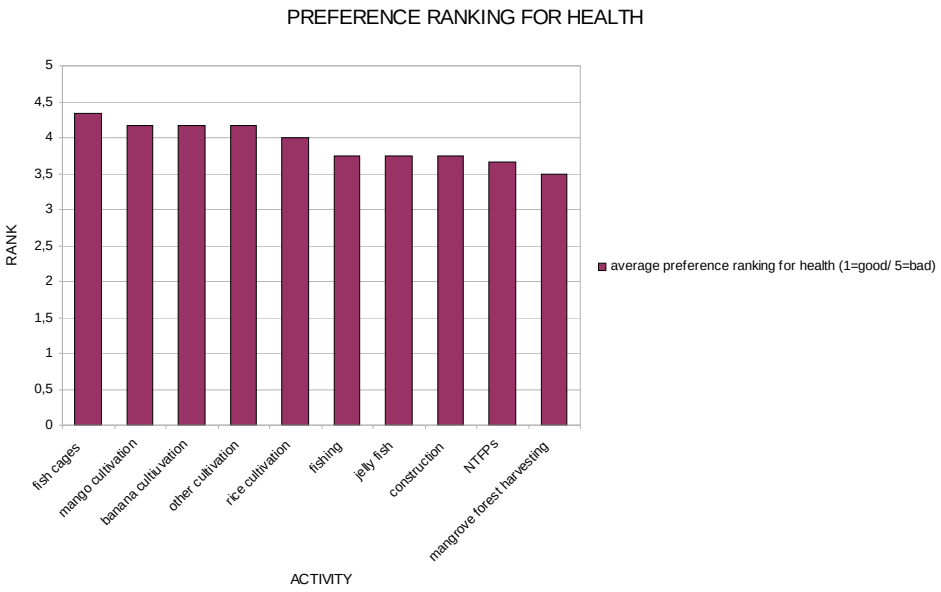
Preference ranking of the diverse activities practiced in within the villagers. The survey was filled up by 14 persons among the workers in the villages.. The more an activity is preferred, the more the rank is close to 7.

3. INCOMES PREFERENCE RANKING



Preference ranking of the ACTIVITY according to the INCOME. The more income people think an activity is offering, the more close to 1 they rank it. The survey was filled up by 12 persons among the workers in the villages.

4. HEALTH PREFERENCE RANKING

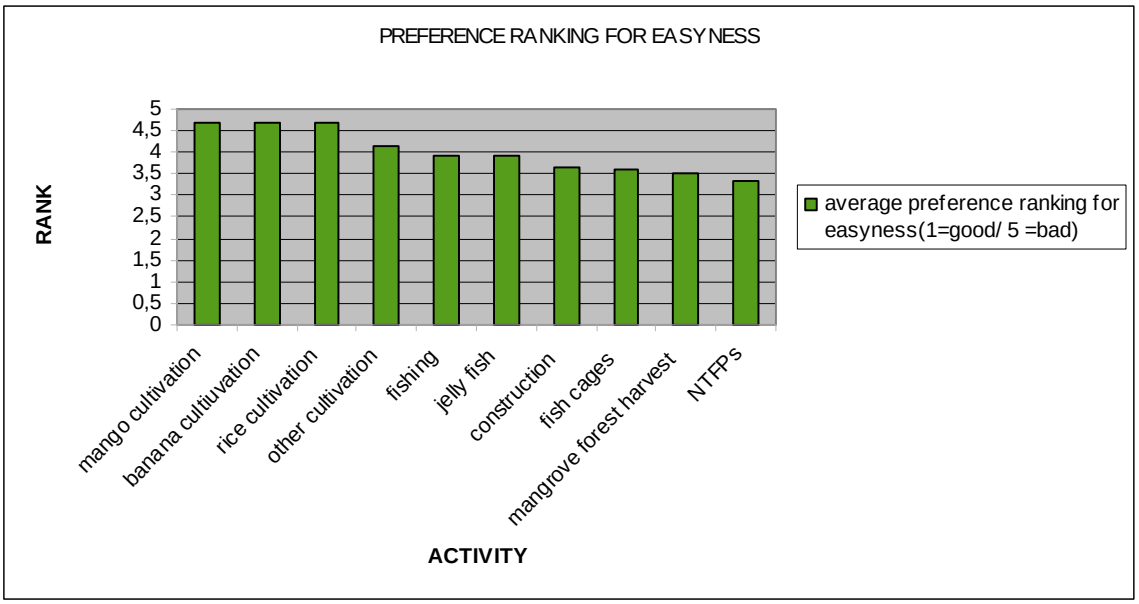


Preference ranking of the HEALTH according to the INCOME. The more income people think an activity is offering, the more close to 1 they rank it. The survey was filled up by 12 persons among the workers in the villages.

5. LABOR PREFERENCE RANKING

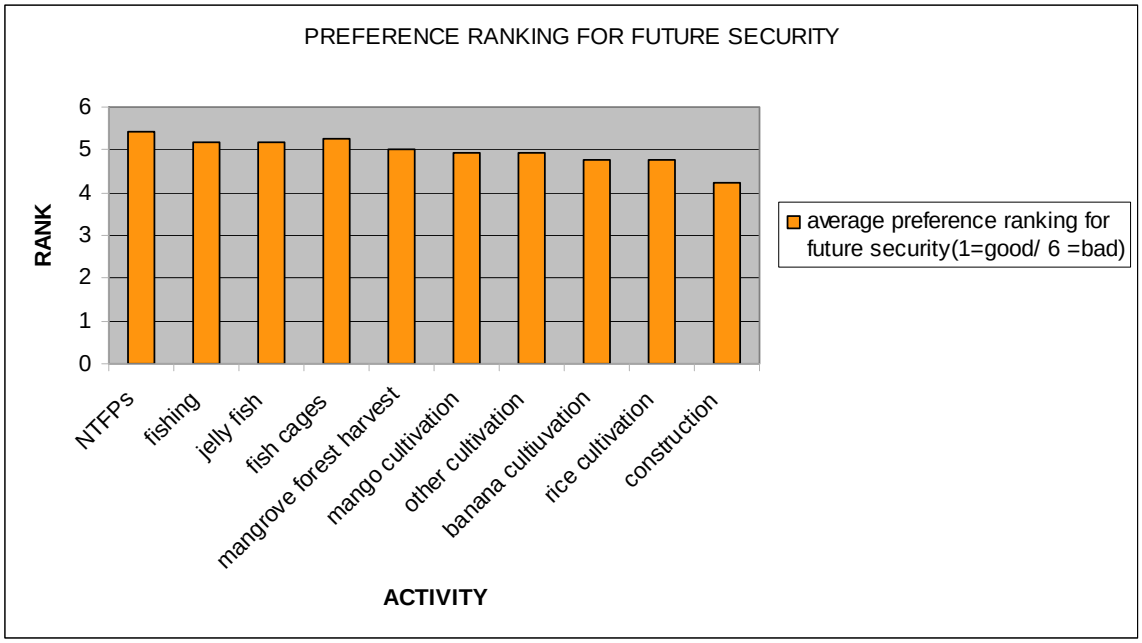
Preference ranking of the LABOR according to the INCOME. The more income people think an activity is offering, the more close to 1 they rank it. The survey was filled up by 12 persons among the workers in the villages.

