social ecology vienna iff
ALPEN-ADRIA UNIVERSITÄT KLAGENFURT

SOCIAL ECOLOGY WORKING PAPER 98

Marieke Hobbes • Rene Kleijn (Editors)

Local Material Flow Analysis in Social Context at the forest fringe in the Sierra Madre, the Philippines

ISSN 1726-3816

September 2007

Marieke Hobbes and Rene Kleijn (Editors), 2007:

Local Material Flow Analysis in Social Context at the forest fringe in the Sierra Madre, the Philippines

Social Ecology Working Paper 98
Vienna, September 2007

ISSN 1726-3816

Institute of Social Ecology
IFF - Faculty for Interdisciplinary Studies (Klagenfurt, Graz, Vienna)
Klagenfurt University
Schottenfeldgasse 29
A-1070 Vienna
+43-(0)1-522 40 00-401
www.aau.at/socec
sec.workingpaper@aau.at

© 2007 by IFF – Social Ecology

Local Material Flow Analysis in Social Context at the forest fringe in the Sierra Madre, the Philippines

Report to the EU financed Project Southeast Asia in transition (SEAtrans)

Coordinated by Marina Fischer-Kowalski & Heinz Schandl

Marieke Hobbes and René Kleijn (editors)

Institute of Environmental Sciences, Leiden University (CML)
P.O. Box 9518; 2300 RA Leiden; The Netherlands
E-mail: hobbes@cml.leidenuniv.nl

Preface

The present report is the result of the local studies of the EU-funded Southeast Asia in Transition (SEAtrans) project in the Philippines. The study was carried out by the Department of Environment and Development and the Department of Industrial Ecology of the Institute of Environmental Sciences (CML), Leiden University and the Cagayan Valley Program on Environment and Development (CVPED), a joint undertaking of Isabela State University, the Philippines, and the CML.

The SEAtrans project is a collaborative effort of the Institute of Social Ecology, IFF Vienna (lead-partner) and universities in the Netherlands, Italy, Spain, Laos, Thailand, Vietnam, and the Philippines. In the Philippines, the University of the Philippines, Los Baños (UPLB), Isabela State University (ISU) and the Resources, Environment and Economics Center for Studies (REECS) participated. The general objective of the project was to explore the sustainability aspects of the modernisation of South-East Asian societies. Part of this project focused on the flows of materials and energy (biomass, oil etc.) on the national level, and another part concentrated on the local (village) level. In the villages, attention was paid to both the flows of major products (corn, rice, logs, etc.) and to the explanation of why farmers choose for the livelihood activities related to these major products. A simplified version of the Action-in-Context methodology had a central place in the latter. The present report gives an extended description of all the findings of the local level SEAtrans project in the Philippines.

The fieldworkers Orlando Balderama, Liesbeth Denis, Sietske Veenman and Marieke Hobbes, and the other scientists directly involved from CML, René Kleijn and Wouter de Groot, would like to thank all people who made this research possible. Marina Fischer Kowalski (project leader), Heinz Schandl and Clemens Grünbühel (IFF) we thank for inviting us as partner in the research project and for publishing this report. We acknowledge the value of the CVPED structure and its staff members, especially the co-ordinators Dr. Andres Masipiqueña and Jan van der Ploeg; they were indispensable for their scientific and practical and logistic assistance. At the CVPED office we thank Madel and Eso for their practical help. Arnold, Sammy, Leonardo and Jane have been great research assistants, interpreters, guides and companions in the field. We are most grateful to our to all our respondents in Dy Abra, Masipi East, and Puerta, who gave us so much of their time to learn about their way of living and who made us feel at home.

The editors
Leiden, September 2007

Contents

Part I: SEATrans and the research area

by Marieke Hobbes

1 SEAtrans in the Philippines

1.1 Research process

Researchers intermittently conducted fieldwork from July 2001 to June 2002 with the support of the research infrastructure built up by the Cagayan Valley Program on Environment and Development (CVPED), a joint undertaking of Isabela State University, the Philippines, and the Centre of Environmental Science, Leiden University, the Netherlands. René Kleijn assisted from the Netherlands.

During the introductory period, we developed research plans and selected the three research sites as was agreed upon for SEAtrans. Denis and Balderama worked together on the MFA/EFA study in the main research site. Veenman worked on putting the MFA findings in context according to the Action-in-Context methodology in the main research site. Balderama continued with the MFA/EFA research in the other two villages, while Hobbes carried on with the AiC in all villages. The researchers from the CML have closely worked together with the Filipino counterpart and worked full time with Filipino research assistants and interpreters, also assisting Balderama.

1.2 Research region

The Republic of the Philippines consists of about 7100 islands, covering a total area of 300,000 square km. It is situated in the Pacific Ocean, to the south of Japan and China, to the east of Vietnam, and to the north of Indonesia and Malaysia. The local level SEAtrans research is carried out in Isabela province. It is one of the five provinces of Northern Luzon (region 02) and occupies the central part of the watershed of the Cagayan River. Its plains and valleys are bounded by two mountain ranges: the Sierra Madre Mountain range on the east and the Cordillera on the West. It has a total land area of 10,664.5 square kilometres, which is approximately 3.5 percent of the Philippines' total land area.

Vegetation/deforestation

The northern Sierra Madre holds the largest contiguous area of intact tropical moist forest in Luzon, and one of the largest in the Philippines. The area is covered by common hardwood species belonging to the family *Dipterocarpaceae*, construction and furniture wood belonging to the families *Casuarina*, *Fabacea*, *Euphorbiacea*, *Moraceae*, *Verbenaceae*, *Dipterocarpaceae*, etc. and softwood such as almaciga (*Agathis philippinensis*) and *malakauayan* (*Podocarpus philippinensis*). Due to the immense scale of commercial logging in the Philippines during the nineteen seventies and eighties, much forest in the region has been lost. However, many protection activities are taking place now. The Northern Sierra Madre Natural Park is the largest protected area in the Philippines with a total land area of 359,000 hectares. The park represents almost ten percent of the remaining primary rain forest in the Philippines and is home to the highest number of endemic and threatened species of plants and wildlife. There is focus on forest protection and conservation in the park, on sustainable use in the buffer zone consisting of secondary forest (such as community based forest management), and a drive towards sustainable agriculture on the post-forest lands (such as integrated social forestry).

Land use

About 25 percent of the province is devoted to agriculture, 15 percent to pasture area and the rest is forest area and residential areas. About 35 percent of the province's total land area is classified as mountain uplands and 47 percent as plain and valley. The lowlands are susceptible to flooding during heavy rainfall. The soils in the rolling and upland areas are suitable for pasture and permanent crops where drainage is adequate. In areas where the slopes are too steep, erosion is a common problem. The total area of farmland producing corn had steadily increased with the expansion of cultivated farmlands during the twentieth century, rising sharply after 1985, when new hybrid corn varieties were introduced (Van den Top, 1998: 342). A major difference between the introduction of new corn varieties and the earlier introduction of high yielding rice in rural farming areas is that yellow corn is exclusively cultivated as a cash crop (*ibid.*).

Climate

Because of the Sierra Madre mountainous spine two different climatic zones can be distinguished. Western Isabela has a relatively long dry season from November to April (Northeast monsoon) and rainfall throughout the remainder of the year (Southwest monsoon). The mean monthly temperature averages around 26 degrees Celsius. The average annual rainfall is 2,200 millimetres. Eastern Isabela experiences moderate rainfall, more or less evenly distributed

throughout the year with temperatures lower than western Isabela. Every year, some 20 typhoons pass the archipelago, especially the northern part of the country. The El Niño phenomenon that is associated with extreme climatic variability resulted in severe rainfall deficiencies in 1997-98.

1.3 Policies

This section will give a short description of the Philippines' environmental policies in general that will serve as background information for the case studies.

Content of agricultural and forestry policies

In the Philippines, environmental policy had been dominated by a centrally determined, top down and non-participatory approach in favour of commercial logging for decades (Kummer, 1992; Broad and Cavanagh, 1993). With the Spanish conquest and rule that started in 1565, succeeded in 1898 by the United States, all the untitled lands were declared Public Domains, owned by the government, comprising about 92 % of the land (Van den Top, 1998). Of all the forest policies, the Americans concentrated most excessively on modernising the forestry sector, which actually meant modern logging. Private business groups were dependent on government decisions for access to forests by means of granting Timber Licensing Agreements or concessions. The issuance of the licenses for large scale mechanised extraction of timber in Cagayan Valley started in 1947 and accelerated after 1970 until 1990 (Van den Top, 1996: 106). From 1990 to 1997, nearly all large scale mechanised logging operations were cancelled or suspended (*ibid.*). The Public Lands Act of 1903 specified a land classification system for the Public Domain that is still upheld:

Alienable and Disposable: Land which have been classified as not needed for forestry purposes (only the A&D lands can be privately owned)

Forest Land (or uplands). There are conflicting definitions of this term, also among the government agencies. The Department of Environment and Natural Resources (DENR) define uplands as hilly to mountainous areas of slopes greater than 18 percent including the table lands and plateaux lying at higher elevations which are not normally suited to wet rice unless some form of terracing and ground water existed. The Department of Agriculture (DA) on the other hand define uplands as areas that are rainfed or not suitable for irrigation.

Three departments will be discussed that are all actively involved in the research sites, namely the Department of Environment and Natural Resources (DENR), Department of Agriculture (DA) and Department of Agrarian Reform (DAR).

Department of Environment and Natural Resources (DENR)

These days, the Philippines has comparatively progressive forest policies with the twin objective of biodiversity conservation and sustainable development. The programs implemented by the DENR in the research areas are:

"Under Integrated Social Forestry Program (ISF) (1982) individuals or families can secure a renewable 25-year Certificate of Stewardship Contract (CSC), consisting of mutual rights and obligations to promote resource management (letter of instruction no. 1260, 1982). The rationale is to promote the socio-economic conditions of forest occupants and communities dependent on forest land for their livelihood, by providing land tenure security that at the same time should improve the quality of the environment"

The Community Forestry Programme wherein non-governmental organisations are involved to develop capabilities of local private sectors to implement community forestry programmes.

Department of Agriculture (DA)

Whereas the DENR's responsibility for land use is applied to the uplands, the Department of Agriculture has the same responsibility in the lowlands (the Alienable and Disposable lands). To increase farm production levels, the DA promotes agricultural intensification through technological innovations and the proper use of new technologies, and livestock production. The National Irrigation Administration is part of the DA and tasked with the development and operation of irrigation systems all over the country.

Department of Agrarian Reform (DAR)

The Department of Agrarian Reform implements the redistribution of large agricultural lands among the actual tillers. The Comprehensive Agrarian Reform Act (CARP) of 1988 stipulated that no landowner would be allowed to retain more than 5 hectares land, plus three for each heir. Areas under Pasture Land Agreements (PLA) are excluded from redistribution. In case the area falls under uplands, occupants are issued CSC by the DENR, in case the area falls under A&D, occupants are issued Certificates of Land Ownership Awards (CLOA). For the latter, financing occurs through the Land Bank of the Philippines or directly. In addition to the land distribution, DAR also handles a CARP Beneficiaries Development Program, intended to identify and strengthen so-called Agrarian Reform Communities (ARC). After a community has been identified as ARC, training programs for development of local organisation and other skills are implemented there, and financial support is given for the development of economic and physical infrastructure (Van den Top, 1996: 192-3)

Local Government

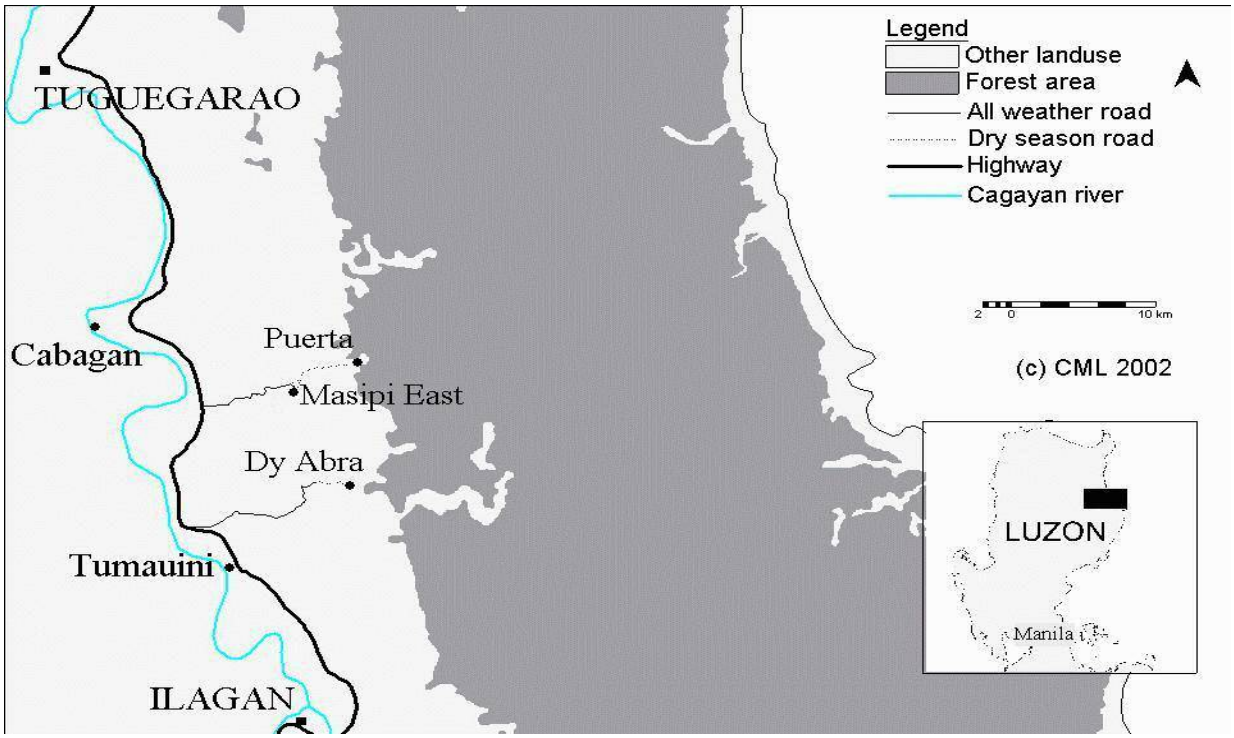
The Local Government Code of 1991 provided devolution of decision-making powers from the national agencies to local government units (LGU), such as provincial, city, municipal and village-level (*barangay*) governments (Republic Act 7160, 1991). Elected governors, mayors and *barangay* captains are supported by elected councils. At the lowest level, the *barangay* councils are each assigned to the sub villages (*puroks* and/or *sitios*), in which *barangays* are subdivided.

The municipal LGU is the only unit of the administrative system the *barangays* deal with. Every quarter of the year all departments (health, environment, agriculture etc.) and *barangays*, represented by their *barangay* captains, prepare a plan for a meeting with the LGU. The *barangay* captain and council, both elected by the inhabitants of the village, write the *barangay* plans for a period of five years. The final plan will be implemented after approval. The other meetings the LGU organises are only attended by the president of the *barangay* captains association, elected by the *barangay* captains of a municipality. The association of *barangay* captains meets every month. The discussed topics during the meetings are mostly about the safety situation, livelihood, and infrastructure. The task for the president of the association of *barangay* captains is to guide and support the captains in implementing the policies and remind them of their function: "*Everybody is human and you can forget the actual purpose*". Personal interest may sometimes be more attractive than implementing the policy as such.

1.4 Site selection

The local studies in SEAtrans provide an insight into the features of a subsistence economy, which is undergoing rapid change. For the local level studies, we selected three villages that are situated at the foot of the Sierra Madre mountain range. They show a gradient of agricultural intensification going from a more extensive land use system focused on subsistence, to a more intensive and market-integrated system. The most important variable looked at for the site selection is resource dependency, being directly connected to the material flows. The three selected sites are *barangays* Dy Abra (Tumauini) and Masipi East (Cabagan) and Puerta, a *sitio* of *barangay* Masipi East (see map). The boundaries of the sites are adjacent by which a total area of about 9000 hectare is covered. The area is characterised by rice and corn based farming systems, wherein rice is mainly cultivated as a subsistence crop and yellow corn as main cash crop. Slash-and-burn fields and banana plantations are found at higher elevations.

Barangay Dy Abra is selected as one research site, covering several sitios, because the whole area of Dy Abra constitutes an economic entity due to the continuous migration of labour between the uplands and lowlands.



Map of research area (made by M. Van 't Zelfde)

Although *barangay* Masipi East belongs to Cabagan municipality, all sites are economically more linked with Tumauini municipality. Puerta is in fact a *sitio* of *barangay* Masipi East (i.e. it is not a separate political entity), but we decided to consider *barangay* Masipi East and *sitio* Puerta as separate sites for the research, because both sites use a different territory and because they could be separated as different autonomous social units. To have a clear picture to which site or area is referred a distinction is made between:

Puerta: referring to the cluster of houses in the uplands and the fields adjacent to the houses

Masipi East: referring to the houses in the village and the fields adjacent to the houses

Barangay Masipi East: Masipi East and Puerta.

Table 1. Overview of the main characteristics in the main research sites

Agriculture	**Masipi East**	**Dy Abra**	**Puerta**

Rice	Irrigated rice (also as cash crop)	Manual irrigated and rain fed	Small portion irrigated, manual and rain fed
Yellow corn (cash)	Intensive	Less intensive	Fairly intensive
White corn (subsistence)	Not	Some people do	Most people do
Forest dependency	Logging (in area of Puerta)	Swidden & logging & NTFP	Logging & swidden & NTFP
Other characteristics			
Land	Flat land: titles	Uplands (steep): no titles and rolling-flat lands: CSC	Upland (rolling-steep): CSC and portion irrigated: titles
Social	Many ethnicities	Mainly Tinguian	Many ethnicities
Labour	All hired	Exchange & hired	Mostly hired
Accessibility (transport)	Whole day transportation (15 easy minutes to highway)	1x day transportation (1 bumpy hour to highway). Hard in rainy season.	3-4 km on foot to Masipi East. Market on border with Masipi (logs & banana).
Projects	Since 1995 target community (road, electricity). Continuous projects for agricultural and social development.	Continuous projects for agricultural and social development.	Only when introduction of CSCs.

During the research we decided to include an extra, fourth research site. New migrants have been encroaching the area at the forest fringe situated within the political boundaries of the *barangays* of Dy Abra and Masipi East since 1990, with a recent increase in pace. The most likely prospect is that they will move further into the mountains and forest, if the number of people continues to increase, and/or when new fields needs to be opened to leave the old ones to regenerate or to produce banana. Up to now, most of the areas in use are fallow fields inhabitants of Dy Abra, and some areas are situated in the community forestry project area of Masipi East. The migrants come from Ifugao province. Along the whole Sierra Madre Mountain range forests and forest frontiers, Ifugao immigrants have settled since the past years. We decided to choose the pioneer settlements of the Ifugao as an extra research site, because:

The settlements together formed a perfect "last village" on the transition gradient.

The settlements are situated within the political boundaries of the *barangays* of Dy Abra and Masipi East and the inhabitants of the other sites assign substantial importance to what they call these "*forest squatters*".

The study covers the whole area by including the fourth research site. We could not let them go unnoticed in view of their importance for the understanding, future scenarios and protection of the Sierra Madre forests. Since the migrants mainly live of swidden farming, this settlement is discussed especially in part III section 5 that deals with swidden and banana. They are referred to as the pioneer Ifugao migrants.

Part II: Material Flow Accounting (MFA) in Dy Abra, and partly in Masipi East, Puerta and the pioneer village

Liesbeth Denis, Marieke Hobbes, Orlando Balderama, and René Kleijn

MFA Acronyms and MFA terms

(source: taken from Stalpers, 2003)

MFA : Material Flow Analysis (or Material Flow Accounting). The analysis of the materials throughput of a social system.

DE: Domestic Extraction. A material flow from the Domestic Environment to the social system.

WE : Wastes and Emissions. A material flow from the social system to the Domestic Environment where the disposal has no value for the actor involved.

DD: Deliberate Disposals. A material flow from the social system to the Domestic Environment where the disposal has utility (the flow results in economic value or contributes to maintenance of society's stock) for the actor involved.

DMI: Direct Material Input. The sum of DE and Imports.

DMO: Direct Material Output. The sum of DD, WE and Exports.

NAS: Net Addition to Stock. The difference between the closing and the opening size of society's stock.

Social system: The social system comprises of the human population, their livestock, and artefacts that require labour to be maintained (for example buildings, roads, household goods).

Domestic Environment: The border of the Domestic Environment defines what is the local territory and what are foreign territories. The Domestic Environment includes built-up areas (roads, buildings), agricultural land, pastures, forests and water bodies. Agricultural plants are also considered a part of the Domestic Environment.

Stock: All objects remaining longer than one year in the social system are part of societies. The MFA is defined over a specific time frame during which the flows are accounted for. The size of the stock can be measured at the beginning of this time frame (opening stock), or at the end (closing stock). In this report, all stock sizes quoted are the values of the closing stock unless specifically stated otherwise.

Import: A material flows from a foreign territory via the market to the social system.

Export: A material flows from the social system to a foreign territory.

Overview of the flow types in the MFA

Input	Domestic Extraction
	Import
Internal Flow	Internal Flow
Output	Deliberate Disposal
	Export
	Wastes and Emissions

Introduction

In the present Part II the Material Flow Analysis will be presented. Most of Part II is based on the MFA results of the village Dy Abra described by Denis et al. (2001). In this previous report no accurate distinction was made between flows and stocks, resulting in the stocks being accounted as flows (leading among others to an immense growth of the society). Besides, the stocks reported appeared to be the closing stock (thus stock + NAS) instead of the opening stock. The resulting MFA was not reflecting the societal metabolism of Dy Abra. The present report shows that we managed to account for a more reliable MFA. We made some far-fetched, but probable assumption in the new calculations of the figures, thus some caution should be taken regarding the accuracy. In addition, we have now included some MFA figures of three additional research sites in the area. Although we do not have sufficient data on these villages to calculate the MFA with any great precision, household interviews, interviews with key respondents, group interviews and other observations do allow estimating the basic figures with a sufficient degree of confidence.

First the research methods will be described. Then, the data collection processes and results in Dy Abra are described. This is followed by the overview and discussion of the overall MFA figures of Dy Abra in an aggregated form of inputs and outputs. Also, some MFA indicators will be discussed. Finally, some MFA figures of three additional research sites will be presented.

1 Research methods for the MFA in Dy Abra

The time frame of the MFA is from October 2000 to September 2001. The administrative boundary of the village is used to delineate the domestic environment. The adjacent forest of the village borders the Northern Sierra Madre National Park. Everything that is taken from the forest is regarded a domestic extraction, as are the swiddens that are found near that area.

Without reliable statistical data available on the local level, research methods the data gathering for the local MFA and EFA consisted of primary data gathering by way of interviews, observations, measurements and estimations.

1.1 Interviews

Semi-structured interviews were done in all 94 household of the village. One person of the family was questioned, men or women. In this way, data were gathered on household size, livestock, area of agricultural production, yields, agricultural inputs (fertiliser, seeds, spray, etc), artefacts, construction materials and energy applications. The questions regarding personal data, artefacts and energy applications were based on a formal interview guide. We discussed the different livelihood activities in a merely informal or unstructured way. This was necessary because the questionnaire that was used in the try-out appeared to be too long. One hour for an interview is the maximum. Thus, dependent on the different activities of the households, one or more topics got the upper hand. We discussed the construction materials if there was enough time; otherwise we gathered the data through measurements and observations.

1.2 Observations

A separate nutrition study was conducted as part of the SEAtrans requirements. Nutritional energy constitutes a relatively a large share in the total energy flows subsistence economies as compared to industrialised economies.

Sampling

For the nutrition study we took a sample of 5 households.[1] Before we selected the sample, semi-structured interviews were done in almost every household. On the basis of the identified household activities and other socio-economic information, we selected a combination of variables (area of the land, amount of water buffaloes and type of the house) classify social categories: high, medium and low-income groups. Out of these groups, we identified key informants, because prudence is demanded for food observations, for both

[1] Of course, a larger sample would create a greater accuracy, but research time was limited.

integrity reasons as well as the possibility that the observed change their food habits when being observed.[2] The results show the total nutritional intake in kg and J (or actual consumption), and gives insights on the total process of food preparation, cooking process and disposal of leftovers and losses.

Course of the observations

The observations took place in four successive days: two days of the weekend, and two days in the week, because the food consumption was supposedly different in the weekend than during the week. For every household, the number of persons joining the meal and their age were recorded. We measured ingredients such as rice, vegetables, meat and other easily measurable foodstuffs. Amounts of products such as oil, sugar, coffee, *bogoong*[3], soja and salt were asked per a month or week. Most people go to the market once a week, and they can exactly calculate the amount of packages, cans or bottles they buy. Some households bought can food, *pancit* (kind of noodles) or sweets for the children, for which we asked for estimations.

1.3 Measurements and estimations

Another method that was used for data collection is measuring for minerals in buildings and for other construction materials. We divided the houses in five types that we measured per type. The area of all the houses was measured and we noted down the kind of materials the house consists of. At the time we collected the data, two carpenters were constructing a few houses. We asked them for each type of house what and how much materials (hallow blocks, cement, sand and gravel, wood, bamboo, iron, cogon, etc) they used. This information was useful to crosscheck our own measurements. For every type of house, the amounts of materials were determined and later converted into kilos. Estimations were used whenever no other method could be applied to collect the data.

2 MFA results in Dy Abra

In this Chapter we present the results of the data gathering of the MFA. The chapter is divided in sections according to main units of materials found in the

[2] Often people insisted to prepare a chicken for their special guests, which would of course disturb the observations.

[3] Bogoong is a grey mixture of water, hot pepper, salted fish and sometimes pomelo. People eat it together with vegetables, sometimes with rice only.

village. Those materials and its connected flows are described. Where appropriate, we give some more background information on the data.

2.1 Rice and other food

Imports, domestic extraction, deliberate disposal and exports

Of the total of 94 households, 13 households (14%) do not have a lowland rice field. The other households together have 56 ha. These rice fields are titled or as fields under a tenure arrangement via the Integrated Social Forestry Program (ISF). The fields all surround the village. Some of the ISF fields, cultivated by 24 households, are too dry in summer by which just one cropping per year is possible. Other fields lie next to a creek (in the south of the village), where two croppings per year can be realized. On the fields in Malaping area, next to the Banig river, also two croppings are possible by irrigation through canals and dikes that the villagers constructed themselves. Table 1 gives an overview of the rice production in Dy Abra.

Table 1. Total area (ha), yield (tons/year) and fertiliser application (tons/year) of rice fields in Dy Abra.

	Households	Area (ha)	Yield (tons/year)	Fertilisers (tons/year)
Lowland rice	81	56	141	25
Rainfed rice (1 crop)	24	17		
Irrigated rice (2 crops)	57	39		
Swidden rice (1 crop)		14	11	

Source: on the basis of Denis, 2001.

The domestic extraction (DE) or total rice production for the village per year (excluding the swidden fields) is about 130 tons. The average yield per ha per year is 2339 kg. This total production uses an input of 25 tons of chemical fertilisers, thus Deliberate Disposal (DD) in MFA terms, that are imported (thus Import in MFA terms). Expressed in average sacks that one ha needs this is 8.9 sacks (one sack weighs 50 kg). 50 kg of rice seeds are planted per ha, thus a DD of 5.6 tons of rice seeds per year. We may assume that people buy seeds once a year, because some households use the second-generation seeds. Thus, there is an import of 2.2 tons of seeds per year.

A total of about 14 hectares of swiddens are cultivated with upland rice.[4] Swiddens rice yields are about 752 kg per ha. The total DE of swidden rice is then 11 tons.

[4] There are between 28 and 29 ha swiddens in Dy Abra cultivated by 30 households. As is shown in Table 1 and 2, the 29 ha of swiddens are divided in about 15 ha corn and 14 ha rice. The rice fields in the kaingin produce 752 kg per ha, the cornfields 2400 kg. The data was collected through interviews and observations.

The total (irrigated, rain fed and swidden) rice production of 141 tons includes the husk of the rice. The rice is milled in town, because there is no (working) rice mill in the village. We will make some far-fetched calculations to estimate the export of rice hulls based on the nutrition study.

Table 2 displays the amount of food consumed in kg of 5 households, directly measured. The average total consumption per household per year is 2358 kg. Extrapolating this figure for the whole village, the total food consumption is 222 tons per year. 30 tons of all the food consumed in the village is imported.[5] Thus, we assume that 192 tons of the food consumed is domestically extracted. Of these 192 tons, 63 % consists of grain products (see Table 2), that mainly consist of rice (we assumed 110 tons) and some corn (we assumed 10 tons). The total harvest of rice was 141 that includes [6]:

rice consumption: 110 tons (there is no import or export of rice),

the rice hulls,

the debt tenants have to pay to the land lord (export of rice of 4.2 tons)[7],

the seeds kept for next season (DD of seeds is 4.5 tons of which 2.2 tons are imported, thus 2.3 tons are saved, which is part of the DE).

Thus, the rice hulls constitute 25 tons that are exported, because the hulls are left at the milling station in town. The remaining of the 192 tons that is domestically extracted, 37 % or 71 tons, consists of "other human food", e.g. vegetables, fruit, eggs, meat, and fish.

Table 2. Food consumption for five households (in kg)[8]

	hh1	hh2	hh3	hh4	hh5	Average in 4days	Average per year	% of total

[5] The calculations are based on interviews with local shop owners and interviews with villagers about amounts bought in town.

[6] A few losses are not counted for, such as the payment of farmers' dept to traders, in case the farmer has no money, or the loss of rice to help out neighbors if they had bad luck, or to laborers in the '*bataris*' (a labour system wherein people work for each other in return of food and money). The latter two are internal flows, thus would not make a difference in the MFA.

[7] 12 farmers in Dy Abra were tenant cultivating a total area of about 7 hectares. The tenancy agreement is that 600 kilos (12 sacks) of rice per ha is paid to the land lord, who does not live in the village. This is thus an export of 4.2 tons in the MFA.

[8] It may be noted that household 1, the rich household, consumed lower amount of grain products, instead, they eat more meat, eggs and fish than the other households. The middle-income and low-income households eat more vegetables and rice instead of meat. While household three does not consume more vegetables and fruits (in kg), the nutritional energy is much higher, because they mainly consist of bananas.

grain products	10.7	19.4	16.9	21.6	13	16.32	1487.4	63
vegetables and fruits	5	6.9	5.5	7.8	4.7	5.98	545.7	23
meat, eggs & fish	2.6	1.8	1.2	2.1	2.1	1.96	178.9	8
sugar & sweets	0.9	0.5	0.4	0.7	0.6	0.62	56.6	2.5
milk products & fats	1.1	0.3	0.2	0.2	0.2	0.4	36.5	1.5
others (e.g. coffee, salt)	0.4	0.5	0.4	0.8	0.8	0.58	52.9	2
total amount of food products (kg)	20.7	29.4	24.6	33.2	21.4	25.86	2358	100

Source: Denis: observations and calculations, 2001

Waste and emissions of the rice and other food product flows

Human excretion

Human faeces are about 250g per day. Urine is about 1-1.5 litres per day per person. The total human excretion is about 316 tons, of which about 250 tons consist of urine.

Wastes and leftovers

Table 3. Average (biomass) wastes and the leftovers for five households

	hh1	hh2	hh3	hh4	hh5	av/ 4days	av/ year
(biomass) wastes (kg)	3,5	2,4	3,3	2,8	3,4	3,08	281
leftovers (kg)	2,1	1	1,8	1,7	1,5	1,62	148

Source: data were gathered by weighing the wastes with the balance for every meal for 4 days (Dennis).

All the food leftovers shown in Table 3 are eaten by animals (pigs, chickens, goats, etc) and included in section 2.3. Waste of human food results for by a linear extrapolation for the whole village in a total of 26.4 tons per year. However, most of this waste constitutes an internal flow because a large part of the biomass waste from vegetables, bananas, corn, bones, etc are thrown in the yard and eaten by animals (especially goats). Thus, the figure of the waste of human food in the MFA is assumed to be 30% (8 tons) of the total waste of human food measured (26.4 tons), because the rest is recycled as feed.

Summing up the rice and other food product flows

Inputs to the economic system:

Imports consist of 30 tons of human food, 2.2 tons of rice seeds and 25 tons of chemical fertilisers. The domestic extraction (DE) of rice is 141 tons and 71 tons of other human food. A total 4.5 tons of rice seeds and 25 tons of chemical fertilisers are deliberately disposed (DD).

Outputs from the economic system:

Export of rice products consist of 4.2 tons of debt rice and 25 tons of rice hulls. Waste and emissions from the input figures consist of excreta of humans amounting to 316 tons including water and 50 tons excluding water. Another 8 tons is accounted as biomass waste of human food.

2.2 Corn

Imports, domestic extraction, deliberate disposal, exports, deliberate disposal and waste & emissions of the corn flows

Table 4 gives an overview of the corn production in Dy Abra. Of the 94 households, 10 did not have a lowland cornfield. These families are young and just settled or belong to the poorest families in the village. Yellow corn is planted as a cash crop. Some people grow white corn for own consumption. The total area of lowland cornfields is 134ha, of swidden corn 15 hectares (see appendix for some background information on the swidden fields in Dy Abra). The DE, or the average production (lowland plus swidden corn) is 846 tons in a year. The average yield of lowland corn per ha is 6044 kg per year; one harvest in August-September, the second harvest in February-March. The average production of the swiddens was 36 tons per year. People planted on average 50 kg of corn seeds per ha. This implies an import of 14.9 tons of corn seeds per year for a total of 149 ha.

The total (lowland and swidden) corn production of 846 tons per year is the weight of grains and cobs together. Assuming that the cob weighs 10%, the seeds weigh 761 tons and the corncob 85 tons.[9]

Table 4. Total area (ha), yield (tons/year) and fertiliser application (tons/year) of rice fields in Dy Abra.

	Area (ha)	Yield (tons/year)	Fertilisers (tons/year)

[9] The hidden flows are not counted for in this MFA. An average percentage of 55% foliage from the corn and rice plants is left over after yield (Landbouwstatistisch jaarboek of the Belgian Federal Government, www.clecea.fgov.be/stat/) that are burnt resulting in a waste and emission, or, when used as fertilizer in a deliberate disposal. Thus, for the total yield of 846 tons, 1034 tons wastes is burnt.

Lowland corn (2 crops)	134	810	55.5
Swidden corn (1 crop)	15	36	

Source: based on Denis, 2001

Summing up the corn flows

Inputs to the economic system

Imports consist of 14.9 tons of corn seeds and 55.5 tons of chemical fertilisers that are in turn deliberately disposed (DD). The domestic extraction (DE) of corn is 846 tons.

Outputs from the economic system

757 tons of corn is exported. 85 tons consist of corncob waste. The remaining 4 tons of corn is used for own consumption and included in section 2.1 and is used as animal feed that (see section 2.3).

2.3 Livestock

The increase in number of water buffaloes shown in Table 4 is a result of the increased need for working animals on the agricultural fields and for transport for hauling of logs. The number of goat and swine is irregular depending on the need for cash. Animal fodder is distinguished in free grazing, scattering and animals fed by humans.

Data on numbers of livestock and domesticated animals in the village is displayed in Table 5. Farmers usually tie cattle and water buffaloes and they bring them every morning to the field to graze. Goat and chickens scatter around freely the whole day. The owners of pigs cook every day or once in two days food to feed the pigs. Normally pigs are raised for six months. Per animal group, we will estimate the total weight of the animals on the basis of which we can calculate the yearly food intake.

Table 5. Amount of livestock and domesticated animals in Dy Abra in 1999, 2000 and 2001.

	1999	2000	2001
Cattle[10]	110	80	9
Water buffalo	105	95	220
Chicken	1250	750	706
Duck	85	110	2
Goat	35	25	161
Swine	75	140	61
Dog	80	95	83

Source 1999 and 2000: office of the municipal agriculturist, Tumauini, Isabela. Source 2001: Denis.

[10] There are more cows than the 9 mentioned here, but they belong to a person that does not live in Dy Abra anymore. His 30 cows are not included in the MFA.

Cattle and water buffaloes

There are 9 cows in the village: 1 young cow and 8 older cows. The older cows have an average weight of 220 kg (personal interview head of department agriculture, Cabagan, Echague), the young weighed about 100 kg. In the village there are 220 water buffalo. 13 households did not have a water buffalo. The age of the water buffalo is found via semi-structured interviews. The weight of each animal was found with help of Ranjhan and Pathak (1979) and De Guzman M.R.Jr. and Perez, C.B.Jr., (1981). The age of the water buffalo is related to the weight of the animals. One-year-old growing bulls weigh 200 kg; two year old bulls 350 kg. For growing heifers this is respectively 150 kg and 300 kg (Ranjhan and Pathak, 1979). For the 3-7 and 8-15 year old animals, we used average data from De Guzman M.R.Jr. and Perez, C.B.Jr., (1981). This study is carried out in Luzon, the island on which Dy Abra is situated.

Table 6. Age, amount and weight of water buffaloes.

Age of water buffalo and average weight	1year (175 kg)	2year (320 kg)	3-7y (410 kg)	8-15y (470 kg)	Unknown (440 kg)	total
Number of water buffaloes	19	32	93	53	23	220
Weight	3330 kg	10250 kg	37900 kg	24800 kg	10100 kg	**86.4 tons**

Cows and water buffaloes eat 2.5-3.0% of their own weight per day. The cows together have a weight of 1860 kg. The total amount of grass eaten in a day is thus about 51 kg. This results in 18.7 ton of grass consumption per a year; DE. The total weight of the water buffaloes is displayed in Table 6.

The total weight of the water buffalo's is 86.4 ton. The total amount of grass that the 220 water buffalo together eat is 2.4 ton per day (2.75%) or 867 ton per year (DE).

Goats

There are 161 goats in the village. In 1997, they were introduced in the village for a livelihood project. In 2001, almost every family has a goat.[11] Goats also eat about 2.75% of its body weight a day. The adults weigh 25 kg, the younger ones about 8 kg. There are 24 young goats and 137 adults. Together they weigh 3617 kg, and eat 100 kg/day. In a year this makes 36.5 tons of biomass of food consumption. In fact, there is not so much biomass waste of food left over because goats eat almost everything.

[11] They serve as a safety net. The villagers complain about the fact that goats eat everything that looks a bit green, referring to the goats as the main reason for not having a home garden.

