The Clean Development Mechanism in Support of Sustainable Livelihoods in Southern Costa Rica

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Abstract

Forests provide the world with some of the most valuable environmental services. However, these services are often neglected in market based economies. As economies grow more interconnected the complexity of forest environmental services should be accounted for. The neglect of forest environmental services in market economies can have negative impacts on livelihoods that depend upon their services. In recent years the negative consequences have not only affected livelihoods directly, but also those that live within the watersheds and even the greater global community. For this reason, more appropriate models need to be applied that accurately reflect the reality of the interaction between forest ecosystems and people. Panarchy is a systems based model that has been used to represent the complexity of social and ecological systems. Panarchy is a strong theoretical model that has helped to influence the development of the sustainable livelihoods approach. The sustainable livelihoods approach is a practical and interdisciplinary tool used to understand how project design and implementation impacts poverty. The focal point for the sustainable livelihoods approach is the access individuals or communities have to multiple assets and the various control mechanisms that promote or inhibit this access. Access to this asset base has been enhanced by payment for environmental services projects. Payments for environmental services are simply direct payment to farmers for planting or protecting forests and are a start to recognizing that the value of forest environmental services has been overlooked in the past. However, payments for environmental services were originally designed as tool for natural resource management and not poverty reduction. At the same time, natural resource management and poverty should not be thought of in separate sectors but very much interdependent upon each other for sustainability. In recent years links between access to natural resources and poverty have only

strengthened the need to focus more on this interaction. The most well developed payment for environmental services program in the world is in Costa Rica. The World Bank BioCarbon Fund has of late provided support for payment for environmental service projects in Costa Rica under the rules of the Clean Development Mechanism of the Kyoto Protocol. The Clean Development Mechanism also provides new guidelines and methodologies for the expanding regulatory and voluntary carbon markets. An enhancement of the payment for environmental services program in Costa Rica through funding from the World Bank BioCarbon Fund brings with it power dynamics that did not exist before and any design without proper stakeholder engagement may skew design according to their perception of the opportunity costs. Perception of the opportunity costs impacting the asset base can be stronger than the actual statistical relevance of the opportunity costs. For this reason, designing projects with a goal of improving a dynamic asset base by properly understanding the goals of all stakeholders in a project is critical to improving livelihood outcomes of the most vulnerable.

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Foreword

This major paper is in partial fulfilment of my MES degree. Therefore, the major paper contributes to the title of my area of concentration for my plan of study; '*Sustainable Livelihoods in Marginal Environments'*. My area of concentration is primarily concerned with non industrialised countries. As a result my research on the topic of payment for environmental services under the rules of the clean development mechanism in southern Costa Rica helps to contribute to the knowledge of my plan of study for two of the three major components; sustainable livelihoods and ecosystem management.

This project provided me with a stronger knowledge of the sustainable livelihoods approach not only in doing the background research but also in the data collection. I was able to gain a much deeper knowledge of the sustainable livelihoods approach through my research of systems theory and panarchy. This helped me to build a strong theoretical model for using the sustainable livelihoods approach as an appropriate tool for poverty analysis. To better understand the perception of social benefits towards the project my interviews were centred

on the sustainable livelihoods framework. This aspect of the research also allowed me to focus on two other important objectives; social capital and public participation. Although public participation was not a key part of the project or my research it was an important part of the discussion. My understanding of public participation previous to my proposal and implementation of my research also guided me in my use of the Q methodology, which focuses on statistical correlation of the perception of people. Social capital on the other hand is an important aspect of the sustainable livelihoods approach and became a central aspect of my research analysis.

My knowledge of ecosystem management was also enhanced by engaging in this research. One of my specific objectives was to better understand how the reforestation and afforestation components of Clean Development Mechanism (CDM) under the Kyoto Protocol can be used as a tool for ecosystem management. In doing my research in Costa Rica on a payment for forest environmental services that was defined by the rules of the CDM I was able to get a unique perspective on how the CDM mechanism design and payment for forest environmental services programs interact. This contributed in large part to my understanding of how people perceived how effective payment for forest environmental services were and whether the CDM is actually able to be a tool for ecosystem management. My background research also provided me with the ability to better understand the carbon market which improved my knowledge of how the CDM fits in the regulatory market. Aside from this background research generated I also did readings on natural resource management which helped to increase my knowledge of how ecosystems are managed.

Both the sustainable livelihoods approach and ecosystem management also overlapped in many ways and this major paper helped to bring these two components closer together. Sustainable livelihoods represented social systems whereas ecosystem management represented ecological systems. This major paper helped me to recognise that social and ecological systems cannot exist in a vacuum but are intrinsically interconnected. In other words, the health of one system is very much dependent on the other. This obviously has big impacts on project design when if the focus is on either the environment or for social purposes. In industrialised countries we fail to see the value in this approach and have slowly separated humanity from nature, often to our own detriment. People in developing countries on the other hand are often far more dependent on ecological systems for their livelihoods. In the end the background research, data collection, and analysis helped me to synthesise the importance of not thinking about social and ecological systems in reductionist terms but within a more holistic framework.

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Chapter 1

Introduction and Methodologies

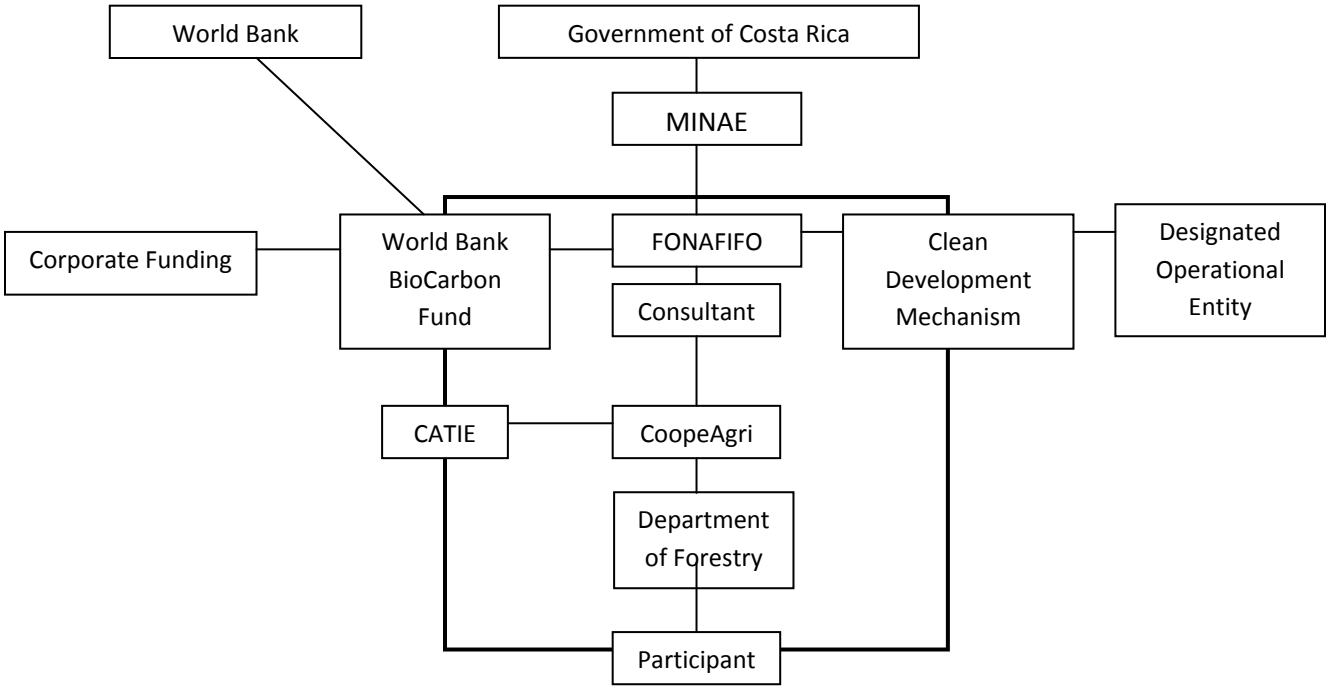
Project Background Information

The project this research is focused on the interaction between payment for forest environmental services programs, the Clean Development Mechanism and the impact this has on livelihoods. This project had three different payments for forest environmental services activities; agroforestry, commercial plantations and natural regeneration. The goal of the project is to plant trees or promote natural regeneration that will encompass 4,140 hectares. The majority of this land (60%) is for commercial reforestation, with 30% for natural regeneration and the remaining for agroforestry. Farmers are paid a flat rate per hectare for reforestation and natural regeneration project and per tree for agroforestry projects. The project is being laid out over three years. The ending of this past annual year (2007) was the end of the second year of the project. Funding was sourced from the World Bank BioCarbon Fund and the project was designed by FONAFIFO (The National Forest Financing Fund) in collaboration with CoopeAgri's department of forestry (Cooperativa Agricola Industrial y de Servicios Multiples el General R.L.). Guidance was provided by the World Bank BioCarbon Fund so as to meet the requirements for the Clean Development Mechanism.

Figure 1 indicates the stakeholders directly and indirectly involved in this project. The institutions that are inside the dark box were more directly involved in the process of this project. The World Bank BioCarbon Fund was an important stakeholder which put up the

majority of the start up capital necessary to design and implement the project. This fund was established as a way to facilitate the development of methodologies for the reforestation and afforestation of the Clean Development Mechanism within the Kyoto Protocol. It has further served as a means to improve standards for both the voluntary and regulatory markets. The support for this funding has come from a combination of government and corporate donations.

Figure 1: Stakeholder model for project



FONAFIFO is the government department that coordinates payment for environmental services in all of Costa Rica. The funding support for this department comes from ingenious collaborations with private sector groups such as hydro electric dams and fuel taxes. For this

project FONAFIFO acted as an intermediate between the World Bank BioCarbon Fund and CoopeAgri. There was very little interaction between the later two stakeholders.

CoopeAgri is a large cooperative with around 12,000 members, and approximately another 5,000 members in Credecoop. Their work is only in the county of Perez Zeledon. Therefore the project also takes place within the geographical boundaries of Perez Zeledon. The majority of members of CoopeAgri are involved in either coffee or sugar cane.

The forestry department at CoopeAgri had been involved in payment for forest environmental services for ten years before this project began. So in reality this is not a new project but a new funding source with a wider range of stakeholders. The number of people that can be accepted into the national payment for environmental service program is a long list, which is limited primarily due to the limited internal resources within Costa Rica. However, the majority of the people in Costa Rica are primarily interested in receiving payments for protecting primary forests and not necessarily planting new forests. Due to the fact that the project's primary objective was to sequester carbon, the protection of primary forests could not be included. Instead the inclusion of agroforestry and commercial reforestation were allowable. This aspect was easy as FONAFIFO and CoopeAgri had already been paying for these types of environmental services over the past ten years. However, this proposal also included natural regeneration as a means to sequester carbon. Natural regeneration is a new activity added to the payment for forest environmental services program in Costa Rica as a result of this project.

A few private consultants were hired by FONAFIFO to put together the final proposal which outlines the design, justification and implementation of the project. Participants played a lesser role in the development and implementation of this project. The participants include people who have been actively engaged in this project since 2006. Participants also refer to the people who attended three different stakeholder meetings with the World Bank BioCarbon fund in the three different regions prior to approval of the project. Not all of the participants of these meetings became participants. The Clean Development Mechanism, although there is a physical office, represents more of a process within figure 1, with the World Bank BioCarbon Fund acting as the intermediate between FONAFIFO and the Clean Development Mechanism. CATIE is the research institution that provides the certified seed for the nursery that CoopeAgri maintains and sells to the participants.

Aside from these main institutional stakeholders there were other more indirect influences in this project. Outside the box are institutions such as the World Bank, Government of Costa Rica, MINAE (Ministry of energy and environment), designated operational entities and corporate funding. The World Bank does not fund the World Bank BioCarbon fund even though the BioCarbon Fund exists under the World Bank (see chapter 4). The designated operational entities were created under the rules of the Clean Development Mechanism as an independent way to verify and certify carbon credits (see chapter 4). Designated operational entities are independent companies that are qualified to carry out these tasks. Due to the fact that this project is in just finishing the second phase of three phases the designated operation

entities have not yet been involved in the auditing process. MINAE is the government department responsible for overseeing the FONAFIFO.

Problem Statement

Payment for forest environmental services has the potential to create sustainable livelihoods. Proper design and implementation of such payment programs can diversify income sources, provide better health, and build stronger social networks for the people connected to forest ecosystems. However, poor design can also have devastating effects on livelihoods. If the project design focuses too much on the environmental services and not on the well being of those whose lands supply the environmental services than livelihoods strategies will be reduced.

For this reason the research question for this major paper is '*Do the reasons for participation in the payment for forest environmental services under the rules of the Clean Development Mechanism in cooperation with the World Bank BioCarbon Fund have any relationship to the sustainable livelihoods framework?*'

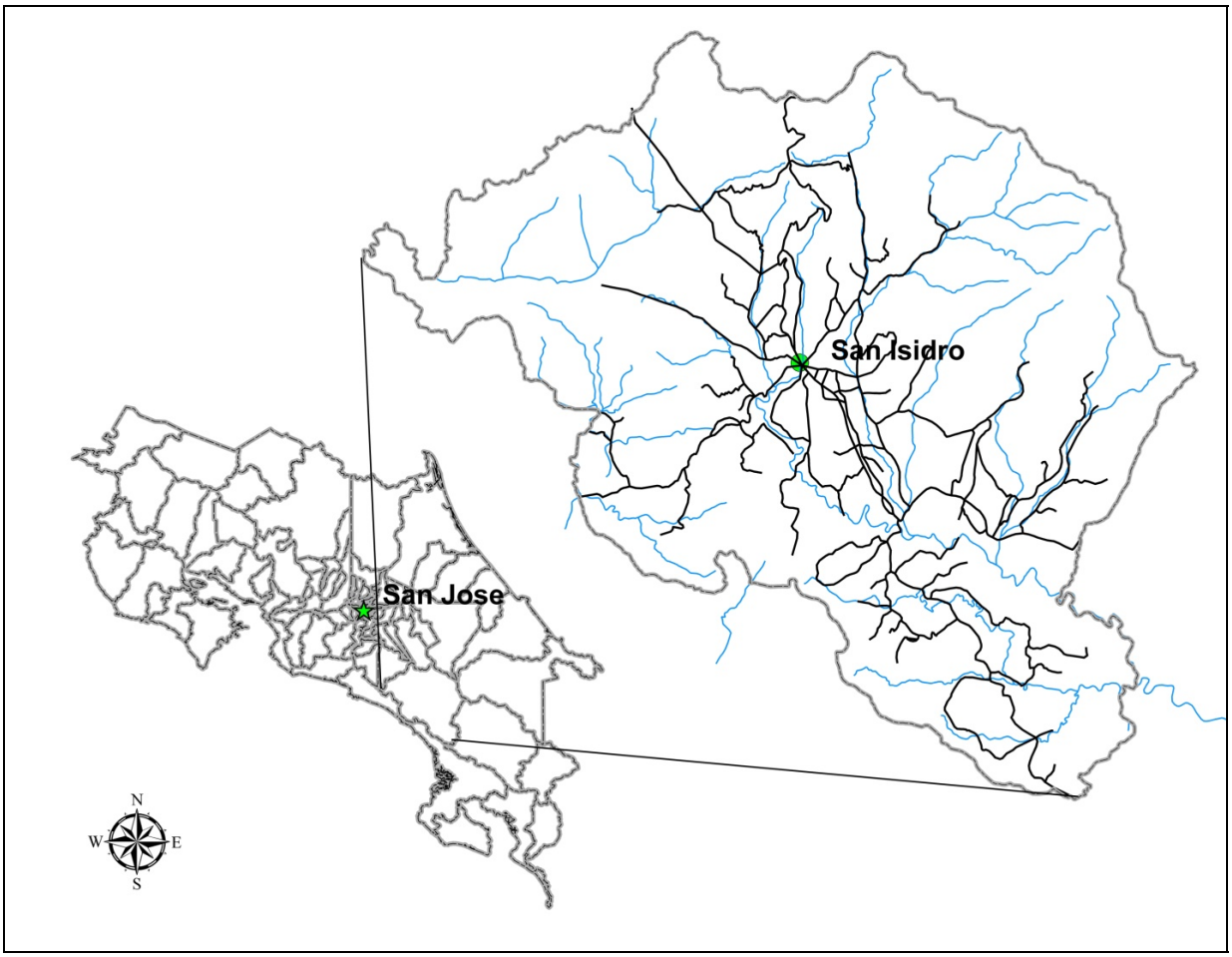
The related objectives that address this research question are;

1. To document the level of participation and the current progress of the project to date.
2. To identify the stakeholders involved in the Clean Development Mechanism project and their respective roles.
3. To portray a multi-stakeholder model within the context of the sustainable livelihoods framework.
4. To understand the context of environmental service programs in Costa Rica and the relation to the current Clean Development Mechanism project.
5. To understand the relationship between sustainable livelihoods and the Clean Development Mechanism project.

The Study Area

This project took place in the county of Perez Zeledon which resides the province of San Jose. Perez Zeledon is in the southern part of Costa Rica and lies closer to the Pacific Ocean (Figure 2). The capital and largest town in Perez Zeledon, San Isidro, is in the centre of the county. The total area of the county is 252,058 hectares.

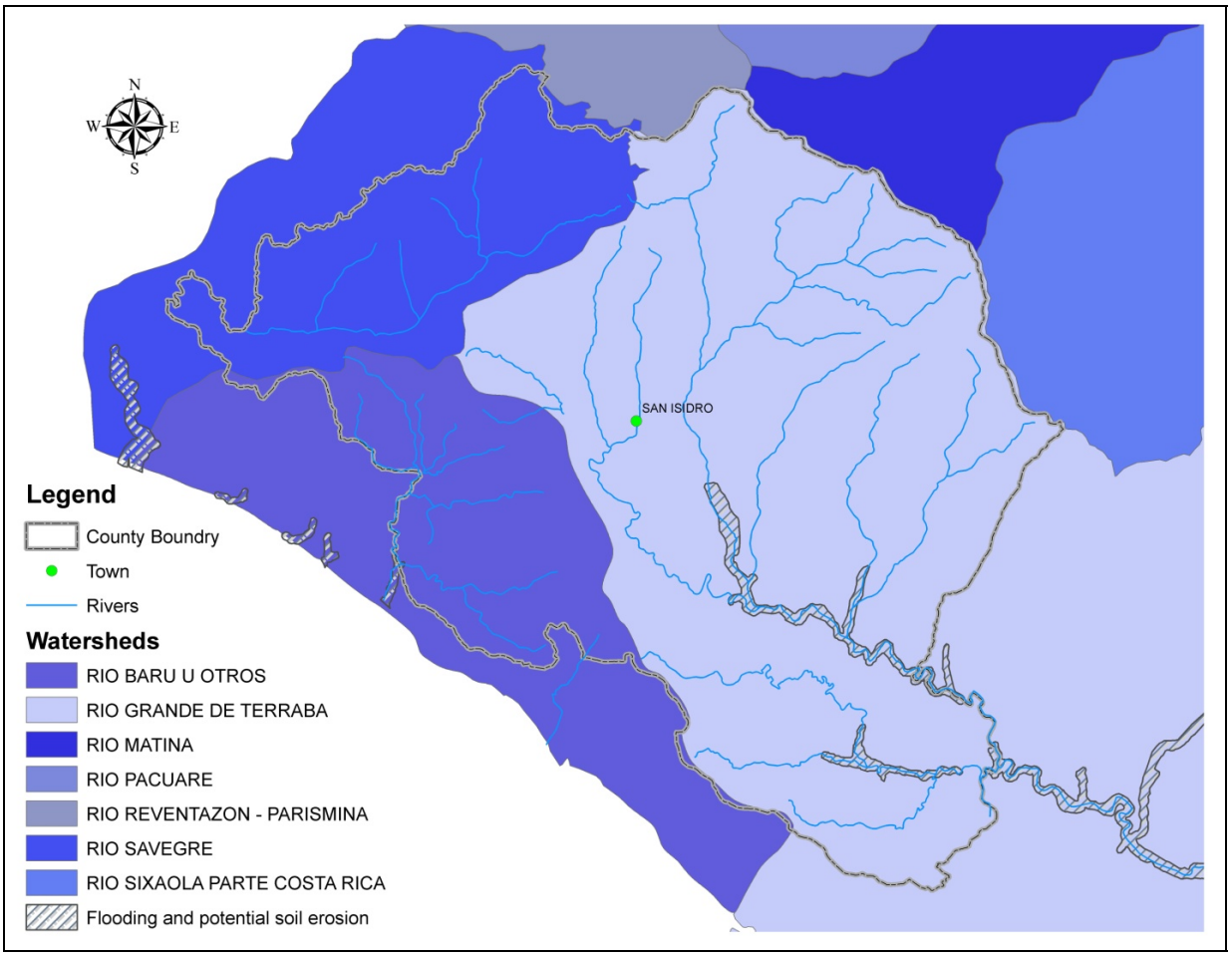
Figure 2: County of Perez Zeledon



The county is defined by three watersheds; Rio Grande de Terraba, Rio Baru and Rio Savegre (figure 3). However, the Rio Grande de Terraba has the biggest influence on the region. The Rio Grande is fed by three main rivers which originate in the northern hillsides; Rio Pacuar, Rio

General and Rio Penas Blanca. Rio Baru watershed runs towards the Pacific Ocean and the Rio Savegre watershed runs toward the north, but both are small watersheds in comparison to the Rio Grande de Terraba. As indicated in figure 3, this watershed also contributes to the biggest potential of soil erosion in the county.

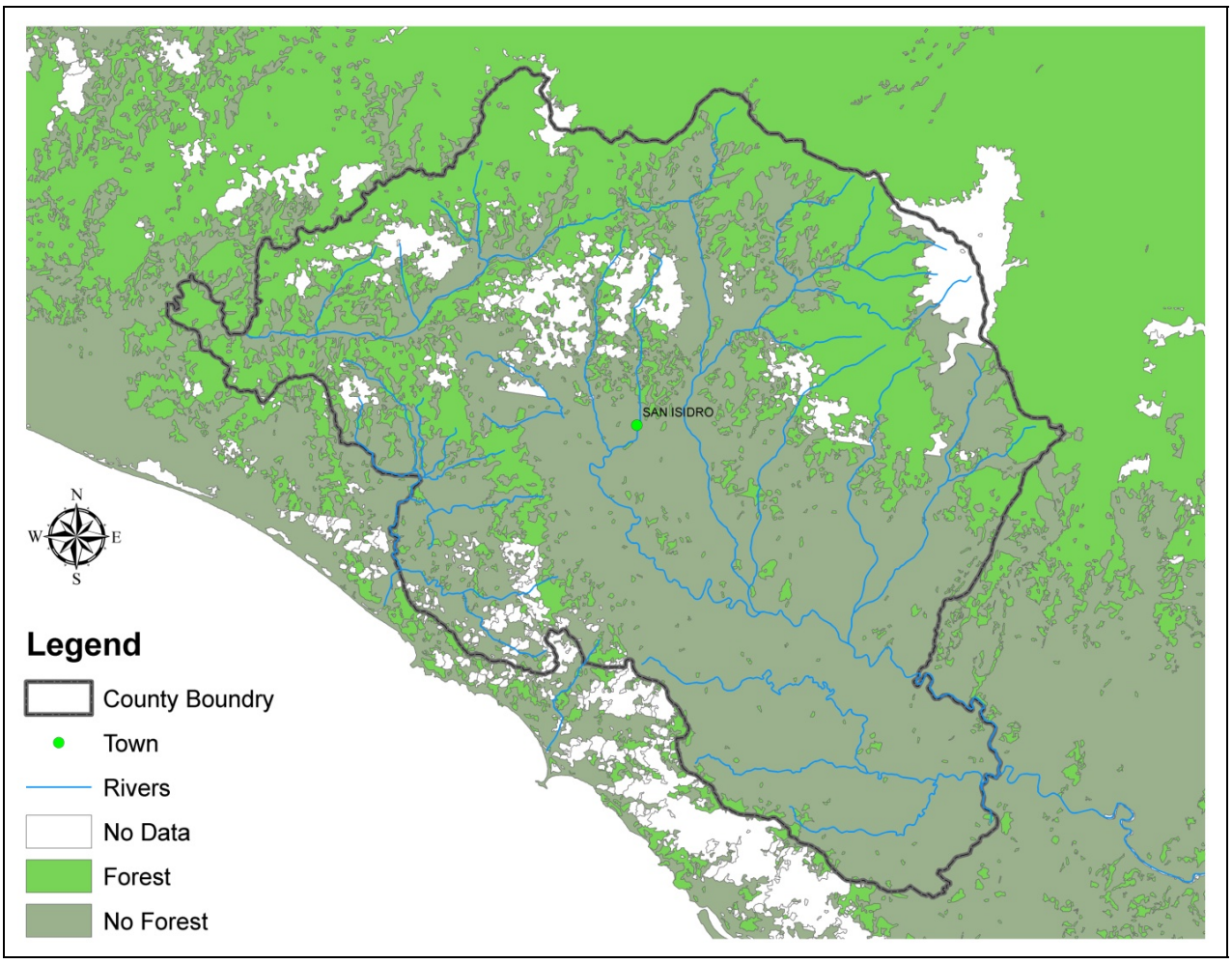
Figure 3: Distribution of Watersheds in Perez Zeledon (Geografica, 2000)



Perez Zeledon is defined by the Rio Grande de Terraba. The Rio Grande flows from the north-west to the south-east. In northern region is Chirripo National Park (highest mountain in Costa Rica at 3,800 metres), which is where the source of the water comes from. The region various from 800 meters to as high as 2200 meters. Much of the northern region of county is very remote. The main farm activities are agriculture or animal husbandry. Due to the

elevation Arabica coffee is commonly grown here. This region also has the greatest level of forest cover (figure 4).