6. EASY PREFERENCE RANKING



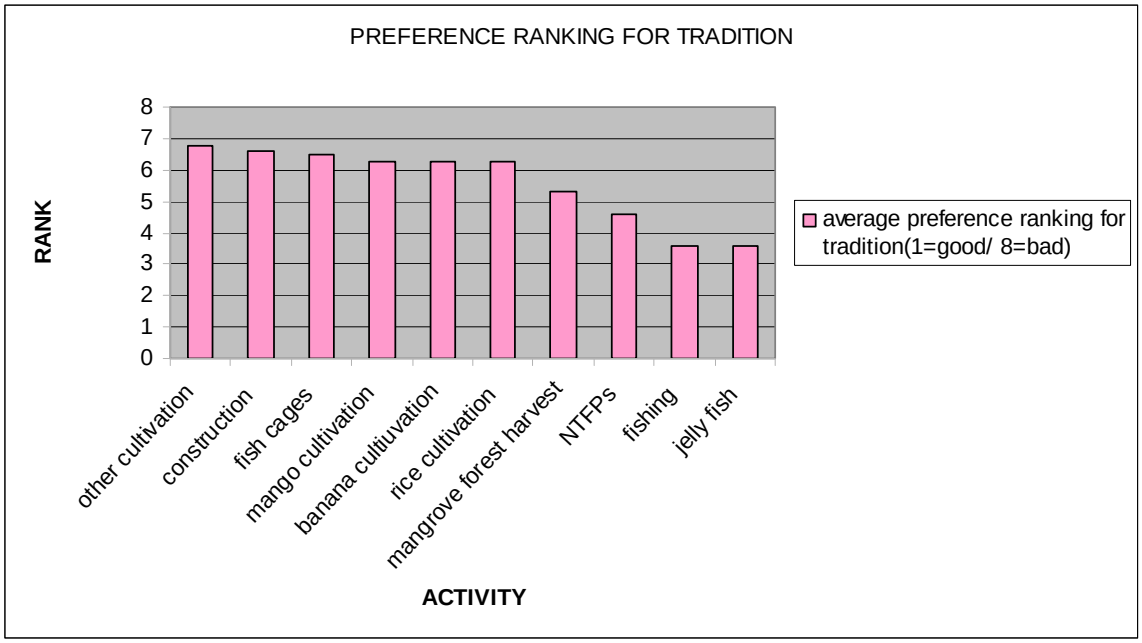
Preference ranking of the EASYNESS according to the INCOME. The more income people think an activity is offering, the more close to 1 they rank it. The survey was filled up by 12 persons among the workers in the villages.

7. FUTURE SECURITY PREFERENCE RANKING



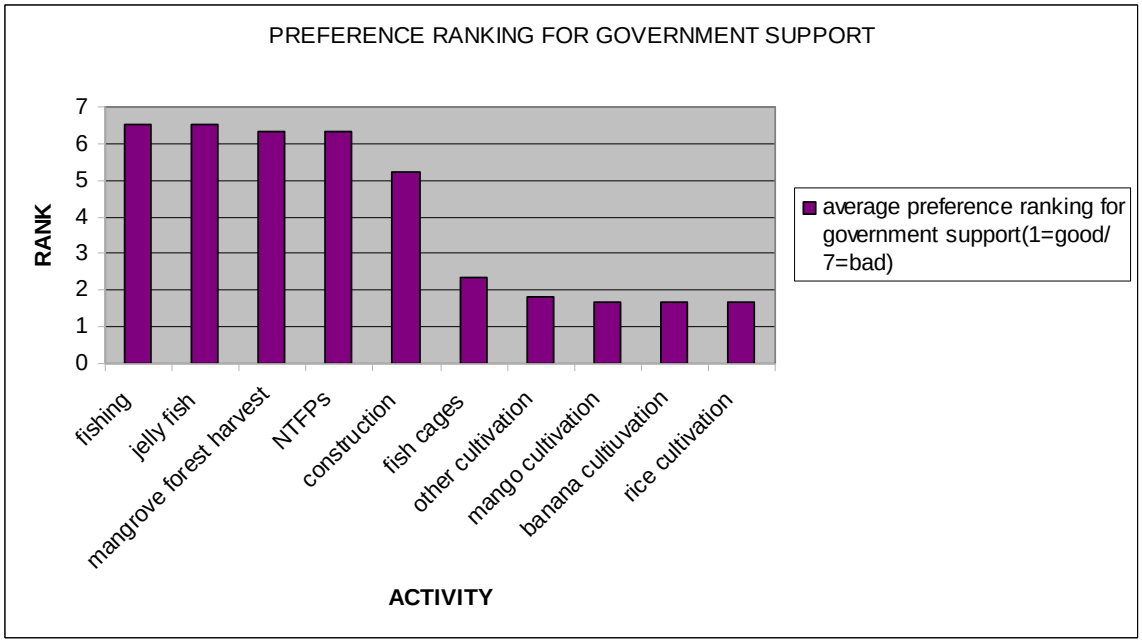
Preference ranking of the FURURE SECURITY according to the INCOME. The more income people think an activity is offering, the more close to 1 they rank it. The survey was filled up by 12 persons among the workers in the villages.

8. TRADITION PREFERENCE RANKING



Preference ranking of the TRADITION according to the INCOME. The more income people think an activity is offering, the more close to 1 they rank it. The survey was filled up by 12 persons among the workers in the villages.

9. GOVERNMENT SUPPORT PREFERENCE RANKING



Preference ranking of the GOVERNMENT SUPPORT according to the INCOME. The more income people think an activity is offering, the more close to 1 they rank it. The survey was filled up by 12 persons among the workers in the villages

Appendix

INTERIM NATIONAL WATER QUALITY STANDARDS FOR MALAYSIA (INWQS)

Parameters	(Units)	Classes					
		I	IIA	IIB	III	IV	V
Ammonical Nitrogen	mg/l	0.1	0.3	0.3	0.9	2.7	> 2
BOD	mg/l	1	3	3	6	12	> 12
COD	mg/l	10	25	25	50	100	> 100
DO	mg/l	7	5 - 7	5 - 7	3 - 5	< 3	< 1
pH	-	6.5-8.5	6.5 - 9.5	6 - 9	5 - 9	5 - 9	
Colour	TCU	15	150	150			
Electrical Conductivity	mmhos/cm	1000	1000		-	6000	-
Floatables	-	N	N	N	-	-	-
Odour	-	N	N	N	-	-	-
Salinity	$^{o}/_{oo}$	0.5	1	-	-	-	-
Taste	-	N	N	N	-	-	-
Total Dissolved Solids	mg/l	500	1000	-	-	-	-
Total Suspended Solids	mg/l	25	50	50	150	300	> 300
Temperature	^{o}C	-	Normal +2	-	Normal +2	-	-
Turbidity	NTU	5	50	50	-	-	-
Faecal Caliform*	counts/100ml	10	100	400	5000 (2000)@	5000 (2000)	-
Total Coliform	counts/100ml	100	5000	50000	50000	50000	>50000

Note:-

N No visible floatable materials/debris
or No objectionable odour
or No objectionable taste

