

Livelihood Strategies in the Buffer Zone of La Amistad Biosphere Reserve, Costa Rica

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Livelihood Strategies in the Buffer Zone of La Amistad Biosphere Reserve, Costa Rica



Course code: DEC 80433
Author: Pascale Schuit
Registration Number: 860728751090

Supervisors:

Fernando Saenz: CINPE, Costa Rica
Jean-Francois Le Coq: CIRAD, France
Rob Schipper: Wageningen University, The Netherlands

Second reader:

Marrit van den Berg: Wageningen University, The Netherlands

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ABSTRACT

The way a household makes a living depends on the available options in terms of assets, activities and the context in which a household operates. People in the buffer zone of La Amistad Biosphere in Costa Rica live under conditions that differ from the national standard. While many are cultivating a piece of land, the remoteness of the area makes it unprofitable to cultivate for the market and limits access to public services. In order to fulfil basic needs many households in rural areas depend on goods collected from nature such as food, timber and medicine. The households in the buffer zone of La Amistad Biosphere Reserve are restricted by law, in cultivating and collecting food products and timber on land that was previously freely available to them. Hunting is forbidden and for lodging permission is necessary. Knowledge on the different types of livelihood strategies that exist, and comprehending the driving factors of each livelihood strategy is crucial for improving mechanisms creating a better balance between nature conservation and poverty alleviation. After conducting a hierarchical cluster analysis, a non-hierarchical cluster analysis was performed on the basis of income shares of different activities. Five distinct livelihood strategies were identified. A Non-parametric test showed that there is no significant relation between livelihood strategies and outcomes in terms of gross annual income, except for day labourers. Day labourers are significantly poorer compared to those who earn income from non-farm activities and coffee producers. Non-farm workers are on average the richest group and have higher education and more often a loan, if compared to the other strategies. Assets between those pursuing strategies based on agriculture (coffee production, day labour, niche market) differ not significantly. The binary choice model determining what factors influence the choice for forest conservation revealed that non-farm-income is insignificant. Thus, agriculturalists are not less likely to conserve forest than those pursuing non-agricultural strategies. Yet, total farm size and owning land with a legal title is significantly positively affecting the choice for forest conservation.

Keywords: Livelihoods, Conservation, Cluster analysis, Costa Rica, National Parks, Nature Reserve, Buffer zone

RESUMEN

La forma en que las personas de un hogar se ganan la vida depende de las opciones disponibles en términos de recursos, actividades y el contexto en el que un hogar funciona. La gente de la zona de amortiguamiento de la Biosfera La Amistad en Costa Rica vive en condiciones que difieren de la norma nacional. mayoría depende de cultivar una parcela, pero la lejanía de la zona hace que esta actividad sea poco rentable para el mercado y limita el acceso a los servicios públicos. Con el fin de satisfacer las necesidades básicas de muchas familias en las zonas rurales, las personas dependen de los bienes recogidos de la naturaleza, tales como alimentos, madera y medicinas. Los hogares en la zona de amortiguamiento de la Reserva de la Biosfera La Amistad están restringidos por la ley, en el cultivo y recolección de productos alimenticios y madera en un terreno que antes estaba a la libre disposición de ellos. La caza está prohibida y para talar árboles es necesaria la presentación de un permiso extendido por una autoridad del Ministerio de Ambiente y Energía (MINAE). Por estas razones, es importante tener conocimiento sobre los diferentes tipos de estrategias de vida que existen y comprender los factores determinantes de cada estrategia de vida. Esto es crucial para mejorar los elementos de política que aseguren la creación de un mejor equilibrio entre la conservación de la naturaleza y la mitigación de la pobreza. Después de realizar un análisis de conglomerados no jerárquico, se realizó el estudio sobre la base de la proporción de los ingresos de las diferentes actividades. Se identificaron cinco estrategias de vida distintas. Un examen más específico mostró que no existe una relación significativa entre las estrategias de subsistencia y los resultados en términos de ingresos brutos anuales, a excepción de los jornaleros. Los jornaleros son significativamente más pobres en comparación con los que obtienen ingresos de actividades no agrícolas y los productores de café. Los trabajadores no agrícolas son en promedio el grupo más rico y de mayor educación y más dados para recibir préstamos, si se compara con las otras estrategias. La base de activos entre los productores de café, jornaleros y los que apuestan a mercados nicho no difieren significativamente. El modelo de elección binaria determina qué factores influyen en la elección para la conservación de los bosques y reveló que la actividad no agrícola de ingreso es insignificante. Por lo tanto, los agricultores tienen menos probabilidades de conservar los bosques a los que persiguen las estrategias de los productos no agrícolas. Sin embargo, el tamaño total de la explotación y tenencia de la tierra con un título de propiedad es significativamente positivo, y al mismo tiempo afecta la elección para la conservación de los bosques.

Palabras clave: Medios de vida, conservación, Análisis de conglomerados, Costa Rica, Parque Internacional La Amistad, Zona de amortiguamiento

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LIST OF ABBREVIATIONS

<i>Bono de vivienda</i>	State supported house
<i>Cajuela</i>	46 kilograms of coffee
<i>Colon</i>	Costa Rican currency
<i>Faneja</i>	1/20 of an cajuela de cafe (2.3 kilograms of coffee)
<i>FONAFIFO</i>	Fondo Nacional de Financiamiento Forestal, Costa Rica
<i>Ha.</i>	Hectares
<i>LABR</i>	La Amistad Biophere Reserve
<i>Median</i>	Median
<i>MINAE</i>	Ministerio de Ambiente y Energía de Costa Rica
<i>PCI</i>	Per Capita Income
<i>PES</i>	Payment for Environmental Services
<i>PPP</i>	Purchasing Power Parity
<i>SLA</i>	Sustainable Livelihood Approach
<i>SLF</i>	Sustainable Livelihood Framework
<i>Std.</i>	Standard Deviation

SECTION 1 INTRODUCTION

This introductory section provides the reader a brief insight into the researched topic. The background is followed by a short description of the study area and research questions. The section is concluded with a brief discussion on the relevance of the study.

1.1 Research context

Environmentalists desire to expand protected areas and reduce the intensity of farming, whilst agriculturalists attempt to increase crop production in order to enhance food security and income of poor communities (McNeeley and Scherr, 2003). Nature conservation is seen as something good in itself, for example by conserving biodiversity, or by contributing to a reduction of greenhouse gases. In contrast to agriculture this can be extremely damaging for biodiversity: tree felling for agricultural purposes, misuse of pesticides and fertilizer which pollutes water, fragmentation of ecosystems and elimination of wild species. The establishment of a national park is a way to protect nature and biodiversity. Access is controlled or even prohibited to assure the protection of natural resources. However, in many cases rural inhabitants depend on the resources found in the park, for food, fuel, and medicine (McNeeley and Scherr, 2003).

The relation between biodiversity conservation and poverty alleviation is contested (Redford and Sanderson, 2003). Bennett's (2010) annotated bibliography concludes that studies have shown that protected areas can have a number of positive social, physical, environmental, and economic benefits for neighbouring communities (Koziell, 2001; Murphey & Roe, 2004; Naughton-Treves *et al.*, 2005; Leisher *et al.*, 2007; Coad *et al.*, 2008; Cohen *et al.*, 2008 in Bennett, 2010). Yet, studies have also shown that protected areas can have a negative impact on local communities such as, restricted access, changes in tenure, conflicts with wildlife, cultural decline and, social impacts from tourism (Vaughan and Katjiua, 2003; Murphey *et al.*, 2004; Coad *et al.*, 2008 in Bennett, 2010). While the park creates potential economic benefits, conventional wisdom says that taking away resources, such as farmland and forests, aggravates poverty. This might lead to a vicious circle since the poor are less likely to invest in environmental conservation (Holden *et al.*, 1998). Reardon and Vosti (1995:1504) state that:

"In the short term, reducing poverty will not necessarily protect the environment, nor will protecting the environment necessarily alleviate poverty".

A recent study, by Andam *et al.* (2010) showed that the opposite is true for Costa Rica and Thailand. Here, protected areas reduced poverty.

The eradication of poverty and conservation of biodiversity are two distinct objectives, driven by different moral agenda's. Yet, there is considerable overlap in practice (Adams *et al.*, 2004). Wunder (2001) suggest that there are few "win-win" options between forest conservation and poverty alleviation.

Nature conservation, for example in the form of national parks, or otherwise, via forest reserves, wildlife corridors, etc., has been going on for a long time in Costa Rica. Today almost one fourth of Costa Rica's total territory is protected area as is shown in Table 1. The created national parks provide a large number of environments services such as fresh air

and water to the inhabitants of Costa Rica. It also created a positive, green, and clean image for Costa Rica. As the official tourism slogan states: “Costa Rica: no artificial ingredients”. This attracts large numbers of (eco-) tourists. However, often these parks or certain aspects of these parks are conflicting with other types of economic use of the natural resources involved such as land, water, forest, plants and animals.

Table 1 Protected Area in Costa Rica

Protected areas in Costa Rica (2003)		
<i>Category of protection</i>	<i>Hectares</i>	<i>% National</i>
National Parks	621.267	12.2
Forest Reserves	227.545	4.5
Wild life refuge	182.473	3.6
Protected Zones	166.404	3.3
Wetlands	65.122	1.3
Biological reserves	21.663	0.4
National monuments	234	0.0
Other categories	17.110	0.3
Total	1.301.818	25.6

(SINAC, 2009)

These parks are created by national authorities, and those who are affected by this government policy need to adapt or develop new livelihood strategies with the assets (natural, social, physical, financial and human capital) that they can access or possess.

1.2 The study area

La Amistad Biosphere Reserve (from now on LABR) is a bi-national park situated in Costa Rica and Panama. In Costa Rica LABR accounts for 32% of total national park area, 15% of all wild life refuge and 4% of Costa Rica’s total territory. In 1982, UNESCO declared the area an International Biosphere Reserve. The goal of a biosphere reserve is to achieve a sustainable balance between conserving biological diversity, economic development and maintaining cultural values. In 1983, just one year later, UNESCO recognized Amistad as a World Heritage Site. A World Heritage Site is of “outstanding value to humanity” (UNESCO, 2009). This is certainly true for LABR; the park has an impressive flora and fauna. Moreover, the park is unique, because of its biodiversity, significant altitude changes, climatic variation, and its location on the land bridge between South and North America. Nine of Costa Rica’s 12 life zones exist in LABR. The Talamanca Mountains contain the largest remaining natural forest in Central America and levels of endemism are high. LABR contains 10,000 vascular and 4,000 non vascular plant species, 400 species of birds, 215 species of mammals, 263 species of amphibians, reptiles, and 115 species of fish. In addition, endangered species such as the great green macaw, osprey, and the harpy eagle live in LABR (Clark, Dixon et al. 2006). Figure 1 below shows the location of LABR in Costa Rica.

La Amistad Biosphere Reserve consists out of several protected areas of which La Amistad National Park is the largest (see Table 2). All villages studied are located in the buffer zone of La Amistad International Park.

Table 2 Protected areas within La Amistad Biosphere Reserve

Protected Areas within La Amistad Biosphere Reserve		
<i>Category</i>	<i>Place</i>	<i>Hectares</i>
Parks	La Amistad International Park	200.000
	Cahuita	1.106
	Chirripó	50.848
	Barbilla	11.944
	Tapantí-Macizo de la Muerte	58.322
Forest Reserves	Río Pacuare	13.177
	Río Macho	22.577
Biological Reserves	Hitoy Cerere	9.949
Protected Zone's	Las Tablas	19.926
	Río Tuis	4.113
	Río Banano	9.247
Wild Life Refugee Areas	Gandoca Manzanillo	3.833
Indigenous Territories	11 Indigenous Reserves Bribri-Cabécar	262.783
Total		667.825

(SINAC, 2009)

La Amistad International Park has a complicated system in which areas are divided in to zones. The majority of the park 98.4% is a no access zone (*Zona de Protección Absoluta, ZPA*). 1.3% is a zone with restricted access (*Zona de Uso Restringido, ZUR*), this zone includes walking tracks such as *Sendero Altamira*, located near to Altamira and Biolley. Only 0.1% of the area is classified as a public zone (*Zona de Uso Público, ZUP*) and 0.2% is classified as *Zona de Uso Especial (ZUE)*, a zone for special use, here one finds the infrastructure needed to maintain and supervise the park. Then there is the buffer zone (*Zona de Amortagimimiento*) in which the villages of our study area are located. Each of these zones has its own rules and regulation. In the absolute protection zone only scientific research is allowed and zones with restricted access permit only a limited number of tourist. The buffer zone is the only area in which people are allowed to live.

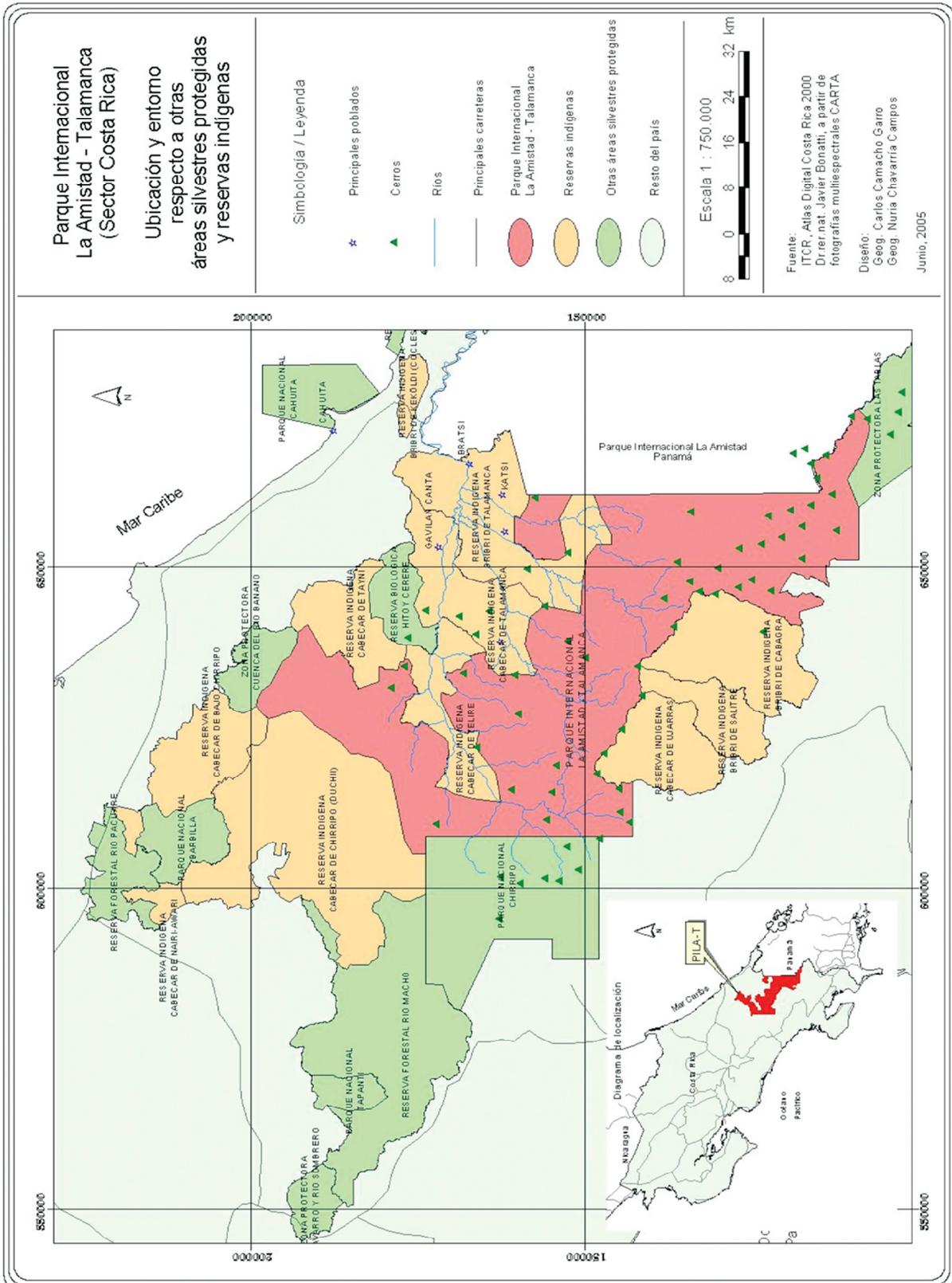


Figure 1 The location of La Amistad Biosphere Reserve in Costa Rica

(Source: SINAC, 2009:10)

In the area of study people live under conditions that differ from the national standard. While many are cultivating a piece of land, the remoteness of the area makes it unprofitable to cultivate for the market. Most inhabitants of the region are employed in agriculture, livestock or fishing (26.5%). Income per capita is 37.3% lower compared to the national income per capital and 43.3% of the population is living in poverty or extreme poverty. The main agricultural products are coffee, palm oil, rice, pineapple, and beans. The region accounts for 3% of total exports and the main export products are palm oil (43.6%), pineapple (28.3%) and seeds (7%) (MIDEPLAN 2009). Although the basic road network in Costa Rica can be described as good; the rural roads that gave access to the study area are often impassable without a four-wheel drive. Scholars argue that remote areas face certain characteristics that lead to economic marginalization. There are few off-farm income opportunities, access to health and education is restricted, lower political bargaining power and, the option to participate to the urban economy are limited to the decision to migrate. People in remote rural areas are thus excluded socially and institutionally (Wunder 2001; Bird *et al.*, 2002). In addition, access to forests, which are often a key resource for food, timber for construction and energy supply, is limited. The households in our sample are restricted in collecting and harvesting from the natural environment. Hunting is forbidden and for lodging permission is necessary. This permission is given by MINEA and the process is described by respondents as slow and expensive. Under these circumstances, livelihoods demand for other ways of income generation than farming only. This thesis is focused on the different types of livelihood strategies that people develop in these circumstances. The analytical framework used is the sustainable livelihoods framework as developed by DFID (1999) and explained into depth in Section 2.

1.3 Research objective and questions

Households in the buffer zone of La Amistad Biosphere Reserve are restricted in the available options in terms of assets and activities to make a living. Assets¹ are defined as financial, human, natural, physical, and social capital. Assets are the building stones in developing livelihoods strategies. In order to increase our knowledge about how households cope and act under these conditions the following research objective was identified: *to identify whether and how the park affects the livelihood strategies of the people living in the buffer zone.*

Against this background, the following research questions have been established:

- 1. What are the dominant livelihood strategies in the buffer zone of La Amistad International Park?*
- 2. Which types of assets (human, financial, natural, physical, and social) are critical for what livelihood strategies?*
- 3. Which assets (human, financial, natural, physical, and social) are critical in determining income level?*
- 4. To what degree are the livelihoods sustainable?*

¹ The terms assets, capitals and resources are used interchangeably in this study.

1.4 Justification of the study

This thesis investigates the interaction between La Amistad National Park and its environmental services, and the economic activities of the population bordering the park. This is studied through a case study of the 'La Amistad National Park'. This research may be relevant to different readers. First, it provides an overview of household needs and livelihood strategies. The range of livelihood strategies that households are now pursuing, and how well they are doing, is critical information for community members and their organizations as well as those that seek to assist them. This information can contribute to more evidence based decision making (Nkedianye *et al.*, 2009). Second, it uses this overall picture of household economies to assess the impact of conservation initiatives on livelihood strategies. The understanding of these livelihood strategies enables policy makers to fine-tune their policy, better towards households with certain common characteristics.

