Swedish University of Agricultural Sciences
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Intercropping Strategies and Challenges in Cacao Production

– A Field Study in Juanjuí, Peru

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Preface and acknowledgement

This bachelor thesis is based on a Minor Field Study in Peru, financed by a scholarship from SIDA (the Swedish International Development Cooperation Agency) and administrated by the International Programme Office for Education and Training.

We have made this thesis as a part of a larger study carried out by ICRAF, the World Agroforestry Centre. ICRAF's objective was to find out how the organic certification scheme of cacao affects the farmers and the environment and to investigate the differences between cacao producers in the Peruvian and the Brazilian Amazon. The study was carried out in collaboration with the cacao cooperative ACOPAGRO in Juanjuí, Peru.

We would like to thank Kristina Marquardt; the staff at ICRAF, Peru especially Julio Ugarte-Guerra, Daniela Hirsch Soares and Marcelo Cunha; the staff at ACOPAGRO; and SIDA for making this study possible. Thanks also to Carin Emenius, Marine DesCamps and Adeline Paule for their great help when we first came to Peru and Juanjuí. Last but not least we want to direct a very special thank you to all of the farmers and key informants who agreed to be interviewed and without whom this study would have been unworkable.

Should you be interested in further reading about cacao in Peru and Brazil, we can recommend reading "Certificação Orgânica de Cacau: Contribuição Efetiva Para Meios de Vida e Ambiente Amazônico?" (Cunha, 2011) and "Livelihood and Transition to Certified Cacao Production in the Peruvian Amazonas - Gendered Responsibilities in Irazola" (Emenius, 2012).

Abstract

In the region of San Martín, Peru, deforestation has led to a loss of biodiversity and agro-diversity. Furthermore, coca cultivation was common in the area a few years back. The Peruvian government has promoted cacao as an alternative crop to coca, which has led to an intensification of the cultivation of cacao and to cacao being the most economically important crop today in the area of Juanjuí, San Martín. Therefore, the aims of this study have been to: (1) study in which ways cacao is being cultivated in the area of Juanjuí, (2) find out for what purposes the farmers intercrop their cacao, (3) find out what challenges cacao farmers are facing, (4) look into how the farmers handle these challenges, and (5) explore if there are any differences between organically certified farmers and farmers without organic certification. Interviews and Participatory Rural Appraisal techniques with cacao farmers and key persons at the cacao cooperative ACOPAGRO, in Juanjuí, were conducted in order to answer the aims.

The results showed that all of the farmers had planted shade trees in their cacao fields. Shade was also the most common reason to have other trees intercropped with cacao. However, most of the farmers also intercropped with trees for other purposes such as fertilizing effect, to restore the environment and to get wood and fruit for their families. Many different fruit- and timber tree species were used but some were more common than others, e.g. guaba, teak and mahogany. Many of the farmers also grew non-woody crops in their cacao fields, plantain/banana being the most common one. The main difference between newly established cacao fields and cacao fields in production was the occurrence of non-woody crops, which was higher in the newly established fields. Almost half of the species were grown systematically in the fields. The challenges that the farmers mentioned were lack of financial resources, uneven precipitation distribution, pests and diseases of cacao, transportation issues, lack of labourers and lack of knowledge about cacao cultivation techniques. The farmers had become members of ACOPAGRO to get access to credits and to achieve a higher price for their cacao. The droughts were handled by replacing dead plants and one of the farmers had bought irrigation systems. The farmers took several means against erosion and the fungal diseases and the pests were combated through both preventive methods and symptom treating methods. The lack of labourers for the harvest was handled through hiring day labourers and participating in the traditional labour-exchange system. There were two challenges that the farmers had not found any solutions to; how to handle flooding and how to solve the transportation issue.

The organically certified farmers got higher yields and a higher cacao price than the non-certified farmers. The organically certified farmers also bought more inputs and came up with more solutions to the challenges. There were two main factors that seemed to influence the cropping systems on farm level: the crops used for intercropping contributed to increase the cacao yield or gave the farmers extra income or products for own use.

ACOPAGRO most likely influenced the cropping systems since they distribute trees and give advice on managing cacao.

The farmers had a good idea of how to handle the challenges connected to cacao production. In many cases lack of financial resources limited the way of handling the challenges. With more financial resources the farmers could invest in more technique and inputs. This would in turn enhance the farmers' working conditions and increase the cacao yield.

Resumen

En la región de San Martin, Peru, la deforestación ha conducido a una pérdida de la biodiversidad así como de la diversidad agrícola. Además, el cultivo de coca era muy común en esta área algunos años atrás. El gobierno peruano ha promovido el cacao como una alternativa al cultivo de la coca, lo que ha conducido a una intensificación del cultivo de cacao hasta el punto de convertirlo en el cultivo de mayor importancia económica en el área de Juanjuì, San Martín. Es por eso que los objetivos de este estudio ha sido: (1) estudiar de qué manera el cacao es cultivado en el área de Juanjuì, (2) encontrar las razones por las que los agricultores intercalan sus cultivos de cacao, (3) encontrar cuales son los desafíos que enfrentan los agricultores de cacao, (4) observar como los agricultores afrontan y manejan estos desafíos, y (5) explorar si existen algunas diferencias entre los agricultores con certificación de producción orgánica y aquellos que no cuentan con esta. Entrevistas y técnicas de valoración rural participativa con los agricultores de cacao y con personajes clave en la cooperativa de cacao ACOPAGRO, en Juanjuí, fueron implementadas para dar respuesta a estas interrogantes.

Los resultados del estudio muestran que todos los agricultores tenían árboles de sombra en sus plantaciones de cacao. La obtención de sombra también fue la razón más común para tener árboles intercalados con el cacao. Sin embargo, la mayoría de los agricultores también intercalaron el cacao con los árboles para otros fines como la fertilización, la restauración del medio ambiente y para la obtención de madera y fruta para sus familias. Se utilizaron muchas especies de árboles diferentes, pero algunos árboles, tales como la guaba, la teca y la caoba, fueron más comunes que otros. Muchos de los agricultores también cultivaron otras especies no leñosas en sus plantaciones de cacao, siendo el plátano el más común. La principal diferencia entre las parcelas de cacao en crecimiento y las parcelas de cacao en producción fue la aparición de los cultivos no leñosos que fue mayor en las parcelas en crecimiento. Casi la mitad de las especies se cultivaron de forma sistemática en las parcelas.

Los desafíos que los agricultores mencionaron fueron la falta de recursos económicos, la distribución desigual de las precipitaciones, las plagas y enfermedades del cacao, los problemas de transporte, la falta de mano de obra y la falta de conocimiento sobre las técnicas de cultivo del cacao. Los agricultores se habían convertido en miembros de ACOPAGRO para tener acceso a créditos y lograr un mayor precio por su cacao. Las sequías se hicieron frente con la sustitución de las plantas muertas, y uno de los agricultores habían comprado sistemas de riego. Los agricultores tomaron varias medidas contra la erosión. Las enfermedades causadas por hongos y plagas fueron combatidas mediante métodos de prevención y el tratamiento de síntomas. La falta de obreros para la cosecha se manejó a través de la contratación de jornaleros y mediante la participación en el sistema tradicional de intercambio de trabajo.

Los agricultores con certificación orgánica obtenían un mayor rendimiento y un mayor precio por el cacao que los agricultores sin certificación. Los agricultores con certificación orgánica también pudieron realizar más inversiones y pensaron en más soluciones a los desafíos.

Fueron principalmente dos factores los que influenciaron los sistemas de cultivo en nivel de la granja: los cultivos utilizados para intercalarse contribuyeron al incrementar los rendimientos del cacao o para dar un ingreso adicional a los agricultores o bien para proveer productos de autoconsumo. ACOPAGRO probablemente influyo fundamentalmente los sistemas de cultivo dado que distribuyeron arboles y proporcionaron consejos sobre el manejo del cacao.

Los agricultores de cacao tenían una buena idea de cómo manejar los desafíos relacionados con la producción de cacao. En muchos de los casos la carencia de recursos financieros limitaba la manera en la cual los desafíos eran afrontados. Con más recursos financieros los agricultores podrían invertir en más tecnología e insumos. Esto a su vez conduciría a una mejora de las condiciones de trabajo de los agricultores y a un incremento de los rendimientos del cultivo de cacao.

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1 Introduction

Areas of cacao (*Theobroma cacao*) cultivation are expanding in the world, many times involving loss of forest and the number of species for intercropping are becoming fewer and fewer (Schroth and Harvey, 2007). Some of the reasons for deforestation in the region of San Martín have been production of coca leaves (*Erythroxylum coca*); small scale swidden farming for staple food crops such as maize (*Zea mays*); and large scale production of for example palm oil (Velarde et al. 2010). Fact remains that different land use systems affect biodiversity in different ways and today there are many threats to biodiversity. It is therefore important to investigate potential reasons for farmers to increase the biodiversity on the farms.

The cacao plant originates from the Amazonian region of South America (Afoakwa, 2010) and it has been cultivated in small scale by the indigenous people of Peru for a very long time. However, during the last decades cacao has been promoted by the Peruvian government as an alternative cash crop, instead of coca (Starn et al. 2005). This means that the production-oriented cultivation of cacao is a relatively new phenomenon in Peru. Therefore it is also interesting to investigate how important cacao is to the farmers, what challenges they meet in the new way of cultivating cacao and how they handle the challenges.

In the region of San Martín, Peru, swidden farming is the most common farming system (Marquardt et al. 2009). It is a system with phases of opening up fields in the vegetation, with slash and burn techniques, for cropping and phases of tree fallows in order to restore the soil fertility (Marquardt Arévalo, 2008). The deforestation in the region has led to a loss of biodiversity in terms of native flora and fauna (Schroth et al. 2004) as well as a loss of agro-diversity. In this context, agroforestry is interesting as a farming system as it is a more permanent way to farm. However, agroforestry and swidden farming do not have to be two separate things. In the area of San Martín agroforestry and swidden farming is often com-

bined (Marquardt Arévalo, 2008). In agroforestry systems the farmer mix cropping of annual crops such as beans and maize or perennial crops like cacao or coffee (*Coffea spp*.), with different tree species. The trees in an agroforestry system can for example be used for timber, fruit and nitrogen fixation (Padoch and De Jong, 1987) that contributes to the production. The trees may also help to preserve some of the biodiversity that otherwise would be lost. Since the mixture of trees and agricultural crops to a certain degree imitates the natural forest, agroforestry systems may be used as corridors for flora and fauna species so that they can move between fragmented areas of natural forest (Gascon et al. 2004).

Agroforestry systems have several advantageous qualities e.g. permanent land cover, constant addition of leaves and other plant material which serve as fertilization, root systems at different depths taking advantage of water and nutrients in different layers of the soil etc. (Marquardt pers. communication, 2011). This may in many cases help to enrich soils and to prevent soil erosion, compared to mono-cultural cropping systems (Ministry of Foreign Trade and Tourism Peru, 2007). Producing more than one crop on the farm will also give the farmer an opportunity to eat or sell various products. When producing various crops, a high yield of one crop may compensate for loss of yield of another crop, thereby the food security of the farmer household increases.

Cacao is a suitable crop to grow in agroforestry systems since it is a shade-tolerant plant which means that it can be grown underneath taller trees (Schroth et al. 2004). There are also different certifications for cacao cultivations, organic certification being one of them.

To investigate these issues this thesis treats two main subjects; intercropping strategies and challenges in cacao production in the area of Juanjuí, San Martín. The aims are:

1. to study in which ways cacao is being cultivated, e.g. together with which trees, with which crops and in what way,
2. to find out for what purposes the farmers intercrop their cacao in order to understand which factors that influence cropping systems at farm level,
3. to find out what challenges cacao farmers in the Juanjuí area are facing,
4. to look into how the farmers handle these challenges, and
5. to explore if there are any differences between organically certified farmers and farmers without organic certification, concerning aim 3 and 4.

2 The study area

2.1 Climate and agriculture in Juanjuí

Peru encompasses three country-parts with very different climates; costal, mountainous and tropical climate (Nationalencykolpedien, 2011). Juanjuí is a town in the region of San Martín, situated in the northern and tropical part of Peru, see Figure 1. The town is situated at about 350 meters above sea level and has a yearly

Figure 1. Map of Peru and the provinces surrounding the town of Juanjuí. Included is also the city of Pucallpa where ICRAF has its research station and the capital of San Martín, Tarapoto. Source: Revision of maps from ACOPAGRO and Flickr.

average temperature of 26.6 ºC (annual average for the period 1955-1990). The average amount of rainfall per year is 1433 mm (annual average for the period 1945-1990) (World Climate, 2011). This is a tropical rainforest climate (Nationalencykolpedien, 2011).

In Figure 2 the economically most important crops for the farmers in the province of Mariscal Caceres, where Juanjuí is situated, are presented. In the year 2000 plantain/banana and rice were the most economically important crops according to the data from the Ministry for Agriculture (2011). During 2005, cacao and plantain/banana were the economically two most important crops. Since then, the economic importance of cacao has increased and surpassed all the other crops. The economic importance of coffee has also increased and in 2010 cacao and coffee were the two most important crops. Plantain/banana and cassava are staple food in the area and are not exported to other countries. Other important staple foods for the families are rice, beans and maize (Sánchez Macedo pers. communication, 2012).

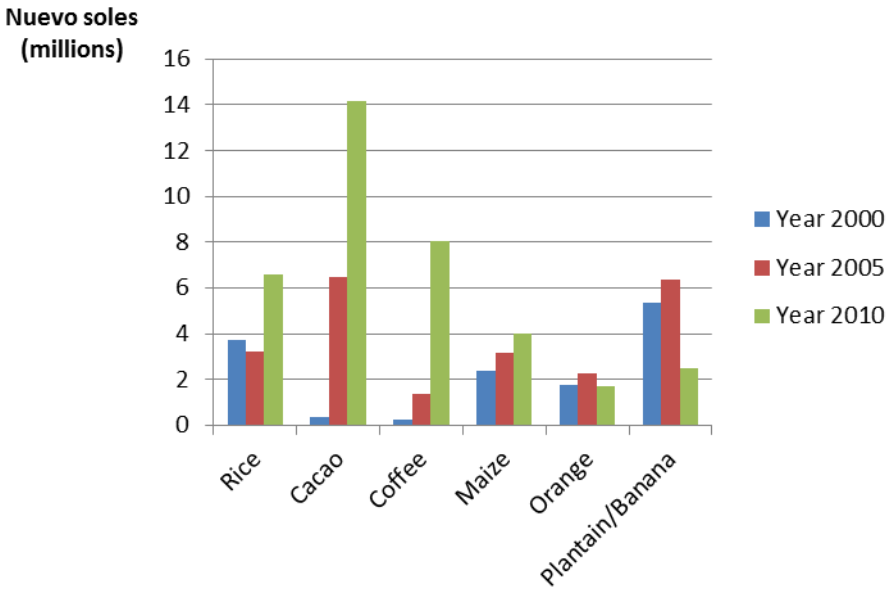

Figure 2. Economic importance of crops, calculated through multiplying the yield per year by the price per kilo, paid to farmers. Statistics received from the Ministry of Agriculture's office in Juanjuí (Ministerio de Agricultura, 2011).

