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I Abstract

This study was carried out in the two villages of Buena Vista and Santa Teresa, department of Jinotega in north central Nicaragua. The purpose of the study was to investigate farmers' attitudes toward timber trees and forests, and to investigate the occurrence of tree species with high timber value in the area. The study shows that people consider the forest to be important for both biological reasons and as an area for extraction of different products, among those timber is one. Today there are only a few farmers who are selling timber, and when it is done it is to some one in the neighbourhood. The study also shows that there is a lack of those tree species with the most valuable timber. On the other hand less popular tree species with good timber properties are abundant. There is a possibility to expand the use of the well-known valuable species: however, the risk is higher and the establishment more difficult than using species that exist today and regenerate in an easy way, for example the *laurel*, *Cordia alliodora*. It is possible to extend the cultivation of trees in the areas where coffee today is grown, but it is also possible to establish areas primary used for the cultivation of trees. The way that the forest act is written today makes it hard for small farmers to use their forest resource in a legal way.

Key Words: Nicaragua, Cultivation of trees, Farmer attitudes, PRA, Forestry

II Resumen ejecutivo

Este estudio es un estudio experimental hecho para conseguir información de la posibilidad de la cultivación de árboles como modo de diversificación para pequeños propietarios en Nicaragua. El trabajo en el terreno en el estudio se centró en dos puntos principales: las actitudes de los productores sobre árboles y bosques, y la existencia de árboles con las buenas características en el área. Siete productores en Buena Vista y Santa Teresa en Cuá-Bocay han entrevistado con varias veces, y los recursos de los árboles de sus fincas eran estudiados.

El estudio demostró que los campesinos tienen buenos conocimientos de bosque y árboles, y también de su manejo. Saben como manejar árboles de sombra en los cafetales, aunque esta actividad no tiene como meta primaria la producción de madera. Con condiciones diferentes, que permitirían una arboricultura comercial, estos conocimientos podrían ser dirigidos a una producción de mayor escala.

Los inventarios de campo mostraron una falta de especias de alta valor reconicida (caoba, cedro, granadillo y nogal), pero una presencia de especios de buena calidad pero de menor demanda (comenegro, ceiba, laurel, madero negro, maria y roble encino). Particularmente, en cafetales y bosque secundario existe una potencialidad tanto de árboles como plantas de especies atractivas, como laurel y madero negro.

Una posible arboricultura futura debe ser concentrada a cafetales, rastrojos etc., y no a los residuos de bosque primario, los cuales tienen su importancia como fuente de varios productos y para la protección del agua potable.

Existe una opción para los finqueros a diversificar su economía por el cultivo de árboles maderables. Hay dos alternativos: plantación de especies demanda reconocida (como caoba), ó el desarrollo de recursos de árboles y plantas ya existentes (como laurel). El primer alternativo corre un riesgo economico en caso de un fracaso de las plantaciones, mientras que el segundo ofrece ingresos más seguros por su regeneración natural. Particularmente deseo proponer una atención a las posibilidades del laurel, con su madera bella y resistente, su regeneración fácil y presencia natural en mucho de las tierras relevantes. El cultivo del laurel podría formar un componente valeroso en los sistemas agroforestales ya existentes y en la transformación de bosque secundario y de pastos de baja calidad. La solución óptima es diferente en cada finca, según los tipos de tierra y su uso corriente.

En algunas zonas la población ya sufre, ó sufrirán en un futuro próximo, de una falta tanto de leña como de madera para construcción. En tales fincas la regeneración del recurso arbóreo debe ser desarrollada hacía las necesidades domésticas. Pero en otras fincas será posible cultivar y vender madera para la comunidad vecina ó, en caso del desarrollo de mecanismos de mercado, a compradores fuera del vecindad. En ambos casos, además del laurel, el madero negro representa una potencial por su capacidad de mejorar los suelos, su uso como alimento de animales, y como madera. Madera negro es común como cercas vivas en el área.

Se recomienda que FondeAgro asiste a los finqueros en el desarrollo de la arboricultura. Inicialmente, esto sería posible en dos maneras; enseñandoles en las potenciales de maderas diversas, pero tambien fomentando la comprensión que madera y leña no es un recurso inagotable. En caso de una estrategia futura de cultivar especies de alta valor, suministar de plantas y asistencia técnica podrá ser una actividad deseable del proyecto.

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Acronyms:

INAFOR	Instituto National Forestal, National Forestry Institute
MAGFOR	Ministerio de Agropecuario Forestal, Ministry of Agriculture and Forestry
MARENA	Ministerio del Ambiente y los Recursos Naturales, Ministry of Enviorment and Natural Resources
NTFP	Non Timber Forest Products
PRA	Participatory Rural Appraisal
RRA	Rapid Rural Appraisal
Sida	Swedish International Development Cooperation Agency
Mzn	Manzana

Glossary:

Cafetal/-es	Coffee plantation, in Nicaragua frequently with managed shade trees.
Closed forest	Formation where trees in the various layers and the undergrowth cover a high proportion (> 70%) of the ground.
Manzana	Measurement used in Nicaragua, one manzana is equalling to about 0.7ha.
Non Timber Forest Products	Products of biological origin (other than timber) extracted from the forest.
Open forest	Formation with a discontinuous tree layer, with a coverage between 30% and 70%.
Patio	Spanish for courtyard, i.e. an area used for cultivation of vegetables e.t.c. near the home.
Primary forest	Forest that is relatively intact and not has been affected by human activity (for a long time).
Pulgada	Spanish for inch (2.54 cm). Often used as a volume of 1*1*33 inches ($0.00054m^3$).
Rastrojo	Spanish for stubble. By the farmers used as a name for both agricultural land in fallow and for land earlier used but now covered by secondary forest.
Secondary forest	Naturally regenerating forest on former clearcut or agricultural land.
Tacotal	Vegetation dominated by natural regenerated trees and shrubs or low forest.

1. Background

1.1 Purpose and objectives

The present report is a Master's Thesis in Forestry at the Swedish University of Agricultural Sciences (SLU), Department of Forest Products and Markets at the Faculty of Forestry. It was carried out with funding from Sida as a Minor Field Study (MFS), a Sida program aimed to give university students, at the final phase of their study, the possibility to conduct scientific work in developing countries. The study was prepared in collaboration between SLU, a Sida funded project in Nicaragua, FondeAgro, and the Swedish consulting company, ORGUT Consulting AB.

FondeAgro is an agricultural project in the provinces Matagalpa and Jinotega in Nicaragua. It spans over ten years and is supported by ORGUT. The overall goal for FondeAgro is to alleviate rural poverty by increasing agricultural productivity and incomes for the smallholders in the area. For a more detailed description, see section 1.6.

1.1.1 Cultivation of trees

The concept "cultivation of trees" is used to indicate the management and use of the tree resource on smallholdings. This concept differs from the well-known concept of silviculture in two ways. "Cultivation of trees" indicates a smaller scale of cultivation compared to silviculture. It also includes all the tree resources on the farm, not only the ones in primary and secondary forest, but also the trees used as shade trees in the coffee growing area (*cafetal*), and trees growing in pastures and other areas of the farm. Cultivation of trees can be seen as one aspect of the greater concept, agroforestry.

Studies have shown that, even after a long time of settlement, most smallholdings include some forest land (Smith, 2001). In the study area coffee is grown in shady conditions (Programme document, 2001). A lot of different tree species are used as shade trees for the coffee in this part of the world (Muschler, 2000, Sistemas agroforestales, 1993 and others). However, it is also shown that the value of wood is increasing at a faster rate than other assets (Management of secondary forests in tropical America project, 2003). As an example, the program document for FondeAgro (1999) says that the shade trees in coffee growing areas, with the current depressed coffee prices, in some cases have been a more important source of income than coffee.

As mentioned above, the overall goal for FondeAgro is to alleviate rural poverty by increasing agricultural productivity and income for the smallholdings (Programme document, 2001). At the time of the beginning of this study, FondeAgro did not work with forest as a resource, but pointed at the fact that at farm level, the forest resource could be a component of income diversification, depending on local demand (Programme document, 2001). The present thesis is intended to be a pilot study about matter. The overall goal is to investigate if cultivation of trees can be a way for the smallholders in Nicaragua to diversify their income.

1.1.2 Objectives

To attain knowledge about the possibility to use cultivation of trees as a way to diversify the income for the farmers, this study is divided in two main lines:

- A study of the farmers' attitudes toward, and uses of, the trees and forests on their land.
    - What knowledge do the farmers have about the importance of forests and trees outside the forest?
    - What is the current use and importance of trees?
    - Is there any management to increase the growth and value of existing trees today?
    - Do the farmers plant/sow for establishing new trees?
    - What are the differences between farms with a higher proportion of forest and secondary forest compared to farms with less forest and secondary forest?
    - How does the Nicaraguan forest act affect the possibility to use the tree resource?

- A survey of the existence of tree species at the farms that can be used in the cultivation of trees.
    - What is the composition of the tree resource on the farms (species and age class)?
    - What timber species occur on the different land types represented on the farms?
    - Is there a sufficient stock of saplings and young trees on the land, or do the farmers have to begin from scratch if they wish to go for cultivation of trees?

1.2 Introduction to Nicaragua

1.2.1 Geography and climate

Nicaragua is situated in Central America (latitude 11-15° N and longitude 83-88°) and has an area of about 128 300 km^2 (Salas, 2002). It is the largest of the Central American countries and had in year 2000 5.1 million inhabitants (Länder i fickformat, 2002). It borders with Honduras to the north, Costa Rica to the south, the Caribbean Sea (Atlantic Ocean) to the east and the Pacific Ocean to the west. A map over the country is shown in figure 1. The country has three distinct geographic regions: the Pacific lowlands, the North-central highlands and the Caribbean lowlands (Lonely Planet, 2001).

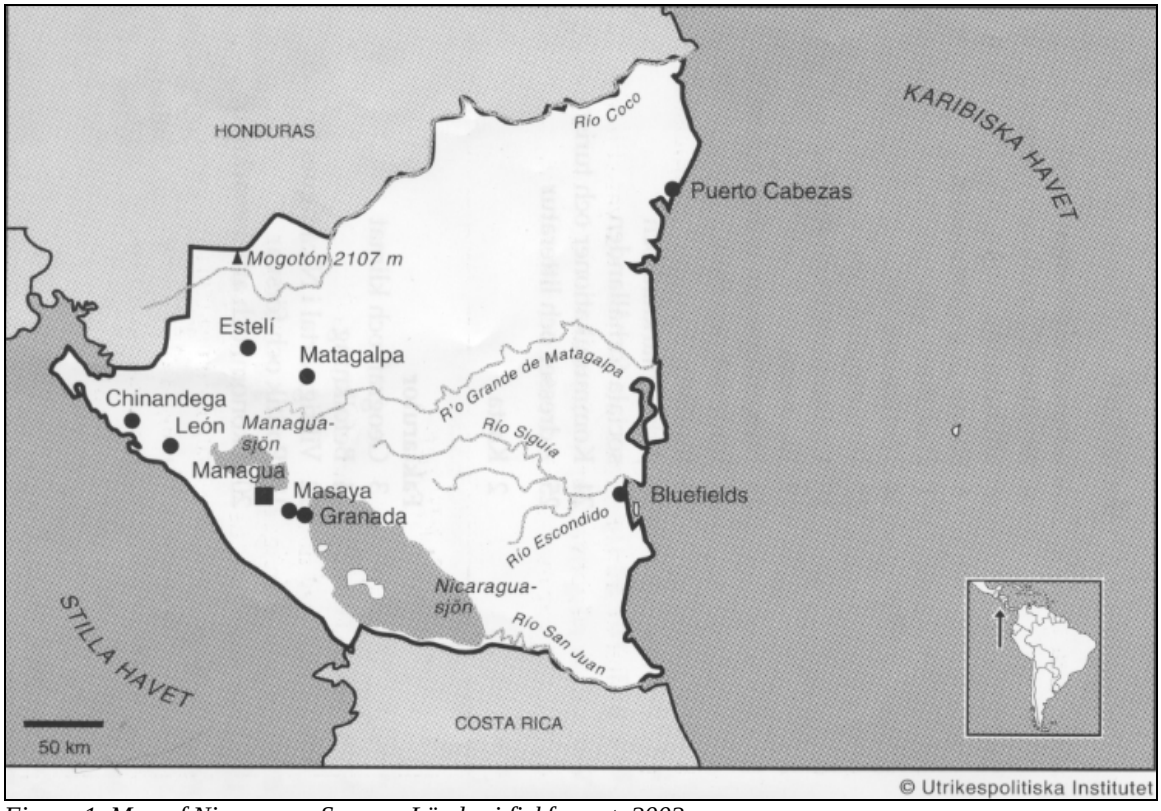

Figure 1. Map of Nicaragua. Source: Länder i fickformat, 2002

The Pacific lowlands are characterized by fertile agricultural soils of volcanic origin, where mainly annual crops are produced in an intensive way (Salas, 2002). The major part of the Nicaraguan population lives in this region. The region has many volcanoes, some of them active today. Two large lakes, Lake Nicaragua and Lake Managua, are also situated in this region (Länder I fickformat, 2002). The Northern highlands have a broken topography, and the major part has an altitude of more than 500 meters above sea. This makes the climate humid and fresh. The soils are relatively poor. The agricultural land is mainly used for cultivation of coffee and for extensive pastures. The natural vegetation of the region is mostly broadleaved forest but the northern part has some pine forest as well (Salas, 2002). The Caribbean lowland is, as the name implies, flatland, partly poorly drained; about 50% of the land is situated below 100 meters above sea. It is dominated by high tropical rainforest, but some parts in the North-East, with extremely poor soils (very

low phosphorus levels) have pine forests as well. This region is sparsely populated (Salas, 2002).

The Nicaraguan climate is tropical with small temperature variations over the year. The climate varies somewhat with altitude. The western part is a bit warmer than the eastern and the highlands are the coolest (Länder i fickformat, 2002). There are distinct wet (May to October) and dry seasons (December to April). The Southeast receives the largest annual rainfall and the Northwest the least. The country is subject to various destructive climatic phenomena like uneven distribution of rainfall, severe drought, tropical storms, floodings and hurricanes (Lonely Planet, 2001).

1.2.2 History and politics

When the Spaniards came to the area that today is Nicaragua during the beginning of the 16:th century, different Amerindian tribes settled the area. The country is said to have its name from one of the Amerindian chiefs. The cultures in the western parts represented an extention of the Mexican culture sphere, while the eastern lowlands were inhabited by a culturally different stock belonging to the Caribbean region. The Spaniards never succeeded in conquering the eastern part of the country, but pirates and English traders reached it in the 1630's. African racial elements, originating in the Caribbean islands, mixed to a notable extent with the original population, and formed a semi-independent "kingdom" of Misquitia, hence the concept Mosquito Coast, referring to the ethnic groups, not to the insects.- Nicaragua became independent in 1838. After the independence there was a turbulent time in the country, armed conflicts and power shifts followed during the rest of the century. During a period a mercenary of US origin, William Walker, became president.

In 1936 the Somoza family came to power through a coup d'état. The Somoza regime was known for relative stability, economic growth and close relations with the USA. However, the opposition was ruthlessly suppressed, and the Somoza family made a big fortune from its engagement in almost every economic venture in the country and from directly milking the state budget. After a devastating earthquake in Managua 1972, which took about 10.000 lives, most of the foreign aid was appropriated by Somoza himself. The Sandinista party, FSLN (the Sandinista National Liberation Front), was founded in 1961 and built on Marxist ideology. It took its name from General Augusto Céasar Sandino who was a liberal general that fought against American forces in Nicaragua in the beginning of the 20th century. Sandino was murdered by the Somoza family in 1934. The assassination of Pedro Joaquin Chamorro, a well-known and respected newspaper editor, in 1978 led to protests from all social classes. The FSLN led the fight against Somoza and several rebellions were fought down before the Somoza regime fell in 1979 and the Sandinistas came to power. In July 1979 Somoza fled the country and the following year he was murdered in Paraguay.

The Sandinista government implemented a policy that, among other things, confiscated the assets of the Somoza family and its officers. The Sandinistas implemented a radical land reform, and put a lot of efforts on education and health care. After Ronald Reagan became president in the USA in 1981, the relations between the countries became worse.

The USA administration feared that the Sandinista government should spread the communism in Central America. However, In spite of fears of the contrary, a Cuba-style dictatorship was never set up. Many adherents of Somoza fled to Honduras in 1979, where they founded the guerrilla, Contras. The Contras wanted to overthrow the Sandinista regime. They got support from the USA government and in 1981 they started to make raids into Nicaraguan territory. The civil war was intensified and until 1984 Contras had the initiative in the combats. In 1984 the Sandinista president candidate Daniel Ortega won the elections. Same year, the secret American support to Contras stopped because it became known that CIA organised the mining of Nicaraguan harbours. But soon the support started again in other forms. Regional peace initiatives resulted in the 1987 Esquipulas agreement, which became the beginning of a peace process through the entire Central America. However, peace was not declared until 1990, and by then, 10.000's of people had been killed in the civil war, and the economy was undermined after an American trade embargo in 1985.