1.5 Outline of the study

The rest of this thesis is divided into six sections. After this introduction, Section 2 provides the reader with a literature review on the sustainable livelihood approach. Section 3 discusses the methodology used in this study. In Section 4, the five dominant livelihood strategies identified by a cluster analysis are presented. Subsequently, in Section 5 the different livelihood strategies are looked at in detail, i.e. what are assets that seem to drive these strategies. Section 6, first addresses the question if livelihood outcomes differ amongst the five livelihood strategies. After that, the results on the linear regression on determinants of gross annual income are discussed. Section 7 offers a discussion on sustainable aspects of livelihood strategies. Finally, Section 8 summarizes and discusses the findings of this thesis.

SECTION 2 LITERATURE REVIEW ON THE SUSTAINABLE LIVELIHOOD APPROACH

This section will introduce the theory on sustainable livelihoods which serves as the conceptual framework of this thesis.

2.1 Background on the sustainable livelihood approach

The sustainable livelihood approach (from now on SLA) arose from the broad context of rural development theory that has moved through three main bodies of thought since the mid-20th century, namely the population and technology model, agricultural development, and political economy theories (Ellis, 2000). DFID (1999) proposed the Sustainable Livelihood Framework (from now on, SLF) as a tool for researchers and practitioners. Cahn (2002) describes the SLF approach as:

“A way of thinking that can be used as a tool for planning interventions, reviewing and evaluating projects, research, policy analysis and development (Cahn 2002).”

DFID (1999) describes the SLF as *“people centred” “holistic” “dynamic”* and *“builds on strengths”*. Because of the flexibility of the livelihood framework and the limitations of traditional poverty indicators such as expenditures, calorie intake or poverty lines the livelihood framework soon gained popularity among researchers, practitioners, and developers.

The concept of livelihood has developed through many years of thought and study on how rural households construct their lives and income earning activities. According to the dictionary a livelihood is: *“means of support; subsistence.”* Although the term *“Sustainable Livelihoods”* has been used widely in poverty and rural development research, there is no broadly accepted definition of this concept, and different governments, organisations, and individuals have adopted their own understandings (Cahn, 2002; DFID, 2002). The origin of the sustainable livelihood concept can be traced back to the Advisory Panel of the WCED in 1987 (Conroy & Litvinoff, 1988 in Shen *et al.*, 2008). Reviewing the WCED panel definition, Chambers and Conway (1992: 6) in put forth their understanding of a sustainable livelihood that was adapted by several other authors:

“A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the long and short term” (Chambers and Conway 1992; Scoones 1998; DFID 1999).

Ellis (2000) stresses that access to assets and activities mediated by institutions and social relations should be highlighted, rather than capabilities. Since, capabilities in the above definition overlap with assets and activities (Shen *et al.*, 2008).

“A livelihood comprises the assets, the activities and the access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household.” (Ellis, 2002:10)

There is no one size fits all definition and context should be taken into account (Shen *et al.*, 2008). Moreover, implementing the livelihood strategy framework requires a combination of quantitative and qualitative method (Jansen *et al.*, 2006).

Hence, a “livelihood” does not just mean the activities carried out to earn a living. It means all the different elements that contribute to, or affect, their ability to ensure a living for themselves and their household. A graphical representation of the sustainable livelihoods conceptual framework is presented in Figure 2. The arrows in Figure 2 capture the interaction between the 5 key features.

Livelihood assets consist of natural, physical, social, human, and financial forms of capital (DFID, 1999).

Transforming structures and processes involve public and private sectors; process is made up of policy, laws, culture, and institutions (DFID, 1999). The welfare generating potential of assets depends on the interaction between assets and the context. Policies, institutions and processes can either help households, or make it more difficult for households to succeed an adequate livelihood (Siegel 2005).

The vulnerability context describes shocks, trends, and seasonality that influence farm-household behaviour. It includes history, politics, macro-economic conditions, climate, and demography (DFID, 1999). Those are factors that the household itself may not be able to control directly.

Livelihood outcomes are the objectives that livelihood strategies achieve. Outcomes can either be positive or negative (e.g. increase/decrease in income) (DFID, 1999).

Livelihood strategies are the activities employed to gain a living (DFID, 1999).

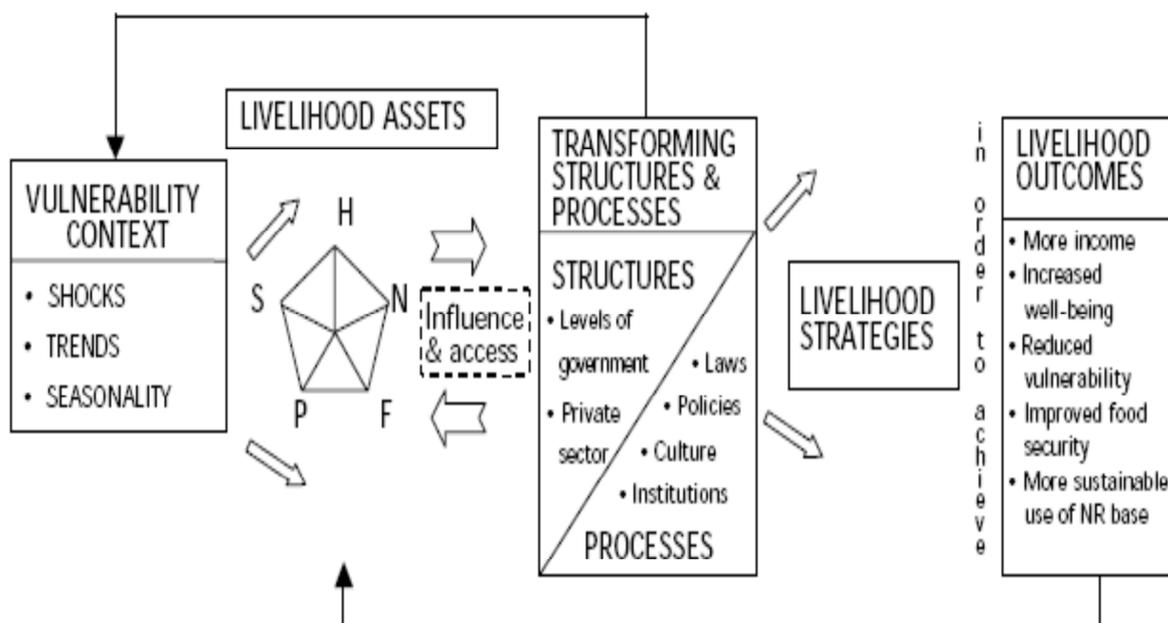


Figure 2 The Sustainable Livelihood Framework

Source: DFID (1999)

The core idea of the framework is that people need a combination of different assets to achieve a sustainable livelihood (DFID 1999). The framework helps to identify the underlying constraints and opportunities of livelihoods. It helps to link micro understanding of poverty into policy and institutional change processes. The sustainable livelihood approach draws on scholars improved understanding of poverty. Poverty has most commonly been assessed against income or consumption criteria. Under these criteria, a person is poor if his income/consumption level is defined below a certain minimum. However, the poor themselves view poverty in a wider sense. Aspects of poverty as defined by the poor themselves include vulnerability, levels of health, education or a lack of voice in their household, community, or government (Chambers, 1995). The sustainable livelihood approach allows us to understand the concept of poverty in a broader sense (Farrington *et al.*, 1999). Since the emergence of the sustainable livelihood definition the framework has been adopted by different types of organizations (NGO's, multilaterals, research centres etc.).

2.2 Basic household needs

The sustainable livelihood framework does not have a clear starting point in the sense that it not addresses *why* households develop livelihood strategies. At what are households aiming when they develop a strategy? Ashley and LaFranchi (1997) start with identifying which households needs exist. They divide household needs into physical needs (food, energy, water, shelter) and other livelihood needs (cash, goods for barter exchange, reserves, drought cropping strategies, production inputs, cultural assets and community strength). However, according to the preferences, expectations, family size and circumstances of the household the extend of these needs varies. For some, "satisfy basic needs" may be only satisfy minimum needs including sufficient food and nutrition, having a house to stay and clothing. While others require more than that for example an improvement in terms of both quality and quantity of education, health care, cultural tradition and spirit. Moreover, not all households have the same asset base to fulfil needs. As a result, rural households develop different livelihood strategies (Ashley and LaFranchi, 1997).

2.3 Livelihood assets

The asset-based approach underlies the livelihood approach. It can be used to explore relationships between assets, context, behaviour and outcomes (Siegel 2005). Livelihood assets are owned, controlled, claimed, or in some other means accessed by the households. These assets may be described as: "stocks of capital that can be utilized directly or indirectly, to generate the means of survival of the households" (Ellis, 2000). The assets of households are broadly defined as financial, human, natural, physical, and social capital. The division of five categories of assets can provide a useful starting point for a household livelihood analysis, as well as a guide to help investigators gain a more complete picture of the household and its livelihood assets. Assets determine the opportunity set of options resulting in livelihood strategies: peoples revealed behaviour. The outcome of this behaviour determines the household's well-being or in our case the economic welfare status. Assets can generate multiple benefits. To illustrate, livestock can be classified as an endowment obtained by nature (natural capital). However, livestock can serve as physical capital (animal traction), social capital (prestige and connectedness to the community), and financial capital, when cattle is sold in situations of stress. Moreover, capitals are

interconnected: land (natural capital) may serve as collateral (financial capital). It is important to keep in mind that the asset status changes constantly, therefore pentagons are constantly shifting (DFID 1999). The DIFID framework proposes five different types of assets.

Human capital reflects the stock of human skills and knowledge available to the household. Skills, knowledge, labour power, and good health enable people to pursue different livelihood strategies and achieve their livelihoods objectives

Social capital refers to networks and connectedness, membership in organizations, informal safety nets, rules, norms, and sanctions. Social capital is not positive per se, for instance, membership of a group or network often entails obligations.

Natural capital is the term used for the natural resource stock from which resource flows and services useful for livelihoods are derived. Examples are: land, forest, wild resources, and water. Natural capital is of great value to those who derive their livelihoods from resource-based activities.

Physical capital comprises producer goods needed to support livelihoods and the basic infrastructure. It includes amongst other things: machinery, technology, buildings, shelter, communication, transportation and sanitation.

Financial capital denotes the financial resources that people use to achieve their livelihood objectives. Financial capital can be divided into available stocks and regular inflows of money, both formal and informal. Examples of available stocks are savings in the form of cash, jewellery, and livestock. The most common types of regular inflows of money are pensions, other transfers from the state, and remittances. If inflows of money are regular people can plan investments. Hence, in order to make a positive contribution to livelihoods these inflows need to be reliable (DFID 1999).

However, over the years different authors have proposed various other assets to complement the scheme. Opponents point out that adding more assets might be confusing.

Political capital such as membership in political parties and citizenship can be key in obtaining or operationalizing rights over assets, and therefore is proposed as an additional category of assets (Adato and Meinzen-Dick 2002). Social capital is said to capture horizontal power lines, whereas political capital should capture vertical power lines (DFID, 2002).

Cultural capital Cahn (2002) proposes a Pacific livelihood model with the integration of culture and tradition. (Throsby 1999) suggest that cultural capital can contribute to our understanding of sustainability since culture is a set of practices and beliefs that are fundamental to the functioning of different societies. The core idea is that people make decisions not only in a social context, but also in a cultural context

Geographical determinants of comparative advantage are an additional category of assets proposed by Jansen *et al.*, 2006:22. This new asset category reflects the economic environment of the household in terms of household's access to markets and public services but also in terms of the vulnerability context. They argue that these factors play a significant role in the household livelihoods choice (Jansen, Pender *et al.* 2006).

Given the available information in our household data set and secondary data sources, we necessarily adapt and narrow these broad asset definitions. The operationalized definitions of these assets as can be found in *Appendix III*, as well as all other variables used in this thesis.

2.4 Sustainable livelihood

A livelihood is viewed as sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (DFID, 1999). Further, livelihoods are sustainable when they: (1) are resilient in the face of external shocks and stresses; (2) are not dependent upon external support; (3) maintain the long-term productivity of natural resources; and (4) do not undermine the livelihoods of, or compromise the livelihood options open to, others (DFID, 1999). Another way of conceptualizing the many dimensions of sustainability is to distinguish between environmental, economic, social, and institutional aspects of sustainable systems:

Environmental sustainability refers to the conservation of natural resources for use by future generations.

Economic sustainability is achieved when a baseline level of economic welfare is reached and sustained in the long term.

Social sustainability denotes the minimization of social exclusion and the maximization of social equity.

Institutional sustainability is achieved when institutions function over a longer period. Very few livelihoods qualify as sustainable across all these dimensions.

This thesis is mainly concerned with environmental & economic sustainability. The theory suggests that conservation will be most successful when communities also benefit from conservation and reach a higher level of economic sustainability. Therefore, in balancing conservation (environmental sustainability) and livelihoods (economic sustainability) a number of models are developed such as Community Based Natural Resource management, Community Based Tourism, Community Based Eco tourism and Community Based Wildlife Management. A wider definition of sustainability would also include economic, social and institutional sustainability. However, a lack of time, money and the difficulties that operationalization of such wider definition brings, restricts the author in defining sustainable more broadly.

SECTION 3 METHODOLOGY

This section will explain why and how this study was conducted. It addresses the methods used to collect primary and secondary data and discusses how villages and households were selected.

3.1 Secondary data collection: a literature review

Reviewing literature is a qualitative method that is unobtrusive as a desk study (Marshall *et al.* 1999). This method was applied in this thesis in reviewing related literature, empirical research, and some secondary data from Costa Rica, such as statistics. The literature review includes a review of concepts such as sustainable, sustainable livelihoods, rural livelihoods, vulnerability, and nature conservation. The sources of this literature include books, papers, reports and the internet. These documents were reviewed before and during the process of doing field work in order to understand concepts on livelihood (strategies). During writing, these documents were reviewed critically again to ensure the analysis of results matched with the operationalized concepts and theories in attempting to answer the research questions. This is helpful to discover new knowledge that obtained from field works to contribute to a mass of available knowledge.

3.2 Primary data collection: group discussions, survey and observation

3.2.1 Choosing a study site

In total there are around 32 villages located in the buffer zone of La Amistad Biosphere Reserve. In November 2009, the villages of Biolley, Tres Colinas, Santa Rosa, and Santa Maria were visited. These villages were selected non-randomly by MINAE based on several criteria. Villages near the park were selected and all villages except Capri had a walking track located close to the villages. This walking track allows tourist to enjoy the scenic beauty of the park and provides the village with a potential of tourist related activities such as lodging. MINAE purposely selected villages with a local development organization. However, the strength of these organizations varied. Biolley, Altamira and Santa Maria are identified as having a strong local development organization, which functions not only as a producers association but is also involved in off-farm activities such as attracting eco-tourists. These villages have the infrastructure (lodging, restaurant) to receive tourist (*see Annex II*). Capri, Santa Rosa and Aguas Calientes have less developed local development organizations. They do not function as a producers association, and are engaged in activities such as reforestation and garbage collection. Because, the MINAET was interested in migration villages were included that are characterized by high levels of (inter)national labour migration. Moreover, they looked at land use where Capri is suited for livestock; Biolley has a local fame for its coffee production. Practical criteria such as the accessibility of the villages were also taken into account.

The November 2009 visit had several objectives. First, presenting the project, and introducing ourselves. Second, it helped exploring the existing range of opinions and views on nature conservation. Third, it was useful in identifying the current agricultural and non-agricultural activities in the area. Fourth, since it improved the understanding of the local context, it helped us to identify not only which villages were suited for our semi-structured

interviews but also, which topics are important to incorporate in the questionnaire. Finally, the group discussion was convenient in identifying local leadership (key actors).

After the fieldtrip the findings were discussed and the decision was made in cooperation with MINEA, CINPE and CIRAD to include the villages of Biolley, Altamira, Santa Maria, Capri, Santa Rosa, and Aguas Calientes in our study.

For those interested, a more detailed description on the study site and local development organizations can be found in respectively *Annex I (Village profiles)* and *Annex II (A description of the six development organizations)*.

The locations of the villages are depicted in Figure 3 below.



Figure 3 Location of the selected villages²

(Source: own elaboration)

² I would like to thank Fernando Saenz for this map

3.2.2 Choosing the households

The households were selected in a non-randomized manner, namely the snowball method. In the area it was difficult and costly to locate respondents. We did not succeed in locating a list of all households per village. In addition, the relative large number of inhabitants in the villages and the distance between the houses made it too time consuming to draw a map of each village. As a result of these restrictions we opted for snowball sampling. This non-probability method is perfectly suited trying to reach populations that are inaccessible or hard to find. The initial subjects were found during the community meetings. In each village, at least one participatory community meeting was held preferably before starting interviewing in the village. To generate additional subject's respondents were located relying on referrals from initial subjects (Babie, 1992). This lowered our search costs both in terms of time and money but came at the expense of introducing bias. Snowballing reduces the likelihood that the sample will represent a good cross section from the population.

The meetings were organized via the local organizations, leading to a low participation of villagers that are not a member of the local development organization. To achieve a balance in our survey between respondents that belong to the local organization and respondents that do not belong to the local organization, we purposely selected households that belong and that do not belong to the local development organization selected. One identifies key-respondents, interviews them and asks these households whether they know a family that would be useful to interview. In this process, we asked specifically for households not belonging to the local development organization.

Amongst environmentalist, there is a debate on the extent to which indigenous inhabitants impact biodiversity and ecosystem in protected areas, particularly as these communities become increasingly acculturated (Peres, 1994). On the other hand the international conservation community voiced in the Durban Accord the concern *"that many costs of protected areas are born locally – particular by poor communities – while the benefits accrue globally"* (WPC 2003: 2). In order to contribute to these debates, in an early design of the research, the research objective was to identify the dominant livelihood strategies of the indigenous communities living within the borders of La Amistad Biosphere Reserve. While examining the practical feasibility of this, we bumped into limitations. MINAE informed us that interviewing indigenous people was very sensitive in Costa Rica. Although we tried; we contacted the local indigenous group situated in Capri. However, no permission was given to perform interviews within indigenous communities.

The fact that this research includes only interviews with non-indigenous people is not a limitation. As Brockington *et al.* (2005) states, the impacts of conservation can be just as serious for non-indigenous people. To illustrate, in the village of Capri that is situated on indigenous territory the impact of nature conservation on non-indigenous people was very clear. The villagers of Capri, living on indigenous territory, are constrained by conservation policies biased towards the livelihoods of indigenous-people. For example, the indigenous community owns all land and it is legally impossible for an individual to obtain a title over a plot of land. This limits non-indigenous farmers in obtaining a loan since they have no land that can serve as collateral. Another example is that if they want to start a new activity such as tourism they need permission from the indigenous board. In the case of Capri the indigenous board refuses to give this permission, constraining the non-indigenous inhabitants of Capri in developing new livelihood activities.

3.2.3 Group discussions

This method was used for collecting information at group level per village. The advantage of group discussions over individual household surveys is that they provoke discussion. However, a disadvantage is that there is social pressure to give socially correct answers, which may not reflect actual opinions and practices. The presence of community leaders impeded participants in expressing their views and opinions. Moreover, assets and perceptions may be different amongst individuals. Therefore it was important to supplement this information collected from group discussions with surveys at household level. The group discussions were organized with help of the local development organizations. Although the whole village was invited, the participation villagers belonging to the local development organization was higher.