* Geometric Mean

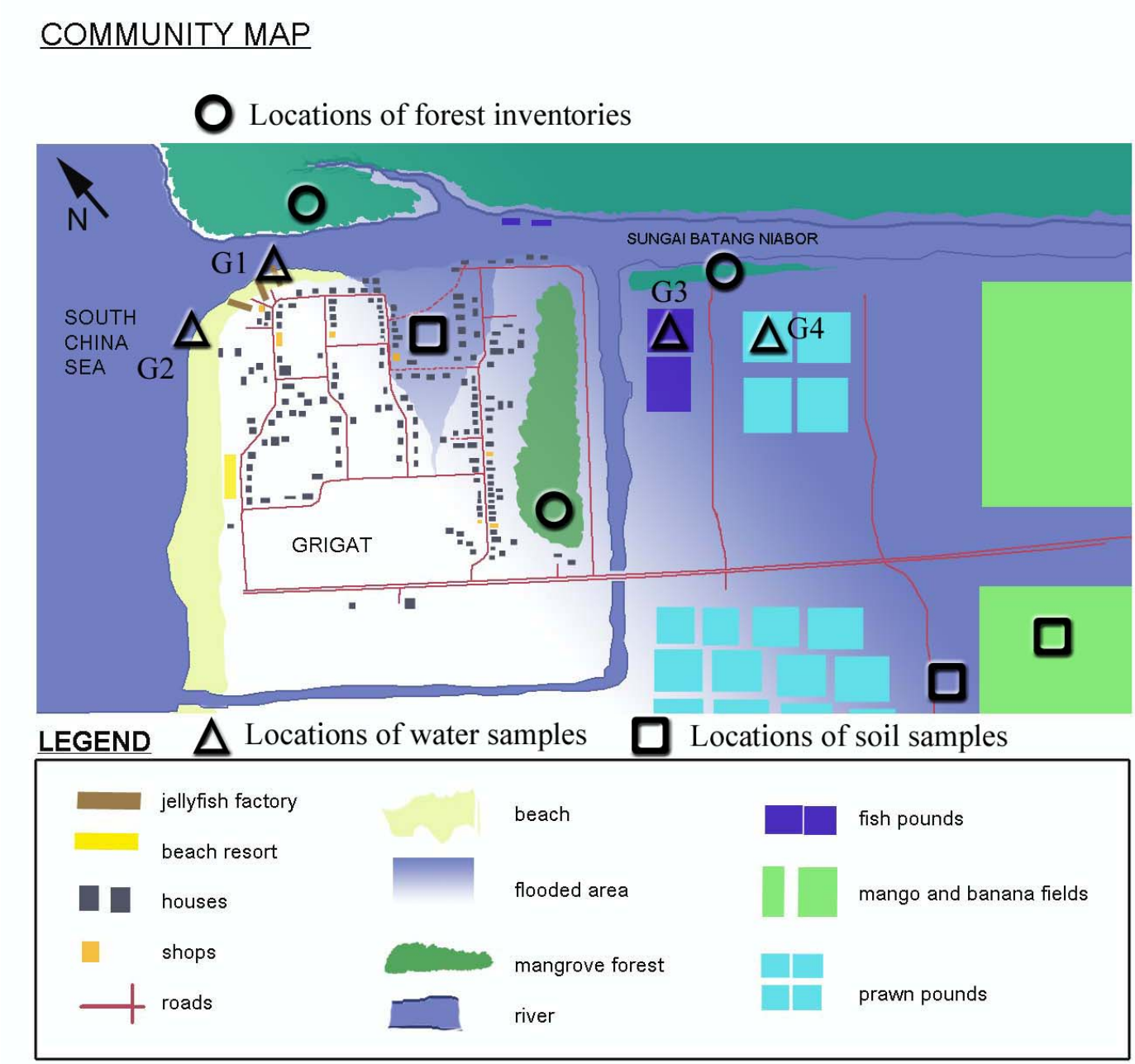
@ Maximum not to be exceeded

Class	Uses
I	Conservation of natural environment Water supply I - practically no treatment necessary (except by disinfection of boiling only) Fishery I - very sensitive aquatic species
IIA	Water supply II - conventional treatment required Fishery II sensitive aquatic species
IIB	Recreational use with body contact
III	Water supply III - extensive treatment required Fishery III - common, of economic value and tolerant species
IV	Irrigation
V	None of the above

http://www.did.sarawak.gov.my/wqis/sgsarawak/inwqsm-standards.htm
http://www.did.sarawak.gov.my/wqis/sgsarawak/effluent-standard.htm
http://www.did.sarawak.gov.my/wqis/sgsarawak/pagetwo.htm

Appendix

Sample map



Appendix

Diaries

Berdi

Friday 7 March

Left Kuching in our plastic car to go to Gerigat. Learned how to drive an automate on the left side of the road while Foo was screaming behind me.
After a tour of the other villages we finally arrived in Gerigat, and the sunset and beach was worth it. After a shower we discussed the plans for the next day.

Saturday 8 March

This day we explored the village, made a transect walk, interviewed some of the villagers we met. We tried to get a first and general impression of the village.

In the evening Ibrahim arrived as well and we had a long group meeting to try to agree on the synopsis. Our translator Ringget also arrived and brought with him a gift of lovely Dutch beer.

Sunday 9 March

Today we visited the mango plantation and the prawn farm. Got a lot of new info. In the afternoon we gathered our data and discussed about it. During the evening we made the presentation.

Monday 10 March

During the morning we presented our synopsis to the teachers and other students in Saratok. We got some useful feedback. We decided to take the afternoon off to do some necessary (birthday) shopping. in the evening we had another group meeting and the interview with the 2 headmen.

Tuesday 11 March

During the morning we visited the jellyfish factory and fish cages. In the afternoon we gathered information, discussed and prepared Elzelina's birthday party!!

Wednesday 12 March

During the morning we collected the water samples in the pouring rain. I almost fell in the fish ponds, got elected miss wet t-shirt and it took the car several days to dry.
In the afternoon we did the water analysis, but I was too tired from the party to really participate.
In the evening we didn't have a group meeting because I was sleeping.

Thursday 13 March

The planning for Thursday was to go to the mangrove on the other side of the river and start the forest inventory. Unfortunately we didn't have a guide nor boat to take us there. We talked about canoeing there but that was too dangerous. So we decided to collect the soil samples so that we could do the analysis on Friday.
In the evening we finally had our group meeting and afterwards we went to a party in Alit.

Friday 14 March

In the morning we finally started the forest inventory on the other side of the river. We assessed 2 plots and went up the river to see if there would be any ecotourism potential.
In the afternoon and evening we did the soil sample tests.

Saturday 15 March

Today I started with waking up Andreas. When he was ready we went to the mangrove near the fish ponds to assess 2 plots there. In the afternoon we assessed the beach a bit more south of the resort and I slept. In the evening we had a group meeting and a party in Plasu.

Sunday 16 March

Today I started with waking up Michael. When he was ready we went to the village mangrove to assess one plot there.
In the afternoon we decided to visit Empayang and Alit to do some beach assessments there. After that Elzelina and I interviewed some people in the village. In the evening we prepared our presentation.

Monday 17 March

During the morning we presented our results in Saratok and after that we took the afternoon off. In the evening we got invited for a prawn bbq by one of the headmen. Plasu came to assess our beach and we had a good time. After that we went to Sessang and partied in Alit. Unfortunately I was the 'Bob' so I couldn't drink.

Tuesday 18 March

After breakfast we did some quick information exchange with Foo and Ibrahim and then we left for Kuching! In the evening we drank cocktails in Mojo.

Wednesday 19 March

We spend the whole day on the beach. In the evening we had the good bye party and celebrated Lausts birthday.

Laust

1. Day: The villagers in Gerigat were expecting us in the afternoon, but we were forced to attend the welcome party so we first got to Gerigat early, and the welcome ceremony was cancelled. We met one of the headmen though, and introduce our self to him. At night we all discussed the plans for the next days.
2. Day: We spend the day on transect walk with the GPS and just in general exploring the village. We did a few informal interviews with random people. At night Ringgit and Ibrahim arrived, so we could start the group discussion. We had a long group meeting where we tried to find common grounds. The two groups had very different level preparation, so it was difficult to fully understand each other. We succeeded in formulating three research questions, which we all, although very broad formulated, could agree on.
3. Day: This day we all went to the mango plantation and the prawn farm just outside Gerigat, and talked to farmers and the manager of the prawn. We were surprised and overwhelmed of how "easy" it was to get a lot of information from informants, but everybody was willing to cooperate which was helpful. At night we prepared the presentation to be held in Saratok.
4. Day: We held our presentation in the morning, and spend a couple of hours in Saratok shopping practical items. At night we had arranged interview with both headmen, and that was a very informative interview, which covered most issues.
5. Day: We started out visiting the jelly fish factory (not Mr. Lau's) and the owner showed us footage from his study trip to Sabah about fishing. Later we walked around the village, and prepared a common party for all groups in the occasion of Elzelina's birthday.
6. Day: This day we all collected water samples together with the technicians from UNIMAS. In the afternoon we went to Kabong, where the water analysis took place.
7. Day: We wanted to go to the mangrove and do forest inventory, but the boat we booked was not available. It was pouring down the whole morning, so we just stayed in and gathered data.
8. Day: Berdi and I hired to youngsters as guides to the mangrove, where we did two forest inventories. We also went up the small northwest going river to assess the potential for river safaris this way. In the afternoon and night Berdi and I did soil sample analysises in the resort.
9. Day: Ida, I and the interpreter went to Sibu to conduct questionnaires about tourism. We were back before dinner, and at night we went to a party in Plasu where we did a lot poco-poco dancing.
10. Day: Processing data in the morning and in the afternoon we visited Empayang and Alit to see the longhouses by day. The night was spend on preparing presentation for the meeting in Saratok.
11. Day: We did the presentation at a very formal and unfulfilling meeting in Saratok, and had lunch with the other groups. The afternoon was spend in Gerigat sharing

information with our Malaysian counterparts. At night we were invited to a prawn-barbecue by one of the headmen, and after that we continued to parties in Sessang and Alit.