In the 1990 elections, the UNO (National Opposition Coalition) and their president candidate Violeta Barios de Chamorro, widow of the murdered journalist Pedro Chamorro, was elected by a people which wanted peace. The violence on the countryside increased again in the beginning of the 90's, since demobilised soldiers from both sides were displeased with not having received the land lots promised by the government. In 1993 peace returned to the country. In 1996 the conservative politician Arnoldo Alemán was elected president heading a liberal alliance. In October 1998 the hurricane Mitch killed 3000 people, making about 500.000 persons homeless and destroying infrastructure and arable land. After the hurricane, Nicaragua got substantial international aid. In 2001 the liberal politician Enrique Bolaños was elected president (Länder i fickfomat, 2002).

1.2.3 Economy

Nicaragua is one of the poorest countries in Latin America. The economy is in a crisis. About half of the population is unemployed and a lot of people work in the informal sector. Women and children in rural areas are those in the most exposed position, and maternal and infant mortality rates are high. Agriculture, livestock breeding and fishing constitute the basis of the Nicaraguan economy. The production is based on export of coffee, shellfish, beef, sugar and bananas, - and some high quality tobacco, and due to this the country is sensitive to changes in world market prices of these products. Nicaragua has a large trade deficit as it imports about two and a half times as much as it exports. The country is deeply indebted; the national debt being more than three times the GNP in 1991. In December 2000, Nicaragua was included in a loan program for highly indebted countries, administered by the World Bank and the International Monetary Fund, as a means to write down parts of the debt. This could improve the development potential in the country, even if it still will depend on foreign loan givers and the world market prices on raw material (Länder i fickformat, 2002). The forestry sector is small, in spite of the extensive forest cover and ideal conditions for timber production. In 1999 the forest sector represented 2.82% of the GNP (Tijerino, 2002).

1.3 Forests and forestry

In 1999 60.120 km^2, or 49.5% of the Nicaraguan territory, was forested. 99% were natural forests and less than 1% (517 km^2) were forest plantations. About 44.200 persons worked in the forest sector; 41.800 in the forest management and 2.400 in the forest industry (Tijerino, 2002). The forest management in Nicaragua started during the 60's and 70's with technical projects founded by FAO (Araquistan, 2002). A large-scale forestry development programme in the 1980s, supported by Sweden, came to a halt because of the political turbulence (Frühling, 2000).

As mentioned above, Nicaragua is divided into three geographic regions: the Pacific lowlands, the Northern highlands and the Caribbean lowlands. Following Holdridge's classification of ecological zones (a little over 100 life zone systems in the world), eight can be found in Nicaragua (Guía de Especies Forestales de Nicaragua, 2002).

1.3.1 Forests in Cuá-Bocay

Cuá-Bocay is a municipality in the department of Jinotega, situated in the Northern highlands. 59% of the area in the department of Jinotega is forested. The main part, 45.8%, is covered by closed broadleaved forest and 12.7% is open broadleaved forest. Cuá-Bocay is the most forested municipality in the Jinotega department, 75% of the area is covered by forest; 61.1% with closed broadleaved forest and 13.8% with open broadleaved forest. The other major land types in the municipality are pasture (16.4%), *cafetal* (5.5%) and secondary forests (2.5%) (Rodriguez, 2001).

There are not many studies done about the composition of the forest in the area. During Rodriguez' (2001) inventory of the Nicaraguan forests 19 parcels were investigated in the highlands. During that inventory 108 species were identified and classified after species and breast height diameter (more species occurring but left out of count because of rarity or small size). Out of these 108 species, 10 species overlap with those species that are investigated in this study. Rodriguez' results of the overlapping species are summarized in table 1. The vernacular names are given in all the tables in this paper and a list of the connection between vernacular names and scientific names can be found in appendix I.

Table 1. The existence in north central Nicaragua of the species inventoried during this study. Source: Rodriguez, 2001

Vernacular name		Diameter classes									
	Data	10	20	30	40	50	60	70	80	90	Total
Caoba	N/ha	1.58								0.11	1.68
	V	0.07								0.58	0.65
Cedro	N/ha				0.11				0.11		0.21
	V				0.04				0.19		0.23
Ceiba	N/ha									0.11	0.11
	V									0.58	0.58
Comenegro	N/ha	0.53			0.11		0.21				0.84
	V	0.07			0.08		0.14				0.29
Granadillo	N/ha	0.53									0.53
	V	0.02									0.02
Laurel	N/ha	12.6	1.58	0.5							14.74
	V	1.07	0.23	0.5							1.8

Table 1. continued

Madero negro	N/ha	1.05									1.05
	V	0.04									0.04
Maria (Santa Maria)	N/ha	2.11	1.05	0.5	0.1	0.1					3.89
	V	0.09	0.16	0.2	0.1	0.1					0.59
Nogal	N/ha				0.1						0.1
	V				0.1						0.1
Roble Encino	N/ha				0.2						0.2
	V	0.09	0.16	0.2	0.1	0.1					0.59
Total (this 10 species)	N/ha	18.4	2.63	1	0.62	0.1	0.21		0.11	0.22	23.3
	V	1.36	0.39	0.7	0.42	0.1	0.14		0.19	1.16	4.4
Total (all species)	N/ha	117	51.1	17	9.9	4.4	2.8	0.8	0.7	1.9	205.9
	V	6.3	8.41	5.7	4.8	3.9	4.1	1.4	2	11	47.2

Among the species inventoried by Rodriguez', some are favoured for there good timber values and are much coveted at the national and international market (e.g. *caoba* - mahogany). Other species are still well known, and used for, different timber purposes, and some species are not well known; they are seldom used for other purposes than firewood. *Laurel* is a particularly good species, out of several, that could be a suitable component in a cultivation of trees system. It is described more in detail in the following section.

1.4 Laurel – Cordia alliodora

Laurel is a fast growing and light-demanding tree. It colonizes exposed fertile soils, and there is often a good regeneration on sites cleared by man. The fact that it is self-pruning and fast growing makes it good as a species to use in different agroforestry systems (Greaves, 1990). *Laurel* is spread from Mexico in the north, through Central America, and down to the north of Argentina and the western parts of Brazil (Guía de Especies Forestales de Nicaragua, 2002). It has a wide span of needed living conditions, with large variations in climate, altitude and soils. It grows on altitudes that vary from 0-1500 meters above sea, it needs a precipitation of over 2500 mm per year and the temperature where it grows varies from 13 up to 32 degrees Celsius (Flores-Vindas, 2003). It prefers freely drained and fertile conditions, but a range of diverse soil types are tolerated (Greaves, 1990). The optimum for the tree is areas below 800 meters altitude with a temperature above 24 degrees (Flores-Vindas, 2003).

The tree can grow up to 30–35 meters of height and do normally reach a diameter at breast height of 70-80 cm. The stem is normally straight and clear of branches for 50-60 percent of the height (Greaves, 1990).

The *laurel* wood has good properties. Its timber has a fine grain, a beautifully coloured heartwood, and is reasonably termite resistant. It is used for several different purposes e.g. furniture, indoor and outdoor constructions, plywood, veneer and pulp (Carpio, 2003).

Different studies have approximated the rotation period to around 20-25 years, and in this time the tree can reach 30-35 meters of height, and have a diameter at breast height of about 40-55 cm (Greaves, 1990). Several studies have shown the possibility to use the

laurel in different agroforestry systems, for example together with coffee and in pastures (Greaves, 1990). Figure 2 show naturally regenerated *laurel* as shade trees above coffee plants.

Figure 2. Naturally regenerated laurel, Cordia alliodora, growing above coffee. Source: Greaves. A 1990

1.5 The forest act

The Nicaraguan Forest Act (Ley No 462) and the Administrative Directives (April 2002) set the legal framework for the utilisation of forest in the country. The act is written with a focus on conservation, and sees the forest as something to be protected, not utilised. It is written mainly with big companies in mind and with less regard to small-scale forest owners (Ariquistan, 2003). There are different regulations depending on the size of the forest area of the property. There is one regulation for forest areas less than 10 hectares,

one for areas between 10 and 50 hectares and another one for areas bigger than 50 hectares (Disposiciones administrativas, 2002), but in the eyes of the author of the present report, the potential of an active forest management and timber production on farmland was not fully realised by the legislators.

When the property is situated in a protected area the forest activities has to be authorised by MARENA (Ley No 462). Today, it is not allowed to use a common chain saw to manage the trees in the protected areas, as farmers are restricted to use a hand saw or a frame saw (Flores, 2003).

The following part of this section will focus on the regulations that concern the properties smaller than 10 hectares of forest situated in a protected area (i.e. the situation for the smallholdings in this study). These regulations do not include all types of cuttings on the farms, only those cuttings done when the timber is meant to be sold or is more than 10 m^3 per year and farm. This means that if the cutting is less than 10 m^3 and the timber only is used on the farm, no permission is needed (Disposiciones administrativas, 2002).

INAFOR is the institution which handles inspections on farms and that gives permissions to utilize the forest. To be able to get permission, the owner of the property (the farmer) has to fulfill the following five criteria:

Article 5 (Source: Disposiciones administrativas, 2002):

- A forest management plan (See below)
- A certificate of registration of title for the farm
- Permission from MARENA when the property is situated in a protected area
- Opinion from the mayor
- Certificate permitting the activity

The “forest recovery plan”, as the management plan is termed, has to be established/authorized by INAFOR and should include the following (article 4 Disposiciones administrativas, 2002):

- A sketch of the farm
- General data of the farm
- Standing stock of commercial species
- Forest protection activities
- Method to regenerate the forest resource
- Time plan for the forestry activities

The farmer has to be a legally registered owner of a legally established property of land. During an inspection from INAFOR the farmer also has to present a plan over the forest activities. When having the plan, both MARENA and the mayor have to accept it. Afterwards, if permission is given, the activity can be undertaken and finally there has to be a new inspection from INAFOR to control the activity.

The permission also includes different costs for the farmer.

First inspection from INAFOR	400 Cordoba[1] (26.7 US$[2])
Permission cost for each m^3 that are cut	Depending on species (table 2.)
Charge for INAFOR service	15 Cordoba/m^3 [3] (1 US$)
Second inspection from INAFOR	400 Cordoba (26.7 Us$)

Table 2. Costs for the permission (Cordoba/m^3) for selected tree species.

Vernacular name	Cost for permission	
	Cordoba/ m^3	US$/$m^3$
Cedro Real	250	16.7
Caoba	250	16.7
Granadillo	250	16.7
Nogal	250	16.7
Laurel	130	8.7
Santa Maria	40	2.7
Madero negro	27	1.8
Comenegro	27	1.8
Roble	20	1.3
Roble encino	20	1.3
Ceiba	20	1.3

1.6 The FondeAgro project

FondeAgro is an agricultural project, spanning over ten years, in the provinces Matagalpa and Jinotega in Nicaragua. The project, which began in 2001, is supported by ORGUT Consulting AB and is financed by Sida, MAG-FOR (Nicaraguan ministry of Agriculture) and others. The overall goal for FondeAgro is to alleviate rural poverty by increasing agricultural productivity and incomes for the smallholders. Currently the productive activities in the area are concentrated to coffee, cattle and basic grain production (Programme document, 2001).

The FondeAgro project is meant to have three phases. The first two years have been a starting up phase, with establishing of links with producers and local organisations. It has been a time of pilot activities in the frame of the production activities and support described below. FondeAgro gives technical assistance providing farmers with alternative solutions to relieve the low productivity in the following major production activities:

- Coffee production and marketing
- Livestock production and marketing
- Agricultural diversification

[1] All the costs is taken from Direccion control de operaciones territoriales.
[2] The exchange rate 1 US$=15 Cordoba is used, this is close to the exchange rate at the time of this study.
[3] The charge is 15 Cordoba/m^3 for broad leaved trees and 6 Cordoba/m^3 for coniferous trees.

To enable the farmers to make necessary investments and improvements FondeAgro also works with complementary supporting services that include:

- Legal services (Legalization of land titles)
- Support to homestead economy (Micro Credits)
- Institutional support

The second phase, which started in 2004, is to be a period of consolidation and expansion (Programme document, 2001). The first phase has been evaluated, and the work will continue with the main production activities from phase one (Plan Indicativo Segunda Fase, 2003). In the first phase, the technical assistance focused on improving the farmers' management and cultivation techniques. In the second phase, the focus will be on creating a business climate that can help the farmers generate a higher income (Programme document, 2001). However, the evaluation of the first phase among other aspects pointed towards a need for an integrated approach to the farms. This means that an interaction of the different production resources and the surrounding factors is to be sought through an integrated approach, instead of only working with the different aspects separately (Plan Indicativo Segunda Fase, 2003).

Finally, the last years will be a phase out period. The FondeAgro project is meant to act as a catalyst to build up existing organisations, and to make them independent, so they can continue FondeAgro's work after the project is phased out. To reach this goal, the last two years (2009-2011) will focus on the transfer of responsibility for the activities to the private sector and to MAG-FOR (Programme document, 2001).

Today, FondeAgro does not work with forest as a resource, but the program document (2001) says that at farm level, the forest resource could be a component of diversification, depending on local demand.

2. Design and Methods

The fieldwork of this study has two main parts: A study of the farmers' ideas about, and uses of, trees and other forest resources, and a field inventory to give a hint about the occurence of useful timber species in the area. The study of the farmers attitudes were made with different PRA/RRA (Participatory Rural Appraisal/Rapid Rural Appraisal) tools, and the invonory in the form of strip surveys

2.1 Study site

The study was conducted in two villages: Buena Vista (latitude 13.33° N, 85.38° W longitude and about 890 m altitude) and Santa Teresa (latitude 13.30° N, 85.36° W longitude and about 570 m altitude). Both of them are situated in the municipality of Cuá-Bocay, in the department of Jinotega in the north central mountainous part of Nicaragua. The area has a rain period between May and January. The Cuá-Bocay municipality has 76.625 inhabitants (year 2000) and the population density is 13.5 persons/km^2. The municipality has a young population, about 64% are younger than 19 years and about 95% of the population live in the rural area (Municipio Cuá-Bocay, FondeAgro).

Buena Vista was settled about 30 years ago and Santa Teresa about 15 years earlier. Buena Vista, which is situated at a higher altitude, has a higher proportion of both primary and secondary forest areas. In Santa Teresa, there are few primary and secondary forest areas; the landscape is dominated by extensive pastures. The secondary forests are former arable land and pasture that were abandoned during the civil war, which was very intense in this area.

2.2 Farm selection

The villages and farms were selected among those being connected to the FondeAgro project. Due to this, the criteria for the FondeAgro farms are of interest. The target group for FondeAgro is the poor, but not the extremely poor. Their income should be between 0.6 and 2.5 USD/day. The income average for the farmers connected to FondeAgro is below 1 USD/day, which is the limit for poverty (0,5 USD/day is the limit for extreme poverty). The families should have some land, and in the municipality of Cuá-Bocay they should cultivate coffee, sell a part of their production, and have a possibility to extend their production. Further, the families should be rural, which means that they should live on a farm or in nearby villages, but not in the main town of the department. They should have been living in the area for at least five years, and the farms should be easily reached with available means of transport (Documento del Programa 2001-2011 FondeAgro). In this case the words "easily reached" mean that it may take at most about five hours by car from the main office to the walking path, and then another three hours of walk to the farm.

The villages and farms were selected in co-operation with field staff working with technical assistance in Cuá-Bocay for FondeAgro. During this study the different farms were visited between five and nine times. Due to the security situation, which made it

impossible to stay overnight in the countryside, the farms had to be positioned close to each other and to functioning infrastructure. Further, the farms were tried to be selected from the criteria that they should have some high forest and, if possible, some secondary forest. The farms were also selected so that they had a variation in size. Some farms should have sizes of more than 10 hectares and some less than 10 hectares.

The intention was that both men and women should be interviewed on the farms. Unfortunately, lack of time and serious problems in the possibility to interview women privately, resulted in only men being interviewed.

2. 3 PRA/RRA (Participatory Rural Appraisal/Rapid Rural Appraisal)

There is a growing awareness that successful research has to take into account the farmers objectives and constraints, and that research can benefit from their knowledge of local conditions (Fagerström, 2003). In recent years, there have been an increasing number of comparative studies of development projects showing that "participation" is one of the critical components of success (Pretty, 1995). Chambers (1997) describes PRA/RRA as a growing family of approaches and methods to enable local people to share and analyse their knowledge of life and conditions and to plan, act, monitor and evaluate them. This extensive and growing menu of methods includes visuals such as mapping and diagramming. Outsiders do not dominate and lecture; they facilitate, sit down and listen. Chambers also mentions that triangulation is an important part of the approach. Triangulation means that one needs to seek multiple perspectives through different methods, analyses etc. PRA/RRA approaches encourage the peasants to play an active role in the communication, and this includes drawing sketches, calendars and maps. There are a lot of different methods used under different conditions and for different purposes.