In November 2009, when we first visited some of the villages, the main aims of this discussion were to introduce ourselves and the project and select villages suitable for research.

In January and February 2010, there were some villages included that were not visited during the trip in November. Therefore, preferably at the first or second day of our arrival we organized a group discussion. During these group discussions information at community level was collected about the history of farming, availability of public services, and shocks. Also information was collected on livelihood activities before and after the declaration of the La Amistad National Park and conditions, favourable and unfavourable, for seeking different livelihood strategies.

In July 2010 we returned to the villages of Biolley, Santa Rosa and Agua Caliente to present preliminary findings and to discuss their relevance and validity for the communities.

3.2.4 Structured interviews

Rural inhabitants in the Buffer Zone of La Amistad Biosphere Reserve were interviewed. No households were interviewed who live within the park boundaries. People living within the boundaries of the park are mainly indigenous people. Indigenous people are likely, to pursue a different livelihood strategy than “white farmers”. Moreover, cultural differences make that the perception on nature conservation probably differs between the two ethnicities. Within the sample, few respondents had ever owned land in what is now the park. Of the households interviewed 47.7% of the household heads was not even born in the province of Puntarenas.

We interviewed household heads and if these were not available their wives. The structured questionnaire provided us with detailed information on the issues of interest, and allowed us to search for structural relationships between concepts. Moreover, sometimes people are more willing to speak in private than in a group especially when the subject is sensitive (e.g. income, education of children, health).

The survey was based on the Sustainable Livelihoods Approach as formulated by DFID (1999). The Sustainable Livelihood Approach was chosen as the survey’s analytical framework because it focuses on people and their practices, and concentrating on what people have (livelihood assets). The survey sample contains 107 households, which cover in total 476 Persons and 171 parcels and plots. Key socioeconomic elements of the survey are summarized *in Annex III*.

3.4.5 Observations

All social science research begins and ends with empirical observations (Nachimias *et al.*, 1996:206). Owing to the controversy and sensitivity associated with nature conservation observation was a necessary methodological complement to gather information. Moreover, observations help to give an understanding of the respondent's attitude and behaviour, which facilitates data analysis.

3.4.6 Triangulation

“Once a proposition has been confirmed by two or more independent measurement processes, the uncertainty of its interpretation is greatly reduced. The most persuasive evidence comes through a triangulation of measurement processes”

(Webb, 1966:3).

To achieve optimal benefit from the data collection methods all data and research methods should be triangulated. In this way validity is increased and a deeper understanding can be attained. Triangulation, it is particularly useful to combine insights derived from qualitative and quantitative methods (Olsen, 2004). Data was triangulated to answer the research questions as described in Section one. The interpretation of the econometric analysis was facilitated by the bulk of qualitative information available to the author. This allowed for a deeper understanding of the situation.

3.4.7 Data analysis

During field work, all data was entered on the spot into Excel spread sheets and later converted into SPSS 17.0, with which the data analysis has been made.

SECTION 4 DOMINANT LIVELIHOOD STRATEGIES

This section answers the first research question. It presents the dominant livelihood strategies that exist in the buffer zone of La Amistad National Park. It starts with a discussion on the theoretical divisions of livelihood strategies as proposed by various authors. Subsequently, attempts aimed at categorizing households into different groups are discussed and the methodology used for this study is explained. After that a short description of the different income earning activities is presented to the reader. Finally, the five different livelihood strategies that resulted from a non-hierarchical cluster analysis are presented.

4.1 Ways in determining livelihood strategies

Different authors propose different categories of livelihood strategies. Ellis (2000) identified two categories, (1) natural resource based activities and (2) non-natural resource based activities (Ellis, 2000). Scoones (1998) identified three categories, namely (1) agricultural intensification or extensification, (2) livelihood diversification, and (3) migration. FAO (2001) proposes 5 main household strategies that would improve livelihoods (1) Intensification of existing production patterns (2) Diversification of production and processing (3) Expanded herd or farm size (4) Increase off-farm income, both agricultural and non-agricultural (5) A complete exit from the agricultural sector within a particular farming system. Siegel (2005) identifies 5 pathways for reducing rural poverty in Central America. (1) Agricultural path, increased productivity and diversification to reach higher value enterprises for both a) commercially oriented small farmers (primarily household employment and income) and b) larger commercial farmers (operated with hired labour). (2) Pluriactive path, focus on off-farm economic activities (including labour on larger farms), and also attempt to generate basic food staples for home consumption. (3) Social assistance path, both formal and informal assistance including safety nets, transfers, remittances, and special targeted programs. (4) Exit paths Migration out of rural areas within country and outside country. (5) Payments for environmental services, rural residents would receive payments for activities related to natural resource management and environmental quality (Siegel 2005).

On an empirical level the literature contains a number of attempts aimed at categorizing households into different groups that represent livelihood strategies. Birch-Thomsen *et al.*, (2001) used income shares to weigh the importance of different sources of household income. Different types of income were allocated points based on source, such as income from natural resources, business, rents, and so on. Groups were then formed based on the frequency distribution of income sources. In a study on land cover changes in a protected area in Kenya clustering techniques were used to group farmers on the basis of physical capital as expressed in land use (Lambin 2003 in Jansen *et al.*, 2006). Valdivia and Quiroz (2001) selected nine variables for their cluster analysis that was built using a household peasant framework. Alinovi *et al.*, (2001), classified households using the Ward's cluster analysis technique. Information on shares of income sources, productive assets and occupational activities were used to let the data identify the most meaningful and homogeneous groups in terms of livelihood strategies. Adato and Meinzen-Dick (2002) implemented the livelihoods framework in five case studies using qualitative methods to assess the impact of agricultural technology and research on people's lives. Barrett *et al.*, (2001) maintains that studies focused on livelihoods should use a diversity of indicators to

assess sources of income and income-earning strategies and argue that assets, activities, or income all have limitations and therefore should be used in combination. Rakodi (1999) favours a conceptualization of household strategies as managing portfolios of different types of assets for the identification of relevant policy recommendations. Jansen *et al.*, (2006) based their definition of a livelihood strategy on household's decisions concerning allocation of productive endowments: land and labour. In order to define a livelihood strategy they used the time-allocation of households on different types of activities and the households land use patterns.

The data collected on income for this study is limited to 2009. Furthermore, it is not corrected for the costs of production (raising livestock or growing crops). Hence, adapting a definition of a livelihood strategy on the basis of livelihood outcomes (income) would be unfavourable. Time allocation on productive activities and land use reflect the way in which a household puts its main assets into use. Therefore, it would provide a more reliable picture of livelihood strategies. In the survey questions on land use and time allocation were included. However, the enumerators did not succeed in collecting data on time allocation. Respondents indicated that they could not answer these questions. Anthropologic studies have described the difficulties in quantifying time-allocation of different activities (Johnson, 1975; Gross, 1984).

In view of the above, we decided to base our definition of livelihood strategy on the share of incomes from different activities. In order to answer the main research question, "What are the dominant livelihood strategies in the buffer zone of La Amistad Biosphere Reserve" we performed a cluster analysis. After that, we tested whether there is a relation between livelihood outcomes (income levels) and livelihood strategies.

4.2 Methodology of the cluster analysis

Cluster analysis is a statistical data reduction method for summarizing a large number of sample observations by assigning them to a smaller number of distinct groups – or "clusters". Similarity is measured with reference to a particular statistic such as, the mean or median of the cluster. This method does not require any assumption about the distributions describing observations within or between clusters. In this study nine income shares are used based on different activities: (1) share of income from coffee (2) share of income from low return off- farm wage employment (3) share of income coming non-farm income (4) share of income from livestock (5) share of income from agriculture (farm work) (6) share of income from self-sufficiency³ (7) share of income from remittances (8) share of income from other transfers (9) share of income from the niche market. Data on total income was available for 97 households.

The shares were calculated by adding up the different income sources that belonged to a certain category and then divide this by the total amount of income earned by the household. *Appendix III* lists the variables used. Each off these activities has its own advantages and disadvantages. Some of these aspects are recognized in the literature, whereas others are specific to the local context.

³ The share of income from self-sufficiency was taken apart because it includes both income from livestock as well as income from agriculture

On the basis of income shares of different activities households were assigned to different groups based on a cluster analysis of the relative importance of income shares. First, the number of clusters was determined from a hierarchical cluster analysis based on squared Euclidean distances and Ward's method. This method ensures that within cluster differences are minimized, it avoids problems with chaining and optimizes the F statistic. A drawback from the hierarchical methods is that an individual can never be removed from the cluster to which he or she is assigned. This may result in suboptimal clustering. Hence, as proposed by Hair (1992) once the number of clusters was determined; a K-means (non-hierarchical) cluster analysis was performed to determine the optimal cluster partitioning. To help identify large relative increases in the cluster homogeneity, the percentage change in the clustering coefficients for the clusters were calculated. Small coefficients mean that relatively similar clusters are merged; large coefficients indicate that two very different clusters are merged. The largest percentage change in agglomeration coefficient to next level was found when moving from two to one cluster. However, the aim is to determine different types of livelihood strategies. Therefore, it is more convenient to have several clusters. The five cluster solution was opted because it showed a substantial acceleration of the increase of the agglomeration coefficient.

4.3 Description of the different activities used for the cluster analysis

In the cluster analysis nine income shares were used to determine livelihood strategies. Table 3 on the next page shows the proportion of households involved in the various income-earning activities, mean levels, and ranges of, total income earned from these various activities (shares of these variables are the basis of the cluster analysis)⁴

4.3.1 Coffee

Since many years, coffee has been the most important cash crop in the region. However, after the coffee crisis, many farmers abandoned or even cut down their coffee plantations and switch to cattle. In the production of organic coffee social capital seems to play a role, since this only was encountered in villages that have a local organization that promotes organic coffee. The instability of the coffee market and the low coffee prices are affecting households negatively. Some households indicated that production costs were above the market price that they received in 2009. In 2009, 39% of the households received income from coffee production.

4.3.2 Off farm employment

Off farm employment provides households with either cash or food. The major constraint of farm wage employment in the area is that there is few/no demand; farm wage employment is difficult to find. If, one has the luck to find a job as day labourer there is no contract. Evidently, this leads to income insecurity.

⁴ The descriptive statistics were only calculated for those households that were involved in a particular activity.

Table 3 Mean levels, and ranges of, gross annual total income earned from various activities in \$ (PPP) per year (N=97)

Mean levels, and ranges of, gross annual total income earned from various activities in \$ (PPP)⁵ per year (N=97)						
Variable	Number of households	Min	Max	Mean	Std. Dev.	Median
Total coffee income	38	228	25725	4391	5147	2858
Total off farm income	32	171	6002	2058	1369	1973
Total non-farm income	33	42	34300	7963	10107	4116
Total livestock income	18	28	22866	5332	5924	3602
Total income of remittances	29	143	37730	6111	9173	3088
Total income of other transfers	63	124	11044	1404	1707	1030
Total income of niche income	33	143	11434	2674	3086	1429
Total savings from self-sufficiency	81	171	20580	1460	2375	1030
Total income of agriculture	23	39	10005	1333	2125	857

4.3.3 Non-farm employment

Non-farm employment provides households which cash. Moreover, non-farm employment is a more regular cash income than farm wage employment. However, demand for non-farm workers and employment opportunities are scarce. The small villages occupy not many grocery stores or bars. The remoteness of the area makes that possibilities to work for the public or private sector are even scarcer. Also, the park has created little off farm opportunities.

4.3.4 Livestock production for the market and own consumption

The data collected on livestock population is a picture at a given moment in time. Poultry is kept by the majority of the households. However, of the respondents with poultry 50% has less than 10 animals indicating that poultry is mainly kept for private consumption. Numbers of cattle and pork are also low. Few households have livestock as their most important source of income. Most cattle grazing is extensive, average stocking rates are 1.3 head of cattle per hectare. In the majority of the households cattle had multiple purposes; cattle was used for both beef, breeding and dairy production. Animal husbandry has several

⁵ A discussion on the PPP conversion rate used can be found in section 6.1

benefits. Food products such as eggs, milk, and meat can be obtained from animals, to either sell or eat. In addition, livestock can serve as financial capital in times of distress when it is sold at the market to generate cash. When asked, households indicate that in general animals are sold for a specific purpose, such as medical expenses, the yearly shopping for clothes, soap and salt. Many authors agree that cattle in the tropics are not sustainable. Cost/benefit analyses conclude that holding cattle is unprofitable land use (Jones 1990, Faminow *et al.*, 1999 in Connelly and Shapiro 2006). In 2009 cattle prices in Costa Rica were low, making it unprofitable for households to raise and sell cattle. It is questionable if the region is very suited for cattle. Distance to markets and bad road conditions increase the cost of transportation. The bad road conditions cause cattle to arrive at the market full of bruises, decreasing even further the price that the farmer receives for his meat. Furthermore, in La Amistad National Park live predators such as jaguars and puma's, which occasionally cause injury or death to animals held close to park borders. Lastly, nature conservation policy in Costa Rica also forbids farmers to keep cattle in steep areas, making a lot of the land in the buffer zone of La Amistad National Park unsuitable for livestock. Yet, only in the village of Biolley, it was pointed out by respondents during the group discussions that the area was not suitable for cattle.

4.3.5 Remittances

A distinction was made between remittances and other transfers. Transfers other than remittances can be seen as gifts. In order to receive remittances one uses human and financial capital. Since, remittances require an investment, in the form of sending family members abroad. Almost 62% of the households interviewed indicated to have family members that migrated over the past 20 years. Migration provides cash income. Cash income can be consumed or invested in assets such as physical or human capital to make (other) assets more productive. In the area it also occurred that migrants send durable goods such as TV's and cars to family members. Migration also has its constraints; it leads to a reduction in the households of labour force as most migrants are young man. Also, the difficulty in obtaining a work visa for the United States make that many migrants are illegal. Illegal border crossing is expensive and dangerous and illegal migrants are vulnerable to exploitation.

4.3.6 Other transfers

Eighth-four per cent of all households is to a certain degree self-sufficient and 65% receives transfers. The majority of the amount of transfers received comes from becas. Becas are provided to households to enable them to buy school equipment such as uniforms and exercise books or to pay for transport. Conversations with school teachers and observations revealed that becas are a necessity for many households. Without becas many households would not be able to send their children to school. On the other hand, it seemed that the system is not functioning perfectly. Some households relatively well-off received becas, whereas some poor households did not receive becas. Turning back to DIFID (1999) definition of a sustainable livelihood which states that "*sustainable livelihoods are not dependent upon external support*" we can conclude that external support, in the form of becas, in order to send children to school is essential for many households. Moreover, we

observed that many households made use of so called “*bono de vivienda*”, a house donated by the state.⁶

4.3.7 Niche activities

Some households sell processed food such as cheese, natilla, and sugar. However, many respondents indicated that the local demand for these products is limited to the local market. Moreover, commercializing these activities (on a larger scale) by for example selling them to local grocery stores is difficult. Costa Rica has a strict food safety law. Therefore, hygiene rules make it difficult to sell these products to local grocery stores.

Costa Rica has a well-developed tourism industry and tourism is one of the main sources of income for the country. However, Cusack and Dixon (2006) reported that there is a risk in ecotourism; it creates economic dependency on the fluctuating industry of international tourism. The decline in tourism after 9/11 shows the volatility of this market (Cusack and Dixon 2006). In the area tourism mainly benefits households in the form of cash income by services such as accommodation, guiding or food. A positive side effect of eco-tourism is that it creates environmental consciousness among villagers; the potential role that tourism can play in fulfilling cash creates an incentive for households to conserve nature. Tourism also increases skills and capacities such as managing English. In addition it creates income earning opportunities especially for women in the form of crafting. However, the villages face constraints in developing tourism. First, a lack of physical assets, in order to develop tourism one ought to have certain assets such as accommodation, food service, transportation, infrastructure, and of course landscape, culture or tourist attractions. These assets are mostly available at community level and not at the household level. Moreover, access to the park, which can be considered as the main touristic attraction, requires a permission that should be asked for 20 days in advance and only a limited number of tourist is allow to the park (in the dry season). This increases transaction costs for tourist. Second, levels of human capital are generally low. Within communities those with relevant skills, such as speaking English, making crafts or having the opportunities to participate in training programmes will have more opportunities in earning income from tourism. Third, the geographical location the distance to the capital is relatively large and roads are in bad conditions. To reach the area a four-wheel drive is necessary. Some villages are accessible by bus. However, bus service is limited and not always available in the rain season.

4.3.8 Crop production (agriculture) for the market and own consumption

Crop production systems in the area can be characterized as low input/low output systems that incorporate few or none and infrequent use of fertilizers and pesticides. The production and use of organic fertilizers, made from either organic residues (banana peel, residues of coffee, rice etc) or made with the help of worms, is gaining popularity amongst respondents. The majority of cultivated substance crops are basic grains (58%). Basic grains are defined as frijoles, cubaces, maize and rice. Frijoles and Cubaces are both beans, but cubaces are more exclusive and require a cold environment and are consequently cultivated high up in the mountains. Hence, having access to upland quintal of cubaces is almost 4 times higher than the price of a quintal of frijoles. Frijoles are produced by 53% of the households, mainly for

⁶ Costa Rica institutionalized four different types of housing subsidy: ordinary subsidies (that combine subsidies with loans); “ABC” subsidies that combine A (*ahorro* or savings), B (*bono* or subsidy) and C (*crédito* or loan); fully subsidized houses for handicapped people, the elderly or for emergency situations; and subsidies for the eradication of slum areas, in certain cases without loans (Stein and Vance, 2003).

consumption only. Cubaces are produced by only 13% of the households and serve mainly as a cash crop. Cubaces were mainly cultivated by villagers of Santa Rosa and Santa Maria. This has to do with climate and location. The major benefit of the cultivation of basic grains and other food products is the increased (sense of) food security. Many respondents interviewed indicated that it was very important for them knowing that they were self-sufficient. An advantage of these subsistence crops is that, surplus goods can be sold or exchanged with family members or neighbours for other goods, such as milk or different vegetables or fruits to diversify the diet. Aspects that are negatively influencing cultivation of agricultural products are related to different elements of the Sustainable Livelihood Framework. First, the vulnerability context: climatic variation, which results in complete crop loss or a minimal harvest. Second, transforming structures and processes: in terms of park restrictions, there exist a conflict between forest authorities and local communities about tacotal when land is abandoned to increase soil fertility it might turn into tacotal. If, it is acceptable to clear this tacotal to cultivate crops again is a point of discussion between households and the MINAE. Third, the asset base: households indicated that a lack of financial assets leads to low levels of physical capital such as fertilizers and pesticides. Also, the quality of assets was sometimes mentioned, unfertile soils reduce production. In addition there are geographical characteristics, the close distance to the park leads to damage from pest and wildlife. The remoteness of the area increases the cost of buying inputs and bringing products on the market. serves is an asset in the production of cubaces. This is also expressed in the price differences between frijoles and cubaces: the price of a

4.4 Results of the cluster analysis: dominant livelihood strategies identified

Based on statistical results from a hierarchical cluster analysis and common sense, 5 clusters were identified, representing five distinct livelihood strategies. The final cluster centre is showed in Table 4.