12. Day: Return to Kuching!

Elzelina

The first day (Saturday) in Gerigat were used to do transect walk with the rest of the group and I schetched informations with Foo about the community map. We were counting and locating the houses and the streets as well as the major landmarks. While walking we meat one of the headman and had an informal interview with Ismael (thanks to Lim's interpretation) who is an old fisherman living not so far from the resort.

The Sunsay morning, I was part of the expedition to visit the prawn farm and the mango field with the rest of the group. I took note especially about the mango cultivation, as we had good discussion with the farmers. In the prawn farm, I was listening and going a bit more around to see the diverse settlement for feeding, etc.

In Saturday and Sunday evening we were also tryed to join the two group synosis and finding common research objective that we had to present monday morning. This was an hard time, expecially to explain Foo and Ibrahim some terms of our synopsis.

Monday, after the presentation in Saratok (where I have presented the first part of the power point),

we took a rest and I prepared with some of other group member the structure of the interview we were going to hold with the headmen on the everning. The everning, I was asking the questions planned in the afternoon, while the rest of the group was taking notes and listening for eventually add other question. The interview finished late and we ad a short discussion after that with Michael who were listening also the interview.

Tuesday morning, I went with the group to visit the fish cages and the jellyfish factory of M. Tiong. The afternoon I was copying my notes from the last days interviews about the prawn farm, the mango field and from M.Tiong and the old people. We had a walk together in the village at the end of the afternoon and had a group meeting for scheduling the next days and gathering data. This day was my Birthday(!), so I got a surprise party on the everning like everybody.

Wednesday, Ibrahim and me went to Saratok for an appointment with JKR in the morning. We got too few informations on the infrastructure and the sanitation, so we decided to stay the afternoon for an appointment with a district officer. The last was more informative. We came back to Gerigat around 7PM, and I started to be sick (the aircondition in the offices...) so I went to bed early, after group meeting while the others went to Alit.

Thursday morning, I went to Sessang with Ida to get the result of the soil sample. Here she explained me which sample they did and how to interpret the result. Later back in Gergigat, we prepared structured questions with Ida and Ringgit, to go to intervew young people in the afternoon. The sickness wasn't helping for interviewing people so I came earlier back to the Resort to prepare other interview for expense and income. I went at 5PM to sea the product of the catch of the fishermen. I draw in the everning and we.

Friday, I went to interview old people about the landscape changes with Ibrahim and Foo. I was copying my notes in the computer in the afternoon and redrawing the transect walks. I was still sick and didn't do much in the everning, watching the soil sample analysis, and copying more notes on the computer.

Saturday, I went with Berdi to a forest inventory in 2 plot of the mangrove close to the fish ponds.

The afternoon, I continued to do young people interviews, while the other started to do preference ranking and questionaires in Sibu. I did a GPS walk allong the beach with Birdy and Michael on the afternoon.The everning we were gathered informations and decided later to go to Plassu for a party.

Sunday, I went to interview people on their income in the morning. The afternoon we decided to visit Empayang and Alit because they had also beach issues and erosion phenomenon. We enjoy to meet the other groups and came back late in the afternoon. We did 2 more interviews with the translater for getting additional informations about the households. In the everning we prepare the presentation of the results for Monday morning. Monday afternoon, we gathered and exchange data and packed to leave the next morning.

Ida

Monday 3rd – Friday 7th

Arrived in Malaysia on Monday the 3rd smack down in the capital

Had a couple of days to acclimatize to the – well climate…

Friday the 7th was the day of the departure.

Spent 7 lovely (wink, wink notch, notch) hours on the backseat of the teachers car, driving through a foreign country. A lot of green and the some more.

I must admit though that spending the time with the teachers did expand my knowledge tree wise if nothing else. Apparently banana is a grass – well who would have guessed?

Arrived in Gerigat late Saturday – to late. But who's counting.

Got our rooms in the "Beach resort". Wauu, so many days I could have saved on the anticipation to experience the place! Three in each room – two in one bed and one on the floor – me.

Saturday 8th

Did a transect walk through the city – what a dump! The garbage is everywhere, we are in the middle of nowhere and there is apparently nothing going on in the city.

Because we were late yesterday we wasn't introduced to public and they don't seem to be at least interested in us

Sunday 9th

Now things are happening – well half an hour, three quarters later then scheduled. We went on a fieldtrip to the mango plantation and the prawn farm. We did semi-structured interview with two mango farmers and the manager of the prawn farm – how lucky! All of them willing to tell us about the production and taking our 1001x6 questions well…

Who would have thought that the prawn farm was that well managed? He even let us return to do water samples. Damn-it – this can only mean they have everything under control.

We managed to get an appointment for Tuesday to go and visit the fish cages and one of the jellyfish factories. And I later went out with the interpreter and got appointments with the headmen.

Had a group meeting that evening trying to mix the Malay synopsis and ours. Luckily we agree on the basics – honestly the rest it's just a matter of words.

Monday 10th

Went to Saratok to present our synopsis – what a waste of time! It occupied most of the day – and was of now use. In the afternoon we had a group meeting and our interview with the headmen. Which by the way went really well!

Tuesday 11th

We all visited the fish cages and the jellyfish factory. Got a lot of information from Mr. Tiong. In the afternoon we reviewed our information and discussed further plans. In the evening we had a birthday party for Elzelina – a blast. Most of the other groups were there.

Wednesday 12th

Water sample day! Lim was with us (Laust, Berdi, Foo and I) the whole day and was a big help. Laust and I had a small scaled discussion with Lim on one of the sites whether or not it was relevant. Nothing serious but Foo took offends to it and showed clearly the different in the relation between teachers and students Malaysia versus Denmark. He definitely thought that Laust and I were out of our league.

In the afternoon we went to Kabong to test the samples in the "hotel" where the technicians stayed – upscale lab. I must say…!

Thursday 13th

Today I went out with Elzelina and the interpreter to interviews young people about their look upon the future and the city. We got 10 interviews done that day – which I must admit was much to my surprise.

Friday 14th

Today I continued the work with interviewing young people and after that I did interviews on income/expenses. We wanted to get a focus group to provide us with this information but even though we asked the headmen to help us gather people for this group it wasn't possible. We then decided to get the information from individual interviews – and I got the job gathering the information about the money. Foo and Ibrahim gathered information for the preference ranking.

Saturday 15th

Field trip! Laust and I went to Sibu to collect questionnaires for the chapter on tourism. 39 questionnaires later we returned to Gerigat and I continued with the interviewed on income and expenses. We started the evening very serious with a group meetin – but soon came to that conclusion that we rather would like to attend the party in Plasu. It was really fun to experience a longhouse. Foo came with us – which really opened him up. Good one Foo!

Sunday 16th

Did a couple of income/expense interviews. In the afternoon we dismissed all group work and went on a tour to visit Empayang and Alit – as a group. When we returned we continued with the interviews only this time we went as a group. In the evening we prepared the presentation for Monday.

Monday 17th

Presentation in Saratok – waste of time one more time… The rest of the day we spent with exchanging data and in the evening we had a farewell barbeque on the beach with one of the headmen. Oh my, freshly cached fish and prawns - yummi!! After that we went on a tour to the other villages to say goodbye there as well.

Tuesday 18th

Return to Kuching – ahhh civilization!