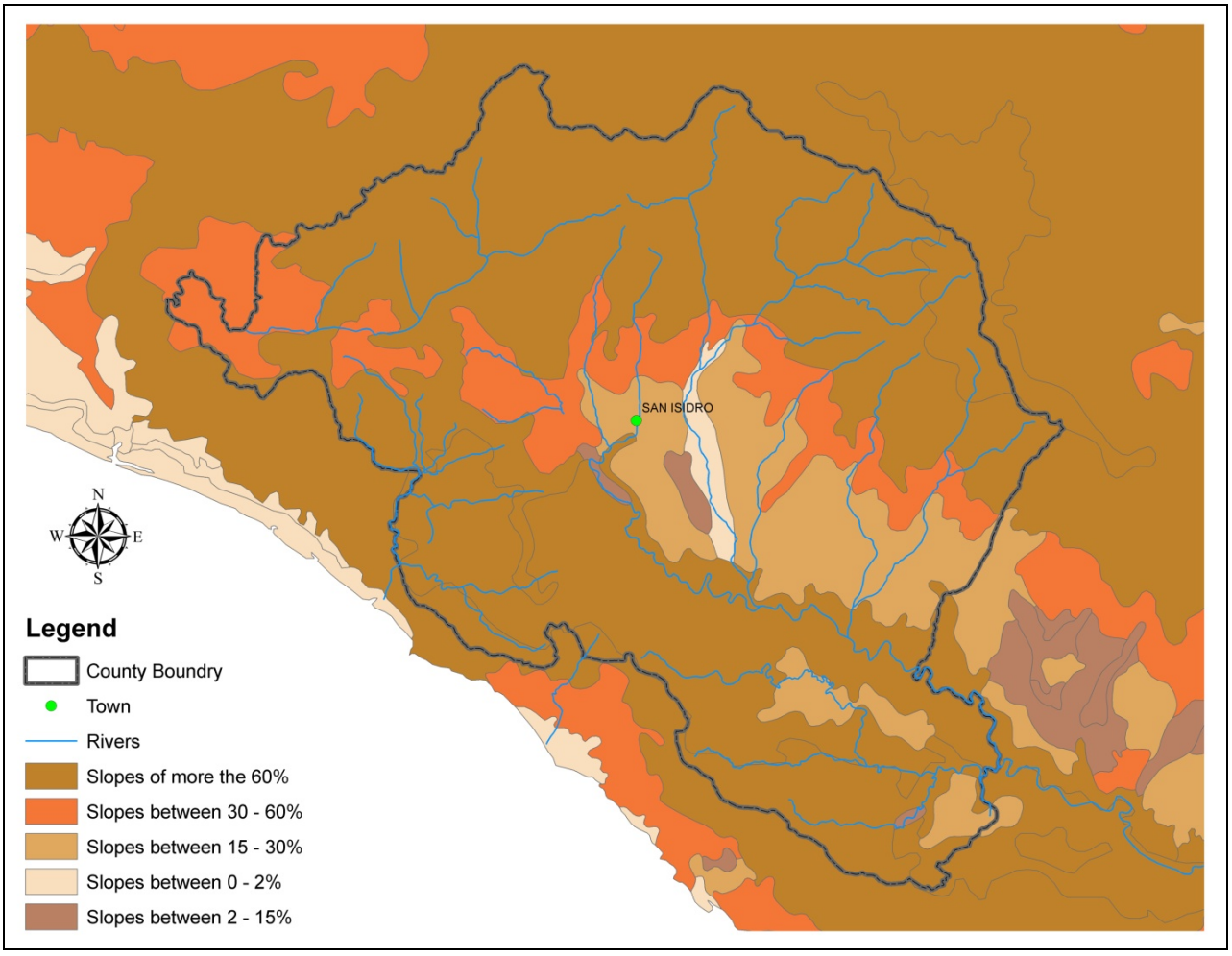
Figure 4: Forest cover data from 1997 (Geografica, 2000)



The Rio Grande, fed by water from the northern hillsides, collects in the valley. The water from the hillsides, as well as the volcanic sediment that has been carried by the rivers, has made the valley the most agriculturally productive part of the county. For this reason the valley is also the most populated. The capital and largest town in the county, San Isidro, lies at the centre of the valley. The region is generally flat (Figure 5) and only ranges from heights of 400 meters to 800 meters. The main economic activity in the valley is the harvesting of coffee,

sugar cane, and pineapple. As a result of these economic activities there is very little forest cover in the valley.

Figure 5: Land characteristics of Perez Zeledon(Geografica, 2000)



The south is also relatively hilly compared to the valley. Elevation can range from between 700 metres to 1200 metres. Slopes can reach up to 60% (figure 5) and cause serious erosion problems. Agriculture and animal husbandry are the main economic activities here. However, much like the valley there is very little forest cover with pasture land competing for most of the land in the region. The southern region of the county does play an important role biologically however as it borders the *Paso de la Danta* biological corridor which is part of the Mesoamerican Biological Corridor.

Methodology

The methodology of collecting data to meet the objectives of the research question took two approaches; quantitative and qualitative. Qualitative information was collected using primary data gathered through informal interviews with members of institutional stakeholders (i.e. FONAFIFO, CoopeAgri, private consultants) and with participants of the project in the county of Perez Zeledon.

The majority of information gathered however, was quantitative information. CoopeAgri was the main source for secondary data with reference to the project. The maps used in this research were compiled with the help of information from the Technological Institute of Costa Rica in Cartago and shape files that were made available by the department of forestry at CoopeAgri. Quantitative information was also gathered though the collection of primary data in the form of a questionnaire.

Secondary data

a. Database

One of the main objectives of this research was to document what the project had accomplished to date. In order to do this, access to all the documents in the department of forestry at CoopeAgri was necessary. Although all of the information was generally within the office it was not easy to analyse the project holistically without having all the data in a central location. This made the design of a database important not only to analyse the data but to

improve CoopeAgri's understanding of the project as it grows. The database was designed using Microsoft Access 2003 (sample page in appendix A).

The database was separated in four sections. The first section documented general information such as information about the person, where they lived, and other civil information. The second category focused on specific information about the project, such as GPS coordinates of the project, name of the community, and area in hectares of the project. The third section was reserved for specific information on activities and tree species planted for the various activities. The last section was used to enter qualitative information about the quality of the trees planted during regular field visits by the staff of CoopeAgri.

As mentioned earlier all of this information was collected with the help of the staff in the department of forestry at CoopeAgri. The information was found in both hard and soft copy. Information was also changing during the time of research as projects were visited. As a result of the database the information was than able to be updated instantly.

b. Mapping

All property area of a potential project had to be delineated by a cartographer before the participant could engage in an activity. The project boundaries are then delineated by staff from CoopeAgri. This information is required by FONAFIFO (government department responsible for the payment of the environmental service). Recently one staff member at CoopeAgri had started creating digital and geo-referenced project parcels. The object was to develop a better

spatial idea of where their projects were taking place. However, they had never been able to put the maps of the county together with the project parcels.

I collected all the project parcels from the forestry department at CoopeAgri along with geo-referenced maps of the region from the Technological Institute of Costa Rica. The purpose of collecting this information and putting it together was to give a spatial representation of the impact of this specific project.

This research combined the information from the geo-reference maps and the project parcel maps using ArcView GIS 3.3 and ArcView Desktop 9.1. This information was not only valuable for spatially representing the extent of the project, but also for CoopeAgri's benefit. However, only projects parcels starting in 2007 are represented in this research due to the fact that CoopeAgri has only started to document in this manner. The project parcels in 2006 were not created.

Primary data

a. Questionnaire

Aside from documenting the project to date an important goal of my research was also to understand why people chose to participate in this project. In order to do this a questionnaire was designed to assess the perceptions of participants and institutional stakeholders. The questionnaire was modeled using the sustainable livelihoods framework (DFID, 1999; Scoones, 1998). The focus of the framework is to understand the dynamic nature of livelihoods in any socio-economic situation. The strength of this tool is in analysing why poverty exists in certain

livelihoods. This tool does not generate specific solutions to these problems per se, but only identifies where the gaps in the design and implementation need to be further addressed.

Before the questionnaire could be used to obtain data officially for the research it went through a testing phase. The clarity of the questionnaire was tested because the questions needed to be phrased using the appropriate language in order for many of the farmers to understand. The questionnaire was tested with two staff members within the department of forestry at CoopeAgri on numerous occasions in October and November. The questionnaire was also tested with farmers on the weekend of October 24th, 2007 in Quizzara of Cajon district. There were initial difficulties especially with the question about vulnerability. Although the question was not changed it was necessary to confirm every time whether or not the interviewee understood the question, and if further explanation was necessary. The other question that was adjusted during the testing period on numerous occasions was the question relating to social capital because of confusion over how best to define what it meant in the context of Costa Rican society. Once the official questionnaire had been established private interviews were conducted by using the questionnaire to obtain the information. The interviewee was asked the questions using the questionnaire and the interviewer recorded their answers on the questionnaire (appendix B). All responses were confirmed before recording the information in the survey. The majority of the questions were designed first with a yes or no option and then interviewees were given the opportunity to expand on their answer without being prompted.

Due to the fact that livelihoods directly depend upon assets[1] this is also the core part of the questionnaire. The core questions (see appendix B) from three to seven addressed whether or not participants thought this project contributed to the asset base. The five assets discussed were natural, financial, physical, human, and social. Human capital, for instance, was broken down into questions about health and education with respect to the project. These questions required yes or no responses. Following these questions interviewees (if they answered yes) were asked to expand on how they thought this project contributed to the respective capitals.

This part of the interview allowed interviewees to respond without being prompted. The responses provided a varying degree of answers that had thematic points. The idea of not prompting interviewees was also used in question two. This question intended to get participants to think about why they were participating in the project, before the questionnaire narrowed down the project into the different assets. Asking this question also helped to confirm whatever answers were given for number eight.

Number eight asked the interviewees to rank the five assets against each other in order of importance with regards to the impact they had on their livelihood. This provided the central piece of data with which the questionnaire was referenced. By leaving it later in the questionnaire valuable first impressions were asked while the interviewee was also able to first think in more in depth about the project.

[1] An asset (or capital) refers to resources with which individuals relay upon for their livelihood strategies. A more intensive discussion will occur in chapter 1.

A major focus was also to understand the motivation for participation. Question number ten addressed whether or not people would have participated without receiving a payment for the environmental service and also if they would engage in different activities than the one they were already participating in.

Along with number eight, number eleven was an important question for understanding people's perception of the future impact of this project. Number eleven used the five outcomes defined in the sustainable livelihoods framework and asked interviewees to rank how they saw this project impacting the future of their livelihood.

The final question focused not on the participants view of the project but on what they thought other people's view of the project was. This question also asked for solutions to whatever barriers they mentioned. In attempting to address the impacts, the questionnaire also addressed how more people could be involved in this project in the future.

The interviewing took place in early November until the middle of December. The interviews occurred in either the office of the department of forestry or while making field visits with the staff. The targeting of the interviewees was random. However, as the results show (table 17 and 18) there was a good distribution across activities, genders, regions and institutions. Those that came into the office and were interviewed were often there to sign contracts and therefore were new participants. On field visits the participants that were interviewed were normally from the previous year or had been partnering with CoopeAgri for many years previous to this project.

b. Database

A database was created using Microsoft Access 2003 (sample page in appendix C) to record all of the information on social impacts. This was the same database that was used to document the project to date so that information on participants could be connected more easily.

c. Qualitative

Aside from the questionnaire there were many informal interviews with staff that represented different institutions including CoopeAgri, FONAFIFO and private consultants. The purposes of these interviews were two-fold. Interviews with institutional representatives were used to build a model of all the institutions involved in this project and their relationships with each other.

The second reason was to get a better general knowledge of the project at the beginning of the research stage. This initial information helped to generate technical knowledge about the project. All of the people interviewed informally were also surveyed in either November or December. These informal interviews occurred between a private consultant for FONAFIFO and various staff from CoopeAgri.

Analysis

a. Software

There were four programs used in order to analyse the quantitative data in this research. SPSS 14.0 and Microsoft Excel 2003 were used to analyse the project information and the social benefits. ArcView GIS 3.3 and ArcView Desktop 9.1 were used to analyse the map data.

b. Secondary data analysis

Pivot tables in Microsoft Excel 2003 were generally the most used method to break down the quantitative information in the secondary data analysis.

c. Primary data analysis

In order to understand why people participate and the relationship of this project to the sustainable livelihoods frame work, understanding people's opinion was important. To do this the Q-methodology was employed. The Q methodology is an approach used to measure subjectivity based on a variety of statements (S. R. Brown, 1996; Kalof, 1997; Stephenson, 1953; Webler, Tuler, & Krueger, 2001). Where the 'r method' is used to measure correlation between variables across a range of subjects, the Q methodology looks for correlations between subjects across a variety of variables.

The statements are referred to as a 'concourse'. Within the concourse are statements about a specific issue on which participants are required to give their opinion. This stage is called the 'q-sort'. The q-sort requires that participants look at the options available and sort them relative to each other.

The concourse or statements that the questionnaire focused on are found in number eight of appendix B. There were five statements on what they perceived to be the most important aspects of this project with respect to the asset base of a livelihood. Participants were asked to rank which of the five assets listed had the greatest impact in their opinion. In this 'q sort'

participants would assign a number between one and five for the five options. There were no negative votes in the scale, only positive. Therefore, as correlations between individuals is calculated there is no disagreement, only that the project did not contribute to the asset base and that some people have different opinions about which assets were more important than others. Due to the fact that the q-sort was not set up for people to disagree on the impact of certain assets, all correlations are relatively high.

All the information is than represented using a correlation matrix. The correlations themselves are not interesting but the factors that drive certain correlations are. The Q methodology enabled the ability to understand which groups were more likely to have common attitudes about a given issue. For this reason, the methodology is a good process for using cluster analysis (Kalof, 1997). Groups were than clustered according to the different socio-economic statuses to analyse the perceptions regarding the various capitals and how the perceptions of the impact of the project would affect their future outcomes of their livelihoods. The analysis involved looking at gender, activities, land size and source of income. Clusters that showed evident patterns were used to analyse the remaining aspects of the project.

Finally, outcomes and asset bases were correlated using the Pearson's correlation coefficient. This was used to show how interventions of certain capital are perceived to lead to certain outcomes and what this says about project design.

Chapter 2

Paradigm Shifts in Poverty Analysis: Panarchy and the Sustainable Livelihoods Approach

Introduction

If someone were to ask you 'what does poverty look like', what would you say? Would you say poverty looks like a child with dysentery, a refugee camp, or houses made of mud? Would you say poverty is any of these things? The truth is while these generalizations are what defines how we think of poverty; it is just not the whole story. If we think that poverty is a child with dysentery than our solution to that single need or problem may be to provide the child with medicine as opposed to understanding the variety of underlying causes and addressing those problems. This type of poverty analysis has always been very linear in its approach. A solution is applied to a single need or problem that has been identified. However, poverty does not live in a vacuum. Poverty must be analysed outside of the box.

If we reduce poverty to isolated problems and solutions we do not capture the complexity and diversity of reality (Robert Chambers & Conway, 1992). Poverty is defined by its environment. The environment is not only a physical representation but also the multitude of relationships that exist within. Therefore the understanding must be that poverty is defined where social and ecological systems interface.

In order to understand these interactions poverty analysis needs to move away from reductionist thinking and engage in a new epistemological approach. This new approach is derived from systems[2] thinking. Systems' thinking has evolved into many different branches that are brought together in a more cohesive model called *panarchy* theory. Using panarchy theory as a theoretical model for how systems organize can then be applied to poverty analysis frameworks such as the sustainable livelihoods approach.

Panarchy

Panarchy brings together components of complexity science as well as complex adaptive systems. The roots of complexity theory occur at the convergence between order and chaos theory (Figure 6). At this convergence is the 'edge of chaos' (Langton, 1990). The 'edge of chaos' is where systems are in balance and have stability. Chaos theory was established in the early 60s when Edward Lorenz discovered the 'butterfly effect' (Jackson, 2000). The 'butterfly effect' was used as an analogy to describe how initial conditions in a system (i.e. input) could have unpredictable results (i.e. output). These unpredictable shifts led to the conclusion that cause and effect relationships should not be assumed.

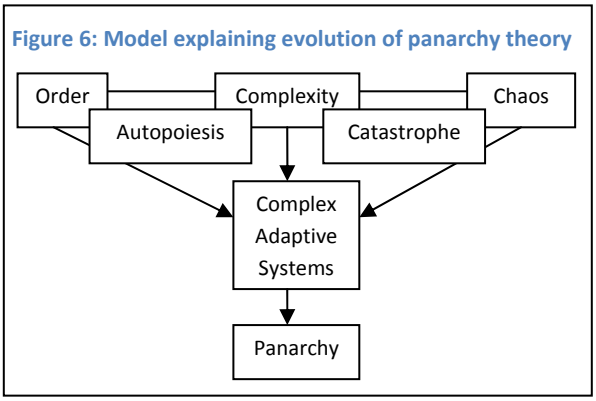


Figure 6: Model explaining evolution of panarchy theory

[2] The term systems will be used to describe the regular interactions of components that form a unified whole. For example a social system consists of the interactions of humans in a particular space. An ecological system represents all living organisms' interaction within a given space.

Catastrophe theory took chaos theory a step further. Catastrophes occurs when a system can have more than one stable state, or can follow more than one stable pathway of change (Casti, 1994; Poston & Stewart, 1978; Woodcock & Davis, 1978). As a result, one stable state that supports certain agents within a system could switch to another stable state that may inhabit very different agents. These phases shifts; known as bifurcations[3], occur because of feedback mechanisms. A positive feedback mechanism will reinforce change and a negative feedback will dampen that change. If an input into a system is governed only by positive feedbacks than changes will continually accumulate, possibly without creating any noticeable difference. A phase shift occurs when a critical threshold is reached due to these accumulated changes.

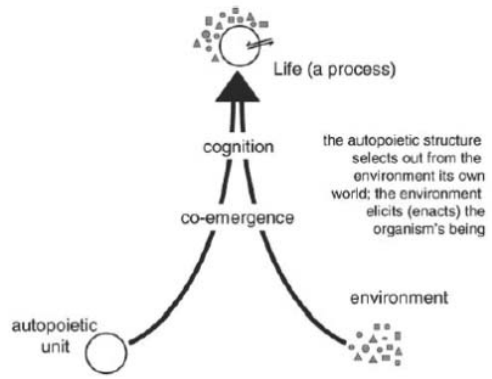
If positive feedback mechanisms govern social and ecological systems there would be no stability and nothing would be able to survive. Therefore, despite the apparent randomness that was evident in empirical studies there was also a sense of order. A system tends toward an 'attractor[4]" although never reaching an equilibrium point. For this reason catastrophes are rare events. However, when they occur they are often unpredictable and unexpected. In order to maintain balance the system is kept within the 'edge of chaos' by both positive and negative feedback mechanisms. These mechanisms are built upon time dependent variables (Thietart & Forgues, 1995). Time dependent variables or historical memory is referred to as autopoiesis.

Autopoiesis is the Greek word that literally translates as 'self producing' and is used to describe what life is. The cell is the basic autopoietic unit. A cell is unique because it is capable of self producing through a network of complex chemical reactions that occur and enable

[3] Bifurcations are the point where an input can take an unexpected alternative path.
[4] An attractor is a fixed location which a system maintains equilibrium around although never reaching it

regeneration of the systems components (Maturana & Varela, 1980; F. Varela, 1979; F. Varela & Maturana, 1998; F. Varela, Maturana, & Uribe, 1974). The most important system component is the boundary, or the cell wall. The nucleic acids, proteins, and enzymes all work towards the production of itself. The concept of a self producing unit also infers that the cell has autonomy. So despite the cells dependence on an external medium for input, there is no dependence on the external medium for survival. Therefore there is a structural coupling (Maturana, 1987) to the environment and cells develop cognition (Luisi, 2003) of their surroundings (Figure 7). If changes occur in the external medium there are two choices for the cell, accept the change or die. Changes in the environment may be a result of other structurally coupled cells reorganizing within the system. In this sense, a network of structurally coupled cells *is* the environment. Over time this network develops a historical memory (Mingers, 1989). The interactions develop complex time dependent relationship by constantly self organizing. A constant self organization of autopoietic units demonstrates different levels of emergent properties. Emergent properties develop into higher levels of structural complexity (Mingers, 1989).

Figure 7: Cognition of Autopoietic units and Environment(Luisi, 2003)

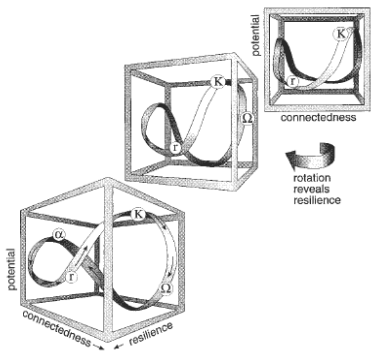


Therefore complexity is the interactions that develop into emergent properties of higher structural complexity due to self organization, rapid changes of state, a strong path dependence on future conditions based on historical events, and chaos (Judd, 1990). However, complexity theory could only explain *why* emergent properties existed; complexity could not explain *how*

they emerged. How emergent properties build the scalar and structural complexity of systems was supported by the theory of complex adaptive systems.

Properties emerged through the adaptive process by using three mechanisms; *combat*, *trade*, and *mating* (Holland, 1992). All three mechanisms required the interaction of agents[5] within a system. As agents come across other agents in a system they undergo an evaluative process of each other and themselves. The agent's accumulated resources and defensive mechanisms against the other agent determine which mechanism is chosen. The more these interactions occur the more rational they become a part of everyday interactions. Certain agents will develop niches and other agents will remember those. While this discussion only refers to two agents interacting, more agents interacting only increase the complexity. Agents must compete and cooperate with each other to maintain their own autonomy which leads to co-evolution, inextricably linking them together in a perversely dependent way. Emergent properties develop out of this continual battle of relativity. In the end, the learning, which agents engage in through interaction, is fundamentally the same as evolution and adaptation (Waldrop, 1992).

Figure 8: Three dimensional adaptive cycle(Holling & Gunderson, 2002)



Panarchy brings together these theories of complexity and complex adaptive systems and builds a conceptual model called the adaptive cycle (figure 8). The adaptive cycle has three properties; *potential*, *connectedness*, and *resilience* (Holling & Gunderson, 2002). These are presented by the *x*, *y*, and *z* axis

[5] An 'agent' is the language that Holland (1992) uses. An agent in this context is the autopoietic unit. However, an agent in a system can refer to any living organism within a system.

respectively (figure 8). The *potential* refers to the available resources and the quality of those resources. *Connectedness* refers to the degree of control that agents in a system have over resources in the system. The last property, *resilience*, refers to the amount of stress an adaptive cycle can absorb before the system changes structure by changing the variables that control the behaviour (Adger, 2000; Folke et al., 2002; Holling & Gunderson, 2002; Scheffer, Carpenter, Foley, Folke, & Walker, 2001; Walker et al., 2002).

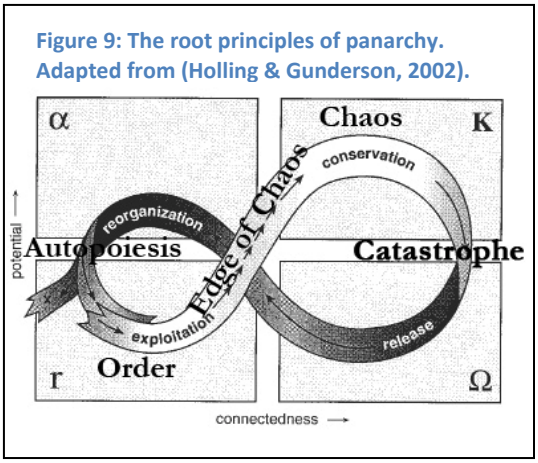


Figure 9: The root principles of panarchy. Adapted from (Holling & Gunderson, 2002).

The adaptive cycle (figure 9) also has four functions; exploitation (r), conservation (K), release (Ω), and reorganization (α) (Holling & Gunderson, 2002). Agents interact in adaptive cycles between these four properties continuously. The stage from exploitation (r) to conservation (K) is referred to as the front loop and this is where (in terms of complexity theory) the 'edge of chaos' would exist. At the centre of this front loop is where the 'attractor' or point of equilibrium occurs. The exploitation (r) phase there will be a wide diversity of agents who all have low potential, poor connectedness, but a high resilience. The potential of agents grows as they accumulate available assets and as a result the connectedness between agents grows stronger. Agents accumulate these assets using the Holland's (1992) three mechanisms; *combat, trade* and *mate.* However, *trade* and *mate* are more likely to occur on the front loop while *combat* is more likely to occur on the back loop. As the system becomes more connected and a historical memory develops some agents will be lost in the process and will be spun off into other adaptive cycles or just die (which in reality still contributes to the whole system). The agents that remain will become more tightly

connected as 'winners' take control. If the system is pushed towards the conservation (K) phase the system becomes more predictable and has less resilience because there are more resources between fewer agents. The further agents move away from the centre the more likely reorganization will occur.

The back loop (transition from the release (Ω) to reorganization (α) phase) occurs when there is a catastrophe. While the front loop is very slow and takes time to build, the back loop is very fast. As the adaptive cycle grows more rigid any amount of stimuli can start cataclysmic collapse. The collapse is fuelled by the release of all the accumulated resources (Holling & Gunderson, 2002). Once critical thresholds are passed there is a great degree of uncertainty over which agents will gain control. The closer the adaptive cycle moves toward the reorganization phase, the more new emergent properties (i.e. agents) will be evident. The new adaptive cycle may have entirely different agents and may exist as an alternative state that is not habitable by the previous agents. This depends on how catastrophic the event was. As new interactions are tested with available resources the adaptive cycle reaches another threshold and certain agents in the adaptive cycle are no longer deemed necessary. The remaining agents will pick up the discarded resources. As these new agents in the adaptive cycle recognize each other and the degree to which they can coevolved (i.e. combat, trade, mate), the potential will begin to grow again. The adaptive cycle will move toward a stronger degree of order as it rebuilds.

The adaptive cycle therefore embraces two opposites: growth and stability on the front loop; change and variability on the back loop (Holling & Gunderson, 2002). Growth and stability

represent the 'edge of chaos', while the back loop represents the catastrophic or chaotic events that occur unexpectedly.

Most of the discussion so far has focused on catastrophic events that completely alter the state. This is not the rule though. When agents move too far from an attractor, the adaptive cycle can still reorganize without a complete catastrophic event. A perpetual self organization can occur without complete collapses. Catastrophic events and growth are controlled and kept in balance by other adaptive cycles of varying 'speeds[6]". The speed of an adaptive cycle controls the ability to adapt to changes in the environment. Slower and larger adaptive cycle levels are emergent properties of faster and smaller adaptive cycles (Holling & Gunderson, 2002). If enough potential is reached adaptive cycles can grow into higher levels within a panarchy. These new levels are slower and have a difficult time adapting to changes. However the slower adaptive cycles have more stability and therefore have built a collection of 'memories' that were gained from attributes of faster cycles as agents emerged. For this reason, larger adaptive cycles tend to protect the unpredictable faster levels below them. At the same time the faster levels are able to invigorate new ideas from below. Collapse occurs when the slower adaptive cycles do not have enough 'memory' to react to a stimulus and bring down all cycles below them.

Within a panarchy there may be multiple adaptive cycles (as indicated above) but also nested adaptive cycles (Holling & Gunderson, 2002). Adaptive cycles can represent one agent or multiple agents. The process of interaction occurs at multiple scales and produces patterns that

[6] Speed refers to the ability to respond to external stimuli.

become reinforced by the same patterns and are self organized (Kauffman, 1993). Various interactions of adaptive cycles at multiple scales contribute to the dynamic and unpredictable behaviour of agents and panarchies.