Before today's cacao dominated agroforestry system in some parts of Peru, many farmers depended on the production of coca (ICRAF, 2009). This does however not show in the statistics from the Ministry of Agriculture. In the 1980´s the Hual-

laga valley, where Juanjuí is situated, turned into the world's most important coca producing area and moreover Peru's most violent region with guerillas, drug mafias, and corruption (Starn et al. 2005). However, in some parts of the country coffee and cacao has now replaced coca as the most profitable cash crop (ICRAF, 2009). This change is a consequence of the Peruvian government's anti-drug campaign (Starn et al. 2005).

2.2 Cacao production

In total, South America stands for 14 per cent of the world production and the main cacao producers in South America are Brazil and Ecuador (ICCO, 2010).
Out of the approximately 40 000 hectares of cacao grown in Peru, the main part is found in the regions of the Eastern Andes, where Juanjuí is situated. More and more of the cacao production is becoming certified as organic due to the increasing demand for organic cacao on the world market (ICCO, 2010). This change is notable also in Peru where organic cacao is becoming an increasingly important export crop (Ministry of Foreign Trade and Tourism Peru, 2007).

Box 1. Cacao facts

- Peru provides for one per cent of the total world consumption of cacao (Ministry of Foreign Trade and Tourism Peru, 2007).
- The organic cacao production is 0.5 per cent of the total world production (ICCO, 2010).
- Peru is the world's 13th largest producer of cacao, but at the same time the world's second largest exporter of organic cacao (Ministry of Foreign Trade and Tourism Peru, 2007).

The canopy of a cacao tree will not close for one to three years after the establishment (Orwa et al. 2009). Hence, food-crops have traditionally been intercropped with cacao during the first years. In places such as West Africa, Ecuador and Jamaica common crops for intercropping with cacao are maize, cocoyam, yams and

plantain (Orwa et al. 2009). In Figure 3 a seven years old cacao tree in production can be seen.

Figure 3. Cacao tree with fruits. Photo by Linnea Persson and Hanna Johansson

2.3 The cacao cooperative ACOPAGRO

ACOPAGRO is a cacao cooperative in the region of San Martín, with its office in Juanjuí. It was founded in 1997 (ACOPAGRO, 2012 a) in order to secure an organized commercialization of cacao to its members and to give advice about good practices and cultivation of cacao (Sánchez Macedo pers. communication, 2011). Today the cooperative has about 2000 members (ACOPAGRO, 2012 a). Approximately 800 of the members are certified by the organic certifier Bio Latina (Sanchez Macedo pers. communication, 2011), and some of the members are certi-

fied by Rainforest Alliance, Fair Trade, Bio Suisse and UTZ (ACOPAGRO, 2012 b). The main reason for providing these certifications is so that the members can get a better price for their products and a healthier environment (Sánchez Macedo pers. communication, 2011).

ACOPAGRO also has a project for reforestation, led by a French organization called PUR PROJET. The organization initiates and finances reforestation projects for carbon capturing reasons. They also pay for trees that the members of the cooperative are given to plant. Which tree species that are planted on the farms is decided through a gathering of farmers and technicians from ACOPAGRO, collectively discussing which species should be grown in their agroforestry systems. The technicians take into consideration economy, suitability to the local environment, growth rate etc. when picking out the trees, while also consulting the producers (ACOPAGRO, 2011).

PUR PROJET pays the farmer 1 PEN (0.37 USD), annually, for each tree planted, as well as covering the transportation cost and paying 0.50 PEN (0.185 USD) to ACOPAGRO for technical advice in the fields (Sánchez Macedo pers. communication, 2011).

According to Bio Latina, cacao farmers have to take actions to save the native flora and fauna on their farms in order to get the organic certification for their cacao beans. The farmers should try to establish integrated agricultural systems, preferably by also having trees, bees and/or fish on their farm (Bio Latina, 2012).

3 Materials and methods

This case study was carried out during May 2011 in the town of Juanjuí, Peru. The fieldwork was made in collaboration with ICRAF (the World Agroforestry Centre). ICRAF has a long experience of working with cacao related issues and chose to collaborate with ACOPAGRO in this study since ACOPAGRO has had organic certification since the year 2002 (Sánchez Macedo pers. communication, 2011).

The fieldwork was made as a qualitative study and was conducted through interviews and two Participatory Rural Appraisal methods with cacao farmers and key informants working at ACOPAGRO. Four of the farmers' farms were also visited to get deeper understanding of the cacao production systems. The interviews were made with the help of questionnaires and were conducted at the farmers' homes, at the office of ACOPAGRO, or in connection to village meetings. The interviewees were selected by using the snowball technique and by farmers coming to the office of ACOPAGRO in other errands and then volunteering for an interview. The key informants were selected because they had a lot of knowledge of the cooperative and of cacao cultivation in the area.

Two different questionnaires were used; one for farmers and one for key informants at ACOPAGRO. In total 24 interviews were made (Table 1). Half of the farmers interviewed had organic certification and half of them had not. Three of the farmers were women and the other eighteen were men. The questionnaires used for the interviews were developed in collaboration with ICRAF, and in this thesis the questions related to the aim of the thesis have been evaluated.

The questionnaire for the key persons at ACOPAGRO covered subjects such as trade agreements, the cooperative's purpose and targets, general conditions and difficulties for cacao cultivation and information about the organic certification of Bio Latina, (for the questionnaire see Appendix 1).

Table 1. Number of interviews, farm maps and farm visits made in the study

	Number of interviews	Number of farm maps	Average time per interview	Number of farm visits
ACOPAGRO key informants	3	0	30 min – 4 hours	0
Organic farmers [1]	10	10	2 hours	4
Non-organic farmers [2]	11	11	1 hour	0
TOTAL	24	21		4

[1] In total ACOPAGRO had approximately 800 organically certified members.

[2] In total ACOPAGRO had approximately 1200 farmers without organic certification.

The questionnaire for farmers consisted of questions concerning production of cacao, intercropping, economics, organic certification and challenges related to cacao production, (see the questionnaire in Appendix 2). The set of questions concerning organic certification was asked exclusively to the certified farmers. Some of the questions had a number of alternative answers, while others were open for the farmers to freely formulate their answers. During the interviews two Participatory Rural Appraisal methods were used to facilitate the communication: farm maps and rankings. Each interview with a farmer began with the farmer drawing a map of his/her farm. The farmers were asked to draw each of their cacao fields, including which trees and crops were grown and how they were distributed in the fields (for one of the farmers' farm map, see Appendix 3). In the farm maps the farmers also gave additional information on the specific systematics of growing the trees, e.g. the distances between the trees. During most of the interviews one of the interviewers asked the questions while the other one took notes.

As a complement to the interviews, four farms were visited. During the farm visits, the farmers showed their fields and explained how their fields were organized and for what reasons. Hence, the farm visits gave more detailed information on the farmers' strategies for their cacao production and on the systematics of the non-woody crops.

The farmers and the key persons at ACOPAGRO were given the option to stay anonymous. Therefore the farmers have been named Farmer 1, 2, 3 etc. in the thesis. One of the key persons, the chief technician at ACOPAGRO, Diofanto Sánchez Macedo chose not to be anonymous. The other key informants were farmers who were elected representatives of the cooperative. Since their answers were sometimes concordant with the answers from the interviewed farmers and

sometimes with Sánchez Macedo, their answers have not been used in order to avoid misinterpretations.

The collected data was analyzed by comparing answers on the questions in the questionnaires and farm maps with the taped recordings of the interviews and notes taken during the interview occasions. Further, the answers from each question were compiled in different categories and written down in tables in order get an overview of the answers. The categories were in some cases already given by the questions i.e. those questions that were phrased in such a way that the farmers should choose among certain alternatives. In those cases the answers could be phrased more openly, the categories were identified by the authors as themes that developed during work.

The materials used for this case study were the following:
• Dictaphone
• Questionnaires
• Writing material
• Material for drawing farm maps
• Camera
• Spanish/Swedish dictionary

4 Results

In total the average production of cacao at ACOPAGRO was 2700 tonnes per year and the average size of cacao fields at the farms of the cooperative was 2.43 hectares (Sánchez Macedo pers. communication, 2011). On average the farmers interviewed cultivated cacao in 25 per cent of their total area. Except from cacao, the farmers had other fields with e.g. vegetables and fruits and many farmers also had some natural forest on their farms.

The members of the cooperative sell their unprocessed cacao beans to ACOPAGRO. The cooperative has *acopios*, which are sites where the members gather their newly harvested cacao beans for fermentation, drying and packing, see Figure 4. The newly harvested cacao beans are poured into the uppermost boxes and get covered with tarpaulin to start the fermentation. After a day or two, the cacao is moved to the box below for further fermentation, and so on until it has reached the box at the bottom. Thereafter the cacao beans are spread out on a tarpaulin to dry in the sun. Every second hour the beans are turned over to dry evenly. After about eight days of fermentation and five days of sun-drying, the cacao beans are packed in sacks and sent to the main warehouse of ACOPAGRO, situated in Juanjuí and from there, the beans are exported to chocolate producing countries, mainly in Europe and to the USA (ACOPAGRO, 2012 c). The *acopios* can be found in almost each village where the members live. Most of the farmers who were interviewed did not live at their farm but either in the town of Juanjuí or in one of the villages in the district where ACOPAGRO works. The farms with the cacao fields were, in many cases, situated in remote areas.

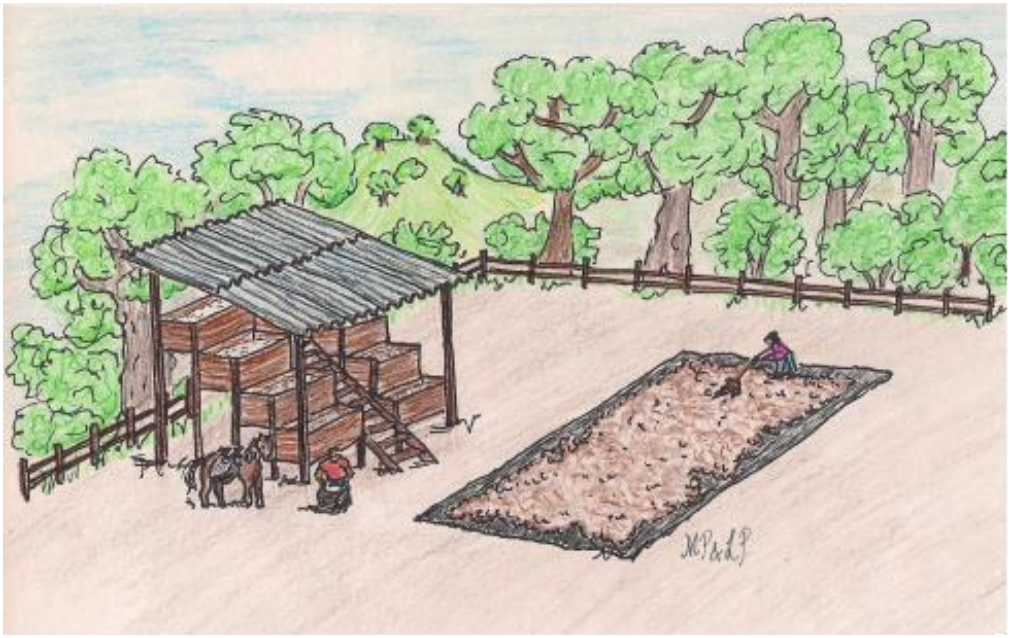

Figure 4. A picture of an *acopio*. (Drawing by Malin Persson and Linnea Persson)

4.1 Intercropping strategies for cacao in the area of Juanjuí

Author: Hanna Johansson

This section focuses on the farmers' strategies and reasons for intercropping. First, some information on cacao cultivation and the extent of intercropping is presented. The following paragraphs treat the species and systems used for intercropping, the purposes of intercropping and lastly, the farmers' alternatives to cacao production.

According to Sánchez Macedo, chief of the technicians' department at ACOPAGRO, the general recommendation from the cooperative is that the members should have 50 per cent shade for the cacao trees. He also meant that cacao in extended complex agroforestry systems[1] is the most common cultivation system used by the cooperative's members. According to ICRAF's definition of agroforestry systems used in the questionnaire, additional tree species other than cacao

[1] Extended complex agroforestry systems are systems with multiple species of trees where trees are grown together with herbs and other plants to make the system resemble primary or secondary forests (Micon et al, 1992).

are required. The results from the interviews with the farmers show that the average size of the interviewed farmers' area of cacao fields was 3.1 hectares (Table 2). Table 2 also presents the farm size and the number of cacao trees per hectare and how they varied.

Table 2. Data on farm size, area of cacao and number of cacao trees per hectare.

	Min. value	Average value	Max. value
Farm size (hectares)	1	10	30
Area of cacao (hectares)	1	3.1	5.5
Cacao trees/hectare	349	1030	1667

Six of the farmers only had cacao fields on their farms. The others had, however, also fields with other crops such as maize (*Zea mays*), beans (*Phaseolus spp*.), plantain/banana (*Musa spp*.), cassava (*Manihot esculenta*), citrus trees and pasture. Some also had fields in fallow and fields for timber tree production. The farm maps showed that all of the farmers used extended complex agroforestry systems with multiple species of trees on their farms. Three of the farmers however, had one cacao field each which did not classify as an agroforestry system, since these fields were only intercropped with non-woody crops such as cassava, maize and plantain/banana, and not with trees.

The age of a cacao tree impacts the intercropping strategy. Among the ACOPAGRO associates the oldest cacao trees are today 30 years old and no cacao tree has been removed because of age (Sánchez Macedo, 2011). This means that the trees are productive for a long time. However, in the beginning of a cacao tree's lifecycle it will not produce any fruit. It takes some years before the cacao tree matures and starts to produce fruit. How many years it takes vary between different places and different conditions. In this study a distinction has been made between newly established fields and fields in production, for analytical reasons. Newly established fields are defined as fields up to two years of age, and fields in production as fields with more than two years of age. The farmers in this study together had 13 newly established fields and 36 fields in production.

When a cacao tree is young and small the shade needed can be provided by plants such as cassava or maize etc. Older cacao trees are usually five to ten meters tall and will need shade from taller plants such as trees (Orwa et al. 2009).

4.1.1 Species for intercropping and agroforestry

In order to know which plants the farmers intercropped with their cacao, they were asked which plants they grew together with cacao in the fields and during the field visits, different crop combinations were also observed. Figure 5 shows the non-woody crops intercropped with cacao.

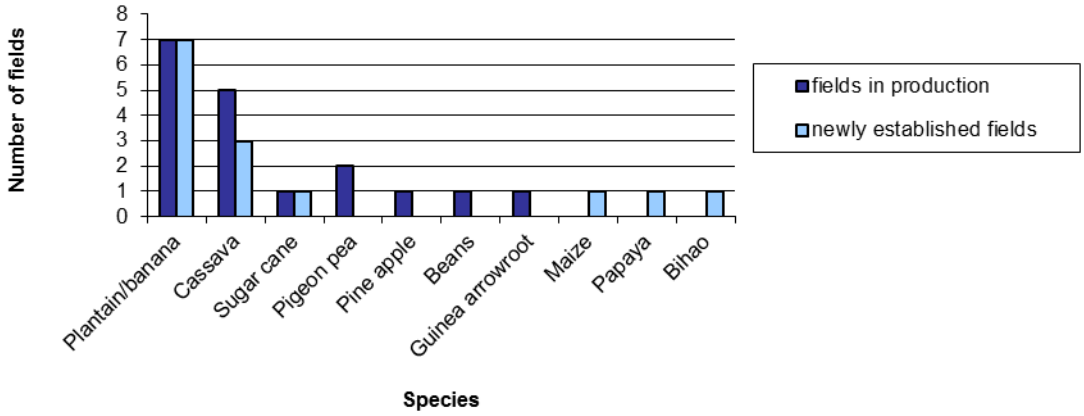

Figure 5. The non-woody crops mentioned by the farmers and observed in both newly established fields and in fields in production.