2.3.1 Semistructured interview

Semistructured interviews (SSI) were the basis for the different PRA/RRA tools used in this study. They were made as dialogues between the interviewer and the interviewed. It is important that the two parts are respecting each other. The interview has no set questions or questionnaires; instead the interviewer uses a checklist of topics, decided in advance, for the discussion. The questions raised were open ended, which means it was not questions of yes-no type, but questions that invite the interviewed to tell more. The interviewer had to be open-minded and flexible. Two persons, one to raise the questions and one to record the answers, normally carried out the interviews. The issues raised during the interviews can be found in appendix II.

2.3.2 Workshop - Farmer group meeting

Two workshops (i.e. farmer group meetings) were held, one in each village. The main idea with the workshops was to get raw material for the further studies, to get a picture of the existence and use of timber species, and the overall use of and thoughts about the forest. The main part of the workshops was a discussion, were the farmers' discussed different issues. The issues raised in the workshops can be found in appendix II.

2.3.3 Pair-wise ranking
The pair-wise ranking is used for the ranking of different options. During this study, it was used to rank the importance of the forest during the workshops, and the importance of different land types for extraction of firewood. In pair-wise ranking, the options are written in a table and compared in pairs. The results of the different comparisons are summarized, and the different options can be compared/ranked.

2.3.4 Direct observation
Direct observations were used during all phases of the study. Direct observations are observations about how a certain thing looks or how something is done by the farmers. The direct obervations were of certain importance during the strip inventory, since by then the farmer and the author were walking around at the farm.

2.3.5 Farming system analysis
In farming system analysis, the interviewer and the farmer discussed the farm as a system and together made a map over the farm. The map gives a more or less complete picture of the farm with its different components and flows, both on-farm flows and some external flows were included. Examples of the latter are markets for buying and selling different products. Figure 3 shows an example of a farming system analysis made during the study.

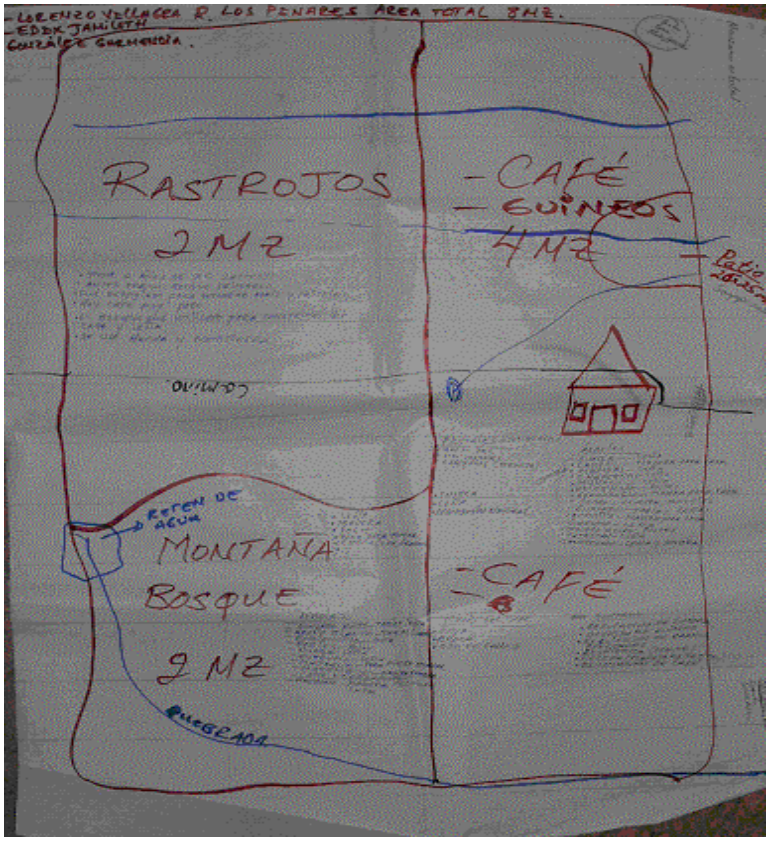

Figure 3. One of the farming system analyses made during the study.

2.5.6 Cause-effect analysis

The cause–effect analysis were made to investigate the farmers knowledge and ideas of an issue or a (complex) problem, to see what knowledge the farmer has about the importance of the forest and trees. The cause-effect analysis was made as a "mind map" with the issue or problem in the middle, and the causes/effects above or below. Both farmer and interviewer drafted the diagram together, and during the writing the interactions between the different components were discussed.

2.4 Strip surveying

Strip surveying is also named belt inventory, transect inventory, strip cruising and strip transect inventory (Ståhl, G. et. al. 2001). Strip surveying is a cost-efficient method for sampling rare forest objects (Lämås, 1996).

The strip surveying was used to get a hint about the composition of the tree resource on the selected farms. To attain this information, some tree species with good timber properties were selected (for information about the selection, see the workshop part of this chapter and the workshop part of the results). Afterwards, the farms were inventoried with a strip survey. Each land type was inventoried separately. First, a small sketch over the area was made. The landowner gave information about the size of the area, and this information was then used for deciding the spacing (S) between the strips. The connection between the investigated area and the spacing used during this study, was taken from the Swedish National Board of Forestry guide for fieldwork with R-POLYTAX (Instruktion för fältarbete med R-POLYTAX, Skogsstyrelsen, 2003), see table 3. The investigated areas were of sizes between about 0.5 and 7 ha. The width (W) of the strips was 14 meters (7 meters on each side of the middle line).

Table 3. Connection between the investigated area and spacing between the strips.

Area (ha)	Area (Mzn)	Spacing (m)
0.5	0.7	30
1.0	1.4	40
1.6	2.3	50
2.3	3.3	60
3.2	4.6	70
4.3	6.1	80
5.5	7.8	90
6.8	9.7	100
8.3	11.8	110

The strips were positioned in either north/south or east/west direction. The direction was decided out of the form of the area that should be inventoried. The strips were put perpendicular to the longest side of the area. When the inventory direction was decided the starting point were put in one of the corners (C). The position of the first strip (A) was randomly decided with help of a random-number (X) between 0 and 1, taken from a calculator. The number was multiplied with the spacing (S) and half of the width of the stripe was subtracted. This gives the formula A=S*X-W/2, which is visualized in figure 4.

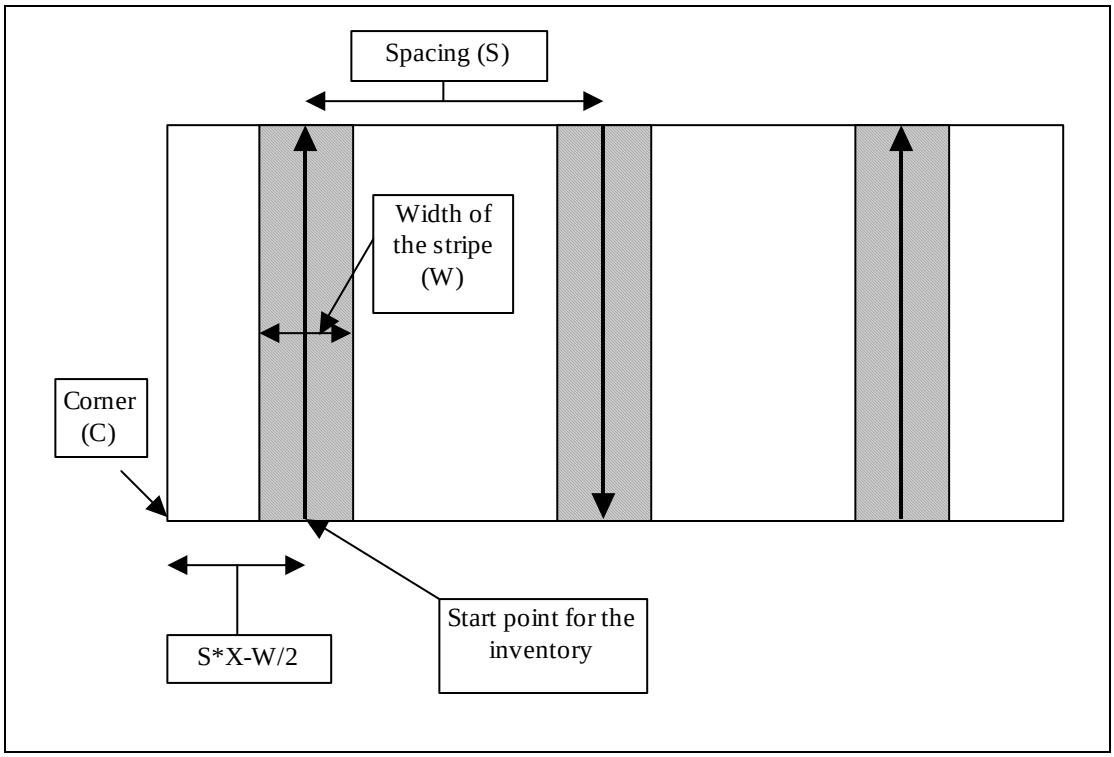

Figure 4. Description of the positioning of the strips.

The inventory was carried out with help of a compass and measuring tape, the latter for measuring widths and lengths of the strips. The base-data for the area and the results of the inventory (number of trees/species, breast height diameter, height and special observations) were summarized in field forms (found in appendix IV).

3. Results

3.1 Farmer interviews

3.1.1 Workshops

Two workshops were held, one in Buena Vista and one in Santa Teresa, figure 5 shows a photo from the workshop held in Buena Vista. The workshops were divided into two different parts. The first part was a free discussion about what timber species exist in the area. The trees were classified after use and where they grow. The second part was a discussion around the different uses and importance of the forest. This part did not include trees on other areas of the farm. The results were ranked in a pair-wise diagram to get a ranking over the different issues (see below).

Figure 5. The workshop held in Buena Vista.

Table 4 and 5 show the timber species listed during the discussions in Buena Vista and Santa Teresa. Table 4 also shows where the different species grow. Table 5 shows for what different purposes the timber is used.

Table 4. Where do the different species grow? Results from discussions. B=Buena Vista, S= Santa Teresa

Vernacular name	**Forest**	***Cafetal***	***Rastrojo/Tacotal***	**Pasture**
Achotillo		S		
Aguacate Canelo	B			
Aguacate Posan	B			
Areno	B	B		
Balsamo	B			
Barba de gato	B			
Caoba	B/S			
Cedro	B	B/S		
Ceiba	B/S	S	B	B/S
Cola de pawa	B			
Comenegro	B/S			S
Granadillo	B	B		S
Guacamaya		S		S
Guanacaste				B
Guayabo blanco	B	B		
Guayabo rojo	B	B		
Jagua	B			
Kerosin	S			
Laurel	B	B/S	B/S	B/S
Macueli				S
Madroño	B	B	B	
Maria	B			
Nispero	B			
Nogal	B	B/S	B	
Ojoche	B/S			S
Pino oocarpa	B			
Roble	B		B	
Roble encino	B			
San Rafael	B			
Sapotillo	B			
Troton	B			
Quebracho	B	S	B	S

Table 5. What are the species used for? Results from discussions. B=Buena Vista, S= Santa Teresa

Vernacular name	Boards	Construction wood	Poles	Furniture
Achotillo		S		
Aguacate Canelo	B	B		B
Aguacate Posan	B	B		B
Areno	B	B		
Balsamo			B	
Barba de gato	B	B		
Caoba	B/S	B/S		B
Cedro	B/S	B/S		B
Ceiba	B/S			
Cola de pawa		B		
Comenegro		B/S	B/S	
Granadillo	B	B/S	S	B
Guacamaya		S	S	
Guanacaste	B	B		
Guayabo blanco		B		
Guayabo rojo	B	B		
Jagua		B		
Kerosén		S		
Laurel	B/S	B/S	B/S	B
Macueli	S	S	S	
Madroño	B	B		
Maria	B	B		
Nispero			B	
Nogal	B/S	B/S		
Ojoche	BS	S		
Pino oocarpa	B	B		B
Roble		B	B	
Roble encino	B		B	
San Rafael	B	B		
Sapotillo		B		
Troton				B
Quebracho		S	B/S	

The tables show that the farmers in Buena Vista mentioned more tree species with good timber properties than the farmers in Santa Teresa. This difference might occur because of varying interest from the farmers to take part in the discussion. Another explanation is that the farms in Buena Vista contains both more forested areas, and have a larger variation in species in the forest and on the farms.

Tables 6 and 7 show the result of the pair-wise-ranking of the scoring assigned by the farmers in Buena Vista and Santa Teresa. In both cases conservation of water got the highest ranking, i.e. is the issue that the farmers think is the most important. The extraction of timber is in both cases lowly ranked, i.e. the other issues are said to be more important than the timber extraction.

Table 6. In what respects is the forest important? Result from workshop in Buena Vista

Nr:		1	2	3	4	5	6	7	8	Sum:	Ranking
1	**Conserve the water**	X								7	**1**
2	**Extraction of timber**	1	X							2	**6**
3	**Conserve the biodiversity**	1	3	X						3	**5**
4	**Extraction of food**	1	2	3	X					0	**8**
5	**To maintain a good climate**	1	5	5	5	X				5	**3**
6	**Listen to birds**	1	2	3	6	5	X			1	**7**
7	**Extraction of medical plants**	1	7	7	7	5	7	X		4	**4**
8	**Extraction of firewood**	1	8	8	8	8	8	8	X	6	**2**

Table 7. In what respects is the forest important? Result from workshop in Santa Teresa

Nr:		1	2	3	4	Sum:	Ranking
1	**Extraction of timber**	X				0	**4**
2	**Conserve the water**	2	X			3	**1**
3	**Conserve the biodiversity**	3	2	X		2	**2**
4	**Extraction of firewood**	4	2	3	X	1	**3**

3.1.2 Summary of important issues

Table 8 shows a summary of the most important issues, which were discussed during the interviews with the farmers.

Table 8. Summary of important issues from the interviews.

Farm and village / Issue	1 Buena Vista	2 Buena Vista	3 Buena Vista	4 Buena Vista		5 Santa Teresa	6 Santa Teresa	7 Santa Teresa
In which respects is the forest important?	To bring oxygen that refreshes the environment. It has vegetation that conserves the water. It is a reserve of products. It protects the animals (for consumption) and it increases the value of the farm.	It is a reserve of products. It protects the water, the animals and birds.	Extraction of products. Conservation of the drinking water.	Outtake of different wood products. To protect the drinking water and to get food (very little).		Extraction of products. For conservation of the water.	Extract products. To protect the water and preserve humidity. Land to cultivate in the future. Hunting (as an enjoyment).	Extraction of wood products. To conserve the water. To look at and listen to the birds.
For which purposes is the forest used?	Extraction of timber, firewood and medical plants.	Extraction of medical plants, timber and firewood.	Extraction of firewood, timber, fibres, some medical plants and fruits (very little).	Extraction of firewood, timber, poles, fibres, medical plants and food (very little).		Extraction of timber and firewood.	Extraction of firewood, timber and fibres.	Extraction of firewood and timber.
How has the forest area changed during the last decade?	No big changes.	No big changes during the last decade.	No big changes during the last decade.	Decreased, an area was cut seven years ago.		Decreased, last time it was cut was two years ago.	Decreased.	Decreased.
Have you sold any timber during last decade?	No.	No but given to a daughter.	No.	Yes, a few trees some years ago.		Not during the last decade.	Yes, now and then.	No.
What are the most important area(s) for extraction of firewood?	1) *Rastrojo* 2) Forest 3) *Cafetal* 4) Pasture	1) *Cafetal* 2) *Rastrojo* 3) Pasture 4) Forest	1) *Cafetal* 2) Forest 3) *Rastrojo*	1) Forest and *rastrojo* 2) *Cafetal*		1) Forest 2) *Cafetal* 3) Pasture	1) Forest 2) *Cafetal* 3) *Rastrojo* 4) Pasture	1) Forest 2) *Cafetal* and pasture

Table 8. continued

What kinds of trees are used for firewood?	Dry trees – large and small, also living trees that are affected during the cutting.	A tree that is dry in the top.	Dry trees, both large and small ones.	Mainly dead trees, size does not matter.		Dry trees and wind affected trees.	Mainly dry trees.	Dry trees.
Who extract the firewood?	The man or another male person on the farm.	The man or a worker.	The man and sometimes the children.	The man.		Some of the male persons on the farm.	The man or one of the workers.	The man.
Do the family use medical plants?	A little.	Some plants against anaemia, infections, diarrhoea, and vomiting.	A little against anaemia.	A little.		No.	No.	No.
Do the family use other types of NTFP?	Honey, fibres and others.	Fibres.	Fibres, fruits and others.	Orchids, poles, fibres and food (very little).		No.	Honey, fibres.	Honey.
For which purposes do you have trees in the cafetal?	To shade the coffee. To conserve the water in the area.To give fruits, firewood and timber.	To shade the coffee. To give firewood, timber and fruits. To conserve the water.	To shade the coffee. To give fruits, firewood and timber. To conserve the water.	To shade the coffee. To give humidity to the soil. To get fruits, firewood and timber.		To shade the coffee and to give humidity to the soil. To get firewood, fruits and timber.	To shade the coffee and to give humidity to the soil. To get firewood, fruits and timber.	Not represented on the farm.
What type of regeneration is used in the cafetal?	Fruit trees are planted, the other trees are naturally regenerated.	Fruit trees are planted, the others are naturally regenerated.	Fruit trees are planted, other trees are left from earlier land use and naturally regenerated. There is a variation in trees due to the different ways of regeneration.	Fruit trees are planted, other trees naturally regenerated. Some trees with good shade effect are replanted.		Fruit trees and some *guabas* are planted, other trees are naturally regenerated or left from when they cut the former forest.	Fruit trees and some good shade trees are planted, the rest are naturally regenerated.	Not represented on the farm.