Appendices

Data table

no.	type of data	place of collection	target /group	topic
39	questionnaires	in Sibu	any groups	tourism potential of the resort
15	semi structured interview	in the village	16-25 years old	education level, ambition, how do they like their village
15	semi structured interview	in the village	workers	incomes and expense of the household
6	informal interview	in the village	key informants	the major issues and activities in the village
2	informal interview	in the village	the oldest generation of the villagers	the landscape changes
27	preference ranking	in the village	workers	which activities are the more popular within the workers
5	additional informal interviews	in the village	head of the households	about the households livelihood
11	soil samples	4 in the mango fields, 4 in the mangrove, 4 in the village	non	soil characteristics
4	water samples	2 in the prawn farm, 1 in the river, 1 in the sluse of the mango fields	non	water characteristics
5	forest inventory	in the village and nearby (mangrove)		Basal area, biodiversity and forest regeneration
1	community map	in the village	non	overview of the community composition
1	GPS mapping	in the village and nearby	non	precise measurement to build the community map
2	transect walks	in the village and nearby north/south, west/est	non	the landscape and the village composition

Appendix

Preference ranking examples

Preference Ranking	Fishing	Mangrove Forest Harvesting	Jellyfish	Mango Cultivation	Banana Cultivation	Other Cultivation	Mangrove Catch	Construction	Rice Cultivation	Fish Cages
Fishing		Fishing	Jellyfish	Fishing	Fishing	Fishing	Fishing	Fishing	Rice Cultivation	Fishing
Mangrove Forest Harvesting			Jellyfish	Mango Cultivation	Banana Cultivation	Other Cultivation	Mangrove Catch	Construction	Rice Cultivation	Fish Cages
Jellyfish				Jellyfish	Jellyfish	Jellyfish	Jellyfish	Jellyfish	Rice Cultivation	Jellyfish
Mango Cultivation					Mango Cultivation	Other Cultivation	Mango Cultivation	Construction	Rice Cultivation	Mango Cultivation
Banana Cultivation						Banana Cultivation	Banana Cultivation	Banana Cultivation	Rice Cultivation	Fish Cages
Other Cultivation							Other Cultivation	Other Cultivation	Rice Cultivation	Other Cultivation
Mangrove Catch								Construction	Rice Cultivation	Fish Cages
									Rice	Fish

Construction									Cultivation	Cages
Rice Cultivation										Rice Cultivation
Fish Cages										

Activities vs Preference	Fishing	Jellyfish	Fish Cages	Mangrove Forest Harvesting	Mango Cultivation	Banana Cultivation	Rice Cultivation	Other Cultivation	Mangrove Catch	Construction
Income	2	2	3	2	3	3	3	3	2	3
Health	3	3	4	3	4	4	4	4	3	4
Labor	1	1	2	1	2	2	2	2	1	2
Easy	4	4	5	4	5	5	5	5	4	5
Future Security	5	5	6	5	6	6	6	6	5	6
Tradition	6	6	7	6	7	7	7	7	6	7
Government Support	7	7	1	7	1	1	1	1	7	1

Appendix

Interview with young people

Nr.	Name	Age	Where is your family from?	Study (what and where)	Job (what and where)	Spare time activity	What kind of job do you want/don't want	Where would you like to live/study/work in the future	Do you know anybody who lives in a larger city? What do they do?	What are the 3 best things about Gerigat	What are the 3 worse things about Gerigat
1	Nora (F)	18	Gerigat	Primary 6 In Gerigat	Taking care of a baby	Nothing	Everything, factory, jellyfish prod.	Siriaman or Gerigat	A house-mate in Siriaman-	The beach	Nothing
2	Bardui (M)	25	Gerigat	Primary in Gerigat-secondary till form 6 in Kabong	Unemployed	Fishing	(+) Part time job as a constucter in Sarikei	Kuching – possibility for experience	A cousin in Kuching teaching math..	Security, convenient, nice place	Fighting
3	Sukma (F)	16	Gerigat	Up until form 6 in Gerigat	Works in the jellyfish factory	Works with Mr. Lau when he has the need for help.	(-) planting rice or fishing	Sibu	Has a Brother and a sister in Sibu working there in	The beach	nothing

									factories		
4	Fermissi (M)	19	Gerigat	Primary in Gerigat. Sec. Till form 6 in Kabong	Unemployed – unloading fish	Fishing	(+) footsoldier, (-) heavy work (fishing, foresting etc..)	West Malaysia	Has an uncle in Sibu – he works in a diner	Nice people, the beach	Nothing
5	Parisan (M)	21	Gerigat	Up until form 5 in Kabong	Unemployed	Plays ball with friends	(-) heavy work – planting rice fishing etc..	West Malaysia (Joho)	Friends in Joho working in factories	The beach	Nothing
6	Nuru Aurri (M)	19	Gerigat	Up until form 5 in Kabong	Unemployed	Plays ball with friends	(+) Policeman in Sarawak (-) manual labour (farming etc..)	West Malaysia Kuala Lumpur…	Has 2 brothers in Kuala Lumpur in the police and the military	The beach	
7	Usu (M)	24	Gerigat	Ud until form 5 in Kabong	Unemployed	Spending time with friends	(+) civil engineer, construction (-) fishing, foresting	Bintulu or Miri	Cousin in Bintulu, friends in Miri, Sibu and Kuching	Safe place, nice people	Fighting because of drinking but that's rare..

8	Saphika (F)	17	Gerigat	Primary in Gerigat	Married	Taking care of her 3. month baby	(+) policeman (-) fishing for jellyfish	Sarawak	Nobody	Safe and secure	The fighting
9	Rohana (F)	16	Gerigat	Form 4 in Kabong	Nothing is still in school	Does homework	(+) doctor (-) a teacher	Doesn't matter	A friend in Sibu - studying	The beach	Bølle boys
10	Linda (F)	24	Gerigat	Form 5 in Kabong	Married with 2 children	Taking care of her children	(+)Clerk with the government/school/hotel (-) Teacher, Police	Sibu or Siriaman	Relatives in Sibu in a factory, Siriaman in a hotel, a cousin in Kuching	The Beach	Nothing
11	Caspar (M)	19	Sarikei (visiting)	Form 5 in Sarikei	Wating for the result from the exam	Spends time with friends in Sarikei	Fireman	Sarikei		The beach	
12	Lina (F)	37	Gerigat		Selling sticky rice	Fuldtime house-wife. 4 children	Her resent job – but is open to everything	Gerigat – with the children	Son and sister in sibu, daughter in Kabong	The Beach	Cow-dong
13	Saidi (M)	26	Kuban/ Saratok	Form 6 Kuban	Works in farming now and then	Fishing with friends	Prefers working in Gerigat maybe with contracting or for the government	Gerigat, would like to study in KL though maybe work in sarikei	One in KL who works in a factory	Harmonic community, easy to get a job	nothing

14	Ma-hade (M)	22	Batang Siribas	Form 6 Kabong	Teritorial Army	Fishing with his dad	(+) government (-) anything involving chineese people....	Prefers to stay in Gerigat with the family, study in Sarawak	A brother in Joho, mekanic, a sister in Joho	The beach, tourist, harmonic community	Cow-dong, garbage
15	Arjila (F)	14	Rajang	Form 3 Kabong	Still in school	Studying	(+) work for a larger company. (-) anything involving chineese people....	Would like to live en a big city study in Sarawak	Nobody	The beach, the jetty with all the fish...	The drunks and those who are sniffing glue

Appendix

Time schedule

February		*Morning*	*Afternoon*	*Evening*
Monday	4	Introduction	Group formation etc	
Tuesday	5	Lecture & group work	Identification and presentation of key words	
Wednesday	6	Literature search	Literature search	
Thursday	7	Literature search	Presentation of 1-2 papers, reference list	Social arrangement
Friday	8	Lecture		
Saturday	9			
Sunday	10			
Monday	11	Field exercises	Follow-up lectures	
Tuesday	12	Lecture	Exercises	
Wednesday	13	Lecture	Group work: draft synopsis	
Thursday	14	Lecture	Group work: draft synopsis	
Friday	15	SPSS lecture		
Saturday	16			
Sunday	17			
Monday	18	Lecture	Finalizing and uploading draft synopsis	
Tuesday	19	Lecture	Preparing for draft synopsis presentation	
Wednesday	20	Draft synopsis presentation	Draft synopsis presentation	
Thursday	21	Lecture	Group work?	
Friday	22	Working on synopsis	Working on synopsis	Working on synopsis
Saturday	23	Working on synopsis	Working on synopsis	Working on synopsis
Sunday	24	Working on synopsis	Working on synopsis	Working on synopsis