The most common non-woody crop used by the farmers for intercropping with cacao was plantain/banana followed by cassava. Some of the non-woody crops were only grown in newly established fields; maize, papaya (*Carica papaya*) and *bihao* (*Heliconia cannoidae*). Others were only grown in fields in production; pigeon pea (*Cajanus cajan*), pineapple (*Ananas comosus*), beans and guinea arrowroot (*Calathea allouia*).

The non-woody crops in Figure 5, like plantain/banana, cassava, sugar cane (*Saccharum officinarum*), pigeon pea etc. were grown as staple food or for fruit and refreshment for the farmers' families and/or for sale. *Bihao* however, is a plant with big leaves that are used for wrapping typical Peruvian dishes like *tamal* and *juane* (Farmer 1).

The timber species most commonly used in newly established fields was teak (*Tectona grandis*), while mahogany (*Switenia macrophylla*) was most common in fields in production (Figure 6).

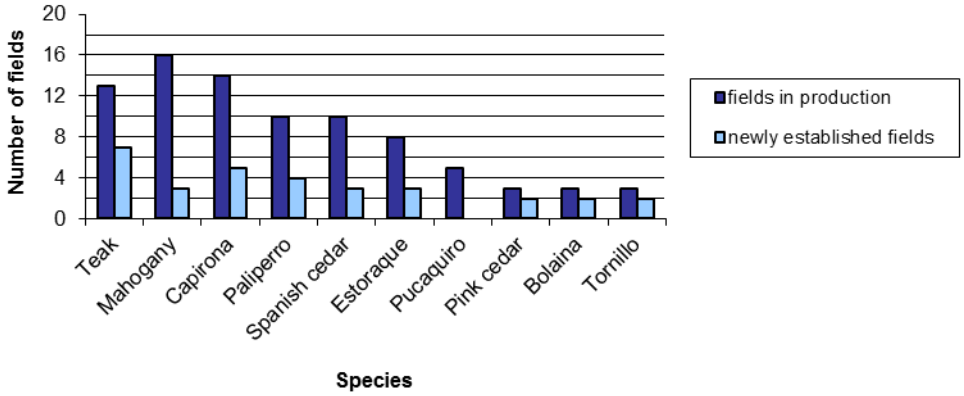

Figure 6. The timber species most mentioned by the farmers in both newly established fields and in fields in production.

Figure 7 shows the fruit trees most commonly grown in the cacao fields. Guaba (*Inga edulis*) was the most common fruit tree planted. Both guaba and *shimbillo* (*Inga spp.)* are members of the same plant genus and are nitrogen fixing trees (Staver, 1989). Figure 7 also shows that fruit trees seemed to be more common in fields in production than in newly established fields.

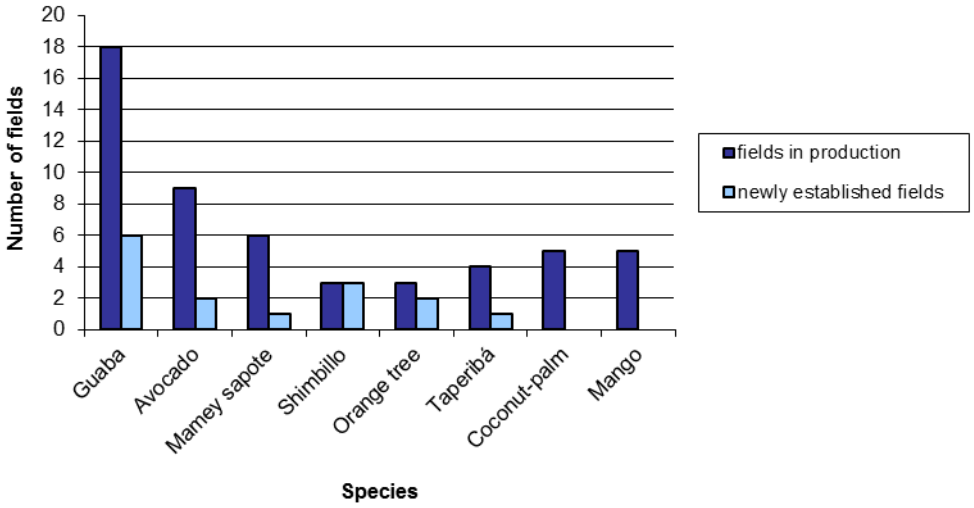

Figure 7. The fruit tree species most mentioned by the farmers in both newly established fields and in fields in production.

When comparing the timber and fruit trees in Figures 6 and 7, it is evident that guaba was the overall most common tree species in the fields. However, this does not imply that guaba was most common in terms of number of trees in the fields. It simply means that it was the tree species found in the most number of fields.

The results from Figures 5, 6 and 7 show that plantain/banana and teak were the species most commonly used for intercropping with cacao in newly established fields. In fields in production, trees were more commonly grown than non-woody crops. Except for the non-woody crop plantain/banana, trees were also more common in newly established fields.

A list of all species mentioned by the farmers, with the plant names in Spanish and Latin, and in some cases in English, can be found in Appendix 4. This full list also shows that there was a bigger diversity among the trees than the non-woody crops.

4.1.2 Systems for growing non-woody crops and trees

By visiting the farmers' fields and from analyzing the farm maps it was possible to see that some species were grown systematically within the fields; along field boarders or in rows, while other species were grown randomly. For a list of all trees and non-woody crops the farmers grew systematically on the cacao fields and how they were grown, see Appendices 5 and 6. Attached is also an original farm map made by Farmer 2 (see Appendix 3).

The non-woody crops seemed to be grown mainly for household consumption and not in any greater amount. Farmer 10, for example, had some pineapple plants and cassava in parts of the fields in production, and a few sugar cane plants and different fruit trees dispersed seemingly randomly in the fields. The timber trees were grown with a distance of ten meters from each other throughout the fields in production and along the borders. Avocado (*Persea Americana*), guaba and peach palm (*Bactris gasipaes*) were also planted at 20*30 meters, covering both of the fields in production. Within the newly established field plantain/banana plants were grown in rows, in the spaces between the cacao plants. A schematic farm map of farmer 10's fields can be seen in Figure 8, below.

Another farmer also had a newly established cacao field where one specimen of *bihao* and a few papaya and plantain/banana plants were grown randomly. In this field, trees i.e. *huayruro* (*Ormicia cocconea*) and *bálsamo* (*Myroxylon toloiferum*), were grown systematically along the boarders and *bolaina* (*Guazuam sp.)* and guaba were evenly distributed among the cacao trees. This farmer also

had a cacao field in production where guaba was evenly distributed all over the field and mahogany over half of the field. There were also other timber and fruit species planted all over the field but no non-woody crops.

On the third farm visited, non-woody crops could not be seen, and the farmer did not mention having this within the cacao fields. Timber species were grown around two boarders of the fields, with a distance of three meters. In the newly established field guaba was grown systematically among the cacao trees. In the field in production different fruit and timber species were grown randomly.

27 species out of all the species the farmers mentioned during the interviews and farm visits were grown systematically. Some of these were grown around field boarders and some were grown throughout the field. The species most commonly grown on field boarders was teak. Other species commonly grown along boarders were mahogany, *capirona* (*Calycophyllum sp*.) and Spanish cedar (*Cedrela sp*.). The species most commonly grown systematically throughout the fields were plantain/banana, mahogany and guaba. There was also a difference between fields in production and newly established cacao fields. Guaba and mahogany were the species most commonly grown in a systematic manner within fields in production, while teak and plantain/banana were most common within newly established fields.

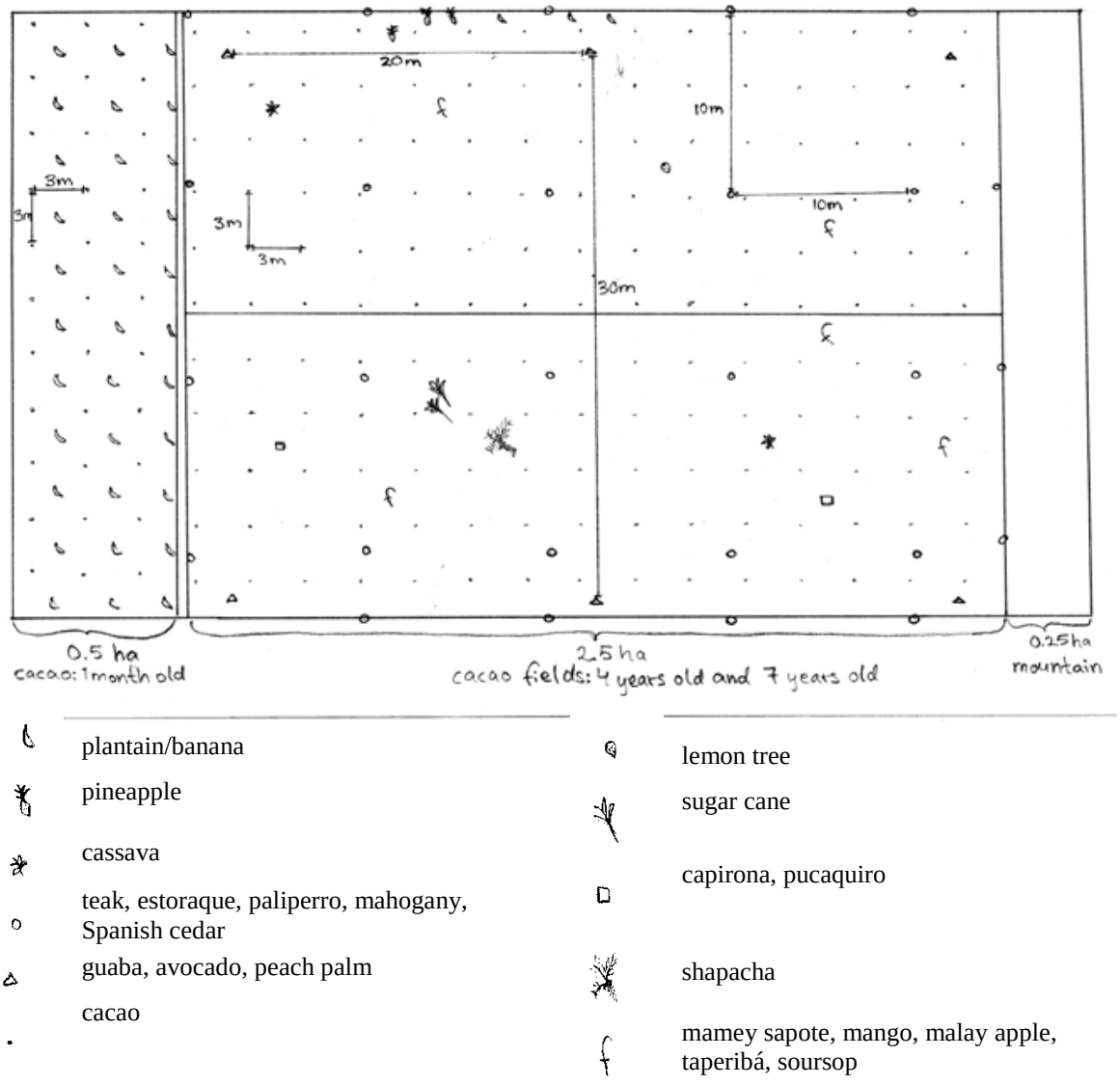

Figure 8. Schematic farm map.

4.1.3 Purposes of intercropping with trees

To understand why farmers choose to intercrop, two relating questions were asked. The farmers interpreted the question "why have you chosen these species?" (number 29 in the questionnaire) in two different ways, hence two types of answers came. One of reasons for choosing to grow trees within the cacao fields, in general, and one for reasons why the farmers chose to grow certain tree species.

The nine last categories of reasons, in Figure 9, are answers to why the farmer chose certain tree species in the fields.

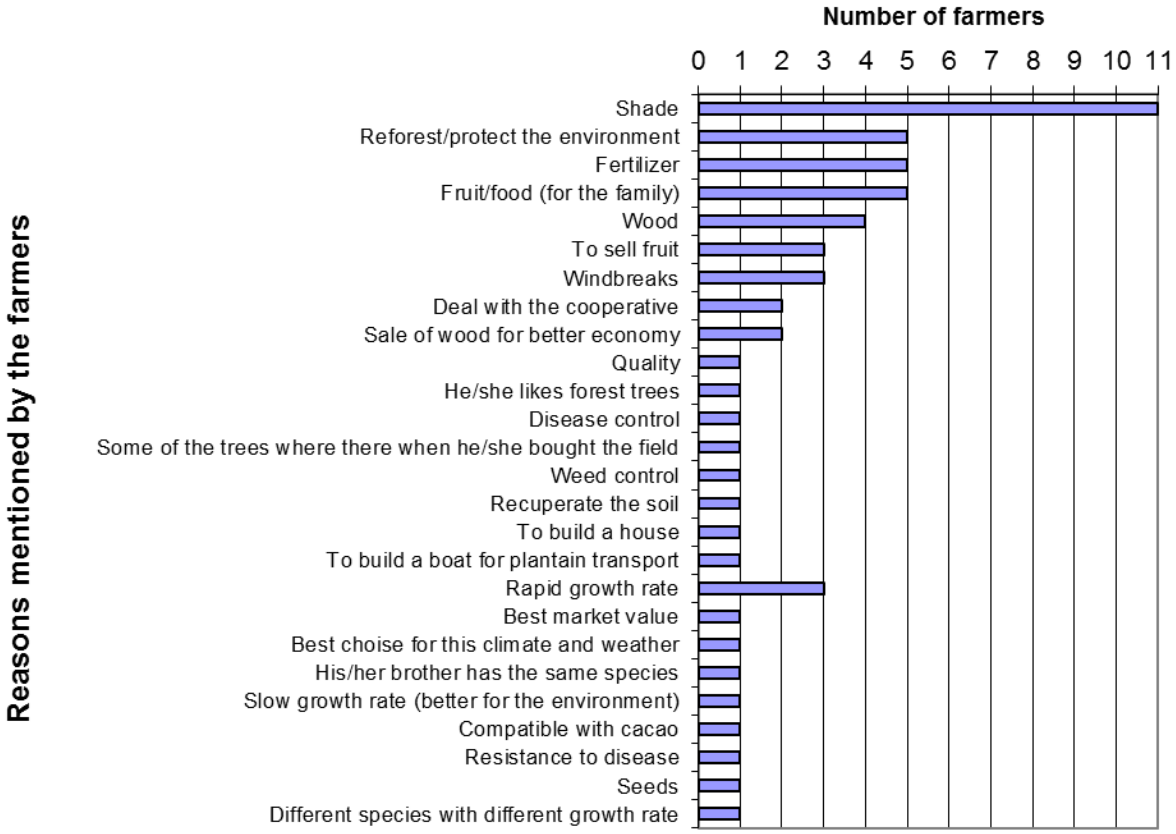

Figure 9. A summary of the farmers' answers to question 29, "Why have you chosen these species?" It shows the purposes (divided into categories) the farmers mentioned. It also shows how many farmers that mentioned each reason.