Table 8. continued

What kind of timber trees do you have in the cafetal?	*Laurel.*	*Laurel, muñeco*.	*Laurel, cedro, guayabo.*	*Laurel, granadillo, cedro, guayabo, achotillo, helequme, madero negro.*		*Comenegro, laurel, achotillo, ojoche.*	*Laurel, nogal*.	Not represented on the farm.
Where do you collect the drinking water?	*Cafetal* (?)	*Cafetal*.	Forest.	Forest.		Close to the house (pasture)?	Close to the house (?)	Pasture (has a regeneration of trees there to protect it).
Do you use chemicals/ fertilisations in the agriculture?	No, not today but earlier.	Not normally.	Earlier, not today – (use some biological methods).	No, only management methods.		Yes.	Yes.	Yes.
Do you have a certificate of registration of title for the farm?	No.	No.	No.	No.		No.	No.	No.

3.1.3 Forest

In some respects, all the interviewed farmers had a similar way of looking at the forest, and in some cases there were differences. There are two issues where they gave a uniform picture. One is that the forest is important to protect water, in some cases mentioned as drinking water and in some cases only as water. One farmer even mentioned the fact that it is the vegetation that protects the water. The other issue is that the forest is important as an area for extraction of different products (see below). The farmers in Buena Vista also mentioned the importance of the forest as a home for animals and birds, that it brings oxygen and refreshes the environment, and that it is a source of food even if that had a very small importance. One farmer mentioned the importance of the forest to increase the value of the farm. Two of the farmers in Buena Vista went one step further and talked about the forest as a reserve of products.

All the interviewed farmers in Santa Teresa mentioned the conservation of water and the extraction of different products as important benefits of the forest. Other issues that were mentioned as well, was that the forest is a source of nice bird song and that it is a home for animals that can be hunted. Their hunting is primarily for amusement and does not really function as a food source. One farmer mentioned the fact that the forest was important as a resource of land that could be cultivated.

The type of products that are extracted from the forest differ between the two villages. All farmers in both villages mention firewood and timber as important products. In Buena Vista medical plants are also mentioned by all the farmers as a product extracted from the forest. In some cases other wood products such as poles, fibers and different types of food (fruits and animals) were mentioned as well. The farmers interviewed in Buena Vista used fruits very rarely and animals were said to be used by “some people” in the area, but not by them. In Santa Teresa, firewood and timber were the only products from the forest that all farmers mentioned. Some told that they also extract different types of fibers. A summary of the farmers ideas about the forest are shown in a cause effect analysis in figure 6.

As mentioned, Santa Teresa was settled about 45 years ago and Buena Vista about 30 years ago. Since then, the forest has been cut and the land has been used for other purposes. However, the interviews gave a picture of cuttings being less frequent during the last decade. In Buena Vista three out of four farmers say that the forest area is of about the same size today as it was a decade ago, but in Santa Teresa all the interviewed say that the forest area has been decreasing during the same period. The picture from Buena Vista is probably not true since it is clear that the forest area is decreasing. Maybe the farmers just want to give a pretense of preserving the forest.

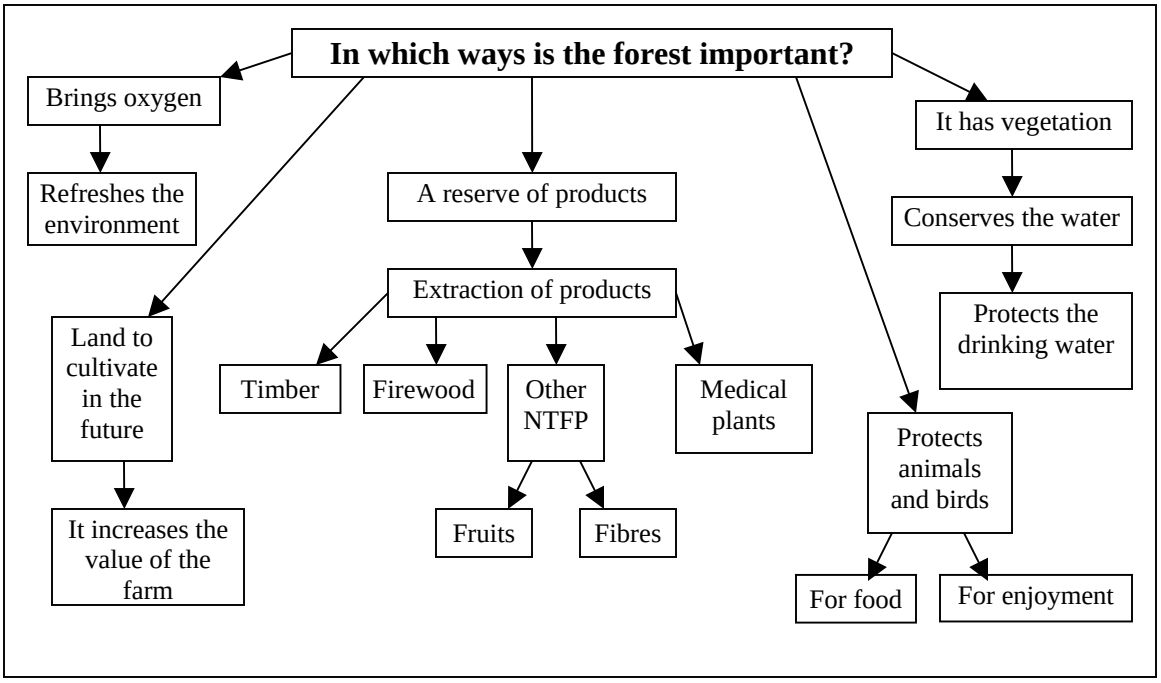

Figure 6. Summary of thoughts from the cause-effect-analysis about the importance of the forest.

The problem with "the truth" about the selling of timber might be the same as for the cutting of forest area. In the beginning the farmers said that they had not sold any timber but later, when we were walking in the forest some of them changed their minds and told about small timber affairs. The timber is normally sawn into planks on the spot were the tree stood, figure 7 shows how a tree is cut into planks.

Figure 7. A tree in a pasture that have been cut and been used to saw planks.

3.1.4 Firewood

Firewood was mentioned as a product of great importance from both the forest and the *cafetal*. Below follows a summary of the pair-wise-ranking of the different areas importance for the extraction of firewood on the interviewed farms.

Table 9. From what areas is most firewood extracted? Summary of ranking.

	Buena Vista					Santa Teresa		
	1	**2**	**3**	**4**		**5**	**6**	**7**
Forest	2	4	2	1		1	1	1
Cafetal	3	1	1	3		2	2	2
Rastrojo	1	2	3	1		X	3	X
Pasture	4	3	X	X		3	4	2

X= Land type not represented on the farm

Table 9 shows that forest is very important for the extraction of firewood on all farms, both in Buena Vista and Santa Teresa, except for one. The ranking also shows that the *cafetal* is important for extraction of firewood, even if it is less important than the forest. This situation is identical in both villages.

The table also shows that the *rastrojo* has an importance for firewood extraction where this land type is represented. Farm 1, 2 and 4 have *rastrojos* of the type that looks like a secondary forest, i.e. the land has been left for a longer time. On farm 3 the *rastrojo* is a part of the agricultural land and only left for a shorter period. The *rastrojo* on farm 6 is a fallow field left since two years. This means that there is no large firewood resource on the two latest farms. The pastures always had the lowest ranking in both villages.

When considering the issue of what kind of trees was used for firewood, all the farmers gave a uniform picture. Primarily, dry and dead trees are used, and this can include both totally dead ones and trees that are only dry in the top. (There is a large extent of dead and dying trees in the area).

All farmers agree on that it is the men's task to collect firewood. It could be the head of the family, a worker or a child, but it is always a man.

3.1.5 Medical plants

There is a clear difference between the two villages regarding the use of medical plants. The farmers in Santa Teresa go to the nearby shop to buy pills when a member of the family gets ill. They also said that they do not use medical plants and that they lack knowledge about them.

The situation is a bit different in Buena Vista. There, all the farmers used some medical plants in the family. During the inventories we also went into several plants that the farmers said they use as medicines.

3.1.6 Other Non Timber Forest Products

It is a bit difficult to analyze the results about the use of other types of NTFP. There is a use of them, and it seems to be larger in Buena Vista than in Santa Teresa, but the results are not enough comprehensive to tell more than indicate trends. Still, they may provide a hint about the use of products like honey, fiber products, orchids and fruits.

3.1.7 Trees in the *cafetal*

All the interviewed gave a uniform picture of the use of shade trees in the *cafetal*. The main purpose to give shade to the coffee plants and humidity to the soil, but the trees also provide various products, such as firewood, fruits and timber. There is often a lot of banana/plantain mixed with the coffee plants. The best shade tree is *guaba,* and both *guaba* and banana are easy to handle when it comes to shade control. The *cafetales* are complex agroforestry systems with several different components were extraction of timber is one. *Laurel* is definitely the most common tree that is said to be used for timber, it was always mentioned as number one of the farmers. Other useful trees mentioned were *cedro, nogal, comenegro, granadillo, guayabo, achotillo, helequeme, madero negro, ojoche* and *madroño*. Figure 8 shows a *cafetal* in Buena Vista with the coffee plants growing beneath shade trees (*nogal* in the middle and a *laurel* to the left), some bananas are seen to the right as well.

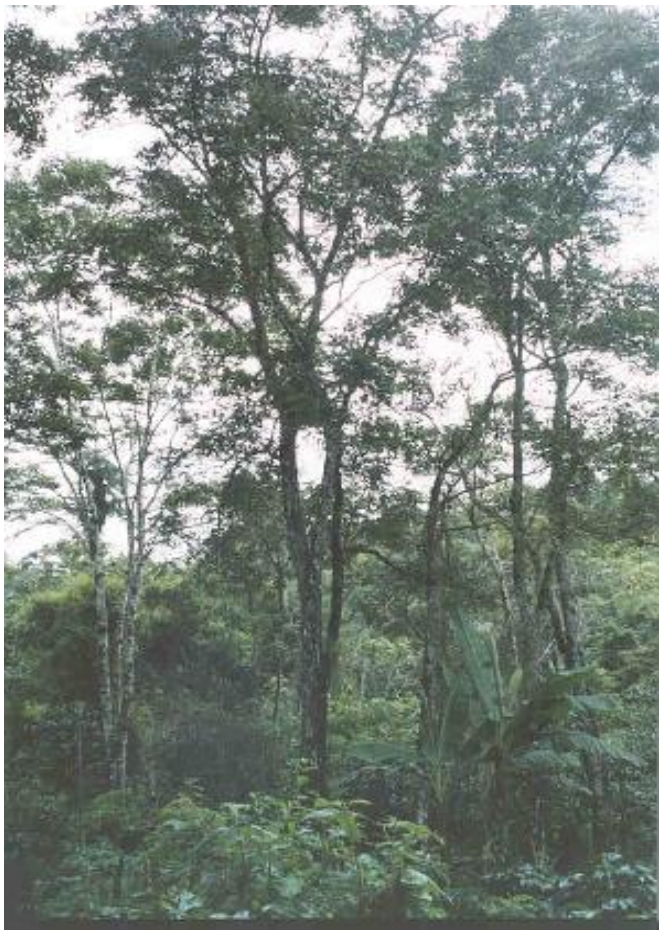

Figure 8. A cafetal with coffee growing beneath shade trees.

Normally, all fruit trees are planted and other trees are naturally regenerated. However, sometimes other trees then fruit trees are planted as well, mainly trees that have good shading effect. In some rare cases replanting is used, but then only to replant trees with good shading effect. Replanting was never mentioned as a tool for managing timber species. All the species that was used for timber was naturally regenerated or left from the earlier land use (primary or secondary forest).

3.1.8 Chemicals

The interviews show that there is a clear difference in the use of chemicals between the two villages. In Buena Vista the farmers do not normally use chemicals today, but they seem to have done so before. The reason why they stopped was that they were not able to manage the cost any longer. In contrast, in Santa Teresa all the farmers said that they use chemicals for the crops.

3.1.9 Certificate of registration of title

None of the interviewed farmers had a certificate of registration of title for the farm. They all have a “title” but it is not registrated and legally accepted. This is something that affects the possibility for the farmers to make legal cuttings and selling of timber, i.e. to use the tree resources. The situation with the lack of certificate of registration of title is the same for most farmers in the area.

3.2 The situation for a carpenter

This section is written based on in an interview/discussion with a carpenter working in the area. The checklist that was used during this discussion can be found in appendix II.

The situation for the carpenter and his company is unstable. This is because all timber he is working with comes from illegal cuttings. It is the farmer who cuts the timber that needs to have the permission, not the carpenter. Table 10 shows the most common species that the carpenter is working with and the price he pays for the timber. The first three species (*cedro, caoba* and g*ranadillo*) are the most important ones since they are expensive and there is a high demand for their wood. Today, there is a lack of these species in the area; there is almost nothing for sale. Some years ago they were more common and easier to buy. The carpenter says that the new forest act is affecting his business in a negative way. It makes it more difficult and dangerous.

Table 10. Prices on the wood that the carpenter pays the seller.

	Price (*Cordoba*/*pulgada*)	**Price (*Cordoba*/m^3)**	**Price (*US $*/m^3)**
Cedro	1.30	2400	160
Caoba	1.30	2400	160
Granadillo	1	1850	123
Laurel	0.80	1480	98.7
Pronto alivio (cedro macho)	0.80	1480	98.7
Coyote	0.80	1480	98.7
Guacamaya	0.80	1480	98.7
Pino de montaña	0.80	1480	98.7

Today, all the timber he buys comes from the communities of Sercana, Golfo, San Miguel de Kilambé, Ya Osca, Avisinia and La Flor. This represents only a few of the communities in the area. Earlier the timber came from several other communities as well, but today there is “no timber” left there.

The carpenter buys the timber directly from the producers (farmers), who transport the sawn timber to his place in Cuá. He emphasizes the fact that Cuá-Bocay is a protected area and due to this, it is not legal to use motor saw for managing the trees. The carpenter sells his products to NGO’s, schools, orphanages, hospitals and similar places in the surrounding area, but also to local people in Cuá. He almost exclusively sells to the local market in Jinotega i.e. the nearby surrounding, and only a very small amount is brought to Matagalpa and Managua.

3.3 Strip surveying

3.3.1 Tree selection

Before the inventory, a selection of which species that should be inventoried had to be made. Three different criteria were used for this selection:

1. The species should be mentioned as important of the interviewed farmers.
2. There should be a possibility to identify the species, both in the field and in the literature.
3. There should be a documentation of the species in the literature.

The selection by the first criteria was made out of the two workshops that were held in the villages. Selection of species that were possible to identify were made in co-operation with the farmers during the interviews. Finally the literature was studied to make sure that the selected species were documented. The species that were selected is shown in table 11.

Table 11. Selected inventory species and the connection between vernacular name and scientific name for the selected species.

Vernacular name	**Scientific name**	**Family**
Caoba	*Swietenia* sp.	*Meliaceae*
Cedro	*Cedrela odorata* L.	*Meliaceae*
Ceiba	*Ceiba pentandra* (L.) Gaertn.	*Bombacaceae*
Comenegro	*Dialium guianense* (Aubl.)Steud.	*Caesalpiniaceae*
Granadillo	*Dalbergia* sp.	*Fabaceae*
Laurel	*Cordia alliodora* (Ruiz & Pavón) Oken.	*Boraginaceae*
Maria	*Calophyllum brasiliense* var. rekoi	*Clusiaceae*
Nogal	*Juglans olanchana* Standl. & L.O. Wms.	*Juglandaceae*
Roble[4]	*Quercus* sp.	*Fagaceae*
Roble encino	*Quercus* sp.	*Fagaceae*
Madero negro	*Gliricidia sepium* (Jacq.) Kunth. ex Walpers.	*Fabaceae*

The selected species can be divided into two main groups:

1. Well-known species with a very high timber value, often used in industries.
2. Species that are used locally and said to have good timber qualities by the farmers.

Group 1 include: *caoba, cedro, granadillo* and *nogal*
Group 2 include: *comenegro, laurel, maria, roble* and *roble encino*
Except for these, two other species were selected as well. One is *ceiba* and the other one is *madero negro*. *Ceiba* was chosen because mature trees are found in rather big quantities that make it a good species to use when starting the use of timber. *Madero negro* has good timber properties, is easy regenerated by cuttings and is also valuable in soil aspects since it is fixing nitrogen (Guía de Especies Forestales de Nicaragua, 2002).

[4] *Roble* is sometimes the vernacular name for *Tabebuia rosea, Bignoniaceae* but the farmers in this study used it as a name for a species of *Quercus.*

The farmers spoke about the *madero negro* as good for the soils but did not mention the timber aspect.

Table 12 and 13 show the results from the strip surveying. Table 12 shows the results from Buena Vista and Santa Teresa´s results are shown in table 13.