Monday	25	Working on synopsis	Working on synopsis	Working on synopsis
Tuesday	26	Working on synopsis	Working on synopsis	Working on synopsis
Wednesday	27	Finalizing and uploading synopsis	Lectures	
Thursday	28		Preparing for field work	
Friday	29	Feedback on synopsis	Leaving for Malaysia	
March		*Morning*	*Afternoon*	*Evening*
Saturday	1			
Sunday	2			
Monday	3	Arriving in Kuching		
Tuesday	4	Arriving in Kuching		
Wednesday	5	National Park	National Park	
Thursday	6	Beach	Beach	Meeting Malaysian counterparts
Friday	7	Leave for Gerigat	Leave for Gerigat	Arrival in Gerigat, discussion of plans for next day
Saturday	8	Exploring village, transect walk, informal interviews, GPS	Exploring village, transect walk, informal interviews, GPS	Arrival Ibrahim, arrival Ringget (translator), group meeting
Sunday	9	Visit mango plantation and prawn farm	Gather information, discussing	preparing presentation
Monday	10	Presentation synopsis in Saratok	Free afternoon	Group meeting, interview with headmen
Tuesday	11	Visit jellyfish factory and fish cages	Gathering information and discussing, preparing the party	Elzelina's party!
Wednesday	12	Collecting water samples	Water samples tests	Gathering information
Thursday	13	Waiting for the rain to stop, interviews	Collecting soil samples, interviews	Group meeting, party in Alit
Friday	14	Forest inventory, interviews (Gerigat)	Soil samples tests, gathering information	Soil samples tests, gathering information

Saturday	15	Forest inventory, interviews, questionnaires (Sibu & Gerigat)	Gathering information	Group meeting, party in Plasu
Sunday	16	Forest inventory, interviews (Gerigat)	Visiting Alit and Empayang, interviews	Preparing presentation
Monday	17	Presentation results in Saratok	Free afternoon, exchange of information with Malaysian counterparts	Good bye party Gerigat, Sessang and Alit
Tuesday	18	Return to Kuching	Return to Kuching	Party!
Wednesday	19	Beach	Beach	Good bye party, Lausts birthday
Thursday	20	Holiday	Holiday	Holiday
Friday	21	Holiday	Holiday	Holiday
Saturday	22	Holiday	Holiday	Holiday
Sunday	23	Holiday	Holiday	Holiday
Monday	24	Holiday	Holiday	Holiday
Tuesday	25	Holiday	Holiday	Holiday
Wednesday	26	Holiday	Holiday	Holiday
Thursday	27	Holiday	Holiday	Holiday
Friday	28	Holiday	Holiday	Holiday
Saturday	29	Holiday	Holiday	Holiday
Sunday	30	Holiday	Holiday	Holiday
Monday	31	Group work, discussions		

Appendix

Synopsis

The influence of water resources on the livelihood in the village of Grigat, Sarawak, Malaysia

ILUNRM-course, February-April 2008

KU Life

Synopsis by

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Introduction

This is a synopsis written in the framework of the ILUNRM-course 2008. The purpose of it is to select, prioritize and describe research questions to be used in the further studies of Grigat village in Sarawak, Malaysia.

Grigat lays on the outermost delta of the Nyabor River, which is part of Rajang River Delta, with the South China Sea towards the west and the river delta towards north, where you also find mangrove forest with its large variety in fauna. Water plays a huge part of the everyday life for the inhabitants of Grigat. Sea fishing and jelly fish production enrols a large part of the villagers.

There is a sandy or silty beach just south of the river mouth which stretches approx. 2 km and is influenced by the sediment supply from the river. The beach is to some extent used for recreational activities by the locals.

The river is supposedly the provider of water to the rice fields and to the mango production surrounding the village. There is a big area with prawn production ponds close to the village, which also clearly is exploiting the rivers proximity.

The village seems to have multiple options for employment and yet it is at the moment experiencing a migration towards the cities for labour. This trend could be due to the youth no longer being interested in fishing in the sea, the prawn producers not hiring locals, the mangrove no longer supporting the income of the workers and the decline of usage of land for non-commercial purposes.

Research question

Since water is such a major resource and comprises a potential for development, we ask ourselves; ‘

How do the water resources surrounding Grigat influence the livelihood of the villagers?

The following sections will describe five different issues, which all will act as partial answers to the research question. The table shown in appendix 1 illustrates the five different issues, which is elaborated in the following chapters.

Prawn production

Research question

Aquaculture is an increasing industry in many developing countries because of the potential economic and social benefits it can bring. It can act as a place for additional labour, adding to the food resources and improve the infrastructure by creating transport opportunities to larger cities for trading. It is though necessary to integrate the aquaculture into the area with concern to the environment and the needs of the villagers (Haylor, G and Bland, S. (2001)) (Hasan, M. R. (2001))

Therefore we ask the question: What is the sustainability of the prawn production?

The prawn production has a potential impact on Grigat in two ways; on the environment and on the livelihood.

It can affect the environment in terms of alternating the landscape by changing rice fields into prawn ponds. By doing that, it removes labour sites and food sources and there could be a potential for polluting the soil underneath the ponds and thereby ruin future agriculture on that spot.

The water used in the ponds could reach excessive levels of organic waste material. If the ponds and the river are directly linked this could serve as a potential pollution source to the river. This problem can be solved i.e. by cleansing filters or by implementing plants that use the nutrient. If not done, these solvents could results in wide-ranging damage to the flora and fauna.

The prawn production could contribute to improve the livelihood of the villagers by increasing the wage labour opportunities, provide an additional source of food and act as an attraction for ecotourism and thereby add more employment to the village. This could compensate for the declining non-commercial agriculture as an income prospect. To comply with the need for trading the prawns the infrastructure could be extended and thus benefit other transport activities. Prawns as an additional food source would supply the village with nutrition rich food adding to the daily vitamin and essential fatty acid intake.

The thought is that the more sustainable and effective the production is, the more it will be able to maintain a reasonable livelihood for the farmers.

Data needed

In order to determine the sustainability of the production we need to establish whether the farms create nutrient pollution and whether the villagers benefit from the extra source of income in terms of additional labour, renting out profits, infrastructure and additional food source

Methods for collecting data

Soil samples and water samples from the area close to the farm and the river will tell us whether it is leading to nutrient pollution or not. An informal interview with the owner or the headman on will give us an idea how the farm is managed. Asking the villagers through interviews and questionnaires will tell us which level the interaction between the villagers and the farm takes place. The local village administration office can hopefully help us with the importance of the farm according to amount of people with income from the farm.

Tourism

Relation to the research question

The interest in tourism in Grigat is based on the fact that there are numerous examples of communities developing because of a tourism industry. Furthermore, tourism can have a tremendous impact on the local environment and therefore makes a suitable case of investigation in relation to our interdisciplinary approach in this project.

We have divided the subject tourism into four parts:

1) Are there any tourist activities taking place in Grigat?
2) What is the potential for developing a profitable tourism industry in the area?
3) Could tourism sustain a number of households in the community?
4) What impact would a tourism industry have on the local environment?

It is not apparent whether there are tourists coming to the area at the moment, although we believe that there are at least local or regional tourists visiting the beach.

Many parts of Malaysia and Sarawak are very well visited due to attractive cultural, historical, nature and climatic conditions. Hence, there exist many examples of remote communities developing because of tourism. Recent examples of this are in the framework of agrotourism and

ecotourism, which take advantage of the extensive farming and the vigorous nature, respectively. The large number of visitors to Sarawak (approx. 3 million in 2006) also means, that there is an existing administrative system to handle tourism activities and that the infrastructure can support a tourism industry to a certain degree.

Beach tourism

The success of a recreational beach is often determined by the quality of the beach and its surroundings. The most important factors constituting the success of a beach are listed in appendix 6.

We assume that the main tourism in Grigat would be the beach west of the village. The beach in has tourism potential but a problem could be sediment contribution from the river.

There are a number of projects in Malaysia which aim to implement ICZM (Integrated Coastal Zone Management). We have not been able to gather sufficient information about ongoing ICZM-projects in SarawakWe plan to learn more about this when going in the field.

Data needed

The ideal data material is listed in appendix 6 of which we have chosen carry out the accessible ones. We will measure the sediment characteristics of the beach as a distribution over the beach profile. This will tell us how dynamic the beach is and what the importance of extreme high waters (during storms and/or tides) is on the beach morphology. The near shore water current conditions are important for swimming safety and will be evaluated based on a combination of historical wind and wave data and of the discharge characteristics from the Rajang River.

In order to investigate the more abstract factors as the local willingness and the non-locals perception of attractiveness, we will talk to locals and non-locals, respectively.

Methods for collecting data

The sediment characteristics will be determined by taking cross shore sand samples from the beach.. These factors will be determined by using the method developed by Folk & Ward (1957). The historical wind and wave data will be obtained from a relevant organization or institutes. The characteristics of the river can be obtained from the literature (Staub et al., 2000).