As can be seen in Figure 9, most farmers mentioned that they plant trees to get shade for their cacao. Five farmers said that a reason for planting trees is to get fertilizer for the cacao, to reforest and protect the environment by the sequestration of carbon and five also mentioned the reason to produce fruit and food for the family. One farmer said that he grows certain trees in order to obtain seeds which then are sold. Others mentioned choosing species with rapid growth rate. One farmer meant that he chose species with slow growth rate, which is better for the environment in his opinion.

In question 31 (Appendix 2) , “The planting of other species within the cacao field has the main purpose of generating? (in order of importance)”, the farmers were asked to rank five reasons for intercropping trees with cacao (see the five bars to the left in Figure 10). They were also given the opportunity to add other reasons to the ranking (see the five bars to the right in Figure 10).

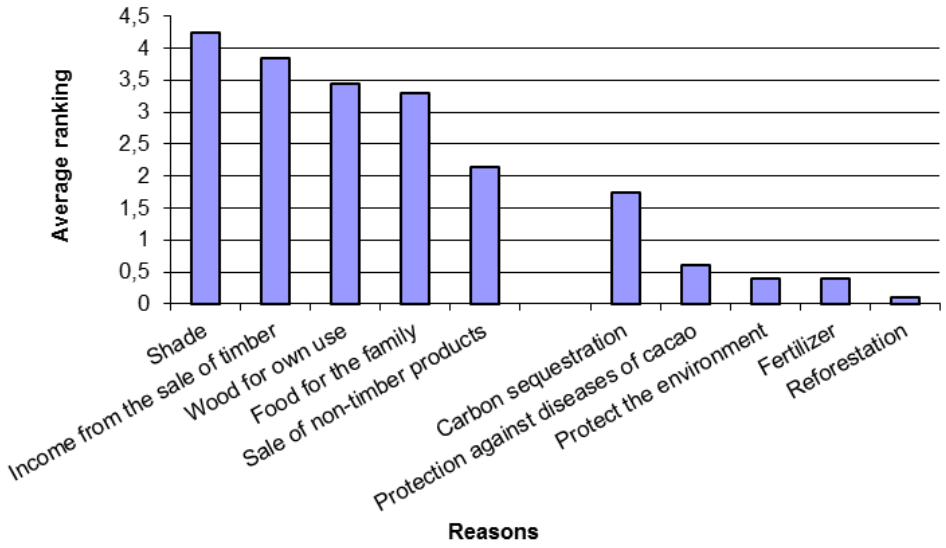

Figure 10. The average scores of how the farmers ranked each reason for planting other species within the cacao fields, in relation to the other reasons.

Figure 10 shows that “shade” and “income from the sale of timber” were the most important reasons for intercropping with trees. Five out of 20 farmers ranked “shade” in first place. Seven out of 20 farmers mentioned “carbon sequestration” as a reason and two of them ranked this as the most important one. Farmer 12 included “protecting the environment” as a reason, motivated by “If there are no trees, there is no life”.

Sánchez Macedo was also asked to make a ranking of the reasons of why he thought the members of ACOPAGRO intercrop cacao. For his ranking and the species he mentioned as being used by the cooperative’s members for each purpose, see Table 3. He also ranked shade as the most important reason for intercropping with trees. Otherwise there is a difference between his ranking and the farmers’ ranking. The reason he added when asked for other reasons was “mulch”.

Table 3. Ranking of reasons for having other trees within the cacao fields, by Sánchez Macedo.

Rank	Reason	Species used for each reason
1	Shade	*Capirona*, Spanish cedar, *Machonaste*, *Paliperro*, Cassava
2	Sale of non-timber products	Guaba, Mamey sapote, Plantain/Banana
3	Income from the sale of timber	*Capirona*, *Paliperro*, Spanish cedar
4	Mulch	Guaba, Mamey sapote, *Capirona*
5	Food for the family	Plantain/Banana, Pigeon pea, Cassava
6	Wood for own use	*Capirona*, *Paliperro*, *Machonaste*

4.1.4 Alternatives to cacao?

In order to estimate the importance of cacao in the area, the farmers were also asked about possible alternatives to their cacao production. Most farmers said that there were no other crops they could grow to obtain the same income they got from cacao (Figure 11). If not for cacao, they would grow crops such as coffee (*Coffea spp.)*, maize and cotton (*Gossypium spp*.), but get less income. However, four farmers said they would grow coca to receive the same income, two would grow coffee and others would have pig production (Figure 11).

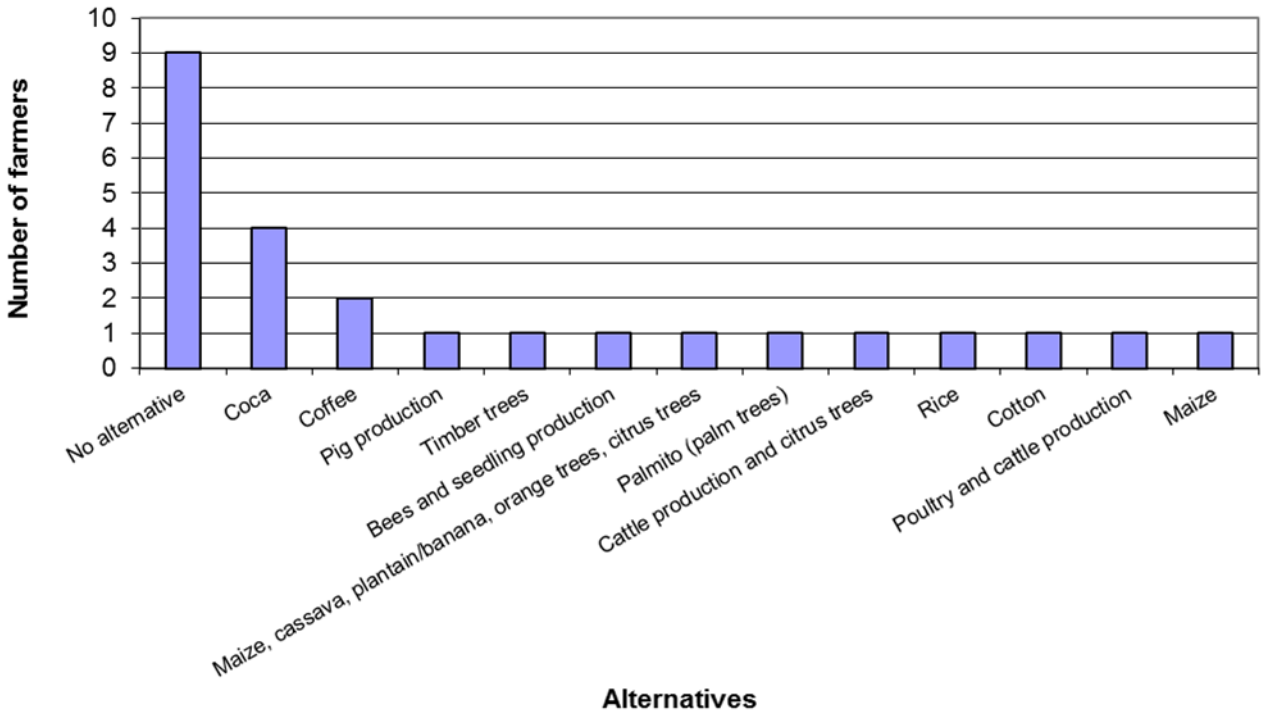

Figure 11. The farmers' answers to the question "If you wouldn't grow cacao, which other activities or which crops would you have to grow, in order to obtain the same income?

4.2 Challenges in cacao production and how the farmers solve or mitigate them

Author: Linnea Persson

This section focuses on the cacao farmers' challenges, connected to cacao production. In the first paragraph the farmers' reasons to start growing cacao and the advantages connected to cacao production are presented. In the following five paragraphs, the challenges with cacao production and the farmers' ways of mitigating and solving them are presented.

4.2.1 Cacao's potential to solve or mitigate challenges

One of the most common reasons to start growing cacao was that the farmers wanted to, or had to stop growing coca (Farmer 1, 6, 7, 9, 10, 14, 15 and 19). The farmers wanted to get a peaceful life through working with something legal and they also wanted to be left alone by the coca mafia in the region (Farmer 6, 9, 14 and 15). For this reason they had to find a new crop to grow.

When deciding which crop they should grow the price for the product was, for many farmers, the most important criteria (Farmer 1, 3, 6, 8, 9, 10, 21, 4, 5, 12, 13, 18, 19 and 20). As mentioned in paragraph 4.1.4 "Alternatives to cacao?" some of the farmers saw cacao as the single most profitable crop, while others meant that they could achieve the same income from other activities such as growing coffee or breeding pigs. Connected to the economical factor, the potential of improved life quality was also an important criterion when the farmers decided which crop they should grow (Farmer 2, 6, 8, 10, 21, 4, 5, 13, 18 and 19). With a better income the farmer families could eat more variable food (Farmer 10, 5), build a more comfortable home (Farmer 10) and buy more clothing and consumables (Farmer 17). A higher income also makes it possible for the farmers to afford a longer education for their children (Farmer 13 and 17).

Since cacao is a perennial crop that gives harvest each month, all year around, it gives a regular income unlike annual crops such as rice or maize, which are harvested once or twice a year (Farmer 20). Another benefit of growing a perennial crop like cacao is the fact that when the field is established the workload is less compared to annual crops (Farmer 15). Even though the establishment of a cacao field requires a lot of hard work, cacao was considered to require less work than annual crops in the long run. Two of the farmers also mentioned that they appreciated that the work in the cacao field is quite easy so that the whole family

can help out in the cacao fields, both men, women and children (Farmer 13 and 18).

Except from the legal, economical and practical reasons, three of the farmers explained that one of their main reasons to start growing cacao was to become a member of ACOPAGRO, to be able to take part of the members' benefits (Farmer 2, 4 and 18). Examples of ACOPAGRO's member's benefits mentioned by the farmers were a higher price for the cacao beans and a possibility to get credits and access to technical advice.

4.2.2 Financial resources

Lack of financial resources was mentioned as a difficulty by five of the farmers (Farmer 1, 7, 8, 12 and 17). When the farmers start to grow cacao the expenses are big and the income from the cacao field is small (Farmer 8 and 12). The cacao starts to produce after about two years. During these first years the only income from the cacao field is earned by selling products from shade crops, such as banana and papaya and from e.g. vegetables grown in between the cacao plants in the cacao field (see paragraph 4.1.1). The labour and the equipment used for weeding were considered to be costly and buying new technique to improve the harvest cost a lot of money (Farmer 7, 17). In Table 4, the inputs that were most common to buy for the establishment and maintenance of the cacao fields during the year 2010 are listed.

Transportation by horse or by *motocar* was bought by 13 of the farmers and was thereby the most common thing to buy. Other common products bought during the year 2010 were plastic bags and sacks, fuel, and fertilizer. The plastic bags were used for the nursery-gardens where the farmer families grew plants of cacao and other trees to plant in their cacao fields and the sacks were used for transportation of cacao. The fuel was used for brush cutters to cut weeds and for *motocars* to transport cacao beans from the field to the *acopio* (Farmer 10, 11 and 20). There were more organically certified farmers than non-certified farmers who bought organic fertilizers. However, neither certified nor non-certified farmers bought non-organic fertilizers.

The most expensive products to buy were irrigation systems, compost and waste disposal facilities and brush cutters. Only a few farmers invested in these products. However, some farmers rent a brush cutter instead of buying one, as this equipment was quite expensive and thereby a larger investment for the farmer to make. Four of the farmers rented their brush cutter, while two had bought a brush cutter of their own. One of the farmers did not buy anything connected to the ca-

cao production. For some more common products bought by the farmers, see Table 4.

Table 4. Products connected to cacao production, bought 2010. Number of farmers, organically certified and non-certified respectively, and how much they spent on each kind of input. The variation, if there was any, is shown within brackets.

	Number of farmers		Invested money (PEN)		Invested money (US-dollar)	
	Certified	**Non-certified**	**Certified**	**Non-certified**	**Certified**	**Non-certified**
Irrigation	1	0	7000	-	2590	-
Compost/ waste disposal	1	2	30	3000	11	1110
Buy brush cutter	1	1	1900	1550	703	574
Fuel	8	4	318 (21-790)	1865 (12-7320)	118	690
Rent brush cutter	2	2	750 (100-1400)	690 (300-1080)	278	255
Horse	2	1	650	700	241	259
Fertilizer	6	2	489 (96-1200)	700 (100-1300)	181	259
Transport	8	5	320 (18-1440)	564 (100-1500)	118	209
Scissors	2	4	286 (122-450)	144 (85-240)	106	53
Cacao plants	1	0	200	-	74	-
Machetes	4	1	31 (20-50)	100	11	37
Organic pesticides	2	0	75	-	28	-
Plastic bags/ sacks	5	7	32 (16-60)	71 (100-2500)	12	26
Seeds	2	4	41 (32-50)	22 (16-28)	15	8
Nothing	0	1	-	0	-	0

When dividing the sum of all the bought products by the number of organically certified and the non-certified farmers respectively, each organically certified farmer bought products for 2106 PEN on average while the non-certified farmer bought products for 2052 PEN on average. Thus, the organically certified farmers spent on average 54 PEN more than the non-certified farmers during the year 2010.

Getting bank credits or other kinds of economic help can be difficult for farmers in the area of Juanjuí (Farmer 1 and 12). Therefore it is attractive that the farmers who have been members of ACOPAGRO for six months or more can get credits up to 10 000 PEN from the cooperative. To become a member of ACOPAGRO, the farmer family must (1) have one and a half hectares of cacao or more, (2) sell all their cacao to ACOPAGRO and (3) participate in meetings and educative events arranged by the cooperative. In addition, the farmers have to pay a registration fee of 50 PEN and a monthly fee of 10 PEN/month during the first four years (480 PEN in total) (ACOPAGRO, 2012 d).

In Table 4 the average farmers' yields and incomes are displayed. The numbers are averages for the organically certified farmers and for the non-certified farmers. As Table 4 shows, there was a difference between the two groups in all of the four categories, with an advantage for the organically certified farmers. The reason that the organically certified farmers on average had a higher income per hectare was a combined effect of bigger area of cacao, a higher production per hectare and a higher price for their cacao beans.

Table 5. Average annual yield and income on cacao farms with and without organic certification. Variation and difference in per cent are shown within brackets.

	Organically certified	Non-certified *	Advantage for organically certified
Cacao price, PEN/kg	6.85 (6-7.60)	6.62 (6-7.40)	0.23 (3%)
Average size of cacao field, hectares	2.9 (1-5.5)	2.6 (1-5.5)	0.3 (12%)
Cacao yield kg/hectare	900 (600-1460)	600 (20-1167)	300 (50%)
Income from cacao PEN/hectare	6 200 (8900-32 370)	4 000 (135-23 625)	2200 (55%)

* Two farmers' (Farmer 5 and 16) answers have been excluded from the calculations since their harvest was exceptionally low and no obvious explanation for the low harvest was found during the interviews.