In the same way that complexity is represented in the adaptive cycle, complex adaptive systems are represented in the multiple adaptive cycles the make up a panarchy. Panarchy conceptually brings together complexity theory and complex adaptive systems into a model that is used to describe how systems organize.

Sustainable Livelihoods Approach

The sustainable livelihoods approach[7] (figure 10) is an appropriate model for analyzing poverty because it reflects the same characteristics seen in panarchy theory. Both panarchy and the sustainable livelihoods approach (SLA) use as their foundational principles the notion that analysis must move away from reductionist thinking and embrace holism. While panarchy is a theoretical model, SLA is the practical model of how best to analyze poverty.

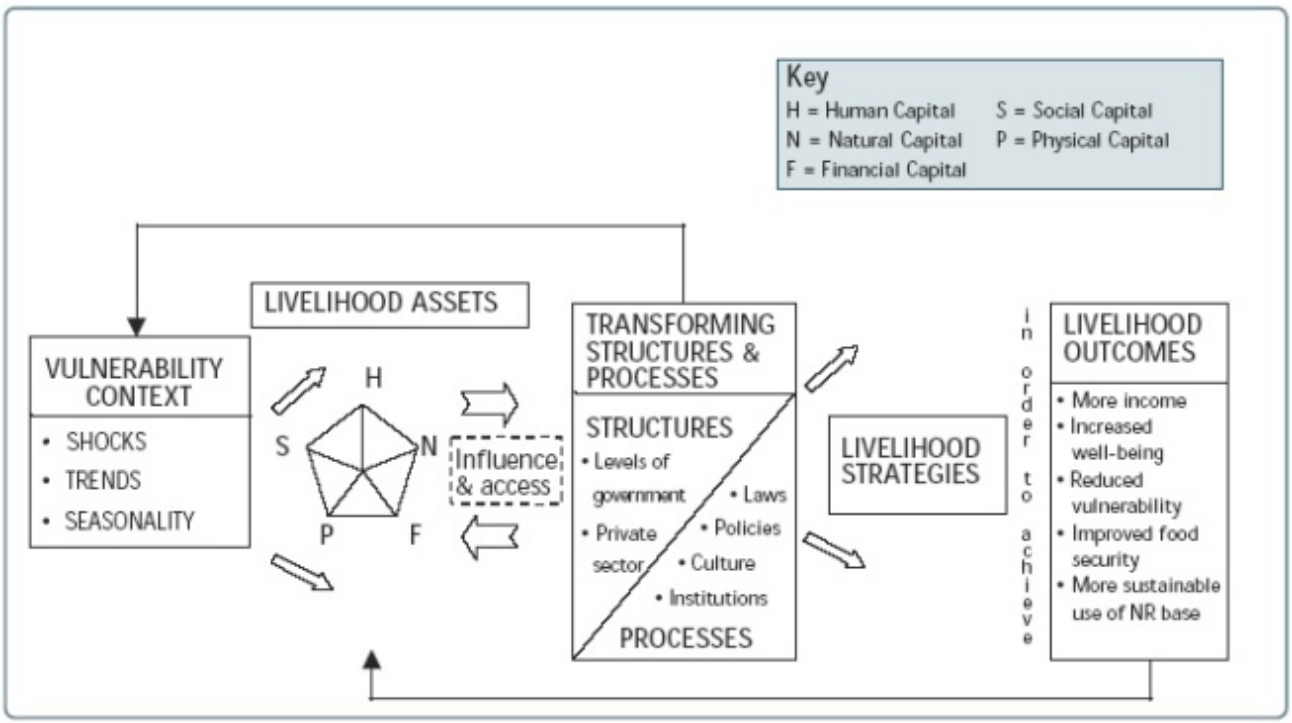
The sustainable livelihoods approach[8] consists of five components; *vulnerability context, livelihood assets, transforming structure and processes, livelihood strategies,* and *livelihood outcomes* (Ashley &

[7] The sustainable livelihoods approach is also referred to as a framework (which is represented by figure 4). However the sustainable livelihoods approach is never referred to as method as they are defined depending upon the situation.

[8] The sustainable livelihoods approach is also very flexible. Although this paper uses the DFID (1999) model, many organizations such as CARE, UNDP and World Bank have adapted the model to their own specific situations (Hussein & Nelson, 1998).

Carney, 1999; Robert Chambers & Conway, 1992; DFID, 1999; Johnson, 1997; Scoones, 1998). These components are not to be understood as being reductionist, but as components all interacting together in a way that impacts livelihoods. Furthermore, the arrows indicated in the framework do not indicate a cause and effect relationship but only a degree of influence (DFID, 1999). These arrows should be thought of as feedback mechanisms.

Figure 10: Sustainable Livelihoods Framework (DFID, 1999)



The *vulnerability context* is schematically drawn on the far left of figure 10 because it exists farthest from the control of the livelihoods it affects. Vulnerability is a result of prior changes and not the future stresses (Kelly & Adger, 2000). These vulnerabilities could be shocks (i.e. natural disaster, economic collapse, or droughts), trends (i.e. population, politics, economic), or seasonality (i.e. production, employment, prices). The *vulnerability context* directly influences the access and quality of *livelihood assets*.

Livelihood assets are at the core of what makes a livelihood sustainable. Understanding the asset base and how it affects livelihoods is an important step away from traditional linear poverty analysis. The assets that livelihoods depend upon are human, natural, financial, physical, and social capital[9].

Human capital is the degree of skills, knowledge, ability to labour, and good health that people possess (Ostrom, 2000; Scoones, 1998). Human capital is often traded for other forms of capital. Different levels of human capital can also enable greater access to capitals other than financial. Human capital is often easy to measure quantitatively through levels of literacy, lifespan, child mortality, etc. However, there are qualitative things such as ability to engage, debate, or negotiate that provide advantages for *livelihood strategies* that cannot be measured (Sen, 1997).

Natural capital is the nutrients in the soil, land, forests, water, air quality, erosion protection, or the degree of biodiversity that is available for human use (Scoones, 1998). Natural capital is the asset most affected by the *vulnerability context* (DFID, 1999), because ecosystems have a harder time adapting to vulnerability than people do. Nature has the capability of remembrance, but humans and social systems have the capacity of consciousness and reflexivity (Westley, Carpenter, Brock, Holling, & Gunderson, 2002). Natural capital is not only the direct

[9] Capital (or asset) is considered an endowment, However, capital means nothing unless it can be utilized (Johnson, 1997). Once utilized, assets become a resource. Capital in itself is not the solution; access to assets is what is important.

productive value that land provides to livelihoods, but all the environmental services ecosystems that are included as well.

Financial capital is the available stock (liquid assets, savings, cash) and regular flow of money (i.e. income, remittances) (DFID, 1999). The approach to development in the 80s focused on the creation of financial capital as a way out of rural poverty (Bebbington, 1999). That meant measurement of poverty only accounted for those generating a formal income and did not recognise the many informal livelihoods in which people were engaged. However, the importance of financial capital should not be discounted. Financial capital is the most versatile asset (DFID, 1999) and most easily transferable to other forms of capital. On the other hand, financial capital is also the least available asset for the poor. Although many livelihoods have financial capital in the form of liquid assets (i.e. livestock, tools, bicycle, home, land), these assets depreciate over time. If static growth occurs than a livelihood actually deteriorates (Sachs, 2005). Due to these facts financial capital is very important to livelihood but at the same time cannot be thought of as the sole capital a livelihood depends upon.

Physical capital is the basic infrastructure that facilitates future production and income generation (Coleman, 1988; Ostrom, 2000). For this reason, building physical capital is tied tightly to the traditional paradigm that focuses on increasing financial capital to reduce poverty. However, physical capital can also improve health and education (human capital) by building schools and hospitals. Most physical capital investments are considered a public good and are often at the expense of natural capital because they must alter the environment in some way.

Lastly social capital is the shared knowledge, networks, connections (vertical or horizontal[10]), trust, understanding, norms, rules and expectations about patterns of interactions that groups of individuals (Coleman, 1988; Ostrom, 2000; Putnam & Goss, 2002) use to generate livelihoods. Social capital is often neglected because there is difficulty in assigning a quantitative measurement. However, the old adage 'it is not what you know, but who you know' indicates the power of social capital. Social capital is the most recent addition to the livelihood asset base (Bebbington, 1999) and perhaps the most important also. The potential in the other capitals is increased by the degree of social capital a person has (Coleman, 1988; Johnson, 1997; Ostrom, 2000; Putnam & Goss, 2002). Social capital is important because the indication is that no other capitals can be utilised in a vacuum. Bebbington (1999) even goes as far as to say that access to other actors is more important and must come before access to other assets for developing livelihood strategies. Social capital makes the critical micro-macro link that is so important in livelihood analysis.

The importance of political (Ashley & Carney, 1999) and cultural (Bebbington, 1999) capital also deserves mention within the context of social capital. Both are often recommended as additional components of an asset base analysis. The difficulty is that cultural capital, although very important, is even more difficult to measure than social capital. Assets are normally viewed as only providing for livelihood goals, but assets also provide a meaning to life for many people (Bebbington, 1999). The cultural values of nature, familial relationships, livestock or

[10] Vertical connections are characterised through macro levels of society such as different levels of government or organisational hierarchy, while horizontal connections are characterised through more micro levels. This is commonly seen through community organisation.

traditions have far deeper meanings that cannot be measured quantitatively but are important aspects of analysing livelihoods.

Political capital also does not receive enough attention. Political capital is included to emphasise the need for a stronger rights based analysis to the sustainable livelihoods approach (Ashley & Carney, 1999; Conway, Moser, Norton, & Farrington, 2002). There is a lot of validity to this because it reemphasises the importance of a 'bottom up' approach facilitated by the *structures and processes*. The difficulty is that any governing *structures and process* rarely see the need to facilitate empowerment, but only pay lip service. A more law binding approach to creating necessary micro-macro linkages are vital instead of letting the process unfold as if they were self-evident (Ashley & Carney, 1999). The problem with the latter approach is that the notion of empowerment actually only encourages the perpetuity of power. Power cannot be created from nothing but requires effective de-powerment of other institutions. De-powerment should receive just as much attention as empowerment. For these reasons political capital is an important aspect of livelihood assets.

All assets have an interdependent dynamic relationship that can generate potential and degradation for livelihoods. Any capital can be used to acquire other capitals (Johnson, 1997) as has been shown. Therefore, assets are continually being traded to secure desired livelihoods outcomes. Likewise, any capital can easily be degraded without complete control. Complete control is never possible as any livelihood is in cooperation and competition with other livelihoods at the same time. Enabling better access to livelihood assets requires influence with the *structures and processes*. Greater access to assets will generate greater influence, but greater

influence will also generate better access to assets. An interdependent relationship exists between influence and access, which is why social capital is an important aspect of the framework.

The *transforming structures and processes* are visually central in the framework, but also conceptually, because it determines access to resources, which define how livelihood strategies are chosen. The *processes* are the 'rules of the game' which consists of the policies, legislation, institutions, power relations and culture (Scoones, 1998). The *structures* are the public, private, commercial and civil societies that implement the *processes*. The *transforming* aspect means that, like livelihoods, the *structures and processes* are constantly adapting. For many authors in the literature this is the most important aspect for enabling livelihoods (Bebbington, 1999; Carney, 2003; Conway et al., 2002; Johnson, 1997; Scoones, 1998). *Structures and processes* often do not operate at the same level that *livelihood strategies* do and therefore limit the access to assets.

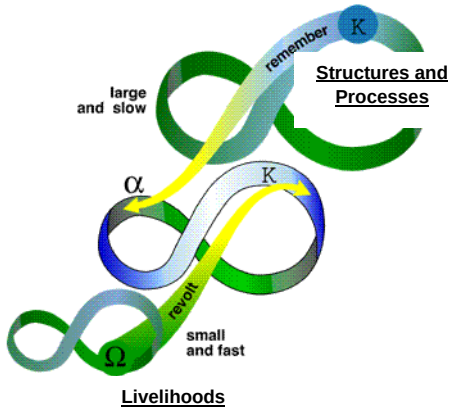
The *livelihood strategies* are the choices and activities people make based on the access and ability to utilise those assets. Often when access is limited the common strategy is to diversify strategies. So while some strategies may seem to be unsustainable they are often born from a rational desperation (Robert Chambers, 1997). The more complex the diversity of strategies the more difficult it is to understand the livelihood.

The *livelihood outcomes* are the achievement of these strategies. Outcomes are indentified/measured through improvements in income, increased well-being, reduced vulnerability, improved food security, and the more sustainable use of the natural resource base

(DFID, 1999; Scoones, 1998). As indicated in the framework figure the chosen outcomes have a strong influence on the asset base and create a positive feedback mechanism.

Panarchy and the Sustainable Livelihoods Approach

Figure 11: A panarchy of multiple adaptive cycles (adapted from Holling & Gunderson, 2002)

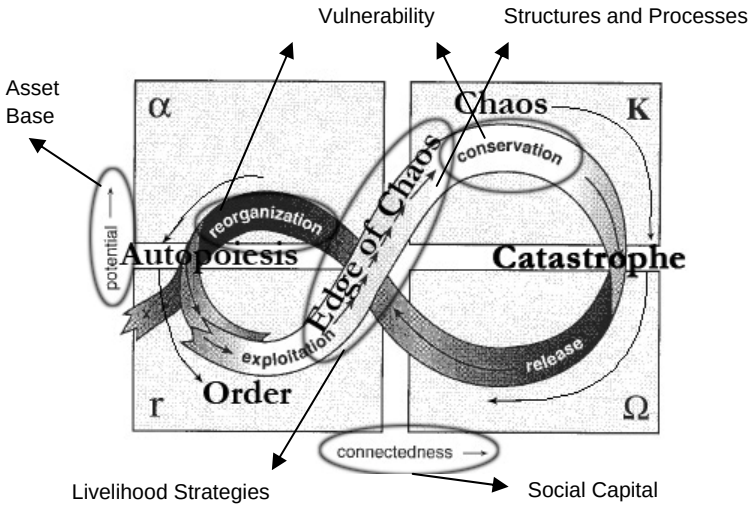


Due to the emphasis of this approach on complex and dynamic interactions, SLA has strong correlations with panarchy. As defined earlier a panarchy is the multiple interactions that occur simultaneously between multiple adaptive cycles of different speeds (Holling & Gunderson, 2002). The sustainable livelihoods framework is a panarchy consisting of interacting adaptive cycles. Adaptive cycles are the *livelihoods* and the *structures/process* that govern them (figure 11). Livelihoods are faster and quicker to adapt than the slower structures and institutional memories that have emerged. The *vulnerability context* and the asset base define how sustainable the various adaptive cycles are (figure 12).

Much of the context of the panarchy discussion above focused on collapses of adaptive cycles due to catastrophes. However, reorganisation can still occur without the complete collapse of an adaptive cycle. In fact, *structures and process* are emergent properties of smaller faster adaptive cycles. If enough potential is accumulated than new larger and slower adaptive cycles

will develop (Holling & Gunderson, 2002). Diamond[11] (1999) has illustrated how early civilisations developed organisational structures as the accumulation of resources grew. The *structures/ processes* were enabled because there was no need for everyone to produce food and other necessities. However, *processes and structures* were needed to maintain a sense of order.

Figure 12: Integration of SLA and Panarchy (adapted from Holling and Gunderson, 2002)



Giddens (1984) describes in his 'theory of structuration' that social systems are not internalised by people, but are defined by 'knowledgeable agents[12]' constantly monitoring interactions with one another. Therefore, the social system is an emergent property. The social system emerges naturally as a way to bring order and efficiency to livelihoods. Livelihoods did not emerge from the *structure and processes,* but define them.

The key to the development of *processes* is communication between people (Giddens, 1984; Luhmann, 1986). *Processes* are developed to remember the multitude of interactions that are constantly occurring between people. If every situation required communication, as if it were

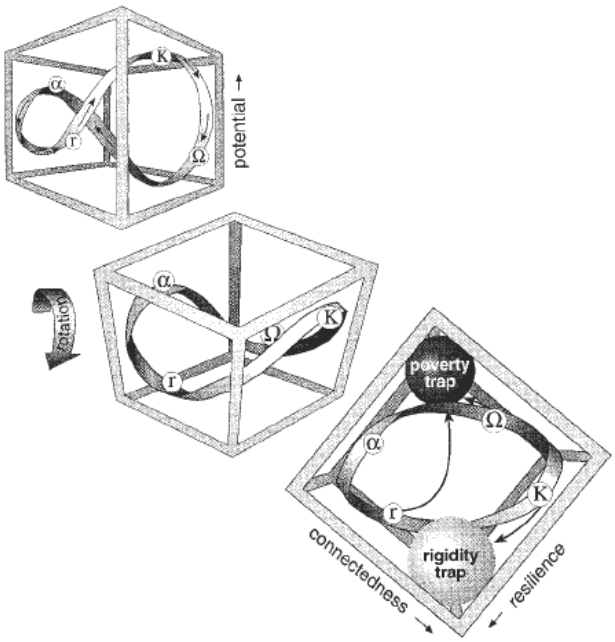
[11] Jared Diamond is a professor physiology at the UCLA School of Medicine and a former Pulitzer Prize winner for *Guns, Germs and Steel.*

[12] From this point on the paper will refer to the agents (elements) as people as it is within the context of the sustainable livelihoods now.

the first time, than there would be too much information to remember and the result would be chaos (Luhmann, 1986). As people come across new situations where there is no memory of how to react than new rules are established. Information that results from communication will than define how all humans interact. The *processes* require structures to interpret and implement (Giddens, 1984). The *structures and processes* are a result of these interactions of groups of people who interact long enough and create a shared set of understandings, norms or routines to integrate action (i.e. *processes*), establish patterns of dominance and resource allocation (i.e. *structures*)(Giddens, 1984; Westley et al., 2002).

Depending on the speed of the adaptive cycle, there are different forms of institutional memory embedded in them which are invaluable for linking livelihoods to *structures and processes*. For example, livelihoods that are dependent on traditional knowledge are beneficial to others within a community (Fikret Berkes & Folke, 2002). However, if these forms of cultural and traditional knowledge are not understood by slower adaptive cycles than broken linkages occur. The broken linkages also create problems because adaptive cycles may be changing faster than slower adaptive cycles are able to change. Broken linkages could also occur between the *structures and processes* and *livelihoods* if the *structures/processes* have not emerged naturally from livelihoods. If the *structures/processes* are 'propped up', without an adequate institutional memory, than they are neither effective protectors or able to learn from smaller and faster cycles. In the end, livelihoods result in poor access to assets.

Figure 13: The poverty and rigidity trap (Holling & Gunderson, 2002)



Despite the fact that *structures and processes* are adaptive cycles that emerge from the accumulation of resources, slower adaptive cycles can also be abused. The poverty and rigidity trap (figure 13) (Holling & Gunderson, 2002) is an example of the importance of the *structures and processes*. A poverty trap occurs when the potential or diversity have been eradicated through misuse by the *transforming structures and processes*. The potential exists in the asset base. Therefore, if there is no potential existing in the asset base than the choices of *livelihood strategies* are reduced. The result is that multiple adaptive cycles collapse and are not able to reorganise because there is no longer any potential in the adaptive cycle. Connectedness and hence reorganisation will only occur when there are assets available to attain through 'combat, trade, or mating' (Holland, 1992). At the same time, many adaptive cycles are suppressed because the remaining resources may be in the hands of slower adaptive cycles (i.e. government, the elites), which will create a rigidity trap. The faster cycles cannot influence the slower cycles because they do not have the means for organisation anymore.

A breakdown has occurred between the *livelihood* and the *transforming structures and process* adaptive cycles. The asset base is in the control of small group of tightly networked people and the smaller adaptive cycles have no way to 'revolt'. Within the sustainable livelihoods

framework, social capital is the asset that enables a 'revolt' to take place. Social capital is the necessary link that holds adaptive cycles together but also creates potential from the existing asset base. Within panarchies, the degree of social capital among people allows for accumulation of assets.

If an adaptive cycle is reorganising (i.e. back loop) new networks will develop between people. However, poor linkages may develop horizontally initially and will undergo a brief period of polarisation before the relationships become more institutionalised (Scheffer, Westley, Brock, & Holmgren, 2002). Better networks and trust that are built over time will lead to better more sustainable livelihoods. Social capital can also be used for negative purposes though (Ostrom, 2000). Highly connected adaptive cycles can lead to control over resources by fewer people as is the case with the rigidity trap. The degree that social capital is being utilised within an adaptive cycle defines the connectedness as well as the potential of the livelihood.

The remainder of the livelihood asset base; physical, human, economic and natural are also vital for livelihoods. Within the livelihood adaptive cycle the asset base is the potential and conceptually exists outside the cycle. However, none of the assets (including social capital) can be utilised without understanding the dynamic effect it causes on other asset bases. All five assets are inextricably linked. Each asset becomes dynamic because different livelihoods have different interactions with the asset base.

If social capital and the livelihood assets define the connectedness and potential of an adaptive cycle, than resilience in the adaptive cycle is defined by how well utilised the connectedness and

potential are together. As resilience in the adaptive cycle decreases, than vulnerability grows, creating an inverse relationship. In the adaptive cycle, vulnerability grows in livelihoods when connectedness and potential grow simultaneously. For example, the livelihood becomes more vulnerable as the resources are accumulated in the hands of a small minority. Within the *vulnerability context* 'trends or seasonality' may slowly accumulate as connectedness and potential increases. A 'shock' in an adaptive cycle, which is increasing in vulnerability, may cause a collapse or create a poverty and rigidity trap.

Livelihood strategies become more diverse as the situation becomes more vulnerable. A certain degree of diversity in livelihoods is often necessary, but too much can lead to high uncertainty also (Hussein & Nelson, 1998). A severe drought that causes famine or conflict reduces livelihood strategies to coping strategies can end up on the back loop of the adaptive cycle. On the back loop there is a lot of diverse strategies, but also high degree of uncertainty which may result in loss of life at the expense of others also competing for survival.

The dynamic behaviour of livelihoods that has been discussed in this paper identifies one final important correlation between the sustainable livelihoods framework and panarchy. The sustainable livelihoods framework is dynamic because of feedbacks[13] between adaptive cycles of livelihoods and the *transforming structures and processes*. The most important feedbacks occur between *transforming structures and process* and the *vulnerability context; livelihood outcomes* and *livelihood assets*. The balance between positive and negative feedbacks are important for

[13] Livelihood literature refers to negative feedbacks as ones that decrease sustainable livelihoods and positive feedbacks as promoting livelihoods. This paper will use positive feedbacks to mean amplifying an interaction whether it is good or bad to be consistent with panarchy language.

maintaining integrity of livelihoods. If the mechanisms that provide the imbalance between positive and negative are understood than vulnerability can be reduced and asset bases could be strengthened. The *vulnerability context* also influences the integrity of the asset base, which than influences the *structures and processes* component. This creates more sustainable strategies, which influence the asset base and will improve vulnerability, greater access to *structures and processes,* and finally greater strategies and *livelihood outcomes.* If balance is maintained between positive and negative feedbacks than growth can occur. If there is no balance than poverty and rigidity traps continue to perpetuate.

If poverty was easy to understand than the solution would already have been discovered. The first step to understanding is admitting we do not know all the answers. These answers to poverty continue to elude governments, public and private domains. However, the answers do not exist in these separate domains, but in the collected knowledge of them, the people who suffer from poverty and the action of all of them together.

Humanity not only as the ability to learn and cooperate with one another, but also the ability to engage more effectively with ecological systems. Therefore, goals of achieving sustainable livelihoods must understand how other systems organise around us. All systems are naturally in flux and design and analysis of projects which attempt to improve access to resources must reflect this dynamic behaviour. Our goals must change so that we foster adaptive capabilities while simultaneously creating opportunities (Holling & Gunderson, 2002). The achievement of reducing poverty will only truly be achieved when livelihoods are seen through this holistic lens.

Chapter 3

Managing Forest Resources for Sustainable Livelihoods: Changing our Approach

Introduction

Forests[14] are key ecological systems that have a large degree of influence on poverty and livelihoods around the world. Around 240 million people live in forested regions and 2 billion people directly depend upon forests for fuel (CIFOR). Aside from providing humans with a source of income and wood for fuel, forests also provide important ecological services such as filtering and regulating water flow, income, biological diversity and protection from flooding or erosion. The sustainable management of forests, both common and private property, are of prime importance to reducing the vulnerability of a third of the people around the world. Additionally, there is increasing evidence that despite the negative effects of natural resource degradation the poor continually adapt to the changing situation and that these adaptations need to be supported (Scherr, 2000) by the *structures and processes.*

Yet not until the Brundtland Commission, *Our Common Future,* was published in 1987 was the link between poverty and the environment brought to the attention of the world. Since then implementation of projects that address environmental sustainability and reduce poverty at local levels has been even slower with very little progress seen. Why has change been so slow to occur? Where were the gaps and what are the ways forward?

[14] In the literature forest management are often included under the broader topic of natural resource management and will be used interchangeably in this chapter.

Solutions to the Traditional Paradigms

Up until the 60s and 70s natural resources were controlled by a centralised state in many non-industrialised countries. However, with the advent of the structural adjustment programs in the 1980s many resources put towards control of natural resources was no longer possible. There were no longer resources to control the extraction of natural resources by people and to provide adequate incentives for conservation projects. As a result many states around the world moved towards a decentralisation of natural resource management (Kapoor, 2001). As decentralisation began so did the move towards participatory development through the influential work of people like Paulo Freire (1970) and Robert Chambers (1983). Participatory processes and decentralisation are often thought of in the same breath. However, decentralisation often happened too fast and local groups or communities in many non-industrialised countries were not prepared to deal with the huge responsibility of managing their natural resources. Much of this decentralisation was also occurring in countries that had very little institutional capacity at local levels. The result is that poor governance and an inability to understand the rules in the decentralisation process have become the main issues that prevent success in this transition and this continues to plague the management of natural resources today (Raik & Decker, 2007).

There is generally wide acceptance that in order to implement successful natural resource management in countries and regions that heavily depend on natural resources for livelihoods that a promotion of good governance has to be done through institutions. However, the definition of what good governance is, in terms of natural resource management, is often misinterpreted. The idea of decentralisation of the management of natural resources often uses

the words institution and organisation interchangeably. This is often a misnomer due to the simplicity of decentralising in this way. Organisations do represent a form of institutional support albeit a very narrow one. An organisation is a formal institution that is represented by an actual physical location. As the centralised state decentralised in many countries the assumption was the decentralisation meant miniature versions of itself in their respective region. This heavy leaning on the traditional and inflexible bureaucratic structure became the model for engaging in the 'new' natural resource management.