3.3.2 Buena Vista

Table 12. Results from strip surveyings in Buena Vista

Oro Verdel **Farm 1**	**Forest**			***Cafetal***			**Secondary forest**			**Estimated volume on the farm**
45mzn	13 mzn			6 mzn			2 mzn			
Species	m^3/ha	N/ha	m^3/in the area	m^3/ha	N/ha	m^3/in the area	m^3/ha	N/ha	m^3/in the area	m^3
Caoba										0
Cedro				0.7	1.2	2.9				2.9
Ceiba										0
Comenegro	17.5	5.4	159.7							160[5]
Granadillo										0
Laurel	0.1	0.5	1.2	27.2	21.7	114.6	8.8	28.5	12.4	128
Maria	5.4	5.4	49.5							50
Nogal										0
Roble	7.4	1.5	67.5							67[5]
Roble encino	9.6	2.2	87.3							87[5]
Madero negro										0
2 Lirios **Farm 2**	**Forest**			***Cafetal***			**Secondary forest**			**Estimated volume on the farm**
40 mzn	1 mzn			6 mzn						
Species	m^3/ha	N/ha	m^3/in the area	m^3/ha	N/ha	m^3/in the area	m^3/ha	N/ha	m^3/in the area	m^3
Caoba										0
Cedro										0
Ceiba										0
Comenegro										0
Granadillo										0
Laurel				8.4	14.0	35.4				35
Maria										0
Nogal										0
Roble										0
Roble encino										0
Madero negro				0.1	4.6	0.6				0.6

[5] The calculation of the circumference is affected by the buttress of these trees, but the figures are corrected due to the this and should thus be a good approximation of the total volume.

Table 12. contiuned

***Dos Lirios/* Farm 3**	**Forest**			***Cafetal***			**Secondary forest**			**Estimated volume on the farm**
10 mzn	4 mzn			3.5 mzn						
Species	m^3/ha	N/ha	m^3/in the area	m^3/ha	N/ha	m^3/in the area	m^3/ha	N/ha	m^3/in the area	m^3
Caoba										0
Cedro				2.2	4.7	5.3				5.3
Ceiba										0
Comenegro										0
Granadillo										0
Laurel	0.6	2.1	1.7	3.5	7.0	8.6				10
Maria	4.7	6.2	13.3							13
Nogal										0
Roble	4.1	2.1	11.6							12
Roble encino	0.2	6.2	0.5							0.5
Madero negro										0
***Los Pinares/* Farm 4**	**Forest**			***Cafetal***			**Secondary forest**			**Estimated volume on the farm**
8 mzn	2 mzn			4 mzn						
Species	m^3/ha	N/ha	m^3/in the area	m^3/ha	N/ha	m^3/in the area	m^3/ha	N/ha	m^3/in the area	m^3
Caoba										0
Cedro										0
Ceiba										0
Comenegro	5.3	2.1	7.5							7.5
Granadillo										0
Laurel				4.4	6.7	12.5				12
Maria	1.0	2.1	1.4							1.4
Nogal										0
Roble	4.0	8.4	5.7							5.7
Roble encino										0
Madero negro				0.1	3.4	0.2				0.2

3.3.2.1 Forest

Most of the forests in Buena Vista gave visually a “virgin” impression, i.e. they seemed not too heavily affected by human activities. The forests on the farms had sizes of 0.7-7 ha, and the majority of them bordered forest belonging to other farms in at least one direction. This means that the total forested area was larger than the one on the inventoried farm. Figure 9 tries to visualise the fact that there is quite much forest in Buena Vista. The inventories showed that five of the selected species are represented in the forest in Buena Vista.

Figure 9. View from Buena Vista, high forest in the background.

3.3.2.2 Cafetal

Out of the species selected for the inventory, *laurel* was the most common. Out of all species though, the *guaba* tree was far more represented. Most of the *laurels* grew in a way that made them suitable for timber production, i.e. the trees had a good stem form. On the other hand, all *madero negro* which occurred on the *cafetales* was used either as living fences or for fodder, or both. Due to this, no one had a stem form that made it possible to use them for timber in the future. Some of the *cedros* were of good quality and some of not so good due to large branches or several stems.

3.3.2.3 Secondary forest

The inventoried farms were selected based on statistics, where *tacotal/rastrojo* was used for both secondary forests and for arable land in fallow. However, the major part of the *tacotales/rastrojo* was arable land in fallow. This gave the effect that there were a lack in the material of secondary forests that was more than a decade old, i.e. where it was possible to make an inventory.

The inventories show a presence of *laurel* in the secondary forest. However, the fact that only about 1.5 ha was inventoried makes it impossible to draw any further conclusions.

3.3.3 Santa Teresa

Table 13. Results from strip surveyings in Santa Teresa

***Florida/* Farm 5**	**Forest**			***Cafetal***			**Estimated volume on the farm**
40 mzn	2 mzn			5 mzn			
Species	m^3/ha	N/ha	m^3/in the area	m^3/ha	N/ha	m^3/in the area	m^3
Caoba							0
Cedro							0
Ceiba	183.9	5.4	258.4				258[5]
Comenegro	14.7	8.8	20.7	19.5	2.3	68.6	89[5]
Granadillo				0.19	2.29	0.7	0.7
Laurel				3.0	10.3	10.6	11
Maria							0
Nogal							0
Roble							0
Roble encino							0
Madero negro							0
***San Fransisco* /Farm 6**	**Forest**			***Cafetal***			**Estimated volume on the farm**
25 mzn	3 mzn			1.25 mzn			
Species	m^3/ha	N/ha	m^3/in the area	m^3/ha	N/ha	m^3/in the area	m^3
Caoba							0
Cedro							0
Ceiba	5.3	2.3	11.2				11
Comenegro	24.6	9.0	51.8				52[5]
Granadillo							0
Larurel				20.0	33.7	17.6	18
Maria							0
Nogal							0
Roble							0
Roble encino							0
Madero negro							0

Table 13. continued

***La esperanza/* Farm 7**	**Forest**			***Cafetal***			**Estimated volume on the farm**
8 mzn	0.7 mzn			0 mzn			
Species	m^3/ha	N/ha	m^3/in the area	m^3/ha	N/ha	m^3/in the area	m^3
Caoba							0
Cedro							0
Ceiba							0
Comenegro	9.8	10.7	4.8				4.8
Granadillo							0
Laurel							0
Maria							0
Nogal							0
Roble							0
Roble encino							0
Madero negro							0

The inventories show that there is a lack of the species in group 1 in both villages. These species may be the most interesting ones and due to this they are the first that are cut in an area. Species that are classified in group 2 are found in a much higher proportion.

3.3.3.1 Forest

Visually, the forests in Santa Teresa gave an impression of being much more affected by humans than those in Buena Vista. The forested areas were smaller and there were often signs of cuttings. As mentioned Santa Teresa also has altogether a smaller portion of forest than Buena Vista. The forest patches on the farms were between 0.5 and 2.1 ha in size, and other types of land use surrounded all of them except one. Figure 10 shows a view from Santa Teresa that visualizes the shortage of forest. The inventories showed that the only species from this studys' selection that were represented in the forests are *comenegro* and *ceiba*.

Figure 10. Photo from Santa Teresa, not much forested areas are seen.

3.3.3.2 Cafetal

The *cafetales* in Santa Teresa gave a similar impression as the ones in Buena Vista. *Guaba* was the most frequently occurring tree species in total, and the most frequently occurring inventoried species was *laurel*. The *comenegros* were all big mature trees left from the time when the area was forested. In contrary the *granadillos* were all small but they have a potential to become good timber trees in the future.

3.3.3.3 Secondary forest

There is a lower portion of *rastrojos* in Santa Teresa compared to Buena Vista. The farms in Santa Teresa did not consist of any rastrojo elder than a decade, and because of this, it was not possible to look into the composition of the secondary forest in Santa Teresa.

Table 14 shows a summary of the presence of the selected species that were inventoried during this study depending on landtype. The forests in Buena Vista and Santa Teresa are rather different and due to this they are presented separately. On the other hand, the *cafetales* are similar in both villages and are thus presented together and secondary forest was only represented in Buena Vista.

Table 14. Summary of the presence of selected species at the different land types.

	Data	**Forest Buena Vista**	**Forest Santa Teresa**	***Cafetal***	**Secondary forest**
Total area:		14 ha	4 ha	18 ha	1.5 ha
Caoba	N/ha				
	V/ha				
Cedro	N/ha			0.9	
	V/ha			0.5	
Ceiba	N/ha		3.1		
	V/ha		67.3		
Comenegro	N/ha	3.7	9.1	0.1	
	V/ha	11.9	19.3	3.8	
Granadillo	N/ha			0.1	
	V/ha			0.0	
Laurel	N/ha	0.8		14.1	28.5
	V/ha	0.2		11.0	8.8
Madero negro	N/ha			1.6	
	V/ha			0.0	
Maria	N/ha	5.0			
	V/ha	4.6			
Nogal	N/ha				
	V/ha				
Roble encino	N/ha	4.9			
	V/ha	12.3			

4. Discussion

This study is a pilot study made to get a picture of the use and the cultivation of trees as a way for the Nicaraguan farmers to achieve diversification. The situation is very complex, and a lot of different circumstances affect the possibility for the farmers to use the trees in a way that can improve their life conditions. The fieldwork in the study focused on two main issues: the farmers' attitudes toward trees and forests, and the existence of trees with good properties in the area. Seven farmers have been interviewed several times, and their farms' tree resources have been inventoried.

4.1 Validity and reliability

To get knowledge about the farmers' attitudes toward their trees and forests, the PRA/RRA approach was used. The validity of the results obtained through this method is high. On the other hand, a low number of farmers were interviewed, and my results can only give an indication of the situation in the two villages, but should not be applied on larger areas without a discussion. Further on, sometimes the farmers wanted to give a certain picture of their situation, and this might affect the reliability in a negative way. The risk was minimized with help of triangulation.

It was not possible to investigate the existence of all tree species on the farms, and because of this, a handful of species with good timber properties were chosen from the workshops. During the strip inventory, random numbers were used for putting out the lines, and this was made to increase the reliability. In total, 38 ha were investigated; 14 ha of forest in Buena Vista, 4 ha of forest in Santa Teresa, 18 ha of *cafetal* and 1.5 ha of secondary forest. These areas are small and the results should only be used as indicators of the existence of the actual species in the area, not as absolute volumes.

4.2 Farmers' attitudes

4.2.1 Forest

The study shows that farmers have good knowledge about the importance of the forest. They are aware of both that it brings oxygen and that it conserves and protects the water. Unfortunately, even if they are aware of the benefits of the forest, it seems like when it really counts, the forest will not be given priority.

There are problems to reach reliable information about both the changes in forest area and the selling of timber from the farms. The fact that it is illegal to cut and sell timber without permission seems to have made the farmers unwilling to admit this activity. During the interviews, which were performed close to the house, the farmers did not admit that they have been selling timber, but after direct observations of stumps when we were walking around on the farm, they told about a few timber affairs. This fact makes it possible that the selling might have been more extensive than this study has shown. However, when a farmer has sold timber it has been to someone living nearby, for example to a neighbour or to someone living in the closest village, and not to for example

a carpenter in Cuá. The farmers get only a low price for the timber and they have to take responeibility for the cutting and transportation.

There seems to be a lack of market channels for timber products in the area. This together with problems with infrastructure and the difficulty of heavy transports makes it hard to extend the possibility to get a good income from the selling of wood.

The situation for the information from the farmers about the change in forest area is similar to the one with the selling of timber. In the beginning some of the farmers told that the forest area had been constant during the last decade, but later, with help of the triangulation through direct observations and other tools, that picture was altered. However, in Santa Teresa all farmers agreed that the forest area had decreased on their farm during the last decade. In Buena Vista, the picture was more heterogeneous, and three out of four farmers said that there had been no big changes in the forest area during the last ten years. As mentioned, this might not be the true, because the farmers might want to give a certain picture. But another explanation could also be that the farms in Buena Vista has had more secondary forest areas and that those have been used for agricultural purposes instead of the primary forest.

When an area has been cut, it has primarily been to get more arable land and *cafetal*. The wood has been used for firewood and timber for on farm use or to someone close-living. Earlier a lot of wood was left to decompose on the ground.

4.2.2 Firewood

The firewood is extracted from any type of land where it can be found, but the forest is the most important source. The *cafetal* is ranked as a good second. This is shown both by the personal interviews with the farmers, and in the workshops. When the firewood is collected from the forest, primary dead and dry trees are used. In the *cafetal*, firewood is extracted every year as a part of the cultivation of coffee. To control the shading effect on the coffee plants, the trees are managed, and when branches or whole trees are cut they are used as firewood. Some farms have so called *rastrojos*, which, rather confusingly, is a term used for both secondary forest and arable land in fallow. On farms where the *rastrojo* consists of secondary forest area, this area is very important for getting firewood as well. On other hand, when the *rastrojo* consists of arable land in fallow, it is not as important as a source of firewood. It is always the male person’s task to make sure that the family has wood for cooking.

It is interesting to see that in Santa Teresa, where the forest patches are smaller than in Buena Vista, the forest is still the most important area for the extraction of firewood. Most of the patches (three out of four) have sizes of less than 0.7 ha, and these small patches had signs after cuttings. The farmer who mentioned that the situation with firewood in the future would be a problem, had left some trees to grow up in the pasture, and he might be the first one to realise the problem. Some farmers in this area will soon experience a lack of firewood, if they do not act. However, there is still time left to change the situation and plant trees that can be used in the future.

4.2.3 Medical plants and other NTFPs

There is a big difference between the village with a high portion of forest (Buena Vista) and the one with very little forest (Santa Teresa), when looking at the use of medical plants. In Buena Vista, the farmers now and then use medical plants for different purposes. Anaemia seems to be the illness that is most frequently cured by medical plants. In Santa Teresa, the farmers do not use any medical plants; instead they buy pills when a family member gets ill. This study focused on the use of medical plants today, but it would be interesting to know if the situation was different in Santa Teresa earlier, when the forested areas were larger.

4.2.4 Cafetal

The *cafetales* are interesting and important for understanding the people and their thoughts. The *cafetales* generate the main income to the farm, and this is the area where the people invest most of their time. The c*afetales* are complex agroforestry systems with a lot of different components, and among those components the outtake of timber is one, even though it is not prioritised. The function of the trees in the *cafetal* is primarily to get shade to the coffee plants and to give humidity to the soil, but they are also used for getting firewood, fruits and timber. Even though the price on coffee has decreased, and that the timber resource sometimes can be generating a larger income than the coffee, the possibility to extend the timber production shall not primarily be seen as a threat to the coffee growing. Instead, it might be possible to extend the cultivation of trees and strengthen it as a complement to the growing of coffee.

Normally, the fruit trees are planted and the other trees are naturally regenerated in the *cafetal*. Sometimes though, the farmers plant other trees than fruit trees on purpose to get better shading effects for the coffee plants, but these actions are never planned as a tool for later getting timber for construction.

4.3 The existence of tree species with good timber

The strip surveying was meant to give an indication of the existence of trees that could be used for timber on the farms. After two workshops with the farmers, eleven species were selected for the inventory *(caoba, cedro, ceiba, comenegro, granadillo, laurel, madero negro, maria, nogal, roble* and *roble encino,* the two latter one are from now on only named as *roble encino)*. The inventory made was divided by land types (forest, secondary forest and *cafetal*). The surveyed area was in total of 38 hectares. However, the tendency is that there is a lack of tree species with the most valuable timber (*caoba, cedro, granadillo* and *nogal),* but on the other hand, other tree species with less attractive, but still good timber are represented on the farms (*comenegro, ceiba, laurel, madero negro, maria* and *roble encino)*.

There are not many studies made about the existence of timber species in this area, neither in forest, nor secondary forest nor *cafetal*. Rodriguez' inventory of the Nicaraguan forest resulted in 108 species found in the north central part of Nicaragua. The species inventoried in this study as well, was among them. The fact that this study

only inventoried small areas makes it difficult to compare the results; once a tree is observed it gives a high response.

As mentioned earlier, the most valuable timber species were lacking. They were very rarely found in the inventories, or when walking around on the farms when no inventory was made. The carpenter also stressed the fact that there is a lack of these species in the area. They are the most coveted, and they have been cut to a high extent earlier. Their timber is often found in houses on the farms, something that confirms that they have existed on the farms earlier.

It is therefore clear that there is a lack of the most valuable species on the farms. As mentioned earlier, species with less attractive, but still good, timber were represented on the farms. Species such as *comenegro, maria, roble encino* were found in the forest in Buena Vista, but in the small patches in Santa Teresa only *ceiba* and *comenegro* were found.