4.2.3 Precipitation distribution and intensity

The weather in the area of Juanjuí varies a lot during the year, shifting between rainy and dry seasons. During the rainy season some of the farmers have difficulties with too much rain (Farmer 8, 21, 12, 20 and 21) and in the dry season some farmers have difficulties with draughts (Farmer 1, 13, 14, 20 and 21). In some cases the farmers get both too much rain in the rainy season and draughts in the dry season (Farmer 20 and 21). The heavy rains in the rainy season sometimes cause flooding (Farmer 20) and obstruct the farmers from working in the fields (Farmer 8). During the draughts, cacao plants wither and the cacao plants' productivity is reduced (Farmer 13). Some farmers mentioned that they replace the withered cacao plants with new cacao plants and one farmer bought an irrigation system to better cope with the draughts (Farmer 1).

One farmer (Farmer 18) mentioned erosion as a major problem, and in that case the erosion occurred alongside the riverbank. Even though the other farmers did not see erosion as a major problem, some of them were taking measures to prevent erosion. During two of the farm visits, the farmers (Farmer 1 and 3) showed and explained how they take measures to avoid erosion in their cacao fields. Since Juanjuí is situated in a hilly area, many of the farmers grow their cacao on more or less steep slopes. Both Farmer 1 and 3 explained that the cacao trees were planted in rows running diagonally to the slope direction. According to Farmer 3 this prevents the rainwater from flowing rapidly down the slope. Farmer 3 also showed how logs had been placed as barriers across the slope to catch the soil if it would start to flow with the rain water down the slope.

4.2.4 Pests and diseases

Nine of the farmers mentioned the pests and diseases that affect the cacao plant as a major difficulty in the cacao production (Farmer 1, 2, 3, 6, 10, 11, 12, 13 and 18). The diseases mentioned by the farmers were monilia pod rot of cacao (Farmer 3, 11, 12, 13) witch's broom disease (Farmer 3 and 13), black pod rot (Farmer 3) and wilt (Farmer 1). The only pest mentioned was *chinche mosquilla* (Farmer 3). In Table 5, the mentioned diseases' and pests' English, Spanish and Latin names are listed.

Table 5. Diseases and pests mentioned by the farmers

English	Spanish	Latin
Monilia pod rot [1]	*Moniliasis* [2]	*Moniliophthora roreri* [2]
Witch's broom disease [1]	*Escoba de bruja* [2]	*Crinipellis perniciosa* [2]
Black pod rot [1]	*Pudrición parda* [2]	*Phytophthora palmivora* [2]
Wilt [1]	*Mal de machete* [2]	*Ceratocystis fimbriata* [2]
English name not identified	*Chinche mosquilla* [2]	*Monalonium dissimulatum* [2]

Monilia pod rot, also called Moniliophthora or watery or frosty pod rot is a plant disease, caused by the fungus *Moniliophthora roreri* (Keane and Putter, 1992). The disease starts when the fungus infects young cacao pods and grows inside the fruit. After 6-12 weeks necrosis appears on the infected fruits. Spores are produced on the cacao pods and can spread to other cacao plants and infect new fruits when they are exposed to wind. Monilia is a severe disease and can cause losses of yield of 15-80 per cent (Keane and Putter, 1992).

Witch's broom disease is caused by a fungus called *Crinipellis perniciosa* (Keane and Putter, 1992). Spores are formed on dead, infected branches during rainy seasons and infect young tissue of the cacao plant. The mycelium is growing intercellular and causes the cells of the cacao plant to expand and multiply in an abnormal way. Strangely formed fruits and branches forming characteristic "witch's brooms" are typical symptoms of witch's broom disease. In severe cases of Witch's broom disease 50-80 per cent of the cacao pods can be infected (Keane and Putter, 1992). Figure 12

Figure 12. From left to right; Witch's broom disease and monilia pod rot. Photo by Linnea Persson.

shows monilia pod rot and witch's broom disease.

Black pod rot is a fungal disease caused by *Phytophthora palmivora* and other subspecies of Phytophthora (Keane and Putter, 1992). The spores infect the cacao flowers and causes the cacao pods to rot and the pod's surface gets brown or black spots. *Phytophthora spp.* can also infect the stem of cacao trees' and in severe cases the fungus kills the whole tree. Black pod rot can cause a loss of yield of up to 90 per cent in wet areas, but on average it causes a loss of yield of about 10 per cent (Keane and Putter, 1992).

Wilt is caused by the fungus *Ceratocystis fimbriata* (Keane and Putter, 1992). Unlike the above mentioned fungal diseases, wilt is often spread by man with tools used for pruning and with wood drilling beetles. The fungus causing wilt in cacao also causes diseases in other tropical plants. Cacao trees infected with wilt dies and in some cases up to 20 per cent of the trees in a field have died due to wilt (Keane and Putter, 1992). In Figure 13 black pod rot and wilt can be seen.

Figure 13. To the left, black pod rot and to the right, wilt. Photo by Linnea Persson.

Chinche mosquilla is a yellow insect that attacks the leaves and young fruits of the cacao plant (ACOPAGRO & ICT, 2010). Where the insects have attacked, small black spots appear and the tissue dies. The development of cacao beans is hindered and sometimes the fruits fall to the ground (ACOPAGRO & ICT, 2010). During the interviews the farmers mentioned several measures they take to combat diseases and pests in their cacao fields. Some of the measures are preventive to avoid diseases and pests whereas some measures treat the symptoms of the diseases and pests.

The use of disease resistant varieties and the practice of maintenance pruning can be considered as preventive measures whereas the practice of phytosanitary pruning and the use of organic pesticides can be considered as symptom treating measures. Concerning disease resistance, the farmers used seeds from disease resistant varieties for sowing and they grafted with branches from disease resistant varieties (Farmer 2, 6, 8).

ACOPAGRO divides the pruning into two categories, maintenance pruning and phytosanitary pruning (ACOPAGRO & ICT, 2010). The maintenance pruning is practiced with the aim to give the trees a good shape and a maximum height of three and a half to four meters as well as to let in enough light and air in the cacao tree's canopy. By letting in air and light, this kind of pruning can be seen as a measure to prevent diseases, since excessive amounts of shade increase the risk of fungal diseases. Phytosanitary pruning is carried out in fields of all ages whenever needed and is performed through cutting off branches and fruits that are diseased or that have been attacked by pests (ACOPAGRO & ICT, 2010). One farmer (Farmer 10) mentioned that they use to bury the diseased fruits in the ground when they have cut them off from the cacao trees, to avoid the spread of diseases.

Some farmers prepared organic pesticides from different herbs (Farmer 1, 2, 3, 9). The herbs recommended by ACOPAGRO for preparation of organic pesticides are tobacco (*Nicotiana tabacum*), chili (*Capsicum spp*.), *higuerrilla* (*Ricinus communis*) and horsetail (*Equisetum spp*.) (ACOPAGRO, 2010). When the farmers encounter new diseases or pests that they do not know how to handle, they can get advice from ACOPAGRO's technicians on how to combat them (Farmer 1, 10).

4.2.5 Transportation

As was mentioned in the beginning of Results, many of the farmers interviewed did not live at their cacao fields but in the town of Juanjuí or in one of the villages surrounding Juanjuí. Some of the farmers had remote fields (Farmer 2 and 4) and in many cases there was no road (Farmer 6 and 11). It could take several hours to walk the pathway between the home and the field and the only way to transport the cacao beans from remote fields was by horse (Farmer 7) or to carry the harvested cacao by hand. All inputs for the cacao cultivation such as fertilizers and tools also had to be transported to the fields. Four of the farmers mentioned transportation between the cacao field and the village or town as a major difficulty (Farmer 2, 6, 11 and 4). The transportation issue is naturally not unique for cacao

farmers. Regardless of which crop the farmers grow, they have to transport their products from the field to the village or town and inputs have to be transported in the opposite direction.

4.2.6 Working conditions and knowledge

Two farmers pointed out that starting to cultivate cacao requires a lot of time and work (Farmer 9 and 19). Felling trees and preparing a field for plantation of cacao is hard work (Farmer 17). Another activity that required a lot of labour was the harvest. Sometimes it could be difficult to find enough workers for the harvest (Farmer 10).

Many farmers mentioned that they participated in a traditional labour-exchange system called *choba-choba* to handle the work intense activities such as harvest and preparation of fields. *Choba-choba* means that a group of farmers work on each other's fields rotatively i.e. working on one farmer's field one day and on another farmer's field the next day and so on, helping each other. The farmer family where the farmers work for the day prepare free lunch for the *choba-choba* workers. Except from the *choba-choba* some of the farmers also hired day labourers. Unlike *choba-choba*, day labourers received a salary of 15-20 PEN per day in addition to the free lunch as payment.

One of the farmers explained that at some occasions they had prepared food and beverages for the workers, but the next day it was raining and they could not go out in the fields. This meant that the food and beverages went bad and they had to prepare new, which cost a lot and required double work (Farmer 8).

Learning how to prune the trees and how to graft also requires a lot of time and practice (Farmer 17). Several farmers explained that the advice and education from ACOPAGRO was important to learn the cultivation techniques quicker.

4.2.7 Fertilizer

A general measure among the farmers to improve the cacao harvest was to apply fertilizer (Farmer 1, 2, 3, 6, 7, 8, 9, 10, 18, 21). The application of fertilizer is not only beneficial as an addition of nutrients for the cacao trees but can also be beneficial in other ways. Some farmers mentioned application of fertilizers as a measure to better cope with diseases and draughts. The farmers used different kinds of fertilizers. Some of the fertilizers, such as phosphate rock and guano were purchased in store while others, such as animal manure, compost and biofertilizers were produced at the farms (Farmer 1, 2, 3, 6, 7, 8, 9, 10, 18, 21). ACOPAGRO

recommend the farmers to apply fertilizers as a step to combat diseases and pests (ACOPAGRO, 2010).

5 Discussion

The main reasons to start growing cacao among the farmers in this study were economical security and personal safety reasons. Coca was mentioned as a crop that would provide as high income as cacao, but it seemed like most farmers who mentioned coca did not see it as a realistic alternative to cacao because of the risks associated to coca production.

Coffee was however, an alternative for some and it is also a common cash crop for agroforestry systems. In Peru, agroforestry systems are used for coffee in high locations, since coffee requires an altitude of 1300-3000 meters above sea level (ICRAF, 2011). It is probably because of this limitation, so few of the farmers mentioned coffee as an alternative. Coffee can otherwise be grown together with basically the same species as cacao and is intercropped for similar reasons. A study by Rice (2008) showed that eight different tree species on average were used by the farmers in the study, with trees from the genus *Inga* being the principal ones. Herbs, growing below the coffee level were also cultivated by the farmers in Rice's (2008) study. Fuel wood and construction material were mentioned as important reasons for having shade trees, however they also had other diverse purposes such as firewood and fruit (Rice, 2008). The farmers in this study did not, however, mention fuel wood as a reason for having trees in the cacao fields. It is nevertheless probable that some of the wood from the trees was used for fuel wood since it is cheaper than buying other kinds of fuel.

Since there were not many good alternatives to cacao all of the farmers had cacao as their main crop. Some had other fields as well with for example food crops or timber trees but the main income was probably received from the cacao production. Relying on one crop for the main part of the income can be risky, especially since cacao is sold on the world market where the prices can vary a lot.

5.1 Reasons for intercropping

Diversifying the cultivations can be seen as a way of mitigating the risks with the price fluctuations, as mentioned above. The farmers mentioned many reasons for intercropping but not specifically the more secure financial situation. They did, however, mention the benefits of getting extra income from other products than cacao, e.g. fruit and timber from trees.

ACOPAGRO was probably a driving force for why the farmers intercropped their cacao with trees and why certain tree species were planted more frequently than others. As members of the cooperative the farmers were taught that cacao needs shade from other trees and the cooperative promoted the planting of trees by paying the farmers to do this through PUR PROJET. Besides getting paid to plant trees, the trees also provide possibilities to sell timber and seeds from them later on. Moreover, there are other benefits trees provide which some of the farmers are aware and take advantage of e.g. a fertilizing effect, hindering of airborne plant diseases and receiving fruit and wood. A few farmers mentioned growing trees because of the agreement with the cooperative. Being a member of ACOPAGRO also gives the farmer family an opportunity to get a certification for the cacao production, meaning that they will get a better price for their product. Some of the certifications promote the planting of trees in the fields and require that the farmer families take means to achieve a higher degree of biodiversity in the fields. When ranking the reasons for growing trees in the cacao fields, the farmers put shade and income from the sale of timber as the most important reasons. Many farmers believed that shade is necessary for cacao trees. This also coincides with what ACOPAGRO teaches. There are, however, different opinions of the proper amount of shade required from different studies around the world. Cultivation systems used for cacao vary significantly between everything from monocultures to plantings inside existing primary forests (Rice and Greenberg, 2000). The species grown together with cacao as well as the amount of shade also vary (Dahlquist et al. 2007). These variations could perhaps be a consequence of different natural conditions or different cultural traditions. Agroforestry systems can also have other benefits, aside from the ones mentioned by the farmers; for example protection against erosion.

The fact that ACOPAGRO promotes the planting of trees probably is a reason why trees were more common than non-woody crops in both newly established fields and fields in production. However there might have been several dif-

ferent varieties of the crops grown in the fields. These varieties also contribute to increased biodiversity. Teak, mahogany, *capirona* and Spanish cedar were the tree species most commonly grown along field boarders. One purpose mentioned for having trees along the boarders was to hinder air-borne plant diseases to enter the field. With such reasoning it makes sense to grow tall trees with dense canopies, which the mentioned tree species have. Mahogany is probably grown because of its timber quality. The most common species grown systematically throughout the fields like plantain/banana, mahogany and guaba are probably grown because of the economic factor, the compatibility with the cacao and the suitability to the location with climate, disease tolerance etc. To avoid negative effects of intercropping, such as competition for water, light and nutrients between the cacao plants and the shade trees, the selection of appropriate tree species is important as well as the management of the trees and choosing the right amount of shade.

The results also showed differences in intercropping patterns where newly established fields had a higher occurrence of non-woody crops than fields in production. The reason for this could be the fact that young cacao trees do not give the farmer an income. The farmer families then have to produce food crops to sustain themselves until the cacao trees start to produce. At the same time the intercropping with food crops will also provide necessary shade for the cacao trees. Another factor is that it takes time to establish the shadow trees in the fields. The food crops will receive enough sunlight to produce as long as the canopies of the cacao and the shade trees are yet to be closed.

Plantain/banana and cassava were the two most common food crops in the fields. To clarify, plantain and banana are two different things. Most likely plantain was more commonly grown than banana. Both plantain and cassava serve as main staple food in the area and are used in many traditional dishes, whereas banana is consumed in less quantity. Cassava fits well in the spaces between the cacao trees. It is also a crop which gives high yields, even under less favorable conditions (Cock, 1982). With the plantain/banana – cacao system in newly established fields, farmers have the opportunity to sell the plantain/banana and receive an income to buy necessities and food from elsewhere if they do not have other fields to grow food crops in. Not only in Peru is the plantain/banana-cacao system common. From a study made in Costa Rica it was concluded that cacao and banana often are intercropped because of their compatibility as organic cash crops and because they are shade tolerant. It was also concluded that plantain can be part of agroforestry systems and either be used for consumption by the family or sold (Dahlquist et al. 2007), which coincides with the results from this study.