Questionnaires and interviews with locals and non-locals will be performed. Interview guidelines to these interviews and questionnaires can be seen in appendix 5.

We will also investigate alternative tourist attractions in Grigat, especially ecotourism. The obvious attractions are the mangrove, prawn farming, river fishing and agriculture. Our first step in the field is therefore to investigate whether there is potential or even willingness for ecotourism.

Agriculture

Relation to the research question

Apart from fishing and aquaculture, commercial agriculture is an important source of income for the villagers of Grigat. The Grigat Irrigation Scheme and the Mango Plantation Scheme stimulate the development of commercial agriculture. However, the area under agricultural production is decreasing. Despite this, the unemployment among youth in the village is prevalent. We will look into three different subjects which could explain this paradox.

According to Gowing et al (2006), one of the environmental impacts related to the development of prawn production in mangrove forests is the increased salinity of the soil in the agricultural areas. This is caused by drainage and seepage from the ponds.

In Grigat, there are several big prawn ponds, which have a potential impact on the soil salinity of the surrounding agricultural fields. A high soil salinity could make the fields unsuitable for agricultural production.

The youth of Grigat is migrating to the surrounding big cities to find other, more profitable sources of income. These livelihoods strategies could also be an important reason of the reduction of the area under agriculture.

Another potential reason for the decrease of the area under agriculture could be the malfunction of the governmental programs.

Data needed

To assess the potential pollution of the agricultural land by the prawn ponds, an observation of the link between the ponds and the agricultural lands and soil samples to assess salinity of the soil are needed. Also farmer experiences are important for this.

To find out which livelihood strategies the villagers prefer, we will conduct questionnaires.

To find out why the area under agriculture is decreasing, a description of the irrigation scheme and mango plantation scheme is necessary. Also the farmers' experiences with the schemes and the importance of agriculture for their livelihoods are important.

Methods for collecting data

The methods which will be used are analysis of soil samples on salinity and assessment of the link between the prawn ponds and the agricultural fields. Other methods are interviews with an IADP (Integrated Agricultural Development Program) officer and questionnaires with villagers (see appendix 8).

Mangrove

Relation to the research question

The mangrove plays an important role in water purification, coastal protection, biodiversity conservation and fish production. Possibly the mangrove also supplies the villagers with NTFPs and timber.. The degradation of the mangrove can negatively influence the river and the pollution of the river can negatively influence the mangrove. This can have severe impacts on local livelihoods, as they rely on the river for irrigation and fishing.

Data needed

To assess the importance of the mangrove on the livelihoods, it is necessary to know which uses local people have for the mangrove. This could be in terms of extraction of NTFPs or timber, fishing etc.

To assess the quality of the mangrove, a forest inventory should be executed. This includes an assessment of the biodiversity of the mangrove. Water samples can provide data about the water quality and biodiversity, both in the mangrove and in the river

Methods for collecting data

In order to find out for which uses the villagers use the forest, questionnaires (appendix 9) will be used. We will also assess this through personal observations. The role of mangroves on rural livelihoods can also be assessed using literature.

To find out how the mangrove area changed since the last 20 years, we will ask the villagers to draw a resource map of the current situation and of the situation 20 year ago.

Water samples will be used to assess the biodiversity and quality of the water in the mangrove and river.

Forest inventories will be used to assess the forest resource and the biodiversity of the forest (see appendix 7).

Landscape

Relation to the research question

Almost all major towns in Malaysia are located beside a river. the Rajang river delta is an important factor influencing the development of the local cultures and the livelihoods in Grigat.

We ask ourselves: in which terms are the locals exploiting and managing the river area? What is the landscape composition? And which factors are influencing Grigat development?

First, the assessment of the river environment helps us to understand the water system. The physical conditions of the river tell us about the interaction between the villagers and the river.

Other factors influencing this relation can be cultural and not only related to the terrain. Thus, we will investigate what are actually the needs and the practices of the locals toward the river. How is this relationship developed over time?

The last sub issue of the river- related landscape analysis will focus on the human settlements of the area whether it is telling the effort of conservation in general and the river basin management approach in Grigat´s river area.

Data needed

The aim is to scheme the variable aspects participating in the river system according to the fluctuations of the water cycle in the landscape. This will clarify the way the water is circulating and playing a major role for

the activity in this area.

A map of the water cycle showing the interaction between the river, aquaculture, mangrove, etc. will visualize this (see appendix 10)

In order to investigate the link between the river and the cultural heritage we will focus upon the following:

- the traditional practices related to the river
- the current daily practices related to the river
- the incomes related to these practices
- the related daily moves of the villagers from the village to the river

The land management system and the history of the village related to its location will tell us about the extensions and the changes in the river exploitation. New investments like the prawn or the mango production could mean new opportunities for labor or cash incomes. But that also means land settlements, modifications of the river banks or of the river flow and have effects on the whole landscape system.

The environmental quality might changes as well in this process and here is a need to assess the ecological impacts of the current management and the sustainability of the new practice in term of conservation and integration in the river biotope.

To quantify the landscape water system potential, we need a guideline identifying the current landscape values and the land use profile of Grigat. (see appendix 12)

Methods for collecting data

A transect walk through the community, will create a base for our further research.

Interview with a key informant and informal discussions with locals will help us to get information about the existing natural resources and the different factor affecting the river (climate conditions and the water management).

Asking local people to draw their own map of the resources and to explain their perception of the relation to the river will help us to understand the distribution of the point of interest for the village.

By handing out questionnaires to the locals will help us rank the major activities related to the river resource (see appendix 14). An interview with the headman will confirm the impression given by the questionnaire and hopefully ad some precision on the origin of specific practices that direct observation cannot explain (see appendix 14). We will use PRA methods to get familiar with the

local´s daily routine and with their seasonal calendar. This will tell us how dependant some activities could be on the river system and how it impacts on the livelihood.

To create a timeline of the landscape evolution we will interview the head man and the administration about programs and policies organizing the management of the river. We will in particular ask about the last settlement created for the prawn production and if there is any plan made to improve the access to the river.

At last, analysis about water quality trough samples will show the amount of garbage, toxics and sediments in the water.

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Appendix 1 – Table of research questions, data needed and methods for data collection

Approach/issues	Research question	Sub issues	Hypothesis	Data need	Methods	Results
Aquaculture	What is the sustainability of the prawn production ?	1. Ecosystem	The form of management leads to excessive nutrient pollution	- Water quality (pollution, biodiversity) - Soil quality (pollution) - Management plan - Production key figures	- Water and soil samples - Informal interview with local director	- Diagram of nutrient flow - Map of pollution (contour plotting)
		2. Livelihood	The prawn farms contributes with limited resources in terms of labour, self sufficiency and income	- Number of Local vs. Outside workers - Amount of fields rented out - Distribution of output	- Interview with villagers/key informants	Distribution of - Local workers vs potential workers - Benefits from prawn farming vs. traditional land use

Approach/issues	Research question	Sub issues	Hypothesis	Data need	Methods	Results
Tourism	To what degree do tourism activities take place in Grigat ?	1. Tourism activity	There are existing local-based tourism activities	- How much and which activities	- Questionnaire to travel agencies, - Locals - Tourists	- List of existing activities
		2. Potential	There is a significant potential for tourism development	- Morphology development of the coast - Assessment of alternative tourist attractions (mangrove, ecotourism etc.)	- Images - Remote sensing/GIS - Wind and wave data - Sand samples, - Interview with tourists and owners of land/attractions	- List of potential attractions/sights - Illustration of morphology development
		3. Economic dependance	A tourism industry would sustain a number of households in the community	- Income oppurtinities - Historical development - Case studies	- Interview with the resort director - Literature - Case studies - Informal interviews with villagers	- Sustainable number of visitors (limitations) - Potential maximum income by tourist activities

		4. Impact on the environment	A tourism industry would have a degrading effect on the environment and on the natural resources	- Experience from similar case studies	- Literature review - Interview with a local environmental agency	- Estimation of loss of natural resources in relation to the extent of tourism