In systems terminology these formal institutions represented the upper levels of panarchies (i.e. the slow adaptive cycles). However, at local levels the formal institutions were not appropriate reflections of what institutions actually looked like or how they operated. Formal institutions at a state or provincial level may represent a necessity and natural evolution but did not represent the dynamic nature of the micro level (Mehta et al., 1999). Hence simplistic interventions proliferate.

The problem with formal institutions is that they are static and rule bound groups. The belief is that formal institutions exist in the form of an idealised community where all members are united by culture and common interests (Kapoor, 2001; Leach, Mearns, & Scoones, 1999; Mehta et al., 1999). However, individuals who make up a 'community' have different needs, may depend upon different resources, may migrate seasonally, and may continually be adapting and choosing different strategies. People in communities are made up of different castes, genders, wealth, origins, as well as other identity issues (Leach et al., 1999). The different needs of

various types of people often come into conflict with one another when trying to design a decentralised process that does not recognize this dynamic nature.

The failure of the decentralisation process through formal local government or formal institutions also failed to realise that without similar existing structures on the ground a power gap would be created. Not enough time was given for formal institutions to recognise the informal institutions that had emerged naturally over time. The result is that during the decentralisation process local elite tended to grab the power and thus have the ability to control the decision making process over who has access and how much access is granted to natural resources. So in reality this form of decentralisation actually reinforced the power dynamics (Baumann, 2000; Mehta et al., 1999) that existed before, which led to greater mistrust and reduced access to natural resources by those who often need them most. As a result a sort of rational desperation occurs (Robert Chambers, 1997). People react against the formal institutions as they do not represent them and these reactions look as if they are unsustainable and unjustified.

This dynamic notion of institutions is complicated further by the dynamic nature of ecosystems. Ecosystems, like communities are also thought to be in equilibrium (Leach et al., 1999). However, ecosystems also are constantly shifting due to pressures not only by social systems but by its own ecological issues. The deterministic, inflexible path through which formal institutions manage natural resources no longer applies when the dynamic nature of communities and ecosystems is recognised. Therefore we must conclude that the formal institution alone is not the answer and that there is a need to move towards institutions that

acknowledge both the dynamic nature of peoples' livelihoods and how these livelihoods are influenced by the dynamic nature of the surrounding natural environment (Raik & Decker, 2007).

A distinction needs to be made between formal and informal institutions. Informal institutions are 'regularised patterns of behaviour between individuals and groups in society' (Mearns, 1995). Formal institutions or organisations are a physical entity whereas informal institutions are the social norms that govern interactions between people and essentially how decisions are made (Leach et al., 1999; Tyler, 2006). Here it is easy to recognise the dilemma of formal institutions. Formal institutions have very little knowledge of how the dynamic nature of a livelihood functions. An approach to understanding how the formal institutions can better understand the dynamic nature is needed.

Natural Resource Management and the Sustainable Livelihoods Approach

The sustainable livelihoods approach provides a better way of understanding the dynamic nature of institutions in terms of improving access to natural resources. Within the *structures and processes* component of the sustainable livelihoods framework there is an emphasis for the role of both formal and informal processes and how these processes impact access to resources. *Structures* can be seen as the formal institutions while *processes* are the informal institutions. An access and understanding of both of these forms of institutions is important for improving livelihoods. Increasingly the literature has focused attention towards both social and political capital (as aspects of the asset base) as a means for people to gain better access to the

structures and process. Therefore social and political capital can be seen as supporting access to natural resources.

Social capital embodies everything that informal institutions are. As we mention in chapter 1, social capital is the shared knowledge, networks, connections (vertical or horizontal), trust, understanding, norms, rules and expectations about patterns of interactions between groups of individuals (Coleman, 1988; Ostrom, 2000; Putnam & Goss, 2002). Informal institutions and social capital govern the way people live and interact with each other. The expectations that are built on past behaviours become a precedent for how activities, costs and benefits will be handled in the future (Ostrom, 2000). An institutional memory is embedded in the way people conduct themselves and therefore act within a set of social norms. There is no physical entity that represents social capital and it is often difficult to measure quantitatively, which makes investment into social capital difficult. However, social capital is the glue that allows the better utilisation of other capitals. As a further point, research has shown that an increase in social capital among people has improved the sustainable management of natural resources (N. Landell-Mills, 1999). The opposite has also shown that a loss of local institutions or even a crisis in government has led to unsustainable use of natural resources (Gunderson, Holling, & Stephen, 1995). On a much larger scale, Jared Diamond's (2005) book *Collapse* shows how ancient civilisations collapse when trust or social capital between the 'powers that be' and those that used the natural resources disintegrate. A strong social capital can emphasise the norms and consequences of natural resource degradation with less transaction costs than exists when social capital is low. A weak social capital increases the transaction costs and attempts to

manage natural resources through heavy handed control mechanisms. While this type of policy may provide short term solutions, it will only create long term problems.

However, a strong social capital may not always have a positive effect on natural resource management. Often social capital may be strong in some groups, but then these groups can be exclusionary (Baumann, 2000; Kapoor, 2001). This type of resource management can also lead to unsustainable practices. Therefore, just as within the sustainable livelihoods framework a case for including political capital should also be made in the context of natural resource management. By not including political capital discounts the fact that power structures exist and can be exploited. The importance of emphasising political capital is that it promotes the rights and claims of people and is an important aspect of natural resource management. While social capital represents the more informal institutions, political capital represents the formal institutions.

Therefore reforms to institutions, both formal and informal, need to be addressed through proper institutional building and organisational reform to promote better management of natural resources (Fikret Berkes, 2002; Kellert, Mehta, Ebbin, & Lichtenfeld, 2000). Focusing on social and political capital are important aspects that help to increase access to natural resources such as forests. An avoidance of the costs and effort to invest in such endeavours should not be overlooked as being too cumbersome and not worth the benefits. The importance of natural resources is a vital part of livelihoods and social systems.

Chapter 4

Payment for Forest Environmental Services: Marketing Natural Resources

Introduction

With the dawn of the industrialised age humanity began to separate themselves from the services that the environment provides. Environmental services progressively began to be seen as limitless and were seen as a means to our own ends. However, as population pressures began to increase over the last century the relationship between humanity and the environment has become more strained. In many cases the environment, such as aquatic or forest ecosystems have already reached thresholds and 'flipped' to different states which are no longer usable states by human or animal populations (Scheffer et al., 2001). Additionally, there is an increasing amount of evidence that links the dependency of social systems to the resilience of ecological systems (Adger, 2000). However, the relationship between people and their environment is still treated as a linear relationship. The environment is often viewed as an endless resource waiting to be exploited, not one that needs to be maintained. The relationship between the environment and humanity is often exploited without realising that the environment has feedback loops that eventually determine our own inability to exploit in the future. A major fault in this system is the way economies are organised. Market mechanisms do not adequately include the services that ecosystems provide as part of their costing mechanisms. At the same time markets may also be the answer to the problems in natural resource management.

Market Based Mechanisms

For markets to function properly they require the efficient allocation of goods and services. This requires two characteristics; *excludability* and *rivalness*. Excludability means that exclusive ownership of any good or service is possible and may prevent others from using it (Daly & Farley, 2004). If a good or service is non excludable than it becomes an 'open access' regime. In this case no one is willing to pay for the necessary investment. Rivalness means only one person may use a unit of that good or service at any given time(Daly & Farley, 2004). In 'open access' regimes the good or service is both non-excludable and rival. Alternatively a non-rival good may or may not be affected by the number of times being used. A non-rival good does not necessarily impact society depending on the number of times it is used.

Therefore, market pricing includes in its mechanism the cost of goods and services that are both excludable and rival. Hence the market cannot efficiently allocate goods or services that are both non-excludable and non-rival. However, an environmental service is both non-excludable (i.e. cannot prevent others from using the good or service) and non-rival (i.e. no impact on society based on how often the good or service is used).

This would not be a problem except for the fact that environmental services potentially provide both positive and negative externalities. 'An externality occurs when an activity or transaction by some parties causes an unintended loss or gain in welfare to another party, and no

compensation for the change in welfare occurs' (Daly & Farley, 2004). For example, a farmer who maintains a forest within a critical watershed may provide clean and regular water flow, reduced erosion or flooding, biological diversity and the maintenance of microclimates. People living downstream benefit from these positive externalities without paying for them because the service is both non-excludable and non-rival. In the same way the service could have negative externalities if the farmer decides to cut these trees. In this case the service is reversed and people downstream suffer from this decision but can do nothing about it.

The result of the inability of the market to account for externalities often results in degradation of the natural resources that provide these ecological services because those who provide them are not compensated. However, just as markets are the problem, they could also be the solution. Payment for forest environmental services has become a popular market based mechanism used to efficiently manage natural resources.

Payment for Forest Environmental Services

The idea of payment for environmental services is derived from Ronald Coase's seminal article in 1960 called '*The Problem of Social Cost*'. Coase is a British economist who viewed economic and social systems as interconnected and that one system cannot be addressed without the other. If we focus only on economic output than social systems suffer. However, if we focus only on social systems and tax economic systems that produce negative effects than both social and economic systems will suffer. In his analogy of the negative effects of smoke stacks Coase says 'the aim of such regulation should not be to eliminate smoke pollution but rather to secure

the optimum amount of smoke pollution, this being the amount which will maximise the value of production'(Coase, 1960). Therefore a balance needs to be found. For a proper valuation of production, all services rendered should have a receipt of payment (Coase, 1960). For environmental services this payment is rarely implemented.

Yet some of the most socially valuable and important environmental services, such as services provided by forests, continue to be excluded from market mechanisms. Some of the important services that forests may provide are watershed protection, biodiversity, and carbon sequestration (Bishop & Landell-Mills, 2002; Chomitz, Brenes, & Constantino, 1999).

Watershed protection services are local benefits. Parties that live downstream benefit from protection of forests upstream by gaining a more regular water flow, better water quality, control of soil erosion and sedimentation, reduction of salinization, and maintenance of aquatic habitats(Bishop & Landell-Mills, 2002). Compensation for the upstream providers of forest environmental services is rarely recognised. Therefore people upstream are driven further to find alternative ways to compensate for these losses. The losses may include further deforestation.

Biodiversity conservation services have local, regional and global benefits. The loss of genetic diversity and endemic species has become an alarming problem due to deforestation. Services such as natural pollination are vital to agricultural productivity. Pollinators are supported (and support) within the complexity of biodiversity. The benefits of biodiversity conservation are often given more importance in western countries (not necessarily for the reasons above) and

they are generally more willing to pay for services (because they hold more of an aesthetic value rather than a perceived economic value) than governments or beneficiaries in less wealthy countries (Bishop & Landell-Mills, 2002). One industry that benefits from biodiversity services is ecotourism. Large pharmaceutical and agricultural corporations may also benefit from biodiversity conservation. Corporations involved in biotechnology and organisations committed to protecting biodiversity are the most willing to pay for these services.

Lastly, forests sequester carbon from the atmosphere. Increasing amounts of carbon dioxide emitted into the atmosphere is being blamed for the increased global temperatures and variability in weather patterns. For this reason, forests in the tropics have garnered much attention in recent years. Carbon offsetting has become a popular way for industrialised countries, companies and individuals to reduce carbon emissions by investing in reforestation or forest protection. For example, many individuals or companies flying for business or vacations voluntarily choose to offset carbon emissions by purchasing carbon credits through various companies that invest into carbon reducing projects. Reforestation projects are popular investments because it attaches a 'feel good story' to itself. Reforestation projects project this idea of promoting social improvements and environmental sustainability.

The desired goal of a payment for environmental services program is that the income of those who manage and protect forests may change from a purely a timber oriented output to ones where farmers manage land based on all these environmental services provided. However, despite these goals and desires payment for forest environmental services (PFES) was not designed as a poverty reduction strategy (Pagiola, Arcenas, & Platais, 2005). While this seems

strange (seeing as how the concept of payment for services rendered comes from Coase's (1960) theory which assumes the interconnectedness of ecological and social systems) there is an increasing amount of literature being devoted to designing PFES projects so that they can have a positive impact on poverty (K. Brown & Corbera, 2003; Natasha Landell-Mills & Porras, 2002; Pagiola, Landell-Mills, & Bishop, 2002). Yet are PFES projects able to be designed so that they support the new 'institutional' framework for natural resource management that was discussed in the previous chapter? Can PFES build social and political capital or is PFES only able to improve the efficiency of natural resource management? If PFES is only able to improve the latter and not both than we would have to conclude that such projects are not a viable option as natural resource management is not an end in itself but must also address the social impacts.

Limitations and Opportunities

There are obvious correlations between payment for forest environmental services and sustainable livelihoods when focusing on the asset base, such as natural (trees), financial (timber), human (improved health and better knowledge of forest management), physical (improved roads) and social (increased access to institutions and markets). At face value an intervention of payment for forest environmental services would seem to have a very pro-poor stance. However, there are limitations to PFES that can not only discourage the poor from participating but further alienate them socially and politically (Wunder, 2005).

As a market based approach, one of the greatest obstructions to making PFES pro-poor is that it is a self-selective process. Individuals choose whether or not they wish to participate in the

program. Each individual must weigh the opportunity costs of participating. The biggest influence for determining project location in Costa Rica's PFES program was self-selection (Sanchez-Azofeifa, Pfaff, Robalino, & Boomhower, 2007). People with low opportunity costs were more likely to participate than those that would have higher opportunity costs. Therefore PFES programs have the tendency to eliminate small landholders who do not have land flexibility. Another study in Costa Rica confirms that one of the greatest indicators for participation was the wealth of farmers, amount of land and off farm incomes (Zbinden & Lee, 2004).

Due to the fact that land flexibility is not always an option for poorer participants the length of the project is also not flexible enough (Smith & Scherr, 2002). As they are locked into long term contracts participants are not granted the same flexibility with their land. Again the opportunity cost of not participating when projects are contracted out over twenty year periods are very low.

Not only is land flexibility an issue, but land tenure or title to land also prevents many people who would otherwise wish to participate on the outside of PFES projects (Smith & Scherr, 2002). One of the prerequisites of PFES programs is that any participant must prove that the land they are submitting a proposal for must be officially theirs. The purpose of this is to avoid conflict in the future. However, many poor people do not actually have land title as they obtained the land through family inheritance or they are renting the land they are working on. For many countries the registry process and cost far outweigh the benefits of participation for poorer smallholders.

Aside from the opportunity costs mentioned above, investment into a group of smallholders to protect or plant trees under a PFES requires much higher transaction costs than a large scale plantation would be (Smith & Scherr, 2002). As a result, from a pure economic standpoint a large scale plantation would provide better return for an investment.

If an approach to improve inclusion of poor smallholders is to occur than an increase in the opportunity cost of participating would be a good overarching strategy. In PFES terms this idea is known as 'additionality'. The definition of additionality is any activity that occurs over and above the baseline study and is not 'business as usual' (Wunder, 2005). Additionality should be the framework in which PFES projects are assessed. As Sanchez-Azofeifa et al. (2007) show participation does not tend towards areas that need management of natural resources or that suffer from poverty due to resource degradation but to areas that would likely have undergone reforestation or protection anyway. There is a need than to identify priority areas through specific targeting (Zbinden & Lee, 2004) and by better use of spatial data (Chomitz et al., 1999; Sierra & Russman, 2005). Only a finite amount of monetary resources are available to pay for all environmental services provided and additionality is a vital way to spend these funds most effectively.

If additionality is successful in identifying poor small landholders than PFES projects also need to reflect the livelihood needs. As mentioned earlier the opportunity costs for small landholders to participate in either protection or planting of trees on their property is too low. Therefore projects such as agroforestry, secondary fallow forests, or community forest plantations that

provide alternative sources of income or are able to be integrated into existing livelihoods need to be added as possible projects (Natasha Landell-Mills & Porras, 2002; Smith & Scherr, 2002; Wunder, 2005).

The last two opportunities for PFES to meet the needs of poor landholders address two of the issues important for the new institutional approach to natural resource management; political and social capital. Political capital is often weak among small landholders because they are not able to make claims and access fundamental rights to their land. This is a serious impediment as many PFES projects define that land tenure and title are important aspects (and with good reason). However, flexibility in this process must be allowed to increase the opportunity cost of people who would otherwise not participate(Natasha Landell-Mills & Porras, 2002; Smith & Scherr, 2002). *De facto* rights of land should be granted to poor landholders who do not have official title (Grieg-Gran, Porras, & Wunder, 2005; Wunder, 2005). This goes against all bureaucratic tendencies project design may have, but fits more into the livelihoods realities of many people. By not addressing these issues PFES runs the risk of having local elites engage in a land grab and therefore further isolating poor landholders from potential opportunities. This is one of the greatest risks of engaging in a market based approach where only those already engaging in market based economies will be able to participate while those unfamiliar with the process will further be pushed to the sidelines.

Social capital needs to be addressed through the ability to engage in good intermediate institutions (formal) with small landholders. Intermediate institutions are able to assist smallholders to bundle projects which makes them far more attractive at a larger scale because

transaction costs are lower. This in turn helps to reduce the transaction costs for investors thereby making it a more attractive option. Intermediate institutions can also offer technical and business support services. However, intermediate institutions should not be 'top down' implementers but engage with the people so that they are able to manage by participating in their own project. Participation has been shown to be one of the keys to reducing poverty in forestry projects (Mayers & Vermeulen, 2002). The unfortunate aspect is that institutions like these may not exist on the ground in areas that are identified as priorities. Therefore projects are limited by having to first identify a good institution to work with before identifying the highest priority areas to work in.

There are many limitations to PFES projects and if designed poorly the consequence of causing more harm than good will occur. However, the opportunities for including poor landholders in PFES project process have a high potential to reduce poverty if aspects of livelihoods are addressed, such as social and political capital.

The Costa Rica Story

Costa Rica is often held up in the world as having the best and most comprehensive payment for forest environmental services program (Zbinden & Lee, 2004). Although, Costa Rica's history in preventing deforestation and promoting reforestation has not been perfect either. Costa Rica's environmental policy has been shaped over the past fifty years by recognising how dependent the country's economy was on the integrity of forest ecosystems. The progression from where the country has been to where the country is today can be thought of in three phases; laissez faire, interventionist, and hybrid (Brockett & Gottfried, 2002).

The laissez faire period began in the 1940s and was characterised by large amounts of clear cutting. The law allowed for possession of up to 300 hectares of land if half of the land was cleared and at least one livestock was kept for every 5 hectares (Brockett & Gottfried, 2002). The scale of this policy can be compared to the frontier days in North America where land was also given away with the promise of clearing it. At the time such policies made sense for increasing agricultural and livestock production. This effects of the policies established during this period have still affected the mentality of many people in Costa Rica to this day.

This policy was to have drastic effects on the landscape of Costa Rica as by 1986 only 29% of the forest cover remained (Chomitz et al., 1999). Deforestation between the 40s and 70s was considered to be among the worst in the world. By the 70s the government of Costa Rica recognised this problem and sought to develop new policies to combat deforestation. The interventionist period began with the establishment of big parks and heavy handed regulatory frameworks for forest management (Brockett & Gottfried, 2002). This new framework prevented any private landowner from cutting down a tree on their property without prior authorisation. The process was so bureaucratic that these rules were rarely followed. Due to the ineffectiveness and large amount of resources required to monitor such a law the Costa Rican government initiated an incentive system in 1979 (Brockett & Gottfried, 2002; Chomitz et al., 1999). Originally only tax deductions were allowed for sustainable forest management, but by 1986 tradable tax credits were also included. However, by 1980 structural adjustment programmes forced the government to cut back on these incentives and only small landholders were able to receive them (Brockett & Gottfried, 2002). This system existed until the early 90s

when the court ruled that the law was unconstitutionally restricting land owners on their own property (Zbinden & Lee, 2004).

In an effort to not lose the progress that had been made between the 70s and the early 90s a forestry reform took place which started the hybrid phase. In 1996 the new forestry law (no. 7575) initiated what is now known as *pago por servicios ambientales* (payment for environmental services) (Brockett & Gottfried, 2002; Chomitz et al., 1999). Driving this law was the 'polluter pays' principle. The services that this new law would pay for were carbon sequestration, watershed protection, biodiversity protection, and provision of scenic beauty(Chomitz et al., 1999). The focus of the project was on both reforestation and protection of primary forests. In order to implement this new law, FONAFIFO (*Fondo National de Finacimento Forestal*) was established. Funds were raised through various ingenious means, such as contracts with hydroelectric dams and through fuel taxes.

In order for farmers to be admitted in payment for environmental service (PES) projects they had to submit a proposal to FONAFIFO which indicated their proof of ownership, plan for the property and approval by a forest engineer or organisation. Forest engineers are 'on the ground' accountability people. They are responsible for the monitoring and verification of projects. FONAFIFO is than responsible for the disbursement of funds to the participants. As of yet payments are not based on any sliding scale or on any international carbon market. The payments made by FONAFIFO continue to be a flat rate (Castro, Tattenbach, Gamez, & Olson, 2000). In this way, although participating in a market based mechanism for environmental management, they do not abide by market price fluctuations of carbon credit.

Although there has been recent criticism that the PES program has not reduced deforestation[15], (Sanchez-Azofeifa et al., 2007) Costa Rica's environmental policies have provided a model for other countries around the world to follow and learn from. While the carbon market continues to entice more countries to develop similar payment for environmental services programs a national framework is the most effective way to implement and have an effective impact (Smith & Scherr, 2002).

Market based mechanisms for management of forests can be a better approach if some of the major design and monitoring concerns are addressed. If these are not addressed market based mechanisms have the potential to cause more exclusion and hence more poverty.

[15] Sanchez-Azofeifa et al. argue that deforestation is not reduced more due to the PES program as compared to the predecessor to the PES program. They argue that deforestation is not reduced because it is not targeting the areas of the country under critical threat. As PES is a self-selective process the areas under critical threat to deforestation perceive low opportunity costs in the PES program. While this is an important point to make about deforestation here self-selection policies will be addressed later in terms of how PES impacts poverty in the results chapter.

Chapter 5

Reforestation in the Carbon Market

Introduction

The role of reforestation in the carbon market has grown by leaps and bounds over the last six years. Reforestation in the carbon market has itself played a bigger role in both domestic and international politics as a form of investment and has created more interest in payment for environmental services.

Reforestation is not the largest aspect of the carbon market mostly due to the difficult methodologies and bureaucratic structures in place to ensure that these carbon credits are legitimate. However, reforestation or land use-land use change and forestry (LULUCF) accounts for 20% of global emissions (IPCC, 2007). The carbon market is dominated by bigger emissions reduction projects such as clean energy or waste reduction. However, if the carbon market is primarily concerned with the amount of carbon sequestered and none of the other services a forest provides will these projects also provide social benefits or is it seen merely as a way to offset carbon emissions? Since 2002 two avenues for trading carbon credits obtained from reforestation have emerged in the carbon market; voluntary and regulatory markets.

Voluntary Carbon Market

The voluntary carbon market has two aspects; a cap and trade system and a 'scattered' system. The cap and trade market system is voluntary because companies that wish to participate are

not bound by any rules but participate for the purposes of corporate social responsibility. These companies set their own targets and trade within these systems. However, there are only a few cap and trade systems that actually allow reforestation projects to be counted. The largest of these is the Chicago Climate Exchange (CCX). The only other two organisations that have established a voluntary cap and trade system for reforestation are the Oregon Climate Trust and Australian Global Forest Fund.

The 'scattered' market is growing and tends to include reforestation carbon credit more than the voluntary cap and trade system. This systems is also referred to as 'over the counter' trading (Hamilton, Bayon, Turner, & Higgins, 2007) because those that participate in this carbon market do so on a one time basis. There are numerous businesses that offer this service. This is geared towards businesses, governments, events, or private individuals trying to offset carbon footprints but who are not willing to commit to any long term carbon trading system. Reforestation makes up 36% of the 'scattered' carbon markets (Gardette & Locatelli, 2007).

In general, reforestation is an attractive option in the voluntary market because it has a 'feel good story' attached to it. However, because the market has grown so fast the standards for such projects have not been able to keep up. Also, businesses that offer this service tend to offer a certified carbon emission for much less because they have not abided by industry standards. As long as the general public is unaware of these standards, abuse of the carbon market will continue to occur.

Regulatory Carbon Market

The formulation of the regulatory carbon market began back in 1997 when the Kyoto Protocol, under the auspices of the UNFCC, was signed by the Conference of the Parties[16](COP). The Kyoto Protocol was an international non-binding agreement in 1997 to reduce greenhouse gas emissions for annex I[17] countries to at least 5.2% less than their 1990 levels. Each of the annex 1 countries was required to institute national policies to reduce the emitting of carbon. In case that this was not entirely possible the Kyoto Protocol also included what is known as the 'flexible mechanisms'. The flexible mechanisms allow for countries to purchase carbon credit from other countries through the Emissions Trading (ET) scheme, Joint Implementation (JI) program and the Clean Development Mechanism (CDM). The CDM allowed annex I countries to invest their money into non-annex I countries for carbon credits. Of the different ways to reduce carbon emissions in non annex I countries using the CDM that of the carbon sinks and whether or not they should be included has been the most contentious.

However, the inclusion of carbon sinks or reforestation and afforestation (AR) in to the 'flexible mechanisms' was not an issue until the COP-6 meeting in The Hague, Netherlands in November, 2000. The lines were drawn between two groups, the European Union (EU) and the United States (US). The EU was backed by the G-77, China and loosely by environmental groups. The US was backed by other industrialised nations; Canada, Australia, Japan and by big

[16] The Conference of the Parties (COP) consists of the 168 countries who signed on to the Kyoto Protocol in 1997. The Members of the Parties (MOP) consists of only those who ratified the Kyoto Protocol. The United States has still not ratified but continues to participate in the development of the many of the mechanisms including reforestation and afforestation under the CDM.
[17] Annex I countries consist of 40 of the industrialized countries.

corporate lobby groups. The debate was over the whether there should be a cap on using AR projects as a means of reducing carbon emissions within the 'flexible mechanisms'.

The EU, G-77 and China were opposed to unlimited caps on trading because they saw the biggest polluters (the U.S.) able to continue to pollute while shifting the problem to the developing countries. In their eyes the industrialised nations were not sharing the burden equally. It allowed the industrialised nations to buy up large amounts of rainforests to allow them to continue to pollute. Their support was more for investment in renewable energies.

Environmental groups such as Greenpeace, Friends of the Earth, World Wide Fund for Nature, and the Rainforest Alliance were in opposition to the inclusion of the AR into the CDM. At the time all the pilot projects had been big plantations. In these project people were often displaced, natural forests torn down, and biodiversity lost for the sake of fast growing trees and carbon credits. Environmental groups also saw an unlimited trading cap as a way for annex I countries to continue to pollute by just buying cheap carbon credits from afforestation projects in developing countries.