Table 4 Final cluster centers

Final Cluster Centres					
	1 N=16	2 N=33	3 N=19	4 N=14	5 N=15
Share of coffee income	.01	.06	.55	.02	.05
Share of off farm income	.03	.24	.05	.03	.19
Share of non-farm income	.83	.05	.05	.04	.01
Share of livestock income	.00	.10	.07	.08	.02
Share of remittances	.03	.02	.08	.63	.04
Share of transfers	.02	.26	.06	.09	.04
Share of niche	.01	.01	.02	.03	.51
Share of self-sufficiency	.08	.24	.09	.08	.11
Share of crop production	.00	.03	.04	.01	.03

A graphical representation of Table 4 is given in

Figure 4. Full output can be found in *Appendix IV*

Cluster analysis revealed five distinctive livelihood groups with relatively homogenous households pursuing a similar mix of activities. The five strategies identified are:

The First strategy (Cluster 1), **non farm workers** are earning their livelihoods in a variety of ways for example, business, construction. Those households have the highest shares of *non-farm wage employment* in comparison with other activities. This is the smallest cluster with N=16. This strategy is consistent with the pluriactive path described by (Siegel, 2005). These households focus on off-farm non-agricultural activities and would fit into the non-natural resource based livelihood category as proposed by Ellis (2000).

The second strategy (Cluster 2), **day labourers** are the largest group (N=33) also follows the pluriactive path only in another direction than those in cluster 1. Households in cluster 2 focus on off-farm agricultural activities and generate basic food staples for home consumption. They have a natural resource based livelihood strategy (Ellis, 2001). However, members of this cluster also rely on social assistance. The average share of transfers (remittances excluded) is relatively high if compared with the other clusters. Note that not all households in cluster 2 earn income from off-farm activities, but for convenience this cluster is called “**day labourers**”.

The third strategies (Cluster 3), **coffee producers** have a diverse range of other income sources. Coffee producers seem not to have a focus towards a certain type of activities (off-farm, non-farm, livestock etc.)

The fourth strategy (Cluster 4), **remittances** has on average highest shares from remittances. This clusters fits in the social assistance path as described by Siegel (2005).

The fifth strategies (Cluster 5), **niche market** are households engaged in other activities mainly the niche market and/or off farm activities. These respondents have diversified their agricultural activities, by processing products e.g. making cheese, sugar.

On the next page a graphical representation of the clusters is presented.

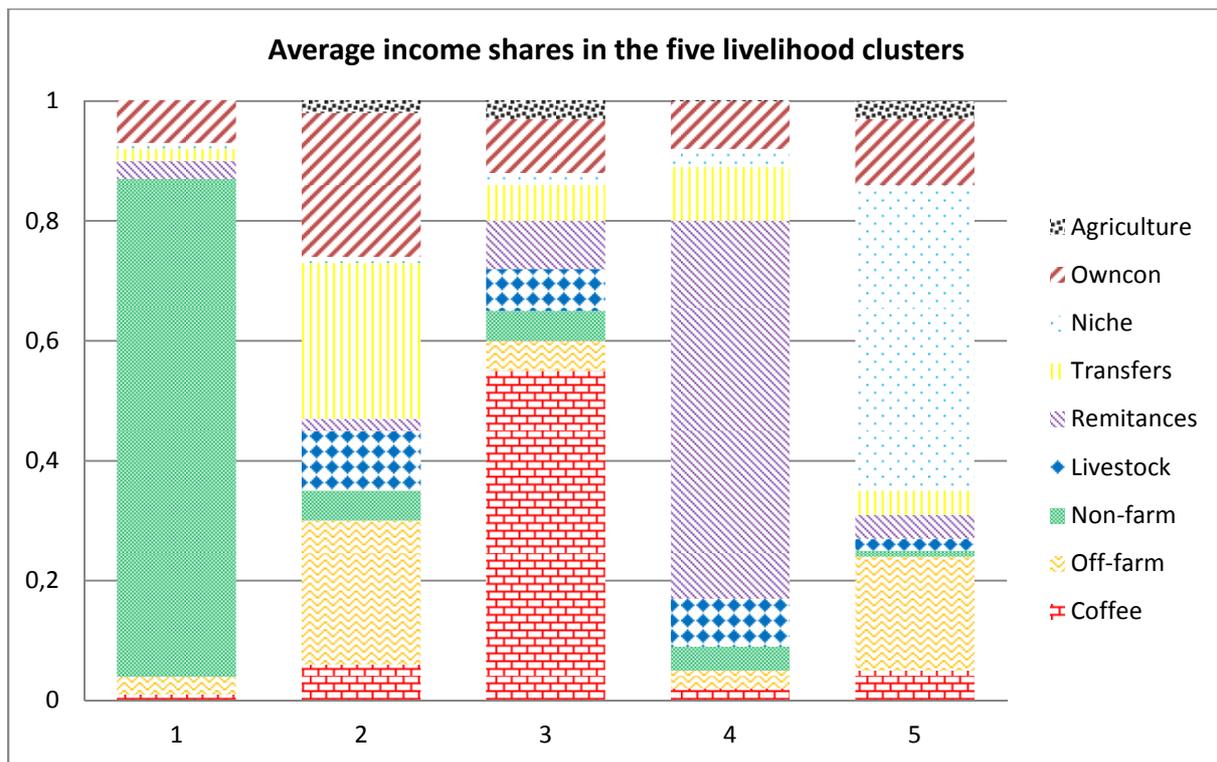


Figure 4 Average income shares in the five livelihood clusters

(Source: own data)

Figure 4 shows that in cluster of the non-farm workers (Cluster 1), 7 of the 9 activities are pursued; livestock and niche market income is not present in this cluster. In the rest of the clusters all categories are present. Of the total sample very few people (4%) collect all their income from just one source, or use their assets in just one activity. On average households receive income from four categories. Pursuing different activities is also called diversification. Scoones (1998) defines livelihood diversification as a strategy in itself. Diversification is commonly understood as a form of self-insurance which reflects individuals' voluntary exchange of assets and their allocation of assets across various activities so as to achieve an optimal balance between expected returns and risk exposure conditional on the constraints they face. By selecting a portfolio of assets and activities that have low or negative correlation of incomes households reduce their vulnerability (Alderman and Paxson, 1992; Reardon *et al.*, 1992, 1998, 2000 in Barrett *et al.*, 2001).

Various authors propose agricultural intensification as a livelihood strategy (Scoones, 1998; FAO, 2001; Siegel, 2005). An analysis on agricultural intensification would require time-series data which is not available. However, informal conversations and observations revealed that few farmers were able to or planning to intensify their agricultural practices. In their perception, this has no use when there are no markets to sell the products. ASOPROLA, the local development organization in Altamira has one project focusing on agricultural intensification, semi-stabled livestock.

4.5 Limitations of the cluster analysis

Several caveats should be emphasized. First, one of the limitations of our research is that we have only income data for 2009. A household's income for a single year as outcome of a household's use of assets may in part reflect its short-term coping mechanism rather than a long-term livelihood strategy. This is because households may be influenced by random events such as weather conditions, which often are particularly variable (Jansen *et al.*, 2006). Second, people might pursue different livelihood strategies sequentially or simultaneously. In this analysis a livelihood strategy is defined as a combination of activities, whereas one could define each activity in itself also could be a livelihood strategy. Small livelihood strategies should not be overlooked, since they can be very important. Having multiple activities, even if they are small, can have important implications for cash, labour, and land availability at different times of the year (Adato and Meinzen-Dick 2002). Thus, a household income composition might be based on multiple activities. Because of the small sample size and the heterogeneity in our sample, we decided to cluster activities together and categorize them under one livelihood strategy instead of naming each activity a strategy and identify sequential or simultaneous strategies performed.

SECTION 5 LIVELIHOOD ASSETS

This section answers the second research question: “What types of assets are critical for what type of livelihood strategy?” (i.e. does higher education is related to a particular livelihood strategy) To answer this question a Pearson’s Chi-Square test was done for the categorical variables and a Mann-Whitney test for the non-categorical variables.

5.1 Methodology to analyse the relation between assets and livelihood strategies

The purpose of the test(s) preformed below is to examine what factors in particular appear to be driven each livelihood cluster. The most convenient way to analyze relationships between a non-metric dependent variable and metric or dichotomous independent variables is multinomial logistic regression or discriminant analysis. Because, multinomial logistic regression does not make any assumptions of normality, linearity, and homogeneity of variance for the independent variables, it is in our case preferred to discriminant analysis. However, the minimum number of cases per independent variable is 10 (Hosmer and Lemeshow, 1989). The small sample size of N=97 and the resulting small clusters (ranging from 14-33 households per cluster) make multinomial logistic analysis unfavorable. In addition, multinomial regression analysis requires a reference case. Without a sound theoretical reasoning to justify a certain livelihood strategy the reference case would be an arbitrary choice.

Inspection of the data revealed that the data is not normally distributed. Therefore, a non-parametric test was chosen. These tests are also called distribution-free tests. All commonly used nonparametric tests rank the outcome variable from low to high and then analyse the ranks. Kruskal–Wallis one-way analysis of variance by ranks is a non-parametric method for testing equality of population medians among groups. It is identical to a one-way analysis of variance (ANOVA) with the data replaced by their ranks. Hence, it compares the medians of two or more samples to determine if the samples have come from different populations (Field, 2005). The Kruskal-Wallis test is used when comparing three or more unmatched groups and the variables are non - categorical and from a population that is not normally distributed. Hence, A Kruskal Wallis test was performed on the variables “Farm size”, “Family size”, “Dependency ratio”, “Number of children”, “Value of agricultural equipment” and “Value of livestock”.

The variables family sizes, dependency ratio, number of children were not significant. Farm size, value of agricultural equipment and value of livestock were significant and Mann-Whitney tests were done, to follow up these findings. A Bonferroni correction was applied and so all effects are reported at a 0.005 level of significance. Table 5 shows the results.

For the categorical data a Pearson's chi-square test was performed, to see whether there are differences in assets between clusters. The Pearson’s Chi-Square test detects whether there is a significant association between two categorical variables. However, it does not tell about how strong that association might be. Table 6 shows the results.

Table 5 Summary of the Mann-Whitney test for differences in assets between clusters

Summary of the Mann-Whitney test for differences in assets between clusters			
	<i>Value agricultural equipment</i>	<i>Value livestock</i>	<i>Farm size</i>
1:2	U=78.0 P=0.00 R=-0.46 -	n.s.	n.s.
1:3	U=31.5 P=0.00 R=-0.57 -	n.s.	n.s.
1:4	U=28.0 P=0.00 R=-0.54 -	U=44 P=0.00 R=-0.52 +	n.s.
1:5	U=30.5 P=0.00 R=-0.54 -	n.s.	n.s.
2:3	n.s.	n.s.	n.s.
2:4	n.s.	U=99.0 P=0.00 R=-0.54 +	n.s.
2:5	n.s.	n.s.	n.s.
3:4	n.s.	n.s.	n.s.
3:5	n.s.	n.s.	n.s.
4:5	n.s.	n.s.	n.s.

A Bonferroni correction was applied and so all effects are reported at a 0.005 level of significance. Descriptive statistics of variable presented in ANNEX III

Table 6 Summary of the Pearson Chi-Square test for differences in assets between clusters

Summary of the Pearson Chi-Square test for differences in assets between clusters					
<i>Cluster comparison</i>	<i>Education</i>	<i>Member-schিপ of a local development organization</i>	<i>Access to credit</i>	<i>Receives remittances</i>	<i>Tenure security</i>
1:2	$\chi^2(1)= 8.48$ P=0.00 *** +	n.s.	$\chi^2(1)=3.89$ P=0.05 ** +	n.s.	$\chi^2(1)=6.02$ P=0.01 *** +
1:3	$\chi^2(1)=3.48$ P=0.06 * +	n.s.	$\chi^2(1)=3.25$ P=0.07 * +	n.s.	n.s.
1:4	$\chi^2(1)=4.05$ P=0.04 ** +	n.s.	$\chi^2(1)=3.77$ P=0.05 ** +	$\chi^2(1)=22.97$ P=0.00 *** -	n.s.
1:5	$\chi^2(1)=8.33$ P=0.00 *** +	$\chi^2(1)=7.89$ P=0.00 *** -	n.s.	n.s.	n.s.
2:3	n.s.	n.s.	n.s.	n.s.	n.s.
2:4	n.s.	n.s.	n.s.	$\chi^2(1)=22.38$ P=0.00 *** -	n.s.
2:5	n.s.	$\chi^2(1)=10.46$ P=0.00 *** +	n.s.	n.s.	$\chi^2(1)=4.95$ P=0.03 ** -
3:4	n.s.	n.s.	n.s.	$\chi^2(1)=15.01$ P=0.00 *** -	n.s.
3:5	n.s.	$\chi^2(1)=5.64$ P=0.08 * +	n.s.	n.s.	n.s.
4:5	n.s.	$\chi^2(1)=10.08$ P=0.00 *** +	n.s.	$\chi^2(1)=21.99$ P=0.00 *** +	n.s.

***Significant at a 0.01 % level, **significant at a 0.05% level, *significant at a 0.10% level

5.2 Results of the relation between assets and livelihood strategies

Education is significantly related to being a member of Cluster 1, those households mainly engaged in non-farm work. Only 6% of those belonging to Cluster 1 have a low education which is defined as primary education or less, compared to 48%, 31%, 56% and 53% for the clusters 2, 3, 4 and 5. Hence, those engaged in non-farm work have on average higher education compared to coffee producers, day-labourers, households that receive remittances and households engaged in the niche market. This is consistent with the idea that a household investing into education (provided that facilities are available) can increase its alternatives for income generation and might be able to find better income sources through regular salaried jobs, or start a self-employed business (Steimann, 2005). Moreover, the cluster of non-farm workers differ significantly in the value of agricultural equipment that they possess (*Median* \$0) from Cluster 2 (*Median* \$159), Cluster 3 (*Median* \$295), Cluster 4 (*Median* \$236), and Cluster 5 (*Median* \$151). Evidently, owning less agricultural equipment is a result of being a non-farm worker rather than a cause.

An important factor in mobilizing agricultural inputs is access to credit (Perkins *et al.*, 2001). Table 6 reveals that there is a significant relation between cluster membership and access to credit, if we compare Cluster 1 with the other clusters except for comparing Cluster 1 and Cluster 5. Fifty-six per cent of those belonging to Cluster 1 has a credit, compared to 27%, 26%, 21% and 33% for cluster 2, 3, 4 and 5. Suggesting, that credit is mainly provided to those engaged in non-agricultural activities.

Membership of a local development organization is related to being a member of Cluster 5, those tied up to the niche market. Eighty-seven per cent of those belonging to Cluster 5 are a member of a local development organization, compared to 38%, 57%, 47% and 29% for cluster 1, 2, 3 and 4 respectively. Three of the local development organizations were actively searching and trying out niche activities such as cultivating honey, and tourism (*see annex II*). Farmers affiliated to these local development organizations belong to a social network in which information on how to practice these types of activities is available which in turn stimulates their participation in “new activities”.

Receiving remittances is significantly related to being a member of Cluster 4. Cluster 4 consists out of those with on average higher shares of remittances. Therefore, this finding confirms the validity of the cluster analysis. All members of Cluster 4 receive remittances, compared to 13%, 15%, 32%, and 13%, for cluster 1, 2, 3 and 5. In addition, they differ significantly in the value of livestock that they possess (*Median* \$1856), from Cluster 1 (*Median* \$32) and Cluster 2 (*Median* \$109). However, they do not differ significantly in the value of livestock from Cluster 3 (*Median* \$206) and Cluster 5 (*Median* \$527). According to Kaimowitz (1995) the first thing almost any small farmer in Central America does after a little land or money is accrued is purchasing cattle. Hence, the evidence suggests that remittances are invested in livestock. Table 5 reveals that there are no significant differences in land size between clusters. To further investigate the relation between remittances and livestock a Mann-Whitney test was performed. The test ($U=745$, $z=-1.71$ and $p=0.087$) reveals that there is a significant difference in land size between those receiving remittances (*Median* 10.0 ha) and those who do not receive remittances (*Median* 3.0 ha.). Moreover, of the households receiving remittances 66% owns cattle compared to 34% of the households that do not receive remittances. The above findings suggest that

remittances provide households with the financial capital to diversify their livelihood activities. Animal husbandry has the advantage that it can provide households with cash in times of distress but also increases food security, resulting in more beneficial livelihood outcomes. Yet, conclusions should be drawn with care; it might also be the other way around. Those households owning a large stock of livestock were able to send migrants abroad.

Economist has long argued that increased security of individual property rights in land leads to increased investments. One of the more recent advocates of this theme is De Soto (2003), he argues that in many poor countries land and real estate property are not secured and protected by law. Therefore, they cannot serve as collateral for loans, which in turn can be used to invest in land. The caveat of using a title as a variable measuring this is that high levels of tenure security can exist without legal title over land and that low levels of tenure security can exist with a legal title over land. Cluster 2, the day labourers, compared to Cluster 1 and 5 shows a significant positive association with regard to tenure security, measured as owning one or more plot with a title. Only 21% of the respondents in the day labouring group have a title over at least one of their plots compared to 56% of the non-farm workers and 53% of those engaged in the niche market. Above we already saw that the non-farm workers have on average more often a loan.

The Chi-Square test for differences in access to a vehicle per cluster resulted in no significant associations, indicating that access to vehicles is equal within all clusters.

The results of the non-parametric test(s) as summarized in Table 5 and 6 add to our understanding of why respondents pursue different livelihood strategies. Yet, while there are differences between groups in asset base, for some variables it is striking how narrow these differences appear to be.

5.2 Risk perception

Not only available assets influence the choices a household makes, perception on risk also might influence a household's behaviour. Respondents were asked to react on several statements about their risk perception, depicted in Table 7.

Table 7 Percentage of households who agreed on the following statements about risk perception

Percentage of households who agreed on the following statements about risk perception			
	<i>"Those who do not take a risk, will not win"⁷</i>	<i>"To invest in new crops is very risky, I prefer not to do so"⁸</i>	<i>"To earn money I am willing to take a risk and to lose"⁹</i>
Non-farm workers	94%	50%	44%
Day labourers	97%	70%	58%
Coffee producers	100%	53%	68%
Remittances	100%	29%	79%
Niche market	93%	40%	87%
Total	97%	53%	65%

⁷ Statement 1 *"Quien no arriesga no gana"*

⁸ Statement 2 *"Invertir en nuevos cultivos es muy riesgoso prefiero no hacerlo"*

⁹ Statement 3 *"Con tal de ganar algo de dinero estoy dispuesto a arriesgar y perder"*

Almost all respondents agree on the fact that one needs to take a risk in order to gain. Many respondents complemented their answer with “agriculture is a risky business, you never know what will happen, and you need to try different things”. However, when the question was narrowed down to investments in new crops almost half of the sample thinks this is too risky. Seventy per cent of the day labours would not invest in new crops, of those engaged in the niche market 40% would not invest in new crop types. Only 30% of those receiving remittances would not invest in new crops. However, these numbers reflect attitude and not behaviour, there might be a difference between what people say and how they act (attitude-behaviour gap).

SECTION 6 LIVELIHOOD OUTCOMES

This section addresses the question of what the livelihood outcomes are in our study area in order to investigate whether there is a relation between livelihood strategy and livelihood outcomes. First, we look at whether there are significant differences in income levels between clusters. After that a regression analysis is performed to determine which assets influence income levels.

6.1 Differences in income levels between livelihood strategies

Measurements of income include a correction for consumption of products cultivated by the household. However, income data was not corrected for costs (of producing livestock, cultivating coffee etc.). Although a section on costs of production was included in the survey, households were unable to answer these questions. They kept no records of costs, and indicated that making estimates was difficult and that these estimates would be unreliable.