Chickens

There are 706 chickens in the village, about 7,5 chickens per family. This is just a rough estimation because a lot of villagers do not know the exact number of chickens they have. Chickens scatter around and pick up grains, leftovers from the human food etc. Chickens are, just as the goat and swine, seen as a safety net. The chickens are small and have a weight between 1 and 2 kg (own measurements). The amount of fodder the chickens eat is based on interviews. Each ten chickens get about 1 kg milled corn and 2,24 kg milled rice a week. This makes about 11,9 tons of food for a year for the chickens.

Pigs

The numbers of pigs vary a lot within a year. According to the villagers, a pig can be raised in six months. Then it can be sold or kept to breed further. We counted 61 pigs in Dy Abra. This is about half the number of the data available in 2000 (of the municipality of Tumauini). The farmers prepare the food for two or three days. The pigs stay close to the house on a rope. We can divide the pigs in four classes by age (according to www.gov.on.ca): the pre-starters, starters, the growers, and the finishers. Each of them has a different weight (table 7).

9 starters, 41 growers and 11 finishers were counted. They weigh respectively about 10 kg, 50 kg and 80 kg. The older pigs might weight more, especially pigs older than five years. This gives respectively 3.2 ton, 29.3 ton and 13.7 ton for the total amount of fodder per year, or a total of 46.1 ton per year. Because the age was difficult to estimate precisely, we joined pre-starters and starters. In one year, a pig can grow from starter to finisher. We assumed that the number of pigs is steady in one year (18 newcomers), the amount of food that is consumed by the pigs can be calculated.

Table 7. Total food consumption by pigs on the basis of age, body weight, food needed and number of pigs in Dy Abra.

	age	body weight	kg food/cap/day	number	**total food kg/year**
Pre-starter	0-3months	5-10kg	0,91-1	9	3154
Starter	3-6months	10-20kg			
Grower	6m-2years	20-80kg	1,83-2,14	41	29331
Finisher	>2years	60-100kg	3,01-3,77	11	13611
Total					**46096**

The farmers prepare different kind of feed: some prepare a mix of palm tree, milled rice cover and water. Another farmer cooked a mix of bananas with (milled) rice cover. A third one cooked gabi-leaves and (milled) rice cover and the last one cooked only (milled) rice cover with water. This is fed to a pre-starter. For the typical preparation and age of the pigs, we consider 36 kg for a pig per year less than three months, 365 kg per pig per year for a starter, 608 kg per pig per year for a grower and finisher 852 kg per pig per year.

Animal manure

Table 8 gives and overview of the animal manure in the village. The waste of 3510 tons per year includes fluids, 456 tons are solid wastes. Manure is not used as fertiliser in the village.

Table 8. Animals and estimated total waste in tons per year

	Waste (tons/year)
Water buffalo*	3300
Cow	45.1
Swine	79.1
Goat	56
Chickens	30.13
Total	3510.33

Source: *: Guzmann, data of 15 tons per year per animal, rest: www.ohioline.osu.edu

Summing up the livestock flows

Table 9. Overview of total weight of animals at closing stock and amount of food consumed per year by animals in Dy Abra

Animal	*Total body weight (tons)*	*Food consumed in tons per year*
Cows	*1.86*	*18.7*
Water buffaloes	*86.4*	*867.0*
Goats	*3.62*	*36.5*
Chickens	*1*	*11.9*
Pigs	*3.03*	*46.1*
Total	*95.91*	*980.2*

Inputs to the economic system for animals

The food of chickens and pigs shown in Table 9 mainly consist of food leftovers and wastes of human food. These are mainly internal flows that were excluded from the measured wastes and food leftovers (section 2.1). Thus, the amount of biomass of animal food of cows, water buffaloes and goats are domestically extracted (DE) amounting to 922 tons.

Outputs of the economic system

The manure produced is 3510 tons per year including fluids, 456 tons per year excluding fluids.

2.4 Wood

Introduction

Deforestation is one of the main environmental problems in the Philippines. There was a peak of exploitation activities in the 1960s and 1970s. In Dy Abra a licensed company (NILCORP) was active from the 1970s until the beginning of the 1990s. In those days a road was constructed through the village. According to a surveyor who worked for NILCORP and makes a living as a furniture maker these days, the daily cut of this corporation was about 60.000-80.000 board feet (1 board foot is 1 foot by 1 foot by 1 inch, or in an other way 1 cubic meter equals about 424 board foot) in the dry season of hardwood (*narra, mayapis, red lawan* and *apito*). Small-scale water buffalo logging activities took over the logging activities at the end of the concession.

The interviews show that more than 2/3 of the households are involved in logging, as a logger, helper or chainsaw operator. This figure may be higher because not everybody is willing to discuss these illegal activities.

Commercial wood

There are 21 chainsaw operators were active in the area, of which 15 come from Dy Abra. We asked 4 chainsaw operators and 1 driver and 1 wood trader on the amount of wood cut in Dy Abra per year. Table 10 shows the results.

Table 10. Estimations of one driver, average of the amount of wood cut by three operators and one trader on the exported amount of board foot Dy Abra.

	bdft/month	amount	average bdft/year
Driver	6000-10000	5 months	480000
Operator	1000-1800	21 operators	350000
Trader	30000	6 months	360000**

**he said that he sometimes buys 2000bdft in one day!
Source: calculations Dennis, Dy Abra, 2001

Most loggers did not have any idea on how much wood was exported. Some of them thought of 10.000 bdft a year. The estimates of the operators and drivers were 10 times higher. The estimation of 30.000 bdft in a month of the trader might be too high. In the rainy season less people go to the forest, and in the harvesting season more people work in their field. But on the other hand, in

summer time he can buy even 2000 bdft in one day. The yearly amount of wood that we assume is exported is between 400.000 and 500.000 bdft.[12] To calculate the mass of the exported wood, Table 11 shows the densities of certain types of wood.

In Dy Abra, most commercial wood is red and white *lauan*, belonging to the common hardwoods. Other hardwoods that are cut for commercial aims are *mayapis, guijo, apitong* and *tanguile*. *Mayapis* and *guijo* belong also to the *Shorea* group. It is probable that they have a comparable density. *Apitong* and *tanguile* are other hardwoods. An average of 640kg/m^3 was taken for density of hardwood. This reflects air-dried (moisture content between 7-15 %) weight.

Thus, an average of 450 000 board feet (1 board foot is 1 foot by 1 foot by 1 inch, or about 2360 cm^3) converted with 640kg/m^3 gives a total amount of 679 tons of wood that is exported from the village.

Table 11. Common wood types and their air-dried density.

Common wood name	air-dried[13] density (kg/m^3)	Philippine name	Scientific name
merbau	800 (12% moisture content)	ipil ipil	Cedrela
dark red meranti	640+	red lauan	Shorea
light red meranti	400 to 640		Shorea
white meranti	480 to 870	white lauan	Shorea
		mayapis	Shorea
		guijo	(para) Shorea

Wood for construction

The total amount of wood measured at the closing stock used for construction in Dy Abra is 185 ton: 15 ton is used for the temporary houses in the forest, 170 ton for the construction of the houses, the church and the school in the village.

[12] The actual extraction is a lot more because of the roots, tops and branches etc. are not counted for in the MFA.

[13] The moisture content of wood on a dry basis is around 6% for kiln dried wood, 7-15% for air dried wood and 28-35% for wet wood. Air-dried means that the biomass is dried in equilibrium with atmospheric humidity.

We accounted the domestic extraction of wood for construction on the basis of the amount of wood used for construction of 7 houses during the MFA time frame based on the following figures:

* the closing stock of wood used for construction (185 tons)

* the amount of artefacts of NAS (95 tons) that is directly measured.

The NAS of artefacts consists of: (1) NAS of minerals, (2) NAS of finished goods and (3) NAS of biomass (wood). Direct measurements revealed that the NAS of artefacts consisted of 85 % of minerals, thus totalling to a total of 81 tons. The NAS of finished goods is 2 tons (see Section 2.8). This leaves 12 tons of NAS of wood for construction or in other words 12 tons of DE of wood for construction.[14]

Fuel wood

During the observations of the five households that participated in the nutrition study, the use of wood for cooking was measured. An other method was that we measured the amount of firewood near the house and after one week we measured the pile again. Next, people were asked to estimate the amount of firewood used at the temporary fields in case people worked in the field during the observations.

The results of the methods are compared and the average outcomes are displayed in Table 12. The Table shows and average of 34,6 kg per week per household. The total fuel wood consumption is 1.8 tons per capita per year or 169 tons per year.

For the figures in Table 12 we assumed that the five households are representative for the whole village. All households indeed use firewood: villagers who sometimes cook on LPG prefer to cook on fuel wood because of the taste (they mainly use lpg in the rainy season). The kind of wood used is *alim, guava, gmelina, epilepil*, red and white *lauan*. Not much energy is needed for gathering firewood: there is abundance in the surroundings and gathered along the road from the field. Waste from the harvest of commercial wood is not used because the cutting area is too far.

Table 12. Use of fuel wood of 5 households in Dy Abra.

	Fuel wood use/week (kg)
hh1	30 kg/week

[14] Comparing these 12 tons of wood used for construction of the 7 houses in relation to the 185 tons of closing stock seems sensible. Because, the wood used for furniture, partly imported from town and partly DE, is less than 1 ton we integrated this in these 12 tons.

hh2	35 kg/week
hh3	32 kg/week
hh4	38 kg/week
hh5	38 kg/week
Average	34,6 kg/week

Source: direct measurement and interviews, Denis (2001)

Summing up the wood flows

Inputs into the economic system

A total amount of 860 tons of wood is DE.

Outputs of the economic system

Of this amount, 12 tons is used for local construction (thus NAS), 679 tons is exported as commercial wood and 169 tons is used as fire wood (thus waste and emission).

2.5 Cogon and bamboo

Cogon and bamboo are used for construction of houses. Only houses of type 1 contain cogon grass for roofing. At the closing stock, a total 5.6 tons of cogon was measured. This includes the 20 temporary houses in the field, which mostly have cogon grass roofs. We calculated the cogon biomass extraction by taking 20 % (assuming that the lifespan of cogon roofs is about 5 years) of the total of the 5.6 tons.

Bamboo is used in most houses for flooring and sometimes for windows. At the closing stock, a total 42.6 tons of bamboo was measured. About 15 tons of this is used in the temporary houses in the field. We calculated the cogon biomass extraction by taking 10 % (assuming that the lifespan of bamboo is about 10 years) of the total of the 42.6 tons.

Summing up the cogon and bamboo

A total amount of 1 tons of cogon for roofing and 4.3 tons of bamboo for houses was DE. In turn, the same amounts return as waste and emissions.

2.6 Fossil fuels

The data for the fossil fuels is collected with help of a household questionnaire covering all households. In the following paragraphs the different types of fossil fuels are discussed.

Kerosene

Kerosene is used for lamps. The lamps exist of a bottle (gin), a fuse and the kerosene. Most families use about 4 l of kerosene in one month. The 94

households use in total 5208 l of kerosene in a year, converted to tons (the density of kerosene is 806 kg/ m^3 (FAO, 1997), this adds to 4.2 tons.

Liquefied Petroleum Gas (LPG)

Some high-income families use LPG to cook instead of fuel wood, especially in the rainy season. People gave an estimation of the use of LPG from the paste year. A total of 75 tanks of LPG are used in the village. One tank contains 20 l with a density of 560 kg/m^3. Thus the total weight of LPG used in the village is 0.8 tons.

Table 13. Overview of the average of fossil fuel use in Dy Abra. The figures indicate the density of the type of fossil fuels, the total kg used per year, the energetic value (GJ/ton) and the total energy GJ tons per year.

	density (kg/m3)	amount (kg/year)	Energy value (GJ/ton)	energy (GJ)
Kerosene	806	4198	43,1	181
LPG	560	825	45,3	37,4
Gasoline*	720	6526	44	285

* the amount of gasoline used for the sheller is not included

Diesel

Only the amount of fossil fuels used in the village are accounted for in the MFA. Thus, the total of 13.77 tons per year of diesel used by the truck and 3 jeepneys is not included: the vehicles mostly drive outside the system boundary, transporting people to and from town, thus only very small part is actually combusted in the village.[15] Thus, there is no diesel use in the village for the MFA.

Gasoline

5.8 tons of gasoline per year is used by chainsaws. There are 22 chainsaw operators working in Dy Abra. In the average two days of a logging trip, an average of 1000-12000 board feet is cut with 20 litres of gasoline (and four litres oil). Thus, for the total extraction of 400 000-500 000 board feet (see section 2.4), 8000 litres gasoline is used. This equals 5.8 ton of gasoline used by chainsaws (density of 720kg/m^3). There is one motorbike in the village for which the owner buys about 260 l of gasoline per year totalling 188 kg. The machines used in the

[15] The owner of the truck estimated that he uses 450 l diesel in one month or 5400 l of diesel in one year. With a density of the diesel of 850 kg/m^3, the truck consumes 4590 kg of diesel in one year. This equals an energy value of 196 GJ (diesel has a energetic value of 42.7 MJ/kg. Assumed is a use 300 l of diesel per month per jeepney, adding to 9180 kg per year.

village are a hand tractor and a shelling machine. There are 6 people who own a hand tractor and 30 families use a hand tractor. These 30 persons cultivate a total area of 44.75 ha in one year. The hand tractors use an average 17 litres fuel per ha. Thus, the total use of gasoline of the hand tractor is 761 litres per year, or 548 kg (density is 720 kg/ m^3).

The consumption of gasoline for tractors is negligible since there are 4 people who hire a tractor on the cornfield (the slopes are too steep to use a tractor).

There is a thresher in the village, but during the time the research it was already more than a half year broken. The villagers picked the fruits by hand.

A shelling machine removes the grains from the corncob. There are three shellers in the village. Everybody uses this machine. Data on the fuel use is missing however.

Summing up the fossil fuel flows

A total amount of 11.5 tons of fossil fuels was imported in the village, of which 4.2 tons was kerosene, 0.8 tons was LPG and 6.5 tons was gasoline (of which 5.8 tons is used by chainsaws). These are in turn released as 11.5 tons of waste and emissions.

2.7 Water

In MFA, we divided water into household water, drinking water and water for agricultural use.

Drinking water

The daily water intake for a man is 1.95 kg, for a woman this is 1.4 kg (Harte, J., 1988). The yearly intake for men is thus 711 kg and for women is 511 kg. For Dy Abra this totals up to 159 ton and 115 ton of water in a year respectively (assumed that there are 50% woman and 50% men in the village). Thus, a total of 274 tons of water per year is used as drinking water.

Household water

Household water includes water used for cooking and water. There are 32 taps in the village that are linked with iron pipelines (diameter 3 cm) to the reservoir 1.5 km farther down the centre of the village. The reservoir on its turn is connected with a bigger pipeline (diameter 10-cm) to the source, 3 km from the village, on the edge of the hills. About twenty of these taps are constructed on a concrete pavement of 1.5 by 1 meter. The taps that are nearest to the source, the water flows abundantly. The further down the pipeline, the lower the water pressure. In summer, there is sometimes shortage of water. The average speed at which water comes out of the taps is 1.93 litres/sec.

The water used in the house is about 6 buckets (@ 16 l) per family per day, thus an average consumption of 96 litres per household a day, or a total of 3294 tons of water for the village per year. This is only for drinking, cooking and washing the plates. Thus, the total household water is 3294 tons minus the 274 tons drinking water, is 3019 tons.

For bathing and washing clothes, people use basins. These are aluminium bowls that the villagers use for washing clothes, sometimes the dirty plates. An average use is five basins a day, amounting to 125 litres per family per day, or a total 4289 tons for the village a year. The leakage or spoiling of water resulting from not closing the taps is assumed to occur for 4 hours per day per tap. This results in a waste of drinkable water of 3.3×10^5 m^3 per year.

Agricultural water

The irrigated fields are connected with a river or a creek via man-made canals. For the MFA, we accounted the water that flows through the man-made canals that irrigates 39 ha. 300 mm of water per season per ha is needed for 110 days of rice crops (IRRI, 1992). In a year, 600 mm per ha is required for irrigation. This adds up to 0.6m x 10000 m^2 x 39 = 234,000 m^3 in a year

Drinking water for animals

The water that the animals drink comes from canals, creeks and ponds. Water consumption increases with size, lactation, increasing dry matter intake and increasing temperature. Some general guides to water intake are summarised in Table 13.

Table 13. Average water consumption of different kind of animals in litres per day and specifically by the animals in Dy Abra

animal	water consumption(litres/day)	water consumption (ton/year)
Beef cattle	26.5-45.4	118.3
Water buffalo	37.1-63.6*	4192
Swine	11.4-18.9	334
Sheep and goats	3.8-15.1	558.3
Chickens (per 100)	30.2-37.9	87.6

Sources: http://agnews.tamu.edu/drought/
*: Subere, V.S., 1978

The total amount of water consumed by the animals in the village is 5290 ton.

2.8 Finished goods

Finished goods that were imported and subsequently DD or W&E were fertilisers, shampoo and soap, batteries and chemicals used for rice and corn. They amount to 83 tons per year as is shown in Table 14.

Table 14.Imported finished goods that are in turn DD or W&E. Thus excluding import of finished goods that are NAS (i.e. 2 tons)

	Amount	Total weight (tons)
Batteries	7032 pieces	0.91
Shampoo & soap	1.5 * 10 ml shampoo/cap/week 1.2 kg per family/month	1.78
Chemicals for rice	56L	0.06
Chemicals for corn	67L	0.07
Fertilisers		80.50
Total		83.32

Source: based on Denis (2001)

Table 15 shows the kind and amount of finished goods measured in the village at the closing stock, a total of 39.5 tons. We may assume that 5 % of these 39.5 tons (2 tons) is imported during the MFA time span, reflecting a sensible growth of the stock of finished goods in the society. Then, the opening stock of finished goods is (39.5 tons – 2 tons) 37.5 tons. The total imports of finished goods are then (83 tons + 2 tons) 85 tons.

Waste

The wastes of finished goods consist of batteries (0.9 tons) and soap and shampoo (1.8 tons), and other goods such as cans, glass, plastics that are estimated at 1 ton per year.

All non-decomposable waste (e.g. batteries, cans, and plastics) is thrown in the garden. Plastics are sometimes burnt while carton and paper serve as firelighter. Beer and soft drink bottles have a deposit thus are returned to the drink station. The waste of 1728 bottles of gin, 600 bottles of soya/vinegar, and 1056 cans weighs about 485 kg. Of the other finished goods (see Table 15) we assumed a waste of half a ton.

Summing up the finished goods flows

A total of 85 tons of finished products are imported per year. Of these imports 83 tons is deliberately disposed or waste: fertilisers constitute 80,5 tons and 0.91 tons of batteries are thrown anywhere, forming an health risk.

Table 15. The amount of finished goods at closing stock in Dy Abra.

	Amount	Total weight (tons)
Clothes + blankets	101kg/family	9.49
Jeepney	3	9.00
Ceramics	55.5kg/family	5.22

Truck	1	4.00
Plastics	25kg/family	2.35
Hand tractor + cart	6	2.16
Kitchen materials	16kg/family	1.50
Plough	94	1.41
Harrow	94	1.13
Mill + shelling machine	3	1.08
Knife (bolo)	124	0.62
Thresher	1	0.48
Chain saw	21	0.38
Storage batteries	17	0.21
TV	5	0.15
Radio	94	0.09
Motorbike	1	0.08
Stereo	5	0.06
Generator	1	0.03
Flash light	94	0.03
Bike	2	0.02
Total		39.49

Source: based on observations, interviews and measurements by Denis (2001).

2.9 Minerals & metals

The accounting of the imports, domestic extraction and NAS of minerals and metals required some far-fetched calculations. The outline of these calculations follows.

Opening stock and NAS of minerals and metals

In section 2.4.2 we described the accounting of the domestic extraction of wood for construction on the basis of the amount of artefacts of NAS (95 tons) that is directly measured. Direct measurements revealed that the NAS of artefacts consisted of 85 % of minerals, thus totalling to 81 tons. There are figures on the minerals measured at closing stock that are displayed in Table 16. The table shows that the total minerals at closing stock were 3587.7 tons. Having a NAS of minerals of 81 tons, we may conclude that the opening stock was 3506.7 tons.

Table 16. Minerals and metals measured at the closing stock. Division is made between the part of the closing stock that must have been stock in the MFA time frame already and the part of the closing stock that must have partly been import or DE during the MFA time frame. The first column indicates the origin of the materials that are only relevant for the MFA for the part of the closing stock that must have partly been import or DE during the MFA time frame.

Part of the closing stock that must have been stock in the MFA time frame already

Origin of materials	Objects including the materials	Cement (tons)	Sand & gravel (tons)	Steel (tons)	Total minerals (tons) at closing stock
	Pavement	79.8	659.4	108.7	
	Concrete road	22.1	199.2	28.8	
	Sand &gravel road		1211.0		
	Taps	0.8		0.8	
	Reservoir	2.6	23.0	1.5	
	Pipes			2.4	
	School	39	302.0	55.1	
	Basketball rings			0.3	
Part of the closing stock that must have partly been import or DE during the MFA time frame					
Import	Hollow blocks	75.9	374.5		
Import	Mortar	27.8			
DE	Mortar		136.6		
Import	Roofing			1.1	
Import	Flooring	17.9		21.5	
DE	Flooring		169.8		
Import	Walls			4.4	
Import	Galvanised sheets			15.5	
DE	Faucets		6.3		
Total					**3587.7**

Source: composed based on calculations of interviews and direct measurement by Denis (2001).

Imports and DE of minerals and metals

Figures on the distribution of the 81 tons of NAS of minerals were missing. We may assume that the 81 tons of minerals consisted of sand & gravel, cement and steel (the latter is not mentioned in the text, but steel goes along with concrete) because it was used for building the seven houses. For the proportions of sand & gravel, cement and steel, we used the part in Table 16 that we identified as part of the closing stock that must have partly been import or DE during the MFA time frame. Table 17 shows the results. On the basis of Table 17 we assume that:

- 11.6 tons of cement was imported during the MFA time frame
- 35.6 tons of sand and gravel was imported during the MFA time frame
- 4 tons of steel were imported was imported during the MFA time frame, and
- 29.8 tons of sand and gravel were domestically extracted during the MFA time frame

Table 17. Part of imports and domestic extractions of cement, sand & gravel and steel of the closing stock that must have partly been import or DE during the MFA time frame (based on Table 16). On the basis of these totals we identify the

percentages of cement, sand & gravel and steel to determine the proportions of their imports and DE during the MFA time frame.

	Cement Import (tons)	Sand & gravel Import (tons)	Steel import (tons)	Sand & gravel DE (tons)	Total
	75.9	374.5	1.1	136.6	
	27.8		21.5	169.8	
	17.9		4.4	6.3	
			15.5		
Total (tons)	121.6	374.5	42.5	312.7	851.3
Percentage (%)	14.3	44.0	5.0	36.7	100
Percentage * 81 tons of NAS of minerals (tons)	11.6	35.6	4	29.8	81

2.10 Materials stock

On the basis of the previous sections we may summarise the stock and the NAS of Dy Abra.

Net Additions to Stock (NAS)

The calculations of the NAS of minerals (81 tons), wood (12 tons) and finished goods (2 tons) was described in the previous Sections. The NAS of the population was 1.045 tons: during the MFA time frame, the population increased with 19 persons: 12 immigrants, 9 neonates, while 2 people deceased (assumed is an average weight of 55 kilos per person). The NAS of livestock is minus 0.19 tons: during the MFA time frame, 2 water buffaloes came in the system, while 1 cow, 3 pigs, 44 chickens, and 18 goats left the social system. The NAS of artefacts was directly measured and added to 95 tons. This figure was used for calculations of the wood, finished products and mineral flows in the previous sections.

Stock

The opening stock of humans was 29.2 tons. There were (549 persons–19 persons) 530 persons at the opening stock. The closing stock of livestock was 95.7 tons (see Section 2.3). The opening stock of livestock was (95.9 tons + 0.19 tons) 96.1 tons. The largest part of the stock consists of minerals (see Section 2.9.1). The opening stock of minerals was 3506.7 tons. The opening stock of wood consists of 173 tons in construction (see Section 2.4.2) and 5.6 tons for furniture. As we showed in Section 2.8, the opening stock of finished goods was 37.5 tons.

3 Aggregation of the results

On the basis of the previous chapter, we will summarise the data on the input and output sides in different levels of aggregation.

3.1 Disaggregated values of flows and stocks

Table 18 displays all the inflows (imports and domestic extraction), outflows (deliberate disposal, waste & emissions and exports), net additions to stock and the stock. The materials flows are categorised according to biomass, fossil fuels, minerals and finished goods categories. The two columns displaying the weight reflect the mass of the flows in total tons per year including and excluding water. The village consisted of 549 people in 94 households (at the closing stock).

Table 18. Inflows (imports and domestic extraction), outflows (deliberate disposal, waste & emissions and exports), net additions to stock and the stock categorised in biomass, fossil fuels, minerals and finished goods in tons per year including and excluding water.

		Total tons/year including water	**Total tons/year excluding water**
INFLOWS			
Import		**195.1**	**195.1**
	Biomass	**47.1**	**47.1**
	Human food	30	30
	Rice seeds	2.2	2.2
	Corn seeds	14.9	14.9
	Fossil fuels	**11.5**	**11.5**
	Kerosene	4.2	4.2
	LPG	0.8	0.8
	Gasoline	6.5	6.5
	Minerals	**51.2**	**51.2**
	Cement	11.6	11.6
	Sand & gravel	35.6	35.6
	Steel	4	4
	Finished goods	**85.3**	**85.3**
	Fertiliser	80.5	80.5
	Shampoo & soap	1.8	1.8
	Batteries	0.9	0.9
	Chemicals	0.123	0.123
	Others	2	2
Domestic Extraction		**40396.1**	**2875.1**

Biomass	**2845.3**	**2845.3**
Rice	141	141
Other human food	71	71
Corn	846	846
Animal food	922	922
Cogon	1	1
Bamboo	4.3	4.3
Wood	860	860
Minerals	**29.8**	**29.8**
Sand & gravel	29.8	29.8
Water	**36272**	
Drinking	274	
Household	3019	
Washing	4289	
Agricultural	23400	
Drinking animals	5290	
Air	**1249**	
Human intake	1170	
Animal intake	?	
Combustion fossil fuels	79	
Combustion biomass	?	
OUTFLOWS		
Deliberate Disposals	**23500.0**	**100.0**
Biomass	**19.4**	**19.4**
Rice seeds	4.5	4.5
Corn seeds	14.9	14.9
Finished goods	**80.6**	**80.6**
Fertilisers	80.5	80.5
Chemicals	0.123	0.123
Water	**23400**	
Agricultural	23400	
Wastes & Emissions	**13974.8**	**793.7**
Biomass	**4098.6**	**778.5**
Fuel wood (gas & ash)	169	169
Excreta humans	316	50
Excreta animals	3510.3	456.2
Corncob waste	85	85
From human food	8	8
From temporary houses	5	5
From cogon roof	1	1
From bamboo in house	4.3	4.3
Finished goods	**3.7**	**3.7**
Batteries	0.9	0.9
Soap and shampoo	1.8	1.8
Other from finished goods	1	1
Water	**7170**	
Household	2881	
Washing	4289	
Fossil fuels		

		11.5	**11.5**
	Air	**2691**	
	Human respiration	191	
	Animal respiration	2500	
	Comb biomass	?	
Exports		**1465.2**	**1465.2**
	Biomass		
	Wood	679	679
	Corn	757	757
	Debt rice	4.2	4.2
	Rice hulls	25	25
NAS		**95.9**	**95.9**
	Population	1.045	1.045
	Livestock	-0.186	-0.186
	Biomass		
	Wood	12	12
	Minerals		
	Cement	11.6	11.6
	Sand & gravel	65.4	65.4
	Steel	4	4
	Finished goods		
	All kinds of goods	2	2
STOCK	**Total**	**3848.1**	**3848.1**
	Population	**29.2**	**29.2**
	Livestock	**96.1**	**96.1**
	Biomass	**178.6**	**178.6**
	Wood in constructions	173	173
	Wood in furniture	5.6	5.6
	Minerals		
	Sand, gravel, cement, steel	**3506.7**	**3506.7**
	Finished goods		
	All kinds of goods	**37.5**	**37.5**

Based on Table 18, we constructed Figure 1 that gives an overview of the composition of the flows on the input and output sides. Because striking is the high amount of biomass (5.2 t/c) in domestic extraction, the Figure subdivides the biomass flows category in wood, land products and non-timber forest products (NTFP). A brief discussion on the various flows follows. For more details we refer to the previous chapter.

Wood

The domestic extraction of wood was 860 tons per year, of which 678 tons of illegal hardwood was exported, 169 tons was fuel wood, and 10 tons was used for construction and furniture.

Land products

The domestic extraction of land products, 2842 tons per year, consisted of extraction of human food (mainly grain products), animal feed (mainly grass) and the cash crop yellow corn, that is used as mixed feed for the livestock industry. The total rice harvest was 141 tons, of which about 110 tons was consumed in the village, 25 tons of rice hulls were exported (because the hulls were left at the milling station in town), 4.2 tons was given by the tenants to their land lord (export in MFA terms), and 2.3 tons of seeds were kept for the next season (deliberate disposal in MFA terms).

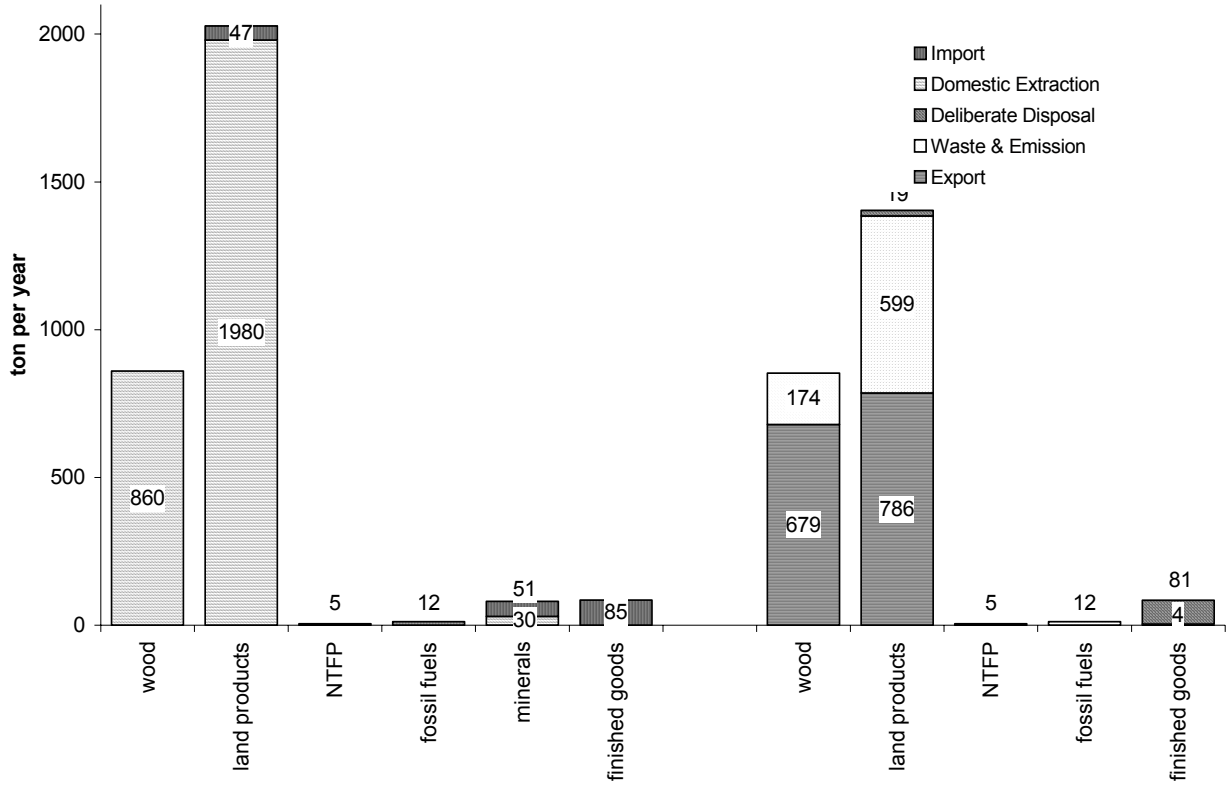
Other food such as vegetables and meat was domestically extracted, to an amount of 71 tons, and 30 tons of food was imported. Of the DE, 32 percent consisted of animal feed, mostly grazing of cows, water buffaloes and goats.[16] Chickens and pigs consumed a total of about 54 tons, consisting of most of the waste of human food such as rice[17] and some yellow corn. The total harvest of yellow corn was 846 tons of which 757 tons was exported as a cash crop. At the output side, most of the waste and emissions of the land products mainly consisted of excreta of humans (50 tons) and animals (456 tons), not being used as manure in the research site, and 85 tons of corncob was left as waste.

NTFP

The 5 tons NTFP that were domestically extracted consisted of cogon and bamboo, used for the maintenance of housing that in turn re-occur as a waste flow, assuming that the lifespan of cogon roofs is 5 years and of bamboo walls 10 years.

Figure 1. Disaggregated values of the flows on the input and output sides. Flows are given as fresh weights, in tons per capita per year, excluding the water flows.

[16] These 922 tons grass includes the water content of grass.
[17] Thus, the waste of human food that was recycled as animal feed is not a waste and emission in MFA terms.



Fossil fuels

Half of the 12 tons imported fossil fuels[18] was gasoline used for chainsaws, the rest was kerosene used for lamps; some people used LPG for cooking.

Finished goods

Eighty five tons of finished goods were imported, 95 percent of which were chemical fertilisers used for the corn and rice production and 0.123 tons of pesticides and herbicides (in turn used and categorised as a deliberate disposal). Noteworthy for its environmental impact and health risks are the 0.9 tons of batteries that are imported and thrown away anywhere after use. Finally, we assumed that the stock of finished goods growths with 5 % per year, amounting to 2 tons.

[18] Only the amount of fossil fuels used in the village are accounted for in the MFA. Thus, a total of 14 tons per year of diesel used by the truck and jeepneys is not included because the vehicles mostly drive outside the system boundary, transporting people to and from town and only very small part is actually combusted in the village.

3.2 Aggregated values of flows and stocks

Table 18 shows the inflows and outflows in a most aggregated form. In the table the total amount of material inflows, outflows and the Net Addition to Stock (NAS) are given both for Dy Abra as a whole and on a per capita basis. Figure 2 displays this graphically.

Table 18. Input-output table in the most aggregate form. The left columns display the total weights in tons per year for Dy Abra as a whole, the right columns display the tons per capita per year.

	Tons per year			**Tons per capita per year**	
	Input	Output		Input	Output
Domestic Extraction	2875		Domestic Extraction	5.2	
Imports	195		Imports	0.4	
Wastes and Emissions		794	Wastes and Emissions		1.4
Deliberate Disposals		100	Deliberate Disposals		0.2
Exports		1465	Exports		2.7
NAS		96	NAS		0.2
Balance difference		615	Balance difference		1.1
Total	3070	3070	Total	5.6	5.6

As may be noticed in Table 18 and in Figure 2, the balance of inflows, outflows and NAS is 615 tons or 1.1 tons per capita short. This mainly results from the fact that the input-output table excludes water. At the input side, most of the water, except for the moisture content of food for human and livestock, is left out. At the output side, the water content in the excreta and the respiration of humans and livestock are left out. Thus, the balance of the metabolism of humans and livestock (water + food = excreta + respiration +milk and growth) is not well reflected in the table leading to the missing balance mainly consisting of water.

The direct material input (DMI) indicates the material dependency of the society. It is equal to the imports and domestic extraction (DE) in Figure 2. The DMI of Dy Abra was about 5.6 tons per capita per year. The DE of Dy Abra was 5.2 ton per capita per year, indicating that 93 percent of the material input of Dy Abra was met by its domestic environment and 7 percent was imported via the market. This shows the almost complete dependence of Dy Abra on natural resources, as is typical for a rural economy.

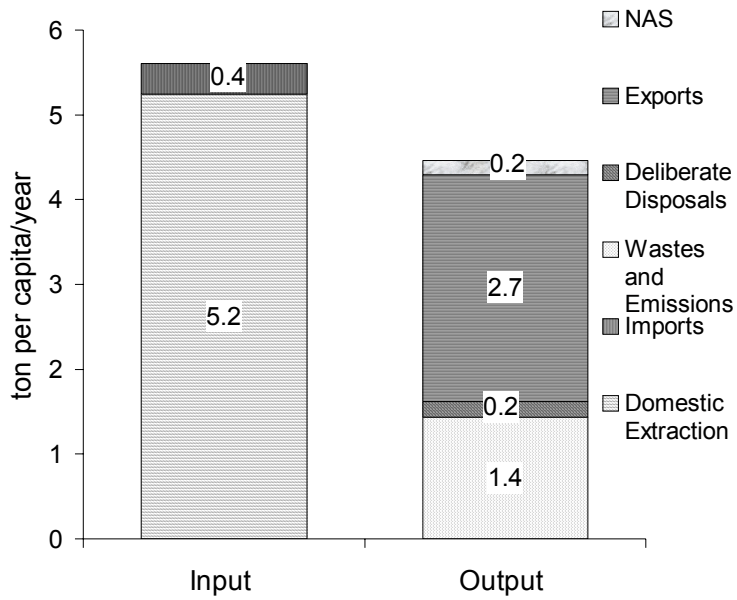


Figure 2. Input and output of the material flows and the Net Addition to Stock in Dy Abra. Flows are given as fresh weights, in tons per capita per year, excluding water flows.

The direct material output (DMO) gives an indication of the total environmental impact of the society in terms of material outflows. It is equal to the sum of deliberate disposals, wastes & emissions, and exports. The DMO of Dy Abra was about 4.3 tons per capita per year. Of these outputs, 37 percent was to the domestic environment, i.e. direct processed output (DPO) and 63 percent was exported.

The physical trade balance (the exports minus the imports) was about 2.3 tons per capita per year; the total weight of exports was 7.5 times as much as that of imports.

In the figures the NAS was directly measured adding to 0.2 tons per capita per year. This results in 2.5 percent growth of the society in material terms of materials (opening stock was about 7 tons per capita), which is mainly due to the building of seven houses.