Most of the non-woody crops have only been mentioned by one farmer and many of them are only grown in either newly established fields or fields in production. The farmers probably have different preferences when it comes to food and therefore grow different crops.

Shade, fertilizer, reforestation and protection of the environment followed by production of food and fruit were the most important reasons for intercropping. However the farmers did not mention the effect on the productivity of their cacao as a reason. This is otherwise known as a good reason for using agroforestry systems. Although, the fertilizing effect will have a positive effect on the cacao production so it might be that the farmers are aware of the improved productivity. The fertilizing effect both comes from having nitrogen-fixing trees and from mulch from the trees and crops, and contributes to higher yields. The mentioning of food and fruit given by the trees, as reasons for intercropping with trees might appear quite natural for some. However, monocultures of cacao do exist in the world where the farmers do not get the extra resources other plants give. Diversification of production is a well-known livelihood strategy for small holders. If for example the cacao yield would be low, or if the cacao price would decrease, diversity in production would allow to have other edible or sellable crops or products, at the farm – i.e. to mix cash cropping with subsistence farming as well as to diversify the cash cropping. This makes the famers less sensitive to both fluctuations in market prices and to biological factors affecting the cacao harvest.

5.2 Farm economy

A good income is important for the famers, as it gives an opportunity of improving their life quality. With more money the farmers can buy more food, clothing and consumables for their family. Even though most of the farmers grew food crops on their farms for the family's own use, the income from cacao was important since it gives the farmer family the opportunity of buying other kinds of food, such as bread, cereals, milk and meat, which they do not produce themselves. They can also afford a longer education for their children. However, as mentioned above the reliance on one crop to support the family is also risky. Growing more food crops in the cacao fields could be one way of receiving both income from the cash crop and reducing the associated risks.

Members of ACOPAGRO get access to a higher cacao price, credits and technical advice. For some farmers these benefits for members of ACOPAGRO

were one of the main reasons to start growing cacao. The higher the cacao price is, the more the farmers can afford to invest in inputs for the cacao field. Among the farmers in this study, five rented a brush cutter while only two bought one. The farmers who rented a brush cutter for a couple of days saved more money when renting the machine, while the farmers who rented a brush cutter for about one month spent almost as much money on rent, as it would have cost to buy a brush cutter. This means that the farmers, who rent a brush cutter for about one month each year, probably would save money in the long run if they bought a brush cutter. If they have a brush cutter of their own they can also rent it out to friends and neighbors and earn some money too. The farmers who only used a brush cutter for a few days each year on the other hand, probably save more money if they rent one when they need it.

The biggest investment any of the farmers in this study made was to buy an irrigation system. The irrigation system cost 7000 PEN, which corresponds to 39 per cent of the average yearly income for the organically certified farms or 66 per cent of the average yearly income for non-certified farms. Considering this, it is understandable that only one farmer invested in an irrigation system, even though five farmers mentioned draughts as a major problem.

Both organically certified and non-certified farmers saw lack of financial resources as a challenge connected to cacao production. A difference in income between organically certified and non-certified farms could be seen in this study. The organically certified farmers had on average 50 per cent higher yield, 3 per cent higher price for the cacao and 12 per cent bigger cacao fields than the non-organic farmers. All the three factors yield, price and size of the cacao fields contributed to a higher income for the organically certified farmers.

If the farmers had access to more financial resources, they could invest in new equipment such as brush cutters and irrigation systems and they could also buy more inputs such as organic fertilizers and organic pesticides. The equipment and inputs can increase the cacao yields and thereby increase the farmers' income. Equipment such as brush cutters also has the potential to improve the farmers' working conditions, since the farmers can reduce the proportion of manual labour. Getting bank credits and credits from ACOPAGRO can be two possible ways for the farmers to get access to financial resources.

Unlike what one might expect, the organically certified farmers bought more fertilizer than the non-certified farmers. The fertilizers they bought were, of course approved for organic production, but compared to agricultural production in e.g. Europe, conventional farms normally buy more fertilizers than organic

farms. In addition ACOPAGRO promoted the preparation of compost at farm level, mulch and the application of animal manure. The fact that the organically certified farmers applied more fertilizer than the non-certified farmers, most certainly contributed to their higher cacao production.

To complement this study it would have been interesting to interview farmers who were not members of ACOPAGRO. Since no interviews were made with farmers who were not members of ACOPAGRO, the reasons why farmers chose not to become members of the cooperative are unsolved. Some reasons could however be that the farmers cannot do not want to pay the entrance fees, that they do not fulfill ACOPAGRO's criteria for membership or that they are members of some other cooperative.

5.3 Challenges and possibilities

Five of the farmers pointed out flooding during the rainy season as a problem, but none of them mentioned drainage as a solution. In some fields drainage could be a solution to the flooding issue, but perhaps an investment in a drainage system would be too expensive to afford for the farmers. In addition, if the cacao field is situated close to a river, as was the case for some of the farmers, a drainage system would not stop the river water from entering the cacao fields.

Neither did any of the farmers mention collection of rain water for irrigation during draughts as a possible solution. Rain water collection is practiced in many parts of the world and could probably be used in the Juanjuí area as well. Maybe some farmers already collect rain water in the area, or maybe the amount of water from the rivers is enough to cover the irrigation needs. However, if more farmers start to irrigate their crops during draughts, collection of rain water would probably be necessary to meet the water requirement.

During the interviews, the organically certified farmers mentioned more solutions to the challenges in their cacao production. This could be an effect of their participation in ACOPAGRO's meetings and education. It could also be that the organically certified farmers had grown cacao for a longer time, and therefore had found more solutions to the challenges.

5.4 Effects of ACOPAGRO's support

ACOPAGRO strongly influences which trees that are planted, as the technicians promotes trees according to the suitability to the local environment, the growth rate and possibilities to economic benefits.

In total guaba was the most common tree. It was grown for a number of reasons such as sale of non-timber products and mulch and can be said to be a multi-purpose tree. *Capirona* was also grown for many reasons, like income from the sale of timber, mulch and wood for own use, see Table 3. This might explain why these species were common in the cacao fields and also that they often were grown systematically. The farmers are probably aware of these multi-purpose effects.

The timber species that were introduced by ACOPAGRO were often also the ones that were grown systematically. It might be that when ACOPAGRO distributes the plants they also instruct the farmers on how and where they should be planted. Whereas with the more traditional plants the farmers plant them more randomly, which is the traditional way of planting.

Quite many farmers mentioned reforestation and protection of the environment as reasons. Sequestration of carbon was also rated relatively high, see Figure 10. This was the most common reason for intercropping with trees of the reasons that the farmers came up with themselves. A reason for this is probably that the farmers are members of, and therefore get educated in these questions by ACOPAGRO and PUR PROJET.

5.5 Other aspects and future of cacao in agroforestry systems

When considering the aspect of biodiversity it is important to remember that even with using agroforestry systems for cacao the cultivation of it is still often contributing to deforestation. With the increase in population in the area there is a lack of available land. When growing cash crops the farmers also have to produce their own food crops or buy food at the local market. This means that more land area is exploited.

There are many different systems for intercropping cacao used around the world. The systems used in this area seem to provide many benefits for the farmers, e.g. allowing them to get certifications for their products. The cultivation systems are however, depending on the world market price for cacao. If the demand

for cacao should decrease in the future the cacao farmers would have to find new ways of supporting themselves. Having an agroforestry system will probably give the farmer extra time to handle the transition, since the other species can provide some food and income.

ACOPAGRO has taken a step to diversify the production since they have started to involve themselves in other cash crops, such as sugar cane and coco-nut trees. This gives the cooperative's members more opportunities if the world market price on cacao should drop. It is also good with diversification if the climate in the area should change in the future. Some crops are better suited for e.g. dry conditions while other crops are more tolerant to heavy rains, thus with several crops on the farm it is more likely that some crops will survive a climate change.

5.6 Future research

When visiting the fields we saw that many small spaces in the cacao fields were not used. The reason for this is not clear and could be an area of future research. It could be that there is a possibility to grow more food crops in these spaces. Putting the planting of food crops into a system, the farmers could probably become more self-sufficient of food and get a better economy. Therefore it could be good if ACOPAGRO would promote this as they do the planting of trees. During the field work the farmers did not seem to put much importance to the intercropping of non-woody crops. This could be because ACOPAGRO focus on trees and not food crops, but could also be because intercropping with food crops is a more traditional farming practice in the area, which the farmers did not think of as important to mention. It could, however, be that the farmers do not have the time or the need to grow more food crops in these empty spaces.

5.7 Method

When working with interviews there is a risk of misinterpretations of questions and answers by the interviewer as well as the interviewee. In this case it was even more so, since there were also language and cultural barriers. Due to this, there have been some problems with the translation of the Spanish and local names of the plants. There is also a risk that the farmers forgot to mention some of the species they grew, or that they did not think of them as important enough to mention.

By using Participatory Rural Appraisal methods like rankings and farm maps, the questions got more visual and easier to understand for both parts. The farmers probably remembered more species when they were able to draw the fields than they otherwise would have done. The results from this exploratory study are representative for the farmers interviewed. If the farmers had been selected randomly, the results would probably have been different. An advantage of volunteering interviewees is that they perhaps were more interested in the study than the average farmers and therefore, their answers might have been more thorough. This study covers the cacao production quite thoroughly, but all the farmers interviewed grew many other crops besides cacao and therefore the total income of the farmer families' cannot be calculated. It would be interesting to investigate how much the farmer families earn from selling other products as well as how much of their home grown crops the farmer families consume themselves.

6 Conclusions

The cacao was intercropped with many different crops and trees in agroforestry systems. Intercropping with non-woody crops was more common in newly established fields than in fields in production. More than 40 per cent of the 62 cacao fields were systematically intercropped i.e. the intercropped species were planted in rows or along the field borders. Guaba and different timber species were the most common trees systematically intercropped with cacao. Several farmers also had separate fields for fruits, vegetables and timber aside from the cacao fields. By growing several different crops, the farmers could spread their risks in case the world market price of cacao would drop or if the cacao harvest somehow would decrease. ACOPAGRO is a driving force when it comes to intercropping cacao with other trees. This probably leads to an increasing agro-diversity in the cacao fields, as well as reforestation in some meaning.

The most common reasons that the farmers intercropped the cacao with other species were; shade; reforestation and protection of the environment; fertilizer; and fruit and food for the family. However, shade; income from the sale of timber; and wood for own use were classified by the farmers as the most important reasons for intercropping. There were two main factors that influenced the cropping systems at farm level. One factor was that the crops used for intercropping contributed in some way to increase the cacao yield. The other factor was that the crops used for intercropping gave the farmers extra income or other products for own use. ACOPAGRO influenced the cropping systems since they distributed trees and gave the farmers advice on how to manage their cacao and taught them about the benefits of intercropping with trees.

According to the farmers, the challenges connected to cacao production were lack of financial resources; drought, flooding and erosion; fungal diseases and pests of the cacao plants; transportation between the cacao fields and the town;

learning how to manage the cacao field; and lack of labourers for labour intensive activities.

Many times lack of financial resources was the limiting factor for how the farmers could handle the challenges. One solution to the lack of financial resources mentioned by the farmers was to become a member of ACOPAGRO. This, because the members of the cooperative could get access to credits as well as a chance to get organic certification, which resulted in a higher price for the organic cacao.

A solution to manage the draughts was to buy an irrigation system. This was however expensive and not many farmers could afford to invest in irrigation. Several farmers took action to prevent erosion e.g. by planting trees diagonally across the slope and by planting bamboo along the river bank. None of the farmers were using non-organic pesticides but there were both organically certified farmers and non-certified farmers who were using organic pesticides. Pruning was used both as a preventive measure against diseases by letting in more light and air into the canopy, as well as a symptomatic treatment by cutting off diseased parts. Some farmers also used disease resistant varieties as a preventive measure against fungal diseases. To quicker learn how to manage the cacao, the farmers took advice from ACOPAGRO's technicians. To find workers for labour intensive activities, many farmers participated in the local labour exchange system called choba-choba and some farmers also hired day labourers.

There were two challenges that the farmers had not found any solutions to; how to handle flooding and how to solve the transportation issue. These challenges would be interesting to investigate more thoroughly.

There were not so many differences between organically certified farmers and non-certified farmers. The major difference was the fact that organically certified farmers received a higher price for their cacao than the non-certified farmers. For this reason the organic farmers could invest in more inputs for their cacao and thereby increase the cacao yield.

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8 Glossary

ACOPAGRO	Cooperativa Agraria Cacaotera (Eng. Agricultural Cacao Cooperative)
Agro-diversity	Biodiversity in terms of cultivated plants in fields
Acopio	Centre for processing of fresh cacao beans by fermenting and drying
Biofertilizer	Organic material mixed with water, digested in a sealed container. An organic fertilizer is obtained.
Bio Latina	Organic certifier in Latin America
Conventional cacao producer	Cacao producer who is not certified by Biolatina
ICRAF	The World Agroforestry Centre An organization that is part of the alliance of the Consultutative Group on International Agricultural Research, CGIAR. This alliance is focused on research and the distribution of new knowledge to stimulate agricultural growth, raise the income of farmers and to protect the environment. ICRAF has two offices in Peru, the main office in Lima by the coast and an experimental station in Pucallpa in the Amazonian Basin (ICRAF, 2011).
Motocar	Three-wheeled motorcycle, also known as tuk-tuk or auto-rickshaw
Mulch	Organic material used for covering the soil surface
Peruvian nuevo soles	Currency of Peru (1 PEN ≈ 0,37 USD)

Appendix I

Questionnaire for key informants

ENCUESTA A REPRESENTANTES DE GREMIOS, COOPERATIVAS, ORGANIZACIONES DE PRODUCTORES CACAOTEROS

Nombre del/a encuestador/a: _____

I. IDENTIFICACIÓN DEL INFORMANTE Y DE SU PERCEPCIÓN INICIAL SOBRE CERTIFICACIÓN ORGÁNICA

1.	**Nombre completo**				
2.	**Cargo / función**				
3.	**Institución**				
4.	**Ciudad**		**5.**	**Estado/región**	
6.	**País**				
7.	**Teléfono/ No. Cel.**		**8.**	**Email**	

9. ¿Cuáles son las principales funciones / actividades que su grupo / institución desarrolla?
10. ¿Cómo ha empezado la organización de su grupo, con cuál objetivo?
11. En su grupo hay un programa de certificación orgánica ( ) no ( ) si
12. En caso positivo, participan cuantos productores/as?
    ( ) hombres ( ) mujeres ( ) total
13. Desde cuando está su organización certificada como orgánica? _____
14. ¿Cómo ha surgido la idea de buscar la certificación orgánica para su grupo?
15. ¿Cuál es el principal objetivo del grupo con la certificación orgánica?
16. ¿Cuál es el principal beneficio de la certificación orgánica para su grupo hasta la fecha?
17. ¿Quiénes son los que se benefician más con la certificación orgánica?