Income is converted to dollars with the purchasing power parity (PPP) conversion factor. The PPP conversion factor shows how much of a country's currency is needed in that country to buy what \$1 would buy in the United States. Data should be interpreted with care since the most recent PPP conversion factor was available only for 2008¹⁰. Moreover, purchasing power parities are statistical estimates. Like all statistics, they are point estimates that fall within some margin of error of the unknown, true values. Nevertheless, for the purpose of comparing levels of poverty purchasing power parity (PPP) rates rather than exchange rates were preferred.

Table 8 gives an overview of the descriptive statistics of gross annual per capita income in dollars per year (PPP) for the different clusters.

Both mean and median shows that day labourers (Cluster 2) are the poorest on average and non-farm workers (Cluster 1) are the richest on average.

The World Bank estimates Costa Rica's GNI per capita based on purchasing power parity (PPP) for 2009 on \$10,930. Looking at the mean and median, there is not one cluster close to this number. Hence, the residents of the buffer zone are on average poorer than the average Costa Rican.

¹⁰ PPP conversion factor for 2008 was 349,856 (source: UNSTATS, 2010) <http://unstats.un.org/unsd/mdg/SeriesDetail.aspx?srid=699>

Table 8 Descriptive statistics of gross annual per capita income (PPP) in dollars per year per cluster

Descriptive statistics of gross annual per capita income (PPP) in dollars per year per cluster						
	<i>N</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Median</i>
Non-farm workers	16	1372	15435	4967	4347	3058
Day labourers	33	429	3430	1490	863	1430
Coffee producers	19	177	8032	3144	2252	2198
Remittances	14	812	17026	3944	4545	2077
Niche market	15	456	3621	1934	1001	2024
Total	97	177	17026	2811	2966	1955

A flaw of the PPP is that the accuracy of the PPPs for these countries depends upon the extent to which the selected goods and services are representative of their entire economy and on their ability to provide nationally representative average prices. For some countries it is likely that results are biased, up or down, depending on the extent of over or under representation or urban and rural areas (UNSTATS, 2010).

The national statistical Costa Rican institute, *Instituto Nacional de Estadísticas* handles their own income classification. They categorize households into non-poor, poor and extremely poor. Different income classifications are used for rural and non-rural households. Extreme poor households are those households who cannot afford the basic basket of goods. The cost per capita of a basic basket of goods is ₡29 321 per month for rural zones. Poor households have an income below the rural poverty line (₡57 762 per capita per month, rural zones) but can afford the costs of a basic basket of goods. The calculation of income includes a correction of production for own consumption (INEC, 2009).

Extremely poor households: those households that cannot afford the basket of basic needs. These households earn the equivalent of or less than ₡29 321,- per capita, per month. Converted to dollars with a purchasing power parity conversion rate this is equivalent to an income of less than \$84,- per capita, per month (INEC, 2009).

Poor households: those households that can afford the basket of basic needs, but are below the rural poverty line. These households earn more than ₡29 321 but less than or the equivalent of or ₡57 762,- per capita, per month. Converted to dollars with a purchasing power parity conversion rate this is equivalent to an income of more than \$84,- per capita, per month but less than \$165,- (INEC, 2009).

Non poor households: those households earning more than the national poverty line of ₡57 762,- per capita, per month. Converted to dollars with a purchasing power parity conversion rate this is equivalent to an income of more than \$165,- per capita, per month (INEC, 2009).

Using the above income classification 19 households are defined as extremely poor (20%), 30 households as poor (31%) and 48 households as non-poor (49%). Hence, half of the respondents in the buffer zone of La Amistad Biosphere Reserve are living below the national rural poverty line of ₡57 762 per capita per month, rural zones. Since, net income was collected (e.g. costs of producing coffee, livestock are not subtracted) in reality poverty levels are likely to be higher.

Table 9 Poverty rates per livelihood strategy¹¹

Poverty rates per livelihood strategy							
Cluster	N	Extremely poor		Poor		Non poor	
		<i>frequency</i>	<i>Percentage</i>	<i>frequency</i>	<i>percentage</i>	<i>frequency</i>	<i>percentage</i>
Non-farm workers	16	0	0%	4	25%	12	75%
Day labourers	33	12	36%	12	36%	9	27%
Coffee producers	19	1	5%	7	37%	11	58%
Remittances	14	2	14%	4	29%	8	57%
Niche market	15	4	27%	3	20%	8	53%
Total	97	19	20%	30	31%	48	49%

The majority of the extremely poor households (63%) and poor households (40%) can be found in the cluster of day labourers; with respectively 36% being extreme poor and 36% being poor. In the clusters of non-farm workers, coffee producers, remittances and the niche market more than half of the respondents are not poor. For the cluster of non-farm workers this is the highest 75% of those receiving on average higher shares of non-farm income are not poor. Table 9 shows that levels of poverty rates are higher in the cluster of non-farm workers these findings are confirmed by a Kruskal-Wallis test which showed that gross annual per capita income levels are significantly different between clusters ($H(4)=19.72$, $p<0.05$). Mann-Whitney tests were used to follow up this finding. A Bonferroni correction was applied and so all effects are reported at a 0.005 level of significance. It appeared that there is a significant difference between gross annual income per capita between the cluster of non-farm workers (Cluster 1) and the cluster of day labourers (Cluster 2) ($U=87.00$, and $r=-0.54$). In addition there is a significant difference between the cluster of day labourers (Cluster 2) and coffee producers (Cluster 3) ($U=$, $r=-0.53$). We can conclude that the day labourers are significantly poorer than the non-farm workers and coffee producers but day labourers are not significantly poorer than those engaged in the niche market or living mainly of remittances. This is likely due to large variation in income within clusters (see Table 8).

Scholars have realized that poverty as conceived by the poor themselves is not just a matter of low income but also includes other aspects such as a state of vulnerability, a lack of social services, illiteracy, etc. (Chambers, 1995; Krantz, 2001). To overcome that the analysis on livelihood outcomes is purely a statistical analysis we addressed the question of livelihood outcomes by asking respondents about their perceptions about their quality of life in general and in economic terms. The results are shown in Table 10.

¹¹ Table 9 displays both percentages and frequencies because the small cluster sizes may lead to misleading interpretation of the data.

Table 10 Perception of quality of life per livelihood strategy

Perception of quality of life per livelihood strategy						
	General terms N=94			Economic terms N=83		
	Bad	Regular	Good	Bad	Regular	Good
Non-farm workers	6%	13%	75%	0%	69%	31%
Day labourers	3%	58%	39%	36%	54%	11%
Coffee producers	5%	32%	53%	43%	43%	14%
Remittances	0%	43%	57%	7%	86%	7%
Niche market	0%	33%	67%	14%	57%	29%
Total	3%	40%	56%	23%	60%	17%

As table 10 shows of all households asked (N=94) the majority of the households classifies their quality of life in general terms as good (56%) and in economic terms as regular (60%) Respondents indicated that they were satisfied with the quality of their live in general because they have three meals a day, are healthy and felt lucky with their family. Moreover, several respondents answered that it would be offending to God to say that the quality of their lives is not sufficient. Therefore, in a later stage of the research we added the question “How do you perceive the quality of live in economic terms?” The above findings show, that for households well-being is a broad concept and is more than money alone.

The table also shows the difference in perception between the different livelihood strategies. Thirty-six per cent of the day labourers and 43% of the coffee producers judge their quality of life in economic terms as bad. Above, we saw that the day labourers are significantly poorer than the coffee producers. However, in the perception of 43% of the coffee producers their economic status can be judged as bad.

Table 11 shows the perception of quality of life in economic terms per income category¹². None of the households defined as extremely poor, using the INEC classification considers their quality of life in economic terms as good or very good whereas in general terms some extreme poor households do consider their quality of life as good.

Table 11 Perception of quality of life per livelihood outcome non poor, poor and extreme poor

Perception of quality of life per livelihood outcome non poor, poor, and extreme poor						
	General terms N=94			Economic terms N=83		
	Bad	Regular	Good	Bad	Regular	Good
Non poor	2%	30%	68%	20%	52%	28%
Poor	4%	48%	48%	22%	67%	11%
Extremely poor	5%	53%	42%	31%	69%	0%
Total	3%	41%	56%	23%	60%	17%

¹² Figure five reports for N=107 and Table 9 for N=94 & N83 for respectively general and economic terms

6.2 Determinants of overall income

The cluster analysis and the non-parametric tests have addressed the research question what the dominant livelihood strategies are pursued by the inhabitants of the buffer zone and the relative importance of the different capitals for the different strategies. Now, we address the question which factors help explain the observed variation in household income levels.

To explore the major factors that help explain the variation in income levels across households a simple regression model was run, using the natural log of annual gross per capita income as dependent variable. The explanatory variables were sometimes used interchangeably and in different forms (categorical and continuous). Some of the variables were transformed into their natural logs to improve the distribution near to normal (Nkedianye *et al.*, 2009). The natural log transformations of the gross annual income improved the distribution to near normal distribution. Table 12 shows the regression results.

Table 12 Determinants of annual gross income

Determinants of annual gross income					
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	13.28	0.27		50.14	0.00
Educational level of household Head	0.13	0.15	0.08	0.87	0.39
Family size	-0.13	0.05	-0.26	-2.97	0.00***
Total farm area	0.01	0.00	0.29	2.87	0.01***
Share of hectares coffee	0.63	0.27	0.21	2.31	0.02**
Share of hectares pasture	0.41	0.23	0.16	1.79	0.08*
Share of hectares forest	-0.27	0.37	-0.07	-0.72	0.47
Access to a vehicle	0.29	0.15	0.18	1.94	0.06*
Membership of local development organization	0.13	0.14	0.08	0.94	0.35
Has a loan	0.27	0.16	0.16	1.76	0.08*
Share of non-farm income	0.80	0.24	0.32	3.36	0.00***
Observations	92				
R²	0.41				
Adjusted R²	0.34				

Dependent variable: natural log of annual gross income per capita

***Significant at a 0.01 % level, **significant at a 0.05% level, *significant at a 0.10% level

The model is checked for multicollinearity¹³ and hetroskedacity (Breusch-Pagan test)

Table 12 Determinants of annual gross incomes shows the results of the best performing linear regression model with the natural log of per capita annual gross income as the

¹³ Checked if the Variance Inflation Factor (VIF) < 10 (VIF=1/(1-R²))

dependent variable. The explanatory power of the model was medium/high, with an adjusted R^2 of 0.34. The parameter estimate for the share of total farm size under coffee and pasture suggest that an increase in hectares causes an increase in annual income. With the amount of hectares cultivated with coffee having a larger effect than the amount of hectares under pasture. An increase with hectares under forest is negatively related to annual gross income, but not significant. The parameter estimate of access to a vehicle is 0.29 and of using a loan 0.27 both are significant and have a positive influence on income. The share of income of non-farm activities, measured as total income from non-farm activities divided by the total income, was another highly significant household variable influencing how well households do in this area. Education of the household head was expected to correlate positively with income. However, education turned out to be insignificant in our analysis. As the number of household members increase gross annual per capita income declines. Finally, being a member of the local development organization does not significantly influence income.

These regression results need to be interpreted with care, membership of a local development organization, usage of a loan, and the share of non-farm income are all endogenous variables. That is, the state of the variables is determined by the states of other variables in the system.

Those who are a member of a local development organization might possess specific characteristics, such as pro-activeness, that would explain the higher income. In addition, farmers choose to participate in an local development organization on the basis of expected pay-offs as well as their taste for certain types of activities carried out by these organizations. Therefore, there is an omitted variable bias.

With respect to the usage of a loan it is hypothesized that production techniques differ between borrowers and non-borrowers, either because access to credit enables households to adopt improved technological practices or because it is the higher productivity households which have greater access to credit (Kochar, 1997). Hence, this variable is endogenous.

Earning non-farm income diversifies a farm household's income, which facilitates bearing the risk of making farm investments, embodying new technology, and to initiate cash cropping (Savadoga et al., 1999). In addition the poor often lack the assets (start-up capital, education, skills etc.) needed to start a non-farm business requires assets (Reardon et al., 2000). Consequently, the share of non-farm income is endogenous.

SECTION 7 SUSTAINABLE LIVELIHOODS

Until now, the question whether livelihoods are sustainable or not is not addressed. The following section addresses the question of environmental sustainability by addressing how economic and environmental sustainability are all related to the park.

7.1 Environmental discourse in our study area

Andam *et al.* (2010) estimated the impact of protected area systems on poverty in Costa Rica and Thailand. Initially they found that communities near protected areas are indeed substantially poorer than national averages. However, when appropriate control variables were used results show that these differences cannot be attributed to protected areas. These results are consistent with our findings that households living near La Amistad Biosphere Reserve do not perceive the park as the biggest threat to generating income. When respondents were asked an open question “*what are the main problems related to earning income for your household*” 60% of the households answered a lack of employment possibilities, 27% answered market related problems¹⁴, 20% a lack of financial resources and 16% mentioned distance¹⁵ as a problem. These are the most frequently mentioned problems. None of the respondents indicated the park or park restrictions as problematic in earning income. Respondents were also asked to mention advantages and disadvantages of the park. Households could mention, as many advantages and disadvantages as they would like and we did not ask to assign them in order of importance. Only 8% of our respondents viewed no advantages of the park. The most frequent mentioned advantage was access to clean water (65%). Respondents mentioned that the area was full of brooks and springs that origin from a source in the mountains. They stated that because the land in the park is protected, these brooks and springs will not dry up. This is important for households because, besides the fact that these springs provide households with potable water, they allow households them to cultivate crops on their land. The second most mentioned advantage was access to clean and fresh air (28%). When mentioning fresh air some households referred to the polluted air in the capital of San José and stated that they enjoyed the freshness and cleanness of the air they breathe. Moreover some households mentioned the health benefits of fresh air. The third most mentioned advantage was a (potential) for tourism (27%). Hence, for these households the discourse is not that the park is a constraint in earning income. But rather the opposite; the park itself is seen as a potential source of income. However, if we compare this discourse with the reality than only 6% of the households in our sample have received income from tourism in 2009 (crafts, lodging, guiding).

All answers to the question “What are the advantages of the park?” were analysed and categorized in 4 asset categories, human capital, natural capital, financial capital, and social capital. In addition, a category sustainable livelihood strategy was created; this category reflects answers that are not related to a certain type of asset. These answers are related to practices, such as “conservation” and “a reduction in hunting”. Households are given a one if they at least had answered one of the answered belonging to a category.

¹⁴ Answers varied from: distance to the market, instability of the market, low producer prices, non-existence of markets)

¹⁵ No public transport, remoteness of the zone

Table 13 shows the categories and the answers.

Table 13 Advantage of the park categorized per capital

Advantage of the park categorized per capital				
<i>Natural capital</i>	<i>Financial Capital</i>	<i>Human Capital</i>	<i>Social Capital</i>	<i>Sustainable livelihood strategies</i>
Mentioned by 79% of all households	Mentioned by 32% of all households	Mentioned by 14% of all households	Mentioned by 13% of all households	Mentioned by 23% of all households
Water Fresh air Flora Fauna Flora & Fauna Climate Soil Protection Beauty Barrier against the wind Land fertility Reproduction of fauna Stability of Environment	(Potential) tourism Economic Benefits Payment for Environmental Services (PES) Source of employment	Source of education (for future generations) Health Recreation Celebrations Source of meat (food)	Generating support from organizations Aggregated value for the community Publicity Greater involvement of municipality	Conservation Soil protection Reforestation Reduction in slash and burn agriculture Reduction of hunting Reduction of deforestation

In terms of assets 79% of the households see the park as natural capital. They enjoy fresh air, water and the beauty of the park. Thirty-two of the households see the park as an asset which can (potentially) generate income, by providing employment or payment for environmental services. Fewer respondents viewed the park as human capital (14%) or social capital (13%). Twenty-three of the respondents gave answers that can be categorized under the label more sustainable livelihoods, according to them the park has led to advantages such as a reduction in hunting and deforestation. In our respondents' opinion the park itself thus contributes to environmental sustainable practices.

We also asked respondents about their opinion about nature conservation in general. They were asked to value three statements. See Table 14.

Table 14 Statements of perception about nature conservation

Statements of perception about nature conservation N=107					
	<i>Totally disagree</i>	<i>Disagree</i>	<i>Neutral</i>	<i>Agree</i>	<i>Totally Agree</i>
The park is a threat to my productive activities	70%	19%	1%	9%	1%
Nature conservation brings new opportunities	6%	4%	6%	48%	36%
We need to do more for the environment	3%	6%	1%	35%	55%

Again, the majority is in favour of conservation and thinks nature conservation is not a threat to their productive activities in contrast (89%); the majority thinks conservation brings new opportunities (84%). With regard to the last statement, almost 90% feels that we need to do more for the environment. However, some respondents added that they felt that rural inhabitants have done enough and have done what lies within their power. They mention that urban citizens should take their responsibility too.

Shelhas and Pfeffer (2005) analysed the values related to forest (conservation) of the population around La Amistad Biosphere Reserve. They show that there are strong forest and environmental values in the area. They identified four main points of conflicts and resistance to the park. In our own research, we asked respondents about the disadvantages of the park. In our sample the majority (81%) mentioned that they do not perceive any disadvantages of the park. However, we should note that within informal conversation rural inhabitants were more likely to mention disadvantages. Alternatively, they mentioned a disadvantage and then classified this as not being problematic too them:

“Predators living in the park have harmed or even killed my chickens, but I do not see this as a disadvantage, those animals have to eat too”.

It is not clear, if people do not mention disadvantages because they feel like they have to give socially, correct answers or that it really does not matter to them. Yet, we have encountered the same points of conflict to the park as Shelhas and Pfeffer (2005). In their study they find that a point of conflict with the park (rules) is that the inhabitants of the buffer zone are not able to cut trees for subsistence needs. Amongst inhabitants there is a strong discourse that you should not waste trees. However, cutting trees for basic needs such as planting crops and building a house should be acceptable (Shelhas and Pfeffer 2005). We found that the above opinion is closely related to another point of conflict identified by Shelhas and Pfeffer (2005) that is, property rights, and the law that prohibits tree cutting on private land. Although people accept conservation in the park, they find it difficult to accept that they cannot cut a tree on their private property (Shelhas and Pfeffer

2005). Especially, in the view that they need this tree in meeting basic needs. When one wants to cut a tree, permission is needed from the MINEAT. During the participatory group meetings held in each of the villages, we encountered that in some villages the MINAE officials were described as “reasonable” and “easy to deal with”, providing permissions when needed and in other villages as “unreasonable” and “difficult to deal with”, not even willing to provide a permission to poor community members who really needed the timber to repair their house. The exact causes of these different perceptions can be due to many factors. To illustrate, the most organized village with the strongest local development organization, a village described by both MINAE and RED QUERCUS a regional development organization as a “model village for development in the zone”, stated that there was no struggle in dealing with MINAE. On the other hand the relationship of the villagers of Aguas Calientes with MINAE is somewhat problematic, one villager is proceeding against the state since he is faced with a sentence of imprisoning for illegally cutting trees and MINAE had recently seized timber for the reconstruction of a house of one of the impoverished households in the village. When asked villagers indicated that they do not deal collectively with MINAE. Hence, those collectively bargaining for permission seem to have more success than those individually. A third point of conflict is tacotal or charrales, young brushy second growth. According to law when there are more than 70 trees per hectare, more than 15 cm in diameter it is not tacotal, but forest. It is allowed to clear tacotal, but it is prohibited to clear forest (Shelhas and Pfeffer, 2005). Shelhas and Pfeffer (2005) found considerable conflict between community members and forest authorities over what is tacotal and what is forest, in particular in the frijol tapado system. In this system, land is selected than paths are slashed through the vegetation to create access for planting after that beans are planted and the system is left untouched until the harvest (Melendez, 2004). We also found conflict over tacotal in relation to land use systems. With few financial assets to buy for example fertilizers, a cheap and convenient way to increase soil fertility is leaving land untouched over several years so that it can recover. However, if there are fast growing trees tacotal becomes forest and cannot be cleared. This leaves the farmer with fertile land that cannot be used for agriculture. In addition, Shelhas and Pfeffer (2005) describe and analyse a common complaint of rural residents that we have also encountered: “*The rich and outsiders can cut trees but we not*”. For rural residents it is difficult to cut trees for basic needs. Yet, they see logging trucks constantly driving in and out of the area while they only cut a tree when they truly need it. Second, the big companies have the money, time, and knowledge to get permissions easily while the process for the small farmer is complicated and difficult. Shelhas and Pfeffer (2005) describe that farmers this fit in a general model about how things work in Costa Rica:

“They fit this in a general model about how things work in Costa Rica, where the poor campesino cannot even do what little he needs to do to meet his basic needs, while rich know how to make things work for them and can do whatever they want” (Shelhas and Pfeffer 2005:394)

This discourse was very strong amongst those we have interviewed. They felt abandoned by the state that in their opinion strongly is in favour of the rich.