4 The major material flows of three adjacent villages

We do not have sufficient data on the other three villages to calculate the MFA with any great precision. Household interviews, interviews with key respondents, focus group interviews and other observations do allow, however, to estimate the basic figures with a sufficient degree of confidence. The following section briefly gives a justification of the main flow sizes in Masipi East, Puerta and the so-called pioneer village.

4.1 Justification of the figures of Masipi East, Puerta and the pioneer village

Masipi East

There were a total of 187 households in Masipi East. The average household size was based on interview data of 158 households and was 4.7. Of 74 households of the total of 187 households in Masipi East we obtained information on corn and rice cultivation. Of these households, 39 had a cornfield and 65 had a rice field.

Corn

We had accurate data on corn yields and fertiliser use of 24 households (n = 39) that was enough to calculate averages per capita:

The average corn yield of the 24 households was 7744 kg per household per year (covering a total area of 25 hectares and 2 crops per year).

The average fertiliser use for corn of these 24 households was 846 kg per household per year

Average corn yield per household in Masipi (n is 74): (7744*39)/74 = 4081 kg/household/year

Average fertiliser use for corn per household in Masipi (n is 74): (846*39)/74 = 446 kg/household/year

Rice

Of 57 households of the 65 households growing rice (n is 74) we have accurate data on fertiliser use, averaging to 386 kg/household/year. Average fertiliser use for rice per household per year is thus: (386*65)/74=339 kg/hh/year

We have data of the 65 household growing rice (of the total of 74). 309250 kg is the total rice yield of 65 household. The average per household is thus: (309250kg/74household) 4179 kg rice per year per household

Puerta

Puerta consisted of 45 households, with an average household size of 4.7 persons. MFA data on Puerta result from 29 household interviews. We averaged the total yields and fertiliser use per year per household (including the households not having a rice or cornfield) that we divided by the average household size of 4.7 people. About 50 % of the household cultivated yellow corn, 50 % white corn, 32 % rice and about 80 % had a banana plantation. The household interviews and interviews with key respondents indicated that 30 % of the households in Puerta have a swidden (60 people or 14 households), of which 6 households opened a new one in 2001. The calculations on swidden and banana production follows in the next section.

Swidden and banana

Data on swidden production has come about by household interviews and focus group discussions that is checked by data of Denis (2001). One year swidden production is 1 time rice 1 time rice @ 750 kg/ha and 1 time corn @ 400 kg/ha (the pioneer swiddeners do not cultivate yellow corn).

We calculated the size of the swiddens on basis of focus group discussions and household interviews. An older woman and her husband had 4 ha kaingin (also banana). One young man opens 1/4 ha kaingin by himself. Overall, we assume that people have about 0.4 ha per capita. Thus, for the swiddens in Puerta we calculated:

14 households = 20 hectares = 20 * 750 kg = 15000 kg rice

14 households = 20 hectares = 20 * 400 kg = 8000 kg corn

Per capita this is : 75 kg rice and 40 kg corn

Village four or the place of the pioneers is called Magansimit and Amucau. In Magansimit there are 4 permanent house (thus assumed is 4 * 4= 16 persons) and 12 temporary houses (thus assumed is 12 *2 = 24 persons). In Amucau are 3 permanent houses (thus assumed is 3 * 4= 12 persons) and 5 temporary camps where young men live (thus assumed is 5 x 8 = 40 persons). Thus, there are about 90 pioneer people who practice swidden farming. Thus, 300 kg rice per capita.

The pioneers directly plant banana, but most of the banana trees were not yet in production, thus for the MFA we assumed about 10 trees per capita. This is calculated based on the knowledge that 1 ha is planted with 500 banana trees. 500 trees yield about 50 000 pieces per year (household interviews and focus group discussions). Thus, 1 tree gives about 8 pieces per month, which is 100 pieces per year or about 25 kg per year.

4.2 Comparison of major material flows of Masipi East, Dy Abra, Puerta and the pioneer village

The figures calculated in the previous section are gathered in Table 19, in tons per capita per year. The figures show the predominance of Masipi East in rice production, reflecting the presence of the irrigated rice scheme there. The other lands of the village were planted with corn, leading to an almost equal flow per capita. Dy Abra may be called a corn village, not only compared to other crops in the village, but also if the villages are compared in terms of corn production. Puerta, on the other hand, had much more focus on bananas. The figures of the pioneer village reflected its flows on swidden agriculture. Its banana production was not very high but on a steep rise because new plantations were bound to become productive. It may be noted that of the first three villages, the total production per capita of the three major land products was almost equal or close to 1.8 tons per capita per year, with Masipi East equally divided over rice and corn, by Dy Abra mainly in corn and Puerta mainly in bananas.

Table 19. Major material flows in the four villages. All figures are in tons per capita per year. The figures of Masipi East, Puerta and the pioneer village are much less precise than those of Dy Abra.

	Masipi East	**Dy Abra**	**Puerta**	**Pioneer village**
Population	980	540	209	90
Main material flows				
Rice (irrigated and rainfed)	0.89	0.24	0.26	0
Swidden rice	0	0.02	0.07	0.30
Lowland corn	0.90	1.48	0.46	0
Swidden corn	0	0.07	0.04	0
Banana	0	Almost 0	1.00	0.25
Wood[19]	0.05	1.56	0	0
Fertiliser	0.167	0.150	0.035	0

In terms of the resulting gross income, differences show up. Given the prices of an average of 8 pesos/kg for rice (and setting the price of swidden rice equal to lowland rice), 6.50 pesos/kg for corn and 2 pesos/kg for banana, and including shadow prices for the subsistence crops, gross income per capita were

13,000 pesos per year in Masipi East

[19] Regarding logging it should be noted that the extraction area of Masipi East was nearby Puerta. Although twenty percent of the households in Puerta were involved in hauling and 6 percent was chainsaw operator making some money out of logging activities, the logging trips they participated in were organised and arranged in Masipi East.

12,000 pesos per year in Dy Abra

8,000 pesos per year in Puerta

In the pioneer village, gross incomes were obviously much lower, about 3,000 pesos per capita per year. It must be kept in mind, however, that low incomes during the pioneer stage are an expected thing; people are in fact investing in land expansion and planting bananas. Moreover, the swidden soils of not require fertiliser; if the cost of fertiliser (about 8 pesos/kg) is subtracted from the gross income in the other villages, the difference becomes somewhat less pronounced.

5 Discussion: major and problematic flows

Potentials for environmental pressures can simply be categorised as material flows adding to the environment extraction from the environment. The next section reflects this on the outcomes of the MFA.

5.1 Flows adding to the environment

The flow of minerals (NAS) is likely to increase in the future because people prefer concrete houses. Although heavy in weight minerals do not specifically lead to environmental pressures in the research sites. Since there is no industry in the Dy Abra, the pressure of emissions and waste flows is also relatively small. The main problematic waste and emissions found in Dy Abra are related to material flows of imported industrial products such as fertiliser (connected to the corn and rice flows) and batteries. The use of fossil fuels is also relatively low, but this could change in the future especially when the road would become better accessible. During the time of the fieldwork there was no electricity in the village. Now, 2003, there is accessibility to electricity, which probably brings about a lot of changes in the village regarding the income and expenditures patterns (e.g. imports of electrical appliances).

5.2 Extraction of biomass

From the preceding chapters, we may conclude that the main material flows related to the domestic extraction of biomass were rice, corn, banana and timber were the major material flows in the villages.

Rice is environmentally and economically unproblematic and it was the major livelihood component or at least the most stable one.

Extraction of corn formed a large material flow and was a major income component, but at the same time probably unsustainable due to soil depletion and erosion; at the time of the fieldwork already, the yields in Dy Abra were

stagnating. Since starting using fertilisers, people said that they have to continuously increase the amount of fertiliser application to keep up the yields. The excessive use of fertilisers and short fallow periods might form the main causes of the soil degradation.

Banana plantations were especially important at sites close to the forest. It appears that banana do not exhaust the soil. Banana do have (economic) problems, however, especially the risk of total loss of the plantation due to diseases or a typhoon. The plantation then needs three years to be re-established.

Wood extraction is a problematic flow as well. Yearly, large amounts of commercial wood are exported from Dy Abra and Masipi East (originating from the area surrounding Puerta). The wood was partly extracted from the previously logged-over areas because there the trees, which were planted as part of the reforestation activities of the former logging concessions, were mature. When these trees are finished and as long as no plantation schemes are developed, logging is an unsustainable activity in the area approaching the borders of the protected Northern Sierra Madre Natural Park.

As long as people re-open former fallow areas for new swiddens, swidden farming can be sustainable. However, when the area will be expanded (when more people will make swiddens), it is likely that people will push the forest frontier further when there is no actual protection of the forest.

Against this background, the problematic flows selected for further explanation through Action-in-Context are the unsustainable flows of extraction of timber, swidden agricultural products and yellow corn. The next part of the present report will describe the results of this study.

Part III: Action-in-Context of the problematic material flows in Dy Abra, Masipi East, Puerta and the pioneer village

Marieke Hobbes and Sietske Veenman

1 Study focus of Action-in-Context

This chapter starts with an overview of the main material flows and problematic activities as discussed in the previous part of the report. The research methods and methodologies are then shortly discusses, followed by the methods and techniques used during the study.

1.1 Main material flows and problematic activities

Agriculture is a vital component in the study villages' economies, but also non-agricultural incomes form a considerable part of the livelihoods. In the main study site, the MFA study identified that negative impact on nature is mainly caused by resource extraction and depletion on the input side of several flows. In the light of this, wood, corn and rice are identified as main flows to be explained using the AiC methodology. These flows are connected to the environmental problems of soil degradation and deforestation as well, problems characterising the entire region.

In the three study sites the AiC study aims to explain the same flows. In this way, the differences in the main flows are explained in each specific context, but also in the broader context, by which comparisons can be made.

Through the AiC methodology, the relationship and changes in the wood, corn and rice flows (including swidden farming) within each study site and between the study sites are analysed and explained in their socio-economic and cultural contexts.

1.2 Research methods

Action-in-Context

"Action-in-Context" (AiC) offers an actors-oriented explanation of observed transitional changes of society-nature interactions, in our case changes of material flows at the local level. This is done by studying the decision-making processes that bring about the transitions in its complexities of economic, social, demographic, geographical and cultural patterns and change. AiC thus explains why the farmers choose for the livelihood activities related to the flows

of the major products found by the MFA study in the study sites. The AiC takes this actor-oriented approach, while linking the actors' decisions to each other and to system-level factors.

One characteristic element of AiC is the "actors field" which describes how the decisions of actors are connected to each other. The interconnections between actors in the actors' field do not depend on whether actors know each other or communicate directly. They depend on the degree to which one actor influences either the range of options for action of another actor, or the type or content of the other actor's motivations for these options. That way, it is possible to step from actor to actor, starting out with the "primary actors", the farmers in this case that are the ones directly standing on the society-nature interface. Going up the causal stream, other actors may then be identified, such as traders, banks, policy agencies, NGOs, national politicians etc., sometimes up to global actors such as the IMF. Thus, the AiC takes the changing material flows at the local level as its point of departure (its 'explanandum'), and then connect these to their primary actors and, *inter alia*, to national and global actors.

In the AiC applied here, the decision-making structure of each of the actors separately is analysed first at a very simple "rational choice" level. For the primary actors it involves what AiC calls a "deeper analysis", in which a second layer of depth is added that includes, for instance, economic endowments, social capital and cultural frames of interpretation. This will lead to semi-quantitative analysis. The well-known types of policy instruments such as economic incentives, regulation, self-help promotion or cultural communication may influence these, in turn.

Primary actors

For the AiC studies, we have taken the household as the main unit of analysis, because they form the decision-making units of the primary actors. It is the main organisational unit in the villages regarding organisation of labour, land use practices and accumulation and allocation of wealth. The households directly stand at the interface of man nature relationship and directly cause the main material and energy flows and thereby the resulting environmental problems.

On basis of the characterisation of the villagers' land use and livelihood activities, we can distinguish several socio-economic groups. The distribution of permanent field and swiddens seemed to be the most important variable for resource dependency. Thus, we distinguished four main groups, namely

Households without landholdings or swidden

Households with only swidden

Households with small to medium landholdings (these mainly grow rice and/or corn but sometimes make swidden as well)

Households with large landholdings (these do not have swidden)

Methods & techniques

AiC data gathering

Appendix 1 shows the general operationalisation of the AiC toolkit as applied in Vietnam and the Philippines. The AiC study can be distinguished between literature study and interviews at "higher actor levels" (others than the primary actors) on the one hand, and the actual study in the field with the local farmers on the other hand.

We could use the CVPED office as basis for literature study, interviews and discussions with other researchers, data processing, preparations of field trips, and organising meetings. We conducted several interviews with other actors than the villagers, such as traders, the DENR and the DA. We were also able to obtain secondary sources about policies and projects implemented in the study sites from the local governments in Tumauini municipality (concerning *barangay* Dy Abra) and in Cabagan municipality (concerning *barangay* Masipi East).

For local level data gathering, the researchers stayed and lived with the villagers for several longer periods. In order to reduce the bias problems associated with why-questions of the explanatory study, qualitative descriptive methodologies were used that allow the researcher to listen to respondents without imprinting pre-set categories upon them. Interview methods consisted of "Participatory Rural Appraisal" methods (like option ranking, historical diagramming and participatory mapping), topical interviews with key respondents, informal interviews for sensitive issues and numerous semi-structured interviews (for qualitative data assessing the returns to land and labour). These methods were used during household level interviews and focus group discussions that were conducted with the identified actor groups.

In the present report, terms and remarks that specifically refer to the AiC toolkit are often put between brackets throughout the main text. This is done only for the technical purpose of showing the connection between field realities and the AiC toolkit.

Livelihood Economics

When we developed the working plans and divided the different study tasks in the very beginning of the project, we agreed to include all overlap between MFA and AiC in the household level MFA interviews. Thus, the structured interviews of the MFA study included many questions regarding all livelihood activities, like: the area of corn, the yields per cropping, fertilisers, and time spent on the different sub-activities, etc. In this manner, we would have had very good

and exhaustive household level data sets regarding economic activities. The MFA studies were not finished completely and the data sets were not yet available before the AiC study started. The outcomes were not fully satisfactory. Although precise economic questions were integrated in all the interview lists, only a few of the interviews happened to contain complete data that can be used for further analysis.

The economic way for calculating returns-to-land would be: all benefits minus all costs (including shadow priced family labour). However, farmers themselves (except for the real entrepreneur farmers who contract out all farm work) will not shadow price their own labour as opportunity cost.

In our case, it is clear from the interviews that farmers hardly value their own labour. The household interviews that are used for further analysis provide data on costs and benefits of one cropping, including data on area (ha), yields (kg), seeds (costs), fertiliser (amount and costs), spray (amount and costs), transportation, harvesting, irrigation, and threshing (costs), tractor (costs) and man- and man-carabao labour days (amount and costs). However, exact distinction between amount of family labour and hired labour is missing.

We only have a couple of interviews where family labour is specified. However, we cannot use these data as indication for the other interviews, because in the latter, the separation between family labour and hired labour is not specified. When asked for the labour inputs in the production cycle, reference was made to the big time consuming tasks for which all farmers hire labour, saying for instance: "ploughing, harrowing and hilling up takes 5 man carabao days @ 120 pesos per day". For our calculations this causes problems, as the farmers have not specified whether or how much family labour is included in these 5 man carabao days. This will be the case when the farmer owns a carabao or can borrow a carabao from friends or family. Thus, for the calculations in this report, we have taken the amount of labour (multiplied by the labour cost) that respondents told us. This implies that, these numbers include all hired labour and a part of shadow priced family labour. It includes only a part of the family labour as: the continuous tasks of checking the field or other tasks like cooking meals for the labourers, planning, arranging labour, etc. are not specified or included when asking about the labour inputs in the production cycle

In this way, the calculated returns to land in this report are somewhere in between the returns to land calculated with shadow prices for family labour, and the returns to land calculated without shadow prices for family labour. Due to the missing data on exact family labour it is not possible to give an indication of the returns-to-labour of the agricultural activities.

2 General description of the study sites

This section will give a general introduction to the study sites. All the different livelihood options and activities by which people make a living in the different sites and attached motivations are briefly described and put in an AiC scheme. This section will also touch upon the main general characteristics of the social organisation and cultural aspects of the different villages that seem to influence the land use decisions of the farmers. More detailed explanation of rice and corn cultivation, swidden and logging practices will follow in next chapters.

2.1 *Barangay* Dy Abra (Tumauini municipality)

Dy Abra is a *barangay* of the nearest town Tumauini that is about 17 km from the village. The *barangays* Cumabao and Camasi are adjacent to Dy Abra, respectively in the west and in the Northwest. One road connects the places. Every morning, the truck of the *barangay* captain goes to Tumauini and returns in Dy Abra in the afternoon. The arrangement for the fee is that the fuel costs are covered. The gravel road is in a bad condition. The Balisig creek can be crossed during dry season, but during the rainy season, the truck is left at the other side of the river to be crossed on foot.

The total area of Dy Abra covers about 2,260 hectares (*Barangay* Profile, 2000). Dy Abra has three *sitio*s, where some people live permanently others temporarily, further in the mountains (Masaan, Sagalong and the abandoned *sitio* Banig, still the official political name of Dy Abra, the place where the inhabitants settled in first instance when they arrived in the 60s). The village proper is situated in the grasslands at the foot of the Sierra Madre at an elevation of 100-300m (Boerwinkel, 2001). The hilly area with the permanent agricultural fields is situated near the centre and is divided under the Integrated Social Forestry (ISF) Program (see Part I section 2.2). The soils around Dy Abra consist of clay and sandy loam and people say that the soils are poor (Boerwinkel, 2001). The distribution of the Certificates of Stewardship Contracts (CSCs) of the present ISF land in Dy Abra shows an unequal distribution. There are some uncultivated areas because the owners live somewhere else or cannot cultivate it because they have more important land to cultivate. Migrants, who arrived after the distribution of the ISF lots in 1989, were not able to claim any certificate for the ISF land. The swiddens, for which no official tenure arrangements exist, lie scattered over the area in the distant *sitio*s near the forest edge.

Land use/ livelihood options and motivations

The main agricultural crops cultivated in the lowlands of Dy Abra are rice and yellow corn. All households would prefer to grow rice if they would have suitable

land, which is solely cultivated for food consumption (*motivational factor: food quality*). Almost everybody in Dy Abra cultivates corn as a cash crop (*motivational factor: returns to labour*). Most farmers plant a small piece of their cornfield with vegetables for own consumption (Boerwinkel, 2001). People prefer growing rice to yellow corn. Rice is a food crop and yellow corn only a cash crop. Labour and other inputs for yellow corn cultivation are higher than for rice while the profits are less. Besides, rice cultivation in comparison to corn cultivation contains fewer risks (*motivational factor: no risk*). People borrow inputs from traders with 7 percent interest per month, and especially for corn cultivation people easily get in debt. Besides, people say that rice fields are productive longer because less fertiliser is applied and no exact inputs are necessary for a fair harvest, although spraying is necessary. In addition, rice seeds in comparison to hybrid corn varieties have no expiration. In contrast to yellow corn, harvested rice is easy to dry and to store, and, in case you want to sell rice, you can wait for a good price.

Lack of access to land is the most important restriction for people to grow rice and yellow corn. In addition, lack of capital to buy chemical input is another restriction regarding cultivating rice and corn.

People who do not own a corn or rice field mostly plant these crops in swidden fields. Next to yellow corn and rice, vegetables are planted on swiddens that are mostly used for own consumption. Swidden making is considered as hard work. The swiddens are far away from the centre of the village, which makes it difficult to bring the products to the market. Most people have a temporary house at the swidden field, while others live there permanently.

Several other activities add to making a living, most of which are directly related to the access to the food and cash sources of corn, rice and swidden. Only some very poor people, who either do not have money to buy vegetables on the market or do not have a swidden, have a home garden. Home gardens look little developed. It appears to be problematic to have a home garden, because goats and other livestock walk around freely while poor soils makes it even impossible to grow certain crops. The relatively low returns to labour demotivates people to have a home garden. Besides, the forest area is relatively nearby from where people can easily get forest products like fire wood and construction materials, while, according to the *barangay* captain, the people are too much used to buy vegetables, choosing the easy way (Boerwinkel, 2001). Another source of cash income for the poor households is farm labour (60 pesos per day). People work on the fields of their neighbours and relatives, especially for the heavy tasks like ploughing, planting and harvesting. In addition, poor families go fishing once or twice a week, as food and cash source, while rich families mostly go for fun. One big river is a fifteen minutes' walk from the centre of Dy Abra.

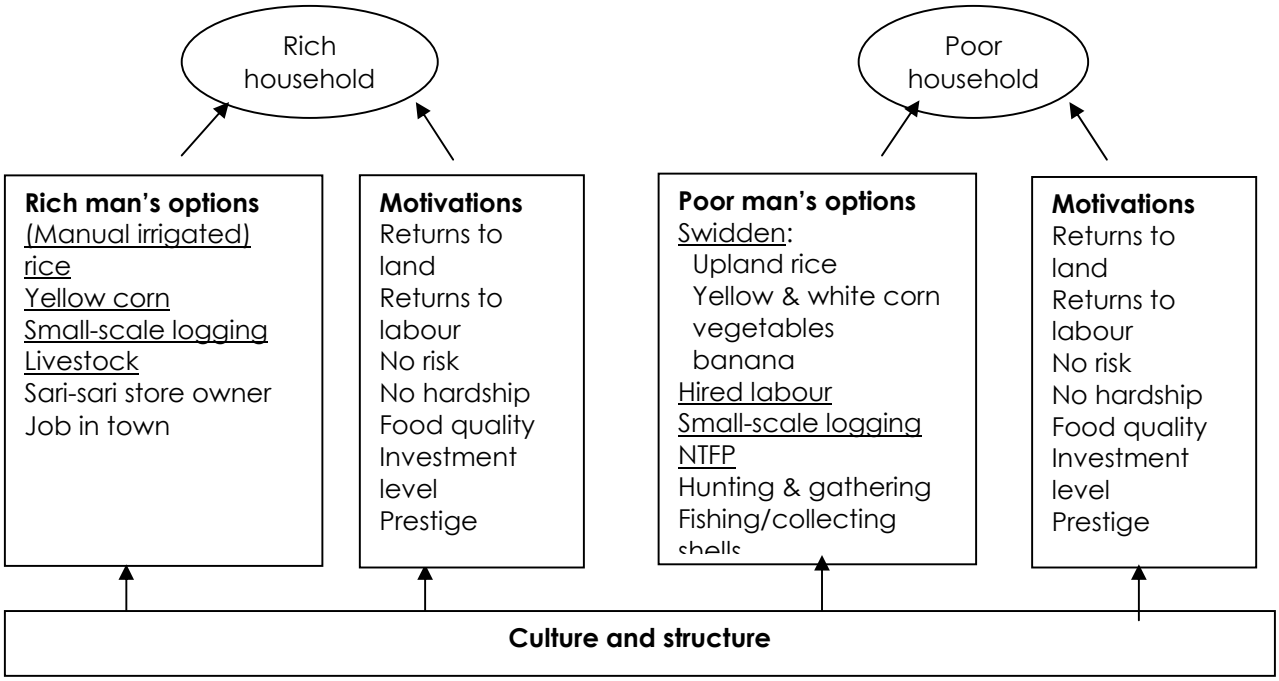
The amount of vegetables and meat people get from the forest also depends upon the access to other food and cash sources. If people have a rice and or cornfield, and therefore cash to buy food, respondents consider it a "*waste of time*", because the forest is far away and going there is physically hard work (*motivational factor: hardship, prestige*). For people with a swidden, no or little land, the forest still provides an important source of food and sometimes cash income as well. People hunt for wild pig, deer, and chicken that everyone favours to domesticated livestock because of the taste (*motivational factor: food quality and returns-to-labour*).

Another reason to go to the forest is for small-scale logging. Almost all households are involved in illegal logging as the biggest income source after corn and swidden making. Logging is considered as hard physical work and a risky business, because it is not sure if you will receive the money: "*You might be caught*". However, it is easy to join logging trips and is lots of "male fun" and various buyers have connections in Dy Abra. Farming has priority to gain a steady livelihood and people only go logging if there is time left after farming.

Keeping livestock is another source of income for most people. As most livestock walk around freely in Dy Abra foraging themselves, it easy and profitable to keep livestock. There is abundance of goats in Dy Abra, introduced by several programs of the government and NGOs (*secondary actors*). Goats and pigs are rarely eaten but function as a safety net. People sell their goats or pigs when they are in trouble. Carabaos are looked after and are important draught animals used for ploughing and transportation of products (including logs). Renting a carabao for farming purposes costs 100 pesos a day. An overview of the options and motivations of people in Dy Abra can be put in AiC-like scheme as displayed in Figure 1.

Figure 1. AiC like scheme of options and motivations in Dy Abra.

<u>main options</u>



People and culture

In 2001, there were about 94 households, with a total number of 549 people (MFA interviews). Most of the people in Dy Abra originate from the Tinguian tribe of Abra in the Cordilleras. People with a Tinguian ethnicity are known as mountain people and famous for practising swidden and hunting. In the late '50s and during the '60s, the founders of Dy Abra migrated from the Cordilleras to the place called Banig, where they opened the forests to practice slash and burn farming. This area was divided in a part named Banig and a part named Malaping. Similar to the situation in Dy Abra now and to the situation in Abra in the Cordilleras before, there was a division between poor and rich in Banig and Malaping[20]. The poor people lived in Malaping and the rich in Banig. Banig consists of relatively flat land where it was possible to cultivate corn and rice. In Malaping it was only possible to make swidden, due to the steeper slope. The separation, still clearly visible in Dy Abra today, goes back to the '40s and before. The richer people had always arrived earlier in the new area and they occupied the most suitable land for agriculture (*ibid.*). The remaining areas that the poorer people occupied were only suitable for swidden making. From 1972

[20] The distinction between rich and poor is based on the houses, and corresponds with the distinguished socioeconomic groups based on landholdings. The rich people have constructed stone houses, while the poor people live in bamboo houses. The majority of Dy Abra is poor considered this distinction and comparing Dy Abra to the other *barangays* of Tumauini, it is one of the poorest *barangays*.

until 1982, most people living in Banig and Malaping were involved in logging for big logging corporation in the area. In 1989, the government resettled the people from Banig and Malaping to the place where they live now due to the violence between the army and New People's Army. The poorer people happened not to be present during the division of the CSC lands suitable for permanent agriculture.

Social organisation

The people in Dy Abra have a strong community feeling. Respondents mention the ethnic Tinguian ties make the community feel like one, saying: "*the differences between rich and poor are big in Dy Abra, but we are still one community*". The ethnic ties and the community feeling are expressed in certain traditions where neighbours and family help and support each other. Exchange labour is one of the Tinguian traditions that the people still uphold (*structural factor and inherent social autonomy resource*). Different kinds of exchange labour[21] are used for the two main crops of rice and corn, and swidden making, although hired labour is becoming a common practice as well. Although the traditions are still strong, people mention a decrease in the community feeling. The main underlying reason that has caused the biggest change in the village that people point out is the road constructed with assistance of the DENR. People consider mostly positive changes caused by the road, specifically that they now have easily access to health services, and that the accessibility to the market has brought about economic development. However, people also point out that since people earn more money that they do not need their family and neighbours anymore and are more focussing on their own household. Besides, many people regard the resulting change in agricultural focus towards modern cash crop production as negative because they got in debt with traders from whom they borrow for yellow corn cultivation. According to the respondents, another negative consequence of the road is that it brought more people to Dy Abra, resulting in more conflicts.

[21] *Burnus* is a labour arrangement where labourers receive a share. It is mainly used for harvesting and is a normal practice in all the study sites. As respondents said: "When the harvest day is set, more than enough people are willing to help harvesting because everyone receives a share of the yield". There are some other arrangements too. *Amuyo* is a form of exchange labour in the most literally sense: "I work on your land and you work on mine". It mostly occurs during planting activities and weeding, and for opening swidden. If someone is in trouble, he might ask for help by offering meat in return for instance. This practice is called *bataries. Bahayinan* refers to community obligations for maintenance or building of common goods, like maintaining roads or school buildings. All households have to provide at least one labourer for these tasks. This is a regular practice in all study sites.

2.2 Masipi East (*Barangay* Masipi East, Cabagan municipality)

Masipi East has a good accessibility to the market. From dawn to dusk one can get transportation passing a solid paved 8 kilometres road connecting the village to the highway. The people of Masipi East usually go to the town market of Tumauini, as they say that they prefer the people at that market to the ones in Cabagan, the municipality to which Masipi East belongs. The transportation costs to Tumauini are equal as to Cabagan. *Barangay* Masipi East covers a total land area of 8,985 hectares. A total area of about 60 hectares is cultivated with corn and about 90 hectares form irrigated rice fields. One person is the "owner" of 576.9 hectares, having a Pasture Land Agreement (see section 2.2). This area is devoted to grazing of a small herd, but a lot of it is left idle and could be suitable for agricultural purposes. Another 6,5% of the area of *barangay* Masipi East used to be Hacienda Vidad. Due to this Hacienda, the whole *barangay* has become an agrarian reform community in 1984 under CARP[22] (see section 2.2). Since 1995, *barangay* Masipi East has become a target village of various institutions like the World Bank, the Food and Agricultural Organisation (FAO), Local Government Units (LGUs), Department of Agriculture (DA), Department of Agrarian Reform (DAR). Respondents from Masipi East say that the infrastructure projects like the construction of all weather roads, access to electricity and the construction of an irrigation dam are the most important to them. Although Puerta should have been taken up in these development projects as being part of *barangay* Masipi East, not much attention is paid to the village.

Land use/livelihood options and motivations

In comparison with the other two study villages, Masipi East is rather integrated into the market economy. The village has the highest income of all the *barangays* belonging to Cabagan municipality. Most household make a living of diverse agricultural and non-agricultural activities. Mono-cropping of rice and corn are the prevailing farm practices found in Masipi East. Rice is not only used for own consumption, but also sold at the market (*motivational factor: returns to land and to labour*). White corn (food product) is not cultivated anymore. Instead, large amounts of yellow corn are produced and marketed. Like in Dy Abra, people prefer to cultivate rice to corn for the same motivational factors. Next to rice for food consumption, rich households mostly produce rice and

[22] Former Hacienda Vidad covered a total area of 586 hectares. 60 hectares came under the area under land agreement of agrarian reform and was divided and sold to about 70 persons based on the actual position at the time, with a remaining area of 526 hectares still under hacienda with about 20 tenants.

yellow corn as cash crops on large scale. They hire labourers for all farming tasks (80 to 100 pesos per day) and hire tractors for ploughing. In general, the farmers with less land hire labour for most farming tasks as well, but also make money out of hiring oneself out. They use a tractor or carabao for ploughing (120 pesos per day). An extra source of income for many people is livestock and poultry. These are used for own consumption and function as safety net. Carabaos are mainly used as draft animals.

The poorest households consist of people who do not have land. They make a living from less appreciated activities like farm labourer, carpenter, having home gardens, hunting and gathering in the grasslands, and fishing and collecting shells in the river and the river banks.

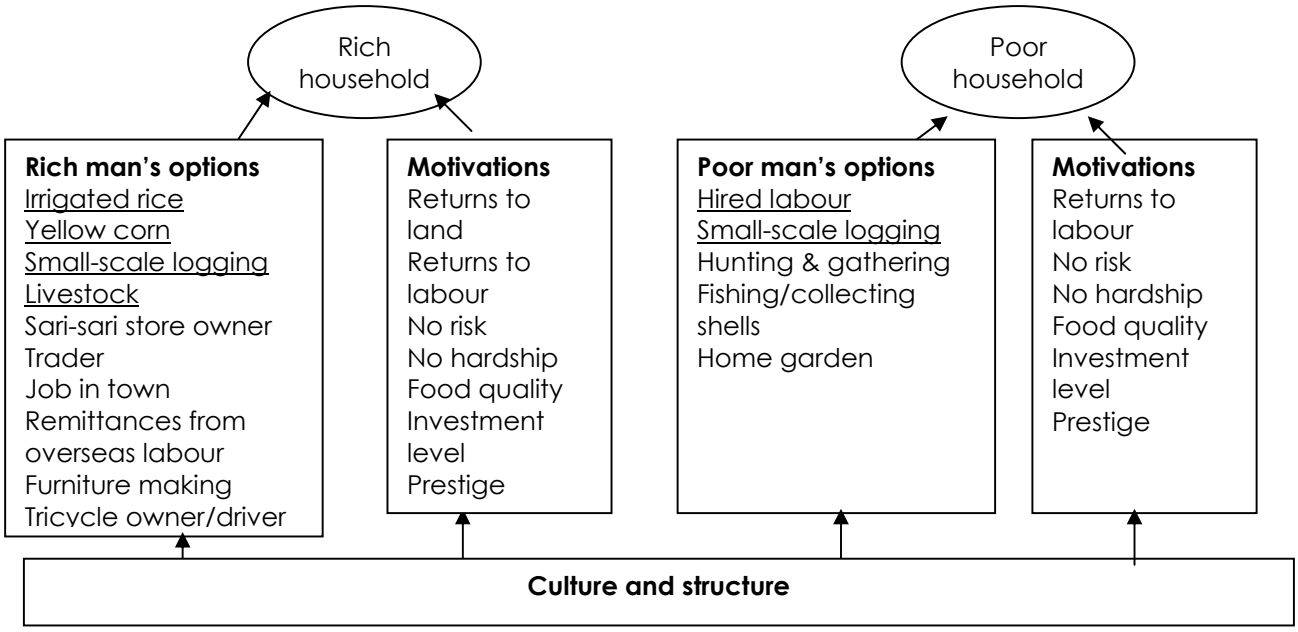
The richer households are more involved in wage and market oriented activities. Since the construction of the road and access to electricity, many people sold their land or carabao to buy a tricycle and make a living as tricycle driver. Some people have contracts as civil servant in town or as construction worker (100 pesos a day). The richest people in the villages are generally households with a large area of land. Farmers inherited the land or, like the richest farmers in Masipi, bought land with remittances from overseas family labour. Five of these farmers in Masipi are trader, and/or have a big shop as well.

There are 11 chainsaw owners in Masipi East. Logging occurs in the area adjacent to Puerta further in the mountains, another site of the study, on small scale and only for extra income often as fast cash (more details about logging will follow in section 8). In comparison with the logging practices in Dy Abra, logging occurs less in Masipi/Puerta. There are two furniture makers in the village that employ carpenters[23] and buy some of the timber. An overview of the options and motivations as discussed is as shown in Figure 2.

Figure 2. AiC like scheme of options and motivations in Masipi East.

[23] One of the furniture makers said that he could not find people in Masipi East willing to work for him and employed carpenters from an adjacent *barangay*. His argument that people from Masipi East are more fond of complaining about being jobless than actually work was underlined by another respondent, who could not find anyone in Masipi East that wanted to be their nanny and shop guard.

main options



People and culture

In 2002, there were about 187 households in Masipi East, with a total of 980 inhabitant (household survey conducted by the MFA researchers). It is a migrant community, of which the original people are Ilocano. In the 40s, five families from Ilocos were the first to settle in the wide and fertile area that is now called Mamaga, in Masipi East. For about five years, the people practised slash and burn farming mainly planting rainfed rice, white corn and mongo beans on the flat area. Meanwhile, they started to remove the tree stumps to develop permanent fields by ploughing and they constructed an irrigation canal. Soon, the actual tillers obtained tenure rights from the government. At the same time, a continuous flow of people from Ilocos and Cabagan (Ibanag tribe) migrated to the area. Informants said that Hacienda Vidad, which is part of *barangay* Masipi East, was established in the 60s. All the farmers tilling in that area became tenants of Vidad. With Marcos' declaration of Martial Law in 1972, the inhabitants of *barangay* Masipi East moved under pressure of the government to the plateau where Masipi East proper is nowadays to protect themselves from the New People's Army[24]. Besides, many families returned to their place of origin (Ilocos or Cabagan). In this period (from 1979 until 1988), about 70 % of the villagers were working for the logging company WESCA. More migrants came to

[24] The mountains and forests of *barangay* Masipi East used to be a centre of the battles between the NPA and the army. *Barangay* Masipi East is known as a village that used to support the NPA.

Masipi East to work for the company and many stayed afterwards. After the safety situation became calm again, and after the logging company pulled out in 1988, the farmers' focus shifted to farming again. Since 1985, the farmers slowly adopted yellow corn in Masipi East, as a very profitable cash crop. Along with the introduction of this crop, fertilisers and pesticides were introduced, and many agricultural changes followed.

All the rich people, having large areas of land, are also member of the founding families. Some of the poor people used to have land but sold or mortgaged when in need for cash for instance. Besides, during the insurgency many people left and sold their land. When they returned, they could not obtain or buy any land. Some rich people became rich because of remittances. Since 1992, Ifugao migrants have arrived in the village (more details about the Ifugao migrants, farming practices and integration in the social structure are described in section 5.3).

Social organisation

Being a migrant community, Masipi East is difficult to organise. Most farmers focus on their own household and direct family. Exchange labour is not practised anymore, instead, all people hire labour for different farming activities (except for the harvesting sharing arrangements apply). Though, except for some land and water conflicts, it is a peaceful community according to respondents. However, many people fear that more land conflicts will occur in the future, especially since mortgaging land has become fashionable these days which is open to conflicts since the arrangements are often not clear to both parties. The *barangay* captain, who is known as a good *barangay* captain, settles individual fights. There is little trust and people protect their houses and guard their fields for theft. This is one of the reasons people pointed out why they hardly plant vegetables or fruit trees. There is a co-operative in *barangay* Masipi East that was set up with help from a NGO to obtain a Community Forestry Program (CFP). This was offered to the community after the logging ban in 1993 by which the community could get involved in community-based development programs, like obtaining annual allowable cut (AAC) certificates that go together with reforestation programs in the 5.000 hectares forest area. There have been many problems with the internal organisation of the co-operative[25]. The future of the co-operative is uncertain.

[25] The barangay captain mentioned that it was harder to handle the co-operative than the community.