The patches with primary forest may not primarily be used as an area for cultivation of trees since it is important to save the forest areas as a resource of other products and as a protection of the drinking water etc. The patches of primary forest are small. Out of all inventoried farms, only one had a patch larger than three hectares, and in Santa Teresa most patches are smaller than one hectare. Hence it is better to begin the cultivation of trees on other existing land types on the farms. Today, the *cafetales* have several different tree species with good timber properties. Of the inventoried species, *cedro, comenegro, granadillo* and *laurel* were found -the three first ones in small numbers, while *laurel* were more frequently spread on the *cafetales.* Further species were mentioned during the interviews but were never found and recorded. However, the complex agroforestry system that is found in the *cafetal* is of course mainly managed with coffee as a starting point. This is natural since coffee is the main source of income for the farmers. Especially in Santa Teresa, there is/will soon be a lack of timber on the farms and sometimes also a lack of firewood, and this makes it possible to stress the importance of the timber species in the *cafetal.*

4.4 Possibilities to develop cultivation of trees

The fact that the farmers manage trees in the cafetales shows that they have the knowledge to handle them. Trees are today a tool in the coffee production, but if the idea about the importance of timber can get a hold, this knowledge can be transferred to more economical and comprehensive management on a larger scale. Either the cultivation of trees can be of great importance in the existing agroforestry system in the *cafetal,* or it can be applied on areas that can be used mainly for cultivation of trees. The latter areas can be secondary forests, but also former pastures can be used, especially if the stock raising is intensified. If that will happen, it makes it possible to set off some areas that today are pasture to areas for cultivation of trees.

As mentioned one possibility is to intensify the cultivation of trees in the *cafetal*. The inventory showed that the most frequently occurring inventoried species in the *cafetal*

was *laurel*. This species is naturally regenerating in the *cafetal* and has a rather short rotation period (20-25 years), and a way of growing that makes it exemplary to grow together with coffee plants, and this makes it a good species to have in this system. There are also other species that are suitable to use in the *cafetal. Madero negro* is one example, it has both good timber properties and is fixing nitrogen. It is today represented on the farms in the area, and it is easy regenerated with cuttings. If the *cafetal* is thought to be used for an extended cultivation of trees, it is important that species that are not in conflict with the coffee production are used, and in this aspect both *laurel* and *madero negro* are good species.

However, which area should be used for tree cultivation varies from farm to farm. Table 15 demonstrates on which farms the different systems could be used. For example a small farm, consisting of some *cafetal*, arable land and maybe a small area of pasture or forest, the extended cultivation of trees in the *cafetal* is to prefer. On small farms, which might have a lack of timber and even firewood in the future, the focus should be to solve the on-farm use to avoid the future cost of buying it.

There are two main alternatives for developing the cultivation of trees in the area. Either the farmers could focus on the most valuable species, or they could use trees that are already represented on the farms. It is possible to make a higher profit with the most valuable species, but the risks are higher as well. If the farmer for example has to pay for plants of *caoba* or other equal species, the farmer will loose all his efforts if the plants die for some reason. If already existing species can be used, the risk of a lost effort will be reduced. If the trees are naturally regenerated or sown with seeds collected on the farm or from the surrounding, the risk will be smaller, and if the trees for some reason die, the loss will only be the invested time.

Table 15. What system and type of species might be good for different farms?

		Type of species	
		Most valuable species	**Existing species**
Type of System	***Cafetal***	Farms with an economical potential to invest	All farms
	Area primary for cultivation of trees	Larger farms with an economical potential to invest	Larger farms

The extended cultivation of trees in the *cafetal* can be applicable on larger farms as well, but if the farms have areas with secondary forests or pastures it is also possible to allocate some of these to areas primarily used for cultivation of trees.

The fact that all the farmers are poor makes it hard and dangerous for them to stake on the most valuable species, and it is better to begin with the existing ones. It might thus be possible for FondeAgro to help the farmers to get access to those plants as well.

4.5 Consequences of the forest act on the utilization of the tree resource

The way that the Nicaraguan forest act is written today, it minimizes a small farmer's possibility to use his forest resource in a legal way. As stated in section 1.5, if the wood is used on the farm, and quantities used are less than 10 m^3/year, no permission is needed. But if the wood is for selling, the forest act put high demands on the farmer. Firstly, the farmer has to have a certificate of registration of title over his farm, which a lot of farmers do not have today. Secondly, the forest act obstructs the possibility for the farmers to sell wood when they are situated in a protected area (which was the situation in these villages). Then the farmer has to have permission, not only from INAFOR but also from MARENA. When the farm is situated in a protected area, the farmer is not allowed to use a common motor saw to manage the wood, but only a hand saw or a frame saw.

Even though the forest act today does not encourage the cultivation of trees, (on the contrary it makes it more complicated), it is important that this is not closing the door for the funding of future use of the tree resource. The rotation period for trees in this part of the world seems short to us used to northern conditions, but it is still 20-25 years for a fast growing species such as *laurel* and everyone knows that during that time, and much faster as well, the legal framework can be changed. It is also possible that the price on wood, or the cost to get permission, can be changed during the time the trees need to be fully grown.

It has to be understood that the farmers live a hard life; they are poor and have periods during the year when they do not harvest or sell any crop. There is a low circulation of money. Having this situation, it is easy to sell some timber without permission, instead of getting a permission that takes a big part of the benefit from the timber. I find it difficult to use the word "illegal" about the farmers' acting, and I think it might be more fair to use the word "informal". The farmers are not, in the situation they are living, given a chance to sell timber legally. They have to do it in their way; a way that is not sanctioned by the legal framework, it could be compared with street sellers in for example Managua. Almost no one has a land title over their property, and then it is not possible to get permission for a cutting. Therefore, the process of land titles to the farmers has to go quicker so that the farmers can use their forest resource to get an income in a legal way.

5. Conclusions and recommendations

This pilot study has shown that the farmers have good knowledge about forests and trees, and that they also know how to manage them. They know how to handle trees in the c*afetal*, but when this is done, it is mainly for non timber purposes. If the idea about the importance of timber can get a hold, this knowledge can be transferred to more economical and comprehensive management on a larger scale. Of course the problem with lack of certificates of registration of titles has to be solved.

This study has shown that there is a lack of the tree species with the most valuable and attractive timber (*caoba, cedro, granadillo* and *nogal),* but on the other hand, other tree species with less attractive, but still good timber are represented (*comenegro, ceiba, laurel, madero negro, maria,* and *roble encino).* It could be interesting to make a more comprehensive investigation of the existence of species with potentially good timber. The species inventoried in this study, were only selected during two workshops and small areas were investigated. A more solid investigation could give further information about alternatives of good timber species to use in a cultivation of trees in the area.

My suggestion is that the small patches with primary forest not primarily should not be used as areas for a cultivation of trees; this since it is important to preserve them as reserves of other products and for the protection of the drinking water, which is sometimes taken inside these patches.

The study shows that there is a possibility for the farmers to use a cultivation of trees as a way to diversify their farming. There are mainly two alternatives for developing the system: either the farmers could plant the most attractive trees (e.g. *caoba*) or they could use trees that they already have represented on their farms (e.g. *laurel*). If they decide to use the former system, with the most valuable species that today are not represented on the farms, then the costs and risks for the establishment will be higher than if existing and naturally regenerating species are used. The *laurel* has good wood, is well represented on the farms and does easy regenerate. If the management of the *laurel* will break through, it could either be as a component in the existing agroforestry system of *cafetal*, or on transformed secondary forests or pastures. The best solution differs between farms, depending on the existence and size of land types on the farm.

Some farms have, or will soon have, a lack of both construction wood and firewood. On these farms, the regeneration of wood resources should primarily focus on wood for household requirements. Other farms, though, could be able to grow and sell timber to either neighbours or, if market channels are created, to others (e.g. companies). In both cases, it is possible to increase the use of for example *madero negro*, that has good effects on soil and can be used for either fodder (in living fences et c.) or timber.

Finally, I recommend FondeAgro to, in some way, support the farmers in the development of the cultivation of trees. In the beginning it is possible for FondeAgro to do this in at least two different ways: by supporting the farmers through giving them more knowledge about the trees, and by helping the farmers to see that wood and firewood is not an inexhaustible resource, and that they have to take this into account. If FondeAgro decide to support the cultivation of trees with the most valuable species, it might be needed to help the farmers to get access to seedling material.

6. Personal Reflections and Acknowledgement

For me as a person this work was a big opportunity to learn about the complexity that is the reality for the people in the developing countries. During my eight weeks in field, FondeAgro and ORGUT supported me and gave me an opportunity to come closer to, and be a part of, the consulting activities. This is important since it is the strategy used by most organisations that work with developing questions. I have also had an excellent chance to get to know a lot of people, to improve my Spanish and experience the hospitality and the beautiful nature of Nicaragua.

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9. Appendix.

Appendix I Tree species Vernacular name – Scientific name

This appendix includes tree species that are mentioned in this paper. The farmers only used the vernacular names, and the scientific names were taken from were vernacular names and sientific names were mentioned together. Some of the species were identified as well. The trees were mentioned in the workshops but not all of them were met seen during the inventories. Sometimes the tree could be identified as a species but sometimes only as a genus. The big variation of trees in the area made it difficult to identify some of the species. Table 1 shows the species that are clearily identified. Table 2 shows the group of species were the identification is more uncertain. In some cases more than one scientific name is possible. Table 3 shows the species where no identification/scientific name could be found during this study.

Table 1. Vernacular name, scientific name and family name for clearily identified species.

Vernacular name	**Scientific name**	**Family**
Balsamo	Myroxylon balsamum	Fabaceae
Caoba	Swietenia humilis Zucc.	Meliaceae
	Swietenia macrophylla King.	Meliaceae
Cedro	Cedrela odorata L.	Meliaceae
Ceiba	Ceiba pentandra (L.) Gaertn.	Bombacaceae
Chilamate	Ficus sp.	Moraceae
Cola de pawa	Cupania sp.	Sapindaceae
Comenegro	Dialium guianense (Aubl.)Steud.	Caesalpiniaceae
Granadillo	Dalbergia sp.	Fabaceae
Guaba	Inga sp.	Mimosaceae
Guarumo	Cecropia sp.	Cecropiaceae
Guayabo blanco	Terminalia sp.	Combretaceae
Guayabo rojo	Terminalia sp.	Combretaceae
Helequeme	Erythrina sp.	Fabaceae
Jagua	Genipa caruto	Rubiaceae
Kerosén	Tetragastris panamensis (Engler) O. Kze.	Burseraceae
Laurel	Cordia alliodora (Ruiz & Pavón) Oken.	Boraginaceae
Madero negro	Gliricidia sepium (Jacq.) Kunth. ex Walpers.	Fabaceae
Madroño	Calycophyllum candidissimun (Vahl) DC.	Rubiaceae
Mampás	Lippia myriocephala	Verbenaceae
Maria	Calophyllum brasiliense var. rekoi	Clusiaceae
Muñeco	Cordia bicolor DC.	Boraginaceae
Nispero	Manilkara achras (Mill.)Fosberg	Sapotaceae
Nogal	Juglans olanchana Standl. & L.O. Wms.	Juglandaceae
Ojoche	Brosimum alicastrum Swartz	Moraceae
Pino oocarpa	Pinus oocarpa Schiede.	Pinaceae
Quebracho	Lysiloma sp.	Mimosaceae

Table 1. continued

Roble[6]	Quercus sp.	Fagaceae
Roble encino	Quercus sp.	Fagaceae
Zapote mico	Couroupita nicaraguensis	Lecythidaceae

Table 2. Vernacular name and sientific name and family name for uncertinly identified species.

Vernacular name	**Scientific name**	**Family**
Achotillo	Bixa orellana	Bixaceae
Aguacate Canelo	Nectandra reticulata	Lauraceae
	Persea sp.	Lauraceae
Aguacate Posan	Nectandra reticulata	Lauraceae
	Persea sp.	Lauraceae
Areno	Homalium racemosum Jacq.	Flacourtiaceae
	Ilex hondurensis	Aquifoliaceae
	Laetia procera (Poeppig.) Eichl.	Flacourtiaceae
	Schoepfia vacciniiflora Pl. ex Hemsi.	Olacaceae
Chaperno	Albizia adinocephala	Mimosaceae
	Lonchocarpus	Fabaceae
Capulin	Muntingia calabura	Elaeocarpaceae
Coyote	Platymiscium pleiostachyum	Fabaceae
Cortez	Tabebuia ochracea ssp. neochrysantha	Bignoniaceae
	Tabebuia sp.	Bignoniaceae
Gavilan	Albizia guachapale	Mimosaceae
Guacamayo	Astronium graveolens	Anacardiaceae
Guácimo	Luehea speciosa	Tiliaceae
	Guazuma ulmifolia Lam.	Sterculiaceae
Guanacaste	Enterolobium cyclocarpum (Jacq.) Griseb	Mimosaceae
	Acacia angustissima	Mimosaceae
Macueliz	Tabebuia rosea	Bignoniaceae
Majaque	Heliocarpus appendiculatus	Tiliaceae
Matazanillo	Casimiroa edulis	Rutaceae
Mata palo	Ficus sp.	Moraceae
	Coussapoa panamensis	Cecropiaceae
Pata de Yanqui	Bauhinia monandra	Caesalpiniaceae
	Bauhinia pauletia	Caesalpiniaceae
	Crataeva tapia	Capparaceae
Pino de montaña	Pinus caribaea	Pinaceae
	Pinus oocarpa	Pinaceae
	Pinus patula	Pinaceae
	Pinus maximinoi	Pinaceae
Pronto alivio	Guarea grandifolia D.C.	Meliaceae
	Carapa guatemalensis Aubl.	Meliaceae
Sangredrago	Pterocarpus rohrii	Fabaceae
	Croton panamensis	Euphorbiaceae

[6] *Roble* is sometimes the vernacular name for *Tabebuia rosea*, *Bignoniaceae* but the farmers in this study used it as a name for a species of *Quercus.*

Table 2. continued

Zapote de montaña	Couroupita nicaraguensis	Lecythidaceae
	Pausandra trianae	Euphorbiaceae
	Pouteria campechiana	Sapotaceae
	Pouteria sapota	Sapotaceae

Table 3. Vernacular name for species which identify could not be found during this study.

Barba de gato	Lechoso	Troton
Barba de sol	Makengue	Yayo
Cangrejo	San Rafael	
Guajiniquil	Sapotillo	

Appendix II. Checklists

Checklist used during the personal interviews on the farms

La familia
¿De cuantas personas esta compuesta su familia?
¿Cuántos de ellos viven en la finca?
¿Cuántas personas dependen de lo que produce en la finca?

La finca
¿Desde cuando vive su familia / usted en la finca?
¿Su finca se la heredó su padre o usted la compró?
¿Usted tiene titulo de propiedad en su finca?
¿Que tipo?
¿Cuánto es el área total de la finca?
¿Cómo está distribuida?
Cultivos
¿Que tipos?
¿Cuantos manzanas?
Pastos
Tacotales
Rastrojas / Arados
Bosque
Patio
Otros
¿Cuáles son las principales plagas en los cultivos?
¿Qué hace para controlarlas?
¿En áreas donde la cosecha es bajo, Que hace?

Dibuje la finca con los cultivos, el bosque, la casa... con todo.

El Bosque (Montaña)
¿Cuál es el uso que usted le ha dado al bosque?
Leña
Madera
Comida
Medicina
Cortinas rompe vientos / protección
Otros
¿Qué árboles maderables tiene en el bosque?
¿Para qué usa estos árboles?
¿Cuántas manzanas eran bosque hace 10 años / cuando usted llegó aquí?
¿Por qué tienes menos/mas/lo mismo ahora?
¿Qué uso le da al suelo que antes era bosque?
¿Cuándo se cortan los árboles?
¿Por qué se cortan los árboles?
¿Cómo corta los árboles? / ¿Con que?
¿para que usa la madera? /¿Vendió madera?

El tacotal
¿Para que usa el tacotal?
¿Qué árboles (maderables) tiene en el tacotal?
¿Para qué usa estos árboles?
¿Qué saca del tacotal?
Leña
Madera
Comida
Medicina
Comida para animales
Proteger cultivos o otros
¿Cuánto tiempo usted mantuvo los tacotales sin tocarlos?
¿Qué había antes?
¿Qué uso piensa darle al tacotal?
Dejar a los árboles crecer
Sembrar cultivos
Otros

Rastrojos
¿Qué uso le da a los rastrojos?
¿Qué árboles (maderables) tiene en los rastrojos?
¿Para qué usa estos árboles?
¿Qué había antes?
¿Por qué lo dejo de usar?

Áreas con cultivos / Cafétal
¿Qué árboles (maderables) tiene en este área?
¿Para qué usa estos árboles?
¿Por qué este tipo de árboles?
¿Por qué tiene árboles aquí?
(¿Qué tipo de regeneración?)
¿Por cuánto tiempo han estado los árboles aquí?
¿Para que son usados los árboles cuando se cortan?

La Casa
¿Qué tipos de madera tiene en la casa?
¿De donde son la madera?

La Leña
¿De donde son la leña?
¿Qué tipos (no especies) de árboles usa para leña?
¿Quien exstrañan la leña?

Checklist used during the workshops in Buena Vista and Santa Teresa

¿Cuál son los árboles maderables en el área?

¿Donde crecen estos árboles?

¿Para que usa estos árboles?

¿Por qué es el bosque importante?

Checklist used during the personal interviews with the carpenter

¿Que tipos de madera usa usted?
¿Come era antes?

¿De donde son los árboles?
¿Como era antes?