In addition to the above-mentioned issues, *crop raiding animals and animals that harm livestock* were mentioned as problematic. People feared that this problem might become worse in the future since the park might lead to an overpopulation of predators such as

jaguars and puma's. Since hunting is prohibited, it was difficult to analyse hunting behaviour in the zone. Respondents indicated that hunting for pleasure and meat decreased over the past 30 years. They now realize that hunting has negative effects on the environment. However, within informal communications respondents indicated that if jaguars or puma's harm or kill too many animals this animal is hunted down (with or without MINEA permission). Hunting as a sport is practised more by "outsiders" from the city. Communities such as Santa Maria have agreements with MINAE, they monitor the area to see whether hunters have arrived. When they suspect hunters, they can call MINAE and they will investigate the case.

7.2 Environmental friendly practices

Above, we have discussed livelihoods in conflict with the park. However, in the introduction of this chapter we saw that respondents see conservation as bringing new opportunities and lead to more sustainable strategies. In the below section we discuss some of these environmental friendly practices

7.2.1 Organic farming

Eleven per cent of our sample is participating in organic farming. 7.5% has more than 1 product certified. Bananas are the main organic product, after that coffee. Only one respondent had certified sugarcane and two respondents had certified garden crops. Organic farming is concentrated in two of the six villages. In both these villages, the local development organization has organic farming as one of their vanguards. Respondents indicated that organic farming is costly since in the first three years, needed to clean the land from pesticides and herbicides, productivity and as a result, income drops. Moreover, organic farming requires other techniques and inputs; there is thus a learning process involved. In addition, the process of obtaining a legal document certifying your products as organic is time-consuming and costly. Having a local organization, which is familiar with the requirements in obtaining this legal document, reduces transaction costs in participating in organic farming. Due to the small sample size logistic regression to explain participation in organic farming is not possible. Although, we are unable to determine which assets are important in determining whether a household participates in organic farming or not, the qualitative observation mentioned above shows that the existence of a local organization influences participation at household level.

7.2.3 Forest conservation

The respondents in our study area are not homogenous. Many scholars have shown that different socio economic factors contribute to participation in reforestation (Dolisca *et al.*, 2006). Therefore, in developing good conservation policy it is important to understand which factors influence conservation decisions.

Of the 107 households interviewed, 39 households have either primary forest in conservation or have reforested at least a part of their farm. The aim of this sub-section is to show what factors influence the decision in forest conservation.

The econometric model: Binary choice model

We are interested in the factors that influence the choice of having forest in conservation or not. Therefore, our dependent variable is:

$Y_i = 1$ if household i has forest in conservation

$Y_i = 0$ if household i does not have forest in conservation

Due to the small sample size primary forest and reforestation are aggregated to one category: forest conservation. Several factors are associated with the decision to participate in reforestation incentive programs (Thatcher *et al.*, 1997). It is hypothesized that total farm size is positively related to forestry (Chambers *et al.*, 1989 in Thatcher *et al.*, 1997). In addition, large landowners in Costa Rica are disproportionately represented in payment for environmental services (Sánchez-Azofeifa *et al.*, 2007). Zhang and Pearse (1996) in Dolisca *et al.*, 2006) found that secure tenure forms provide more benefits to their holders in terms of Payment for Environmental Services (from now on PES) and are therefore more likely to stimulate reforestation. Costa Rica abandoned a previous formal land title requirement for PES. Hence, enrolment in PES in Costa Rica without a title is possible, but still difficult (Pagiola, 2007). We hypothesize that legally possessing land has a positive effect on forest. First, a title increases the changes in future PES participation a financially lucrative way of forest conservation. Second, the process of obtaining legal title may indicate a level of experience in dealing with legal and government bureaucracies that may impart a willingness to participate in government programs (Thatcher *et al.*, 1997). A study in Bangladesh, observed that, in situations where agriculture is the main source of income, farmers are discouraged from planting trees on their homesteads (Salam *et al.*, 2000 in Dolisca *et al.*, 2006). In addition, households with non-farm income are more likely to invest in activities that are labour extensive. Therefore, we expect that a positive relation between non-farm labour and forest conservation (Thatcher *et al.*, 1997). Education has been reported to influence farmers' participation in forest management and conservation (Glendinning *et al.*, 2001; Owubah *et al.*, 2001 in Dolisca *et al.*, 2006). Forest conservation has to compete with other land-uses such as agriculture and cattle. The majority of our sample does not receive any compensation for conservation; the above-mentioned land-uses have higher returns to land. Local organizations in our study area had a strong environmental discourse we therefore expect that membership of a local organization positively influence the choice to conserve forest. Due to the very low participation in payment for environmental services (N=2) it was not possible to include this variable in the analysis. Table 15, on the next page, summarizes the variables hypothesized to influence farmer's forest conservation decisions.

Table 15 Variables definitions included in the binary regression equation model

Variable definitions included in the binary regression equation model			
Variable	Definition	Measurement	Expected outcome
Farm size	Farm size in ha.	Ha.	+
Education (human capital)	Household head has primary education or less	1: yes, 0: otherwise	+
Title (natural capital)	Farmer possesses legal land title to at least part of farm system	1: yes, 0: otherwise	+
Non-farm income (financial capital)	Share of income from non-farm labour	Share of gross annual income per capita from non-farm labour	+
Membership of local development organization (social capital)		1: yes, 0: otherwise	+

The results of the binary regression are presented in Table 16. The model has a Chi-square of 25.6 (5) with a p-value of $0.00 < 0.01$. So, our model is significant.

Table 16 Factors influencing forest conservation (Binary choice model)

Binary choice model on forest conservation						
	B	S.E.	Wald	df	Sig.	Exp(B)
Farm size	0.04	0.01	10.85	1.00	0.00***	1.04
Education	0.84	0.59	2.02	1.00	0.16	2.31
Title	-1.00	0.52	3.74	1.00	0.05**	0.37
Membership of local organization	0.01	0.52	0.00	1.00	0.99	1.01
Non-farm income	-1.01	0.87	1.33	1.00	0.25	0.37
Constant	-1.10	0.65	2.87	1.00	0.09	0.33

Farm size and having a title, resulted significant at a respectively 0.01 and 0.05 level of significance. In our analysis the variables: education, membership of a local organization, and the share of non-farm work in total income result insignificant. We can now use this model to predict the odds that a respondent will decide to participate in forest conservation.

In Table 16 one finds the odds ratio predicted by the model, The 1.04 odds ratio for farm size indicates that the odds of participating in forest conservation increases with 1.04 with a one hectare increase in total farm size. This is consistent with findings in earlier literature.

The odds ratio of tenure security shows that the odds of participating in forest conservation are 1.00 times lower for those without a title over one or more of their plots. These findings are also consistent with the literature, tenure security increases the likelihood to engage in forest conservation.

Verifying empirically the impact of tenure security, having a title, membership of a local development organization and non-farm income on the choice to conserve forest is a more difficult task than what may appear at first sight. Since, these variables are endogenous.

There is a causality problem of inferring from the existence of a significant relationship between tenure security and agricultural investment, which runs from the former to the latter (Brasselle et al., 2001). Agricultural investment in turn is related to the choice of forest in conservation. In Costa Rica title acquisition and title maintenance involve real expenditures. Therefore, it is possible that farmers tend to register land parcels that benefit from comparatively high levels of investment, or that registered farms are those which have better profitability conditions. Especially, if we take into account that tenure security enhances payment for environmental services.

7.2.4 Payment for environmental Services (PES)

Siegel (2005) describes payment for environmental services as a strategy to improve livelihoods in rural Latin America. The concept of PES is that rural residents receive payments for activities related to natural resource management and environmental quality. However, the prime focus of PES is protecting the environment. Although, PES it is not designed to be a poverty reduction program, the organization in Costa Rica in charge of forest conservation (FONAFIFO) has sought to maximize their poverty impact by adding particularly disadvantaged districts to the priority areas for the PES program. Research in Costa Rica showed that PES plays an important role in the livelihood of poor landowners in the Osa Peninsula (Muñoz, 2004 in Pagiola, 2007). However, large land owners are disproportionately represented among participants at national and regional levels (Sánchez-Azofeifa *et al.*, 2007). The majority of the respondents in our sample can be classified as small land owners. 65% of the respondents in our sample indicated that they were not familiar with the concept of payment for environmental services. Only, 2 respondents in our sample received PES. Hence, there is no evidence of a potential positive (future) impact of PES in our sample.

SECTION 8 CONCLUSION

Data on 107 households was collected; of 10 households no complete income data was available. The non-hierarchical cluster analysis (N=97) revealed five dominant livelihood strategies. Cluster 1, consist out of 16 households and has on average higher shares of non-farm income. Cluster 2, is the largest cluster (N=33) and has on average higher shares of day-labourers. Shares of income saved from self-sufficiency are relatively homogenous amongst clusters except for Cluster 2 which shows a relatively high share of savings from self-sufficiency compared with the other clusters. Cluster 3 (N=19), are coffee producers who besides coffee have a diverse range of other income earning activities. Members of Cluster 4, are those who live mainly of remittances, it is the smallest cluster with N=14. They also pursue a wide range of other activities. Cluster 5, are those engaged in the niche market and contains 15 households. Hence, there are five dominant livelihood strategies identified: non-farm workers (Cluster 1, N=16); day labourers (Cluster 2, N=33); coffee producers (Cluster 3, N=19); remittances (Cluster 4, N=14); and niche market (Cluster 5, N=15).

A Kruskal-Wallis test showed that gross annual per capita income levels are significantly different between clusters ($H(4)=19.72$, $p<0.05$). It appeared that there is a significant difference between gross annual income per capita between non-farm workers and day labourers and day labourers and coffee producers. Those pursuing the strategy of day labouring are thus significantly poorer than those engaged in non-farm activities or those producing coffee. All other comparisons resulted insignificant. So, except for cluster 2, there is no significant association between what people are doing and how well they are doing in terms of income. This is likely due to the large variation still occurring within the clusters. On the other hand, the five livelihood clusters are a good indication of the different strategies observed during the fieldtrips and group-discussions. Moreover, the research is a snapshot in time. Time-series data is necessary to validate any statement about long term strategies and their economic sustainability.

Several non-parametric tests were performed to identify differences in assets (human, natural, physical, financial and social) amongst clusters. For the categorical variables a Chi-square test was done and for the non-categorical variables the Kruskal-Wallis test followed up by Mann-Whitney test. Those belonging to the non-farm income cluster (Cluster 1) show a clear difference in the asset base, compared to the other clusters. Respondents in the non-farm cluster have higher education compared to the rest and are more likely to have a loan. Farm sizes are on average smaller in Cluster 1 but, this difference is not significant. The percentage of respondents in Cluster 1 having a title over one or more of their plots (56%) significantly differs from those earning the majority of their income with day labouring (Cluster 2). At last, the value of the agricultural equipment in Cluster 1 is significantly different from all other cluster. However, this is an effect rather than a cause of pursuing a strategy based on non-farm income.

In the largest and poorest cluster of day labourers few respondents own at least one plot with secured tenure (a legal title) if compared with those engaged in the niche market (Cluster 5) and non-farm work (Cluster 1). However, total farm size resulted to be insignificant amongst livelihood strategies.

Cluster 3, the coffee producers; seem not to differ that much from the other clusters. They have less education and more often no loan than those in cluster 1. Moreover, they are more likely to not receive less remittance than those in Cluster 4.

Respondents in the group that have on average higher shares of remittances (Cluster 4), have a higher value of livestock (stock wealth) compared with the non-farm workers and day labourers.

Respondents in cluster 5 differ significantly from all other clusters in membership of a local organization (86%), compared to 38%, 36%, 47% and 29% for cluster 1,2,3,4 respectively. Suggesting that membership of an organization increases the likelihood of being engaged in the niche market. This might be due to the tourism related activities that compromise the niche market.

Findings show that certain types of assets are critical for some livelihood strategies. Such as non-farm workers, have more often a loan and higher education if compared to other clusters. However, this type of research always raises questions about endogeneity of variables. Research has shown that a high education results more often in non-farm work; the asset base of this households influence the type of strategy chosen. Yet, one can debate if those receiving remittances buy livestock and therefore have a higher stock value of livestock or it works the other way around. That is, these households owned already a large amount of livestock and were therefore able to send family members abroad. Consequently, findings on which types of assets are critical for what livelihood strategies should be interpreted with care.

The next step undertaken was to identify the determinants in gross annual income levels. The linear regression model shows that gross annual income levels across households in the buffer zone of La Amistad National Park can be explained by natural assets, share of hectares under coffee and pasture which have a positive effect on income. The share of forest has a negative effect but is not significant. The share of hectares under coffee production has a larger effect than the share of pasture. An indication, that coffee cultivation is a more profitable activity than livestock. Social assets defined as, membership of the local development organization resulted to be insignificant. Human capital in the form of educational level of the household head was insignificant whereas and family size was significant and negatively influencing income. However, results should be interpreted with care since membership of a local development organization, usage of a loan and the share of non-farm income are not exogenous to the model.

When addressing the contested relationship between poverty (alleviation) and conservation we conclude that in the perception of the rural inhabitants their economic welfare status has little to do with the presence of the La Amistad Biosphere Reserve. Certainly, park restrictions do not make livelihoods easier for inhabitants. River resources, trees and wild plants can provide in many of the basic needs for rural households. The households in our sample are restricted in collecting and harvesting from the natural environment. Hunting is forbidden and for lodging permission is necessary. Both group discussions and informal conversations with villagers revealed that (illegal) hunting and fishing are not very common in the area. Moreover, having little access to timber or the increase in crop raiding animals causes inconvenience but is not perceived as the major problem. Although only two participants in our sample receive payment for environmental services, 39 households have

forest in conservation. It seems that factors other than compensation count in participating in forest conservation. It is important to pay attention to this fact. Since, in Costa Rica, requests to participate in the program far surpassed available financing.

A binary logistic regression was done to test what factors determine participation in forest conservation. Only 2 variables resulted to be positively significant related, farm size and tenure security. The share of non-farm income resulted to be insignificant, as well as education.

Though not explored in depth in this paper, the transforming structures and processes and the vulnerability context influence the choice of livelihood strategies. The coffee crisis and the decline in prices received for livestock caused that households switched or add new activities to their portfolio of activities. In the cluster of coffee producers the average share of income from coffee production is 0.55. The remaining 0.45 per cent of income comes from a variety of other activities. Moreover, respondents indicated that major problems in pursuing profitable livelihood strategies are related to causes external to the household such as access to markets and employment. A lack of financial or human capital such as credits, production inputs, and new technology knowledge for development of new economic activities was mentioned but perceived to be less of a problem than (the non-existent) access to markets and the few employment opportunities.

The question whether livelihood strategies are sustainable is difficult to answer with only 2009 data available. Assuming that a livelihood is sustainable when it can cope with and recover from stresses and shocks, it seems that households are doing relatively well, taking the coffee crisis and the decline in livestock prices into account. Some respondents indicated that they have abandoned coffee, but found other activities to make a living. Occasionally, households were encountered that had not enough money or financial resources to reach services such as children's (secondary) education or (specialized) health care. However, all households have access to primary education and basic health services since these services are available freely in Costa Rica for all residents. So, if we take into account that a livelihood is sustainable when a household is not dependent on external support it seems that household indeed use and need to use outside support in the form of health, education and housing (*bonos de vivienda*) in order to manage a living .

With respect to environmental sustainability we can conclude that households are environmental friendly minded. They appreciate benefits of the park such as clean air and water. Moreover, they do not perceive the park as a threat to their productive activities. Still, to truly answer this research questions more research on economic and environmental sustainability is needed.

The objective of the study was to identify *whether and how the park affects the livelihood strategies of the people living in the buffer zone*. This exploratory study shows that the evidence directs to the remoteness of the area instead of the presence of a national park as a major factor in causing hardship in developing profitable livelihood strategies. It is the non-existence of markets instead of the existence of park restriction access to resources and the strategies that follow.

However, this thesis has some limitations. The major limitation is its small sample size and the non-random selection of villages and households. With a small sample size it is harder to find significant relationships from the data, as statistical test normally require a larger sample size to justify that the effect did not happen by chance alone. In addition, the non-random selection of villages and households influences the validity of the results. This means that the sample is not representative for all households and villages in the area. As a result, findings cannot be generalized to other populations. Especially because the criteria on which the villages were selected such as presence of a local development organization might (positively) influence the perception of the park. Moreover, there are unknown factors. The park was created in the nineteen eighties, and as MINAE stated some of the village have high outflows of labour migrants. Hence, it might be that those who were affected the most choose an “exit strategy” leaving the area and building a new life in another place without constraints. Also, with only 2009 income data available it is not possible to say anything about long term strategies. Therefore, this thesis lacks the power to give a reliable answer to the fourth research question “To what degree are livelihood strategies sustainable?”. Besides the limitations related to the study design which decrease the validity of the results, one can question the validity of the answers collected. The sensitivity of the subject might cause respondents to give socially desirable answers such as “there are no disadvantages of the park” and “we do not hunt”. As a consequence of the above mentioned limitations, the conclusion drawn in this should be interpreted with care.

In order to increase the validity and reliability of the results a study with longitudinal data would allow investigating further the relation between the park, access to assets and the livelihood strategies by those living near. Likewise an impact study, with a control group would allow investigating whether there are differences in access to assets and livelihood strategies between those we live in the buffer zone and those who do not live in the buffer zone of the park.

Yet, the strength of the research is the combination of both quantitative and qualitative data.

The above findings highlight the necessity to include all aspects of the sustainable livelihood framework in trying to understand the choices that household make in pursuing their strategy.

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ANNEX I VILLAGES PROFILES

This annex provides the reader with basic information about the socio-economic characteristics of the villages visited. In the province of *Puntarenas*, six villages were visited: *Biolley, Altamira, Capri, Santa Rosa, Santa Maria and Aguas Calientes*. For this section, survey data is used and disaggregated per villages.