2.3 *Sitio* Puerta (*barangay* Masipi, Cabagan municipality)

Puerta serves as the gateway to the forests of the Sierra Madre and is situated at the eastern portion of *barangay* Masipi East that used to be the last place where logging trucks passed before entering the forest. It is close to the forest area and all small-scale loggers from Masipi East pass through the village. The area occupies important watersheds for Masipi East providing a dense network of drainage channels. Water is clean and abundant. The area of Puerta is quite comparable to the area Dy Abra. The lands are classified as uplands, belonging to the Integrated Social Forestry (ISF) program by which many households obtained a certificate of stewardship contract (see section 2.2). The soils in Puerta are generally low in fertility, shallow, poorly drained and strongly eroded. A small portion is suitable for irrigated rice production. The flat areas near the creeks are converted into rice fields that are irrigated manually. The moderate and steeper areas are ploughed and planted with yellow or white corn. Swiddens are found on steeper areas, but most are converted into banana plantations. There is no nearby land left to make new swidden fields according to the inhabitants. Adjacent to Puerta is the 5.000 hectares forest area covered by the community forestry program that was awarded to the co-operative of *barangay* Masipi East (that includes inhabitants of Puerta) in 1992.

Land use/livelihood options and motivations

Almost all nearby and relatively easily accessible areas that are suitable for agriculture (including the swidden areas) have been converted into rice or cornfields, or are fallow swiddens or swiddens converted into banana plantations. Rice is cultivated on the small area of irrigated rice fields. Some areas are planted with rainfed lowland rice or irrigated by hand from nearby creeks. Further, upland rice is planted on (re-) opened swiddens during the first and sometimes second year. The former slash and burn fields on the moderate slopes have been converted into permanent fields by ploughing and are mainly planted with yellow or white corn. The yields from these fields are often low due to wash-out of fertilisers, infertility, and soil erosion. Yellow corn is only cultivated as cash crop. Many farmers, of whom some did cultivate yellow corn before, prefer to plant white corn. Mostly, they are afraid to borrow inputs from the traders, which is necessary for yellow corn. Besides, white corn can also function as a staple, although all farmers consider white corn as a poor man's staple. People gave several other reasons for cultivating white corn instead of yellow corn. Small business is possible when cultivating white corn, as you can roast or boil the corn and sell it. Yellow corn, on the other hand, is a cash crop and can only be eaten as snack, and is not suitable for as a staple. Besides, like rice cultivation, white corn involves fewer risks than yellow corn.

The steeper fields are converted into banana plantations. Banana is next to corn an important cash crop. Almost all households have a banana plantation and banana traders come every Friday. Most people are not interested in planting other trees, as one respondent pointed out: "*Not many people are interested in planting citrus trees, for instance, because it takes a long time before you can harvest them and people consider it a waste of time. Marketing is not the problem, however. Transportation and timing form the biggest obstacles. Last year (2001) a big typhoon destroyed most banana plantations. The 1990 earthquake and typhoon destroyed all roads, while the big typhoon Iliang struck in 1998, leaving people with nothing*".

Pigs and poultry mostly walk around freely. Some people have a home garden, but this is not very common because of the risk that livestock destroys the crops. Only a few people tie or cage their animals and/or put a fence around the home garden. Most people however plant some vegetables in their fields that are further away from the houses. Carabaos are the most favoured livestock. They are used for ploughing the fields, transportation of products and hauling of logs and bamboo. Bamboo is gathered for construction purposes and is also sold to people in lowland *barangays* for construction purposes. It is seasonally gathered in large amounts for selling (directly) to tobacco farmers in the lowlands that use bamboo for drying the tobacco (Kusters, 1999). Not only people from Puerta cut bamboo in the public forest surrounding Puerta, also tobacco farmers from the lowlands come to cut the bamboo themselves (*ibid.*). Renting out one's carabao (that always goes along with hiring a man riding the carabao is 100 pesos a day) for ploughing or hauling practices of wood is common and provides an extra source of income. Hired labour within the village also provides extra income for some farmers (60 pesos a day).

Hunting, gathering, and fishing are other sources of food and cash income. Although there is still abundance of water, there are no loads of fish anymore. People blame the use of electrical, cyanide or natural poisonous fishing methods, destroying all living creatures in the water. These methods are illegal, but are still commonly practised. People working for the logging company introduced these methods. The logging company is pointed out as the cause of the main environmental changes in the area by cutting the forest and introduction of destructive fishing methods. According to the respondents, this has caused a decline of fish availability and a change of climate, saying: "*There is less rainfall than before and the temperatures are much higher now: before, we kept the fire burning the whole day because of the cold and the difficulty of start the fire. Now, it's always warm.*" People say that with the disappearance of the forest, many animals have disappeared as well. Hunting has become a sideline activity, for which people put traps in the forest. If people go to the forest for logging or bamboo gathering, they hunt as well (*connected option*).

The amount of shops is increasing. When we visited the village for the first time in June 2001, there was one shop in the village. The last time we visited the village, in May 2002, there were five shops. The owner of the first shop said that she hardly made money out of it, since people mostly buy on credit and have difficulties in paying off the debts. She buys the products from the banana traders that come every Friday to a market place that is located in between Masipi and Puerta. This is the farthest place that a jeepney from the lowlands can reach. The main marketable products that come from further up the mountains, mainly banana, bamboo and logs are brought to this place. Here, traders or middlemen from Tumauini or Masipi East come to collect the products and in turn sell products like can food, noodles, salt, cigarettes and gin.

People and culture

Inhabitants of Puerta divide their village that consists of about 209 people in 45 households in three parts related to ethnicity and family ties. Ibanag, Tinguians (coming from Dy Abra), and Ilocano are the different ethnicities in the village. Ibanag, like Tinguians and Ifugao, are said to have a slash and burn tradition. Ilocano on the other hand, are normally more focused on permanent agriculture. Since the past two years, no new migrants have arrived in the village. In the territory adjacent to Puerta (belonging to *barangay* Masipi East) migrants from Ifugao Province have entered since 1992, but they hardly have contact with the people living in Puerta (see section 5.3). In the 60s, the first people came to Puerta to practice swidden farming. Like the people from Masipi East, the people from Puerta all worked for the logging company from 1979 until 1988. During the highest peaks of the conflicts between the army and the New People's Army the government resettled them. Most people returned to Puerta to convert the flat areas and moderate slopes into permanent rice and cornfields[26] in anticipation of the distribution of certificates of stewardship contracts (CSC), in 1986 (see section 2.2). After the logging company pulled out, people actually started focussing on agriculture. With the expansion of families and arrival of more families, the moderate and steeper slopes were also converted into permanent agricultural fields. In the 80s and 90s there was still lots of forest in Puerta. Now, no nearby forest can be found anymore, except for logged over and bamboo forests.

Social organisation

Puerta is a *sitio* of *barangay* Masipi East. A few of the inhabitants of Puerta also have a residence in Masipi East, especially when they have children going to school in Masipi East. Although Puerta is a small community, it does not seem like a close community. The households belong to several families of different ethnicity and several migration flows to Puerta had taken place. Respondents

[26] The fields were cleared with the help of the bulldozers from the logging company.

say that the households are not organised and that they are only involved with their friends and families. Besides, people outlined some ongoing feuds between various families. They said: "*If there would be a good co-operation in Puerta between the villagers, there would be a good life. We see each other and are friendly to each other; our faces are of plastic from the outside, but that is fake [these mostly concern land conflicts]. However, we don't like to fight. We need an official, a leader, who stands up for us, a good one with brains and respect, so he will make sure we receive projects*". If serious disputes occur, the local leader tries to settle them before people would go to the *barangay* captain who lives in Masipi East.

The people from Puerta feel discriminated against by the political influential people of *barangay* Masipi East. The farmers argue that none of the development projects reaches Puerta, but that all is given to Masipi East. One of the several examples that people gave is: "*now, there is a road to the fields in Mamaga (in Masipi East), but there are no houses there. The road to Puerta is not good, while many people live in Puerta*." The *barangay* council member assigned in Puerta does not live in Puerta and is not interested at all in "his *sitio*", according the inhabitants. During the elections, the council members, representing a *purok* or a *sitio* are elected as well. However, the people of Puerta do not organise to put forward one council member they would all elect to represent their *sitio* in the *barangay*.

Exchange labour is hardly practised anymore in Puerta. Instead, most labour is provided by one's households or is hired. Even respondents from poor households, who have difficulty paying labour, mentioned that they prefer paid labour. People say: "*when you use Amuyo, you are obliged to work to exchange the labour, while for paid labour it is up to you to decide whether or not you like to work and besides, it is much more difficult to organise Amuyo.*"

2.4 Comparison

Rice and corn

This section gave a general description of the study villages. All farmers used to cultivate white corn and rice for food consumption. Intensifying rice production started with the introduction of new varieties and better irrigation facilities. All households would prefer to grow rice for food consumption if they would have suitable land. Only some rich farmers from Masipi with a large area of land cultivate rice as a cash crop as well. The introduction of yellow corn that some farmers adopted immediately, showed high returns that encouraged many other people to cultivate new varieties as well. Farmers that do not have a rice field, say that they mainly plant yellow corn to buy rice. In all villages, yellow corn and rice constitute the main agricultural products, while some poorer households in Puerta and Dy Abra grow white corn for subsistence purposes.

Risk appears to be a very important motivational factor, especially for poorer households. Rice has a good minimum yield, as farmers say: "*If you have money, you can buy fertiliser for good yields, but if you do not have money, you can still harvest*". On the contrary, for yellow corn cultivation exact inputs are necessary for a good yield, and minimum yield is virtually zero. Moreover, new or second generation varieties have to be used when cultivating yellow corn in contrast to white corn and most rice varieties that have no expiration. Farmers are dependent on traders for obtaining inputs by which many farmers got in debt. Besides, the fertility of cornfields is decreasing much faster than of rice fields, due to the large amount of fertilisers according to the respondents. Especially permanent corn production on sloping areas in Puerta leads to fast deterioration of the soils. In addition, if yellow corn is harvested it needs lots of sun and a good drying place. Postponement of drying immediately leads to decrease in the qualification and price. Yellow corn cannot be stocked but has to be sold within two weeks. White corn on the contrary, as well as rice, can even dry in the house if necessary. Farmers can easily stock these products and wait for a good price if they would like to market them.

Other livelihood activities and options

Next to cultivating rice and corn, people have several additional food and income sources. In Puerta, many former swidden fields are converted into banana fields, providing cash income. For some of the poorer households, home gardens provide an extra source of vegetables. Keeping livestock is favoured in all villages, and is linked to the wealth of the household. Hunting and gathering of NTFP, fishing and collecting shells are only income and food sources for the poorest people in Masipi East and Dy Abra, while in Puerta most households are involved in these activities. Logging is mostly practised in Dy Abra, but in Masipi and Puerta, it provides a source of fast cash for many households as well. For poor people without land, hired labour is a main source of income, while for poor farmers it is an important income source. Prices of hired labour are the same in Dy Abra and Puerta, 60 pesos per day, or with carabao 100 pesos per day, while in Masipi it costs 80 pesos and 120 pesos per day, respectively. Only in Dy Abra and on swidden farms, exchange labour is still organised. Other more wage and market oriented activities, like being a trader, furniture maker, driver and tricycle driver are mostly found in Masipi East. Comparing the different livelihood activities in the three villages shows that Masipi East is the most oriented to the market and the economically most developed, followed by Dy Abra and then Puerta.

Structural and cultural factors

The main structural and cultural factors influencing the livelihood activities appear accessibility to the market, access to and division of land and quality of land, and some other factors found in the social structure and culture.

Accessibility to the market

The accessibility of the villages shows that Masipi East is very accessible, followed by Dy Abra and then Puerta. Transportation possibilities from Dy Abra to the market are possible at least once a day although it takes about two shaking hours and during the rainy season, difficulties occur crossing a river. Transportation from the various swidden areas to Dy Abra can be very difficult. People from Dy Abra go to traders in Tumauini themselves to get the inputs and to bring their products. Puerta is difficult to reach. No normal motorised vehicles reach the place and people bring all the products down by hand or carabao crossing many creeks and rivers. They transport their products to Masipi East, where several traders arrange all kinds of marketing to the bigger markets. Masipi East is very well accessible by an all weather road with transportation possibilities during the whole day.

Access to and division of land and quality of land

Access to land is a very important factor for land use decisions and other livelihood activities. Unequal distribution of land is visible in all villages. In Dy Abra, the division of certificates of stewardship contracts (CSC) by the government in the 80s was unequally. The other families received less land and later immigrants have no land. In Puerta, people occupied lands to receive a CSC. Although there is a maximum area per household for CSC, people were able to receive more hectares by naming their children as inheritors. Mortgaging and selling of the CSCs occurs regularly, although not officially. In Masipi, a large area is occupied by a pasture land agreement, while the former hacienda is divided under the agrarian reform. Most land is titled and selling, mortgaging and leasing of land are common practises.

In Masipi East, the agricultural area consists of flat land that is converted into corn and irrigated rice fields. In Puerta, a small area consists of irrigated rice fields with private titles. Most agricultural fields in Puerta and Dy Abra are divided under the Integrated Social Forestry program. The area in Dy Abra is flatter than in Puerta and more suitable for permanent corn and rice production. In Dy Abra, some people have enough land for making a living of corn and rainfed or manual irrigated rice cultivation. Most people who do not have enough land or no land at all, practise swidden near the forest in the mountains. Most people in Puerta converted former swiddens in banana plantations.

Social structure and culture

In the Philippines, ethnicity is known to play an important role in the way people make land use decisions. Ilocano, are known as permanent farmers, for instance, who do not know how to work in the forest[27], while Tinguians and Ifugao have a slash and burn tradition and are proclaimed as hard workers who like to be in the forest. All the villages consist of migrants with inhabitants from different ethnicity. Most people from Dy Abra are Tinguian that originate from a few families. Although the coherence of the village appears to weaken these days, the community feeling seems quite strong. Masipi East is a large migrant village, encompassing various ethnicities and migrants that have arrived over the years. This seems to negatively affect the unity of the village. Although Puerta is small community, it appears hard to organise the community. Various ethnicities are living in the village, feuds between families occur and everyone is focused on its own family and relatives.

3 Rice

Rice is a staple in the Philippines that Filipinos prefer to eat at least three times a day. A meal without rice is not complete and substitutes like cassava or white corn are considered as "*poor people's food*". People prefer growing rice to any other crop (see section 1.3). Distinction can be made between different kinds of rice cultivation. Rice is planted on swiddens (so called upland rice), on land without irrigation and on irrigated lands. These three types of rice involve different kinds of farming practices. Upland rice from the swidden fields will be treated in a separate section (section 5), since this involves a different kind of agriculture in the uplands with other kinds of environmental impacts.

This section will deal with irrigated rice. Analysing the rice production according to the AiC methodology, we will first describe the production process of rice cultivation in the three villages. A characterisation of all the elements of the production process will be given like the availability of suitable land and water, the use and availability of material inputs (e.g. seeds, fertilisers and pesticides), farming skills and labour. These are the elements that together determine the returns-to-land and returns-to-labour of the rice option, the core of the identified motivational factors. Tables are constructed for the three villages that show the economic calculations based on interviews[28]. In AiC terms the elements refer to

[27] During a focus group discussions with Ilocano farm labourers in Masipi East, we asked them to rank their preference: (1) Making swidden, stimulated by the *barangay* captain in terms of allowing them to go into the forest to practice swidden, while even providing carabaos for transportation and security, (2) a piece of land only suitable for corn production, as a tenant, and (3) what they do now. The ranking was, without discussion: 2, 3 and 1. When we asked about the necessary inputs, the respondents said, without deliberation, "*The traders*".

[28] Unfortunately, data on family and exchange labour, necessary for calculating the returns to labour, is missing in most cases, except for three household interviews in Dy Abra. Separate time use studies are being conducted in Dy Abra that will provide more data for analysis the returns to

autonomy factors that indicate whether intensive rice cultivation is an implementable option, or a potential option that cannot be implemented constrained by lack of autonomy factors. In other terms, these factors refer to opportunities or constraints in maximising the outcomes of rice production that might be translated into opportunities. In addition, a connection with other actors influencing the options and motivations of the primary actors appears.

3.1 Rice in Masipi East

Land

108 of the total of 164 households interviewed for the MFA study have an irrigated rice field totalling 90 hectares. Nine percent of the tillers said that they use mortgaged land, 79 percent claimed to have and official title while the rest (12 percent) declared to be a tenant farmer. The maximum area per household is 2 hectares and the minimum 1/4 hectares. In Masipi East, there is just one rainfed rice field of 3 hectares that the owner uses for own consumption.[29]

Not all land suitable for rice production and that could be irrigated is in use. This seems to indicate an abundance of land, but is actually a result of the unequal division or ownership of land. The bigger landowners say that the costs of making uncultivated areas productive do not counterbalance the benefits. The owners could make money out of the land by leasing it to other households. However, if the owners are not in desperate need for money they prefer to leave it vacant. There is a risk that the tenant will not comply with the sharing system they agreed upon or that delays in payment occur[30], along with all the accompanying unpleasant expectations regarding negotiations, etc. Next to ownership and tenancy, mortgaging of land is a frequent use in Masipi. When an owner is in cash shortage, or would like to invest in building a house or buying a tricycle for instance, he or she will look for someone who likes to mortgage his or her land. After bargaining, the mortgager pays the owner the full amount of cash for the land at once (normally below the standard land price as the owner wants fast

---

labour as well. Here we confine ourselves to calculating the returns to land of rice production in pesos per hectare, showing what the net returns would be if all the rice would be sold.

[29] The owner of this land is a successful rich farmer. The 3 hectares rainfed rice field yields enough for own consumption and next to this field he has large rice and cornfields for cash income, he is a trader and owns a shop as well.

[30] Respondents told that are five kinds of sharing systems in Masipi East. Muerto implies that the farmer has to give 8 cavans (400 kilos) *palay* per cropping per hectare to the landowner, while the farmer has to provides its own inputs. The 10 percent system implies that the owner provides all inputs, and that the work of the tenant is awarded with 10 percent of the yield. The 1/4 system implies that the tenant provides all inputs while giving 1/4 of the harvest to the landowner. The 1/3 system implies that the owner provides all inputs and the tenant receives 1/3 of the harvest minus the costs of the inputs. The system implies that the owner pays for the hand tractor while the tenant pays the rest of the inputs and gives half of the harvest to the landowner.

cash). The owner keeps his or her land title, while the one mortgaging can till the land until the official owner repays the full amount (without interest). Normally, the *barangay* captain or another regarded person plays as arbiter in mortgage deals which are fixed on paper. It also happens that two persons make the deals unofficially. This is happens mostly when it concerns position for which no official titles exist and is very prone to land conflicts.

All households that in one way or the other do not have a rice field to till would like to have one, but mostly lack the money or the potential to make a deal. Land prices greatly differ per classification of the land, title, and the location. Titled irrigated land for instance costs between 70,000 and 100,000 pesos per hectare, depending on the classification of the rice field.

Irrigation

Two water intakes enable the farmers to engage in irrigated rice farming yielding two crops a year. A newly build diversion dam downstream irrigates an additional 200 hectares, of which about 30 percent is in former Hacienda Vidad (Masipi East), the rest in the adjacent *barangay* of Masipi West. The irrigation intake in Puerta was constructed in the early 1980s with help from the National Irrigation Administration, a government-owned and controlled corporation (*secondary actor*). It provides about 12 hectares in Puerta and the whole of Mamaga area (about 50 hectares) in Masipi East. The Irrigation Association entitled with the management and maintenance consists of 118 members from Masipi East and Puerta. Members have to help repairing the irrigation system at least one day a month (penalty is 40 pesos, 140 pesos (4 times 40, as one cropping takes 4 months on average) is taken up as shadow price in Table 1) and pay membership fee of three cavans (150 kilos) of unhusked rice, *palay*, per harvest per hectare. The members of the board of the Irrigation Association (8 people) pay 1.5 cavans. Consideration is given to farmers who had a bad yield. The fees are, in turn, given it to the Provincial Irrigation Office as repayment of the construction loan.

The association provides schedules for the diversion of the water. Therefore, two rice cropping seasons would be possible for all the members. However, water availability is scarce during the dry season for the rice fields in Masipi East and conflicts about water occur[31]. People from Masipi East point out two main reasons for the water scarcity. The people using the irrigation about 3 kilometres upstream in Puerta often divert more water to their field by closing the dikes, and waste the abundance of water. The only solution the respondents could think of is to construct concrete canals by which diversion is not possible. When discussing this issue with the accused people they agreed in jesting. The other

[31] A few years ago a man was killed as a result of a water conflict. The case has never been solved, since there appear to be several motives to remain mute about the incident.

reason for the water scarcity pointed out is the unstable current in the river. People said: "*There used to be abundance of water (and fish) in the river, having a rather stable current. Currently, flash floods and drying up of riverbanks alternate along with the dry and wet season, of which the wet season is usually accompanied with typhoons*". According to the people, the main cause for the unstable river current is the disappearance of the forest (which usually results in less infiltration and more direct run-off). The most important reason for the loss of the forest pointed out by the respondents is the big logging corporation that was active in the area in the 80s, and to a lesser extent current small-scale logging and swidden practices. The coming years, people expect more water problems, especially during the dry season.

Seeds

These days, all irrigated rice fields are planted with hybrid rice varieties that were developed by the International Rice Study Institute (IRRI) and the Philippine Rice Study Institute (PHILRICE) and produced by private and public institutions. Farmers from Masipi East get seeds from the Department of Agriculture (DA) or they buy the varieties from traders at the market in Tumauini or Cabagan. Often, however, people lack the money to buy first generation varieties. There are only a few people in Masipi East that buy new varieties. People mix first and second generation seeds or they exchange seeds after the harvest, by which they can plant second generation seeds the next cropping. However, the yield of the hybrid varieties is lower when using a second or third generation. If the farmers would buy varieties themselves or would have the option to choose between different varieties, they said that they would choose for the variety on basis of the following considerations: amount of yield, costs of buying the variety and the prices received for selling the rice, resistance against diseases, especially tungro and cohol, and grain quality characteristics in terms of taste, substance, colour and odour.

Fertilisers

Chemical fertilisers, herbicides, and pesticide are other main inputs used in the rice fields that came along with the introduction of high yielding varieties in the 80s. People can buy inputs at the market, but mostly farmers are stuck with traders to borrow inputs that they will pay back in rice after the harvest with 7 percent interest per month (the informal credit system is explained in more detail in chapter 7). Only some people say that they can afford to apply full inputs in their lands for yield- and profit maximising. However, people say that rice can still grow well without optimum inputs (in contrast to yellow corn), although spray is necessary. Most people cut down on the fertilisers due to lack of money and the hesitance to borrow more money than necessary from the traders. Besides,

farmers complain about the rising prices of chemical fertilisers while the price of rice continues to lag behind (*macrostructure: market prices*: see chapter 7).

Farming skills

During the interviews it appeared that knowledge about the right amount of inputs is sometimes lacking, especially the application of herbicide and pesticides often happens unchecked. The knowledge that people have about timing and the amount and kind of fertilisers that they apply mostly results of continuous testing. Information about the rice varieties, herbicides and pesticides is provided by the salesmen of the products, but also of testing oneself and contact with neighbouring farmers within the village and outside the village.[32] These days, for instance, many people try out direct seeding techniques instead of transplanting which needs specific farming skills. Besides, government extension officers provide many agricultural courses. Dozens of agricultural projects have been implemented wherein agricultural inputs were provided together with technical assistance for successful farming techniques. The idea is that farmers become familiar with and use the new techniques, as well as that diffusion of information of the courses is often supposed to occur automatically in the village. The courses however hardly seem to reach the expected outputs. Key respondents and other farmers pointed out several reasons:

"The main reason that they do not always follow the advises is because the new techniques are often focused on profit maximising that go together with taking risks that require capital inputs and more time investments without being positive of the effects".

"Bad timing of the training (busy with other things like working on the farm) by which women or children are sent to attend the training, who don't have any decision-making power regarding land use decisions".

"Bad experiences with former courses" (stories about officials who did not act upon promises and negative outcomes of earlier adopted techniques and technologies)."

It also appears to be difficult to act differently than your neighbours, as distinct behaviour is not commonly accepted. In line with this, a main cultural influence appears the idea of backwardness. Farmers who know about the advantages of organic fertilising for instance, are reluctant to adopt it in their own practises because they feel as if they go back in time instead of forward. The time and effort spent on collecting organic fertiliser is negatively approached.[33] In all the villages this was mentioned by various respondents.

---

[32] Masipi East is a migrant village. Many people still have family and a piece of land in their place of origin that they visit and also learn from extension officers, family or friends there.

[33] In 1999, for instance, 22 interested farmers from Masipi East followed an Integrated Pest Management course. The participants were taught to cultivate rice without spraying pesticides

Labour and agricultural calendar

Table 1. Average returns to land of one cropping irrigated rice per hectare in Masipi East.

	Kilos	Pesos
Irrigation		
Fee**	150	1200
Maintenance (shadow price of fine)**		160
Total		**1360**
Material inputs		
Seeds**		1000
Fertilisers**	300	2546
Spray**		553
Total		**4099**
Labour		
Ploughing & harrowing*		1329
Planting & uprooting & fertilising*		1567
Harvest (share 8.7%)*	279	2235
Thresher (share 7%)*	248	1986
Total		**7117**
Yield		
Palay*	3546	**28368**
After harvest & threshing shares (for transport)	3109	
Transport		
From field to house and town (0.5p/kg-shares)**		1555
Sacks (0.2p/kg)**		709
Total		**2264**
Loan (for material inputs, labour, transport)**		9259
Interest (7% per month)**		3704
Returns to land per cropping (pesos/ha)		**9824**

* average based on 37 household lev interviews

** based on interviews with key respondents and focus group discussions

There are different kinds of labour arrangements in Masipi East. While better-off farmers in Masipi East hire most of their labour needs from outside the household, all farmers organise labour for the most heavy and time consuming tasks of Aside from land, irrigation facilities, inputs (e.g. seeds, fertilisers, and pesticides) and farming skills, labour is the last condition in the production process of rice cultivation. In general the main crop (wet season) is planted somewhere in May to July and harvested between August and October. The second crop (dry

---

and with use of organic fertilisers on a demo farm. Participants we spoke with were quite enthusiastic about the results. At the same time, however, they hardly apply these techniques. Reasons given are that the techniques are only profitable if the soils are of good quality (otherwise the expenses don't pay off the gain) and that bat dung, a good organic fertiliser for instance, is difficult to collect because it is a far walk, heavy to carry and just takes much time to collect.

season) between November and January and harvested in February to April. Farmers say that they decide on the dates of rice production activities on basis of the kind of varieties and the availability of labour. The main activities of the rice production process are land clearing in preparation for ploughing and harrowing (use of hand tractor, and/or carabao), seedbed preparation, fertilisation, uprooting and transplanting of the seedlings, spraying of herbicide and insecticide, harvesting, threshing, hauling, drying, ploughing, transplanting, harvesting and hauling. There are hardly reciprocal labour arrangements anymore in Masipi East, instead most is hired labour paid in cash, or in kind for harvesting and threshing (mechanical). Table 1 shows the costs made for labour in rice production.

Transportation and marketing

A project of the World Bank assisted in the construction of a road and bridge, by which all rice fields in Masipi East are easily accessible. Threshing of the rice is done in the rice field, after which it is transported by car to the house. There is a rice milling in village, for which people pay 1 pesos per kilo. Piles of rice husks are laying next to the milling and once in a while people set it on fire. No one seems to know that it could be very useful as organic fertiliser. Masipi East is the only village of the three sites where people sell rice to the market. Sometimes people have to sell more rice than they would otherwise keep for own consumption until the next harvest.[34] People say that this occurs when they are in debt with the traders and are obliged to pay back the loan after the harvest in kind (see chapter 7). If people do not have loan and would like to sell a part of the rice harvest, they will look for the merchant that offers the highest price at the market in Tumauini or Cabagan.

Returns to land

Table 1 shows a calculation of the returns to land of one rice cropping in pesos per hectare, where we quantified as much as possible according to what the farmers themselves quantify. It shows what the net returns would be if all the rice would be sold. All inputs in the production process as described are taken up as costs in calculation. Section livelihood economics (1.2.3) describes the way we dealt with the labour component of the calculations. Exact data on family labour necessary for calculating the returns to labour are missing. Thus, we confine ourselves to calculating the average net benefits of one hectare rice in Masipi East.

[34] It is uncommon for farmers to buy rice; once we wanted to buy rice to bring on a three days logging trip but we could not find any shop in Masipi East selling rice. Instead of buying, farmers borrow rice from better off family or neighbours and pay back in kind after the new harvest; the labourers are often paid in rice.

Discussion

This section explored the production process of rice cultivation in Masipi East. Rice cultivation is fairly intensive, using irrigation, high yielding varieties, chemical inputs like fertilisers and pesticides, contract labour and machines. Lack of capital makes it impossible for some people to have access to a rice field. For others, it appears to restrain the intensification of the production. Farmers easily cut down on the material input post. The labour costs form the highest component as is shown in Table 1, but people hardly try to save on it. They prefer to hire labour for the main activities to get it done at once and try to gain as much time as possible by hiring tractors for instance. Despite the many agricultural extension programs that focus on proper farming techniques or on organic farming by using less chemical pesticides and fertilisers, people mostly rely on their own knowledge and experiences. Besides, time is regarded as an important factor for not applying organic fertilising for instance and huge amounts of chemical fertilisers are applied. Water scarcity might form a threat to future practices.

3.2 Rice in Puerta

Land

The area of Puerta is more rolling and hilly than in Masipi. There are about 12 hectares of irrigated rice fields that get water from the same intake as the fields in Masipi East. It is not possible to develop more irrigated rice fields because the soils and the terrain are less suitable for more irrigation and neither is it possible to divert the water from the irrigation channels to other fields. For the irrigated rice fields, 14 households (of the total of 45 households that live in Puerta) own private land titles covering between 1/4 and 2 hectare that fall under the Department of Agriculture (see section 2.2). These households are also members of the irrigation association of Masipi East. There is abundance of water in these rice fields and no competition about water like in Masipi East.

The remaining of the area in Puerta is classified as uplands and falls under the Department of Environment and Natural Resources that provided certificates of stewardship contracts (see section 2.2). Some of the flat areas are used for rice cultivation. If these fields are nearby creeks, people irrigate their land manually otherwise they plant rainfed rice. However, the area suitable for rice production is very limited. Exact data on area and production process of non-irrigated rice fields are missing. People always plant upland rice during the first and sometimes second year of newly opened swidden fields. Some people have an irrigated rice field in the lowlands in other barangays.

Material inputs

Table 2. Average returns to land of one cropping irrigated rice production per hectare in Puerta.

	Kilos	Pesos
Irrigation		
Fee*	150	1200
Maintenance (shadow price of fine)*		160
Total		**1360**
Material inputs		
Seeds*		0
Fertilisers**	184	1546
Spray*		553
Total		**2099**
Labour		
Ploughing & harrowing*		480
Planting & uprooting & fertilising*		1200
Harvest (share 8.7% average)*	200	1600
Thresher (share 7% average)*	161	1288
Total labour		**4568**
Yield		
Palay**	2295	**18360**
After harvest & threshing shares (for transport)	1934	
Transport		
From house to Masipi to town (0.6p/kg-shares)*		1160
Sacks 0.2p/kg*		600
Total		**1760**
Loan*		5539
Interest (7% per month)*		**2216**
Returns to land (pesos/ha)		**6357**

* based on hh level interviews and focus group interviews and adapted from data Masipi East
** based on hh level interviews

For the 12 hectare irrigated rice fields applies more or less the same story as for Masipi East, although the rice production in Puerta is less intensive in terms of material inputs (compare Tables 1 and 2). In Puerta, everyone plants the same variety (Isabela) that is also frequently planted in Masipi East. However, people told that no one buys new seeds, instead, they all exchange seeds with friends, family and/or neighbours. People apply between zero and 500 kilos of chemical fertiliser per hectare. Spraying is also necessary. To buy these inputs, the farmers mostly go to two traders in Masipi East and pay back when they have money, or otherwise after the harvest in kind. For the rainfed and manually irrigated rice fields people choose varieties which do not need much water; mainly Wagwag and Los Baños varieties are used. Farmers will always save enough seeds to for the next crop, or exchange with neighbours or family, as there is no expiration.

Labour and agricultural calendar

In contrast to Masipi East, there is a more standardised agricultural calendar for rice production in Puerta. The reason pointed out by the respondents is that all the irrigated fields are connected and the farmers all plant the same varieties. In Puerta, there is still some exchange labour, but most labour is paid in cash or in kind. The prices of farm labour are lower than in Masipi East (average of 60 pesos per man-day against 80-100 in Masipi East, and 120 pesos per man-carabao day against 150 pesos in Masipi East). This causes the main difference in labour costs as is shown in Table 2 when compared to Masipi East (Table 1). Next to the lower man-day labour prices, the absence of (hand) tractors explains the lower expenditure on ploughing and harrowing which is all done with carabaos. Besides, most people who have a rice field also have a carabao and people can thus economise on hiring them.

The average yields from the irrigated fields are lower than the average yields in Masipi East, between 2000 and 4000 kilos per cropping, with an average of 3000 kilos. All the rice fields lie next to the houses, so that transportation is not problematic. Except for one person, who has also rice fields in Masipi East, everyone keeps the rice for own consumption. This also counts for the rice from the rainfed or manually irrigated rice fields. Mostly, people do not harvest enough rice to meet their subsistence needs and eat white corn as well, or buy rice with income made of yellow corn and banana.

Returns to land

Table 2 shows a calculation of the returns to land of one cropping rice production in pesos per hectare. It shows what the net returns would be if all the rice would be sold at the market. All inputs in the production process as described are taken up as costs in calculation. As was the case in Masipi East, exact data on family and exchange labour necessary for calculating the returns to labour are missing. Thus, we confine ourselves to calculating the average net benefits of one hectare rice in Puerta (see section livelihood economics (1.2.3) for the way we dealt with the labour component).

Discussion

This section dealt with the production process of rice cultivation in Puerta. Only a small flat area is suitable for intensive irrigated rice cultivation. The rice production is less intensive than in Masipi East, using less material and labour inputs and yielding less on average. In other fields, people cultivate rainfed rice or irrigate manually from the creek. All the areas suitable for rice production are already converted into rice fields.

3.3 Rice in Dy Abra

Land

86 % of the households cultivate rice in Dy Abra. The rice fields on the ISF (see section 2.2) area are irrigated manually from the nearby creeks. In contrast to corn, rice is also grown outside the ISF on rainfed fields. Some people have irrigated rice field in the lowlands in other *barangays*. If people do not have a rice field nearby the centre of Dy Abra, they most likely have a swidden further on the mountains in the logged over areas near the forest. The availability of suitable land and water are main restrictions for rice cultivation.

Material inputs and labour

The interviews with key respondents revealed that lack of capital to buy inputs, especially spray, restricts many farmers to intensify rice cultivation. Most data from the household level interviews are still missing to give the exact status. However, Table 3 shows the returns to land and returns to labour of one rice cropping of two households in Dy Abra to give an indication of the production process.

Exchange labour in the rice fields is not as common as in the cornfields. The reason people point out is that rice cultivation is less labour intensive than corn cultivation. Still, exchange labour and hired labour are both used in the rice fields, especially for the big time consuming tasks like uprooting, transplanting and harvesting. For ploughing, most people use their own carabao and labour or exchange labour, to cut back labour costs. The prices of farm labour in Dy Abra are the same as in Puerta.

Table 3 shows the returns to land and labour of two households of one hectare rice production in Dy Abra. Distinction is made between all the different tasks in the cultivation process, and between hired and family labour. Household 2 manages to find cheaper labour than household 1 (but perhaps also hire themselves out for less). To make these data comparable with the data of Puerta and Masipi East, the costs paid to the thresher are included in the total labour costs. However, milling forming a high expense, is not taken up in the calculations (in reality, people do not sell their rice, but have it milled for own consumption). Comparable are the transportation costs to the milling station that we have taken as a shadow price for bringing the rice to the market.

Discussion

The production process of rice cultivation in Dy Abra rather resembles the situation in Puerta regarding labour use. The high returns to land shown in Table 3

Table 3. Returns to land and labour of one cropping rice on 1 hectare of two households in Dy Abra.

	Household 1		Household 2	
Material inputs		**Pesos**		**Pesos**
Seeds		0		0
Fertilisers	(200kg/ha)	2008	(400kg/ha)	3440
Spray		300		600
Tools (average)		222		222
Total		**2530**		**4262**
Labour	**Family labour days**	**Hired labour days (@ 60P)**	**Family labour days**	**Hired labour days(@ 50P)**
Repair irrigation (days/ha)	2		1	
Cut grasses (days/ha)	8		4	
Plough (days/ha with carabao)	16		4	
Harrow (days/ha with carabao)	18		1	
Nursery (days/ha rice field)	8		8	
Uprooting (days/ha)	4	16	2	20
Transplanting (days/ha)	8	16	2	16
Growing (days/ha)	64		42	
Harvest, etc (days/ha)	52	28	8	28
Transport (days/ha)	2		4	
Drying (days/ha)	12		8	
Total labour (days/ha)	**194**	60	**84**	64
Cost hired labour (pesos/ha)		3600		3200
		Pesos		**Pesos**
Threshing	(0.2p/kg)	800	Manually	0
(Milling	*(0.65p/kg)*	*2600*	*(1p/kg)*	*3600)*
Total labour costs (including threshing not milling) (pesos)		**4400**		**3200**
Yield				
Rice area (ha)	0.25		0.25	
Yield (kg/ha)	4000		3600	
Gross benefits (if sold at 8p/kg)		**32000**		**28800**
Transport				
Transport to milling (used as shadow price transport to market)	(0.48p/kg)	**1920**	(0.3 p/kg +24p)	**1104**
Total costs (pesos)		**8850**		**8566**
Returns to land (pesos/ha)*		**23150**		**20234**
Returns to labour (pesos/day)*		**119**		**241**

* Excluding shadow prices for family labour.
Source: taken from interviews conducted by Sietske Veenman.

mainly result from the amount of family labour used instead of hiring labour in comparison to Masipi East. There are no irrigation facilities, and all rice is rainfed or irrigated manually in Dy Abra.