The U.S. backed by Canada, Australia, and Japan favoured unlimited caps and especially AR projects. They were also supporting protection of forests because annex I countries with large forests were lobbying to include carbon sinks against their emission reduction targets. The large corporate lobby groups, such as the International Emissions Trading association, which included BP, Shell, Unocal, Lafarge, DuPont, and ChevronTexaco was one of the biggest lobby

groups. Investing in AR was the most efficient and cheap way to get carbon credits. Many new carbon trading companies also stood to benefit by the new market that was to be created.

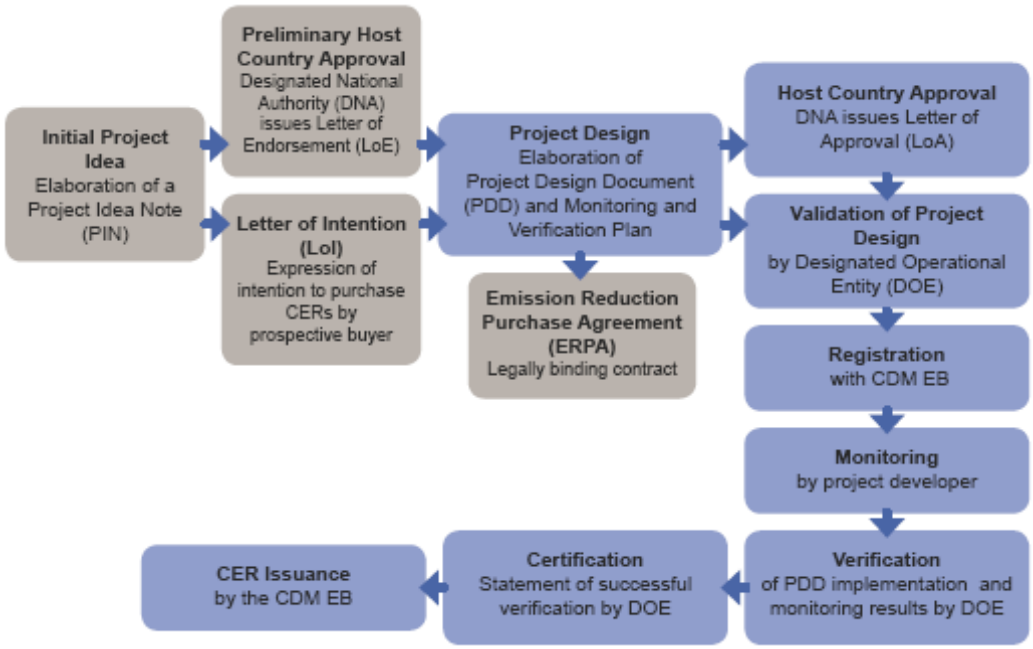
At the time, COP 6 in The Hague was considered to be a failure. This was the eventual turning point which led to the U.S. backing out of the commitments in the Kyoto Protocol in 2001. Despite many of the concessions that were made for the resumed COP 6 in Bonn, the U.S. was no longer in agreement. By COP 7 in Marrakech, carbon sinks were considered valid, but caps on the trading of them were going to be strict. By the time the Kyoto Protocol would come in action in 2008 a trading cap of 1% per year up until 2012 was to be the limit traded in AR projects (or a total of 5% of total emissions could be offset using AR projects).

The resolutions at COP 9 in Milan, Italy (2003) agreed to forestry rules and the by late 2006 the first AR projects were approved under the CDM. However, to date only one project has been registered (seven other awaiting validation) under AR, while 789 projects in all other sectors (Neeff, Eichler, Deecke, & Fehse, 2007). The slow development and bureaucratic nature of the methodology for AR projects has limited the number of projects submitted compared to other sectors. The hope is that after this phase (ending in 2012) there will be more projects submitted.

The AR projects under the CDM are often held up as the standard way of developing a reforestation carbon project. Although, CDM projects do not always meet all the international and industry standards either.

The process (Figure 14) for CDM-AR projects must be coordinated through the Designated National Authority (DNA). Every country that signed the Kyoto Protocol established a DNA as a means to negotiate 'flexible mechanism' projects. Engaging the DNA may occur before the project begins and this approval must be attained before submission to the CDM executive board.

Figure 14: Process for development of any CDM project. Blue boxes are mandatory and grey are optional but commonly part of the process (Neeff & Henders, 2007).



After a project design document has been created validation by a third party must occur. The third party is referred to as a designation operational entity (DOE). There are currently 19 in total for CDM projects but only one of them can validate CDM-AR projects. After this stage has been approved they may register with the CDM executive board. There is a brief wait period so that comments may be made on the project. If there are revisions to be made than this must be done before implementation can begin. Once registered, implementation may begin.

Verification occurs after the trees have been established and depending upon the type of contract signed (i.e. temporary or longer term certified emission reduction units) determines when verification will take place. Currently there is not a DOE which can verify and certify CDM-AR projects. As the commitment period has just started in 2008 this is not a big issue but it will need to be solved soon. After the certification is done the CDM executive board may issue the carbon credits, which are than able to be traded through the Emissions Trading scheme.

Carbon Market Standards

Developing standards for AR projects do exist but the lack of knowledge about proper AR projects is limited, which often allows for poor regulation of reforestation carbon markets. A report by the Financial Times of London last year discovered that many organisations and individuals are paying for carbon offsets that actually do not occur (Harvey & Fidler, 2007). Neef et al. (2007) list some industry standards that should apply to all projects before they begin to engage in the reforestation carbon market. These are additionality, determination of leakage, baseline setting, permanence of carbon removals, timing of removals, double counting, verified carbon credits by a third party, environmental and social impacts. Additionality ensures that before any project takes place there is an assurance that if the project did not occur the area would not have been at risk, or planting would not have occurred otherwise. Additionality also needs to prove that the forest was simply not cut down to plant trees for carbon credit. The rule is that a forest must be non-existent since December 31st, 1989. A forest can be

defined by these three options; minimum crown cover (10 - 30%), minimum height at maturity (2-5 metres) or minimum are between 0.05 – 1 hectare of forest (Neeff & Henders, 2007). Additionality allows for projects to be justified on a large scale and occur in places that actually need help.

Leakage refers to the need to prove that a project is not displacing the problem to another region. For example, if reforestation is occurring on land that was formally used for agriculture, than those agricultural practices should not be shown to shift to another region and result in more trees being cut down. If leakage occurs than it virtually eliminates the impact that the reforestation could have had. In order to show progress once a project begins a baseline study needs to be done. This shows what occurred before implementation and how much progress has been made in sequestering the carbon. All carbon credits verified are shown against the baseline.

One of the biggest concerns with forestry carbon projects is the issue of non-permanence. Forestry projects sequester carbon as long as the carbon remains stored in the vegetation or soil. However, this process can be reversed by fire or cutting of trees. There are two ways to register forestry projects, each with its advantages. A temporary certified emission reduction unit (tCER) is only valid for five years. Liability is not an issue with tCERs because credit is only given for existing stocks. For those purchasing tCERs they may only use them during that commitment period and then after the commitment period will have to replace them(Neeff & Henders, 2007). This process is more expensive as it has to be done every five years. The alternative is long term certified emission reduction units (lCER). A lCER is valid for the length

of the project and stock is only credited every time a verification is done (Neeff & Henders, 2007). This could be valid for a 25 year period and for this reason would be cheaper. However, lCERs carry a higher liability as any loss in the period must be replaced as stipulated under a contract. Both tCER and lCER allow for removal or pruning of trees if the timing of removals is identified. Of course this would reduce the carbon credit stalk but it does allow for flexibility in order to support livelihood activities.

In order to remain transparent, projects should also engage third party verifiers and auditors so that those purchasing the credits have confidence that their purchases are valid. Also in order for the carbon market to maintain its integrity the avoidance of double counting in different markets needs to happen. Unfortunately there are no overarching bodies that can monitor this as the international standards are not well known yet.

There are a number of international standards used that can help to verify that some of these rules are being followed and that consumers are aware of more responsible organisations within both the regulatory and voluntary markets. Some of the standards used are the Gold Standard, Climate, Community, and Biodiversity standard (CCB), Voluntary Carbon standard, GhG protocol, and the process used by CDM projects (Peskett, Lttrell, & Iwata, 2007). Only CCB and the Gold Standard sell premium credits due to the fact that they emphasise sustainable development alongside the other industry best practices.

As none of these standards are well recognised among the general public yet, monitoring of forestry carbon projects will continue to be difficult. The result is that many of the industry

standards are left out so as to save in the transaction costs. Forestry projects in voluntary carbon markets are far less expensive to invest into than those in the regulatory carbon markets. For example, the CCX, the largest voluntary cap and trade carbon market, does not need to demonstrate additionality, co-benefits and is far looser with the pre-1990 forest eligibility rule (Neeff et al., 2007). The regulatory market is far more stringent in its process and as a result costs a lot more the projects submitted under the voluntary carbon market. For this reason projects under the regulatory market are more difficult for small landholders to participate in because of the large capital needed to go through the process.

As a result there are more forestry carbon projects existing under voluntary carbon markets compared to the regulatory carbon markets. As mentioned earlier there are only eight in the pipeline under the CDM. Part of the problem in the regulatory market has been the slow development of the methodologies but the other has been the demand for forestry carbon credits.

Carbon credits have recently had a poor market value because the EU Emissions Trading Scheme (ETS) has not accepted carbon credits coming from AR projects in this commitment period (2008-2012). Although, countries in the EU can trade 40% through the EU ETS, which means that there is still an option for countries to purchase their remaining carbon credit from the CDM-AR (Neeff & Henders, 2007). With some countries showing interest and Japan warming up to the idea, Neeff and Henders (2007) estimate the 75 million tonnes of carbon credit will be traded in the first commitment period.

The biggest player investing in the regulatory market has been the World Bank Carbon Finance Unit. This division of the World Bank began in 2005 as a way to foster the role of LULUCF in the carbon market. World Bank started with the Prototype Carbon Fund and then moved into the first tranche of the BioCarbon Fund. The first tranche of the BioCarbon Fund has been dedicated to developing projects for the first commitment period of the Kyoto Protocol. As of March 2007 the second tranche of the BioCarbon fund has started. The first tranche of the BioCarbon Fund had a portfolio of 53.8 million of which 54% was from the private sector and 46% was from governments (Bosquet, Francois, & Baroudy, 2007). In total the World Bank BioCarbon Fund has purchased 22 million tonnes of credit from carbon forestry projects (Neeff et al., 2007).

Clean Development Mechanism for Sustainable Livelihoods

So if one is able to work through the bureaucratic process of the afforestation/reforestation component of the CDM would it provide social and even environmental benefits (we have already concluded that they are both inextricably linked together)? One possible way to encourage more social and environmental benefits through the forestry carbon market using the CDM is to complement its pitfalls with the structure payment for environmental services projects. Many of the industry standards for both the CDM and payment for environmental services are similar. Additionally, payment for environmental services would be able to increase investment into countries where local investment is difficult. Selling the forest environmental service of carbon sequestration is rarely purchased locally, therefore countries and individuals may retain the rights to sell the other services internally. Payment for

environmental services projects alternatively provide carbon forestry projects with a more ethical way to engage in projects.

However, for this to happen, more support in financial and capacity terms need to be granted to designated national authorities (DNAs). Reviews of forest carbon projects in Brazil, Bolivia and Cameroon found that DNAs played a crucial role (Bass et al., 2000; May, Boyd, Veiga, & Chang, 2004; Minang, McCall, & Bressers, 2007). Often in the voluntary carbon market the government tends to get bypassed. The government could play a crucial role in generating more accountability by creating a sense of ownership of these ideals. However, a national framework alone cannot improve the forest carbon market. Accountability structures need be set in place through the inclusion of NGOs and project developers (K. Brown & Corbera, 2003). NGOs are especially important as the modalities of the carbon project process are far too complex for many community groups.

Not only is a 'top down' approach needed but also a 'bottom up'. Using the PES framework as a good foundation for providing benefits at a local level has already been established in chapter 2. With the complexities of such projects local community groups should be supported rather than starting new groups to serve the purpose of the project.

The CDM-AR, as with PES, needs to work towards improving social and political capital in order to successfully implement projects as both capitals are not direct capital interventions. Without proper formal institutions that can represent strong political capital (rights people have over land and forest) and informal institutions that help build social capital (within

communities and between other organisations or the government) projects will not provide social benefits and will not sustainably manage natural resources.

Chapter 6

Results and Discussion

Results

The results in this section are based on data that was collected from September to December 2007. The *Project Progress* section data was collected in October 2007 from the various records within the department of forestry at CoopeAgri and consolidated into a database by myself. This section describes the various activities, type of participants, different regions, activities, previous land uses, membership of participants with regards to CoopeAgri, and the different tree species planted. This data helps to provide an objective view of which people are participating, and why they are participating. The results from this section help to emphasise the primary data collected in the following section.

The primary data in the *Social Benefits* section was collected between November and December 2007 during field visits to various participants' farms and meeting participants in the office at CoopeAgri. Whereas the collection of secondary data focused on objective reasons of why participants are involved, the primary data focuses on the perceptions of why participants are involved in this project. Data was collected so that it could be analysed using the sustainable livelihoods framework. Therefore analysis of the second section focuses on the asset base and the impact people perceive this project to have on the asset base and their future outcomes.

Project Progress

This project first started accepting participants under the new funding provided by the World Bank BioCarbon Fund in the beginning of 2006. By the end of 2007 CoopeAgri had completed the second year of a proposed three year project. Table 1 gives an indication of how much this project has grown since the new funding have become available. The statistics indicate that CoopeAgri was much more involved in payments for the protection of primary forests before the BioCarbon funding. However, now that the new project does not include payment for protection of primary forests the other two activities have grown exponentially. Even between 2006, when the funding first became available, and 2007 the project has shown a growing amount of interest.

Table 1: Growth of project due to increased funding from World Bank BioCarbon Fund

	Before 2006 (ha)	2006 (ha)	2007 (ha)	Total (ha)	Percentage of growth before 2006 to end of 2007	Percentage of growth between 2006 and 2007
Agroforestry[18]	28.6	48.3	163.3	240.2	741.0	338.1
Reforestation	26.0	29.8	67.0	122.8	372.3	224.8
Natural Regeneration	-	296.3	138.3	434.6	NA	46.7
Protection	13,117.0	NA	NA	NA	NA	NA

It is also important to note that CoopeAgri has not abandoned the protection of primary forests for this new funding. FONAFIFO continues to pay for the protection of primary forests and CoopeAgri continues to include new projects (where funding is available) but at the same time have greatly increased their own departments' activities in other areas. Additionally there are many trees planted under agroforestry systems in which the research on how much carbon

[18] This number was calculated based on 1 hectare = 400 trees (Ortiz & Elena, 2006). The purpose of converting to trees planted to land planted is for the purpose of calculating the amount of carbon sequestered.

is sequestered has not been compiled (Freizelh Vargas Fallas, personal communication, November 16, 2007). These trees are still considered for payment for environmental services through FONAFIFO but farmers are paid through a different mechanism and not the BioCarbon Fund.

Activities

The focus of this project for payment for forest environmental services is concentrated on three activities; agroforestry, commercial reforestation, and natural regeneration. In the proposal the idea was to implement the project over a three year period. However, to date the expected outcome of the project over the first two years has been less than expected. Although all have fallen short of the goals set out originally, reforestation has been the most difficult to implement. Table 2 indicates that only about 4% of the proposed trees have been planted under reforestation projects. Reforestation was also allotted the most amount of land in the proposal. However, despite the unexpectedly slow uptake of the project to date seen in table 1, the project is already growing exponentially.

Table 2: Proposed size of project and current progress to date

	Proposed[19]	Total planted	Percentage
Agroforestry	450[20]	211.6	47.0
Reforestation	2490	96.8	3.9
Natural Regeneration	1200	434.6	36.2
Total	4,140	743	17.9

[19] Information was taken from proposal (Ortiz & Elena, 2006)
[20] The total number of trees planted is 180,000 (Ortiz & Elena, 2006)

a. Agroforestry

Agroforestry systems have been the most successful aspect of this project because this system is the most adaptable and most suited to the pre-existing farming activities that are at the centre of the economy of this area. Agroforestry systems allow trees to be planted so that they are integrated with other farm activities.

Table 3: Various ways agroforestry was integrated into other livelihoods

	Frequency	Total trees
Coffee	53	44,162
Blocks	42	44,541
Windbreaks	20	21,800
Silvopasture	7	13,110
Perennial crops	2	1,020

Coffee was the most popular way to integrate with trees (table 3). Planting trees between rows of coffee potentially increased the value of the coffee, provided a more balanced ecosystem for maintaining quality, and also an extra source of income when the trees were mature. Forest blocks were the second most common way to integrate trees because participants could plant different species of trees in a small area. Agroforestry blocks by definition had to be less than one hectare. This was a very attractive option for farmers with less land. Windbreaks were also a very convenient way for farmers to plant trees without displacing any other activity. Windbreaks could be planted around the properties edge. Simply planting rows around a property the size of one hectare (spaced three meters apart) would provide about 120 trees alone.

The mode of payment for agroforestry systems is different than the other two activities also because it is paid based on the number of trees planted (1.3 US$/tree) and contracts are for five years. Payments are only made in the first three years of the contract; 65%, 20% and 15% respectively (Ortiz & Elena, 2006).

b. Commercial reforestation

The difference between agroforestry and commercial reforestation is that commercial reforestation plantations are blocks of trees greater than one hectare. Where agroforestry systems tended to be a more diversified mix of trees planted, commercial reforestation projects tended (although not the rule) to be plantations of mono-species trees.

Commercial reforestation projects were paid a total of 816 US$/hectare. However, the participant had to sign a contract for ten years. The payment was annual with the majority paid at the end of the first year (46%) and the remaining spread out equally (6%) over the next nine years (Ortiz & Elena, 2006). These are stipulations of the PFES program in Costa Rica and accepted by the World Bank BioCarbon Fund.

c. Natural regeneration

Natural regeneration did not require the planting of trees, but to leave tracts of land alone and let seeds of trees that were previously there to regenerate. With natural regeneration it was necessary to take precautions such as putting up fences that would prevent people or animals

near to the site. The purpose of these precautions was to prevent fires and animals from eating the trees regenerating within the project area

In order to prevent people from cutting down large tracts of land and then applying for payment under this program the area the project that was taking place had to be vacant of a forest since December 31, 1989. Natural regeneration contracts were for five years at a time but renewable up to twenty years. Every year the participant was eligible to receive 41 US$/hectare (Ortiz & Elena, 2006).

Type of participant

Participants were grouped into four categories (table 4). The category 'both' refers to a few occasions where married couples both had their name on a title of land so both would be registered for the project. Corporations are known as *sociodad anonimos* in Costa Rica. Quite often foreigners must register themselves as a corporation in order to obtain some sort of legal status within the country. In this case four of these corporations were registered under foreigners. The remaining corporations were owned by nationals.

Table 4: Frequency of participants in the different activities

	Male	Female	Corporation	Both	Total	Percentage of total
Agroforestry	59	15	9	7	90	67.7
Reforestation	22	2	4	1	29	21.8
Natural Regeneration	10	0	4	0	14	10.5
Total	91	17	17	8	133	

Agroforestry was by far the most popular activity accounting for nearly 70% of the total participants. The fact that agroforestry was more flexible indicates that participants were more likely to participate in these activities. The categories, 'female' and 'both', seemed to be far less flexible in terms of what activities they were most likely to engage in than 'males' or 'corporations'.

As shown in table 1 in the first two years of the project the extra funding has shown an increased amount of land being planted. The same is true for the growth in frequency of participants (table 5).

Table 5: Growth among frequency of participants

	Year		Total
	2006	2007	
Male	27	64	91
Female	1	16	17
Corporation	6	11	17
Both	2	6	8
Total	36	97	133

Every category recorded in this research saw an increase, but participants that were women showed the largest increase. Not surprisingly men were more likely to participate than any other group in table 5. This is due mostly to the ability to obtain title to land.

Land distribution

Before projects were registered, area planted and total area had to be delineated. These were than reported within each participant's proposal. The majority of land was reserved for natural

regeneration projects. However, as table 4 indicate only 10.5% of the participants were involved in regeneration projects. People that were involved in regeneration projects had far more access to land and also converted far more than the other two activities.

For agroforestry systems only 8.2 hectares (table 6) were reported as total area. This statistic however may be slightly misleading as people were only required to report land that the project was taking place on, not the total land they owned. A person involved in a small agroforestry project could possibly have land elsewhere. This rule, which is generally true, will be more evident in the social benefits section. At the same time the county average for average land size per household is 8.7 hectares (Geografica, 2000). Those who use land for agroforestry projects could describe the average land size of the population in Perez Zeledon.

Table 6: Comparison between land planted and land reported for the different activities

	Agroforestry	Reforestation	Natural Regeneration
Total area planted	211.5	96.8	434.6
Average land planted	2.4	3.3	31.0
Total land reported	740.6	483.3	1110.1
Average land reported	8.2	16.7	79.3
Percentage of land converted	28.6	20.0	39.1

Although agroforestry blocks could not be greater than one hectare (where after they become reforestation projects) the statistics in table 6 indicate that the average planted was 2.4 hectares. This is due to the fact that agroforestry projects can be planted over one hectare if they are *not* planted in blocks. For example they can be planted in plots greater than one hectare when integrated with coffee.

While the reforestation projects had double the amount of land available much less was actually converted to plantations. This has a lot to do with the fact that reforestation would have to displace any on farm activity in order to be implemented. Therefore farmers were slightly less likely to convert large areas of land.

Natural regeneration projects were restricted to certain groups of people; men and corporations (table 7). Not only is there less access to land between natural regeneration and the other two activities, but these two groups of participants obviously have more land available also.

Table 7: Average land planted per participant in various activities

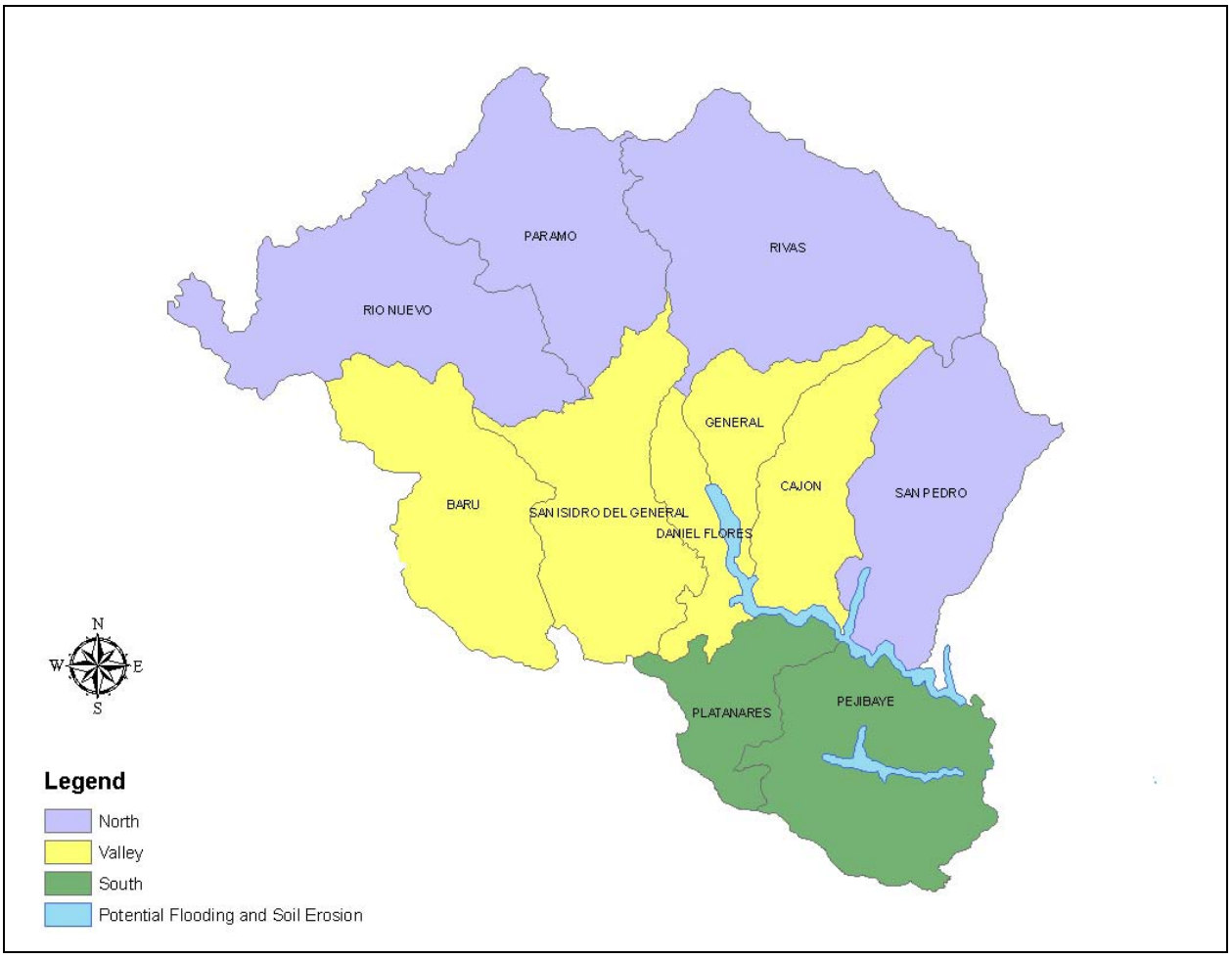
	Agroforestry (ha)	Reforestation (ha)	Natural Regeneration (ha)	Total Average (ha)
Corporations	2.8	1.5	26.5	8.1
Male	2.4	3.6	32.9	6.1
Both	2.5	7.8	-	3.2
Female	1.7	1.7	-	1.7
Grand Total	2.4	3.3	31.0	5.6

However, if the participants are involved in agroforestry projects there is almost an equal distribution of land for the different groups of participants. Only women show a significantly lower average. Reforestation projects show that when projects require a little more land, 'men' and 'both' genders were more likely to participate. Overall women registered far less land planted than any of the other three groups.

Regions

Perez Zeledon is divided up into three separate regions (Figure 15). Each region is characteristic of the type of economic activity and landscape that occurs there. The valley, which runs north-west to south-east, is flatter and generally the most productive region of the county with plantations for pineapple and sugarcane commonly found.

Figure 15: Various districts and their respective regions in Perez Zeledon(Geografica, 2000)



The northern region has the highest altitudes in the county and there are a lot of coffee farms as well as pasture lands in the more remote areas. The south is dominated more by pasture lands but still grows a large amount of coffee at higher altitudes.

Due to the fact that the valley is more productive the population density is also higher (table 8), which limits access to land. The north on the other hand has the lowest population density and therefore large tracts of land are available. Although, in the north the terrain is considerably steeper and a lot more isolated, making access more difficult.