Approach/issues	Research question	Sub issues	Hypothesis	Data need	Methods	Results
Agriculture	Why is the area of agriculture decreasing ?	1. Link aquaculture and agriculture	Due to pollution from the prawn ponds the soil is unsuitable for cultivation.	- Salinity of the soil in the field	- Soil samples	- Comparison with soil samples outside the area potentially affected by the prawn farm. - Description of link between aquaculture and agriculture
		2. Governmental planning	The IADP program does not work in an effective way.	- Description of the IADP programme	- Interview of the IADP officer	- Description and assessment of the efficiency of the IADP program
		3. Livelihood	People are not interested anymore in farming because there are other more profitable sources of income available	- Livelihood strategies	- Questionnaires with farmers/villages	- Description of livelihood strategies of villagers - Why they prefer one above the other

Approach/issues	Research question	Sub issues	Hypothesis	Data need	Methods	Results
Mangrove	The role of the mangrove for the livelihood ?	1. Forest inventory	The forest [area] is severely degraded and does not offer much protection against floods	- Uses of the mangrove	- Questionnaires and observation	- Comparison with the forest resources of the Sematan mangrove forest (Ashton et al, 2002)
		2. Uses	The mangrove and river are used for fish cultivation and in this way they contribute to livelihoods	- Physical/social link between mangrove and river	- Observation and GIS - Interview of fisherman	- Assessment of the current importance of the mangrove for livelihoods
		3. Resources	The forest resource has limited biodiversity and hence no potential for ecotourism	- Quantification of biodiversity	- Water samples for biodiversity assessment - Literature	- Detection of potential water pollution - Assessment of the biodiversity

Approach/issues	Research question	Sub issues	Hypothesis	Data need	Methods	Results
Landscape	What are the benefits from the river for the village ?	1. Environment	The river is a special location where different water exchanges take place.	- Interactions between sea/ river/ mangrove/ aquaculture/ agriculture - Locations of these - Water cycle	- Transect walk - PRA: mapping with locals - Informal discussions with locals - Interview to key informants	- Map of the whole physical hydrologic system - Calendar showing the seasonal fluctuations of the river area
		2.Culture and uses	There is specific practices related to the river and a traditional background	- The villagers uses and needs from the river - Traditional practices - Current daily work - Related moves - Related issue	- Questionnaire to the locals on their activities related to the river - Interview of the head man - Interviews to old and young ocal people - Direct observations of locals' activities - Ask people to describe there daily routine (PRA)	- Comparison of old and new uses/needs -Trend Analysis & Community History (Time-line) - Photo report showing cultural practices

		3. Recent changes	There have been changes in the water management in the last 20 years	- Former and new management - New investments - Infrastructure related to the river - Environmental quality changes	- Interview of the head man and the administration - Direct observation of the infrastructures - Information on the internet on the river management program - Water samples	- Describe the river basin management approach - Assess the environmental impact of the current river related activities

Appendix 2 Time schedule

Week/date	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
3 March – 9 March				- Starting course - Meeting Malaysian counterparts - Discussing synopsis - Preparing questions for the headman	- Agreeing on synopsis, data needed and methods - Transportation to Grigat - Settling down	- Mapping the village - Transect walk - Meeting the headman/administration	- Identification of key informants - Adjusting research questions according to observations - Finalize draft map
10 March – 16 March	- Finding and interviewing local administration/ government, if any - Quantify the degree of tourism - preparing interviews with key informants	- Interviewing key informants - Water samples	- Interviewing key informants - Water samples	- Soil samples in fields/mangrove - Questionnaire in the village	- Beach assessment - Sediment samples	- Timeline PRA exercise with locals	Buffer day / data assessment
17 March – 23 March	- Goodbye - social gathering	- Transport to Kuching	- Discussion and treatment of data	- Discussion and treatment of data			

Appendix 3

Specification of water samples

We will investigate the levels of:

Oxygen

Carbon dioxide

Nitrogen

Phosphate

Ammonia

Nitrate/nitrite

We will measure

Temperature

Salinity

pH

Hardness (calcium level)

Stream

We will look on biomarkers such as snails, worms etc. (all listed in *mini sass*)

Specification of soil samples

We will investigate levels of:

Nitrogen

Phosphate

We will measure:

pH

Salinity (Electrical conductivity, Sodium adsorption ratio and Residual sodium carbonate)

Appendix 4

Interview guidelines for informal interview with the local manager of a prawn farm

- How big is the farm?
- How many ton do they use as seed?
- How many tons do they harvest?
- Where are the prawns sold – and how are they transported there?
- How many workers work there?
- Do they have special training/education?
- What is the daily routine?
    - Feeding
    - Cleaning
    - Water cleansing
- Where does the water in the ponds come from?
- Where does the waste water goes – do they clean it before? Is the system closed or connected with the river or irrigation system?
- Do they have plans for expanding?
- Is the farm open for the public?

Appendix 5

Interview guidelines for interview with the beach resort manager and/or head man

- How many tourists come to the community?
    - Of them, how many to resort?
- Why do the tourists come to Grigat?
    - Attractions
    - Places
    - Activities
    - Social relations
- Where do the tourists come from?
    - Local
    - Regional
    - International
- What would a tourism industry mean to the community?
    - Economically
    - Culturally
- What is the attitude in the community towards developing a more extensive tourism industry?
- Does anyone in the community possess experience with tourism activities?
- What should be done in order to attract more tourists?

Appendix 6 - Factors constituting the success of a beach

Direct influencing factors		**Indirect influencing factors**	
Factor	**Measurement**	**Factor**	**Measurement**
Sediment characteristics	*Beach profile distribution of grain size, sorting and skewness*	Infrastructure	*Parking spaces, approach roads, service facilities etc.*
Beach and nearshore morphology	*Gradient, water depth, morphological features, vegetation*	Accommodation	*Type, size and number of visitors*
Sediment dynamics	*Longshore- and cross shore transport, current dynamics*	Local willingness	*Economic value of a tourism industry*
Wave and wind climate	*Wave height, length and period* *Wind direction and speed*	Attractiveness	*Non-locals perception of the beach as an attraction*
River dynamics	*Seasonal discharge, sediment transport*		

Appendix 7

The forest inventory will be conducted in 2-3 plots of 10 x 10 m., depending on the size of the area and the available time. The parameters will be: species, basal area (diameter) and abundance of the species. The results will be compared with the research of Ashton et al (2002), who did a forest assessment of the near virgin mangrove forest of Sematan, Sarawak, Malaysia.

Appendix 8 – Questions about agriculture to the villagers

1. Why did you choose to engage in commercial agriculture? Why not?
2. How many hectares do you have?
3. Do you own this land?
4. What crops do you grow?
5. What importance has agricultural production for your income?
6. Do you participate in the irrigation scheme or the mango plantation scheme?
7. Are there any negative impacts from the prawn ponds on the agriculture in the village?

Appendix 9 – Questions about the mangrove to the villagers

1. Do you get any products from the mangrove? If yes, which kind (NTFPs, timber, animals).
2. Did the amount and type of products from the mangrove change compared to 20 years ago?
3. Did the quality and area of mangrove change compared to 20 years ago?
4. Do you use the mangrove for anything other (fishing, prawn nursery etc)?

Appendix 10

Appendix 11

Appendix 12

Appendix 13

Appendix 14

Interview guide line to to the head man:

- **Cultural background of the relation between the villagers and the river**

  - What are the major traditions related to the river ?

  From when?
  From What?
  From which culture (Malay, Iban, local from Grigat? ?)
  - what is their related folklore?

  - what are the activities related to them?

  Activities:
    - Fishing
    - Bathing
    - Drinking water
    - Transportation
    - Irrigation
    - Aquaculture

  - What are the other activities?

  - Tell me a brief history of the village?

  - What are the ancient practices?

  - what are the new practices?

  - Is there a relation to its location?

  - Do you think the villagers benefits from the river?

  - Do you think they could improve it?

Questionnaires to locals

- **What are you using the river for?**
  - **Fishing**
    How often are you fishing?
    In which season?
    What do you catch?
    How much?
    Do you sell it?

Do you eat it?
Do you do anything else?

- **Bathing**
  When are you bathing?
  How often?
  Why?

- **Drinking**
  How do you drink this water?
  Is it for cooking as well?
  Is there any dieses coming from the water?

- **Transportation**
  What kind of transportation you use?
  How often do you go by the river?
  To go where?

- **Irrigation**
  How do you irrigate your fields? What is the system?
  How much?
  Why?
  Since when?

- **Aquaculture**