3.4 Conclusion

This chapter explored the rice production processes in the study sites villages. Without access to suitable land no rice can be cultivated. Irrigation facilities make two crops per year possible. The National Irrigation Administration constructed an irrigation intake in Puerta providing irrigation possibilities to a small area in Puerta and a large area in Masipi East. For these fields, mainly the economic resources of the farmers determine the intensity. In Masipi East, rice has become a cash crop for some farmers. The prospects of water scarcity might form a threat to future practices in Masipi East. Next to the irrigated rice fields in Puerta, people cultivate fields that are rainfed rice or are manually irrigated. Further, swiddens are (re) opened to cultivate upland rice due to lack of suitable or available land. This is also the case in Dy Abra, where there are no irrigation facilities. Consequently, all rice fields are manually irrigated or rainfed. Like in Puerta, these fields do not yield enough for meeting the daily rice needs.

Comparing the production process in the three villages, on the basis of Tables 1, 2 and 3, several conclusions may be drawn.

(1) Chemical fertiliser from the highest input costs in the three study sites.

(2) The total labour costs, including threshing, are about the same in Puerta and in Dy Abra. The two households in Dy Abra economise on hiring labour by only contracting labour for planting and harvesting, all the rest is done by family labour. In Masipi East, most is contracted out, especially for ploughing. Besides, the wages are much higher in Masipi East in comparison to Puerta and Dy Abra.

(3) The yields in Masipi East and Dy Abra are about the same, while Puerta lags behind. This is probably due to the soil characteristics, in combination with the kind of seeds and appropriate farming techniques.

(4) In Puerta and Masipi East, farmers said to borrow money from traders for rice cultivation, forming an extra cost.

(5) The main differences in the three study sites in the returns to land of rice are caused by the labour costs and the yields. Labour costs can be economised upon by using more family labour. Due to missing data on family labour in Masipi East and Puerta, we cannot show the differences this makes in the returns to labour.

Aside from some rich farmers, most people fulfil their basic needs for rice through additional sources of food and cash (especially to buy rice). Poor farmers from Puerta and Masipi who do not have (enough) land opened swiddens where they cultivate rice and/or cash crops. Yellow corn forms an important cash crop that is widely grown on permanent fields in Masipi, Puerta and Dy Abra, but also on swiddens.

4 Yellow corn

"Our soils are getting old and are addicted to chemicals and vitamins. We have to apply more and more fertiliser without gaining more yield". While farmers ascribe the soil degradation to the use of chemical fertilisers, according to agricultural experts it is not necessarily caused by the chemicals, but by their continuous and unbalanced application. The use of chemicals came along with the introduction of the high yielding yellow corn varieties in the 80s. White corn is a traditional staple of the northern provinces of Cagayan valley. After the logging companies pulled out and the study sites were freed from the insurgencies between the army and the New People's Army, farmers soon started to adopt the high-risk cash crop yellow corn (see section 4.3 for motivational factors of growing corn). Yellow corn is planted on permanent fields in Masipi East, Puerta and Dy Abra. Next to the permanent fields, corn is also planted on swiddens, which will be treated in a separate section (chapter 7). Analysing yellow corn production according to the AiC methodology, this section will characterise the elements of the production process like the availability of suitable land, the use and availability of material inputs (e.g. seeds, fertilisers), farming skills and labour.[35] In AiC terms, these factors refer to autonomy factors that indicate whether intensive corn cultivation is an implementable option, or a potential option that cannot be implemented constrained by lack of autonomy factors. The gain of the corn production enterprise is determined by the prices received for the grain. For all study sites a picture of the economic motivations for the production of yellow corn is drawn best possible given the available data to get deeper insights in the returns to land and returns to labour while showing the high risk factor. A connection with other actors and factors influencing the options and motivations of the primary actors appears.

4.1 Corn in Masipi East

Land

40 % of the households in Masipi East have a cornfield ranging between 1/4 and 3 hectare, covering a total of 65 hectares. Not all land that is suitable for corn production is in use as a result of the unequal division or ownership of land. The prices of the cornfields depend on the location and quality classification and are anyhow less than the prices of rice fields. The owner of the pasture land agreement, covering 576 hectares, allows five households to till a piece of his land with corn.[36] The quality of the soils of cornfields is degrading much faster than the quality of the soils of rice fields according to the respondents. They say

[35] Some of the figures of Dy Abra in this chapter are taken from Hobbes and de Groot (2003).
[36] The owner is known as a good and honest man and no one occupies the land.

that they have to augment the amount of fertilisers every cropping and change the kind of fertiliser every few cropping seasons to keep an optimum yield.

Material inputs

Table 4. Areas of corn land, yields (one cropping) and fertiliser use of 24 households in Masipi East. Farmers usually have two croppings per year.

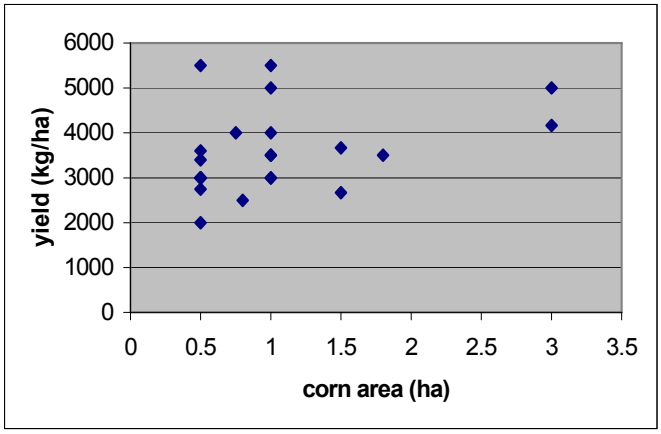
Household	Corn area (ha)	Yield (kg/ha)	Fertiliser (kg/ha)
1	1	3000	400
2	1.8	3500	389
3	0.5	3000	400
4	1	5500	600
5	0.5	5500	600
6	0.5	2750	200
7	1	3500	300
8	0.5	2000	300
9	1	3500	400
10	0.5	3000	300
11	0.5	3400	600
12	1	4000	300
13	1	5000	500
14	1.5	3667	267
15	3	4167	467
16	1	3000	400
17	0.75	4000	333
18	0.5	3000	400
19	1.5	2667	233
20	1	2500	0
21	0.5	3000	200
22	0.5	3600	400
23	3	5000	700
24	0.8	2500	438

Source: household interviews

Figures 3, 4 and 5 show scattergrams based on Table 4. Figure 3 shows that there is not much relationship between the corn area held by the households and the yields from that land and neither between the corn area held by the households and the application of fertiliser as is shown in Figure 4. This is not contradictory to the relation regarding optimum amounts of fertiliser being essential for good yields as is demonstrated in Figure 5.

Key respondents and respondents in focus group interviews all said that depending on the quality of the soil, different kinds and amounts of fertiliser should be used. Especially for corn production, optimum amounts of fertiliser are essential for good yields. Table 4 shows data on this feature based on household interviews.

Figure 3. Corn area and yields (Masipi East).

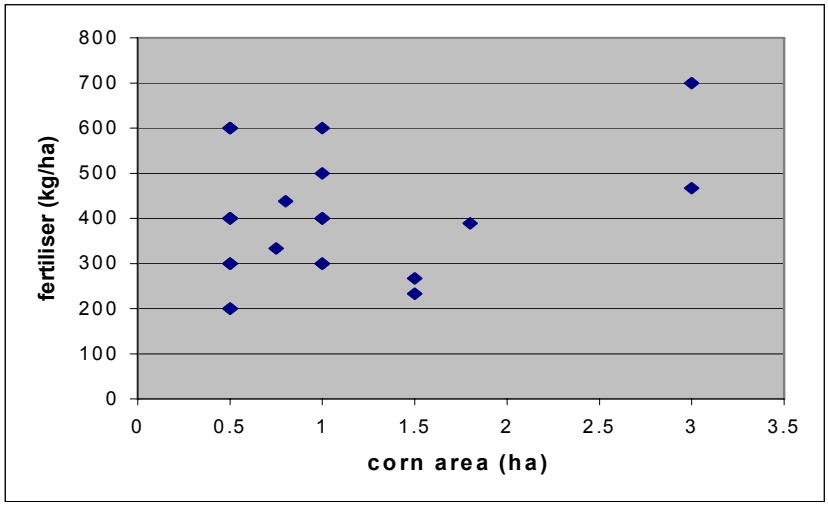


The correlation coefficient (R) between fertiliser input and yield is 0.68. The intercept of this relation is 1942, meaning that theoretically the yield of corn without fertiliser input is 1942 kilos. The slope is of the regression line is 4.2, meaning that 4.2 extra kilos corn will be harvested per extra kilo fertiliser application. Thus, the production function is: yield = 1942 + 4.2 * fertiliser. The dependency on chemical fertilisers makes yellow corn a risky crop. This is not so much shown in this production function, but if the case of zero fertiliser input would have been left out the slope would have been much steeper (yield = 1696 + 4.7 *fertiliser) showing a much higher risk. Respondents told that poorer farmers usually cut down on agrochemical inputs due to lack of money. The results of such choices will be shown in the calculation of the returns to land wherein different scenarios with chemical input use are shown. Almost all farmers go to traders to borrow material inputs, but also money to pay labour for corn cultivation against 7 percent interest per month to be paid off after the corn harvest (see chapter 7). The outcomes of the household interviews resemble what has been told in the focus group discussions. There respondents told that rich farmers who apply complete inputs and under favourable weather conditions, can harvest a maximum yield of 100 cavans (5000 kilos), and a minimum of 90 cavans (4500 kilos). On average, respondents estimated that the yields are between the 50 and 70 cavans (2500- 3500 kilos). The average yields of the 26 households shown in Table 4 correspond with the general views, namely an average of 3531 kilos, with a minimum of 2000 kilos and maximum of 5500 kilos. The farmers use different kinds of hybrid seeds that are all 120 days varieties. Sometimes, farmers use second-generation seeds that yield less and are more prone to diseases.

Labour and agricultural calendar

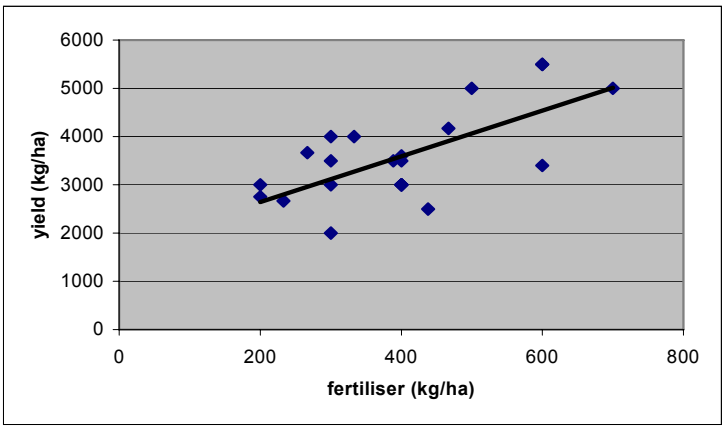
Except for the rich farmers who hire labour for all the activities of the production process, farmers normally hire labour for the heavy tasks like ploughing, planting and harvesting. Usually, one or two family members work with the labourers as well. For the small tasks, only family labour is used.

Figure 4. Corn area and fertiliser input (Masipi East).



There are 15 household interviews that show complete data on the costs of labour for yellow corn cultivation. Table 5 depicts five different scenarios of returns to land, wherein the labour costs are based on these households. The average is taken of the costs of ploughing, harrowing and uphilling together because the methods are not fixed. Most people hire a tractor, costing between 800 and 1400 pesos per hectare, and most people also hire a carabao for 120 or 140 pesos per day. Labour is hired for planting and fertiliser application, paid in cash @ 80 pesos per day. For the harvest labour is hired as well, but this time paid in kind: 1 sack out of 9. After the harvest, a thresher is brought to the field, which is also paid in kind. Drying of the corn is important, since the high yielding varieties are prone to decay and rot. Two sunny days is good, but when farmers have bad luck the classification will be C instead of A. There are three classifications for selling corn: class A is 7 per kilo, class B is 6.50 pesos and C is 5 pesos, at the time of the study. After drying, the corn is immediately sold to the traders.

Figure 5. Fertiliser input and yields (Masipi East).



Farming skills

Comparable to extension programmes for rice production, many agricultural courses have been given that focus on corn production. The corn production process could be very well improved according to the agriculturists. Most farmers however, are not interested in planting nitrogen fixing plants, like mongo beans, after the first corn crop or leave their plot fallow for one cropping season. Organic fertiliser, like manure that could very well replace the chemical fertilisers, is not used.

Returns to land

Since the application of chemical fertilisers highly influences the outcomes of the yields as depicted by the general interviews, underpinned by the household interviews as shown in Table 4, Table 5 shows five different production scenarios. Four fertiliser levels are taken (600, 300, 150 and 0 kg/ha). The first scenario calculates the costs and benefits of yellow corn cultivation to what farmers refer to as full inputs. The second shows the economic calculations for average application of chemical fertilisers (300 kg/ha) under normal circumstances while the failure scenario, chosen to show the risk element, applies the same inputs but has a bad harvest due to weather (i.e. wash-out in very heavy rain or typhoons affecting the crop), rot, pests, etc. This affects the price classification as well. The same price classification we chose for in the 150 kg/ha fertiliser input, in combination with economising on the seeds that is likely to result in a lower cob quality, like the failure case.

Table 5. Returns to land of five scenarios of one cropping yellow corn (per ha) in Masipi East. 'Fert' is the fertiliser application in kg/ha. Failure is a case of crop failure due to bad luck.[37]

	600 kg-fert: luck	**300kg-fert: average**	**150 kg-fert: average**	**0-fert: average**	**300 kg-fert: failure**
Yield (kg)	4432**	3196**	2569**	1942**	600***
Classification***	A	B	C	C	C
Yield (pesos)	**31024**	**20774**	**12845**	**9710**	**3000**
Labour					
Ploughing & harrowing (pesos)*	1292	1292	1292	1292	1292
Planting & fertiliser (pesos)*	595	595	595	595	595
Harvest 1:9 share (kg)*	492.44	355.11	285.4	215.78	66.7
Harvest: use shadow price (pesos)	3200.9	2308.2	1855	1402.6	433
Yield after harvest share (kg)	3939.6	2840.9	2284	1726.2	533
Drying (pesos)	200	200	100	100	100
Total (pesos)	**5288**	**4395**	**3842**	**3390**	**2420**
Material inputs					
Fertiliser (kg)	600	300	150	0	300
Fertiliser (pesos)***	5040	2520	1260	0	2520
Spray***	2000	1500	1500	1000	1500
Price seeds***	2000	1500	1500	1000	1500
Total (pesos)	**9040**	**5520**	**4260**	**2000**	**5520**
Transport & threshing					
Transport to farm (0.24p/kg)***	945.49	681.81	548.1	414.29	128
Transport to traders (0.3p/kg)***	1181.9	852.27	685.1	517.87	160
Threshing (0.28p/kg)***	1103.1	795.45	639.4	483.34	149
Total (pesos)	**3230**	**2330**	**1873**	**1416**	**437**
Loan (total input cost)	14357	9937	8120	5403	7944
Interest (7% per month) (pesos)	**5743**	**3975**	**3248**	**2161**	**3178**
Returns to land (pesos/ha)	**7723**	**4555**	**-378**	**744**	**-8555**

* Average of 15 household interviews

** Calculated on basis of production function of 24 household level interviews

*** Based on focus group discussions and key respondents

Several conclusions may be drawn from Table 5.

(1) The case of full inputs shows a substantial profit, more or less coinciding with what farmers in focus group interviews mentioned as a good profit with good inputs and good circumstances (namely 10.000 pesos).

[37] Section livelihood economics (1.2.3) describes the way we dealt with the labour component of the calculations.

(2) The case of average inputs of 300 kg fertiliser per hectare still gives some profits. The lower profits are mainly due to the lower yields when fertiliser input is reduced and the lower prices received for the corn. According to the respondents, 6.5 pesos/kg is the normal price to receive for the grain.

(3) The case of 150-fertiliser input, where farmers economise on the input side shows a negative outcome. Farmers still spend on material input costs and the labour costs are fixed, while the yields are lower due to the lower inputs, following the production function of Figure 6 (yield = 1943 + 4.2 * fertiliser). The outcome now mainly depends on the price received for the corn. In this case we chose for 5 pesos per kg profit, but if the farmer would receive 6.50 pesos/kg, the returns to land would be positive.

(4) According to this Table while using the production function of Table 4, farmers could better choose for zero fertiliser application than for 150-kg. This corresponds with what a key informant told: "*If you want to use chemical fertilisers for yellow corn, apply the correct amounts. Otherwise don't apply any fertiliser. Many farmers economise on the fertiliser input, but that is not wise to do.*"

(5) The misfortune case shows the high risk that farmers take. The loss is about as large as the profits in the "lucky full input" case. Comparing the misfortune case with the 300 kilos fertiliser application case, one time of failure would offset two times of success. Crop failure, obviously, can bring farmers into serious debt problems.

Discussion

Yellow corn is a cash crop widely cultivated in Masipi East. This section described the production process. The most striking characteristic of yellow corn is that it is a high risk crop that needs optimum inputs for being profitable. Especially the application of chemical fertilisers appears important as was pointed out during the focus group discussions, interviews with key respondents and household interviews. The different returns to land scenarios sketched in Table 5 also underline this feature. Labour costs are high as it is mainly hired in Masipi East and people will most probably economise on it when foreseeing a bad harvest, minimising their loss for instance by using more family labour if possible. The high risks are aggravated by the indebtedness cycle with traders that farmers can easily enter when facing a bad harvest (see chapter 7). Another main characteristic of the present day corn cultivation with excessive use of chemical fertilisers is the quick soil degradation. The quality of the soils of cornfields is degrading much faster than that of rice. It appears that farmers are just continuing with the cultivation, adapting the kind and amount of fertilisers all the time, not foreseeing what will happen when the soils will be completely exhausted.

4.2 Corn in Puerta

Land

84 percent of the households in Puerta have a cornfield. Of the people holding a corn field, 19 percent plants both white corn and yellow corn, 44 percent exclusively cultivates white corn and 37 percent solely grows yellow corn. Yellow corn production appears to be problematic in Puerta, due to the unsuitable sloping fields that are prone to soil erosion, wash-out of fertilisers and give low yield. Soil erosion is visible and farmers indicate the same problems with soil degradation as in Masipi East, caused by the use of chemical fertilisers. According to the (key) respondents, almost everyone tried cultivating yellow corn before, and some have switched to white corn again. These days, 20 percent of the farmers having a cornfield focus on yellow corn as main agricultural activity. Banana is becoming the main cash crop grown in the area, and many people eat white corn if they run out of rice.

Material inputs

People in Puerta started cultivating yellow corn a few years later than in Masipi East, being inspired by what they saw there. However, the farmers appear to take fewer risks in Puerta. They only started using fertilisers since 1994/5, in small amounts. For this, they borrowed fertilisers from the traders in Masipi East (see chapter 7). Dirkx (1995) stated that in Puerta that when certified seeds and inputs were used for yellow corn, the income earned by the farmers was spent almost entirely on paying back the loans taken out to cover these investments. These days, no-one plants only certified seeds but use second generation seeds, or mix first generation with second generation seeds. Poor farmers sometimes noted a harvest of 10 cavans (500 kilos) due to lack of fertilisers, use of second generation seeds in combination with drought, decay, and pests. Respondents told that the yields of their last yellow corn crop lied between 600 and 1500 kg/ha per crop. This is very low in comparison to Masipi East. We have complete data on corn area, amount of fertiliser and yield for only six households. Analysing the data of the six households shows no significant correlation between any of the variables and even a negative one between fertiliser input and yield. The explanation is most probably the huge differences in soil quality and slopes of the cornfields.

Farming skills

Intensive cultivation of yellow corn does not appear to be the most suitable farming practice in Puerta. The moderate slopes are prone to erosion, and the only soil and water management measures taken are contour ploughing. For clearing, farmers burn the cornfields to remove grasses and weeds and after the harvest they burn the leftovers. This might be done as a way to fertilise the field. However, according to agriculturists working in the area, it is just a stupid tradition of the people, by which people remove the protection for the soils and

they should not do so. With the issuance of the Certificates of Stewardship Contracts (see section 2.2) people were trained in agroforestry and later, DENR developed together with interested farmers a SALT model farm. No one adopted these techniques (see 5.1 section farming skills).

Returns to land

Table 6 shows different scenarios of cultivation of yellow corn in Puerta. The scenarios have a slightly different rationale than those for Masipi East. Of the 15 households who cultivate yellow corn, we have data of 9 households on fertiliser application, ranging between zero fertiliser application and 500 kg/ha. Because there is no relation between fertiliser application and yields in these data, which is probably dependent on wash-out of fertilisers, we decided to choose for three scenarios on basis of moderate slope with luck, average and failure in terms of wash-out of fertilisers and additional bad luck. For the lucky case, we chose for 300 kilos of fertiliser input, because respondents depicted this amount in a good case scenario. On average however, key respondents and focus group discussions pointed to an application of 150 kilos of fertiliser per hectare in general. Thus, in the average and misfortune scenarios we chose for 150 kg/ha fertiliser application. More or less the same story holds for the seeds. In the good case scenario, people buy mostly first generation seeds, while in the other two scenarios people choose for mixing first and second generation seeds. For the application of herbicides and pesticides, half of the optimum amount as was pointed out by the respondents is taken, because farmers will not apply the full amount of herbicides and pesticides when they noticed wash-out of fertilisers. The labour costs are taken as fixed. The same holds for threshing and transportation, although these costs are dependent on the amount of harvest. Of course, the yields and the prices paid for the corn, are the biggest determinants for the outcomes of the returns to land.

The yields chosen for in Table 6 stem from the focus group discussions and interviews with key respondents regarding general characteristics of corn cultivation in Puerta. These are checked against the household level interviews and are more or less in accordance. Lastly, assumed is that all the farmers borrow all input costs from the traders against 7 percent interest per month, to be paid back after the harvest.

Table 6. Returns to land of three scenarios of on cropping yellow corn (per ha) on moderate slopes in Puerta. Luck and good inputs imply that no wash-out of

fertilisers occurs. Average results refer to average yields and fertiliser application. Misfortune is a case of crop failure due to wash-out of fertilisers and additional bad luck.[38]

	300 kg-fert: luck	**150 kg-fert:** average	**150 kg-fert:** failure
Yield (kg)	1500	1000	600
Classification	A	B	C
Yield (pesos)	**10500**	**6500**	**3000**
Labour			
Ploughing & harrowing (pesos)	480	480	480
Planting & fertiliser & cutting (pesos)	1080	1080	1080
Total (pesos)	**1560**	**1560**	**1560**
Material inputs			
Fertiliser (kg)	300	150	150
Fertiliser (pesos)	2520	1260	1260
Herbicides/pesticides	500	500	250
Seeds	1000	500	500
Total (pesos)	**4020**	**2260**	**2010**
Transport & threshing			
Threshing (1:16)(kg)	94	63	38
Threshing (pesos)	609	406	188
Transport to Masipi (0.3p/kg)	422	281	169
Total (pesos)	**1031**	**688**	**356**
Loan (total input cost)	6002	4101	3739
Interest (7% per month)	**2401**	**1641**	**1496**
Returns to land (pesos/ha)	1488	351	-2422

Source: household interviews, interviews with key respondents and focus group discussions.

The purpose of Table 6 is to show three scenarios of profitability of corn cultivation in Puerta. It is immediately clear that corn cultivation is hardly profitable, even in the lucky case. The misfortune case shows a bigger loss than the gain in the lucky case. Even though there is a wider range of possibilities than the options chosen for here. People could probably cut down on the labour costs for instance by using exchange labour or perhaps more family labour. However, people said to prefer hiring labour. The material inputs are already economised upon. Threshing could also be done manually and the transportation costs disappear if people use their own carabao with sledge. Still, although these factors might positively influence the outcomes, the basic picture is clear. Intensive cultivation of yellow corn shows to be hardly profitable in Puerta. The main reason is probably the quality of the soils, giving low yields even if there is no wash-out of fertilisers. However, there is a very high risk for the latter factor as well, because of the moderate slopes.

Discussion

[38] Section livelihood economics (1.2.3) describes the way we dealt with the labour component of the calculations.

Intensive cultivation of yellow corn is not popular in Puerta. Most farmers tried it, but most quit it as well. In this section it is shown that it is hardly profitable indeed to cultivate yellow corn, even if the farmer is lucky, while indebtedness easily occurs. This has several reasons. Most importantly is that the land is not suitable for intensive corn cultivation, it is rolling thus prone to erosion and the top soils are mostly gone. It is thus hard to get high yields which is a prerequisite for profitability because of the large input costs. Besides, people have not adopted techniques to overcome soil erosion problems, except for contour ploughing. For steeper fields this is not enough however. The difficulty faced with yellow corn production explains why few people still focus on yellow corn. Most people switched back to white corn and most fields are converted into banana plantations as source of income (see chapter 7).

4.3 Corn in Dy Abra

Land

White corn has almost disappeared from the fields being replaced by yellow corn. The most important reason for this shift is that yellow corn became profitable with the accessibility to the market by the construction of the road. Almost everybody in Dy Abra grows corn as a cash crop. 85 percent of the people in Dy Abra cultivate a cornfield in the ISF area. People who do not own a cornfield often plant yellow corn on their swidden.

Material inputs

The most important distinction in the process of growing corn results from economic resources of people. Rich people always use fertilisers on their field, while poor people only do this if they have money. Lack of capital to buy inputs is a restriction regarding intensive cultivating corn. The difference in yields resulting from optimal use of fertilisers and no use of fertilisers are big, according to the respondents. However, no application of fertiliser can still be profitable, according to some people in Dy Abra. Table 7 shows data on this feature based on household interviews of 16 households from Dy Abra, of which we have reliable data at present.

Figures 6, 7 and 8 show scattergrams based on Table 7. As is shown in figure 6, a certain relationship exists between the area of corn land held by the household and the yield from that land. The correlation coefficient (R) is – 0.55. This relationship is likely to be caused by that small farmers apply not only more time, but especially more fertilisers on their land. Figure 7 demonstrates this relation graphically. The correlation coefficient (R) is – 0.43. The relationship between fertiliser input and yield is displayed in Figure 8. The correlation coefficient (R) is 0.76. The intercept of that relationship 1016, meaning that theoretically, the most likely yield of corn without fertiliser input is 1016 kilos per hectare. The slope of the

regression formula is 10.53 kg/kg, meaning that on average, yields will be 10.53 kg higher for each extra kg of fertiliser. Another interesting feature of Figure 8 is the wide range of yields existing in the area of fertiliser input of 200 kilos per hectare; this range may indicate the combined influence of soil quality, slope and crop care.

Table 7. Areas of corn land, yields (one cropping) and fertiliser use of 16 households in Dy Abra. Farmers usually have two croppings per year.

Household Number	Area Corn (ha)	Yield Corn (kg/ha)	Fertiliser (kg/ha)
1	0.25*	6000	400
2	0.5*	7000	500
3	0.5	4000	200
4	0.5	5500	400
5	0.5	5000	200
6	0.5	5000	400
7	1	2750	200
8	1	3500	300
9	1.5	4000	167
10	1.5	3333	267
11	2	1675	200
12	2	1000	200
13	2	3200	200
14	2.5	2100	0
15	3	2500	117
16	5	1300	200

Source: household interviews by Denis.
*Estimated value.

Next to fertiliser application, some people spray corn. According to the respondents it is less necessary than for rice cultivation. Although some people do spray herbicides, the vines can also be removed manually. Some people spray pesticides if worms threaten the corn.

Mostly, people approach traders to borrow inputs. These informal moneylenders give people the opportunity to borrow inputs, but many people are hesitant to borrow more than absolutely necessary (see chapter 7). Some farmers decided not to borrow from traders anymore and cultivate yellow corn on own expenses (earned by logging for instance), and some farmers also decided to plant white corn again.

Figure 6. Corn area and yields (Dy Abra).

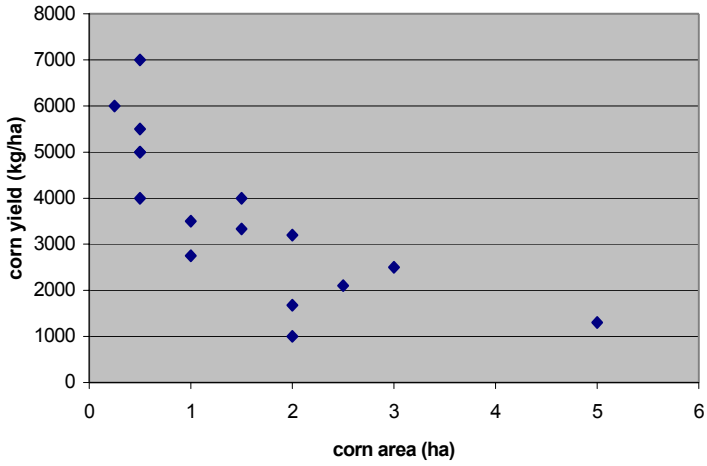
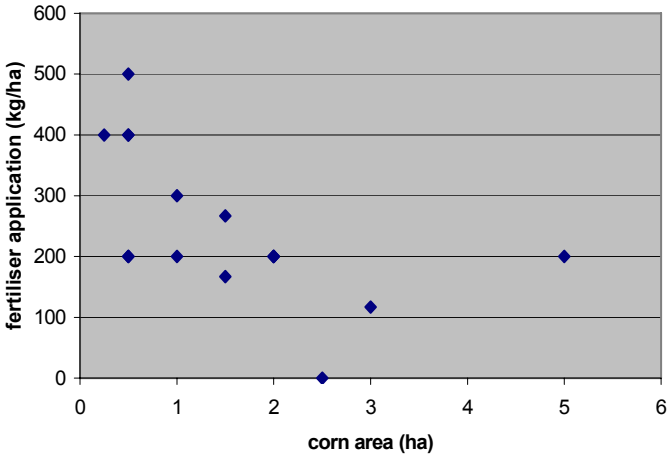


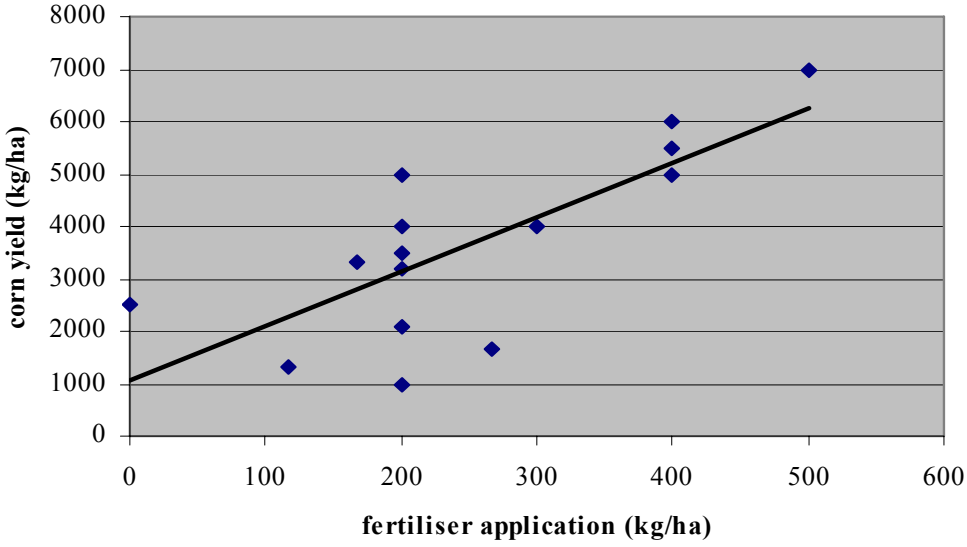
Figure 7. Corn area and fertiliser input (Dy Abra).



Labour and knowledge

Cultivation of corn requires lots of labour. In Dy Abra, people still arrange exchange labour for the big tasks in corn cultivation, in contrast to Masipi East and Puerta. Comparable to the practices in Puerta, most people in Dy Abra do not use a tractor for ploughing. People prepare the cornfield for ploughing by carabao, by cutting grasses and piling and burning the grasses. The costs of hired labour are lower than in Masipi East and about the same as in Puerta (@ 60 pesos). The amount of family labour input is the main determinant for the outcomes of the returns to labour of corn, calculated on basis of the returns to land.

Figure 8. Fertiliser input and yields (Dy Abra).



Returns to land and returns to labour

Table 8 follows the costs and benefits of the production cycle of yellow corn in general in Dy Abra. The figures are based on interviews with key respondents and focus group interviews. It might be questionable to give an average picture of corn cultivation, as we just showed that amount of fertiliser application highly influences the outcomes of the yields. However, Table 8 shows the picture as will normally be outlined by farmers when talking about yellow corn production in general, showing that it is quite profitable to cultivate yellow corn. Often it takes a while before farmers will show negative scenarios and will talk about indebtedness etc. Table 9 shows 4 different scenarios of growing corn (per hectare).

The first two of the four cases are chosen to illustrate the need to go for high inputs. Two fertiliser levels are taken (300 and 150 kg/ha). The 300 kg/ha represent the level that farmers usually refer to as 'full inputs', more or less corresponding with Table 8. The 150 kg/ha represent a case of an 'economising' farmer. Fertiliser is the only input factor that may be really economised on (you cannot "half-plough", for instance). However, labour costs could be replaced by family or exchange labour, but one should not forget the opportunity costs of this labour.[39] The respective yields are estimated using the average production

[39] We do not have good data on separation between family labour and hired labour. Part of the labour in the tables calculating the returns to land may be family labour, which is shadow priced with the same prices as hired labour. Extra family labour is likely to be used for smaller tasks, as is

function of Dy Abra (Figure 9; Yield = 1016 + 10.53 * fertiliser). The zero-fertiliser case (without bad luck factors) is the third one; the yield also follows from the production function. The final case is chosen to illustrate the risk element in corn.

Table 8. Yellow corn production per hectare in general with good harvest in Dy Abra.

Labour	Person days and costs *	Total (pesos)
Cut grasses	5 @ 60	300
Piling and burning grasses	2 @ 60	120
Ploughing	6 @ 100	600
Harrowing	4 @ 100	400
Ploughing for planting	4 @ 100	400
Planting & fertiliser	10 @ 60	600
Weeding	30 @ 60	1800
Spraying	1 @ 60	60
Harvest	20 @ 60	1200
Drying	4 @ 60	240
Total	86	**5720**
Material inputs		
Fertiliser		3400
Spray		2000
Price seeds		1800
Total		**7200**
Transport & threshing		
Transport to farm	0.12p/kg	570
Transport to traders (free sacks)	0.24p/kg	1140
Threshing	0.2p/kg + lunch operator	970
Total		**2680**
Loan (total input cost)		**15600**
Interest (7% per month)		**6240**
Yield (gross benefits)	yield: 4500-5000 kg/ha	**[illegible]875**
Returns to land (pesos/ha)		**9035**

*Part of this labour may be family labour. It is shadow priced here with the same price as hired labour (see section livelihood economics (1.2.3).
Source: key respondents and focus group discussions

It is called "misfortune", because bad luck is assumed, combining rats or a disease with a wash-out of fertiliser (wasting the whole fertiliser input of 300 kg/ha). A yield of 500 kg/ha is taken, following interview data on a 'normal' crop failure.

shown in Table 10. Because we do not have this clear distinction, it is not possible to calculate the returns to labour.

Table 9. Cost and benefits of four scenarios of growing corn (pesos per ha) in Dy Abra. 'Fert' is the fertiliser application in kg/ha. Failure is a case of fertiliser wash-out and additional bad luck.

	300 kg-Fert	**150 kg-Fert**	**0-Fert**	**300 kg-Fert: failure**
Yield (kg)	4200*	2600*	1000*	500**
Classification**	A	B	B	C
Yield (pesos)	**29400**	**16900**	**6500**	**2500**
Labour				
Total (pesos)*	**5300**	**5300**	**5300**	**5300**
Material inputs				
Fertiliser (kg)	300	150	0	300
Fertiliser (pesos)**	2400	1200	0	2400
Spray (pesos)**	250	250	250	250
Seeds (pesos)**	1000	1000	1000	1000
Total (pesos)	**3950**	**2600**	**1250**	**3950**
Transport and threshing				
0.8 pesos/kg (pesos)**	**3360**	**2080**	**800**	**400**
Loan (total input costs)**	12610	9980	7350	9650
Interest (7% per month) (pesos)**	**5044**	**3992**	**2940**	**3860**
Returns to land (pesos/ha)	**11746**	**2928**	**-3790**	**-11010**

* Household interviews (see Table 7)
** Focus group interviews
***Section livelihood economics (1.2.3) describes the way we dealt with the labour component of the calculations
Source: Hobbes and de Groot (2003), and constructed in the same way as the Table of Masipi East.

Several conclusions may be drawn from Table 9 (taken from Hobbes and de Groot).

(1) The case of fertiliser application of 300 kg/ha shows a substantial profit, coinciding with what farmers in the focus group interviews mentioned as a normal profit with good inputs and good circumstances (matching with Table 8).

(2) The case of fertiliser application of 150 kg/ha, however, with a cost of 13.4 thousand pesos and a benefit of 16.9, is already close to a zero profit enterprise. This is caused by the high fixed costs of labour combined with the steep decline of yields when fertiliser gift is reduced.

(3) The 'misfortune' case shows a loss almost as large as the profit in the lucky case one. This implies that only one crop failure is needed to bring the farmer in serious debt problems.

(4) The 'zero fertiliser' case shows a much smaller loss, because fertiliser was not paid for and no other crop damaging factors are assumed in this case. It should be born in mind especially here that if the framer would manage to use only family labour on his field, a small profit of 3000 pesos would remain after the

harvest. This can only be attained, of course, on small fields, depending on family size.

The conclusions underscore the important role of credit in the corn system, which will be explained in chapter 7.

Table 10. Yellow corn production per hectare of two households in Dy Abra.

	Household 1	Household 2
Hired labour (pesos)	2700	1200
Threshing & transport (pesos per yield)	1540	1540
Fertiliser (kg/ha)	300	350
Fertiliser (pesos)	2610	3045
Seeds (pesos)	0	2100
Materials (pesos)*	222	222
Spray (pesos)	250	260
Total input costs (pesos)	**7322**	**8367**
Interest 40% (pesos)	2929	3347
Total costs (pesos)	**10251**	**11714**
Yield (kg/ha)	3500	3500
Gross benefit (pesos/ha)	**23800**	**24500**
Returns to land (pesos/ha)**	**13549**	**12786**
Family labour days	**52**	**61**
Returns to land (pesos/ha)***	**10429**	**9126**
Returns to labour (pesos/day)***	**200**	**150**

* Calculated average on basis of household interviews and focus group discussions: tools and carabaos are used for several purposes
** Without shadow price family labour
*** With shadow price family labour.