Table 8: Regional characteristics of Perez Zeledon (Geografica, 2000)

	Population	Area (ha)	Households	Average household	Average area per household (ha)
Valley	80,929	45,117	19,648	4.1	2.3
North	25,323	177,209	5,744	4.4	30.9
South	15,935	29,732	3,485	4.6	8.5
Total	122,187	252,058	28,877	4.2	8.7

The three different regions economic bases and population densities define the more appropriate forest activities for the respective regions. As a total percentage agroforestry was clearly the more popular activity. However, in the original proposal the projects perceived activity allotment would heavily favour reforestation (60%) over natural regeneration (30%) and agroforestry (10%) (Ortiz & Elena, 2006). Table 9 shows that participants to date are far more interested in the opposite of those who designed the project. Agroforestry was an overwhelming 67% of participant's choices while reforestation and natural regeneration were only 22% and 11% respectively.

Table 9: Distribution of activities among the three regions for individual participants

	North	South	Valley	Total
Agroforestry	18	50	22	90
Reforestation	14	7	8	29
Natural Regeneration	12	-	2	14
Total	44	57	32	133

Participants from the south and the valley clearly chose agroforestry (as a total percentage) over the other two activities (table 9). Due to land pressures and population densities these were the easiest projects people could participate in. The south had the most projects of any region because this region was a balance between having enough land to be able to plant trees and a less competitive land value than the valley.

Contrast this information to the northern region where agroforestry was not nearly as popular as the south and the valley. The majority of the reforestation and natural regeneration project occurred in this region because land was available or often not even in use.

Aside from participation rates in the various regions actual land planted in the northern region was more than double what the south and valley had planted all together (table 10). There were less people planting or protecting more land in the north than in the south or the valley. This also confirms what table 8 shows about availability of land and ability to plant or protect more forests. However, at the same time this shows nothing about people's willingness to participate even if they have access to less land as the south had more participants than the north.

Table 10: Total land planted in the various regions

	Area planted (ha)
North	488.6
South	118.4
Valley	136.0
Total	742.9

However, this does mean that when there is more land available people are willing to convert more of the same land towards forestry. Table 11 confirms that even when agroforestry projects occurred in the north they were still larger on average than any in the valley or south.

Table 11: Average land planted for the various regions and activities

	North	South	Valley	Total
Agroforestry	3.2	2.0	2.5	2.4
Reforestation	3.4	2.7	3.8	3.3
Natural Regeneration	31.9	-	25.8	31.0
	-	-	-	
Total	11.1	2.1	4.3	5.6

However, despite the greater land pressures and population densities in the valley the average land planted was higher in the valley than the south. Although, most people in the valley live in San Isidro, the capital of the county, the numbers are slightly skewed. In certain districts in the valley, such as Cajon (7.1 ha/household) and General (5.6 ha/household), there is a greater amount of land available than the average (2.3 ha/household) (Geografica, 2000).

In Perez Zeledon there are eleven districts (figure 15). Between the first two years the greatest increase in participation was in the valley followed by the south (table 12). However, overall the south and north had the most active projects. The south also had only two districts. The valley had the least amount of projects (figure 16), which was most likely due to the high opportunity costs of engaging in reforestation projects. Projects that did occur in the valley were also much smaller than the north or south.

Table 12: Participation rates over the first two years in the various districts and regions

	District	Year		Total
		2006	2007	
North	Paramo	2	1	3
	Rio Nuevo	1	0	1
	Rivas	7	14	21
	San Pedro	6	13	19
	Total	**16**	**28**	**44**
South	Pejibaye	10	27	37
	Platanares	5	15	20
	Total	**15**	**42**	**57**
Valley	Baru	2	3	5
	Cajon	1	9	10
	Daniel Flores	0	5	5
	General	0	2	2
	San Isidro de General	2	8	10
	Total	**5**	**27**	**32**

The south saw the greatest participation in total numbers and in terms of communities that participated. In the south there were two communities that participated a lot. The reasons for this are not necessarily because of greater community engagement by CoopeAgri but for the reasons mentioned earlier. The south had lower opportunity costs the other regions as people still had access to larger amounts of land. This is not to say that success of the projects in 2006 did not encourage more people to participate in 2007.

In San Miguel of Pejibaye there were 10 people participating (figure 17). The majority of the participants were engaged in small agroforestry or reforestation projects. The projects on both sides of the river in Pejibaye are of high importance as this region has a high probability of flooding and soil erosion. And by evidence of forest cover data in figure 4 the southern region has little to no forest cover.

In the other district of the southern region, Platanares (figure 18) San Carlos was the community with the highest participation (4 people). Again projects were more likely to be agroforestry or reforestation. Issues of flooding and soil erosion were more of a concern in the northern side of this district.

The northern region only had two districts with high participation rates; Rivas (figure 19) and San Pedro. Rivas had two communities with a significant number of people participating. Herradura had five and Chimirol had 4. However, most of the projects in this district were large natural regeneration projects.

San Pedro (figure 20) did not have any strong community participation. Projects were scattered around the district. People in San Pedro were more likely to participate in agroforestry or reforestation projects as opposed to Rivas' majority of natural regeneration. Flooding was an issue as the water flowed to the southern side of the district.

In the two other districts of the north (Rio Nuevo and Paramo) there were also few projects (figure 21). These were also the more isolated parts of the northern region as indicated by the lack of major roads into the district.

In all regions (minus a few exceptions in the southern region) projects and participants are isolated from each other. When the process of participation is self-selective, instead of targeted, than this isolation of participants is bound to be found. However, where participants of the same community (such as in the south) are found these are areas where the success of

the project is self-evident as measured by the relatively higher degree of participation in a concentrated area.

Figure 16: Distribution of different projects for valley region including Baru, San Isidro, Daniel Flores, General and Cajon Districts (Geografica, 2000)

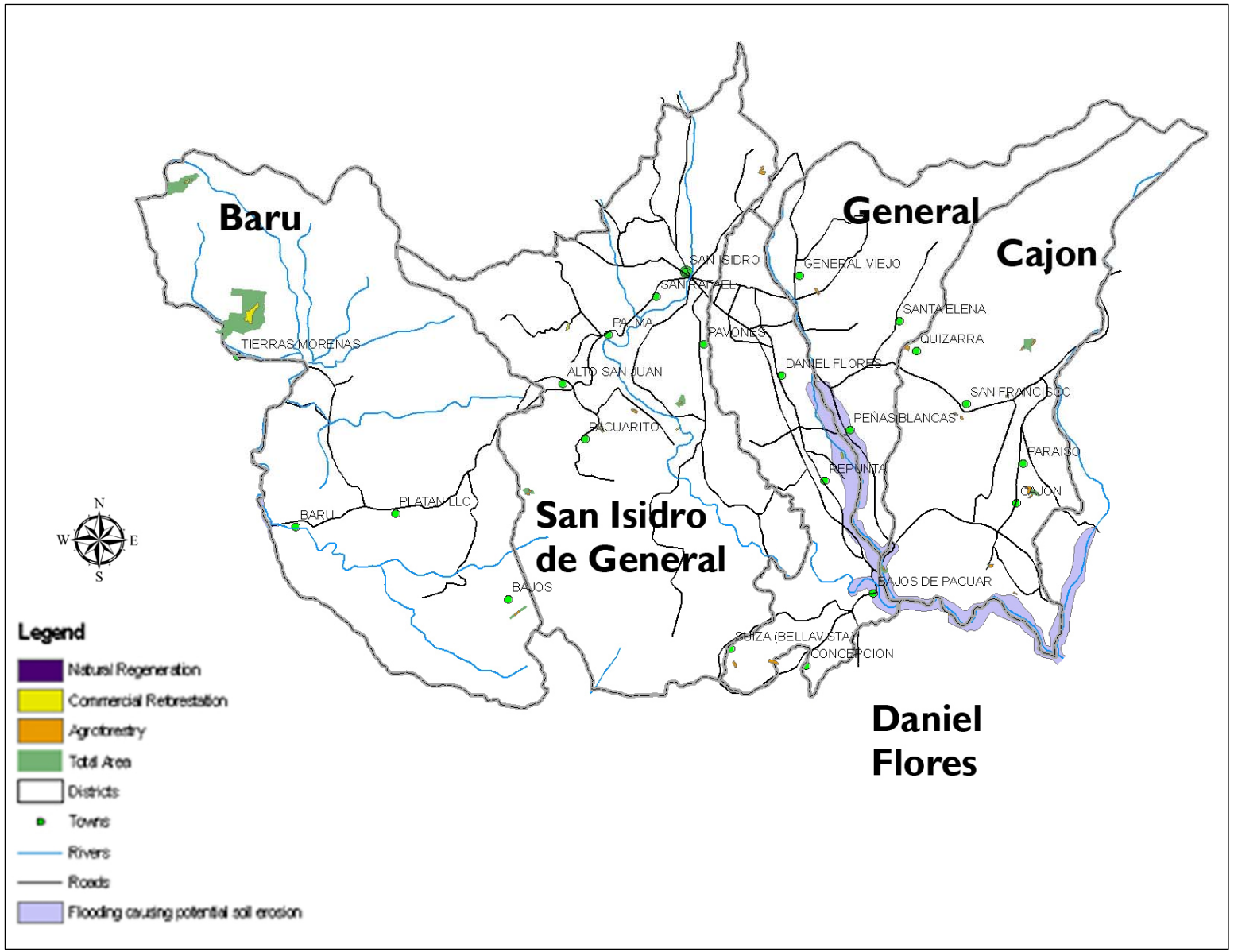


Figure 17: Distribution of projects for district of Pejibaye in the southern region (Geografica, 2000)

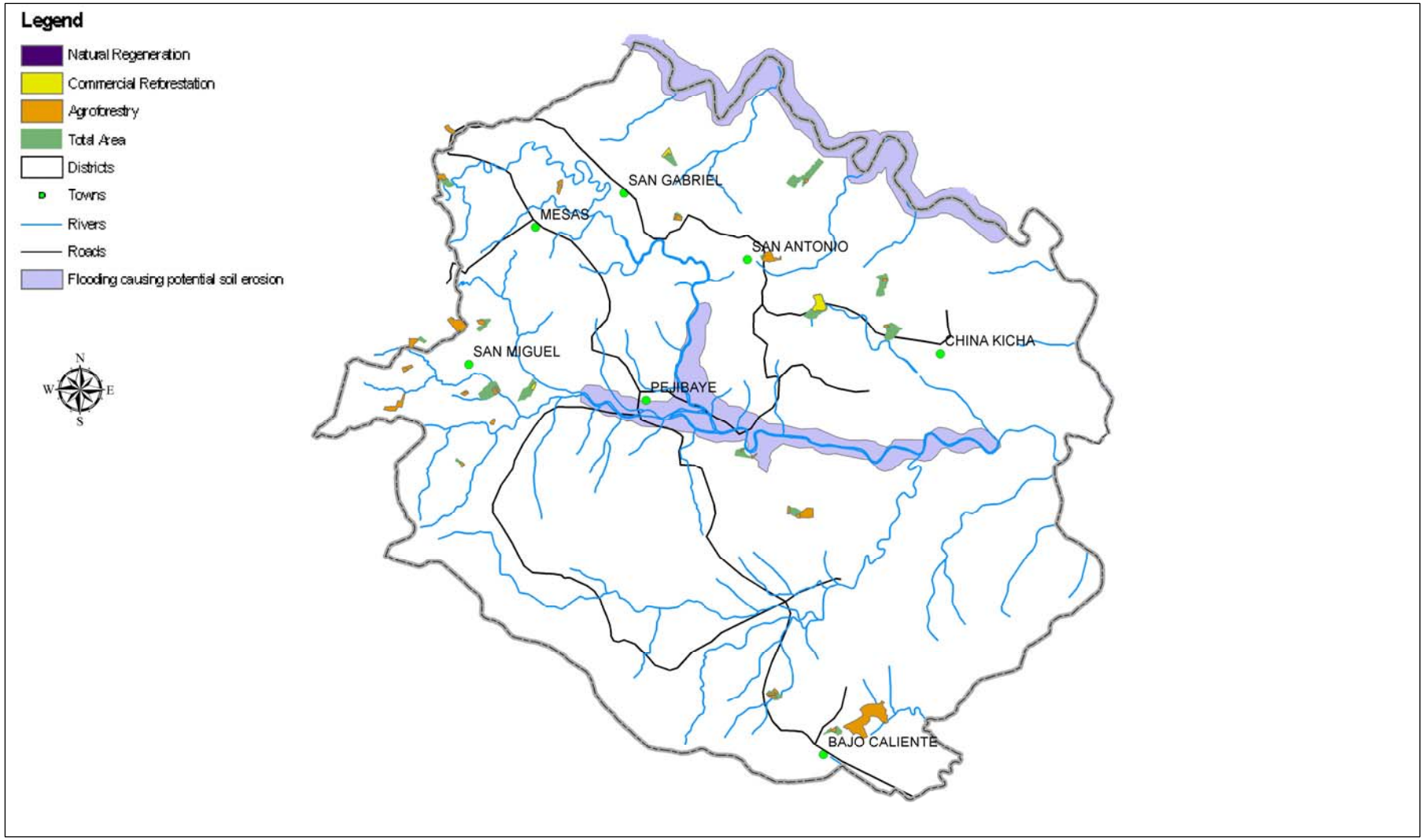


Figure 18: Distribution of projects for Platanares in the southern region(Geografica, 2000)

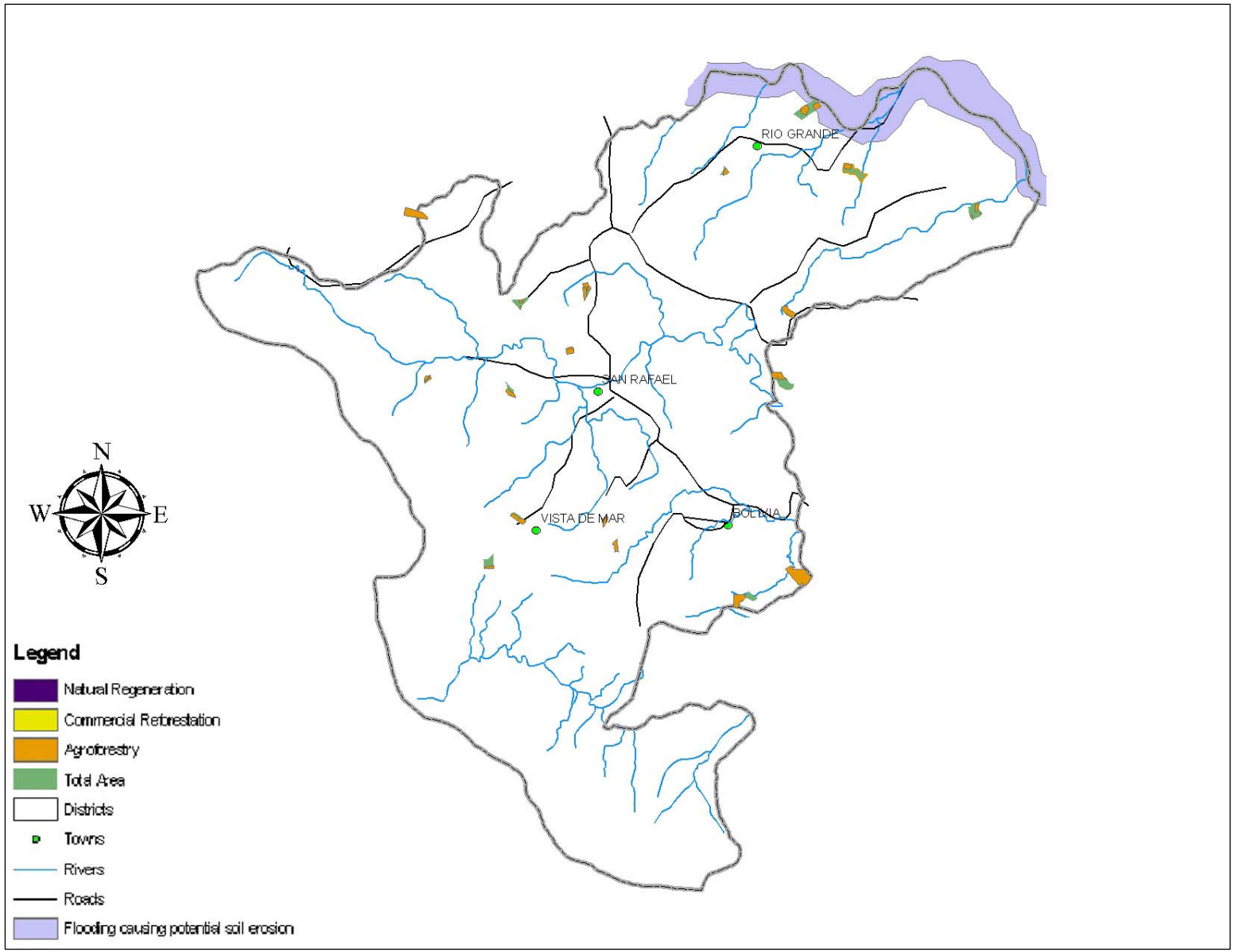


Figure 19: Distribution of projects in the district of Rivas of the northern region

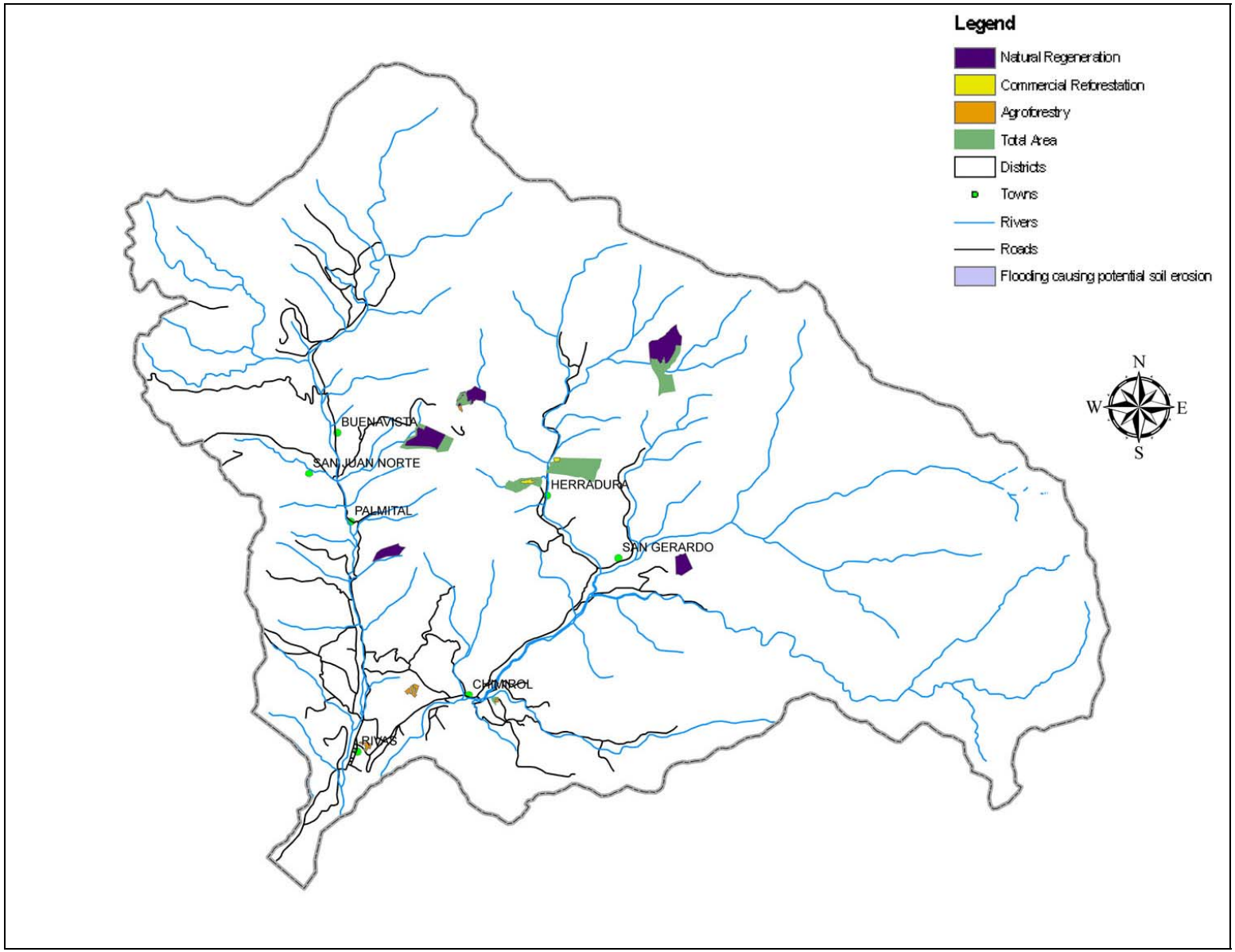


Figure 20: Distribution of projects in San Pedro of the northern region (Geografica, 2000)

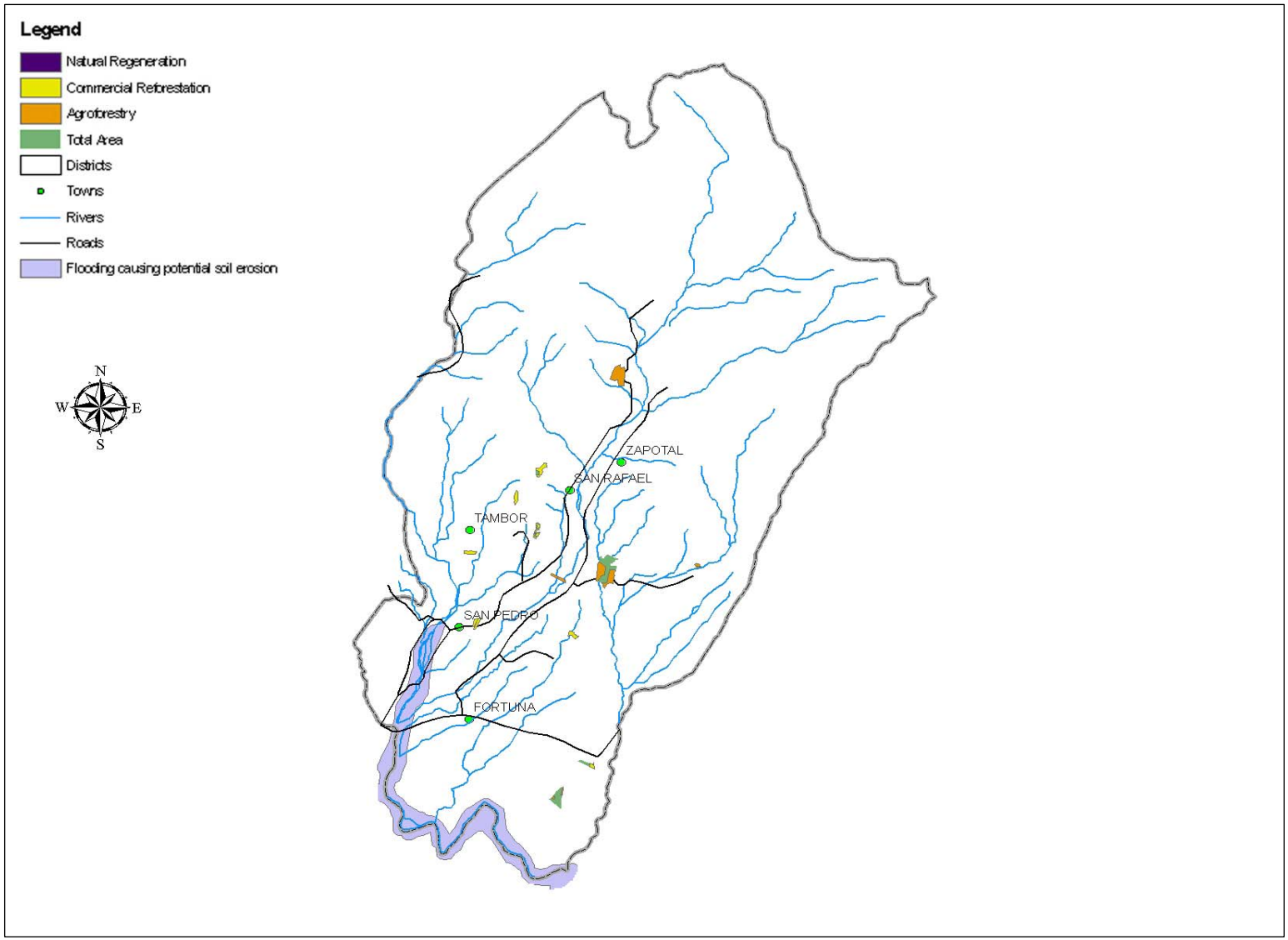
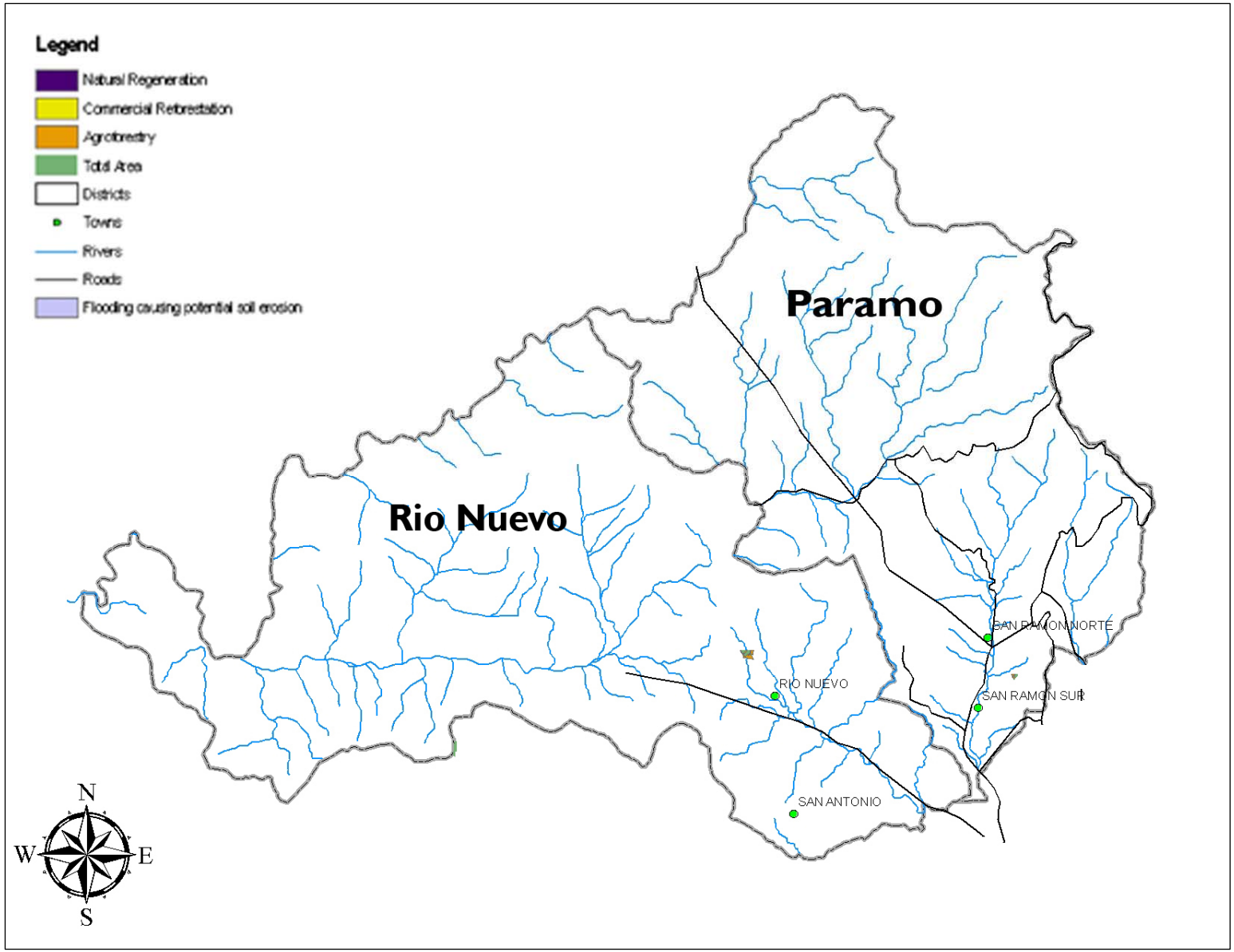


Figure 21: Distribution of projects in Rio Nuevo and Paramo of the northern region



Previous land use

An important way to understand why people chose to participate is to understand the previous land use that participants were willing to replace or integrate with. People practicing agroforestry systems were more likely to integrate trees with coffee (78%) and over half of the total participants (53%) were integrating coffee with trees (table 13). Due to the fact that coffee is such an important part of the economy in Perez Zeledon there is a lot of sense in adding value to your coffee. There are multiple benefits of agroforestry systems as mentioned earlier in the agroforestry section.