II. CUANTIFICACIÓN DE LA PRODUCCIÓN LOCAL / REGIONAL DE CACAO

18.	**Número estimado de fincas/predios que**	**Tamaño promedio de las fincas /predios que producen**	**Área promedia de producción de cacao por finca**	**Producción estimada total de cacao (toneladas/año)**	**Produc-tividad promedia (kg / ha)**	**Producción promedia de cacao por finca / hogar (kg/finca)**

	producen cacao	cacao (ha)	(ha/finca)			
Región / Estado						
Municipio						
Grupo certificado						

III. CARACTERIZACIÓN DE LA PRODUCCIÓN DE CACAO EN LA LOCALIDAD

19. ¿En qué período el cultivo de cacao comenzó a ser importante en su localidad?

( ) anterior a 1900 ( ) entre 1900 – 1950 ( ) entre 1950 – 1980

( ) entre 1980 – 2000 ( ) Después del año 2000

20. El cacao es el principal cultivo perene en su localidad?

( ) si ( ) no. En este caso, ¿cuál es el principal cultivo perene? _____

21. Cuál es el tiempo promedio de cultivo de las parcelas de cacao en esta localidad?

( ) menos de 5 anos ( ) 5-10 anos ( ) 10-20 anos ( ) 20-30 anos ( ) más de 30 anos

22. Cuál es el tipo más frecuente de sistema de producción cacaotero en su localidad?

(a) Cacao silvestre, nativo

(b) Cacao en agrobosques (chakra, cabruca)

(c) Cacao en Sistemas Agroforestal (SAF) extensivo complejo (múltiples especies).

(d) Cacao en SAF extensivo simples (una especie adicional al cacao).

(e) Cacao en monocultivo (intensivo en capital)

Proporción de sombra en el cacaotal:

23. **Plantas jóvenes:** ( ) a sol ( ) 1-15% ( ) 15-30% ( ) 30-50% ( ) más de 50%

24. **Plantas adultas:** ( ) a sol ( ) 1-15% ( ) 15-30% ( ) 30-50% ( ) más de 50%

25. El plantío de otras especies dentro del cacaotal tiene como principal finalidad generar?

(ordene de 1 a 6 por orden de importancia: 1 = más importante; 2 = segunda orden, etc.)

Para cada finalidad, por favor informe las principales especies utilizadas (o promisorias).

Finalidad	Especies utilizadas	Especies potenciales
( ) sombra		
( ) venta de productos no maderables		
( ) alimento para la familia		
( ) ingresos por la venta de madera		
( ) madera para uso propio		
( ) otra finalidad. Cuál?		

26. Forma de organización social predominante entre los productores de cacao:

( ) Asociación ( ) Gremio ( ) Cooperativa ( ) Individual/Familiar ( ) Empresarial

27. ¿Cuáles son los tres principales factores que impulsan la actividad cacaotera en su localidad y región? Por favor conteste en orden de prioridad:

28. ¿Cuáles son los principales factores que limitan la actividad cacaotera en su localidad y región? Por favor conteste en orden de prioridad:

(a) localidad

(b) región

29. ¿Cuáles son los principales requerimientos para el éxito de un productor en la actividad cacaotera en su (a) localidad y (b) región? Por favor en orden de prioridad:

(a) localidad

(b) región

IV. RENTABILIDAD Y BENEFICIOS DEL CULTIVO DE CACAO

(indicar a qué situación se refiere el análisis de costos del cuadro)

30. Tamaño de la parcela de cacao: _____ ha.

31. Cantidad estimada de árboles de cacao: _____árboles

32. Edad de la parcela de cacao: _____ años.

33. Productividad promedia: _____ (Kg/ha/año)

34. Costos por ano/ha en moneda nacional 2010	**Cantidad**	**Unidad (por ej. kg)**	**Precio por unidad**	**Costo total (2 x 4)**
1. Semillas (híbridas)				
2. Plantones				
3. Fertilizantes o abonos químicos/o				
4. Calcário o fertilizante mineral				
5. Abono animal y orgánico				
6. Pesticidas/herbicidas/ Fungicidas químicos				
7. Pesticidas/herbicidas/ Fungicidas orgánicos				
8. Animal para trabajo				
9. Mano-de-obra contratada				
10. Mano-de-obra de la familia				
11. Alquile de máquinas (Mecanización del suelo)				
12. Combustible				
13. Alquile de la tierra (parcela)				
14. Mantenimiento de infra-estructura para procesamiento y depósito				
15. Bolsas (sacaría)				
16. Transporte (para venta)				
17. Otro capital invertido (especificar)				

18. Otros (especificar):				
19.				

V. GESTIÓN, COSTOS Y BENEFICIOS DE LA CERTIFICACIÓN ORGÁNICA

35. Hay algún sistema de control interno para la certificación orgánica? ( ) si ( ) no

36. Costos adicionales para el manejo de un SCI – Sistema de control interno:

Para manejar el Sistema de Control Interno, cuales costos adicionales tienen? (cuantificarlo mismo en los casos cuando el personal esta pago por fondos exteriores e.g. cooperación Internacional): Informar la suma de los valores de los cuadros (37) y (38): _____

37. Personal	Cantidad de personas	Salario pago SOLES / día	Días por ano	Costo total anual (SOLES)
1. Coordinador SCI				
2.Técnicos de campo				
3.Inspectores Internos				
4. Otros:				

38. Material	Unidad	Cantidad	Costo por unidad (SOLES)	Costo total/ año (SOLES)
5. Combustible técnicos	Litros/ mes			
6. Combustible Inspectores internos	Litros/mes			
7. Material de oficina (e.g. para la impresión manual interno, registros etc.)	Gastos/ mes			
8. Costos capacitaciones a los productores	Evento de capacitación			
9. Costos capacitaciones al personal SCI	Evento de capacitación			

39. Quién paga los costos de la certificación?

	Costo anual total (de los cuadros 37 y 38)	Fuentes pagadoras
Personal		
Material		

40. El grupo ha recibido o está recibiendo ayuda de un consultor externo? ( ) si ( ) no

41. De cuál institución? _____

42. Hace cuanto tiempo? _____ años

43. Quién paga el salario de esta persona? _____

44. En el caso que ustedes pagan: Cuantos le pagan al mes? _____ SOLES

45. Esta persona dedica qué % de su tiempo a asesorarles con el SCI? _____%

46. La certificación ha generado nuevos empleos en los últimos 3 años? ( ) no ( ) si

47. ¿Cuántos empleos adicionales fueran generados a través de la certificación? _____

48. ¿Qué tipo de empleos se han generado a través de la certificación?

49. La certificación ha posibilitado distribución de lucros a socios en 2010? ( ) no ( ) si

50. En caso positivo, ¿Cuánto fue el lucro distribuido para los productores (en total) al final del año? _____ Soles en 2010

51. La certificación ha posibilitado acceso de socios a crédito bancario en 2010? ( ) no ( ) si

52. En caso positivo ¿cuánto fue el valor estimado del crédito disponible a los productores (en total) _____ Soles en 2010

53. La certificación ha posibilitado acceso a fondos de proyectos o donaciones en 2010? ( ) no ( ) si

54. En caso positivo, ¿de qué donantes?

55. ¿Cuál fue el valor recibido por el grupo? _____ Soles en 2010

56. La certificación ha posibilitado acceso a nuevos mercados / negocios? ( ) no ( ) si

En caso positivo, por favor detallar: _____

57. Tipo de beneficio: _____

58. Empresa o negocio involucrado: _____

59. Monto o valor del negocio: _____ Soles en 2010.

60. Por favor evalúe el potencial de la producción orgánica certificada del cacao para contribuir para la conservación del medio ambiente. Para esto considere las variables ambientales listadas en el siguiente cuadro:

(Marcar con un X ➔ 0 = efecto totalmente negativo; 5= neutro (no hay cambio); 10 = efecto muy positivo)

Factores ambientales											
a. Conservación del medio-ambiente											
b. Protección contra la erosión											
c. Conservación de la estructura y las propiedades del suelo											
c. Manejo de materia orgánica											
d. Protección a ríos y lagos											
e. Biodiversidad (flora y fauna en la finca)											
f. Microclima favorable a flora y fauna											
g. Diversidad de especies cultivadas											
h. Área de bosques nativos											
i. Enfermedades (cultivos)											
j. Manejo de residuos inorgánicos											
k. . Concientización ambiental											
otros aspectos:											

61. Por favor evalúe la <u>contribución</u> de la producción orgánica certificada del cacao para el desarrollo socio-económico local. Para esto considere las variables sociales y económicas listadas en el siguiente cuadro:

(Marcar con un X ➔ 0 = efecto totalmente negativo; 5= neutro (no hay cambio); 10 = efecto muy positivo)

A. Variables sociales											
a. Empoderar conocimiento local											
b. Apoyo a la organización social (incluso ayudarse unos a otros)											
c. Integración (en grupos)											
d. Enfermedades (personas)											
e. Condiciones de trabajo											
f. Salud de productores y familiares											
g. Adecuación para la realidad local											
h. Empoderamiento organizacional de la asociación/cooperativa											
i. Educación											
otros aspectos:											
B. Variables económicas											
a. Acceso a mercados											
b. Infraestructura (e.g. Carreteras)											
c. Oportunidades de empleo											
d. Desarrollo económico local											
e. Distribución de beneficios											
otros aspectos:											

62. ¿En tu opinión, cuáles son los principales requerimientos / condiciones para que la certificación orgánica tener más éxito, contribuir más para el desarrollo socioeconómico y la conservación ambiental en la Amazonía?

63. ¿Que debería ser diferente en el proceso de certificación del cacao orgánico para tener más beneficios (e.g. sociales y económicos) para los productores de la Amazonía?

VI. MERCADO DE CACAO EN LA LOCALIDAD

64. ¿Cuál(es) es (son) la(s) principal(es) estrategia(s) de mercado? En orden de prioridad.

( ) Venta de granos de cacao a través del grupo / cooperativa

( ) Venta de granos a un intermediario local / regional.

( ) Procesamiento de granos a nivel de finca local. ¿Cual(es) forma(s) de procesamiento?

( ) Procesamiento de granos a través del grupo / cooperativa, ¿Qué forma(s) de procesamiento?

( ) Otra modalidad. ¿Cuál?

65. Si venden el cacao a través de intermediarios, ¿Cuantas opciones de compradores / intermediarios existen? ( ) 1 ( ) 2-3 ( ) 4-5 ( ) 6-10 ( ) más de 10

66. ¿Quiénes son los compradores más frecuentes / importantes? En orden de Prioridad, por favor:
( ) grandes industrias ( ) pequeñas industrias ( ) intermediario ( ) otros, cuales

67. ¿Cuantos intermediarios existen hasta que el producto llegue a la industria?: _____

68. Si procesan el cacao en su finca, a nivel familiar, ¿que productos obtienen?

69. ¿Qué forma de venta de productos del cacao predomina en la localidad:

( ) Por asociación, gremio ( ) por Cooperativa ( ) Individual/Familiar

70. La demanda por el cacao orgánico certificado desde el inicio de la certificación en su organización:

(a) Ha aumentado. Si posible, indique en que porcentaje: _____%

(b) Ha disminuido. Si posible, indique en que porcentaje: _____%

(c) Ha superado la oferta. Si posible, indique en que porcentaje: _____ %

(d) Permaneció igual

71. Relación Producción y Consumo

1. Déficit (kg) (Producción < Consumo)	2,Superávit (kg) (Producción > Consumo)	3. Estoques (kg)

71. ¿Cuál fue el ingreso bruto proveniente de la exportación de granos de cacao por la organización en 2010? _____Soles

72. ¿Cuál fue el ingreso bruto proveniente de la venta de granos de cacao directamente a la industria nacional, por la organización, en 2010?_____Soles

73. ¿Cuál fue el ingreso bruto proveniente de la venta de granos de cacao a intermediarios, por la organización, en 2010?_____Soles

VII. IMPACTO DE LA INVESTIGACIÓN Y DE POLÍTICAS PÚBLICAS

74. En esta localidad cual es la intensidad e impacto de los proyectos de investigación para el desarrollo de la actividad cacaotera (últimos 10 años)

a. Intensidad: ( ) muy alta ( ) alta ( ) mediana ( ) baja ( ) ausente

b. Impacto: ( ) muy positivo ( ) positivo ( ) mediano ( ) débil ( ) ausente

75. En caso tenga conocimiento de iniciativas de investigación y/o desarrollo relacionados a la actividad cacaotera siendo implementadas en su localidad en los últimos 5 años, por favor informe:

Titulo de la Iniciativa, Proyecto	Objetivo princi-pal	Institución(es) involucrada(s)		
		Ejecutor	Socios	Financiador

76. En caso sea de su conocimiento alguna publicación relevante que resultó de las iniciativas mencionadas, favor mencionar.

77. En esta localidad cual es la intensidad e impacto de políticas públicas y programas de gobierno asociados a la promoción de la actividad cacaotera.

a. Intensidad: ( ) muy alta ( ) alta ( ) mediana ( ) baja ( ) ausente

b. Impacto: ( ) muy positivo ( ) positivo ( ) mediano ( ) débil ( ) ausente

78. Por favor informe las principales políticas públicas y/o programas de gobierno relacionados a la actividad cacaotera e implementados en su localidad.

Titulo del Programa / Acción	Objetivo principal	Ejecutor	Resultados

Appendix II

Questionnaire for farmers

ENCUESTA A PRODUCTORES CACAOTEROS

Nombre del/a encuestador/a: _____

VIII. IDENTIFICACIÓN DEL INFORMANTE Y DE SU PERCEPCIÓN INICIAL SOBRE CERTIFICACIÓN ORGÁNICA

2. Nombre completo			
3. Comunidad			
4. Ciudad		**5. Estado/región**	
6. País			

7. Tenencia de la tierra: (1) título individual; (2) ocupación individual; (3) área colectiva; (4) tierra del gobierno; (5) tierras indígenas; (6) otros, cual: _____
8. Distancia y tiempo entre (el hogar en) la finca y la ciudad: _____ (km) _____(minutos)
9. Distancia y tiempo entre (el hogar en) la finca y la carretera: _____ (km) _____(minutos)
10. Número de personas que viven en el hogar ( )
11. Tiempo de residencia en la finca: ( ) años.
12. **Modalidad de producción de cacao:**

( ) productor de cacao convencional (no-certificado)

( ) productor de cacao orgánico certificado

( ) ambos, con predominancia de cacao convencional

( ) ambos, con predominancia de cacao certificado

13. ¿Hace cuántos años usted participa en la certificación orgánica del cacao? _____ años
14. Si usted no participa de la certificación orgánica, ¿cuál la razón principal?
15. ¿Cuál es el principal objetivo para buscar la certificación orgánica?
16. ¿Cuál es el principal beneficio de la certificación orgánica en la región hasta la fecha?
17. ¿Quiénes son los que se benefician más con la certificación orgánica?
18. Participa de alguna organización de productores: ( ) no ( ) sí. ¿Cuántas? _____
19. ¿Qué tipo de organización participa?

( ) Asociación ( ) Gremio ( ) Cooperativa ( ) Empresa rural ( ) Sindicato ( ) otra

IX. CARACTERIZACIÓN DE LA PRODUCCIÓN DE CACAO EN LA PROPRIEDAD

20. Por favor informe cuál es el sistema de producción de cacao predominante que usted practica en su propiedad?

(a) Cacao silvestre, nativo

(b) Cacao en agrobosques (chakra, cabruca)

(c) Cacao en Sistemas Agroforestal (SAF) extensivo complejo (múltiples especies).