¿Donde se vende los productos?
¿Como era antes?

¿Cual es la situación hoy para tu compañía?

¿Como se compra la madera?

¿Como afecta el nuevo ley forestal tu trabajo?

¿Quien tienen que pagar el permiso?

Appendix III. Farmer Interviews

Oro Verde, Buena Vista

The farm is situated in a mountainous surrounding with a mixture of forest, pasture, *rastrojo* and *cafetal*. The forests are rather big and dense.

Family: The family (that is dependent on the farm) consists of 14 persons. All members are not relatives, but anyhow in practice all 14 concist a family. Sr. José Angel Herrera Pineda (50 years old) and his wife Señora Rosa Amelia Blandón Benavidez are two of them. One of the 14 persons is a worker on the farm. Sr. Herrera bought the farm in 1976, and before that he lived in another part of Jinotega. He says that normally the woman work in the house and the man on the farm. Today the family is not eating much meat and when they do it is it almost only pork. The period between June and September is a hard time for them since they do not produce anything to sell and thus they can not buy anything. The family can survive thanks to the coffee. Sr. Herrera says that there is only a small circulation of money and that they are poor.

Farm: The total area of the farm is about 45 mzn. It is distributed in 7 mzn of *cafetal*, 14 mzn of arable land/*rastrojo*, 12 mzn of *rastrojo* and pasture, 2 mzn of pasture and about 13 mzn of forest. The farm also has a 25x25 m *patio,* which is an area used to grow vegetables. Today they are growing bananas, cabbage, carrots, radish and *ayote* in the *patio*. The farm has some pigs, chickens and ducks. When they moved to the area it was forested and they started to cultivate different areas. During the 1980's they abandoned many of the cultivated areas because of the war, and due to this there are quite much *rastrojo* in the area. There was much violence in the area during the war and the economy crashed. They do not have a title over the farm.

Forest: The forest consists of a lot of different tree species, and among the species that are used as firewood are *muñeco*, *chaperno* and *guacimo*. The species that are used as timber is listed below:

Species	*– use:*
Roble	– poles, firewood
Roble encino	– poles, firewood
San Rafael	– construction wood, boards
Pino de Montaña	– boards, construction wood
Guayabo rojo	– construction wood, firewood
Madroño	– construction wood, boards
Cedro	– boards, construction wood
Cojoyo Colorado	– construction wood, boards
Cangrejo	– construction wood, firewood
Zapote de Montaña	– construction wood
Laurel	– boards, construction wood
Comenegro	– poles, construction wood

Kerosine – construction wood, firewood
Grandillo and *Caoba* – construction wood, firewood it ”might exist a few” of those species.

The forest is important because it:

- Brings oxygen and refresh the environment
- The vegetation protects the water and therefore conserves the water
- Is a reserve of primary timber and firewood and also medical plants
- Protects the animals (that can be used for consumption)
- It increases the value/price of the farm

There has not been any big change in the forested area during the last years. When timber is cut it is used on the farm. Earlier they used a handsaw when making planks out of the trees but now they are using a motor saw. They have a neighbour that owns a motor saw and they pay him 200 cordobas a day for his work (45 meters of 12x1 inches) and he makes about 90 meter a day.

Firewood: It is Sr. José Angel or some other male person on the farm that collect the firewood. They oftentake a branch or log with them when they are walking home after being out in another purpose. They collect (cut) dry, not living trees in different sizes. Smaller living trees are taken if they are affected when cutting the dry ones.

Table 1. From what area do you extract most firewood?

		1	2	3	4	Sum	Rank
1	*Rastrojo*	X				3	I
2	*Cafetal*	1	X			1	III
3	Forest	1	3	X		2	II
4	Pasture	1	2	3	X	0	IV

Table 1 shows the pair-wise-ranking of the importance of the different areas for extraction of firewood on the farm. The fact that this farm has a lot of *rastrojo* that has not been used for a long time and thus could be defined as secondary forest, makes the *rastrojo* very important for the firewood collection. The forest is the second most important area and the *cafetal* is ranked as the third one. The pasture were said to be of very small importance for the firewood collection and were almost not used at all.

Other NTFP: They use medical plants from the forest in the household, but only in a small amount. Different types of fibers and honey are also used on the farm.

Cafetal: The trees are grown here to shade the coffee and to give fruits, firewood, and construction timber for the houses, conserve the water in the area. The drinking water for the house hold comes from this area. A lot of fruit trees can be found in tha area (avocado, limes, oranges, mandarins, bananas and pears). Among those trees that are used only for shading and firewood are *guaba, sangredrago, muñeco, chaperno* and *majague* were mentioned. The bark of *majague* is also used for constructions. The species that are used for timber are shown below.

Species *– use*
Laurel – construction wood, boards, furniture

The fruit trees are planted while the other trees are naturally regenerated. The family do not have seeds or capital to by plants for planting timber trees. Earlier they used very expensive chemicals to control the plagues in the coffee, but today they only control it by management methods (shade, to clean and to remove/add leaves).

Arable land/*Rastrojo*: 25 to 30 years ago this area was forested. The area is now used for growing corn and beans and for collecting firewood. Half of the area is used for growing and the rest is in fallow. After 5 to 10 years of growing they change area. The trees that grow here (*guaba, laurel, aguacate, sangredrago, muñeco, chaperno, majague, mampas* and *guacimo*) are used as firewood.

Natural pasture/*Rastrojo*: This area is used to feed horses, mules and a cow. The same trees as in the arable land/rastrojo grow here.

2 Lirios, Buena Vista

The farm is situated in a mountainous surrounding with a mixture of forest, pasture, *rastrojo* and *cafetal*. The forests are rather big and dense.

Family: On the farm live Sr. Genaro Villagra Blandón (74 years old), his wife Señora Máximina Reyes Hernandez and eight other persons. One of the persons works off the farm. Sr. Villagra has four sons and four daughters (one daughter live in a house on the farm). In 1990 the family bought this farm and moved to it from another farm nearby.

Farm: The farm has a total area of about 40 mzn, distributed as 6 mzn of *cafetal*, 8 mzn of arable land/*rastrojo* (today 3 are grown with corn), 24 mzn of pasture and about 1 mzn of forest. The farm has a 30x30 m *patio* and during the investigation they were growing cabbage, *chayas* and beans. The farm has 15 chickens, 7 cows, 2 mules, 2 ducks and 2 pigs. The farmer does not have a title over the farm today.

The family also has a house in San Miguel, since four years. Sr. Villagra spends most of the time on the farm especially when there is work to do. The house in San Miguel was bought built. Sr. Villagra also owns two other farms. One is about 50 mzn (fifty–fifty forest and *rastrojo*) and the other is 48 mzn with only *rastrojo*.

Forest: Earlier the farm had a higher portion of forest but today there is less than one mzn. Earlier, when the forest was larger, it had a large number of tree species, but today only a few are found and they are listed below.

Species *– use:*
Guayabo – construction wood, poles, firewood
Laurel – boards, construction wood, poles

The forest is important for several different purposes. It serves as a reserve for timber, firewood and medical plants. It protects the water and the animals and birds. The two latter are important not for food, but to look at and listen to them.

The farmer says the area with forest is more or less the same today as it was 14 years ago when he moved into this farm. On another hand, the forest have been used to cut timber since then, both for the house and for a daughter's house, the last one less then one year ago. He has not sold any timber but given some to the daughter. About the future, Sr. Villagra say that in first place they will use timber from the forest, and when this not is possible, they will buy timber from another farm

Firewood:
Table 2 shows that the *cafetal* is the most important area to extract firewood from on this farm. The *Rastrojo* is ranked as the second one. The forest is small and far away and due to this, they almost do not use it for extracting firewood at all. It is the man or a worker who extract the firewood on the farm. The firewood to the house in San Miguel comes from the farm.

Table 2. From what area do you extract most firewood?

		1	2	3		Sum	Rank
1	Pasture	X				1	III
2	*Cafetal*	2	X			3	I
3	*Rastrojo*	3	2	X		2	II
4	Forest	1	2	3	X	0	IV

It is the *cafetal* and the forest that today is used for extraction of timber. The trees that were cut 25 to 30 years ago were to a high extent left on the ground to decompose, and was thus not used at all. The first criteria when selecting a tree for firewood or timber from the forest is the species and the second is that it should be dry in the top. Where it is situated in the forest does not matter.

Other NTFP: The family uses several different medical plants, see below. They also use different types of fibers that come from the forest.

Medical plant – use	*-origin*	
Bejunco de sangre	– anemi	-forest
"Kidney grass"	– kidney infections	-forest
Sacate limon	– diarrhoea	*-cafetal*
Cascara de Guayaba	– diarrhoea	*-cafetal*
Mandarin	– vomiting	*-cafetal*

Wood in the house: The house was constructed 10 years ago and all the timber (*areno, cedro, pino de monte, comenegro, roble*) came from the forest on the farm.

***Cafetal*:** In this area trees are grown to give shade to the coffee. The shade gives humidity to the soil and conserves the water. They take their drinking water from this area. The trees in the *cafetal* give firewood, timber (boards, furniture, roofs, construction wood) and fruits. About 25 years ago the area was forested.

The trees that grow in the cafetal are fruit trees (bananas, avocado, limes and mangos), trees that are used as shade trees and for firewood (*guaba, muñeco, gavilan, chaperno, chilamate*) and trees that are used for timber (see below). The fruit trees are planted, the rest of the trees are naturally regenerated. Normally they do not use any chemical fertilization on the farm.

Species	*– use:*
Madroño	– construction wood
Laurel	– construction wood, boards, furniture

Arable land/*Rastrojo:* This area was forested untill about 28 years ago. The area was cut with an axe to get timber for a house and to give place for cultivation. During the investigation 3 mzn are cultivated with corn and the rest is since 10 months in fallow. They cultivate both corn and beans during the year.

Pasture: The farm has three different pastures. On one part, 12 mzn, they grow special grasses, and there a few *guacimo, nogal* and *guanacaste* could be found. The second area, 3.5 mzn, has a small number of fruit trees (avocado, orange, mandarinas and mangos) and a few *guaba, laurel, guacimo, mampas, muñeco* and *achote*. The third part is a natural pasture without trees.

Dos Lirios, Buena Vista

The farm is situated in a mountainous surrounding with a mixture of forest, pasture, and *cafetal*. The forests are rather big and dense.

Family: The family that is dependent on the farm consists of seven persons: Sr. Mario Villagra Reyes (31 years old), his wife Señora Adelayda Blandino Herrera and their five children. The family have also a house in the village San Miguel. Sr. Villagra was born on the farm that in that time was a part of his father's farm. In 1991 he got married and started to work on this farm.

Farm: The total area of the farm is about 10 mzn, distributed as 3.5 mzn of *cafetal*, 1.5 mzn of arable land (corn and beans), 1.5 mzn of *rastrojo* and 4 mzn of forest. The farm also has a 25x25 m *patio*. The *patio* is not in use today. No crops can be grown there, because of the *somposos* (big ants) that causes problems in the whole area since they eat the leaves of vegetables and trees. Today the farmers do not have enough money to by chemicals to kill the ants and because of this they are not using the *patio*. The family has a lack of money and due to this they do not by any vegetables (they do not consume any vegetables today, except for corn and beans). The farm has some hens. The farmer does not have a title of the farm today.

10 Months ago the family bought a piece of land in San Miguel, and there they are now building a house. When they bought the piece of land in San Miguel they also bought the wood to the house at the same time. Sr. Villagra stay on the farm when there is work to do otherwise he lives in the house in San Miguel, it takes about one hour to walk between the farm and San Miguel.

Forest: There is a lot of different tree species in the forest, and even if the *guayabo* is most important for the outtake of firewood, all tree species are used for this purpose. The important species that are used for timber is listed below.

Species	*–use:*
Areno	– boards, firewood
Roble	– poles, construction wood
Maria	– boards, construction wood
Guajabo	– boards, firewood
Madroño	– construction wood
Laurel	– construction wood, boards, firewood

The forest is used for extraction of firewood and timber for the houses. The farm takes its drinking water from the forest and the farmer stressed that the forest was important to protect their drinking water. The forest has several wet places and they take their drinking water from one of them.

The farm has more or less the same amount of forest today as it had when Sr. Villagra started to work on the farm (14 years ago). Since then, the forest area has been used for an outtake of timber to use on the farm (house construction), but it has not been used to sell timber. 45 m of boards is said to cost about 300 cordoba.

Firewood: They only collect dry trees from the forest. Both large and small trees are taken. It is the man, sometimes the children, that collects the firewood. In San Miguel the majority of the people buy their wood and firewood from producers that live very near. There is about 30 families living in the village most of them have farms, only a few do not. When people buy firewood in San Miguel they normally buy a whole tree.

Table 3. From what area do you extract most firewood?

		1	2	3	Sum	Rank
1	Forest	X			1	II
2	*Cafetal*	2	X		2	I
3	*Rastrojo*	1	2	X	0	III

If the family had to build a new house today the wood would be taken from their own forest. They go to the forest when they need timber or firewood. The firewood for the house in San Miguel mainly comes from the farm but they also buy some. They started to grow coffee in the area in the mid of the seventies. The trees that was cut was only left to decompose in the area and were not used. The cutting was made with an axe.

Other NTFP: There is a small use of medical plants, see below. There is also a small use of fiber products (baskets for collection made out of *carriso, areno, piletta* to smash for example coffee or rice made out of *guayabo* and *cedro*). There can also be a small outtake of fruits (*ojoche* and *zapote),* but this family does not kill animals in the forest to get extra food.

Medical plants	*-use*	*-origin*
Bechuco de sangre	-anemia	-forest

Wood in the house: About five years ago they built a new house on the farm. A small part of the wood came from an old house and the rest from the farm's forest. The tree species used for the house were *areno, pino de monte* and *roble*.

***Cafetal*:** The trees are grown in the *cafetal* to shade the coffee, give fruits, firewood, and construction timber for the houses, and to conserve the water in the area. There have been trees in the *cafetal* as long time as they have grown coffee there. Lemmon, lima, apple, coconut and orange are examples of fruit trees, *guaba* and *areno* are used for firewood. The following species are used as timber:

Species	*– Use:*
Cedro	– construction wood, boards
Laurel	– construction wood, boards, firewood
Guayabo	– boards

There are fewer trees today in the *cafetal* than it was ten years ago. There is more or less the same amount of *laruel* and *muñeco,* but there is less *guayabo* and more *guaba*. All these tree species have a natural regeneration with stump shoot. There is less *cedro* and *areno*, they do not get stump shoots. There is more *guaba* today than it was ten years ago because it has a good shading effect and due to this they favor this tree. A problem with regeneration of the trees is that there is no access to seeds for those species that do not regenerate naturally. The fruit trees are planted because they give food.

Earlier they used very expensive chemicals to control the plagues in the coffee (*Rolla*, *Antracanocis* and *Broca*), but since one year they intend to use a mixture of cow milk and sulphur. They also intend to fertilize the coffee with a mixture of cow dung, sugarcane, leaves from *madero nego*, "black soil", carbon and calcium. The calcium and sulphur are bought and the others come from the farm (cow dung and cow milk comes from the farm of Sr. Villagra's father). Both these mixtures are introduced by FondeAgro.

Arable land/*Rastrojo:* The area is used to cultivate corn and beans. The cultivated land are changed every year, one year they have the crops and the other year they leave it in fallow. During the fallow the area becomes a *rastrojo*. The area has almost no trees only a few *laurel*, *guaba* and *mampas,* and those are all used for firewood. When they start preparing the *rastrojo* (1th of October) they cut down all bushes that have grown up during the fallow and let the residues incorporate with the soil.

Los pinares, Buena Vista

The farm is situated in a mountainous surrounding with a mixture of forest, pasture, and *cafetal*. The forests are rather big and dense.

Family: On the farm live Sr. Lorenzo Villagra Reyes (32 years old), his wife Señora. Edix Jamileth Gonsàles Garmendìa and their six children.

Farm: The farm has a total area of 8 mzn, distributed as 4 of mzn *cafetal*, 2 mzn of *rastrojo* and 2 mzn of forest. The farm has a 25x25 m *patio* but it is not in use because of the problems with the *sompopos*. The farm has some hens and pigs. The farm has no arable land, but they grow corn and beans on their uncle's farm, which is situated nearby. They do not pay anything to use that land. Today they do not have a title over the farm.

Forest: The forest is situated in the mountainous part of the farm. There are several species that are used for firewood and among those are *guarumo, roble encino, guayabo*. The species that are used as timber are listed below:

Species	*– use*
Guayabo rojo	– boards, firewood
Areno blanco	– boards, firewood
Roble encino	– poles, firewood
Roble	– pole
Makengue	– construction wood
Comenegro	– pole
Madroño	– timber for house constructions and roofs

The forest is used for outtake of firewood and timber for local constructions. There is also an outtake of poles and *majague* (natural fiber). The drinking water is taken from the forest, and some food as well, even if the latter is not done to a high extent.

The farm has less forest today than it had ten years ago. About seven years ago one part of the forest was cut since timber for the house was needed. Some trees were also sold a couple of years ago. In both this cuttings they paid a neighbor to cut the wood into planks with a motor saw.