Table 13: Previous land use for the different activities

	Agroforestry	Reforestation	Natural Regeneration	Total
Coffee	70	11	0	81
Livestock	34	16	10	60
Forestry	24	13	6	43
Subsistence	17	15	0	32
Total	145	55	16	216

For reforestation systems, livestock and subsistence farming were the former land uses before the planting of trees. However, in these cases the land is not necessarily being replaced as seen in table 6. The land may still be used for these purposes. As of now the market value for trees would not outweigh that for coffee. Therefore in table 13 coffee plants are not being replaced. The trees are just planted on a different part of the same property. What we do know is that farmers are more likely to plant trees in larger quantities if the land use was previously used for livestock or subsistence farming.

In the case of natural regeneration the most common land use before the project was livestock. Table 9 indicated that most of these projects occurred in the north where there are very large tracts of land. Many of these areas are very isolated. They were once used for livestock but often had been abandoned because of the isolation. Some people even indicated that they had already started planting trees on the same property previous to entering into this program.

The totals of all the activities indicate that there is more previous land uses indicated than there are participants. This just indicates that the land had multiple uses before the trees were planted there. For agroforestry it indicates that there multiple ways that people would integrate trees into their property.

On average those who participated in natural regeneration projects converted 38% of their total land reported for this activity (table 14). However, as natural regeneration normally took place in isolated regions of the county the former land uses were either for livestock or forestry.

Table 14: Average land reported and planted for previous land uses and activities

	Agroforestry		**Commercial Reforestation**		**Natural Regeneration**	
	Average land planted	Average land reported	Average land planted	Average land reported	Average land planted	Average land reported
Coffee	1.7	4.8	1.7	11.1	-	-
Livestock	0.9	5.4	2.4	15.2	18.6	47.4
Forestry	0.6	3.4	1.6	5.3	16.7	46.4
Subsistence	0.4	0.9	1.8	11.6	-	-
Average	0.9	3.6	1.9	10.8	17.6	46.9

Participants in agroforestry projects were a distant second in terms of the amount of land converted. The percentage of land converted by participants practicing agroforestry systems was 25% (table 14). However, when participants indicated coffee as a land use they converted a total of 35% of their land. Quite often farmers would interplant some of their coffee with trees but not always. Although the planting of trees does increase the value of coffee it also reduces the yield. Therefore, participants in agroforestry systems sometimes planted forest blocks next to the coffee or planted only part of the coffee plantation with trees.

Participants in reforestation projects only converted a total of 18% of their land towards plantations (table 14). This should be obviously lower than the other two activities because of the inflexibility of the land for commercial reforestation. However, if the former land use was already forestry, conversion rates were up to 30%. This can be seen as an encouraging sign as it indicates that people participating in this payment for environmental services project already had plantations on the same property previous to this specific plantation. Therefore this shows that once people have committed to establishing forests for whatever reason they will be more likely to do so in the future also.

Membership

One of the greatest assets CoopeAgri has is their community networks. With over 12,000 members, either producing coffee or sugar cane, they have established themselves in virtually every community in Perez Zeledon. This fact and their experience in working with a payment

for environmental service program before this project started were some of the reasons CoopeAgri was chosen an implementer.

However, surprisingly only 63% of the participants were registered members of CoopeAgri (table 15). Regionally the north was more likely to have participants as registered members of CoopeAgri than either the south or the valley. Due to the isolation of the region there may be less influence of other organisations than exist especially in the valley and the south. Therefore the northern region depends more on the services of CoopeAgri in general. Males and corporations were slightly more likely to be members than the average. However, this was more likely because their livelihood depended on some form of agriculture and CoopeAgri was a good support system for that. Females and participants whose property was registered in both genders names were the least likely to be members of CoopeAgri. This may be for the same reason why men are slightly more likely to be registered members of CoopeAgri; they depend more upon CoopeAgri for agricultural services whereas the gender division of roles for women in Costa Rica is focused less on the agricultural sector.

Table 15: Frequency and percentage that are members of CoopeAgri

	North	South	Valley	Total	Percentage
Male	26	23	12	61	67.0
Corporations	3	5	3	11	64.7
Female	2	4	2	8	47.1
Both	1	1	2	4	50.0
	32	33	19	84	
Percentage	72.7	57.9	59.4	63.2	

The bottom line is that the total percent is *only* 63% and this indicates a large untapped resource. CoopeAgri's links to the communities could provide the forestry department with far more people to participate in the project than currently exist.

Tree species

Planting trees are the central part of the agroforestry and reforestation activities. The original proposal only outlined four trees that would be acceptable based on similar projects in the north of Costa Rica (Ortiz & Elena, 2006), but CoopeAgri requested that there would be more success if species that were more relevant to the environmental and geographical specification of the region were added. The native species that they promoted are Cedro Amargo, Amarillon, Jaul, Roble Sabana, Corteza Amarilla, Manzana Rosa and Zota Caballo. The exotic species included were Melina, Eucalyptus, Teak, and Cypress. Most of these trees were included on economic grounds. Eucalyptus for example is a very water intensive tree and therefore planting of this tree species weighed the economic value over the environmental impacts.

Although both systems used many of the same trees, reforestation systems were dominated by Melina (table 16). Melina is a fast growing tree that will be mature for 10 to 15 years. The current market value of a hectare of mature Melina is 2,000 to 3,000 US$ (Luis Salazar Salazar, personal communication, October 26, 2007), which was higher than Cedro Amargo. Melina timber can be used for furniture as well as construction. Due to the versatility and speed at

which this timber grows it was the best option in many of the participants in the reforestation projects.

Table 16: Comparison of tree species planted for agroforestry and reforestation

	Agroforestry		Reforestation	Total
	Trees planted	Area Planted[21] (ha)	Area Planted (ha)	
Melina	20,548	51.4	70.3	121.7
Cedro Amargo	38,141	95.4	8.6	104.0
Eucalyptus	7,160	17.9	5.9	23.8
Amarillon	7,510	18.8	3.1	21.9
Cypress	3,604	9	1.6	10.6
Teak	2,092	5.2	3.1	8.3
Ira Rosa	3,000	7.5	-	7.5
Jaul	1,100	2.8	3.0	5.8
Roble Sabana	600	1.5	0.6	2.1
Pilon	600	1.5	-	1.5
Cortez Amarilla	300	0.8	-	0.8
Manzana Rosa	0	0	0.3	0.3
Zota Caballo	10	0	-	-
Total trees	84,665	211.7	96.4	308.1

Melina was used a lot (24%) in agroforestry systems also but not nearly as much as reforestation (70%). Melina was not a good tree to plant between coffee plants because of its broad leaves. The shade the leaves brought when these trees were mature would not let the appropriate amount of light through. Although there were occasions were people had planted Melina between coffee plants, this was not recommended by staff of the department of forestry at CoopeAgri. If this happened it was due to the fact that people were anticipating faster results from Melina which they would eventually cut anyway. Trees such as Cedro Amargo and Amarillon were more appropriate because their leaves were not nearly as broad. These trees had a slower growth rate (about 15-20 years) but were a much better tree for integrating with

[21] Converted at the rate of 400 trees = 1 hectare (Ortiz & Elena, 2006)

coffee. In general this indicates that people who planted trees in agroforestry systems put more thought into the whole farm as a system.

Social benefits

The information in table 17 indicates that there was a balance of subjects interviewed (using the questionnaire in appendix B) in the various activities. 16% of the people interviewed were women. However, some of these women were either wives or mothers of the actual person registered in the project. This was also valuable information from people who were outside the process of registering but had a different opinion as to why they were participating in maintaining the project. The non participants in the project consisted of one representative from FONAFIFO, a private consultant, and two representatives from the department of forestry at CoopeAgri. Another representative from the department of forestry was also interviewed, but this person was also engaged in a payment for environmental service project. This person was categorised under that specific project.

Table 17: Frequency of interview for different activities

	Gender interviewed		Total
	Female	Male	
Agroforestry	5	18	23
Commercial Reforestation	-	9	3
Natural Regeneration	-	2	2
Non Participants	1	3	4
Total	6	32	38

Each male and female listed in table 17 represented either themselves or someone else. On two occasions a female was interviewed where a male was registered in the project and on

three occasions a female was interviewed where the corporation was registered (table 18). In the case of the corporation three of the seventeen were actually owned by women. In this case two of the corporations interviewed were owned by women.

Table 18: Representation of people interviewed

	Female	Male	Total
Male	2	28	30
Corporation	3	2	5
Female	1	1	2
Both	0	1	1
Total	6	32	38

Socio-economic Asset Based Analysis

In order to better understand the perceptions of why people participated in the project the responses to asset bases were broken down into different socio-economic groups. The information in this section analyses how the different groups responded to the importance of the five assets (natural, financial, physical, human, social) with regards to this project. It is important to note that the correlations do not indicate disagreement but only relative agreement. Different socio-economic statuses were analysed by looking at the differences in responses of gender, activities participated in, land size holdings, and source of income.

a. Gender

In general there was a relative similarity in the way genders responded to the issues (table 19). Men were more likely to agree with each other, while women were even more likely to agree

with each other. Men and women were the least likely to agree but were still relatively similar. In general though there was agreement.

Table 19: Correlations between male and female responses

	Male	Female
Male	0.92	0.91
Female	0.91	0.93

b. Activities

When socio-economic analysis was based on the different activities participants engaged in, one of the more interesting points in this subjectivity test is that those who were not participants (i.e. FONAFIFO, consultants, and employees of CoopeAgri) had agreed very strongly with each other about the most important reasons people participate in the project (table 20). On the other side non-participants agreed less with both those involved in reforestation and agroforestry while agreeing more with participants involved in natural regeneration. Although natural regeneration participants did not agree with each other (there were only two interviewed) they both agreed relatively strongly with the non participants. Large land owners may be participating for reasons that were less economical and more environmental.

Table 20: Correlations between participants in different activities

	Reforestation	Agroforestry	Natural Regeneration	Non participants
Reforestation	0.912	0.918	0.901	0.895
Agroforestry	0.918	0.918	0.906	0.914
Natural Regeneration	0.901	0.907	0.836	0.923
Non participants	0.895	0.914	0.923	0.955

Reforestation and agroforestry participants were more likely to say similar things with each other than with the other two groups interviewed. The similarity between reforestation and agroforestry could be explained by the fact that they were not too different of programs and those that participated had similar access to land in comparison to those participating in natural regeneration (table 6).

It is interesting to note that those who were responsible for managing or designing the project agree most with each other and also those with large tracts of land. On the other side these same people agreed less with participants involved in reforestation or agroforestry projects while those participants agreed more with each other.

c. Land size

Land size was used as a way of measuring economic status. The assumption is that the smaller the land size the less income a farmer had. Total land size was not reported for every project (as indicated in the analysis in activities section) so the questionnaire asked specifically how much land the participant had in total. That is the information that is represented in table 21.

Table 21: Correlations between participants with different land size

	0-10 ha	11-50 ha	50+ ha	Non participants
0-10 ha	0.912	0.919	0.907	0.914
11-50 ha	0.919	0.921	0.913	0.904
50+ ha	0.907	0.913	0.913	0.901
Non participants	0.914	0.904	0.901	0.955

The categories were chosen based on the average land size reported in table 8. Average land size was 8.7 hectares. Therefore the first category is everyone who owned between 0 and 10 hectares. The intermediate group is from 11 to 50 hectares and the large land owners are 50 hectares and above.

There is more relative similarity between the groups than documented in the previous section. The smallest land owners were less likely to agree with the large land owners and more with the intermediate land owners. Intermediate landowners agreed most with those that had similar size land holdings (both in the groups above and below) but more so with the small land owners. The large landowners agreed most with others that had large areas of land and with intermediate landowners. We get the same information we saw in table 20 about the relative agreement among non participants. However, this time we see that they agree more with the smallest landowners than the other two groups. This is due to the fact that many of the non-participants were staff at the forestry department at CoopeAgri but were also small landholders. Therefore, these people would agree more with people of similar land holding size. So this statistic is slightly skewed because it bulks non participant small holders with non participant large land holders also.

Despite this last statistic there seems to be more agreement with landowners whose category is above or below you. Also landowners agree less with other landowners who are have far more or less land than they do. The perception of value from this project between large and small landowners has already been made. However, of all the different breakdowns in socio-economic status this is the least contentious. The assumption that land size is a definite

determinate of economic status is not necessarily true in this case. It is possible that many of the participant's economic status were based on something other than land.

d. Source of income

The last method used for analysing socio-economic status was the participant's primary source of income. In the interview participants were all asked their primary source of income as well as their total land size. These two variables could then be put together to show which sources of income had access to the largest amount of land. The assumption in this case is that different sources of income have different economic status.

Participants who depended upon the public and private sector for income had an overwhelming larger amount of land (table 22) than the other groups. Agriculturalists came in a distant third. Agriculturalists included farmers that produced cash crops such as coffee, sugar cane, or any other. This category also included participants who depended upon pastoralism for their primary source of income. CoopeAgri included participants in the program who were not only from the department of forestry, but other sectors of the cooperative. This is not to say their perceptions of the program were different though. It must also be noted that two of the participants interviewed from CoopeAgri were staff of the department of forestry and had no land. The representative from FONAFIFO was a coordinator and also the consultant mainly responsible for drafting the original proposal for this project.

Table 22: Comparison of land size for various income sources

	Total land	Number interviewed	Average land size (ha)
Public	198.0	3	66.0
Private	419.1	8	52.4
Agriculturalists	321.5	18	17.9
CoopeAgri	23.4	7	3.3
FONAFIFO	-	2	-
Total	962.0	38	

The two representatives from FONAFIFO clearly agree with each other almost exactly on the impact this project has on livelihoods (table 23). The second highest correlation is with CoopeAgri. After this there is minimal agreement with the public, private or agriculturalists sectors. CoopeAgri in the same respect agrees most with FONAFIFO. It is odd that CoopeAgri agrees so little with other members of CoopeAgri, but this can be accounted for in the fact that not all were part of the department of forestry. Other than this, CoopeAgri employees had similar beliefs with public, private and agriculturalists sectors. These were higher than FONAFIFO's, but less than the agreement between participants of the other three groups.

Table 23: Correlations between different sources of income

	Public	Private	Agriculturalists	CoopeAgri	FONAFIFO
Public	0.952	0.927	0.921	0.910	0.858
Private	0.927	0.906	0.919	0.911	0.897
Agriculturalists	0.921	0.919	0.926	0.911	0.895
CoopeAgri	0.910	0.911	0.911	0.895	0.916
FONAFIFO	0.858	0.897	0.895	0.916	0.982

When we analyse the correlations between the other three sectors together there are much stronger agreements. The public sector agreed least with FONAFIFO and CoopeAgri. The

private sector agreed least with FONAFIFO and finally, agriculturalists agreed the least with FONAFIFO and CoopeAgri.

The theme of institutional stakeholders agreeing less with actual participants is also evident from the analysis in the 'activity' and 'land use' section earlier. There is generally strong agreement within the three groups of participants but less so outside of that. In this last section there is a divide between FONAFIFO and the participants as far as the value of the project goes. CoopeAgri is slightly less. This indicates that as an implementer CoopeAgri is a good intermediate institution between the participants and FONAFIFO. This will be discussed more on the analysis on social capital.

Assets

a. General

Since the analysis points to the fact that there are noticeable differences in opinion between groups that have a different source of income, this will be the form of analysis for better understanding the social benefits. Table 24 lists the five capitals from this study that are at the core of the sustainable livelihoods framework; natural, financial, physical, human, and social. The overall opinion was that this project's greatest impact on the livelihoods of the participants was improving natural capital. Financial capital was only slightly more valuable than social capital. Physical and human capital was considered the least important impact of this project.

The information in table 24 further confirms the analysis of the previous section. While most groups considered the greatest asset of this project to be natural capital, FONAFIFO

considered it to be financial. Financial capital was also far less important for those in the public and private sector. For these two groups the impact this project had on social capital was far more valuable. At the same time agriculturalists and CoopeAgri put financial capital in second place as far as impacts this project had. All groups did not disagree much on what the fourth and fifth capitals that contributed to this project were. Both physical and human capitals were not considered nearly as important as natural, financial and social capital.

Table 24: Average point scores of the different assets and sources of income

	FONAFIFO	CoopeAgri	Public			Total
			Private		Agriculturalists	
Natural	2.5	1.6	1.3	1.0	1.0	1.24
Financial	1.0	2.6	3.0	4.0	2.8	2.79
Physical	5.0	4.3	4.1	3.7	3.9	4.05
Human	4.0	4.0	4.0	4.3	4.1	4.08
Social	2.5	2.6	2.6	2.0	3.2	2.84

b. Natural capital

When asked whether they though this project could improve the environment every interviewee responded 'yes'. Table 25 below indicates the ways they thought the natural capital would be improved as a result of this project. Due to the fact that natural capital was the most important asset in this project the responses below indicate what the participants thought were the most valuable aspects of the project.

Table 25: Percentages of answers to impact on natural capital

	Agriculturalists	Private	Public	CoopeAgri	FONAFIFO	Percentage
Contributes to biodiversity	44	38	100	71	100	55
Improves the landscape	44	75	33	57	-	50
Better water in the property/watershed	44	38	67	57	50	47
Provides more oxygen	50	50	67	43	-	47
Reduces erosion	44	25	67	43	-	39
Absorbs carbon dioxide	17	13	-	57	50	24
Assimilates waste	22	25	-	14	-	18
Reduces temperature	11	25	-	43	-	18
Provides more rain	6	13	33	29	-	13
Reduces possibility of floods	-	-	-	-	50	3
Reduces sedimentation of rivers	-	-	-	-	50	3
Other	-	13	-	-	-	3

These responses indicate that people are very educated on the value that trees and forests will provide towards their livelihood. The majority of participants considered themselves to be educated on the importance of trees and forests and considered one of the greatest barriers to other participants was this lack of knowledge (as will be indicated in the section on barriers). There is a very holistic understanding how trees and forests can provide sustainability for other parts of their livelihood.

c. Vulnerability

The strength of natural capital often has the greatest impact on the vulnerability context (DFID, 1999). A weak natural capital can further degrade the vulnerability context and a strong one can provide positive feedback mechanisms to the vulnerability context. For most participants, even those who had other primary sources of income, the prices of coffee and other crops were what made their livelihood most vulnerable. Many of the participants still directly depended upon their farms for their livelihoods. Furthermore, when asked whether they

thought this program would help in reducing these vulnerabilities all but one of the 38 people interviewed said 'yes'. Not only would the project improve the natural capital but it would also provide another source of income.

Table 26: Percentage of responses about vulnerability

	Agriculturalists	Private	Public	CoopeAgri	FONAFIFO	Total
Price of coffee	83	50	33	57	100	68
Price of other crops	17	25	33	57	100	32
Change in climate	22	13	33	57	-	26
Erosion of soil	17	13	-	14	-	13
Less biodiversity	-	13	33	29	50	13
Other	6	25	-	14	-	11
Price of livestock	6	-	33	-	50	8
Less transactions with other countries	-	-	-	14	50	5

d. Financial capital

Financial capital was the second most valued aspect of this project. Only two of the interviewees said that this project had not improved their financial capital. When interviewees were asked if this project had improved their capital many people were thinking into the future. The economic incentives were minimal and generally only covered the necessary start-up capital to participate in the project. Although many people either indicated that they would not have planted any trees or would have planted far less without the economic incentive. In the end the greatest justification for planting trees (in terms of financial capital) was to add value to the farm in case they should ever want to sell it (table 27). The other was adding another source of income, which was just discussed in the vulnerability context.

Table 27: Percentage of responses to impact on financial capital

	Agriculturalists	Private	Public	CoopeAgri	FONAFIFO	Total
More value for farm	78	71	100	57	-	69
Another source of income	78	43	-	86	50	67
Improve savings	17	43	50	-	-	19
Improve profits	11	-	-	14	-	8
No answer	6	14	50	-	-	8
Other	-	-	-	14	50	6

e. Physical capital

Physical capital was not seen as having been impacted by this project all that much. 84% of interviewees thought there was a possibility. However, it was hard to determine the impact in the immediate future. People answered in two ways. The most popular way to answer was the improvement this project would have on more personal physical infrastructure, such as their home or more personal items. Fewer responded that infrastructure, such as better roads, schools, or hospitals, were likely to improve. If they did respond in this way it was because their hope that a better market for timber would encourage government to provide improved services.

Table 28: Percentage of responses to impact on physical capital

	Agriculturalists	Private	Public	CoopeAgri	FONAFIFO	Total
Improve house	69	17	67	67	0	56
Purchase equipment to improve income	31	33	33	50	100	38
Improve roads	19	17	33	17	0	19
Other	6	17	0	67	0	19
Buy personal things	13	33	0	17	0	16
Improve schools	13	33	33	0	0	16
Provide more services	6	17	33	0	0	9
Provide new businesses	0	0	0	17	0	3

f. Human capital

i. Health

Human capital was divided up into two sections; health and education. All but one person thought that this project had provided better health and education for their livelihood. The health that this project provided was more thought of in terms of their micro-climate (table 29). There would be better air and water as a result of this project. Interestingly a number of people even responded that this project had provided them with psychological peace of mind. There was much less talk of improvement of access to health services.

Table 29: Percentage of responses to impact on the health aspect of human capita

	Agriculturalists	Private	Public	CoopeAgri	FONAFIFO	Total
Clean air	83	71	33	43	-	65
Clean water	17	71	33	29	1	32
Need less chemicals	28	29	-	14	1	24
Psychologically	11	29	33	57	-	24
Access to more health services	11	14	33	-	2	16
Reduce sickness	6	-	33	-	1	8
Improve health services	11	-	-	-	-	5
No answer	-	14	-	-	-	3

ii. Education

The response towards educational impact of this project focuses solely on the technical advice given to them from CoopeAgri staff in the department of forestry and at the CoopeAgri nursery. Although people thought that their educational knowledge of trees and forests was greatly improved they never indicated any other type of education that was provided through this project. The technical advice given by CoopeAgri is done at least on an annual basis with

direct visits to every farm. If the project is in the early stages than the same farm may be visited up to three times a year. Almost all interviewees were very appreciative of the constant advice given to them.

Table 30: Percentage of responses to impact on the education aspect of human capital

	Agriculturalists	Private	Public	CoopeAgri	FONAFIFO	Total
More technical information	100	100	100	100	100	100
Access to same information in future	100	100	100	100	100	100

g. Social capital

The responses, with regards to the impact of social capital as a result of the project, were much different than the responses to the other capitals. Social capital was a close third in overall rankings after financial capital, but only half of the interviewees thought that their social capital was improved as a result of this project. This was the lowest response of all the capitals, yet those who said their social capital was improved rated it high relative to the other capitals.

Table 31: Percentage of responses to which sector of social capital

	Agriculturalist	Private	Public	CoopeAgri	FONAFIFO	Total
Private sector	83	20	-	80	100	63
Community	33	40	100	60	-	42
Public sector	-	40	-	20	50	21
Civil society	-	-	-	20	-	5

There are a variety of reasons for this. Those that chose to respond 'no' to the impact social capital had on this project were often members of CoopeAgri already and therefore had a strong social capital. Those that were not members and joined the project were introduced to new people in different sectors, especially CoopeAgri. Furthermore some people that were members of CoopeAgri had also met new organisations as a result of this project.

The responses in table 32 indicate how people felt this new social capital improved their livelihood. Those that were not members of CoopeAgri received new technical advice that they would not have gotten otherwise. Those that were members of CoopeAgri had been introduced to new organisations which improved their access to other markets.

Table 32: Percentage of responses to how social capital helped them

	Agriculturalist	Private	Public	CoopeAgri	FONAFIFO	Total
Technical assistance	67	-	100	60	100	53
Stronger access to market	33	20	-	80	100	47
More confidence in other organisations	50	20	100	20	50	37
More confidence in community	17	20	100	20	-	21
Access to other things	-	20	-	40	-	16
Improve knowledge of PSA	-	20	-	20	-	11
Equipment for farm	-	-	-	-	50	5
More access to loans	-	-	-	20	-	5
More access to public services	-	20	-	-	-	5

Social capital is often seen as the asset that is most likely to influence access to the structures and process (DFID, 1999), which in turn has the ability to impact the vulnerability context and create a positive feedback. At the same time social capital is one of the hardest assets to measure and hence to understand. In this analysis there is no exception. The word 'social capital' was never mentioned in the interviews (as were the names of the other capitals) but was described as relationships and networks. For those that said 'yes' their social capital had improved agreed that their relationship/network base had increased. Those that had said no already had strong social capital. At the centre of this is CoopeAgri. Without an institution like CoopeAgri, with the technical knowledge of implementing this project, technical assistance on forestry, and community linkages, a project like this would be much more difficult. As

analysed in table 23, CoopeAgri was a good intermediate institution because they agreed most closely with FONAFIFO and also with participants. Bridging institutions such as these that have a well developed trust with community members are vital for the success of large projects.

h. Integrated asset base

Despite breaking down the asset base into the various sections, the asset base should never be looked at in isolation. During the interviews people would often think of their responses and say 'every asset is of equal value to me, I cannot choose just one'. Although this analysis chose to break down the different assets this does not discount the fact that they all depend on each other. Furthermore this analysis only looked at one specific intervention (i.e. forestry) and the impact it has had. The people in Perez Zeledon had many more interventions such as, coffee, sugar cane, pineapple, blackberries, or commercial enterprises that affected their asset base in an infinite number of ways. People viewed the impact to their natural capital as the greatest aspect of this project and in the opinion of the interviewees all the other capitals would benefit.