Table 10 shows that the total costs of two households for corn production do not differ that much. Household 1 economised 1000 pesos on seeds, using second generation, while household 2 cut down on hired labour, but did invest in first generation seeds. The main differences are found in the yields. They have high yields if compared with Table 9 and with the relatively low input costs make high returns to land, also when compared with the figures of Masipi East. Next to the yields, labour investment is one of the main flexible determinants for the returns to labour and land. One can economise on this factor by using more family labour. However, if one would count for the family labour days with a shadow price, since every day counts as such and could be spent on other income generating activities (opportunity cost), the households happen to show an contrary outcome between intensity and benefits to what would be expected. If the family days would be counted for with shadow prices @ 60 pesos a day, the least intensive household 1 would have total input costs of 13371 pesos with the highest returns to land of 10429 pesos/ha, while the household number 2 would have 15374 pesos input costs with 9126 pesos/ha benefits. The variables causing this relationship can be of many kinds, such as timing and farming skills,

combined with weather, kind of soil, soil quality and slope. These are, next to the correct inputs, general factors pointed out by the farmers to be of influence for the yields.

Discussion

Like in Masipi East, yellow corn is a cash crop widely cultivated in Dy Abra. However, not all people completely focus on yellow corn, and people also cultivate white corn for own consumption. The most striking characteristic of yellow corn as being a high risk crop that needs optimum inputs for being profitable is also emphasised by the farmers in Dy Abra. This feature is asserted by the household level data showing a production function wherein yields are (highly) determined by chemical fertiliser application. The costs and benefits of four scenarios of growing corn as outlined in Table 9 further affirm the risk factor. It can be very profitable, but when a bad harvest occurs, or when just being unlucky with the weather when drying the grains for instance, people face losses and debt. Labour costs are relatively low and relatively much family and exchange labour is used for corn cultivation in Dy Abra. This can be seen as a cut on the input costs.

4.4 Conclusion

This chapter described the enterprise of yellow corn cultivation in the three study sites. We took a closer look at the production factors (land, labour, inputs and farming skills) in relation to the yields and in turn the economic profits of the cultivation of yellow corn. This is the main motivational factor indicated by all farmers to cultivate yellow corn. However, farmers also identify risk and debt factors influencing their decision making that have been grounded in this chapter as well. Next sustainability issues affect the outcomes.

Land characteristics seem to highly determine the outcomes of the corn endeavour, as is most apparent in Puerta. Access to suitable land is problematic in Puerta. The soils are often of low quality and fields rolling, and cultivation of yellow corn is hardly profitable, even if the farmer is lucky. In Masipi East and Dy Abra there is rather much and appropriate land available for corn cultivation. Farmers mainly face soil degradation that they ascribe to the application of huge amounts of chemical fertilisers. These fertilisers are a main input that came together with the introduction of yellow corn in the 80s. Masipi East was the first of the three sites where farmers adapted this crop, cautiously followed by Puerta. In Puerta, it has never been as intensive as in Masipi East and many farmers quit already. In Dy Abra, people started to cultivate yellow corn when the people received tenure security in consideration of resettlement.

As the farmers in the villages pointed out, we identified fertiliser application as main determinant for the yield on basis of household interviews, taking the land

characteristics as fixed. Comparing the data on areas of corn land, yields, and fertiliser between Masipi East and Dy Abra, several remarks can be made. The data of Dy Abra show a correlation between the area of corn land and yields which is likely a result of fertiliser application: small farmers apply more fertiliser on their land. This relation is not found in Masipi East. The two households with three-hectare corn land apply large amounts of fertiliser. The rationale is most probably that these big land owning farmers are farming like entrepreneurs, trying to maximise profits by taking big risks. A correlation between fertiliser application and yield is found in Dy Abra as well as in Masipi East, although it is stronger in Dy Abra than in Masipi East. The production function in Dy Abra is: yield = 1016 + 10.53 * fertiliser, while in Masipi East it shows: yield = 1943 + 4.2 * fertiliser. This would imply that increase in fertiliser application has more impact on the yields in Dy Abra than in Masipi East. Besides, the intercept shows that theoretically farmers in Masipi East yield 1943 kg/ha with zero fertiliser application while in Dy Abra 1016 kg/ha. This is likely a result of the soil characteristics. In Dy Abra soil samples show that the soils are sandy clay loam to sandy clay (Boerwinkel, 2001). The soils in the lowland corn areas of Masipi East range in texture from clay to clay loam which is more suitable for rice production (FEARDP, 1999).

Keeping up this argument, different cost benefit scenarios were outlined on basis of household interviews, focus group discussions and interviews with key respondents. In Dy Abra and Masipi East, the starting base was fertiliser application together with a failure case to show the risk element. For Puerta we focused more on the ideal situation described by the farmers, an average and a misfortune case since we do not have enough household data to say anything about the relationship between fertiliser application and yield. Besides, people mostly referred to bad luck with wash-out of fertilisers due to slope with heavy rain. The mountain soils of Puerta range from clay to loam, and are strongly eroded, shallow, low in fertility level and poorly drained (FEARDP, 1999).

Comparing the Tables (5, 6 and 9), several conclusions may be drawn.

1) The lucky case scenario as depicted in Puerta, yields even less than the zero fertiliser case in Masipi East.

2) Material inputs form the highest input costs in Masipi East and Puerta. These are borrowed from traders with 7% interest per month to be paid back after the harvest.

3) Labour input costs are in Dy Abra as high as in Masipi East. In Masipi East the costs of ploughing by tractor are included in the labour costs that seem to be equal to the costs of hiring carabaos. However, people in Dy Abra often use their own carabao by which they can minimise costs. Thus, many of the labour costs in Dy Abra may be substituted by family or exchange labour while the costs of hired labour per day are also lower than in Masipi East. In Puerta, the

labour costs are the lowest and people mostly rely on their own carabaos and family.

4) More labour and less fertilisers are used in Dy Abra as compared to Masipi East. The yields in Masipi East are not higher.

5) Due to the production functions used for calculating the yields in Dy Abra and Masipi East, the zero fertiliser case in Masipi still has net benefits, while negative in Dy Abra. The highest fertiliser cases in Masipi East (600 kg/ha) and Dy Abra (300 kg/ha) show more or less the same net benefits. The same holds for the second ones: 300 kg-fertiliser case in Masipi East and 150 kg-fertiliser in Dy Abra. Their misfortune cases show about the same loss.

The differences between the three study sites in the returns to land and the returns to labour of yellow corn cultivation result from several factors and influence the farmers strategies in several ways. The amount of risk the farmers are willing to take highly influences the production process. The risk factor also has to be seen in the light of indebtedness. Land characteristics appear to highly influence the outcomes of the corn enterprise as well as insecurities mostly related to weather and market prices for the yellow corn.

5 Swidden and banana

Making swidden is an important agricultural activity in Dy Abra and Puerta. There are several areas where people make swiddens, all of them situated near the forest frontier, usually at logged over areas. During the study, we discovered a "new site": two clusters of houses in a black desert of newly opened swidden fields, cultivated by Ifugao migrants that have started to come to the area since a couple of years. It is unclear to which *barangay* the area belongs. We decided to include these household clusters called Magansimit and Amucau. First of all, these people are pioneers, who have just started to make a living in the area and completely focus on subsistence, being at the very beginning of the transition gradient. Secondly, these people might form an actual threat to the Sierra Madre forest, living at the forest fringe, about to move further into the forest. Besides, this group of people is often referred to by the respondents of the other sites as forming a threat to their communities.

In this chapter, the general characteristics and socio-economic contexts of swidden making in the three villages will first be described following the AiC deeper analysis scheme. Then, a general outline will be given of the production process of swidden farming based on household interviews and focus group discussions. Next, we will take a closer look at the banana plantations, since

most people convert the swidden into banana plantations as a favourable cash crop.

5.1 Swidden in Dy Abra

Actors

The original people from Dy Abra used to practice swidden. In the Philippines, the Tinguians are known as shifting cultivators that like to be in the forest. Since 1986, people have shifted to permanent agriculture when they moved to the lowlands where they obtained stewardship certificates.[40] Most of the people stopped practising swidden and shifted their focus to the permanent fields they obtained near the contemporary village centre. The swidden fields are far from the village centre by which it becomes more difficult to focus on both at the same time. However, several people remained practising swidden to add additional cash or food to the cornfields. Some people solely have a swidden, because they do not have a cornfield in Dy Abra. Finally, some people first abandoned the swiddens, shifting completely to corn cultivation, but recently reopened old swiddens again, like the people living in the *sitio* called Sagalong.

Motivations

The farmers who recently opened swidden again pointed out two main reasons. During the time that they focused on corn cultivation, the benefits were enough for the family. However, with the expansion of the family and deteriorating quality of the cornfields, the benefits were not sufficient to cover the maintenance costs of the children. The main advantage of making swidden pointed out by the respondents is that it is not necessary to apply fertiliser, a main input for cornfields. Most farmers had bad experiences with permanent corn cultivation in Dy Abra saying that everyone gets in debt with traders by borrowing the inputs necessary for corn cultivation, not able to repay at least once. People often said: "*We are victims of corn*", and another respondent said: "*Making swidden is the only way to distance ourselves from the traders*". Although some farmers said that they still cultivate their cornfield, they do it less intensively because they are happy they got independence from the traders. Next to this freedom, people practising swidden say that they enjoy the independence from social control of neighbours and government agencies regarding agricultural practises. People consider swidden making hard work, especially the opening of new fields. The capital investment level is low however, only simple tools are used, like bolo and kabas. Another positive point put

[40] According to DENR and DA classification these are no lowlands but still uplands, as the area falls under DENR for which people received CSCs (see section 2.2). In comparison with the place where the inhabitants of Dy Abra stayed before in the mountains it looks like lowland however. Besides, the slightly sloping fields are far more suitable for permanent cultivation in comparison to the fields in Puerta.

forward is that you do not have to plough your swidden neither to apply fertilisers. If necessary, people spray pesticides on the rice crop.

Yellow corn and rice are the main products cultivated on swiddens in Dy Abra. Swiddens are normally cultivated for three to five years, depending on the soil quality. The first and often second year, upland rice is planted which need good soil fertility. Upland rice is highly appreciated because of the taste and smell. After the rice cropping season(s), people plant yellow corn. Next to these two crops, people always plant a variety of vegetables on swiddens. Mostly, farmers plant banana or fruit- or lumber trees (like Gmelina, a commercial wood tree to be harvested after 10 years) in the last productive years when they still plant corn. The reasons are cash income as well as that trees informally secure land ownership.

Autonomy and structural factors

These days, people mostly reopen their abandoned swiddens that have had a regeneration period of more than 10 years. In addition, people open swiddens in the logged over forests. Although swidden making is illegal in the Philippines, people do not fear penalties. There are no actions directed at people who make swiddens and the *barangays* and the government leave them alone saying that the poor people do not have other options. Thus, policies prohibit making swidden, but the law is not implemented. This gives the farmers access to what roughly may be called common property resources. Ownership of swidden areas is clear to everyone. The one who first opens a swidden is the *de facto* owner and identifies ownership by planting trees at the borders. In general, no one will open an area that belongs to some one else, no matter how long the area has not been used. However, although there are no open conflicts yet, this might happen with the new Ifugao migrants who appear to have opened fallow areas of Dy Abra's Tinguians. Both parties refer to potential conflicts, as the Tinguians claim the areas that the Ifugao occupy now and ask them to pay for it, while the Ifugao migrants say that they do not feel like paying or that they would like to but do not have the money. Selling of the swidden positions occurs. There are several areas where people make swidden in Dy Abra. The relatively nearby swidden areas of Soleto and Masaan are already fully occupied, where most people have a temporary house field, but some live there permanently. The swiddens in Banig, the place where the people from Dy Abra originally lived are abandoned with only fruit trees left. Further into the direction of the mountains are some houses in Kamarig. Kamarig was a logging area at the time of the study, while the other areas used to be, easily to open for swidden making. The area furthest away (about a 4 hours walk, at the border of the area of Masipi East) is called Sagalong, where eight households recently reopened swiddens and where one Ifugao resides. The swiddens are far away from the houses in the centre of the *barangay*, which makes it hard to carry the products

home, especially for people who do not have a carabao for transportation. At the nearby swiddens, people guard the swidden, not only because animals destroy the crops but also against theft. Exchange labour is not common anymore for most people, depending mostly on family labour. In Sagalong on the other hand, the eight households are all relatives and do exchange labour for the clearing and burning practises. These fields are used for consumption purposes only. According to the farmers transportation of cash crops entails too many risks. Some of these households still have a cornfield in Dy Abra, which is looked after by the eldest son for instance.

5.2 Swidden in Puerta

Actors

Before, all households in Puerta practised swidden next to some permanent rice cultivation. A shift came in the late 80s when people started to cultivate yellow corn. People converted the moderate and less sloping swiddens into permanent cornfields. Most people have tried to make a living of corn production. However, the corn production is stagnating, due to the rapid decrease of soil fertility (see chapter 6). Whereas Kusters (1999) states that no people were practising swidden anymore in 1999, people are reopening swidden fields again. In 2001, six households originating from Puerta opened a new swidden in Puerta. During the time of the study, about 30 percent of the inhabitants have a swidden (household interviews by Balderama).

Motivations

Some farmers said that they make new swiddens to make sure that they can pay the debt of the fertilisers they borrow for yellow corn cultivation. People in Puerta mentioned that they delayed the application of fertilisers as long as possible, but since 1995, everyone cultivating yellow corn on permanent fields uses fertilisers. Some farmers said that they never want to borrow money from traders (anymore), because of the high risks of debt (see chapter 6). For these farmers, swidden is one of the income generating activities. People prefer to plant upland rice on the swiddens, as food crop. In Puerta, one rice crop is possible, while on new good fields in the forest three cropping seasons are possible according to the respondents (in Dy Abra, two rice cropping seasons were pointed out as general). Depending on the growth of weeds that compete with the rice, farmers determine how many rice cropping seasons are possible on a swidden. Farmers say that the slope of the swidden and kind of soil mainly influences the pace of the deterioration of the soil quality that is indicated by the presence of weeds. All farmers plant a variety of vegetables on their swidden and some farmers in Puerta plant white corn on the swidden for own consumption and some yellow corn as feed for the chickens. Some farmers

favour to plant fruit trees on the swidden, but say to have difficulty finding seedlings. Most swiddens are soon converted in banana plantations. Banana plantations form an important cash income for people in Puerta.

Structural factors

Many swiddens are covered by a stewardship contract of the ISF (see section 2.2). Along with the issuance of these contracts a project was implemented. Participants developed together with agroforestry experts a model farm with sloping agriculture techniques. During the first years, some people had tried the new techniques but quit after two or three years. People and key-informants pointed out several reasons. First, the yields did not increase while people were investing more labour. Besides, the new techniques complicated the normal farming practises. Barriers built against soil erosion for instance make ploughing difficult. Moreover, neighbours have a big influence on individual farmers. A key respondent said "*Neighbours laugh at you if you do it differently, especially if the yields are lower or the same as the yields resulting from the large amounts fertilisers while you invest more labour*".

Currently, people open new swiddens in the last relatively accessible places. These are the extraction places of the current small-scale logging practises where only small shrubs have to be removed. Many people have difficulty to find areas to open swidden. All nearby fields are already owned, meaning fallow that are *de facto* (sometimes *de jure* as well, covered by a stewardship contract) owned, in use or converted into banana plantation or cornfields. People who have lived for a long time in Puerta have no problems finding land for opening new swiddens, because they can still claim abandoned fallow areas. For migrant people or newly weds, however, it is problematic to find places to make swidden. People could go further into the forest, but people say that they do not feel like going there on their own because the forest is relatively far away with wild animals and it is difficult to bring products.[41] Instead, they try to make a living of banana plantations, collecting of NTFP, participating in logging activities and practising hired labour.

5.3 Swidden by pioneer Ifugao migrants

Actors and motivations

Inhabitants of Puerta and Masipi East said that over the past 5 years, 25 households from Ifugao province came here to make a living and in search for

[41] It is questionable whether the respondents told the truth about this matter, but they persisted in this argument, no matter how hard my study assistant tried to open them up. If the needs are high it seems is most likely that they will go further into the forest and not leave themselves starving "*being afraid of the forest*", especially since they have always lived in and nearby the forest, making swidden, logging, hunting and gathering…

land. Ifugao immigrants do not stay in Puerta, but go further into the forests. Non Ifugao respondents said: "The Ifugao come from far, so they do not care about going further in the forest, having their own rice mill". One logger told me that he cut big trees for the Ifugao to make swidden, in return for a chicken for instance. Of all the inhabitants of Puerta and Masipi East, the loggers have most contact with the Ifugao. The pioneers have settled along the forest fringe of the Sierra Madre forest. Older settlements to the north from Puerta, Balete, barangay San Pablo, are well known in the area. The new wave of migrants entering the areas of Masipi East and Dy Abra is less known. We "discovered one new area", Amucau, a name of which the people in Masipi East never heard. Arriving at that place, it appeared that the areas the pioneers opened are fallow fields of the Tinguians from Dy Abra that they used when they still lived in Banig. The other area, called Magansimit, is in the direction of Puerta, situated in the community forestry project area of barangay Masipi East. The migrants come from Ifugao province. They were landless older or young people, saving money to start a new living. People say: "The purpose of coming here is food! There are no sources to make money here. There is no more land available at the place where we are coming from". One respondent went deeper into his motivations to live here, telling this story: "I prefer to work on the swidden in the mountains than to work on a rice field. When it is time for transplanting at the moment that the nursery is ready, you are obliged to work and need many companions to help you. Here, you can do everything slowly, at your own pace and on your own. I asked the barangay captain for permission to go to the forest to plant vegetables, additional to the rice field I used to have. He said that it was ok, as long as it would just be a small piece and not making it bigger. So, I made many small pieces, ending up in one big piece".

There are four permanent houses in Magansimit. 12 households have a temporary house at the *kaingin* and a permanent house in Masipi East as well. Everyone is relative, originating from Aguinaldo municipality, Ifugao province. In 1995, the first people arrived in Amucau, followed by a new batch of 8 men (cousins and brothers) in 1999, not knowing the first settlers, and in 2000 they were followed by a batch of 6 men. They come from the same town in Ifugao, but are no relatives. There are 3 permanent houses in which three families live (one aged married couple and one intermarriage between an Ifugao woman and an Ibanag man) and 5 temporary camps, where young men between 18 and 25 years live together. During summer break, young boys come to help on the *kaingin* to return home to attend school again. The first batch did not know the families already living in the area and took free land and marked the borders with trees: about 3-5 ha per person, good for 4-5 years. The new ones got the land nearby. People said that there are no land conflicts between the Ifugao and that they will not occur either, as they will just move further up the mountains

if land scarcity occurs. They say that the Tinguians, however, are always coming to claim the land and ask for money.

Settlement history

When asking Ifugao respondents about their settlement history in this area, they told more or less the same story the non-Ifugao key respondents told me about the Ifugao migrants.

Mr. Tundagi was the first Ifugao that came to Masipi in search for land. Mr. Tundagi became a good friend with the former *barangay* captain who allowed him to stay in the village and later to enter the forest. In principle, everyone is welcome in the *barangay*, as long as the person has a clearance from the place he is coming from. Besides, it is worthy for the captain to accept migrants as a respondent stated: "*If you are the one accepting migrants, you are the one receiving the votes. In return, if receive votes, you give benefits from projects etc. The Ifugao also offer their friendship in terms of gifts, help and beautiful carvings in which Ifugao are masters.*"

Ifugao are known for their search for land and money. A non-Ifugao respondent told me for instance: "Mr. Tundagi was the first Ifugao that went to Balete to occupy land, when he heard that the government was about to give land titles in that area. He got 8 hectares land and went back to his town in Ifugao province to invite other Ifugao. When they came, he sold his 8 hectares to them for a high price. Now, only Ifugao live in Balete". Everyone we spoke with, including Ifugao, agreed with the story and added: "Thanks to Mr. Tundagi, other Ifugao got to know about this place worth trying to make a new living. He invited the Ifugao that arrived after him and people who arrived after them form a direct or indirect linkage with him".

Ifugao and non-Ifugao respondents say that Ifugao do not need or ask for protection. Their friendly smiling attitude is enough in combination with showing their poverty so that people pity them. Besides, they bring their daughters for intermarriages by which strong family ties develop. Finally, they know how to ease the government, by planting trees for instance, showing their motivation towards protecting the forest.

The pioneers settle in the area in several ways. Strong young men arrive in a small group, passing by the village directly into the mountains (or stay with Ifugao friends for a few days in the village). There they open *kaingin*s and return to their home town to get their family for harvesting. Another way is that strong young men come with enough savings to survive until the first harvest from the *kaingin*. Following is the story of an older woman: "*We came from Ifugao province where we gave our rice fields to two of our children. Mr Tundagi said to come to Masipi if we wanted cheap land. The prices of rice fields in our hometown are over 100.000 pesos per hectare (here more or less 10.000). We sold our livestock and*

bought some land in Masipi East. Now, our son is looking after the rice field. We opened our first kaingin here in 1995 and now permanently live here. In total we have 4 hectare kaingin now."

The people from Masipi East say that they did not have real problems with the Ifugao before. Now, however, the inhabitants feel a thread because the amount of Ifugao is increasing fast while they do not integrate in the village: young men arrive in groups and directly enter the forests. The inhabitants of the *barangay* are protesting saying: "*We don't want an Ifugao barangay captain. We don't know with how many they are and most of them haven't even registered and thus not shown their clearance; perhaps they are thieves or criminals hiding here. We are planning to get them out*". The first signs are present. There has been a killing, under the guise of a water conflict, a while ago. The whole incident has been hushed up, in the hope that it will scare away new Ifugao migrants. Many gossips about the Ifugao go around. Everyone says to be afraid of the drugs that the Ifugao would cultivate as they are used in their own province and besides, they would be armed[42]. The *barangay* captain of Masipi East has ordered the Ifugao to follow the regulations which is that all new inhabitants have to register in the *barangay* showing their clearance. However it is also clear that, as is apparent in some of the preceding quotes as well, there is a lot of envy towards Ifugao since Ifugaos are known as having a high work ethic. There are many jokes about Ifugao illustrating this; people characterise them as very hard workers and thrifty people, who know how to deal with money especially by investing in land and do not squander their money like Ilocano. Thus, resistance against the Ifugao could also be fed by jealousy (something mentioned as a key tenet of Philippines culture) and fear of becoming out competed in the long run.

5.4 Production cycle of swidden

This section describes the general production cycle of swidden farming as several farmers with swiddens estimated.

Land

The size of the swidden fields range from one half to two hectares. People said that the size of the area they open depends on how much land one needs and can look after. If people solely depend on swidden, they obviously need a bigger area than people who have a corn and/or rice field as well, for instance.

[42] Except for my study assistant, all people I spoke with were afraid to visit the Ifugao. When we visited the fields and settlements of the Ifugao further in the mountains that were never visited by anyone from Masipi East we did not find any trace of marihuana plantations that people were afraid of.

People who have a permanent field next to the swidden said that the size of the swidden depends on the amount of time someone has left after farming on the permanent fields. One respondent stated that the area he opened is dependent on the amount of seeds he has. The pioneer farmers usually open as much as they can handle. One strong young man was said to be very industrious, looking after more than one half hectare himself.

The pioneer farmers appear to be the most industrious people of all *kaingineros*. They are determined to start a new living and would like their family to come over or marry here. The best areas to open are, according to the respondents who cultivate a swidden, where there is water supply, moderate slope, good soil (black colour and thick vegetation) and the least big trees. The opening of the swidden is considered as the hardest work and after that the cleaning of grasses.

Labour and agricultural calendar

The size of the swidden area mainly depends on labour available, and the strength of the labourers. Swidden making is hard work and requires lots of bodily strength. The general division of labour among the Tinguian in Dy Abra is that the site selection and planting decisions are made by the men who are also responsible for cutting and burning. The women decide on the vegetables. Everyone helps cleaning and looking after the *kaingin* and collecting fuel wood. Older people say that they have smaller swiddens than the younger people. Table 11 shows an average of what people estimated on time spent on opening and cultivating a new swidden field. Sources are 5 household interviews, 3 at the Ifugao pioneers and 2 in Puerta, and 1 focus group discussion at the swidden fields in Sagalong. The agricultural calendar and labour inputs are more or less as follows (much depends on the weather).

From January up to March people clear the field: first cutting small trees and vines (small clearing that takes about 10 labour days) then big trees (big clearing that also takes about 10 labour days). All respondents use exchange labour (Amuyo) for the opening of a new field.

During the month of April everything is left for drying to be burned at the middle or end of April or beginning of May. The leftovers are piled up and burned again. People use (Amuyo) or work people on themselves and estimate an average of 14 labour days.

People wait for the rains to come, usually in May or June, to start planting. The first crop on a *kaingin* will always be upland rice (an average of 20 kilos of seeds are planted per hectare from previous harvest or borrowed). One person digs holes with a stick, followed by one person planting the seeds. An average total of 20 labour days is estimated by the respondents for this activity. Often people already plant banana (see section 5.5).

After 3 to 4 weeks weeding is necessary. People said that depending on whether they live at the *kaingin* permanently or temporarily, different working schemes apply. If people live there permanently they most probably work on the *kaingin* almost every day (except for Sundays) and will weed every day. However, if people live temporarily at the *kaingin*, exchange labour is usually arranged for weeding, twice. For the weeding activities, an average of 25 labour days is taken up in Table 11, but people who live at their *kaingin* permanently will obviously spend much more time on their *kaingin*. While waiting for the harvest people usually go to the *kaingin* every day to check and chase away birds (not included in Table 11). Only if necessary, people spray pesticides (this is not taken up in Table 11).

The rice can be harvested after about 5 months, in September, October or November. Often, exchange labour is used with an average of 20 labour days. Rice is harvested and stored in different manners. Some people make bundles that are hung upside down to dry in the house or in the shelter in front of the house, after which they put it in sacks. For consumption, people estimate how much they will need, pound the bundle and mill it manually. Others immediately pound the rice to be dried afterwards and put it in sacks. Except for the Ifugao, who manually pound and mill the rice every day (between half to one and half hour per 10 kilos palay, good for 7 kilos bigas), most other people bring the rice to the milling station (transport is about 0.6 p/kg and sacks cost 0.2 pesos per kg, and milling 1 pesos per kilo) in Tumauini when living in Dy Abra or in Masipi East. For the calculations in Table 11 we take the labour used for manually pounding and milling the rice. The transportation costs to the milling station and the costs of the sacks are taken as a shadow price to bring the rice to the market. The market price is 22 pesos per kilo for the upland rice, but none of the respondents sell the rice in reality.

Table 11. Indication of returns to land and labour of 1 crop upland rice and 1 crop yellow corn on 1 hectare swidden. Sources are 5 household interviews (3 at the Ifugao pioneers and 2 in Puerta), and 1 focus group discussion at the swidden fields in Sagalong. It concerns one rice crop on a newly opened (fallow) swidden, followed by one crop yellow corn after the rice harvest.

Swidden rice

Opening (man days)	20	
Burning & piling (man days)	14	
Planting (man days)	20	
Weeding (man days)	25	
Harvesting (man days)	20	
Milling and pounding (man days)	9	
Total labour (man days)	108	
Seeds (kg/ha)	20	
Harvest palay kg/ha	750	
Harvest bigas kg/ha	500	
Transport pesos/harvest (0.8 pesos/kg)	384	
Returns to land bigas (if sold at 22 pesos/kg)*	**10176 pesos/ha**	
Returns to labour bigas (if sold at 22 pesos/kg)*	**4 kg/day**	**94 pesos/day**

Swidden yellow corn

Total labour (man days)	70
Seeds (kg/ha)	40
Harvest corn kg/ha	400
Transport pesos/harvest (0.8 pesos/kg)	288
Returns to land corn (if sold at 6.50 pesos/kg)*	**2052 pesos/ha**
Returns to labour corn (if sold at 6.50 pesos/kg)*	**30 pesos/day**

* Excluding shadow price family labour.

After the rice harvest, people usually plant corn and vegetables (like, garlic, onion, (string) beans, bitter curd, tomato, (Chinese) cabbage, squash, taro and eggplant) in November to be harvested in February or March. Depending on whether the swidden is easily accessible, people plant yellow corn and vegetables as a cash crop, or otherwise white corn and vegetables for own consumption and (native) yellow corn for feeding the chickens.

The returns to land and labour of one crop yellow corn as cash crop are displayed in Table 11. Less labour is involved in yellow corn than in rice cultivation since the corn is directly planted after the rice crop, by which the main activities are cleaning, planting, weeding, and harvesting. The costs of the hybrid seeds are assumed to be left from the previous harvest or exchanged. The market price taken in the calculations correspond with class B of 6.50 pesos per kg.

5.5 Banana

Banana is a favourable cash crop that is grown on large scale in Puerta. Of the 30 respondents interviewed by the MFA team, 24 have a banana plantation, with a mean of 265 trees per household (250 trees per half hectare). Banana is also widely grown in Dy Abra. The pioneer migrant farmers already plant banana during the first cropping season. They have to bridge the first year without food or cash income, and this will be their first and sole source of cash income from natural resources as they are not involved in logging.

In Puerta, most farmers plant banana after the first rice crop on the swidden. People get suckers from plantations of themselves, their family, or neighbours. After one year, bananas can be harvested. Various varieties are grown. The first couple of years people try to plant Lakatan that has higher net returns, but needs better soil than other varieties. Respondents say that as long as you look after the banana trees (cleaning and cutting), they will continuously bear fruit that can be harvested every month. The first three years, the harvest is higher than the following years, but the trees can bear fruits for 10 to 15 years. For optimum harvest however, people say it is advisable to replant every 5 years. This is the basis taken in Table 12 that shows the costs and benefits of one hectare banana plantation.

Every Friday, banana traders come to a "market place" that lies between Masipi East and Puerta, the last place that normal motorised transportation can reach (*secondary actor*). Transportation to the "market place" from Puerta takes about two hours for which a carabao and cart are used. Mostly, people own this equipment themselves. In Table 12 a shadow price is taken for the calculations of the returns to land and labour, referring to what people would pay in case they would contract out transportation. This is the same price the pioneer farmers said they pay, although they bring the banana directly to Masipi East (they live at the forest fringe situated in between Dy Abra and Puerta. The fastest way to the lowlands is going to Masipi East directly). The banana traders classify the bananas on basis of quality and the variety. Lakatan is a highly valued variety, costing between 80 and 120 pesos per 100 pieces. The traders buy the other varieties for 30 to 80 pesos per 100 pieces.

Table 12. Costs and benefits of one hectare banana (500 trees) per month in Puerta and at Ifugao pioneers.

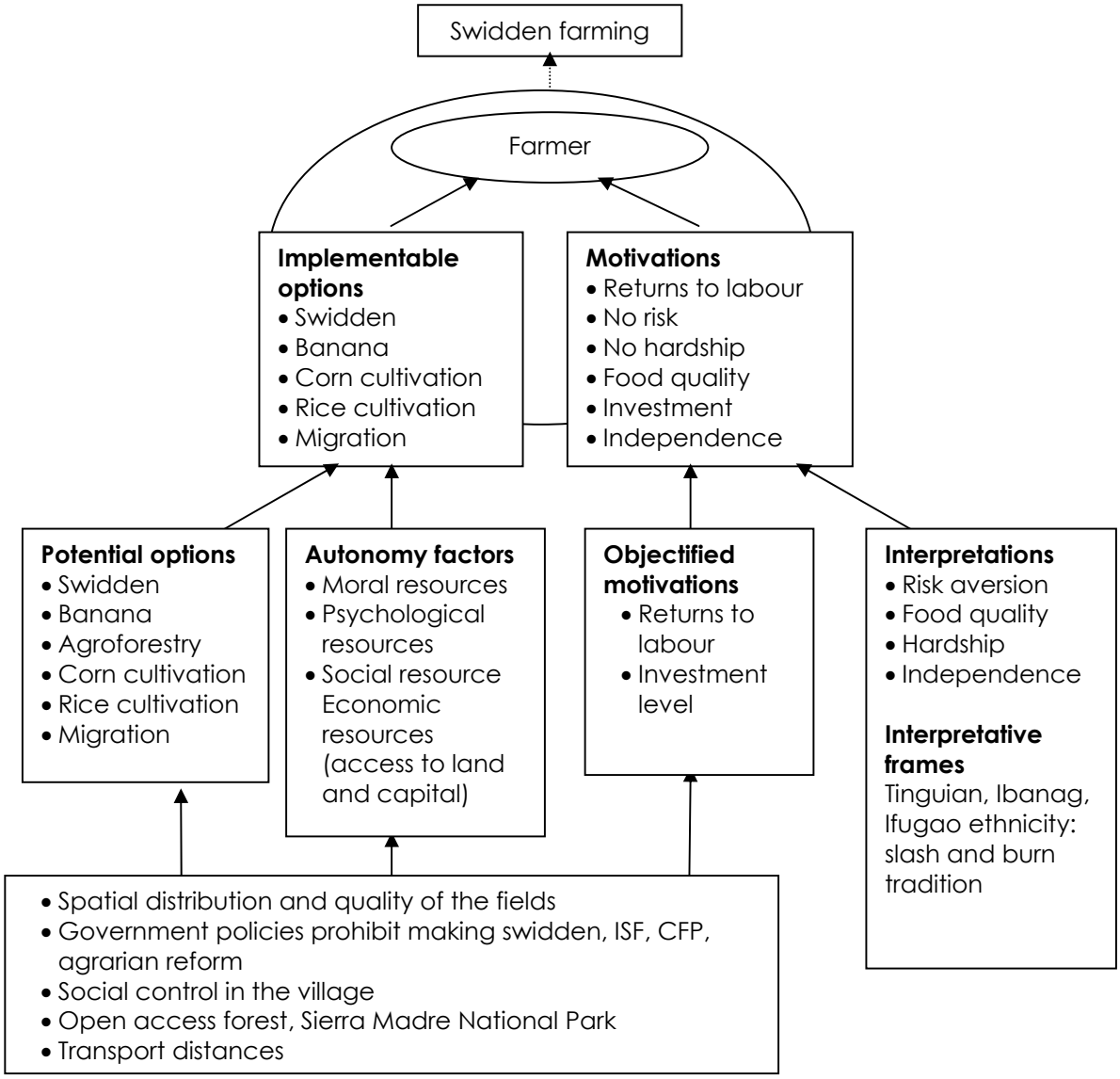
		class A	Class B
Labour			
Development plantation (average 1x per 5 years (30 days)	Total time in days per month	0.5	0.5
Cleaning	Total time in days per month	4	4
Maintenance/guarding	Total time in days per month	1	1
Harvesting and transport	Total time in days per month	4	4
	Total labour per month	9.5	9.5
Transportation cost: Puerta-Masipi East			
Hire a carabao: 10 pesos per 100 bananas	Costs for 4000 pieces	**400**	**400**
Harvest			
Average of 4000 pieces per month		4000	4000
Selling price (pesos per piece)	Class a: 0.65, Class b: 0.30	**2600**	**1200**
Total costs		400	400
Gross benefit pesos		2600	1200
Net benefits in pesos = returns to land (pesos/hectare/month)*		**2200**	**800**
Total labour days		9.5	9.5
Returns to labour (pesos/day)*		**232**	**84**

* Excluding shadow price family labour.

Despite the high returns of banana cultivation, it is a risky crop according to respondents, for which they point out several reasons. Firstly, animals often destroy the crop (many farmers put traps to catch wild animals, and in case the farmer noticed destruction he will return during the night to hunt). Besides, the crop is vulnerable to typhoons. Respondents said that most banana plantations were destroyed during the well known typhoons in 2001, 1998 and 1990. Next, the tungro sickness can affect banana, which is the main reason that many respondents pointed out for not growing banana in Masipi East. There is less tungro in Puerta and the swiddens, according to the respondents, because of its higher elevation. However, if the disease affects the tree, the tree is lost. Transport is considered as risky and as one of the main restrictions for cultivating banana as well. If the swidden is difficult to reach, people do not consider converting it into a banana plantation. However, people with a banana plantation that is easy to reach say that they still have difficulty with transportation. No cars can reach the plantations, meaning that all products have to be brought down with a carabao and sledge passing rough roads and crossing many creeks. People say that the risk of damage is quite high during transportation which the trader reflects in the classification, thus the price. This risk factor is taken up in Table 12 where we chose for the two scenarios of the other varieties than Lakatan, namely Class A for 0.65 pesos per piece and Class B for 0.30 pesos per piece. The traders, in turn, sell the bananas to markets in Cabagan and Tumauini, but also to markets in other provinces. The traders mentioned that the price depends on the prices in Manila.

5.6 Conclusion

Figure 9. Deeper analysis scheme of swidden farming according to AiC



This chapter described the swidden practices in Dy Abra, Puerta and of the Ifugao pioneers residing between the other sites. The situation in Puerta and Dy Abra is quite comparable. Before, everyone used to practise swidden. When the people resettled to the current place of Dy Abra, they obtained stewardship contracts for permanent corn and rice fields in the lowlands. When the situation was safe again, some people decided to return to swidden farming near the forest. These were mostly people who did not have (enough) area for permanent agriculture in the lowlands. Other people first focussed on corn in

their ISF area. Due to limited area, deteriorating soil quality, indebtedness with traders or expansion of the family, they decided to open swidden fields again as additional food and/or income source. Good areas for making swiddens are quite far from the centre further into the mountains. People returned to Puerta permanently, after the logging company pulled out. Like the people in Dy Abra, they obtained stewardship contracts. People started to convert the former swidden fields on moderate slopes in permanent yellow corn and rice fields. However, many fields appear not suitable for ploughing and intensive corn production. Almost all areas suitable for making swidden are (re) opened. People say that they are hesitant to go further due to the hard accessibility and swiddens are soon converted into banana plantations that have relatively high returns to land and labour. Since banana plantations are widespread, everyone has easy access to suckers.

The number of pioneers from Ifugao is augmenting fast in search for land meaning that more land needs to be converted into swidden fields. At the time of the study, most Ifugao we met cultivated former fallow areas, but they are likely, as other Ifugao in nearby areas, to enter deep into the forest to open lands. They do not deter or perhaps even prefer to distance themselves from other people and do not fear to live in isolation in the forest. The inhabitants of Dy Abra, Puerta, and Dy Abra are worried about the Ifugao, and conflicts are likely to occur. Figure 9 gives an overview of swidden farming according to the AiC framework.