General perception on the park and nature conservation

In Biolley the creation of La Amistad International Park had a significant impact on the community. There was poor communication from the government to the communities affected. Respondents indicated that rules and restrictions were implemented in a “military way”. Families settled in the park were removed from their homes. Although compensation was promised, there are still people who are not compensated for their displacement. After the creation of the park, some people migrated to other parts of the country, whereas others stayed. Coffee production, an important cash crop in the region, was not effected severely, since the activities concentrated in the park were mainly livestock, timber and basic grains. Yet, the anniversary of the park is celebrated every year by the communities living near demonstrating a positive discourse about the park. The services that the park provides such as, water, fresh air, and biodiversity are high valued by all the communities. There is a strong perception that without the park there would be no water and that the climate would probably be less favourable (for agriculture). Moreover, there is a culture of nature conservation; people conserve forest without payment because they feel that it is important. This is also expressed in actions that for example the community of Biolley undertakes. They monitor biodiversity with help of the RED QUERCUS¹⁶ and MINAE (Ministerio de Ambiente y Energia de Costa Rica). All communities visited stopped the practice of burning land already ten years ago. In the group discussion villagers were asked what their main problems of the community are. The bad road conditions and lack of employment were mentioned in all communities. Moreover, garbage was seen as a problem. With no garbage trucks coming into the villages, households are left to either burn or burry their garbage.

Biolley

The community of Biolley is located at 250 kilometres of San José. Biolley pertinence to the canton of Buenos Aires and the district of Biolley. From San José, it takes about seven hours to reach the village. Only a four-wheel drive can make the stony track. Around seventy families live in the village. Sixteen households were interviewed in this village.

¹⁶ Red Quercus is a development organization working in the district of Brunka, Potrero Grande and Biolley. Their activities include sustainable production, sustainable tourism to reforestation and the protection of biodiversity in La Amistad National Park. Members are: La Asociación de Productores La Amistad (ASOPROLA) de Altamira de Biolley; La Asociación Cámara Ecológica de Turismo de Santa María de Brunka (ACETUSAMA) ; La Asociación de Turismo de Tres Colinas de Potrero Grande ; La Asociación de Mujeres Organizadas de Biolley (ASOMOBI), de Biolley de Buenos Aires; Grupo Comunitario de La Lucha de Potrero Grande. They have an extensive social network and cooperate with organizations such as INBIO (Instituto Nacional de Biodiversidad, Costa Rica), TNT's (The Nature Conservancy) Parks in Peril Project and HORTIFRUTI (affiliate to Walmart Central America).

Electricity is available to most households, except one. One fourth of the households collect their water from a spring or brook and the rest has a connection to a rural aqueduct. There are three small shops, selling some basic food and goods of daily use. The closest market, where all kinds of shops and service providers are available, is in Buenos Aires. There is one primary school and no high school in the village.

Farmland owned varied between 0 hectares and 130 ha. (*Median* 11 ha.) Of the 16 households interviewed 8 had secured tenureship, in the form of a legal title, over one or more of their plots. The village depends mainly on coffee production and other agricultural products. The land is unsuited for livestock. The crisis of coffee in the 1990s affected the village of Biolley, since the whole community was practically dependent on coffee. In addition in the 1980s *el Consejo Nacional de Producción* (CNP) stopped buying basic grains such as beans and maize from farmers. Today, as markets are far away, agriculture mainly serves for subsistence only coffee is an exception.

Altamira

Altamira belongs to the canton of Buenos Aires and the district of Biolley. Approximately 60 families live Altamira. It is located close to Biolley. 55% of the households collect their water from a spring or brook, the rest of the households receives water from a rural aqueducts.

In the village there are three small shops, selling some basic food and goods of daily use. The closest market, where all kinds of shops and service providers are available, is in Buenos Aires. In the village there is one primary school and no high school.

Farmland owned varied between 0 and 16 ha. (*Median*. 4) Of the 18 households interviewed, there were 7 households who had secured tenureship over at least one of their plots. The village depends mainly on coffee production and other agricultural products (bananas).

Capri

Capri is a small community located in the canton of Buenos Aires and district of Portrero Grande. Approximately 90% of the inhabitants are non-indigenous. All households collect their water from a spring or brook since no rural aqueducts is available.

The village is difficult to reach with no proper roads available. The village of Las Palmas is even harder to reach from Capri it takes about an half an hour by horse. Las Palmas has electricity since October 2009.

Farmland owned varied between 0 and 158 ha. (*Median*. 6) Of the 19 households interviewed, there were 2 households who had secured tenureship over at least one of their plots (located outside the indigenous territory).

Capri is an exceptional case, since it is located in indigenous territory. This has two main impacts. First, there are no individual titles over land. Second, the indigenous organization has to give permission for every project developed on the land. As the villager's state: "The only advantage that we have is that we do not pay taxes". Having both "white farmers" and "indigenous" people on the same territory with the indigenous people having the right over the land causes some friction between the two groups. The non-indigenous feel that the

indigenous people are not interested in development. They do not allow tourist related activities on their territory. But also as one respondent mentions “they are not interested in development, if they can enter a road by foot or horse that is good enough for them”. People described personal relations between indigenous and non-indigenous as fine. However, the general discourse is that indigenous people are lazy, and aid depended. The indigenous people also dislike the “white man”. The typical talk would be “We are all equal but....”.

Santa Rosa de Brunka

Santa Rosa is located in the buffer zone of La Amistad International Park, in the canton of Buenos Aires and the district of Brunka. Approximately 50 families live in Santa Rosa. Although the community is small there exist around 12 community based groups and committees. 72% of the households collect their water from a spring or brook.

Farmland owned varied between 0.02 and 138 ha. (Median. 3.5) Of the 25 households interviewed, there were 7 households who had secured tenureship over at least one of their plots.

The main products cultivated are beans, bananas, coffee and livestock for both milk and meat production. Beans are sold at the market and intermediary visit the community. Livestock inputs are very expensive and the price of livestock is very low. A calf can be sold for 20.000 colones, but transportation cost lie around 10.000 colones. Subtracting the cost of raising the calf makes livestock a business that is non-profitable. Some members migrated; other tried to diversify their activities in other ways, such as planting orange trees. However, plagues and a lack of commercialization of oranges make that if one enters the village one finds oranges rotting on the ground. The community feels that there is a lack of tourism possibilities since there is few for tourist to do in the area. However, Santa Maria a nearby community is aiming at tourism.

Santa Maria de Brunka

Santa Maria de Brunka is located in the canton of Buenos Aires in the district of Brunka. It is a small community with 13 families. All households collect their water from a spring or brook, since there are no rural aqueducts providing the village with water.

Farmland owned varied between 0.04 and 101 ha. (Median. 21) Of the 11 households interviewed, there were 3 households who had secured tenureship over at least one of their plots.

Aguas Calientes

Located in the canton of Coto Brus and the district of San Vito, Aguas Calientes is a remote community with approximately 80 families. All households receive water, from a rural aqueduct.

Farmland owned varied between 0 and 98 ha. (Median 3 ha.) Of the 18 households interviewed, there were 10 households who had secured tenureship over at least one of their plots.

ANNEX II A DESCRIPTION OF THE 6 LOCAL ORGANIZATIONS

This annex provides the reader with basic information about the organizations of the villages visited.

Biolley: ASOMOBI – Asociación de mujeres de Biolley

In Costa Rica the coffee market has been traditionally dominated by men. However, ASOMOBI a group that consist only out of women has managed to set up a successful coffee business.

In 1997, a group of around 15 women came together for sewing classes with the idea of making money to support their families. However, they recognized that the location of Biolley is a disadvantage for ready-made clothing. Even though, they had no money, no place to work and no knowledge about coffee processing they started their coffee business. A loan provided them with the financial resources to buy a coffee grinder and an old coffee toaster. In the courtyard of one of their members they started to toast coffee and sell it in the local grocery stores. They charged 2000 colones for every cajuela¹⁷ of coffee toasted. The people who could not pay this, they charged 2 kilos of grounded for each cajuela toasted. In 1998, they constructed a building with help of donated materials and labour, only the supervisor got paid. Every day one of the women should send a day labourer to work either a, husband, brother, men or hired day labourer. The fine for not sending a day labourer was 3000 colones.

Infrastructure of ASOMOBI

- ❖ Conference room (capacity of 40 persons)
- ❖ Restaurant (only for reservations)
- ❖ Bakery
- ❖ Lodging, with 5 rooms (capacity of 18 persons)
- ❖ Possibilities for home stays
- ❖ Walking tracks

Today, around 30 people are associated with ASOMOBI, the women grind, pack and sell the coffee that APROLA receives. One person has a fixed salary and around 15 people are employed per hour (coffee processing, bakery, cooking). Working for and with ASOMOBI not only helps women to support their families but it also makes them feel useful. In 2009 ASOMOBI received coffee from eight producers; there are only few able to sell to ASOMOBI because many producers find it difficult to deliver the coffee beans the same day of harvest.

ASOMOBI processes coffee grown on altitudes higher than a thousand metres. In 2009 they received 600 fanejas de café of which five hundred fanejas were exported at an average price of \$135-150 per faneja the remaining hundred fanejas were for local consumption. ASOMOBI aims at producing coffee in a sustainable way, using few pesticides and herbicides. The production of organic coffee is difficult, since many coffee producers they work with are not willing or able to produce organic coffee. Producers describe the process of organic coffee as costly, with in their perception few benefits. Moreover, there is little information available to them about how to produce organic coffee.

¹⁷ 1 cajuela is the equivalent of 46 kilograms of coffee; 1 faneja is 1/20 of an cajuela (2.3 kilograms of coffee)

Activities of ASOMOBI

- ❖ Rural Tourism
- ❖ Coffee processing and sale
- ❖ Volunteer Projects

Over the years, ASOMOBI has diversified their activities mainly in the direction of rural tourism and foreign volunteers. Volunteers are used to paint schools, construct buildings not only in Biolley but also in nearby communities.

Costa Rica has several advantages with respect to (eco) tourism, there is political stability, it is relatively safe to travel and the main roads are well maintained. Moreover, Costa Rica has a dense biodiversity and a structured national park system. The ICT (*Instituto Costarricense de Turismo*) reports on their website that more than 2 million tourists visited Costa Rica in 2010. The concept of eco-tourism is popular in all communities. The communities of Biolley, Altamira and Santa Maria have ecotourism projects. Aguas Calientes and Capri are all interested in developing ecotourism projects, but they lack the knowledge, money and infrastructure to do so. The women of Santa Rosa indicated that although, a tourism project would be appealing however, they felt that there was not much to show to tourist in the area.

Some community members indicated that ASOMOBI has divided the community in those who benefit and those who do not benefit from the organization. All respondents belonging to communities with an active organization were asked to value their satisfaction of different aspects of the organization on a 1 to 10 scale. The results are presented in Table 17. In general non-members are less satisfied with respect to local development.

Table 17 Satisfaction with local development organization

Satisfaction with local development organization						
Statement	ASOMOBI		ASOPROLA		ASETECUMA	
	Member (N=7)	No-Member (N=7)	Member (N=7)	No-Member (N=10)	Member (N=5)	No-Member (N=2)
Satisfaction with commercialization of products	8.3	n/a	6.4	n/a	9.0	n/a
Satisfaction with local development	9.4	5.3	7.3	6.6	9.2	8.5
Satisfaction with nature conservation	9.8	8.3	8.3	8.5	8.8	9.5

Altamira: ASOPROLA -Asociación de Productores La Amistad

ASOPROLA exist since 1997. It is an organization that consists of a variety of people, men, women, adults and young people. The activities of ASOPROLA are both agricultural and non-agricultural and are described in the text boxes. Their main activity is concentrated around the production of coffee. ASOPROLA receives both conventional coffee and organic coffee. In 2009 they received 250 *fanejas* organic coffee from approximately 17 producers and 400 *fanejas* organic coffee from around 10 producers.

ASOPROLA has a contract with café Britt and pay around 90.000 colones for a *fanaja organico* and 65.000 colones for a *faneja convectional*. This amount is not paid at ones; almost half is paid at the end of the year. As producers indicated this is inconvenient, since money to invest in coffee is needed during the year.

Infrastructure of ASOROLA

- ❖ Restaurant
- ❖ Lodge with 8 rooms (capacity 35 persons)
- ❖ Guided tours

Besides coffee ASOPROLA serves as a producers association for banana's. In 2009: 40526 kilo's de bananas were sold for 75 colones per kilo, they pay they producers 55 colones per kilo. Hence, with 810520 colones ASOPROLA has to cover all the costs of transportation, administration, collection and working hours; this makes banana's an unprofitable business for them. Two persons have a fixed salary and one person is paid per hour. They pay the women who work in the restaurant with a complicated BONO system, in which workers collect BONO's that are worth a certain amount of money. However, until now BONO's are never paid out and work is thus done on a voluntary base. As a result, many have left the

organization feeling disillusioned by the system. ASOPROLA helps farmers receiving an organic certificate. The costs are high \$18000, - for the certificate and an additional \$3500, - for each inspection (in 2010 there will be three inspections).

ASOPROLA has built up relatively large debts with different credit providers. In the beginning of 2010 they were looking for a large loan so they have only one loan to pay off.

Activities of ASOPROLA

- ❖ Organic garden crop production
- ❖ Processing and commercialization of both conventional and organic coffee
- ❖ Rural Tourism
- ❖ Volunteer Programs
- ❖ Environmental education
- ❖ Apiculture
- ❖ Pisciculture
- ❖ Organix fertilizer
- ❖ Semi-stabled livestock

Capri: ASOTICA – Asociación de Turismo e Investigación Científica de Capri

ASOTICA was set up in 2007 in a nearby community called la Lucha. They have 22 associates from different villages: Capri, la Lucha, Las Palmas and San Rafael. Although both men and women are allowed to join ASOTICA, there are only 4 female members. ASOTICA has no projects yet. But, different ideas exist varying from honey production, milk production, organic coffee, and rural tourism. The first step in rural tourism

would be to construct a lodge to receive tourist and develop a walking track. They feel that the problem lies not in the production but in the commercialization of the products, how and where to sell their products on the market. Because of the location in indigenous territory they face problems in obtaining loans from banks since banks require a mortgage. Moreover, the village is characterized by low human capital. Until now nobody from the village has finished university and today youngsters start to finish college. They feel like they

lack capacity to develop projects for example, nobody from ASOTICA can manage a computer. The land is classified as not good but also not bad. Moreover, they feel that they receive little help from the MINAE. They wanted to start an animal refugee centre but the cost were too high. Regulations require a full-time vet and the paper work. For, the same reasons a tepizquite breeding did not came off the ground.

ASOMUSAR- Asociación Ambientalistas de Mujeres de Santa Rosa de Brunka

Activities of ASOMUSAR

- ❖ Organic garden crops
- ❖ Reforestation projects

Infrastructure of ASOMUSAR

- ❖ Salón comunal
- ❖ Cocina comunal
- ❖ Mini bazaar

In 2004 ASOMUSAR was created, today the group consist out of 7 women. They are in charge of the administration of the *Corredor Biológico Rió Cañas de Santa Rosa de Brunka*. The main activities of ASOMUSAR are centred on the production of garden crops that they sell locally to community members and the school. Also they have a mini bazaar in which they sell products that are not available in the local grocery store. The objective of the group is to inform and motivate communities about the benefits of the *Corredor Biológico*. However, when asking some key actors to define what a *Corredor Biológico* is they could not explain this. All the work that they do for the *Corredor* is voluntary; they receive no financial support or whatsoever for MINAE. Also non-members indicated that they have no clear idea about what the organization actually does.

ACETUSUMA – Asociación Cámara Ecológica de Turismo Santa Maria de Brunka

ACETUSUMA was born in 1991, and consist of men and women. They have around 22 associates. Around 60% is woman and 40% man. ACETUSMA has associates in 4 communities: Santa Rosa, Santa Maria, Guadalajara and San Rafael. The organization is characterized by a strong leader with a clear vision about the future. The main activities of the organization are organic production and developing tourism. The construction of a lodge for tourist is in process. The walking track (Cerro Cabécar) that can be reached from Santa Maria has a limit of 9-10 people daily in the dry season. Reservations should be made 20 days in advance. Moreover, no roads exist to the park decreasing access to the park. Tourism opportunities are thus limited and the transaction costs for tourist are relatively high if compared with other national parks.

Activities of ASETUSUMA

- ❖ Organic Banana farming
- ❖ Rural Tourism

Infrastructure of ACETUSUMA

- ❖ Kitchen
- ❖ Lodge
(under construction in 2010)

ASOFAC – Asociación Femenina Aguas Calientes

Is a young organization that consists of women only, they have no activities or infrastructure yet. They recently started a recycling project. They have collected garbage to recycle. However, they have no organization contacted yet who can and will collect the garbage in Aguas Calientes. Women in this organization indicated that they have problems with machismo. Man, sometimes forbid woman to participate in the organization. They feel like they lack the capacity to develop projects.

ANNEX III OPERATIONAL DEFINITIONS

This annex presents and describes the choice of the variables to on the five livelihood assets, i.e. human, natural, financial, social, and physical assets. Assets give an idea on a household's quantitative and qualitative potential. For this study, the household is defined as those living and eating together and have not or will not stay stayed outside the household for a period longer than six months.

Table 18 Income categories, based on aggregated sources of activities

Income categories, based on aggregated sources of activities	
<i>Variable name</i>	<i>Income sources</i>
Total income of coffee	Coffee (both organic and inorganic)
Total off farm income	Day labour
Total non-farm income	Construction, transport, business, salary
Total income from livestock	Livestock
Total income of crop production	All agricultural products cultivated on farm except coffee, cubaces, and sugercane
Savings from self-sufficiency	Estimation of savings by consumption of agricultural products on farm
Total income of transfers	Grants, family support, pensions and payment for environmental services
Total income of remittances	Remittances
Total income of the niche market	Cheese, organic fertilizer, honey, cubaces, sugarcane, tilapia, lodging, guiding, crafting, local organization.