(d) Cacao en SAF extensivo simples (una especie adicional al cacao).

(e) Cacao en monocultivo (intensivo en capital)

21. Si utiliza otras especies en el cacaotal, ¿cuáles son estas especies?

22. Porque ha seleccionado estas especies?

23. Información de la producción y productividad de cacao en 2010

Tamaño de su finca /predio (ha)	Área de producción de cacao (ha)	Número estimado de árboles de cacao	Producción de cacao (kg/año)	Produc-tividad (kg / ha)	Precio de venta (soles/kg)	Número de personas que trabajaron con cacao por dia en promedio al largo de 2010

24. ¿Desde qué año su hogar cultiva cacao? _____

25. ¿Sus familiares cultivaban o cultivan cacao? ( ) si ( ) no

26. El cacao es el principal cultivo perene en su finca?

( ) si ( ) no. En este caso, ¿cuál es el principal cultivo perene?

27. ¿Cuantas parcelas de cacao tiene usted (en su finca)?_____

28. Tiempo promedio de edad de las parcelas de cacao en su finca (por favor, marcar una opción para cada parcela, caso tenga más de una parcela)

( ) menos de 5 anos ( ) 5-10 anos ( ) 10-20 anos ( ) 20-30 anos ( ) más de 30 anos

29. Proporción de sombra en el cacaotal:

(Para calcular la sombra se dibuja un croquis para cada parcela de cacao junto con el productor, dónde el productor indica las diferentes especies en sus parcelas de cacao y la distancia plantada)

a. Plantas jóvenes: ( ) a sol ( ) 1-15% ( ) 15-30% ( ) 30-50% ( ) más de 50%

b. Plantas adultas: ( ) a sol ( ) 1-15% ( ) 15-30% ( ) 30-50% ( ) más de 50%

30. El plantío de otras especies dentro del cacaotal tiene como principal finalidad generar?

(ordene de 1 a 6 por orden de importancia: 1 = más importante; 2 = segunda orden, etc.)

Para cada finalidad, por favor informe las principales especies utilizadas (o promisorias).

Finalidad	Especies utilizadas	Especies potenciales
( ) sombra		
( ) venta de productos no maderables		
( ) alimento para la familia		
( ) ingresos por la venta de madera		
( ) madera para uso propio		
( ) otra finalidad. Cuál?		

31. Mano-de-obra utilizada en el cacaotal:

( ) predominante familiar

( ) predominante contratada, trabajadores permanentes

( ) predominante contratada, trabajadores temporarios / mensual

( ) predominante contratada, trabajadores temporarios / jornaleros

( ) familiar y contratada en proporciones similares

32. Cuál es el número aproximado de días de trabajo utilizados en las actividades relacionadas a la producción de cacao en su finca en el ano de 2010?

(OJO! solo para el 2010!)

	Mano-de-obra total (días)	Mano-de-obra Familiar	Mano-de-obra contratada
1.Desbosque			
2.Quema			
3.Preparo del área			
4. Formación de plantones			
5.Plantío			
6.Cultivo / limpia			
7.Poda			
8.Aplicación de abonos			
9.Aplicación de pesticidas			
10.Cosecha			
Otras (especificar)			

33. Utilización de insumos:

Fertilizantes químicos: ( ) si ( ) no Nombre: _____

Fertilizantes minerales: ( ) si ( ) no Nombre: _____

Abonos orgánicos ( ) si ( ) no Nombre: _____

Insecticidas: ( ) si ( ) no Nombre: _____

Fungicidas: ( ) si ( ) no Nombre: _____

Semillas híbridas: ( ) si ( ) no Tipo: _____

Prácticas de enjertación: ( ) si ( ) no

Mecanización del suelo: ( ) si ( ) no Herramienta:_____

34. Valores gastos en 2010 con:	**Cantidad**	**Unidad (por ej. kg)**	**Precio por unidad**	**Costo total**
20. Semillas (híbridas)				
21. Plantones				
22. Fertilizantes o abonos químicos/o				
23. Calcáreo o fertilizante mineral				
24. Abono animal y orgánico				
25. Pesticidas/herbicidas/ Fungicidas químicos				
26. Pesticidas/herbicidas/ Fungicidas or-				

	gánicos				
27.	Animal para trabajo				
28.	Alquile de máquinas (Mecanización suelo)				
29.	Combustible				
30.	Alquile de la tierra (parcela)				
31.	Mantenimiento de infra-estructura para procesamiento y depósito				
32.	Bolsas (sacaría)				
33.	Transporte (para venta)				
34.	Otro capital invertido (especificar)				
35.	Otros (especificar):				

X. MOTIVACIÓN DEL PRODUCTOR PARA LA ACTIVIDAD CACAOTERA

35. ¿Por qué usted decidió plantar cacao? (favor listar las razones en orden de prioridad)
36. Si no hubiese sido cacao, en qué otras actividades se involucraría o qué otros cultivos tendría para obtener los "mismos" ingresos?
37. ¿En su opinión cuáles son las principales dificultades de la actividad cacaotera? Por favor listar los factores en orden de prioridad:
38. ¿En su opinión cuáles son los principales requerimientos / condiciones para usted tener éxito en la actividad cacaotera? Por favor en orden de prioridad:
39. ¿Qué soluciones usted ha buscado para resolver las dificultades en la producción de cacao? Por favor en orden de prioridad:
40. ¿En qué actividades relacionadas a cacao hay participación de las mujeres en su hogar? Por favor en orden la siguiente orden (1.=mayor participación y 5.=menor participación)

XI. BENEFICIOS ECONÓMICOS DE LA CERTIFICACIÓN EN EL 2010:

(aplicar la sesión solo a productores de cacao orgánico certificado)

41. Cuál es el costo de la participación en su grupo (cooperativa/ asociación integrada a un sistema de certificación)_____Soles/año
42. La certificación ha posibilitado distribución de lucros a socios en 2010? ( ) no ( ) si
43. En caso positivo, ¿cuántos Soles son distribuidos a usted por su grupo (cooperativa/ asociación integrada a un sistema de certificación) al final del año? _____ Soles 2010
44. La certificación ha posibilitado a crédito bancario?
    ( ) no ( ) si, cuanto y en cual año? _____Soles en el año:_____
45. La certificación le ha posibilitado acceso a nuevos mercados / negocios? ( ) no ( ) si
    En caso positivo, por favor detallar:
46. Tipo de beneficio: _____
47. Empresa o negocio involucrado: _____
48. Monto o valor del negocio: _____
49. **Por favor evalúe el potencial de la producción orgánica certificada del cacao para contribuir para la conservación del medio ambiente. Considere los factores ambientales listados en el siguiente**

cuadro. (Marcar con un X ➔ 0 = efecto totalmente negativo; 5= neutro (no hay cambio); 10 = efecto muy positivo)

Factores ambientales											
a. Conservación del medio-ambiente											
b. Protección contra la erosión											
c. Conservación de la estructura y las propiedades del suelo											
c. Manejo de materia orgánica											
d. Protección a ríos y lagos											
e. Biodiversidad (flora y fauna en la finca)											
f. Microclima favorable a flora y fauna											
g. Diversidad de especies cultivadas											
h. Área de bosques nativos											
i. Enfermedades (cultivos)											
j. Manejo de residuos inorgánicos											
k. Aprendizaje acerca del medio ambiente											
otros aspectos:											

50. **Por favor evalúe la contribución de la producción orgánica certificada del cacao para el desarrollo socio-económico local. Considere los factores sociales y económicos listados en el siguiente cuadro.** (Marcar con un X ➔ 0 = efecto totalmente negativo; 5= neutro (no hay cambio); 10 = efecto muy positivo)

A. Factores sociales											**0**
a. Fortalecer conocimiento local											
b. Apoyo a la organización social (incluso ayudarse unos a otros)											
c. Integración (en el grupo)											
d. Enfermedades (personas)											
e. Condiciones de trabajo											
f. Su salud y de sus familiares											
g. Manejo de basura, plástico											
h. Fortalecimiento organizacional de la asociación/cooperativa											
i. Educación											
j. Compatibilidad de la producción orgánica certificada con su realidad											
otros aspectos:											

B. Factores económicos											
a. Acceso a mercados											
b. Infraestructura (e.g. Carreteras)											
c. Oportunidades de empleo											
d. Desarrollo económico local											
e. Reintegro al final del ano											
otros aspectos:											

51. ¿Qué debería ser diferente en el proceso de certificación del cacao orgánico para tener más beneficios (e.g. sociales y económicos) para los productores?

XII. MERCADO DE CACAO EN LA LOCALIDAD

52. ¿Cuál(es) es (son) la(s) principal(es) estrategia(s) de mercado? En orden de prioridad.

( ) Venta de granos de cacao a través del grupo / cooperativa

( ) Venta de granos a un intermediario local / regional.

( ) Procesamiento de granos a nivel de finca local.

( ) Procesamiento de granos a través del grupo / cooperativa

( ) Otra estrategia de mercado ¿Cuál? _____

53. Si venden el cacao a través de intermediarios, ¿Cuantas opciones de compradores / intermediarios existen? Número exacto: _____

( ) 1 ( ) 2-3 ( ) 4-5 ( ) 6-10 ( ) más de 10

54. ¿Quiénes son los compradores más frecuentes? En orden de Prioridad, por favor:

( ) grandes industrias

( ) pequeñas industrias

( ) intermediario

( ) otros, cuales _____

55. ¿Cuantos intermediarios existen hasta que el producto llegue a la industria?: _____

56. Si procesan el cacao en su finca, a nivel familiar, ¿qué productos obtienen?

57. ¿Qué tipo de proceso utilizan? (marcar todos los relevantes)

( ) Fermentación

( ) Secar los granos

( ) Moler los granos

( ) otros, ¿Cuáles? _____

58. ¿Qué forma de venta de productos de cacao utilizan:

( ) Por asociación, gremio ( ) por Cooperativa ( ) Individual/Familiar

59. En su opinión, en esta localidad cual es la intensidad e impacto de los proyectos de investigación para el desarrollo de la actividad cacaotera (últimos 10 años)

a. Intensidad: ( ) muy alta ( ) alta ( ) mediana ( ) baja ( ) ausente b. Impacto: ( ) muy positivo ( ) positivo ( ) mediano ( ) débil ( ) ausente

Appendix III

Farm map

Appendix IV

Species for intercropping

Local name	*English*	*Latin*
Teca	Teak	*Tectona grandis*
Paliperro		*Vitex sp.*
Caoba	Mahogany	*Switenia macrophylla*
Estoraque		*Myroxilon balsamum*
Capirona		*Calycophyllum sp.*
Cedro nativo	Spanish cedar	*Cedrela sp.*
Cedro rosado	Pink cedar	*Acrocarpus fraxinifolius*
Bolaina		*Guazuam sp.*
Pucaquiro		*Simiria williamsii*
Shaina	Glandular nakedwood	*Colubrina glandulosa*
Tornillo		*Cedrelinga cateniform-is*
Pino chuncho	Brazilean fern tree	*Schizolobium sp.*
Ishpingo		*Amburana cearensis*
Balsa/Topa	Balsa	*Ochroma pyramidale*
Fapina		*Cupania latifolia*
Bálsamo		*Myroxylon toloiferum*
Huayruro		*Ormicia cocconea*
Electrina		
Chupsacha		*Solanum obliquum*
Shimbillo		*Inga spp.*
Guaba	Guaba	*Inga edulis*
Palta	Avocado	*Persea americana*
Zapote	Mamey sapote	*Pouteria sapota*
Coco	Coconut-palm	*Cocos nucifera*
Naranja	Orange tree	*Citrus sinensis*

Limón	Lemon tree	*Citrus x limon*
Lúcuma/Lucma	Egg fruit	*Pouteria lucuma*
Caimito	Star apple	*Pouteria caimito*
Loreto		
Sacha mangua	Piton tree	*Grias Neuberthii*
Taperibá/Tapisho		*Spondias cytherea*
Mango	Mango tree	*Mangifera indica*
Huito/Jagua	Jagua	*Genipa americana*
Ubos	Yellow mumbin tree	*Spondias mombin*
Caignito		
Mandarina	Mandarin orange	*Citrus reticulata*
Uvilla	Amazon grape	*Pourouma cecropiae-folia*
Achiote	Annatto	*Bixa orellana*
Ciruelo chino		*Prunus salicina*
Ciruelo	Hog plum	*Spondias purpurea*
Huallava		
Pomarosa	Malay apple	*Syzygium malaccense*
Guanábana	Soursop	*Annona muricata*
Limón dulce	Sweet lemon	*Citrus limetta*
Fito		
Sangre de grado	Dragon's blood tree	*Croton lechleri*
Manchinga	Breadnut	*Brosimum alicastrum*
Llanchama	Panamanian	*Poulsenia armata*
Machonaste		*Clarisia racemosa*
Shapaja (palmito)		*Attalea sp.*
Pijuayo	Peach palm	*Bactris gasipaes*
Shapacha		
Plátano	Plantain/banana	*Musa spp.*
Yuca	Cassava	*Manihot esculenta*
Caña	Sugar cane	*Saccharum officinarum*
Piña	Pine apple	*Ananas comosus*
Maíz	Maize	*Zea mays*
Frijol de palo	Pigeon pea	*Cajanus cajan*
Frijoles	Beans	*Phaseolus spp.*
Dale dale	Guinea arrowroot	*Calathea allouia*
Papaya	Papaya	*Carica papaya*
Bihao		*Heliconia cannoidae*

Appendix V

Table of species grown systematically in fields in production and in newly established fields.
The numbers represent how many fields each species was grown in. The green boxes represent the most common species in fields in production and in newly established fields.

Species:	Number of fields in production (out of 36):	Number of newly established fields (out of 13):
Guaba	19	5
Mahogany	19	1
Teak	17	6
Plantain/banana	3	6
Spanish cedar	18	1
Capirona	12	5
Paliperro	9	4
Estoraque	8	3
Avocado	6	1
Tornillo	4	1
Pink cedar	3	2
Bolaina	3	2
Coco-nut palm	5	
Orange tree	2	3
Pucaquiro	4	
Shimbillo	2	1
Brazilean fern tree	1	2
Balsa/Topa	2	1
Shapaja	2	1
Ishpingo	1	1
Electrina	1	1
Peach palm	2	
Maize		2
Cassava		2
Huairuro		1
Balsamo		1
Fapina	1	

Appendix VI

Table of species grown systematically in the cacao fields

The numbers represent how many fields each species was grown in. The green boxes represent the most common species in fields in production and in newly established fields.

Species:	Field boarders	Throughout the field
Guaba		24
Teak	16	7
Mahogany	11	9
Spanish cedar	11	8
Capirona	12	5
Paliperro	9	4
Estoraque	6	5
Plantain/banana		9
Avocado	2	5
Tornillo	3	2
Pink cedar	1	4
Bolaina	3	2
Orange tree		5
Coco-nut palm	3	2
Pucaquiro	2	2
Shimbillo		3
Brazilean fern tree	1	2
Balsa/Topa	3	
Shapaja	3	
Ishpingo		2
Electrina		2
Peach palm		2
Cassava		2
Maize		2
Huairuro	1	
Balsamo	1	
Fapina		1