Firewood: The *rastrojo* on this farm is like the beginning of a secondary forest. Therefore it is important for the outtake of firewood. It is mainly dead trees that are used for firewood, no matter which size they have. It is Sr. Villagra that makes the firewood cutting.

Table 4. From what area do you extract most firewood?

		1	2	3	Sum	Rank
1	Forest	X			2	I
2	*Rastrojo*	1/2	X		2	I
3	*Cafetal*	1	2	X	0	III

Other NTFP: The family use medical plants about twice a month, and sometimes they collect orchids to get a good smell in the house. There is a very small outtake of food in form of fruits.

Wood in the house: The house was built about seven years ago and the wood came from the forest (the area that today is *rastrojo*). Among the species used are *areno blanco, pino de monte* and *roble*.

***Cafetal*:** In this area trees are growing to give shade to the coffee and humidity to the soil. They also give fruits, firewood and timber. Among the fruit trees are: oranges, mandarins and grapefruits. All the fruit trees are planted and the rest of the trees are naturally except for *corallito,* that have a good shading effect and gives a good humidity to the soil. There are also several species that are used for firewood (*guaba, mampas, chaperno, muñeco, guarumo, tatascan* and *sangregrado*), and some timber species listed below:

Species – *Use*
Laurel – boards, construction wood
Helequme – poles
Grandillo – boards, construction wood
Cedro – boards, construction wood, furniture
Guayabos – boards, firewood
Achotillo – boards, construction wood
Madero negro – poles

There are several kinds of plagues in the coffee (r*oya (Hemelenia bastatrix), broca (Hipotenemus hampei*) and *ojo de gallo*). Several management methods are used to control the plagues: to regulate the shade, to cut small plants, remove infected grains, remove weeds, prune and to cut old plants and plant new. They do not use any cemicals.

***Rastrojo*:** The area has been *rastrojo* for about seven years, and before it was primary forest. Most of the cuttings were made with axe, but a motor saw was used for the timber trees. The forest was cut because they needed timber to build a house and an area for cultivation of corn, beans and coffee. There is also a continuous outtake of firewood from the *rastrojo*. The area has some small *guaba, madero negro, chaperno* and *guayabo.* The two latter species will be cut away to give place for the other two since they have a better shading effect on the coffee.

La Florida, Santa Theresa del Cedro

The area around the farm is mostly pasture and arable land. There is not much forest and the forest patches are small and very affected by human activity.

Family: On the farm live Sr. Eduardo Castro Manzanarez (75 years old), his wife Señora Juana Paula Moncada Moran and five other persons.

Farm: When Sr. Castro came to the farm 45 years ago the whole farm was forested, They started to cultivate the area closest to the house, but afterwards they went further and further away. During some years the cut area was used for cultivation, and it was then used as pasture. The farm has a size of about 40 mzn, distributed on 6 mzn of *cafetal*, 2 mzn of forest, 5 mzn of arable land and about 35 mzn of pastures. The family does not have a *patio*, but in the area around the house there are both fruit trees (orange, mango, mandarin, lemon) and shade trees (*helequeme, yamarada del bosque, acacia, guaba, jicaro*). The drinking water is taken close to the house. The farm has 22 cows, 3 horses, 20 hens and 8 pigs. They do not have a title of the farm.

Forest: The farm has two small areas of forest, less than one mzn each. Several species are used for firewood, and a few are used for timber. The latter ones are listed below.

Tree species	*– use*
Caoba	– boards, construction wood (a couple of small trees)
Bálsamo	– pillars, (medical use)
Cortez	– constructions for houses
Comenegro	– poles

The forest is important for the extraction of timber and firewood, which are the products that are used from the forest on the farm. It is also important for the conservation of the water.

The forest area has decreased over time. Last time the forest was cut was about two years ago when more arable land was needed. During the last period the wood has been used on the farm and not been sold. About the future of the forest Sr. Castro says “I havenot much time left to live...”

Firewood: It is the dry trees and trees that the wind has overturned that are used for firewood and timber. It is some of the male persons on the farm that collects the firewood.

Table 5. From what area do you extract most firewood?

		1	2	3	Sum:	Rank:
1	**Forest**	X			2	I
2	***Cafetal***	1	X		1	II
3	**Pasture**	1	2	X	0	III

Other NTFP: the family does not use any medical plants, or any other NTFP.

House: The house was built about 22 years ago. The trees that were used for the house were extracted from the forest, i.e. the area that today is pasture. The species that were used for the house construction were *caoba*, *cedro, granadillo* and *yayo*.

Cafetal: The farm has two areas with coffee; one large (5 mzn) and one small (1 mzn). Earlier the large *cafetal* was forest and the small was a *rastrojo*. They selected the trees that were left to shade the coffee. The shade increases the humidity to the soil. *Guaba* gives a very good shade for the coffee plants, and the *guaba* have been growing for about 15 years. Some of the *guabas* were planted. The dry trees are used for firewood and when it is to much shade, they de-branch the trees. Where a tree is cut *guaba* and in some areas a *laurel* start to grow. These species have a natural regeneration. The fruit trees that grew in the *cafetal* are planted. The branches from the de-branching are used as firewood and the *laurel* timber is used for constructions.

The big area has been used for coffee cultivation for about 25 years and before that it was forest. One part of the area has many *laurels* and some small trees while the other has more large trees (*comenegro, barba del sol* et c). Among the species used for firewood are *guaba*, the species used for timber are listed below. The small area was bought a couple of years ago. This area has a lot of fruit trees (avocado, mango, bananas, orange, cacao, *pijibay*), but no timber trees.

Tree species	*– use*
Ojoche	– boards, firewood
Comenegro	– poles, firewood
Laurel	– boards, pillars, firewood
Achotillo	– construction wood

Arable land: The area with arable land has the size of about five mzn. The area is used to cultivate corn and beans. The areas with arable land have been used for 14– 15 years except for one part that have only been used for six years. Earlier these areas were forest. There are several plagues in the crops and some of them are managed with chemicals, some with management methods, and for some of them nothing is made. The area with arable land does not have any trees.

Pasture: The area with pasture is about 35 mzn. The age of the pastures varies from 30–35 years. Now and then some parts of the area are used to grow corn and beans. There are very few trees in the pastures. The *ceibas* are not used for anything and the timber species are listed below.

Tree species	*– use*
Laurel	– board, pillars, firewood
Macuelis	– boards, furniture
Granadillo	– boards, furniture

San Fransisco, Santa Teresa del Cedro

The area around the farm is mostly pasture and arable land. There is not much forest and the forest patches are small and very affected by human activity.

Family: On the farm live Sr. José Anibal Raite Pao 25 years old, his wife Señora Elba Esminer Gonzáles Hernández and their three children.

Farm: The farm consists of about 25 mzn, distributed as 1.25 mzn of *cafetal,* 3 mzn of forest, 1 mzn of *rastrojo,* 4 mzn of pasture, 2 mzn of pasture and arable land, 4 mzn of arable land, 1 mzn of bananas, 1.5 mzn of corn and 0.5 of mzn as an area where to keep the animals. Sr. Ratie inherited the farm five months ago, but he has lived on the farm all his life. The most important parts of the production are coffee and cattle. The farm has a small *patio,* and during the study they are cultivating cabbage, watermelon and some other vegetables. The *patio* has a fence to stop the hens from entering it. The drinking water is taken from an area next to the house where some fruit trees are growing. The farm has 10 cattle's, 2 horses, 3 pigs, 26 hens, 3 *patos* and 1 sheep (*pelibuey*). They do not have a title of the farm today.

Forest: The forest is about three mzn and contains several different timber species listed below. The forest is important for the extraction of firewood, timber (both to the house and for selling) and sometimes for *mahague,* which is used to roofs and walls.
The forest is also important to protect the water; when the trees are cut the water goes deeper into the ground. It also affects the humidity.
The forest is also important because it is land that can be cultivated in the future. Hunting is mainly done for having fun, but animals caught are eaten and can even be used as medicines, animals that are haunted are *cusuco, mapachin, pizote, ardilla*. The family knows that the forest can be used for medical purposes, for example bark from *kerosin* can be used to cure for young bulls from an illness, but the family do not use this by them selves.

Tree species	*– use:*
Comenegro	– poles
Jagua	– boards, construction wood
Yayo	– construction wood, firewood
Ojoche	– boards, pillars, firewood
Laurel	– boards, poles
Coyote	– boards
Cedro	– boards
Pata de Yanqui	– poles
Barba del sol	– boards
Guano	– rejones for the house
Kerosin	– poles, boards
Balsamo	– boards, (medicine)

During the last decade, the forest has been cut to give place for arable land and to sell/use the timber. He is selling the timber (*ojoche* and *comenegro*) in boards and pillars. They

are managed with a motor saw that belongs to a relative. It costs about 260 cordoba to make 12 boards (4 *varas* x12 *pulgadas* x 1 *pulgada*) and that takes about half a day. Sr. Ratie has to transport the sawn timber about one kilometer to the main road, and there he is paid about 300 cordoba for the 12 boards.

Firewood: Mainly dry trees are cut and used for timber and firewood. The firewood is extracted by Sr. Ratie or some of the workers.

Table 6. From what area do you extract most firewood?

		1	2	3	4	Sum:	Rank:
1	*Cafetal*	X				2	II
2	Forest	2	X			3	I
3	*Rastrojo*	1	2	X		1	III
4	Pasture	1	2	3	X	0	IV

Other NTFP: The family does not use medical plants**,** instead they by pills when someone get sick. The family has some bees (Italianos) in the forest and they give about 8 l honey/year. They also use *mahague* for fibers, roof and walls.

Wood in the house: The house was built five years ago and all the wood was taken from the forest. The species that were used were *barba del sol, comenegro, guayabo* and *cedro*.

***Cafetal*:** The cafetal has been used for about 25 years and before that the area was forested. The trees are primarily growing here to shade the coffee and the shade gives humidity to the soil. If it is too much shade, though it gives a lot of sicknesses and plagues on the coffee plants. Because of this, they cut branches from the shade trees (in April) to control the shade, and the wood is used for firewood. The best shade tree is the *guaba*, *yamarada del bosque* but *laurel* also gives a good shade. There are some problems when they are cleaning the area with a machete due to the fruits from the *nogal* trees. The trees are used in different ways both for timber (*nogal* and *laurel*), mainly to use on the farm but sometimes to sell to a neighbor, and for firewood and fruits. The fruit trees (avocado, cacao and grey fruit), *yamarada del bosque* and helequeme are planted and the other trees regenerate naturally. The fruits are used for a family consumption. Among the trees that are used for firewood are *guaba* and *yamarada del bosque*. The species used for timber are shown below. There are several sicknesses in the coffee plants. Some of them are handled with management methods and some of them with chemicals.

Species – use:
Laurel – boards, construction wood, poles
Nogal – boards, construction wood

Arable land: The area is about 4 mzn, and is used for growing corn and beans. They use improved seeds of the corn but not yet for the beans. There are several plagues and

diseases in the crops and some of them are managed with chemicals. One chemical is used every time beans are cultivated. The arable land does not contain any trees.

Pasture: The area with pasture is about 6 mzn. The pasture is mainly cleaned with a machete but sometimes also with fire. There are a few trees in the pasture; *yamarada del bosque*, *achote* and *helequeme* that are used for firewood. The last one is also used as living fence. There are also some fruit trees (cacao) and timber trees (see below) in the pasture.

Tree species – use:
Laurel – boards, construction wood, poles, firewood

Bananas: The area with bananas has the size of about 1 mzn. There are a lot of fruit trees, pears, *jochote*, mango, *pimipenta*, oranges, lemon, *guabas*, and they are all used for the family consumption. There are a few *laurels* as well.

***Rastrojo*:** The area of *rastrojo* is about 1 mzn, and is around two years old. Earlier, the area was cultivated with corn and beans for a couple of years, and before that it was forest. There are a few *laurels* in the *rastrojo*.

La Esperanza, Santa Theresa del Cedro

The area around the farm is mostly pasture and arable land. There is not much forest and the forest patches are small and very affected by human activity.

Family: On the farm live Sr. Eduardo Castro Moncada, his wife Sandra Azurena Ratio Pao and their four children. They moved to the farm 5 years ago. Sr. Castro inherited the farm from his father; at that time the area was a part of his father's farm.

Farm: The farm is about 8 mzn, distributed on 6 mzn of arable land, 2 mzn of pasture and about 0.5 mzn of forest. There is also a 200 m^2 *patio*. They started to use the *patio* about one year ago and due to Sr. Castro it works really good. Before that, they did not have any cultivation of vegetables except for the corn and beans. Before, they had to buy vegetables, but today they only consume vegetables from the farm. During the investigation the *patio* had cabbage, tomatoes, cucumber, beetroot and carrots. The farm has about 25 hens, 1 pig and three sheeps (*pelibueys*). They do not have a title of the farm.

Forest: The area with forest is about 0.5 mzn. The species that are used for timber are listed below. The forest is used for several purposes. It is used to extract firewood but is also important for the extraction of timber for constructions on the farm, and sometimes for selling, last time they sold timber was about 15 years ago. The forest is also important because it conserves the water, but they also said it was important since it gave them the possibility to look at, and listen to, the birds.

Tree species – *use*
Comenegro – poles, pillars.
Barba de sol – planks, construction wood
Ojoche – planks, firewood
Kerosin – construction wood, firewood
Guacamaya – planks, pillars, construction wood

The amount of forest has decreased; it has been cut to give place for arable land. When they are cutting in the forest they use axe, motor saw and hand saw. A couple of years ago a small part of the forest was cut to give room for new arable land.

The forest will in the future be used for extraction of firewood. In the coming years, they will also make an extraction of timber, which will be used to repair the house. Sr. Castro wants to reforest the area around the forest with acacia and *melingo* trees from which he already has seeds. He says he would like to use other species as well (*caoba, cedro*) but he lacks the seeds. He will plant the seeds in plastic bags filled with soil, and when they have grown up, replant them in the field. All this will be made on the farm. The reforestation will be made to give the farm a supply of firewood in the future. Sr. Castro never mentioned getting timber as a reason for reforesting.

Firewood: Today there is enough of firewood on the farm, but there will be in the future. Because of this he is working with living fences and letting more trees in the pasture grew up. As already mentioned, in the future he also wants to reforest the area close to the forest. The living fence is made out of tree branches that are stuck down in the soil, and then start to grow. One species used is *helequeme*.

Table 7. From what area do you extract most firewood?

		1	2	3	Sum:	Rank:
1	***Cafetal***	X			1	II
2	**Forest**	2	X		2	I
3	**Pasture**	1	2 / 3	X	1	II

Primary dry trees are selected for firewood. The man does the extraction of firewood. The family only uses firewood in the kitchen.

Other NTFP: They do not use medical plants and they have no knowledge about them. They go to the village to by pills when someone gets sick. The family have some bees (Italians) that are situated in the cultivation area. The baskets that are used for collecting the coffee are bought from a farm in Buena Vista, or they use tins for this purpose.

The house: The house was built five years ago when the family moved to the farm. The majority of the wood came from an old house on the father's farm for example *comenegro, barba del sol, bimbayan* and *caoba*. The new timber was *zapote* and this was taken from the forest.

Arable land: The area with arable land is about 6 mzn, and is used to grow beans and corn. The whole area is used at the same time, and in December he will start to cultivate beans. There are different plagues and diseases in the crops and some of them are handled with natural methods and some with chemicals. They do not use any fertilization, except residues from the crops. There are only a few trees in the arable land: mango and *jochte jobo* that are used for food, *ceibas* that are used for boards and *quebracho* that are used for construction wood, poles and firewood.

Pasture: The pasture is about 2 mzn. During the investigation a neighbor is using his pasture for horses but the family's sheep's are using the pasture as well. There were no trees in the pasture five to six years ago. The trees that are growing here are naturally regenerated, but they were selected when the pasture was cleaned with a machete. The majority of the trees are situated in the area were the family collect their drinking water. They let the trees grow up because they give shade, and the shade makes the water stay closer to the ground, and thus it becomes more water available. The well has water all the year around and even though the water has a bad taste it is not contaminated. The trees will in the future be used for firewood (*sangredrago, chaperno, guaba, quebracho, mampas*) and timber (see below).

Tree species	*– use*
Granadillo	– boards, pillars, and firewood
Laurel	– boards, construction wood, firewood

Appendix IV. Field Form

Nombre del productor: Fecha:

Nombre de la finca: Área de la finca:

Tipo de vegetación / Uso de la tierra:

Área: E/W o N/S: Distancia del primer punto:

Ancho de la línea: Ancho entre las líneas:

Largo de la línea:

No.	Especie	Ancho (cm.)	Altura (m)	Observaciones

Appendix V. Interviewed people

Buena Vista:
Sr. José Angel Herrera Pineda
Sr. Genaro Villagra Blandón
Sñ. Justina Villagra Blandón
Sr. Mario Villagra Reyes
Sr. Lorenzo Villagra Reyes

Santa Teresa:
Sr. Eduardo Castro Manzanarez
Sr. José Anibal Raite Pao
Sr. Eduardo Castro Moncada
Sr. José Luis Navarrete Chavarria