Table 19 Shares of income categories

Shares of income categories	
<i>Variable name</i>	<i>Measurement</i>
Share of coffee production	Derived as total income from coffee production divided by gross annual income
Share of off farm income	Derived as total off-farm income divided by gross annual income
Share of non-farm income	Derived as total non-farm income divided by gross annual income
Share of livestock	Derived as total livestock income divided by gross annual income
Share of remittances	Derived as total income from remittances divided by gross annual income
Share of transfers	Derived as total income of transfers (becas, pension, PES, financial support of family) divided by gross annual income
Share of niche market	Derived as total income of the niche market activities divided by gross annual income
Share of own consumption	Derived as total savings from self-sufficiency (crops, milk, eggs) divided by gross annual income
Share of crop production	Derived as total crop income (minus coffee) divided by gross annual income
Gross annual income	Derived as an aggregated value annual income from crops, livestock, off-farm, non-farm, transfers, remittances and savings from self-sufficiency

Table 20 Variables per asset category

<i>Variables per asset category</i>		
<i>Variable</i>	<i>Definition</i>	<i>Measurement</i>
Human Capital		
Dependency	Dependency ratio: Ratio of the number of dependent household members younger than 12 years old or older than 55 years old, divided by the number between 12 and 55	Ratio
Education	Household head has low education (primary education or less)	Dummy 0 = yes; 1 =no
Age	Household head is between 21-55	Dummy 1 = yes; 0 =otherwise
Social Capital		
Membership of local organization	At least one household member is member of a local community organization in 2009	Dummy 1 = yes; 0 =otherwise
Number of migrants	No of migrants in households in 2009	Number
Natural Capital		
Farm size	Size of total farm in 2009	Ha.
Natural log of farm size	Natural log of land size	Ha.
Share of hectares coffee	Share of total farm size with coffee	Share
Share of hectares pasture	Share of total farm size with pasture	Share
Share of hectares forest	Share of total farm size with forest	Share
Title	Household owns plot with a title	Dummy 1 = yes; 0 =otherwise
Value of livestock	Derived from the aggregated value of the 2009 stock of cattle, pigs, poultry, goats and sheep's.	Value in dollars
Forest	Household has forest under conservation	Dummy 1 = yes; 0 =otherwise
Physical Capital		
Access to a vehicle	Household owns a vehicle (car, motor, pick-up, truck) in 2009	Dummy 1=yes; 0=otherwise
Value of agricultural equipment	Value of agricultural equipment in 2009	In colones

Financial Capital		
Access to credit	Receives a credit in 2009	Dummy 1 = yes; 0 =otherwise
Remittances	Receives remittances in 2009	Dummy 1 = yes; 0 =otherwise
Livelihood strategies		
Cluster	The different livelihood strategies households are pursuing in derived from the cluster analysis in section four. The households are grouped into four livelihood strategies in the buffer zone and each household belongs to one group	Dummy
Livelihood outcomes		
Gross annual income	Derived as an aggregated value annual income from crops, livestock, off-farm, non-farm, transfers, remittances and savings from self-sufficiency	Value in dollars per year
Annual gross per capital income	Annual gross income divided by family size	Value in dollars per year
Natural log of annual gross per capital income	Natural log of annual gross per capita income	

ANNEX IV ASSETS

This section focuses on the five livelihood assets, i.e. human, natural, financial, social, and physical assets for the sample as a whole

House structure and tenure

88% of the households own their house, the remaining cases are free rented (borrowed) houses. Rented houses (against money) exist in none of the six villages. The majority of the houses have zinc roofs and walls made of a combination of cement and wood (*socola*). Almost all households in our sample have access to electricity (96%). Hence, there is almost no need for fuel wood to cook. Yet, some households prefer to cook on fuel wood, although electricity is available. All households have access to potable water for drinking, cooking and washing; the source of the water varies. In 60% of the cases the water is directly collected from brooks or streams. This water is potable and comes directly from the mountains. However, livestock held close to streams might contaminate the water, which concerns a health risk. In 42% of the cases a rural aqueduct provides the households with water. The lack of rural aqueducts demonstrates a low involvement of the municipality. As can be seen in Table 21 some of the villages are completely dependent on water from either a spring or brook.

Table 21 Dependency on water from springs or brooks

Dependency on water from springs or brooks	
<i>Village</i>	<i>Water from spring or brook</i>
Biolley	25%
Altamira	55%
Capri	100%
Santa Rosa	72%
Santa Maria	100%
Aguas Calientes	0%
% of total sample	60%

Access to telecommunication

70% of our households have access to a (mobile) phone. Households are depending much on mobile phone use since in many villages it is not possible to have a phone connection in the house. 15% has a phone line in the house and 60% has a mobile phone. Only 3% of the households indicated to have access to internet. Having a phone is important it reduces transaction cost in obtaining market price information and facilitates access to (public services).

Human capital

Human assets such as household size and education give an idea on a household's quantitative and qualitative potential. A household investing into education (provided that facilities are available) can increase its alternatives for income generation and might be able

to find better income sources through regular salaried jobs, or start a self-employed business (Steimann, 2005).

Household size

The smallest family size in our sample is 1 and the biggest family consisted out of 8 persons. A household that consist out of 5 persons was most common in our sample. An average family in Costa Rica has 4.2 persons, in the study area family sizes tend to be slightly bigger. The average number of children in our sample is 4.3. The national average of Costa Rica is 2.1 family sizes are thus bigger than the national average. In the literature it is often concluded that people living in larger and (generally) younger households are typically poorer (Lanjouw and Ravillion, 1995). Although, larger families have a greater potential labour force, they also more expenses on food, health and education. A female headed household is defined as a household, where no man is present because the women are either single, widow, divorced or separated. 9% of the households in our sample is female headed.

Migration

Migration plays an important role in all villages. Thirty per cent of all households receive remittances and more than half of the households 62% have one or two (male) migrants. This underlines the high importance of labour migration as a livelihood strategy.

Education

The level of education of the head of the household is low 41% has completed primary education and only 3% has completed secondary or university education. Taking all household members into account, we can also conclude that education levels are low. Of the people that are 55 years or older 70% has no or not finished their primary education. In the category of 21-55 years old, 27% has no or not finished their primary education. In the category 21-55 years old 10% has secondary education or higher.

Natural Capital

Land

Data on 171 on plots is collected. The minimum number of plots in our sample is 0 the maximum number of plots is 4. The majority of the households have only 1 plot. Most parcels are either bought (56%) or inherited (34%). The majority of the plots is held under private ownership (71%). Nevertheless, only 38% of the 122 parcels held under private ownership have a title. Of the respondents with parcels under private ownership 42% has a title on 1 or more of their parcels. Of all households recorded, 7 households have no access to land.

The distribution of land is highly unequal 50% of the respondents have 5 hectares or less as can be seen in Table 22.

Table 22 Distribution of land

<i>Distribution of land</i>	
<i>N=104</i>	<i>Ha.</i>
Minimum	0.00
Q1	1.38
Median (Q2)	4.94
Q3	18.63
Maximum	157.50
Average	23.69

Water & Forest resources

In all villages, several mountain brooks are running across the plots – during the rain season, they bring a lot of water. Irrigation systems are uncommon only 8% of the parcels has an irrigation system. There might be several explanations. First, few farmers indicated to have drainage problems. Rivers, streams and brooks are located near plots supplying the plots with water. Second, low financial assets might restrain farmers in placing irrigation systems. There is no formal/legal access to forest resources such as fuel wood and construction timber is easier for residents of the buffer zone of La Amistad Biosphere Reserve. Although 36% of the households own “private” forest according to the law, people cannot cut a single tree without permission of the MINAET on their land.

Social capital

Social assets or social capital is a much debated term. DFID defines it as “*the social resources upon which people draw in pursuit of their livelihood objectives*” (DFID, 2001, 2.3.2). According to this definition, social resources basically consist of membership in more formalized groups, networks and connectedness, and relationships of trust, reciprocity and exchanges. All these elements are closely interlinked, and do basically increase people’s ability to cooperate with others, to expand their access to certain institutions and resources, and to improve their informal safety nets.

Membership of more formalized groups

13% of the respondents indicated that none of their family members relate to any organizations. 42% of the household heads does not belong to any organization. Few household heads are a member of a cooperative (6%) or organization of producers (2%). However, data should be interpreted with care sine in Biolley and Altamira the local organization functions also as a producer’s organization. However, in general we can conclude that respondents do not use pure producer’s organizations to bring their product on the market. Membership of a local development organization is higher, suggesting that rural households prefer organizations that provide more services than just an access to the outlet market

Physical assets

Private means of transport

In all villages there is on irregular basis public transport available. Prices of illegal taxis are high and respondents indicated that this sometimes restricted them for going to appointments in the hospital. Therefore, having private means of transport is an important asset. It reduces transaction costs and brings both persons and goods to the market.

Table 23 Percentage of households that own a vehicle per category

Percentage of households that own a vehicle per category						
Vehicle	Car	Pick-up	Truck	Motor	Quad	Tractor
Respondents	28%	4%	5%	17%	5%	1%

If we defined access to a vehicle as a household owns either one of these means of transportation above than 45% of the respondents in our sample have a vehicle. A car or motor is the most common vehicle used in the area. Vehicles that are able to transport products to the market such as a pick-up or truck are rare in the area. Most respondents thus have to search and rent transportation methods increasing transaction cost of bringing products to the market.

ANNEX V SPSS OUTPUT

Table 24 Descriptive statistics value of livestock

Descriptive Statistics value of livestock						
	<i>N</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Mean</i>	<i>Std. Deviation</i>	<i>Median</i>
Cluster 1	16	0	88209	6198	21945	32
Cluster 2	33	0	27884	1668	5126	109
Cluster 3	19	0	28909	2793	7160	200
Cluster 4	14	4	35482	6664	10938	1856
Cluster 5	15	0	15909	2202	4457	527
Total	98	0	88209	3404	10762	255

Table 25 Descriptive statistics value of agricultural equipment

Descriptive statistics value of agricultural equipment						
	<i>N</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Mean</i>	<i>Std. Deviation</i>	<i>Median</i>
Cluster 1	14	0	447	62	135	0
Cluster 2	28	0	3193	410	667	159
Cluster 3	18	0	6673	789	1530	295
Cluster 4	12	0	1760	420	546	236
Cluster 5	13	0	1356	370	444	151
Total	85	0	3670000	235512	472266	145,4545

Table 26 Descriptive statistics farm size

Descriptive statistics farm size						
	<i>N</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Mean</i>	<i>Std. Deviation</i>	<i>Median</i>
Cluster 1	16	0.0	98.0	9.2	0.0	1.4
Cluster 2	31	0.0	160.5	17.7	0.1	3.0
Cluster 3	19	0.1	98.0	19.9	0.1	6.4
Cluster 4	14	0.0	137.5	30.6	0.1	11.9
Cluster 5	15	0.0	128.0	28.7	0.1	14.3
Total	95	0	161	20	37	4,0

The results of the hierarchical cluster analysis are shown by a dendrogram, which lists all of the samples and indicates at what level of similarity any two clusters were joined. The x-axis is some measure of the similarity or distance at which clusters join and different programs use different measures on this axis. Determining the number of groups in a cluster analysis is one of the first steps. Although objective methods have been proposed, their application is somewhat arbitrary. Typically, one looks for natural groupings defined by long stems. Although the cluster structure is not clear-cut, 5 clusters were identified with hierarchical cluster analysis our data (see dendrogram below). In addition to this the agglomeration table was inspected. Since the cluster analysis was based on dissimilarity, large coefficients

tell you that you're combining dissimilar clusters. Table 27 is not provided as output by SPSS but in this table it is easier to see the changes in the coefficients as the number of clusters increase. The columns suggest that a 2 cluster solution is suited. However, in order to determine multiple livelihood strategies a 5 cluster solution was chosen.

Table 27 Reformed agglomeration table (hierarchical cluster analysis)

Reformed agglomeration table (hierarchical cluster analysis)				
<i>No. of clusters</i>	<i>Agglomeration last step</i>	<i>Coefficients this step</i>	<i>Change</i>	
2	37.8	28.6	9.2	
3	28.6	23.6	5	
4	23.6	19.3	4.3	
5	19.3	15.6	3.7	
6	15.6	12.4	3.2	
7	12.4	10.0	2.4	
8	10.0	8.5	1.5	
9	8.5	7.8	0.7	
10	7.8	6.5	1.3	

Table 28 Iteration History

Iteration History					
<i>Iteration</i>	<i>Change in Cluster Centers</i>				
	1	2	3	4	5
1	.349	.680	.473	.375	.570
2	.105	.116	.081	.038	.117
3	.065	.068	.043	.053	.051
4	.000	.017	.032	.000	.000
5	.000	.000	.000	.000	.000

a. Convergence achieved due to no or small change in cluster centers. The maximum absolute coordinate change for any center is ,000. The current iteration is 5. The minimum distance between initial centers is 1,287.

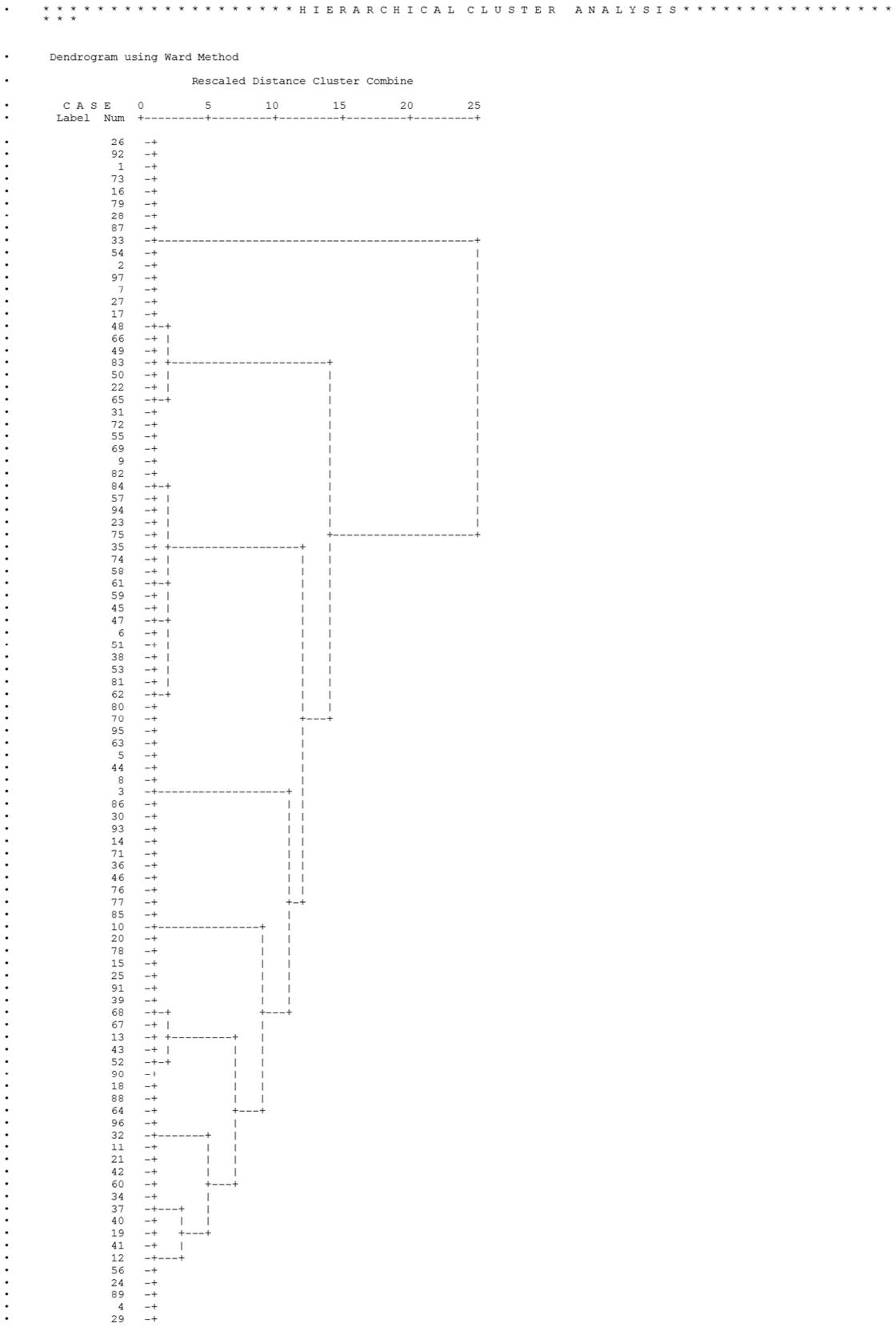


Figure 5 Dendrogram

Descriptive statistics gross annual total income coffee in colones per year 2009						
Variable	Number of households involved	Min	Max	Mean	Std. Dev.	Median
Non-farm workers	2	300000	300000	300000	0	300000
Day labourers	10	80000	1000000	462000	336082	350000
Coffee producers	19	120000	9000000	2476100	2105340	1925000
Transfers	3	200000	2800000	1250000	1370220	750000
Niche market	4	360000	1000000	591250	291730	502500

Descriptive statistics gross annual total income off-farm in colones per year 2009						
Variable	Number of households involved	Min	Max	Mean	Std. Dev.	Median
Non-farm workers	1	960000	960000	960000	0	960000
Day labourers	19	60000	2100000	731000	537374	720000
Coffee producers	3	350000	1440000	730000	615386	400000
Transfers	2	240000	720000	480000	339411	480000
Niche market	7	240000	1440000	720000	380925	648000

Descriptive statistics gross annual total income non-farm in colones per year 2009						
Variable	Number of households involved	Min	Max	Mean	Std. Dev.	Median
Non-farm workers	16	110000 0	12000000	4893800	4032590	3180000
Day labourers	7	91000	1500000	639000	586986	420000
Coffee producers	5	100000	2500000	860800	1018020	360000
Transfers	3	130000	4000000	1536700	2140480	480000
Niche market	2	15000	225000	120000	148492	120000

Descriptive statistics gross annual total income livestock in colones per year 2009						
Variable	Number of households involved	Min	Max	Mean	Std. Dev.	Median
Non-farm workers	0	0	0	0	0	0
Day labourers	7	350000	4100000	1667100	1297520	1620000
Coffee producers	5	10000	8000000	2762000	3582380	680000
Transfers	5	54000	2810000	1220800	1138070	900000
Niche market	1	200000	2000000	2000000	0	2000000

Descriptive statistics gross annual total income crop income in colones per year 2009						
Variable	Number of households involved	Min	Max	Mean	Std. Dev.	Median
Non-farm workers	1	200000	200000	200000	0	200000
Day labourers	8	60000	480000	252625	147618	250000
Coffee producers	6	50000	3500000	808333	1329830	355000
Transfers	4	13700	960000	355925	438770	225000
Niche market	4	30000	1500000	557500	677661	350000

Descriptive statistics gross annual total income self-sufficiency in colones per year 2009						
Variable	Number of households involved	Min	Max	Mean	Std. Dev.	Median
Non-farm workers	10	120000	960000	403200	267025	300000
Day labourers	29	96000	7200000	708000	1319480	480000
Coffee producers	19	60000	1200000	315368	256587	300000
Transfers	11	120000	1200000	449455	309747	360000
Niche market	12	120000	1440000	490000	394554	420000

Descriptive statistics gross annual total income transfers in colones per year 2009						
Variable	<i>Number of households involved</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Median</i>
Non-farm workers	7	132000	396000	240000	111714	264000
Day labourers	30	120000	3864000	648533	805539	366000
Coffee producers	11	43200	1260000	456655	344848	420000
Transfers	10	132000	552000	339600	173809	336000
Niche market	5	132000	432000	276000	147214	264000

Descriptive statistics gross annual total income remittances in colones per year 2009						
Variable	<i>Number of households involved</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Median</i>
Non-farm workers	2	108000 0	1980000	1530000	636396	1530000
Day labourers	5	55000	300000	181400	98284	200000
Coffee producers	6	50000	3000000	1201700	1100040	860000
Transfers	14	480000	13200000	3540000	4156880	1750000
Niche market	2	600000	660000	630000	42426	630000

Descriptive statistics gross annual total income niche market in colones per year 2009						
Variable	<i>Number of households involved</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Median</i>
Non-farm workers	3	50000	480000	236667	220530	180000
Day labourers	4	50000	560000	333750	211084	362500
Coffee producers	5	50000	620000	393000	245041	500000
Transfers	6	100000	864000	366500	286212	307500
Niche market	15	200000	4000000	1644600	1268750	1275000



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Course code: DEC 80433
Author: Pascale Schuit
Registration Number: 860728751090

Supervisors:

Fernando Saenz: CINPE, Costa Rica
Jean-Francois Le Coq: CIRAD, France
Rob Schipper: Wageningen University, The Netherlands

Second reader:
Marrit van den Berg: Wageningen University, The Netherlands

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