6 Small-scale logging

Activity and actors

Logging happens very openly in the study sites. A larger amount of timber is taken from the forest from Dy Abra than from Puerta, as is counted in the MFA study. Small-scale logging refers to a small-scale mode of timber extraction with use of a chainsaw. Carabao logging, implying that a carabao is used for hauling the square logs from the logging place to the pick-up point, is a common practice in Dy Abra and in the extraction area of Puerta. In Dy Abra the river is sometimes used as means of transportation. People call this water logging.

Most of the timber is extracted by the inhabitants of the villages, but people from nearby villages that do not have forest areas also extract in the area of Dy Abra and Masipi East. The extraction area of *barangay* Masipi East is nearby *sitio* Puerta. Six of the 30 households interviewed for the MFA study in Puerta are involved in hauling, while two are chainsaw operator. Eleven people in Masipi East own a chainsaw. There are 12 chainsaws in Dy Abra and more than 2/3 of the households are involved in logging, as a helper or chainsaw operator or organising logging trips and marketing. You can easily buy chainsaws legally, but

most chainsaws in use are the ones that the big logging companies left behind that operated in the area about 10 years ago.

The owner of the chainsaw organises the logging trips and is the so-called "owner of the logs". If he has made a deal with a buyer, he organises a logging team of young men to help him. The logging team consists of a chainsaw operator (sometimes the owner of the chainsaw) and two helpers. Depending on the distance, a surveyor is sent ahead. Logging teams from Masipi East sometimes include people from Puerta. The owner provides food, gin and cigarettes and pays the helpers 100 pesos per day. In case the owner of the chainsaw hires a chainsaw operator, he is paid 1,50 pesos per board foot.[43]

On average, a team goes two times a month from September to May, and one time in the months of June and August (rainy season). The highest peak of logging is after preparing the fields in January, in the dry season when there is not much farm work as respondents said. One respondent said: "*Farming is more important than logging, but I use a tractor on my corn field, so that gives me much time for logging*". In *barangay* Masipi East, logging trips take about 3 to 4 days, depending on the distance of the extraction area in the communal forest near Puerta. In *barangay* Dy Abra, it normally takes 5 days because the forest is farther away. The limiting factor for the amount of trees felled and cut into square logs is the amount of gasoline the team brings (with 20 litres ten to twelve logs can be cut and sliced in 80 to 100 board feet per log at the cutting place. Much depends on the skills of the operator). The team leaves the logs at the cutting place. The hauler will come later to transport the square logs to the pick-up place with his carabao. During one trip that takes about one day work, a hauler can transport a maximum of 70 to 72 board feet, for which he is paid 4 pesos per board foot. In Dy Abra, logs are also transported by the river in case the owner has no carabao.

Selling of the logs occurs in two ways. Mostly, the buyer sends someone to the village to get the timber himself. The buyer has good connections with the police and the department of environment and natural resources (DENR) that are responsible confiscation of the illegal logs. The other way is that the owner of the logs brings the timber to the buyers. This only happens if the owner has good connections with the controlling agencies. The logs are mainly sold to nearby furniture makers in nearby *barangays* and municipalities. In Masipi East, there are two furniture makers. Key respondents estimate 30.000 board feet extraction of timber per year in Masipi East and Puerta.[44] They estimate that 10 percent stays in Masipi East for construction and furniture making (one of the furniture makers

[43] One board foot is a piece of lumber that is 1 foot wide, 1 foot long and 1 inch thick, or its volumetric equivalent of about 2360 cm^3.
[44] 500 board feet average per day, but not in the weekends. Thus, 2500 board feet per week or 30.000 board feet per year.

uses about 10.000 board feet per year). In Dy Abra, the MFA study estimates that between 400.000 and 500.000 board feet is extracted yearly.

Table 13. Costs and benefits of an illegal logging operation, softwood, one trip, 4 days in Masipi East. Average is 2 trips per month in July and August and 1 trip a month during the remaining of the year, thus a total of 22 trips per year.

Activity	**Amount**	**Costs**	**Benefits**
1000 board feet average per trip			
Gasoline &oil	20 litres a 20 pesos per litre	400	
Hauling	4P/ board foot (max of 70-72 brdft/day)	4000	
Helpers (2 or 3)	100P/day	800	
Chainsaw operator	1.50P/ board foot for chainsaw operator	1500	
Food	100 pesos per person per day	1200	
Pick up by buyer (who arranges trip)	11P/ board foot		11000
(Bring out (max of 600 brdt per trip)	15P/ board foot nearby, 20-21P/ board foot further)		
	Total costs and benefits	**7900**	**11000**
Net benefits owner (1 logging operation)			**3100**
Net benefits chainsaw operator per day (excluding food etc.)		**375**	
Net benefits helpers per day (excluding food etc.)		**100**	
Net benefits average hauler per day (1 trip that takes about 1 day)			**300**

Source: interviews with key respondents.

Motivations

Logging is not a real business in Masipi East. People participate if they feel like it. It is fun and male adventure being in the forest, fishing, camping, drinking gin, etc. However, logging is considered as hard physical work, only done by young men. The risk factor is heavy, since it concerns illegal operations and you could be caught, ending up with nothing. It is only done if there is time left after farming. Farming has priority to gain a steady livelihood. Nevertheless, the households involved in logging from Dy Abra and Puerta say that logging the biggest source of cash income after corn and swidden making. Money made out of logging is considered "quick money", while cash income made of farming is steady. Table 13 shows the net benefits of the various participants of a logging trip. A helper earns 100 pesos per day which is more than normal wage labour, plus free foods, drinks and cigarettes. The chainsaw operator earns an average of 375 pesos per day, depending on the amount of board feet he makes. Hauling is big business as well, since a hauler makes about 300 pesos a day on average (although he is not enjoying the free foods and drinks and male adventure). Finally, the organiser of the logging trip, the one taking the highest risks, is the one having the highest benefits, about 3100 pesos per operation.

Structural factors

The current extraction areas in Puerta are closer to the village again. As part of the TLA of the large scale logging company, reforestation of Gmelina trees occurred (by throwing seedlings from the logging trucks as part of the reforestation agreements) about ten years ago. Now, these trees are harvested.

There are more connections with buyers in Dy Abra than in Masipi East. This is the reason people point out for the larger amount of extraction in Dy Abra. There are several agencies that can apprehend timber, namely the police, DENR and the army. However, everyone has good contacts. Nevertheless, in case they are caught they usually get away with it by paying a bribe, only if you transport large amounts (for 500 board feet about 100 pesos, for 1000 board feet about 200 pesos). The army that is permanently stationed in Masipi East (safety reasons against the New People's Army) made a deal with the villagers.[45]

The co-operative of *barangay* Masipi East had received a logging quota under the community forestry program (CFP). There have been many problems within the management of the co-operative that was established to obtain the community forestry program in 1992. The CFP covers an area of 5000 hectares for which the co-operative obtained several Annual Allowable Cut (AAC) certificates that go together with reforestation projects. Until the time of the study, there was more illegal than legal logging by people from Masipi. The main reason is that, according to key respondents, it is difficult to find buyers for legal timber, because the prices of legally obtained timber are higher. According to key respondents, agencies should support the market of legal wood. However, these agencies would not do so because they themselves are said to make money out of the illegal logging operations. However, the gain for the people directly involved in the logging operation could be equal or even more profitable when doing it legally (although the labour prices are fixed and only cutting of softwood is allowed). Besides, people point out the lack of management in the co-operative by which the legal logging is not stimulated. In addition, one has to be member of the co-operative.

7 Secondary actors for rice, corn, swidden and logging

Integration in the cash economy has gradually occurred in the three study villages. Especially since the introduction of the new corn varieties in 1985 that farmers had adopted in a few years, the focus on cash became reality. These days, most people in all villages depend on traders to borrow in cash or in kind.

[45] The army receives goods in kind, like kitchen utensils, knifes, roofs, etc. and leaves the villagers alone. The villagers do not trust the army though. The former group promised to hand back everything to the community, but they took it or sold it, according to the villagers. A new group arrived in the end of 2001 asking for new goods.

In Action-in-Context terms, traders are secondary actors influencing the decision-making of farmers. Through the farmer's options, traders give the possibility to borrow money to cultivate rice and corn. Through the farmer's motivations, traders give the possibility to sell the rice and corn but are also partly responsible for the high risk factor that goes along with borrowing money for corn cultivation. The government also forms an important secondary actor regarding titling of land, development, forestry and agricultural programs and projects, and the construction of roads.

7.1 Traders

Most farmers cultivating yellow corn depend on traders to borrow cash for hired labour, sickness, social purposes, or educational purposes or in kind, like seeds, fertilisers, and pesticides. Farmers do not go to the bank for a loan. First, a loan from the bank requires a title and most of the farmers from Dy Abra and Puerta do not own titled land. Banks do not consider the certificates of stewardship contract as a title for a loan. Most people in Masipi East do have titles, but the bank is not interested in giving small loans to individuals and it is almost impossible to get a small private loan. Besides, banks do not extend personal credit. Corn traders have taken the position as informal moneylenders. They borrow money from the bank charging 2% to 3% interest a month. In turn, the interest the traders ask from the farmers is 7% a month. The traders finance the farmers and the farmers usually repay their loan with the harvest. This also means that after harvest the farmer has to go to the trader who financed him to sell the harvest. Traders deal in corn and rice. The story is quite comparable for both products, although people usually borrow less for rice and farmers hardly sell rice. Only some farmers from Masipi East sell rice, all the other farmers keep the rice harvest for own consumption. Yellow corn is a pure cash crop. Almost all farmers in the study sites have difficulty paying their debt, face indebtedness, and have thus become entangled in a patronage linkage with the traders.

The relationship between traders and farmers is characterised by the combination of inequality in power with mutual (dis)trust, acquaintance, and social control (Van den Top, 1996: 354) and the combination of potential coercion and exploitation with voluntary relations. The wealthy traders have more power because they can decide who can be their clients. The farmers depend on the trader because of the relationship. For the short term however farmers are helped since this is the best (receiving cash instantaneously in case of emergency for instance) and only way to borrow money. This relation will be outlined in the next section. Then, the focus will be on the traders and their options and motivations. Finally, the driving forces behind the traders' decision making will be described.

Trader-farmer relation

Indirectly, and having your family or friends acting as insurance, all the farmers had reached a trader to borrow money for inputs from 1989 onward. The strategy of the traders as well as the farmers is to become friends and gain trust. For the farmers, it basically means that they show the traders that they pay back what they borrowed after the harvest[46], because they want to be the trader's client. Being a client of a trader means that you can easily borrow money, for agricultural purposes, but also for any other expenditure, such as fiestas, medical bills and school fee. Besides, traders often have influential political positions and/or relations, by which clients will receive political protection from traders. One guarantor said that he also helps farmers to find the best marketers for "his farmers" where they can sell their surplus products. Traders are friendly to the farmers for good bargaining position and because they gain the farmers' loyalty more easily if the farmers like the traders.

There are several strategies or "tricks" that farmers use to gain and misuse trust (mentioned by farmers and traders). According to one trader in Masipi East, 80 per cent of the farmers in Masipi East have difficulty in repaying their debt, after usually one or two years of good behaviour. Then, the farmer starts paying back less and less, saying, for instance that a part of their harvest is destroyed by insects, or has been stolen. Many farmers then try to get more credit from other traders. This usually fails because the traders keep tabs on which farmer 'belongs' to whom, through other traders or via a "trusted man". This farmer, living in the village, informs the trader about the harvesting circumstances of the clients. Finally, some people that started as guarantors for the farmers, have become a kind of middleman. In Masipi East for instance, most farmers are connected to one of the five guarantors that in turn arrange everything with the trader they work for. The gain for the guarantor is that the trader uses his car for transportation for instance. Besides, having a very close relation with the trader, the guarantor can easily borrow money from the trader without paying interest.

There are several reasons mentioned by farmers to call the traders liars. The main problem that farmers point out is that prices of inputs keep on increasing partly due to the traders, while the prices for corn and rice lag behind and are fluctuating. Traders are accused of having unfair weighting scales and not to be honest in classifying the corn and rice.[47] Farmers say that many traders delay the promised payment or provision of inputs.

Farmers as well as traders acknowledge the difficult position of the farmers. The worst that can happen to a farmer is a natural calamity destroying the total harvest. Farmers are well aware of the risks of indebtedness. "*We are the victims*

[46] Crop collateral is usually the basis for the loan. For bigger amounts of money, land titles, farms, livestock, etc. serve as collateral

[47] The prices given for rice and corn are based on the classification (A, B or C). The quality depends on the moisture, colour, weight

of corn", many farmers stated during our fieldwork. Unlucky farmers become caught in a debt trap, tied to his one creditor in a quite lopsided balance of power and profit.[48]

Farmers react in several ways to indebtedness. As some farmers see it, it leaves them only one option that is growing even more corn, hoping to strike it big one time and escape from debt bondage. As one farmer said: "*If you have many debts you are forced to plant yellow corn on large scale*". Others are now trying out options to escape from indebtedness without being forced to grow ever more corn. As one farmer from Puerta said: "*Last year we had to sell our carabao to pay back the debt to the trader because the corn harvest was lost. Now, we only cultivate a small portion of yellow corn at our own expense. We are afraid to borrow money again. On the other portion we plant, instead of yellow corn, rainfed rice and white corn. And we focus on banana*". Another respondent from Puerta was basically following the same route, only voluntarily. He said to be busy trying to pay back his debt not in the form of a corn crop but in cash, earned by other means, such as bananas or small-scale (illegal) logging. Quite likely, also this respondent will not go back to a focus on yellow corn only after debt repayment but try to diversify into a mixed system with the corn risk covered by other crops or livelihood sources such as logging or off-farm work.

Package deals

All the farmers of the three study villages go to various traders in Tumauini or work through a guarantor in Masipi East. All kinds of traders offer different "package deals" that have various pros and cons for the different individual farmers. The package deals are offered in different combinations like: providing direct cash or cash advance, giving good prices, providing inputs in kind, providing rice/corn sacks for free, including transportation and milling, giving discounts and use of a fair classifying strategy. The package deals traders offer are partly dependent of the trading network of the trader. There are big, average and small traders that take different positions in trading networks (*Autonomy factor of traders that makes lending money an implementable option: possibility of offering package deals which is possible by the network traders are in and their own assets)*. Depending on whether the trader owns a warehouse to store the rice or corn, has own transportation, has a rice milling and is able to finance the farmers, four major categories can be distinguished:

[48] Traders have a tendency to ascribe indebtedness not so much to objective factors such as crop failures but rather to personal characteristics and behaviours of farmers, such as laziness, converting all their profits directly into gin and fiestas, and so on. "*Before, farmers hardly sold their land, but now everyone is busy selling or mortgaging their land to buy a tricycle or a house of concrete*". "*People buy luxury goods instead of investing it in their fields*". "*If you want to be successful, you have to be industrious. But as you can see, what people do here is hang around and drink gin the whole day.*" There is a need to study the relationship between male dominance, alcohol and underdevelopment.

(1) Small traders, who do have a warehouse, but cannot finance the farmers. These traders sell corn and rice to bigger traders. The price bigger traders pay for corn increases with the volume. The small traders offer the farmers about one pesos per kg more than the big traders. This is the only way to attract farmers, because these traders cannot bind farmers to them by the credit system.

(2) Small traders, who do not have a warehouse, but can finance small farmers. Farmers, who cannot be a customer of the big traders, will go to these smaller traders for finance. They sell their corn to big buyers and make their profit by selling corn in larger volume. These small buyers take bigger risks than the big traders do, since big traders only lend money to farmers with enough collateral, while these small traders have to be satisfied with crop collateral.

(3) Average traders who have a warehouse and cannot finance farmers. These traders wait to sell the corn by which they receive high prices from bigger traders. In case of rice they sell directly to the corporate buyers in Tumauini, Cabagan, Ilagan, Manila and Bulacan.

(4) Big traders who have a warehouse and can finance farmers. These traders sell the corn to the feed mills themselves, located in Manila and Bulacan. The reason why the other identified categories of traders do not sell it to the feed mill directly is lack of transportation means. Big traders have their own transportation company.

Traders often work together forming a trade cartel, setting prices (structural factor of traders being part of traders network monopoly: price setting that influences the objectified motivations of profit maximising). Farmers say that they need the traders while they are stuck with them on individual basis at the same time giving the following reasons:

Traders convince farmers to come to them individually: good sales talk and safe and easy way to borrow money

Farmers are already in debt with one trader

Regarding corn, farmers have to sell the corn to the traders immediately after harvest. If corn is not stored in a warehouse, it is unprotected from decay due to moulds and rodents.

Table 14. Corn traders' profits. Example of the approximate profit traders make during one corn cropping according to one trader, and verified by other traders.

Benefits
The benefits for the trader depended on various factors
(1) Traders who financed farmers gave lower prices for the corn, because they had the security of farmers selling their corn. These traders made 50 centavos profit on each kilogram of corn they bought (the price they gave at time of the research was 6.80 pesos/kg).
(2) Traders, who could not finance farmers, gave higher prices (7.10 pesos/kg). These traders made 20 to 30 centavos profit per kilo.
(3) Traders who sold directly to the feed mill received higher prices than traders who sold it to other traders. The feed mill paid between the 8.00 and 8.50 pesos per kilo.
(4) Corn sold as ingredient for food for human consumption was generally 0.50 to 1.00 pesos per kilogram higher (8.50 to 9 Ps/kg), than when used for animal feed.

Costs
Costs the traders made include:
- Transport, loading and unloading: 50 centavos per kilogram.
- Interest to the bank.
- Salary of labourers (100 pesos per day) and snacks for the farmers.
- Rent of their warehouse.

One respondent outlined the specific cost and benefits per month:

Benefits per month
- He bought 200.000 kg corn in a harvest month (two times a year) with 50 centavos profit per kg. Thus, gross benefits were 100.000 pesos.
- In other months he could buy 100.000 kg. Thus, gross benefits were 50.000 pesos.
- Average gross benefits per month were: (2* 100.000) + (10* 50.000) / 12 = 58.000 pesos

Costs per month
- Labour: 4 persons @ 100 pesos per day times for 30 days: 12.000 pesos per month
- Rent of stock house: 5.000 pesos per month
- Food and the rent buying station is 250 pesos per day for 30 days: 7.500 pesos per month

Tax (paid quarterly to the Bureau of Internal Revenues): 1.000 per pesos month

Net benefits per month
58.000 pesos – 25.500 pesos = 32.500 pesos per month
(If the trader would work full time, say 6 days a week, then the returns to labour would be 1350 pesos per day)
source: based on interviews conducted by Veenman (2002)

Traders' contexts

After having some insights in the patron-client relationship between traders and farmers, and the different kinds of traders, the driving forces behind the traders will be explored.

Traders could choose to be involved in other business, but marketing corn and rice appears to be the most profitable (the example of Table 14 shows a returns to labour of 1350 pesos per day). For marketing timber applies a logging ban and it is thus a risky business. There is little demand for trading in other farm crops and there is no industrial processing capability in the region. This actually counts

for every other business apart from farming (laundry, cloth shop etc. etc.) (*other options are less profitable for traders, thus they choose for trading*). The main reasons why trading in rice and corn is very profitable is related to the fact that the demand for corn and rice is still increasing in the Philippines and that banks are in favour of traders (*market prices and networks of banks are structural factor influencing the objectified motivations of the traders. These factors are a result of activities of secondary actors*).

Market prices

Regarding rice, Filipino consumers pay 2 or 3 times as much for rice as do Thai and Vietnamese consumers (USDA, 2001). These high consumer prices can be seen as a result the relatively high local rice production costs (more than costs in Thailand and Vietnam) even though the domestic production volume is increasing (*ibid.*). Besides, the Philippine government, through the National Food Authority, has always controlled the rice market (*secondary actor influencing the prices*).[49] High rice prices are a logical result of the suppression of rice imports to levels lower than domestically desired. The new government strategy for rice sufficiency is twofold (*ibid.*). A national hybrid rice program (Administrative Order No. 25, 2001) directs the Department of Agriculture, the Department of Trade and Industry, the National Food Authority and their respective agencies to promote domestic rice production. At the same time, the government is pursuing liberalising rice imports by removing the National Food Authority's monopoly over rice imports.[50]

The increase in demand for yellow corn is caused by the increase of the demand for meat and poultry as yellow corn accounts for about 70% of livestock mixed feeds. It is also processed in high value products, such as cornstarch, corn oil, gluten, and snack foods that are popular in the Philippines. A small number of international marketers, processors and distributors of agricultural, food, financial and industrial products, like Cargill, Ayala Corporation and the San Miguel Corporation, highly influence the trading and marketing of corn in the Philippines (Van den Top, 1996). The increase in demand finds its roots in two main trends on macro-structural level, namely population growth and change in consumption pattern (Van den Top, 1998). This is related to the country's economic progress and corresponding changes in food preferences, especially in the rapidly expanding urban areas. More protein-rich diets are becoming affordable to more Filipinos, as wealth is increasing.

[49] As a result, big volumes of illegally imported rice find their way to the market.
[50] A logical consequence would be a collapse of the Philippine rice market, unfortunate for Filipino farmers producing for the market. In the study sites, however, most households produce for own consumption.

Banks

The banks made much more profit dealing with traders than with farmers. By lending the informal moneylenders, the banks could participate in the business opportunities of commercial small holder farming without having to worry about labour-intensive borrower supervision or low recovery rates (Van den Top, 1998). By opting for crop collateral from the farmers, the traders ensured that they would be the first to be paid after harvest.

7.2 Government programs

The Department of Agriculture (DA), in close co-operation with the agribusiness sector, is a leading actor behind the region's preoccupation with the production of rice and corn. Servicing the demand of consumers and food production industries in the country, its mission is to stimulate cereal output (Van den Top, 1998: 337).

The DA is, often in co-operation with the LGU or NGOs, the far most important provider of information about farming techniques in the villages. The extension programs are part of several national programs and policies that aim at improving equality and stimulating remote areas. These policies are the output of structural targets of the government: keep peace and order, stimulate economic and political growth in the municipality and in the province. Most of the programs consist of providing agricultural inputs for the farmers like fertilisers, herbicide and pesticide spray, and high yielding variety seeds together with technical assistance. The assistance directs and supervises the farmers focused on agriculture. The focus of most programs is on profit and yield maximisation while farmers also highly emphasise the risks they take.

The *barangay* captain fulfils a key role as contact person between the village and the outside world about policies and projects. The *barangay* captain is the one receiving the livestock, medicines, or educational tools with the responsibility to distribute among the community. In all the study villages various respondents complained about unequal distribution favouring friends and family of the captain as well the ones voting for him.

The Department of Environment and Natural Resources (DENR) is responsible for the upland areas that are divided under the Certificates of Stewardship Contracts and Community Forestry programs (CFP). Following is the story about the CFP as several (key) respondents from Masipi East told me:

"In 1992 the CFP was awarded to an NGO for implementation of a three year program. The founding of the co-operative was to receive the CFP. The first loan was given to the NGO. During that time the projects were very successful: everyone was planting for reforestation and agroforestry and people were paid as agreed upon, 80 pesos a day. In 1994-5, the program was handed over to the

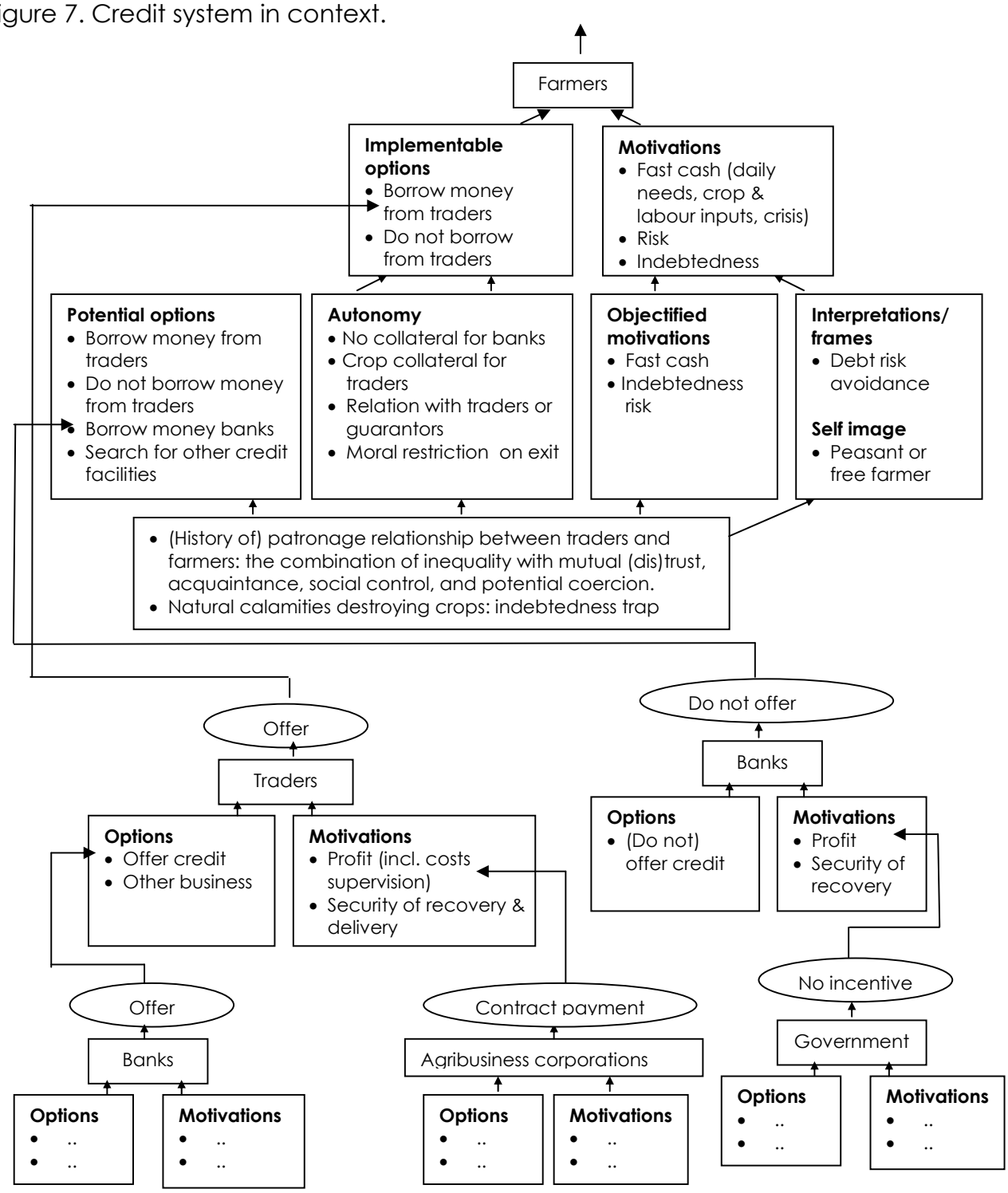
co-operative and was given additional loans by the Asian Development Bank through the DENR for the implementation of several projects (i.e. assisted natural regeneration, timber stand improvement, rattan plantation, reforestation, and training). The loan would be converted into a gift after positive evaluation of the DENR: paid on accomplishment. This is where it went wrong. Mismanagement is the biggest problem. The actual accomplishment of reforestation was, for instance, 5 hectare, while the co-operative was paid on accomplishment of 144 hectares set by the DENR. The former chairman of the co-operative must have conspired with the officers of the DENR, and lots of money has vanished. We reported it to the mayor of Cabagan with a petition, signed by most members of the co-op, but we never received any reaction. From that time people never received their wage. Another mismanagement feature of the DENR responsible is, for instance that the co-operative bought 50,000 germ of rattan of 7 pesos each from Nueva Viscaya. The DENR confidant would buy the seedlings being responsible for organising the planting activities as well. Nothing has been organised and the seedlings were from a different place but put in a different sack and the money gone.

Within the community and co-operative members, the people from Puerta feel discriminated against, as they never received seedlings and only the people from Masipi East are the ones that received while the forestry projects are actually developed for them living at the forest fringe.

People have a wait and see attitude/style. People don't value money correctly if they receive it from a program or government, they regard it as free money. They are only interested in their income, not in the outcomes of the project. Besides, the members were not informed about their duties and responsibilities, while the government is not sincere tolerating illegal activities. Organisations or the government will only receive respect from the community when they prove that they are sincere".

In sum, key respondents in Masipi East point out several main reasons for the failure of the co-operative and the Community Forestry Program. These are (1) mismanagement within the board (the *barangay* captain said that he has more difficulty managing the co-operative that managing the community), (2) mismanagement within the DENR (money and they do not take their tasks seriously and neither their responsibilities (for instance, DENR gives Annual Allowable Cut certificates, but no support in reforestation), and (3) information and awareness are not present and are preconditions for success.

Figure 7. Credit system in context.



8 Discussion

Part III of this report described and discussed the results of the AiC study that was a component of the local level SEAtrans study in the Philippines. The MFA identified main flows that cause environmental problems of soil degradation and deforestation. The AiC study is conducted in order to explain the livelihood activities and their underlying structural and cultural factors causing these problematic flows. We selected four study sites on basis of their *prima facie* position on the transition gradient of market incorporation. As it turned out, the degree of market incorporation was not the key variable distinguishing the sites, however.

In this section, therefore, we will first discuss the transition gradient found in the study on basis of spatial landscape characteristics rather than market incorporation. On the basis of a proposed classification, we will then review the explanation of the wood, corn, and rice flows. This will be done by giving an overview of the decision-making structure regarding land use decisions per actor group classified along the transition dimension. Finally, key factors and actors influencing the options and motivational factors of land use decisions will be identified.

8.1 Study sites selection

Market oriented (e.g. Thünian) theories and population oriented (e.g. Boserupian) theories form the common explanation of land use transitions. Thünian theory, for instance, states that the expansion of markets and roads will change extensive land use in pre-incorporated places into intensive production for the market in time. Following the Thünian perspective, the selection of the study sites has focused primarily on distance-to-markets as the key variable, supposed to be linked with degree of market incorporation and land use (hence material flows) change.

Without denying that population densities or distance to market may play a decisive role in many places and/or larger scales, in the present case study the physical landscape characteristics, rather than population or market factors, appear to predominate land use patterns. The following observations may illustrate this.

(1) In all study sites, people are in some way incorporated in the market and focus on cash crops like banana or participate in commercial logging activities although the focus may be on subsistence production.

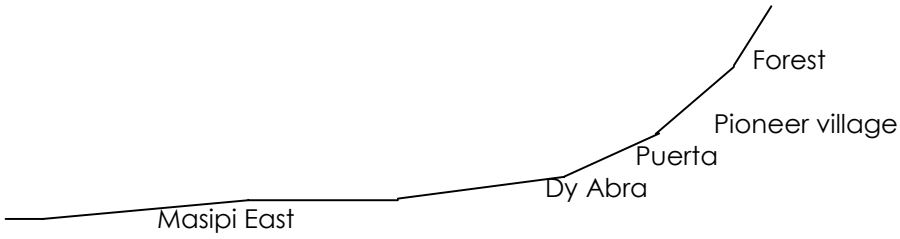
(2) The absence of cultivation of cash crops is not a consequence of the distance to the market, but a consequence of the landscape possibilities to

cultivate crops or the market demand of crops suitable for the location. Sloping areas, for example, are not suitable for intensive corn or rice cultivation, while the lowlands are not suitable for banana because of the high risks of rot. Thus, some crops are simply no feasible options in certain areas.

(3) Suitable land use in the uplands could be intensive, such as vegetable production or intensive agroforestry systems. Lack of these appeared during the interviews not to be dependent on access to the market, but people referred to risks of natural calamities for long-term crops such as fruit trees, or to the general lack of market demand for vegetables, or to lack of personal and communal drive.

(4) The transportation costs to the market do differ in the study sites, but are not decisive for crop choices as is shown in the returns to land and labour calculations in the preceding chapters where transport costs only show up as minor elements. The transportation costs from Dy Abra and from Puerta to the market are higher than from Masipi East, and corn is more intensively grown in Masipi East than in Dy Abra and Puerta. However, this does not result from the differences in transportation costs, but results from, among other things, differences in landscape and the risk farmers are willing to take.

Figure 10. Cross-section of the land use gradient as found in the research sites. The line reflects the distance and differences in slopes between the Cagayan River and the forest.



The case study shows that the landscape dimension is a key variable in the land use patterns. We are thus concerned with a spatial line of land use change. The pioneer village is situated in the forest fringe including the steeply sloping areas along the forest fringe covered with some patches of secondary forest or shrubs where people make swidden fields. The area of Puerta used to be covered with forest but where people are now trying to permanently cultivate the fields. The landscape in Dy Abra changes from generally steep sloping areas to moderate sloping. Masipi East is situated in the plane surfaces, best suitable for intensive permanent agriculture. Figure 10 shows a cross-section of the landscape gradient that goes together with the slopes as found in the study sites of the area.

8.2 Land use decisions along the landscape gradient

Pioneer village (swiddens)

The Ifugao pioneers and some people from Puerta and Dy Abra focused on swidden farming near the forest frontier, mainly in logged-over areas. All people who practised swidden have shifting cultivating culture and history; they like to be in the forest. During the time of the fieldwork the number of Ifugao pioneers was rising fast in search for land to start a new living. The Ifugao immigrants have a high work ethic and like to distance themselves from other ethnic groups. The people from Dy Abra and Puerta who made swidden had (partly) focussed on permanent agriculture before but did not have (enough) area for permanent agriculture to fulfil their subsistence demand. They used to make swidden fields in the area by which they had easy access to land for new swiddens by reopening of regenerated fallow areas. The Ifugao pioneers had more difficulty finding land and mainly occupied old fallow areas that belonged to the people of Dy Abra or Puerta. People hardly feared the possibility of being sent away as squatters and the government officials ignored the presence of the swiddens. In fact, people faced more risks of destruction of the crops by wild animals, as the fields were situated near the forest.

Prestige appeared not to be an important motivational factor for people who practised swidden farming, indicated by the neutral value in Table 15. In general, people who practise swidden show an undignified attitude, because swidden farming is commonly not valued as prestigious, only done by poor people who have no other option to make a living. The Ifugao pioneers, who were not much involved with the nearby communities, did not show this attitude. Although acting humbly, the people practising swidden farming all highly valued their independence, reflected by the positive value in Table 15. People were content not having to deal with the rules and regulations of the government and social control of neighbours and the dependence on traders.

Swidden rice is the most preferred crop that can be grown for one or two years on the same field. For swidden farmers, it would be quite profitable to sell the upland rice and buy normal rice with the revenues (upland rice costs 22 pesos per kg and normal varieties about 8 pesos per kg). However, people said they prefer to taste their upland rice and that it would not pay off all the efforts they put in cultivating the delicious rice on the swiddens. Thus, people forewent approximately 7000 pesos per hectare per year, only in order to have the better quality; in a sense, then, swidden farmers are rich. Other food sources were vegetables and meat caught in the nearby areas and people usually had chickens as well.

Table 15. Activities and motivational factors of farmers with swiddens. The returns of the lower quality of banana are displayed. Lowland rice and yellow corn are no option the area. The swidden rice is used for home consumption; the returns to land and labour are calculated using the market price of 22 pesos per kilo.

	Returns to labour	Returns to land	No Risk	Prestige	Food quality	Adventure	Independence
~~Rice~~							
~~Yellow corn~~							
Swidden yellow corn	30 P/day	2000 P/ha/yr	+	0	++	0	++
Swidden rice	90 P/day	10000 P/ha/yr	+	0	++	0	++
Banana	80 P/day	9600 P/ha/yr	-	0	++	0	+
Logging	100P/day	n.a.	-	+	n.a.	+	+

Some people from Dy Abra and Puerta cultivated yellow corn on their swidden as a cash crop for one or two cropping seasons after rice. This entailed fewer risks than cultivating yellow corn on permanent fields, because no inputs from the market were used on the swidden and the investments only consisted of labour. The reason that people cultivated yellow corn for the low returns in comparison to banana (see Table 15) could be explained by the fact that they planted yellow corn between the young banana trees while waiting for the banana to become productive.

Indeed, most people directly planted banana on their swidden fields (or waited for a year if two rice crops were feasible) that formed a main cash income but also supplemented the diet. Larger banana plantations were only developed if the swidden was relatively easily accessible, because only then transportation of banana to the market did not damage the banana too much. In fact, this is the only instance where distance to market was found to play an important role in our case study area. Banana plantations had relatively high returns that were quite steady, but are prone to typhoons, wild animals, and diseases as is reflected by the negative value on the risk factor in the Table. The respondents evaluated the risks of loosing investment not as high as with yellow corn cultivation on permanent fields, since only labour investments would be lost in case of loss of harvest.

In short, the main drive for people that went to the forest fringe to make swiddens was to be independent and/or to start a new living. There had not yet been enforcement of law against swidden making by local government during the time of the study. For cash crop choices, accessibility of the fields was an important factor. Bananas were the only possible cash crop in these areas; they were feasible only when situated along good passable roads, otherwise hauling results in damaged bananas.

Puerta

The area with permanent fields in Puerta is mostly covered with stewardship contracts, providing tenure security. A small flat area is suitable for intensive rice production, which is only an option for those 12 households that have titles for these fields. People cultivate rice for own consumption there, and many other people cultivate rainfed rice. Another important food source in Puerta is white corn, cultivated for own consumption.

Sixty-six percent of the inhabitants of Puerta cultivate yellow corn, of whom 20 percent focus on yellow corn as main agricultural activity. However, yellow corn is not very popular. Even the lucky case scenario displayed in Table 16 shows a quite low returns to land of only 3000 pesos per hectare per year. Moreover, the risks of poor harvests are high due to the sloping terrain and poor soil quality. Since most farmers borrow money for inputs, in such cases investments are lost and farmers may be caught in a debt trap.

Table 16. Activities and motivational factors of farmers in Puerta. The returns of the lucky and good inputs case for corn is displayed. The returns of the lower quality of banana are displayed. The irrigated rice is used for home consumption; the returns to land and labour are calculated using the market price of 8 pesos per kilo.

	Returns to labour	Returns to land	No Risk	Prestige	Food quality	Adventure	Independence
Rice	++	13000 P/ha/yr	++	++	++	--	+
Yellow corn	+	3000 P/ha/year	--	+	n.a.	--	--
~~Swidden~~							
Banana	80 P/day	9600 P/ha/year	-	-	++	0	+
Logging	100/300/375 P/day	n.a.	-	+	n.a.	++	+

Most people have a banana plantation that yields more on average than yellow corn and forms a steadier source of income although there are also risks involved mostly concerned with disease, weather circumstances, and transportation. However, the investments in developing and looking after banana plantations only consist of labour and not of capital as is the case with yellow corn cultivation.

People do not solely focus on yellow corn and the banana plantations for cash income. People often participate in logging trips, making 100 pesos a day as a helper, about 300 pesos a day as a hauler, and making 375 pesos a day as a chainsaw operator. Only people with a carabao can haul logs (done by 20 percent of the households) and it is a lonely business in contrast to joining a logging trip. The latter goes along with male fun and adventure with lots of food, drinks, smokes, and forest camping.

Next to logging, some people collect bamboo seasonally on demand of the lowland tobacco farms, hire out their labour in Puerta (@60 pesos a day) or own a shop. Being close to the forest and when being in the forest for logging or bamboo gathering, people spend time on hunting and gathering. Fishing also forms an extra food source.

In short, people in Puerta have diverse sources of food and income. It shows a failing copy of intensive yellow corn agriculture found in the more moderate or flat area. Instead of developing the sloping eroding fields, people continue to grow corn intensively on fields that are not suitable for this kind of production method. People focus on banana plantations as steady source of income and add to their income with hired labour, logging and collecting bamboo.

Dy Abra

Most agricultural lands of Dy Abra are characterised by moderate rolling lands that are covered with stewardship contracts. The main livelihood activities cause the material flows of wood, rice, and corn, two of which are unsustainable. Most households cultivate a rice field, irrigating it manually, or planting rainfed varieties. It is solely used for own consumption. Rice cultivation is highly valued for the economic returns, the steadiness of the income, the high prestige and food quality. Since the introduction of yellow corn, most households cultivate yellow corn on the fields that are not suitable for rice production. Corn cultivation needs less labour input than rice, but more investments to be profitable. This enterprise contains more risks, being a sole cash crop that is highly dependent on optimum chemical inputs for being profitable. The costs of hiring labour are low in comparison to the central area and relatively much family and exchange labour is used on the cornfields. Not all people completely concentrate on yellow corn and some people cultivate white corn for own consumption as well.

Next to agricultural activities that bring a steady income, more than two-third of the households are involved in logging. They are involved in logging activities as organiser of logging trips (@3100 pesos per trip), chainsaw operator (@375 pesos per day), helper (@100 pesos per day), or hauler (@300 pesos per day). Twelve people in Dy Abra own a chainsaw and the organisers of the trips have good marketing connections by which it is easy to join logging trips for other people. Moreover, most people have livestock and poorer people hire out their labour @ 60 pesos per day, go fishing and to the forest to gather vegetables. Differences between rich and poor families are apparent.

Table 17. Activities and motivational factors of farmers in Dy Abra. The returns to land of the lucky and good input case for corn is displayed. The manual irrigated rice is used for home consumption; the returns to land and labour are calculated using the market price of 8 pesos per kilo.

	Returns to labour	Returns to land	No Risk	Prestige	Food quality	Adventure	Independence
Rice	200P/day	40000P/ha/yr	++	++	++	--	+
Corn	200P/day	20000P/ha/yr	--	+	n.a.	--	--
~~Swidden~~							
~~Banana~~							
Logging	375/300/100 P/day	n.a.	-	+	n.a.	++	+

Masipi East

Masipi East is situated on a fertile plateau, where all fields are titled. Cultivation of yellow corn and rice forms the main agricultural products found in the barangay, of which the cultivation of yellow corn forms the most unsustainable material flow.

Table 18. Activities and motivational factors of farmers in Masipi East. The numbers are taken from the calculations in chapters 3, 4 and 6 and rounded off. The returns to land of the lucky and good input case for corn is displayed. Swiddens and banana are discussed in the previous sections. Most of the irrigated rice is used for home consumption; the returns to land and labour are calculated using the market price of 8 pesos per kilo.

	Returns to labour	Returns to land	No Risk	Prestige	Food quality	Adventure	Independence
Rice	++	20000P/ha/year	++	++	++	--	0
Corn	++	16000P/ha/year	--	+	n.a.	--	--
~~Swidden~~							
~~Banana~~							
Logging	3100/375/100 P/day	n.a.	-	+	n.a.	++	+

Some farmers market their rice, but most people use it for own consumption. Everyone would like to cultivate a wet rice field connected to the irrigation system developed by the government. Rice cultivation is highly valued for the economic returns, the steadiness of the income, the high prestige and food quality.[51] The motivational factor of adventure scores neutral, but never outweighs the other motivations. Whereas people with swidden fields highly value their independence, most people living in Masipi East see themselves most happy as farming permanent rice fields, and would even prefer tenant yellow corn farming to making swidden. The independence motivational factor weighed on the different crops is also displayed in Table 20.

[51] The difference between Masipi East and Dy Abra in the returns to land of rice cultivation is not a result of differences in yields, but is mainly caused by the labour costs. In Masipi East people hire more labour and at higher prices per man day during the production process than in Dy Abra (see chapter 3).

Forty percent of the households cultivate a yellow cornfield. A good case scenario as is displayed in Table 20 shows that it can be quite profitable.[52] However, people take high risks cultivating yellow corn, especially with the high investments made in labour and material inputs and indebtedness easily occurs. Besides, the excessive use of fertilisers has led to soil degradation jeopardising the sustainability.

Logging forms an important source of income for some people. Most of the logging trips in the forest and forest fringe areas in Puerta are organised in Masipi East. The chainsaw owners live there and the organisers who have marketing contacts. Young men often join as helper. However, no one is a full-time logger preferring a safe and steady income from farming. Other more wage and market oriented activities, such as being a trader, furniture maker, driver, are found in Masipi East.

8.3 Key factors and actors for land use decisions

The first thing that we have to realise in order to understand the land use related flows in the case study region is its relatively small scale, its relatively high landscape diversity and its relatively static forest fringe. In a country such as Brazil, these factors are reversed: the scale is huge, the landscape is more monotonously flat, and he forest fringe is rapidly moving. In a case such as Brazil, Thünian laws of distance-to-market explain the basic land use dynamics. In our case study region, *landscape characteristics* are the predominant factor. The data shows that transport costs are only seldom decisive; slopes and soils determine what can be grown at any place. Table 19 gives the overall characteristics per crop.

Lowland rice is the best crop on all accounts (economically and culturally). It can be grown only on (nearly) flat land, however. This implies that the rice flow of the study area is basically a function just of *the available flat land*. A slow process of terracing will slowly push the rice fields and the flows upward in the future. Change in rice prices will not make much difference because the rice, due to the limitations of flat lands, is mainly grown for subsistence.

Table 19. Motivations for the major material flows in the four research sites.

[52] The difference between Masipi East and Dy Abra in the returns to land of yellow corn cultivation is mainly caused by the costs of material inputs. In Masipi East people spend more money on inputs for the same yields (see chapter 4).

	Returns to labour	Returns to land (pesos/ha/year)	No risk	Prestige	Food quality	Adventure	Independence
Irrigated rice in Masipi East	+++	20000	++	++	++	--	+
Irrigated rice in Dy Abra	+++	40000	++	++	++	--	+
Irrigated rice in Puerta	++	13000	++	++	++	--	+
Rice on swiddens	+	10000[53]	+	--	+++	0	++
Yellow corn in Masipi East	++	16000	--	+	n.a.	--	--
Yellow corn in Dy Abra	++	20000	--	+	n.a.	--	--
Yellow corn in Puerta	+	3000	--	+	n.a.	--	--
Yellow corn on swiddens	+	2000	++	-	n.a.	0	++
Banana in Puerta and swiddens	++	9600[54]	-	-	++	0	+
Logging	+++	n.a.	-	+	n.a.	++	++

Upland rice will grow in swidden areas (on any slope), but for a few years only. New swiddens are made in the study area only on sloping land, because some non-protected forest is left there. Flows are small at present and will reduce further because non-protected forest will be gone (assuming that the protected forest will indeed be protected).

Yellow corn grows well (for the time being) on the soils of the rolling landscape. Returns to land and labour are satisfactory but prone to high economic risk. Soils appear to be degrading under yellow corn, and yellow corn flows may in the future diminish and be replaced by more banana or –if markets would be developed– by white corn or cassava. On sloping land, yellow corn is a minor crop already and likely to be abandoned soon due to low yields and high risk, leaving it only as minor (feed) crop. Hobbes and De Groot (2002) sketch three land use scenarios for the uplands based on the dynamics of corn, thus implicitly "keeping constant" all the other factors. The "going down" scenario predicts severely degraded lands that eventually will cause out-migration and increased pressure on the forest. In the second scenario yellow corn will be grown sustainably in such a way that farmers remain free of debt and the soils free of degradation by adaptation of appropriate soil management measurements. The third scenario emphasises diversification of livelihood activities into a number of crops and other activities.

[53] The swidden rice is used for home consumption; the returns to land and labour are calculated using the market price of 22 pesos per kilo as shadow price. This price is much higher than the 8 pesos per kilo paid for lowland rice, and it is doubtful whether the swidden rice is indeed worth that much for the swiddeners themselves. This issue does not affect the overall conclusions, however.
[54] The returns of the lower quality of banana are displayed.

Banana flows are at present basically a function of the amount of (post-forest) sloping land. Banana flows are likely to increase due to two processes (1) slow opening up of more unprotected forest, resulting in more banana plantations, and (2) more uncertain but potentially on larger scale, a shift from corn to banana on the rolling land.

Logging does not receive priority over farming, but forms an important source of fast cash for people having the right connections. Illegal logging is likely to continue as long as there is a market demand. Change in market demand to sustainable wood such as gmelina will change the character of the logging activities, protecting the forest by developing plantations in the (post) forest fringe area.

This "reading the future in the landscape" is of course contingent on relatively stable markets for the major cash crops of banana, corn, and logs. (Access to these markets, as said, plays a role only in the case of banana that cannot be grown too far from a road connection.) Other major shifts in material flows may be caused by a collapse of the forest protection system that may result in increased logging and increased immigration (thus forest fringe swiddens). Finally, physical causes may result in major shifts of material flows; the major elements in this category are (1) the unsustainability of the corn system on the rolling lands, (2) the unsustainability of the illegal logging in the forest, and (3) the risk of new diseases in the bananas, which is a crop with an extremely low genetic variation. Below the relatively stable and predictable 'landscape-based' patterns of land use and material flows, therefore, lies a weak and risky foundation.

With respect to the flows of rice, corn, banana, logging, and swiddens secondary actors (GO, NGO, traders, etc) play various roles.

(1) For the two major cash crops of corn and banana, secondary actors work to connect the markets to the farmers. Traders are a major category here, taking care of transports, credits, inputs and so on, often weaving farmers in debt bondage. This system is supported by GO actors, supplying land tenure security, agricultural extension and, most importantly, roads.

(2) Rice is not a cash crop in our case study area and thus not very interesting for traders. Government actors strongly support rice, however, especially by supplying irrigation projects, agricultural extension and so on.

(3) Logging is the major flow in which market actors and regulatory actors (GO, NGO) are opposed rather than mutually supportive. The outcome of the ongoing struggle will be one of the decisive factors in the fate of the Sierra Madre forest.

(4) With respect to swidden making, the most salient characteristic feature of secondary actors is their absence. Swidden making is not encouraged in any

way, but neither is it actively counteracted (e.g. for reasons of forest protection). Fortunately for the forest, bananas are the only possible cash crop on the slopes and bananas cannot be grown profitably far from roads. This implies that if government continues to be absent in the sense of not maintaining, improving or constructing roads very close to (or through) forested areas, swiddening pressure will not be acute. Swiddeners who do not care much for cash, however, will continue to be attracted to the forest and continue to threaten it with a slow but irreversible loss.

Finally with respect to roads in general, it should be clear that contrary to roads leading very close or through the forest, roads that improve connections with areas that are agricultural already (such as the rolling lands that are now under corn) do not imply a risk for the forest. They rather help to improve agricultural opportunities and thus help farmers to become less forest-dependent. In spite of this basic clarity, policy dilemmas do remain in 'post-fringe' areas that are patchy, *i.e*. neither simply forest nor simply agricultural. Improving roads to such places gives rise to both effects at the same time and forest patches that may now still survive due to lack of swiddening motivation may be converted rapidly to banana plantations.

References

Balderama, O. F. (2002). Empirical data of MFA study Masipi East and Puerta.

Boerwinkel A. (2001). Home gardens in Isabela province, the Philippines: biophysical characterization and management practices under various household conditions. CML student report. Leiden and Cabagan, Isabela: CVPED.

Broad, R. and J. Cavanagh (1993). *Plundering Paradise: The Struggle for the Environment in the Philippines.* Berkley and Los Angeles: University of California Press.

Dirx, E. J. (1995). Shifting cultivation and farmers' decision making in the Sierra Madre uplands, the Philippines. CML student report 59. Leiden and Cabagan, Isabela: CVPED.

FEARCDP (Far East Agrarian Reform Community Development Plan) (1999). *Applied farming system development approach: a World Bank assisted project*. Masipi East, Cabagan, Isabela.

Hobbes, M. and W.T. de Groot (2003) "Corn and beyond. An exploration of sustainability, indebtedness and future land use of the Sierra Madre forest fringe, Philippines. In: J. van der Ploeg, E. C. Bernardo, A. B. Masipiqueña (eds.). *The*

Sierra Madre Mountain Range: Global Relevance, Local Realities. Tuguegarao: CVPED.

Kummer, D.M. (1992). *Deforestation in Postwar Philippines.* Manila: Ateneo de Manila University Press.

Kusters, K (1999). A case study of bamboo utilization in the context of deforestation in a Sierra Madre community, the Philippines. CML student report 119. Leiden and Cabagan, Isabela: CVPED.

Stalpers, S.I.P., 2003. Material Flows in a Small Village in Vietnam's Northern Mountain Region. A Case Study of Tat Hamlet. Report of the SEAtrans project, CML, Leiden University.

USDA (2001). report from Manila, Philippines: http://oryza.com/asia/philippines/index.shtml

Van den Top, G. M. (1998). *The Social Dynamics of Deforestation in the Sierra Madre, Philippines.* Universitair Facilitair Bedrijf, Leiden.

Band 1
Umweltbelastungen in Österreich als Folge menschlichen Handelns. Forschungsbericht gem. m. dem Österreichischen Ökologie-Institut. Fischer-Kowalski, M., Hg. (1987)

Band 2
Environmental Policy as an Interplay of Professionals and Movements - the Case of Austria. Paper to the ISA Conference on Environmental Constraints and Opportunities in the Social Organisation of Space, Udine 1989. Fischer-Kowalski, M. (1989)

Band 3
Umwelt &Öffentlichkeit. Dokumentation der gleichnamigen Tagung, veranstaltet vom IFF und dem Österreichischen Ökologie-Institut in Wien, (1990)

Band 4
Umweltpolitik auf Gemeindeebene. Politikbezogene Weiterbildung für Umweltgemeinderäte. Lackner, C. (1990)

Band 5
Verursacher von Umweltbelastungen. Grundsätzliche Überlegungen zu einem mit der VGR verknüpfbaren Emittenteninformationssystem. Fischer-Kowalski, M., Kisser, M., Payer, H., Steurer A. (1990)

Band 6
Umweltbildung in Österreich, Teil I: Volkshochschulen. Fischer-Kowalski, M., Fröhlich, U.; Harauer, R., Vymazal R. (1990)

Band 7
Amtliche Umweltberichterstattung in Österreich. Fischer-Kowalski, M., Lackner, C., Steurer, A. (1990)

Band 8
Verursacherbezogene Umweltinformationen. Bausteine für ein Satellitensystem zur österr. VGR. Dokumentation des gleichnamigen Workshop, veranstaltet vom IFF und dem Österreichischen Ökologie-Institut, Wien (1991)

Band 9
A Model for the Linkage between Economy and Environment. Paper to the Special IARIW Conference on Environmental Accounting, Baden 1991. Dell'Mour, R., Fleissner, P. , Hofkirchner, W.,; Steurer A. (1991)

Band 10
Verursacherbezogene Umweltindikatoren - Kurzfassung. Forschungsbericht gem. mit dem Österreichischen Ökologie-Institut. Fischer-Kowalski, M., Haberl, H., Payer, H.; Steurer, A., Zangerl-Weisz, H. (1991)

Band 11
Gezielte Eingriffe in Lebensprozesse. Vorschlag für verursacherbezogene Umweltindikatoren. Forschungsbericht gem. m. dem Österreichischen Ökologie-Institut. Haberl, H. (1991)

Band 12
Gentechnik als gezielter Eingriff in Lebensprozesse. Vorüberlegungen für verursacherbezogene Umweltindikatoren. Forschungsbericht gem. m. dem Österr. Ökologie-Institut. Wenzl, P.; Zangerl-Weisz, H. (1991)

Band 13
Transportintensität und Emissionen. Beschreibung österr. Wirtschaftssektoren mittels Input-Output-Modellierung. Forschungsbericht gem. m. dem Österr. Ökologie-Institut. Dell'Mour, R.; Fleissner, P.; Hofkirchner, W.; Steurer, A. (1991)

Band 14
Indikatoren für die Materialintensität der österreichischen Wirtschaft. Forschungsbericht gem. m. dem Österreichischen Ökologie-Institut. Payer, H. unter Mitarbeit von K. Turetschek (1991)

Band 15
Die Emissionen der österreichischen Wirtschaft. Systematik und Ermittelbarkeit. Forschungsbericht gem. m. dem Österr. Ökologie-Institut. Payer, H.; Zangerl-Weisz, H. unter Mitarbeit von R.Fellinger (1991)

Band 16
Umwelt als Thema der allgemeinen und politischen Erwachsenenbildung in Österreich. Fischer-Kowalski M., Fröhlich, U.; Harauer, R.; Vymazal, R. (1991)

Band 17
Causer related environmental indicators - A contribution to the environmental satellite-system of the Austrian SNA. Paper for the Special IARIW Conference on Environmental Accounting, Baden 1991. Fischer-Kowalski, M., Haberl, H., Payer, H., Steurer, A. (1991)

Band 18
Emissions and Purposive Interventions into Life Processes - Indicators for the Austrian Environmental Accounting System. Paper to the ÖGBPT Workshop on Ecologic Bioprocessing, Graz 1991. Fischer-Kowalski M., Haberl, H., Wenzl, P., Zangerl-Weisz, H. (1991)

Band 19
Defensivkosten zugunsten des Waldes in Österreich. Forschungsbericht gem. m. dem Österreichischen Institut für Wirtschaftsforschung. Fischer-Kowalski et al. (1991)

Band 20*
Basisdaten für ein Input/Output-Modell zur Kopplung ökonomischer Daten mit Emissionsdaten für den Bereich des Straßenverkehrs. Steurer, A. (1991)

Band 22
A Paradise for Paradigms - Outlining an Information System on Physical Exchanges between the Economy and Nature. Fischer-Kowalski, M., Haberl, H., Payer, H. (1992)

Band 23
Purposive Interventions into Life-Processes - An Attempt to Describe the Structural Dimensions of the Man-Animal-Relationship. Paper to the Internat. Conference on "Science and the Human-Animal-Relationship", Amsterdam 1992. Fischer-Kowalski, M., Haberl, H. (1992)

Band 24
Purposive Interventions into Life Processes: A Neglected "Environmental" Dimension of the Society-Nature Relationship. Paper to the 1. Europ. Conference of Sociology, Vienna 1992. Fischer-Kowalski, M., Haberl, H. (1992)

WORKING PAPERS SOCIAL ECOLOGY

Band 25
Informationsgrundlagen struktureller Ökologisierung. Beitrag zur Tagung "Strategien der Kreislaufwirtschaft: Ganzheitl. Umweltschutz/Integrated Environmental Protection", Graz 1992. Steurer, A., Fischer-Kowalski, M. (1992)

Band 26
Stoffstrombilanz Österreich 1988. Steurer, A. (1992)

Band 28
Naturschutzaufwendungen in Österreich. Gutachten für den WWF Österreich. Payer, H. (1992)

Band 29
Indikatoren der Nachhaltigkeit für die Volkswirtschaftliche Gesamtrechnung - angewandt auf die Region. Payer, H. (1992). In: KudlMudl SonderNr. 1992:Tagungsbericht über das Dorfsymposium "Zukunft der Region - Region der Zukunft?"

Band 31
***Leerzeichen.* Neuere Texte zur Anthropologie**. Macho, T. (1993)

Band 32
Metabolism and Colonisation. Modes of Production and the Physical Exchange between Societies and Nature. Fischer-Kowalski, M., Haberl, H. (1993)

Band 33
Theoretische Überlegungen zur ökologischen Bedeutung der menschlichen Aneignung von Nettoprimärproduktion. Haberl, H. (1993)

Band 34
Stoffstrombilanz Österreich 1970-1990 - Inputseite. Steurer, A. (1994)

Band 35
Der Gesamtenergieinput des Sozio-ökonomischen Systems in Österreich 1960-1991. Zur Erweiterung des Begriffes "Energieverbrauch". Haberl, H. (1994)

Band 36
Ökologie und Sozialpolitik. Fischer-Kowalski, M. (1994)

Band 37
Stoffströme der Chemieproduktion 1970-1990. Payer, H., unter Mitarbeit von Zangerl-Weisz, H. und Fellinger, R. (1994)

Band 38
Wasser und Wirtschaftswachstum. Untersuchung von Abhängigkeiten und Entkoppelungen, Wasserbilanz Österreich 1991. Hüttler, W., Payer, H. unter Mitarbeit von H. Schandl (1994)

Band 39
Politische Jahreszeiten. 12 Beiträge zur politischen Wende 1989 in Ostmitteleuropa. Macho, T. (1994)

Band 40
On the Cultural Evolution of Social Metabolism with Nature. Sustainability Problems Quantified. Fischer-Kowalski, M., Haberl, H. (1994)

Band 41
Weiterbildungslehrgänge für das Berufsfeld ökologischer Beratung. Erhebung u. Einschätzung der Angebote in Österreich sowie von ausgewählten Beispielen in Deutschland, der Schweiz, Frankreich, England und europaweiten Lehrgängen. Rauch, F. (1994)

Band 42
Soziale Anforderungen an eine nachhaltige Entwicklung. Fischer-Kowalski, M., Madlener, R., Payer, H., Pfeffer, T., Schandl, H. (1995)

Band 43
Menschliche Eingriffe in den natürlichen Energiefluß von Ökosystemen. Sozio-ökonomische Aneignung von Nettoprimärproduktion in den Bezirken Österreichs. Haberl, H. (1995)

Band 44
Materialfluß Österreich 1990. Hüttler, W., Payer, H.; Schandl, H. (1996)

Band 45
National Material Flow Analysis for Austria 1992. Society's Metabolism and Sustainable Development. Hüttler, W. Payer, H., Schandl, H. (1997)

Band 46
Society's Metabolism. On the Development of Concepts and Methodology of Material Flow Analysis. A Review of the Literature. Fischer-Kowalski, M. (1997)

Band 47
Materialbilanz Chemie-Methodik sektoraler Materialbilanzen. Schandl, H., Weisz, H. Wien (1997)

Band 48
Physical Flows and Moral Positions. An Essay in Memory of Wildavsky. A. Thompson, M. (1997)

Band 49
Stoffwechsel in einem indischen Dorf. Fallstudie Merkar. Mehta, L., Winiwarter, V. (1997)

Band 50+
Materialfluß Österreich- die materielle Basis der Österreichischen Gesellschaft im Zeitraum 1960-1995. Schandl, H. (1998)

Band 51+
Bodenfruchtbarkeit und Schädlinge im Kontext von Agrargesellschaften. Dirlinger, H., Fliegenschnee, M., Krausmann, F., Liska, G., Schmid, M. A. (1997)

Band 52+
Der Naturbegriff und das Gesellschaft-Natur-Verhältnis in der frühen Soziologie. Lutz, J. Wien (1998)

Band 53+
NEMO: Entwicklungsprogramm für ein Nationales Emissionsmonitoring. Bruckner, W., Fischer-Kowalski, M., Jorde, T. (1998)

Band 54+
Was ist Umweltgeschichte? Winiwarter, V. (1998)

Mit + gekennzeichnete Bände sind unter
http://www.uni-klu.ac.at/socec/inhalt/1818.htm
Im PDF-Format downloadbar.

Band 55+
Agrarische Produktion als Interaktion von Natur und Gesellschaft: Fallstudie SangSaeng. Grünbühel, C. M., Schandl, H., Winiwarter, V. (1999)

Band 57+
Colonizing Landscapes: Human Appropriation of Net Primary Production and its Influence on Standing Crop and Biomass Turnover in Austria. Haberl, H., Erb, K.H., Krausmann, F., Loibl, W., Schulz, N. B., Weisz, H. (1999)

Band 58+
Die Beeinflussung des oberirdischen Standing Crop und Turnover in Österreich durch die menschliche Gesellschaft. Erb, K. H. (1999)

Band 59+
Das Leitbild "Nachhaltige Stadt". Astleithner, F. (1999)

Band 60+
Materialflüsse im Krankenhaus, Entwicklung einer Input-Output Methodik. Weisz, B. U. (2001)

Band 61+
Metabolismus der Privathaushalte am Beispiel Österreichs. Hutter, D. (2001)

Band 62+
Der ökologische Fußabdruck des österreichischen Außenhandels. Erb, K.H., Krausmann, F., Schulz, N. B. (2002)

Band 63+
Material Flow Accounting in Amazonia: A Tool for Sustainable Development. Amann, C., Bruckner, W., Fischer-Kowalski, M., Grünbühel, C. M. (2002)

Band 64+
Energieflüsse im österreichischen Landwirtschaftssektor 1950-1995, Eine humanökologische Untersuchung. Darge, E. (2002)

Band 65+
Biomasseeinsatz und Landnutzung Österreich 1995-2020. Haberl, H.; Krausmann, F.; Erb, K.H.;Schulz, N. B.; Adensam, H. (2002)

Band 66+
Der Einfluss des Menschen auf die Artenvielfalt. Gesellschaftliche Aneignung von Nettoprimärproduktion als Pressure-Indikator für den Verlust von Biodiversität. Haberl, H., Fischer-Kowalski, M., Schulz, N. B., Plutzar, C., Erb, K.H., Krausmann, F., Loibl, W., Weisz, H.; Sauberer, N., Pollheimer, M. (2002)

Band 67+
Materialflussrechnung London. Bongardt, B. (2002)

Band 68+
Gesellschaftliche Stickstoffflüsse des österreichischen Landwirtschaftssektors 1950-1995, Eine humanökologische Untersuchung. Gaube, V. (2002)

Band 69+
The transformation of society's natural relations: from the agrarian to the industrial system. Research strategy for an empirically informed approach towards a European Environmental History. Fischer-Kowalski, M., Krausmann, F., Schandl, H. (2003)

Band 70+
Long Term Industrial Transformation: A Comparative Study on the Development of Social Metabolism and Land Use in Austria and the United Kingdom 1830-2000. Krausmann, F., Schandl, H., Schulz, N. B. (2003)

Band 72+
Land Use and Socio-economic Metabolism in Pre-industrial Agricultural Systems: Four Nineteenth-century Austrain Villages in Comparison. Krausmann, F. (2008)

Band 73+
Handbook of Physical Accounting Measuring bio-physical dimensions of socio-economic activities MFA – EFA – HANPP. Schandl, H., Grünbühel, C. M., Haberl, H., Weisz, H. (2004)

Band 74+
Materialflüsse in den USA, Saudi Arabien und der Schweiz. Eisenmenger, N.; Kratochvil, R.; Krausmann, F.; Baart, I.; Colard, A.; Ehgartner, Ch.; Eichinger, M.; Hempel, G.; Lehrner, A.; Müllauer, R.; Nourbakhch-Sabet, R.; Paler, M.; Patsch, B.; Rieder, F.; Schembera, E.; Schieder, W.; Schmiedl, C.; Schwarzlmüller, E.; Stadler, W.; Wirl, C.; Zandl, S.; Zika, M. (2005)

Band 75+
Towards a model predicting freight transport from material flows. Fischer-Kowalski, M. (2004)

Band 76+
The physical economy of the European Union: Cross-country comparison and determinants of material consumption. Weisz, H., Krausmann, F., Amann, Ch., Eisenmenger, N., Erb, K.H., Hubacek, K., Fischer-Kowalski, M. (2005)

Band 77+
Arbeitszeit und Nachhaltige Entwicklung in Europa: Ausgleich von Produktivitätsgewinn in Zeit statt Geld? Proinger, J. (2005)

Band 78+
Sozial-Ökologische Charakteristika von Agrarsystemen. Ein globaler Überblick und Vergleich. Lauk, C. (2005)

Band 79+
Verbrauchsorientierte Abrechnung von Wasser als Water-Demand-Management-Strategie. Eine Analyse anhand eines Vergleichs zwischen Wien und Barcelona. Machold, P. (2005)

Band 80+
Ecology, Rituals and System-Dynamics. An attempt to model the Socio-Ecological System of Trinket Island. Wildenberg, M. (2005)

Band 81+
Southeast Asia in Transition. Socio-economic transitions, environmental impact and sustainable development. Fischer-Kowalski, M., Schandl, H., Grünbühel, C., Haas, W., Erb, K-H., Weisz, H., Haberl, H. (2004) Helmut Haberl

Band 83+
HANPP-relevante Charakteristika von Wanderfeldbau und anderen Langbrachesystemen. Lauk, C. (2006)

Band 84+
Management unternehmerischer Nachhaltigkeit mit Hilfe der Sustainability Balanced Scorecard. Zeitlhofer, M. (2006)

Band 85+
Nicht-nachhaltige Trends in Österreich: Maßnahmenvorschläge zum Ressourceneinsatz. Haberl, H., Jasch, C., Adensam, H., Gaube, V. (2006)

Band 87+
Accounting for raw material equivalents of traded goods. A comparison of input-output approaches in physical, monetary, and mixed units. Weisz, H. (2006)

Band 88+
Vom Materialfluss zum Gütertransport. Eine Analyse anhand der EU15 – Länder (1970-2000).
Rainer, G. (2006)

Band 89+
Nutzen der MFA für das Treibhausgas-Monitoring im Rahmen eines Full Carbon Accounting-Ansatzes; Feasibilitystudie; Endbericht zum Projekt BMLFUW-UW.1.4.18/0046-V/10/2005. Erb, K.-H., Kastner, T., Zandl, S., Weisz, H., Haberl, H., Jonas, M., (2006)

Band 90+
Local Material Flow Analysis in Social Context in Tat Hamelt, Northern Mountain Region, Vietnam. Hobbes, M.; Kleijn, R. (2006)

Band 91+
Auswirkungen des thailändischen logging ban auf die Wälder von Laos. Hirsch, H. (2006)

Band 92+
Human appropriation of net primary produktion (HANPP) in the Philippines 1910-2003: a socio-ecological analysis.
Kastner, T. (2007)

Band 93+
Landnutzung und landwirtschaftliche Entscheidungsstrukturen. Partizipative Entwicklung von Szenarien für das Traisental mit Hilfe eines agentenbasierten Modells.
Adensam, H., V. Gaube, H. Haberl, J. Lutz, H. Reisinger, J. Breinesberger, A. Colard, B. Aigner, R. Maier, Punz, W. (2007)

Band 94+
The Work of Konstantin G. Gofman and colleagues: An early example of Material Flow Analysis from the Soviet Union. Fischer-Kowalski, M.; Wien (2007)

Band 95+
Partizipative Modellbildung, Akteurs- und Ökosystemanalyse in Agrarintensivregionen; Schlußbericht des deutsch-österreichischen Verbundprojektes. Newig, J., Gaube, V., Berkhoff, K., Kaldrack, K., Kastens, B., Lutz, J., Schlußmeier B., Adensam, H., Haberl, H., Pahl-Wostl, C., Colard, A., Aigner, B., Maier, R., Punz, W.; Wien (2007)

Band 96+
Rekonstruktion der Arbeitszeit in der Landwirtschaft im 19. Jahrhundert am Beispiel von Theyern in Niederösterreich. Schaschl, E.; Wien (2007)

Band 98+
Local Material Flow Analysis in Social Context at the forest fringe in the Sierra Madre, the Philippines. Hobbes, M., Kleijn, R. (Hrsg); Wien (2007)

Band 99+
Human Appropriation of Net Primary Production (HANPP) in Spain, 1955-2003: A socio-ecological analysis. Schwarzlmüller, E.; Wien (2008)

Band 100+
Scaling issues in long-term socio-ecological biodiversity research: A review of European cases. Dirnböck, T., Bezák, P., Dullinger S., Haberl, H., Lotze-Campen, H., Mirtl, M., Peterseil, J., Redpath, S., Singh, S., Travis, J., Wijdeven, S.M.J.; Wien (2008)

Band 101+
Human Appropriation of Net Primary Production (HANPP) in the United Kingdom, 1800-2000: A socio-ecological analysis. Musel, A.; Wien (2008)

Band 102 +
Wie kann Wissenschaft gesellschaftliche Veränderung bewirken? Eine Hommage an Alvin Gouldner, und ein Versuch, mit seinen Mitteln heutige Klimapolitik zu verstehen. Fischer-Kowalski, M.; Wien (2008)

Band 103+
Sozialökologische Dimensionen der österreichischen Ernährung – Eine Szenarienanalyse. Lackner, M.; Wien (2008)

Band 104+
Fundamentals of Complex Evolving Systems: A Primer.
Weis, E.; Wien (2008)

Band 105+
Umweltpolitische Prozesse aus diskurstheoretischer Perspektive: Eine Analyse des Südtiroler Feinstaubproblems von der Problemkonstruktion bis zur Umsetzung von Regulierungsmaßnahmen. Paler, M.; Wien (2008)

Band 106+
Ein integriertes Modell für Reichraming. Partizipative Entwicklung von Szenarien für die Gemeinde Reichraming (Eisenwurzen) mit Hilfe eines agentenbasierten Landnutzungsmodells. Gaube, V., Kaiser, C., Widenberg, M., Adensam, H., Fleissner, P., Kobler, J., Lutz, J., Smetschka, B., Wolf, A., Richter, A., Haberl, H.; Wien (2008)

Band 107+
Der soziale Metabolismus lokaler Produktionssysteme: Reichraming in der oberösterreichischen Eisenwurzen 1830-2000. Gingrich, S., Krausmann, F.; Wien (2008)

Band 108+
Akteursanalyse zum besseren Verständnis der Entwicklungsoptionen von Bioenergie in Reichraming. Eine sozialökologische Studie. Vrzak, E.; Wien (2008)

Band 109+
Direktvermarktung in Reichraming aus sozial-ökologischer Perspektive. Zeitlhofer, M.; Wien (2008)

Band 110+
CO_2-Bilanz der Tomatenproduktion: Analyse acht verschiedener Produktionssysteme in Österreich, Spanien und Italien. Theurl, M.; Wien (2008)

Band 111+
Die Rolle von Arbeitszeit und Einkommen bei Rebound-Effekten in Dematerialisierungs- und Dekarbonisierungsstrategien. Eine Literaturstudie. Bruckner, M.; Wien (2008)

Band 112+
Von Kommunikation zu materiellen Effekten - Ansatzpunkte für eine sozial-ökologische Lesart von Luhmanns Theorie Sozialer Systeme. Rieder, F.; Wien (2008)

Band 113+
(in Vorbereitung)

Band 114+
Across a Moving Threshold: energy, carbon and the efficiency of meeting global human development needs. Steinberger, J. K., Roberts, .J.T.; Wien (2008)

Band 115
Towards a low carbon society: Setting targets for a reduction of global resource use. Krausmann, F., Fischer-Kowalski, M., Steinberger, J.K., Ayres, R.U.; Wien (2010)

Band 116+
Eating the Planet: Feeding and fuelling the world sustainably, fairly and humanely - a scoping study. Erb, K-H., Haberl, H., Krausmann, F., Lauk, C., Plutzar, C., Steinberger, J.K., Müller, C., Bondeau, A., Waha, K., Pollack, G.; Wien (2009)

Band 117+
Gesellschaftliche Naturverhältnisse: Energiequellen und die globale Transformation des gesellschaftlichen Stoffwechsels. Krausmann, F., Fischer-Kowalski, M.; Wien (2010)

Band 118+
Zurück zur Fläche? Eine Untersuchung der biophysischen Ökonomie Brasiliens zwischen 1970 und 2005. Mayer, A.; Wien (2010)

Band 119+
Das nachhaltige Krankenhaus: Erprobungsphase. Weisz, U., Haas, W., Pelikan, J.M., Schmied, H., Himpelmann, M., Purzner, K., Hartl, S., David, H.; Wien (2009)

Band 120+
LOCAL STUDIES MANUAL
A researcher's guide for investigating the social metabolism of local rural systems. Singh, S.J., Ringhofer, L., Haas, W., Krausmann, F., Fischer-Kowalski, M.; Wien (2010)

Band 121+
Sociometabolic regimes in indigenous communities and the crucial role of working time: A comparison of case studies. Fischer-Kowalski, M., Singh, S.J., Ringhofer, L., Grünbühel C.M., Lauk, C., Remesch., A.; Wien (2010)

Band 122+
Klimapolitik im Bereich Gebäude und Raumwärme. Entwicklung, Problemfelder und Instrumente der Länder Österreich, Deutschland und Schweiz. Jöbstl, R.; Wien (2010)

Band 123+
Trends and Developments of the Use of Natural Resources in the European Union. Krausmann, F., Fischer-Kowalski, M., Steinberger, J.K., Schaffartzik, A., Eisenmenger, N, Weisz, U.; Wien (2011)

Band 126+
Masterstudium "Sozial- und Humanökologie": Selbstevaluation 2005-2010. Schmid, M., Mayer A., Miechtner, G.; Wien (2010)

Band 127 +
Bericht des Zentrums für Evaluation und Forschungsberatung (ZEF). Das Masterstudium „Sozial- und Humanökologie". Mayring, P., Fenzl, T.; Wien (2010)

Band 128+
Die langfristigen Trends der Material- und Energieflüsse in den USA in den Jahren 1850 bis 2005. Gierlinger, S.; Wien (2010)

Band 129+
Die Verzehrungssteuer 1829 – 1913 als Grundlage einer umwelthistorischen Untersuchung des Metabolismus der Stadt Wien. Hauer, F.; Wien (2010)