Figure 22: The dynamic asset base

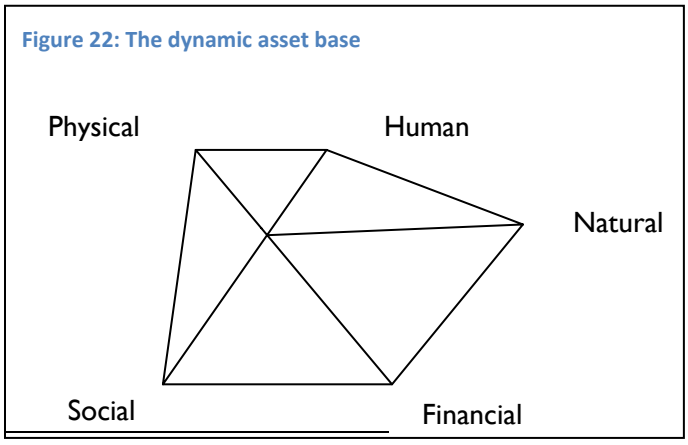


Figure 22 is a mathematical representation[22] of how the perceptions of influence this project has had on the different asset base and how they are integrated. This projects stakeholder's

[22] This was calculated by using the information in table 24. The allotted score for each capital (i.e. natural capital was 1.24) was subtracted from the total score (i.e. 5) giving an amount that represented the influence of that capital (i.e. natural capital's total was 3.76).

perceived natural capital to have the greatest overall influence to their livelihoods, followed by financial, social, physical and human capital. At the centre where all capitals intersect represents the fact that despite a greater influence by some capitals, all are integrated together and have influence on each other. The model also represents a dynamic asset base because it only represents the total. Every individual has their own perceptions as to how this project influences their livelihood. All of these individual perceptions combine to make this model a dynamic asset base.

Outcomes

Just like the interconnectedness of the asset base the five outcomes are also quite interconnected. There are no real negative outcomes but some outcomes mean different things to a livelihood. The outcomes listed in table 33 are based on the sustainable livelihoods framework guidance sheets (DFID, 1999). These outcomes are the goals of obtaining a sustainable livelihood.

Table 33: Average point scores for responses to outcomes for the different sources of income

	FONAFIFO	CoopeAgri	Private	Public	Agriculturalists	Total
Higher Income	4.0	3.0	2.6	2.7	2.3	2.63
Improvement of well-being	2.5	2.7	2.9	3.3	2.9	2.89
Reduction of vulnerability	1.5	3.3	3.9	3.0	4.1	3.68
Improvement of food security	5.0	4.3	4.0	4.7	3.9	4.13
Sustainable use of the natural resource base	2.0	1.7	1.6	1.3	1.7	1.66

Participants felt that the most valuable long term outcomes of this project would provide a more 'sustainable use of the natural resource base'. Most of the groups of different sources of income agreed with this statement. FONAFIFO representatives however, chose the statement

'reduction of vulnerability' as the greatest outcome this project could have. Overall reduction of vulnerability was the fourth highest outcome people saw as a result of this project. However, reduction of vulnerability can be seen as looking at the outcome from a more global perspective, which FONAFIFO would have as an intermediary with the World Bank BioCarbon Fund.

A higher income was the second most likely outcome of this project overall. Most of the participants in the project would agree with this statement, however again the institutional stakeholder groups of CoopeAgri and FONAFIFO felt that this was the fourth highest expected output. Both CoopeAgri and FONAFIFO thought that an improved well-being was more likely as an outcome. Their thoughts were focused less on the fact that the timber market would be able to compete with some of the other high income industries in the region, but instead would provide more of a global benefit than an individual benefit.

All groups agreed that improvement of well being was a good third choice, while improvement of food security was a distant fifth. Clearly better food security was not really something people thought this project would provide.

Understanding the relationship between question eight (asset base) and eleven (outcomes) are important. If the answers to question eight are used as a point of intervention we could see what people are most likely see to be the outcome of these same interventions. However, the conclusions are quite different than one would assume by looking at table 33. The assumption

is that people would see the intervention of natural capital as a way to improve the sustainable use of natural resources. There are quite different results.

If a project wanted to encourage sustainable use of natural resource an intervention of social capital (and to a lesser extent natural capital) was perceived to be the most likely way. There were more correlations between the social capital and the sustainable use of natural resources than any of the other assets in this research. The stronger social capital is the greater the sustainable use of natural resources was perceived to be.

Table 34: Correlations between asset base and the sustainable use of natural resources

	Sustainable use of Natural Resource Base	
	N	R
Financial		
Total	38	-0.431**
Private	8	-0.667*
Public/Private/Agriculture	29	-0.367*
CoopeAgri	7	-0.807*
Social		
Total	38	0.426**
Private	8	0.711*
Public/Private/Agriculture	29	0.410*
FONAFIFO	2	1.000**
Natural		
Private	8	0.800**
Public/Private/Agriculture	29	0.364*
FONAFIFO	2	1.000**

* Correlation is significant at the 0.05 level (1-tailed).
** Correlation is significant at the 0.01 level (1-tailed).

For example, social capital in the context of this research meant greater trust and relationships between individuals, communities, CoopeAgri, government and other institutions. If trust is

strong between these different stakeholders than there is less likelihood of breaking the established social norms to exploit natural resources. However, if trust or relationships are weak between these stakeholders, than there is an increased likelihood that a individual will exploit his natural resource and cause negative externalities if he/she feels there will be no consequences. Also an individual may be more likely to exploit a neighbours natural resources or even a public source of natural resources. This is what was described as an open access regime in chapter 3. A breakdown in social norms or a weak social capital will lead to a higher likelihood of exploitation of natural resources, while a strong social capital will have the tendency to enforce social norms for the sustainable management of natural resources.

An intervention of natural capital will obviously improve sustainable use of natural resources. For example investment into watershed protection, rehabilitation of mines, and reduction of chemicals in agriculture will lead to healthier natural resources. In this project stakeholders saw the planting of trees as beneficial to improving the sustainable use of natural resources.

However, on the other side financial capital was perceived to have a negative effect on the sustainable use of natural resources (table 34). The more attention paid towards financial capital was perceived to reduce attention paid towards the sustainable use of natural resources. For example, an improvement in the market for timber could be seen as a pure financial intervention. However, the perception of participants is that this will lead to the promotion of deforestation and not promote the planting of more trees. Hence the reduction of sustainable natural resources use.

An intervention of financial capital was also not perceived to be able to reduce vulnerability (table 35). Financial capital is seen as a short term solution to long term problems. On the other hand an intervention of either social or human capital was perceived to be more likely in reducing vulnerability. Social capital improves networks which can also improve people or institutions on which to rely upon when times are difficult. A person who is less connected and has poor relationships with communities or other institutions is less likely to find support when times are more difficult. Human capital, in the context of this research, was an improvement in technical knowledge about trees, forests and how to integrate them into your livelihood successfully. Both social and human capitals are long term investments that are seen as protecting against unknown vulnerabilities, whereas financial capital was seen as short term solution. In order to reduce vulnerability there needs to be a focus on the larger time scale.

Table 35: Correlations between asset base and the reduction of vulnerability

		Reduction of Vulnerability
Financial	n	r
Private	8	-0.891**
Public/Private/Agriculture	29	-0.497**
Human		
Total	38	0.298*
Social		
Total	38	0.324*

* Correlation is significant at the 0.05 level (1-tailed).
** Correlation is significant at the 0.01 level (1-tailed).

Despite the analysis above there is one obvious conclusion that can be made by looking at the correlations. The perception of achieving a higher income was related to an intervention of financial capital (table 36). However, at the same time social and human were perceived at

reducing the outcome of a higher income. Although the correlations are low, this still presents a dilemma from a project design point of view.

Table 36: Correlations between asset base and a higher income outcome

	Higher Income	
	n	r
Financial		
Total	38	0.487**
Private	8	0.857**
Public/Private/Agriculture	29	0.585**
CoopeAgri	7	0.907**
Social		
Total	38	-0.329*
Human		
Total	38	-0.310*
Physical		
CoopeAgri	7	0.828*

* Correlation is significant at the 0.05 level (1-tailed).
** Correlation is significant at the 0.01 level (1-tailed).

While social capital is good for sustainable resource management, financial capital was seen as negative and while financial capital is seen as good for a higher income, social capital was seen as reducing the likelihood of a higher income. Social capital may perceived as reducing the likelihood of a higher income because while a strong social capital can help support some people in times of vulnerability it also means that others will depend upon those with more resources available. Therefore any financial gains by a given individual will be limited by any number of dependents that exist within his/her social network. If this is recognised by some individuals that exist within strong social networks their incentive to increase their economic standing may be reduced for the same reasons mentioned above. Strong communities are often

reliant on each other when resources are minimal, and break down when financial times are better.

The question is than is there juxtaposition between an outcome of sustainable natural resource management or a higher income? There is juxtaposition depending on whether or not the focus is short or long term project design. Shorter term interventions will focus more on financial gain at the expense of exploiting the natural resource base. This gives certain individuals a stronger financial capital at the expense of the natural resource base. In turn this reduces the ability of other to access the same natural resources and hence creates the poverty gap that was discussed in chapter 2. A longer term focus will approach investment into social capital instead of financial capital for an outcome of sustainable use of natural resources. This way there are no clear economic gains and there is less potential for a poverty gap created and more potential for equality in the use of the natural resource base.

The important part of this project however, is that the primary intervention was not perceived to be financial or social capital, but natural capital. Natural capital had its strongest relationship to the sustainable use of natural resource base (table 34). Other than this, natural capital's only other perceived outcome was an improvement in food security. Although an intervention of natural capital alone does not necessarily improve social, human, or physical capital.

This analysis concludes again what was said about the asset base; a program cannot be designed to focus on only one asset. For example, if this project would have only focused on financial capital through designing of a better market for timber than the perception of people is that it

would have eroded other outcomes such as responsible use of natural resources, and failure to reduce vulnerability.

There are certain assets that will always be the primary target as in this case. However, if the other assets are not addressed within the same project design framework, than there will be a struggle to address the social benefits of the participants. Through conversations with participants all the assets were of value to them just as the outcomes that they all strove for. Some outcomes may be more likely with certain interventions than others, but all will be affected by ignoring some asset interventions and may result in catastrophe for a livelihood.

The future

Aside from the increasing the number of participants there is a lot of room for growth in this specific project with the full potential not having been reached. Eight perceived barriers were chosen based on a list derived from the original proposal designed by FONAFIFO (Ortiz & Elena, 2006). The purpose in the original proposal was to understand all barriers to different land uses and opportunity costs. The results of the survey in the proposal when assessing the barriers to forestry projects were similar to the results in table 37 except for one omission. In table 37 there was not one response indicating that the market for timber was a barrier to participation. Lack of markets may have been a barrier but compared to other reasons markets were not the priority.

Table 37: Perceived barriers to other people

	Frequency	Percentage
Finance	24	63.2
Cultural	20	52.6
Legal	8	21.1
Policy	1	2.6
Other	1	2.6

All conversations during interviews focused on either a financial or cultural barrier. Financial barriers meant that the payment for environmental service was not sufficient enough to replace the current land activity. In other words many people depended upon cash crops or livestock as a major part of their livelihood and displacing that for forestry was not possible. The opportunity costs were too high. A few people even referred to the system of payments used. Even if participants are accepted to participate in the project, they will not receive their first payment until after the first year is complete. Many farmers do not have the capital to purchase the tree seedlings and transport them to their farm. The cost of this is often the same cost that a farmer will receive at the end of the year as a payment for environmental service.

The second most reported barrier was cultural. This referred to the fact that people did not understand the project enough (this can also be argued as an educational barrier). The perception was that many people were stuck in certain cultural traditions where reducing trees on their property for other cash crops was the best way to maintain their livelihood. People often referred to the times when the government of Costa Rica promoted the cutting of forests for other crops (mentioned in chapter 4) and how this has become embedded in their cultural framework. This is despite the fact that Costa Rica has an international image of being 'green' and supporting ecotourism. Like any country in the world, rural areas are less likely to change their traditional views than more urbanised areas. If people still had this frame of mind

than planting of trees for a livelihood or for better protection of the ecosystem would be counter culture to what they believed the purpose of their land was for.

Legal barriers were also an issue. These barriers referred to the fact that many people could not participate because they did not have title to their land, and were therefore prevented from participating in a program they might have otherwise been willing to participate in. Lack of a land title often occurs when the land is passed down through family. There may have been land title for the large property but as it is divided up between the children new titles are not issued.

A lack of title was one of the prerequisites to be a participant. Before participants are even considered they must present a deed for the land and a topographical plan of the same property. While a topographical plan may only take a month, obtaining title to your land may take years. Not only is there a big time commitment but the cost of obtaining title to land may be upwards of a 1,000 US$ (Luis Salazar Salazar, personal communication, October 18, 2007). This is also a financial barrier.

While the department of forestry at CoopeAgri considers this to be one of the biggest obstacles to participation Luis Salazar Salazar, director of the department of forestry, indicated that each of the activities also had their own limitations. The struggle with natural regeneration is the definition of a forest. The CDM offers certain definitions of what a forest is and each respective country picks the one that best represents their program. Costa Rica's AR-CDM definition says eligible land has no forest before December 31, 1989, no forest presently, and no forest in the period from 1990 to the present. No forests are lands that have an area less

than one hectare, or lands of more than one hectare but a crown cover less than 30%, or land with more than one hectare, or crown cover of more that 30%, but that have or will have at maturity a mean height of less than 5 meters. However, FONAFIFO has a different definition of what a forest is (or is not). This was established in 1996 with forestry law 7575 (see chapter 4). In this definition land no forest exists if there is less than 2 hectares, has a crown cover of less than 70% and has less than 60 trees per hectare, where the trees are 15 cm diameter or more. (Edgar Ortiz Malavassi, personal communication, September 5, 2007). The stricter rules under the AR-CDM have left land that would have been considered under the Costa Rica forestry law 7575 not available for this project. Therefore there are large tracts of land in the northern and southern regions that are do not qualify as natural regeneration projects.

Commercial reforestation has suffered the most in terms of land and participation. The land value for cash crops are, or are perceived to be, higher than the value of timber. A market for timber cannot compete against other crops in the region such as coffee, sugar cane, and pineapple. Even pastoralism often has greater land value. In the project proposal an economic analysis shows how the opportunity costs are low in favour of reforestation projects (Ortiz & Elena, 2006). However, what is important to understand is the perception of people. Whether or not the conclusion that reforestation projects have a low opportunity cost for people in this region is irrelevant if people *believe* that that reforestation projects have high opportunity costs. The project to date has indicated that the only project with minimal barriers is agroforestry because it is the only activity that is adaptable to working with on farm activities. Therefore, there is less sacrifice of the opportunity costs.

Measures to reduce barriers to participating

When participants were asked what they thought could be done to overcome the barriers more education was almost always the answer. Both financial and cultural barriers often considered education as the answer. Financial barriers could be overcome by better education about agroforestry systems and how people could integrate trees into other parts of their livelihoods. Other educational solutions that people mentioned were reducing the cost by participating in projects at a community level. If the project was aimed at a community level than participants could coordinate purchasing and transportation of seedlings and therefore reduce the overall cost. At a community level the sharing of success and failures would also be easier. In the long term a community participating would also have better economic and social impacts.

Table 38: Solutions of barriers to project

	Frequency	Percentage
More education about the project	23	60.5
Other	12	31.6
Increase payments to farmers with less than a hectare	7	18.4
Make the process more flexible	6	15.8
More resources to help people obtain a title	2	5.3
Open the project up to protection also	1	2.6

Cultural barriers often considered education of the program even more important though. Education that simply explains the benefits of trees for sustainability of the farm and environment were crucial aspects. Those that participated always talked very knowledgably about the importance of forests, but explained that many people did not have the same outlook. Again this may be done better at a community level. As people see the results than they may become more interested; success breeds success.

There were a lot of responses for 'other' also because many people just thought that it is not possible for everyone to participate. Often people said the rich people who could participate do not want to bother themselves with such small payments. As a result large tracts of land are left out of the project. Those who have less land and would like to participate cannot because they cannot sacrifice their current livelihood to plant trees. Seven of the twelve respondents for the 'other' category referred to the fact that there was no solution. This is the reality of the situation and this has to be accepted. Forestry as a livelihood cannot be for everyone.

Discussion

This project in Perez Zeledon has had many successes and proves that the possibility of payment for environmental service projects and the carbon market can be pro-poor. One of the key indicators of successes is shown in table 6. Almost 70% of the total participants were involved in agroforestry projects. The average land each participant reported was slightly lower than the average for the county. This indicates the willingness to participate among farmers with less land flexibility. However, at the same time participation rates have been far lower than expected. As this project is one of only a few in the world many lessons can still be learnt about how to improve the process. The conclusion of this research points to the need to design, implement, and monitor projects by continually focusing on the entire asset base by better understanding the perception of all stakeholders, especially participants.

The main focus of this project was through a direct intervention of natural capital. This project did an excellent job of identifying appropriate trees, raising seedlings and offering continual technical advice on forestry management (although CoopeAgri was already providing these services before the BioCarbon funding was provided). As this is already the focus of the forestry department for CoopeAgri the assumption is that this will continue through the life of the project and even beyond.

Financial capital was considered the second most important aspect of this project. While nothing can be done about increasing the payments made for planting and managing trees and forests, an extra incentive would be to improve market access. Long term economic incentives are important for sources of income that do not have an annual turnover. CoopeAgri has already recognised this and are working towards developing a better market for timber within the region though the construction of a saw mill in San Isidro. The intention was to start construction in 2008 (personal communication with Luis Salazar Salazar, December 4, 1997). However, participants in this research found that financial capital may conflict with the sustainable use of natural resource management (with reference to forest ecosystems) and would not reduce vulnerability (financial capital was perceived to be a short term solution that would not reduce long term issues). The only positive outcome financial capital would bring were higher incomes. While this is important in reducing poverty, it cannot be seen as the only way anymore. Fortunately this project is not directly focusing on financial capital as an intervention, but these results do indicate how people feel about this type of intervention.

The least important aspect of this project was the intervention of physical capital. While people saw that any future income may have improved their household possessions they saw very little likelihood that the project would provide any physical infrastructure. Perez Zeledon already has a strong income base in pineapple, coffee, and sugar cane. CoopeAgri plays a large role in encouraging these commodities and will soon increase the cooperative's influence in the timber market. However, there is no real advocacy role played by the institution. As the region is growing stronger economically more public infrastructure such as better roads and hospitals in more of the remote regions should be encouraged. CoopeAgri has the potential to better lobby the government to improve infrastructure to more remote communities.

The education aspect of human capital was seen as one of the most important solutions that have prevented people from participating in this project. People interviewed in this research identified that human capital was most likely to reduce their vulnerability as a long term outcome. This was not a focal point for CoopeAgri's intervention in this project in a major way. The majority of the education of this project was done in general assembly meetings so that members were aware. There was also some radio advertising. The rest was dependent upon 'word of mouth' advertising. Due to the fact that CoopeAgri has created strong community linkages the information has slowly trickled out and has shown an increase in numbers every year. However, this project has not seen a real community effort yet. All projects are occurring somewhat independently of each other around the county (see table 12). While the department of forestry at CoopeAgri recognise this weakness they do not have the staff capacity within their department to engage communities better. One suggestion would be to work more with the community coordinator for CoopeAgri on a more official level. The

other option would be to hire someone specifically for the purpose of training and engaging communities on a more educational level and less of a technical level.

Communities could be better engaged by improving targeting methods. Better targeting methods are seen as an effective way to distribute resources to the poor (Coady, Grosh, & Hoddinott, 2004). In this project it really is no different. Coady et al. (2004) found that targeting methods that used means testing, geographical, and self selection methods were the most effective ways of transferring benefits to the poor. Due to the fact that this project is based on market principles self selection already exists as a targeting method. However, the concept of 'additionality' needs to be incorporated here also through the use of geographical means. The best way to do this would be to identify communities with high participation rates, lower levels of poverty in environmentally fragile regions of the county. A means test would only help to better identify the most appropriate geographical region. However, as CoopeAgri is well known in the region and understands the region these expenses could be spared.

Once a community or specific region has been targeted, one cannot depend entirely on people to judge their own opportunity cost (some communities are suggested within the results section of this chapter). A better educational system needs to be incorporated so that people make more educated decisions with regards to the opportunity costs. Focus groups and community meetings should be held with members so as to dispel some of the myths about the project such as, contract commitments, length of contracts, and adaptability of projects with other on farm activities. By engaging with farmers more directly an improvement in social capital will help to build trust and encourage people to participate. This process should have

been done more effectively during the design of the project but the proposal (three community meetings were held) seemed to show participation as more of a token gesture. However, despite this fact the project could *still* be more effective with more direct community involvement. This not only will help CoopeAgri encourage more people to participate but it will also help to reduce their own logistical nightmare of having to visit so many different farms throughout the year. If a community was organised, visits from forest engineers could all be made on one day instead of having to come back many different times to monitor various projects. This sort of community participation would also help to reduce the cost of transporting seeds as they could coordinate deliveries better.

Improved education and a better understanding of the project will also show that there are aspects that are pro-poor. It is often hard to balance sustainable natural resource management and pro-poor designed projects. However, this project seems to be able to do both, although the selection of activities is still based entirely on self selection targeting methods and no use of additionality methods. Projects such as natural regeneration will have a greater impact on the environment. Many of the natural regeneration activities occurred high in the watersheds, covered large tracts of land and will improve water quality and reduce erosion, but will have little direct impact on poverty. On the other hand agroforestry projects are small and scattered across the county. Therefore these projects have a less likelihood of impacting the natural resource base but a greater opportunity to reduce poverty. At the same time, if community involvement is high than many projects in a concentrated region could also have a significantly positive impact on the natural resources base. If education and targeting is done so that projects will show the different types of forestry projects and how to better integrate

them into on farm activities than benefits will be more obvious than hopefully participation will occur.

Finally social capital (and political capital) needs to be improved by better connecting the current 'top-down' approaches with a 'bottom-up' approach. The heavily bureaucratic structures such as the cost and time necessary for processing applications often discourage people. Formal institutions have to include the perceptions of people into projects design on a much more active level and be able to adapt the formal process to a more dynamic one. Staff from the department of forestry at CoopeAgri commented on the fact that they spent more time processing applications for FONAFIFO than they did actually visiting farmers and projects in the field. This in itself severely limits the amount of time that is necessary for building trust and strong relationships between institutions and beneficiaries.

Participants interviewed felt that an intervention of social capital would improve sustainable use of natural resources and decrease vulnerability, but not really provide a higher income. This is the direct opposite of how people felt about an intervention of financial capital. While financial capital is recognised as an important contribution to this project there are mixed results for the importance and impact of social capital.

However, supporting formal and informal institutions are something CoopeAgri as an organisation is good at. CoopeAgri just celebrated their 45th anniversary this past year (2007) and have developed a strong level of trust in the region and with the communities. However, this project has not been able to tap into the existing structures that exist in communities (as

was mentioned previously). The lack of understanding about the project was in many participants' interviewed a hindrance to participation. A lack of understanding may result from unawareness or mistrust that the project may not help them and make their livelihoods more vulnerable. The proposal (Ortiz & Elena, 2006) does a good statistical analysis showing the opportunity costs of participating in this project for many different livelihood strategies were low. Yet whether opportunity costs are low or high is besides the fact. If people perceive the opportunity costs to be high, (whether or not this is true) than participation is bound to be low or nonexistent. Addressing people's perceptions can be improved through more effective engagement with communities. As levels of trust and more effective means of working with communities are self evident, than a multiplier effect will occur. Success breeds success, and more communities will see the advantage of this approach, thereby reducing the need of CoopeAgri to continually educate. While this approach may seem less cost effective, in the long run the successes will pay for themselves.

Another major constraint was the lack of title to lands they currently live on. This shows a weak degree of political capital and prevents many people from participating in this project. Unfortunately, this is the way the project was designed. If more appropriate engagement had been conducted before the design than issues like this may have arisen and an approach that addressed a more *de facto* notion of land title could have been developed. Although there is no statistical evidence to prove otherwise, the poor are often more likely to not have official land title and therefore are being cut out of this opportunity. This aspect of the project is the most unfortunate as there is little likelihood that it will change, however it is an important lesson for future project design.

Conclusion

Costa Rica is the one country in the world where investment into the carbon market can be done easily because of a well established payment for environmental services national program. This research also shows that reforestation under the carbon market and payment for environmental services program work together and can complement the different risks inherent in the different models. While no country can take a payment for environmental services project and transfer it exactly, the 'best practices' mentioned in this research paper can be carried forward.

Using the sustainable livelihoods approach, based on systems theory, appropriately helps to address the concerns in designing, monitoring and evaluating natural or forest resource management projects developed under carbon market principles. Both social and ecological systems are dynamic, integrated and have emergent processes that are developed over time and need an approach that can properly analyse this. As the voluntary and regulatory market develops for reforestation projects, access by people to the entire asset base must be evaluated. The entire asset base is integrated and influences the strength or weakness of other assets for individuals, communities and ecological systems. Furthermore, special emphasis must be placed on investment into political and social capital along with a proper understanding of institutions and their impact is needed if projects are to benefit the most vulnerable people of society. Focusing on only a few capitals will only further isolate people from society.

Poverty should never be regarded as an afterthought, but as the central focus of project design in terms of payment for forest environmental services projects and reforestation under the Clean Development Mechanism. The sustainable livelihoods framework is an appropriate tool for analysing the complexities that exist within communities and also within ecological systems. Admitting we do not understand everything about how systems organise around us is the first step to more effective engagement with people and our ecological systems.

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Appendix A

Database for the Collection of Information to Date

Informacion de Proyecto a la fecha:

Informacion Por General:

ID:	1	Domicilio:		Situacion de participando:	
Nombre:	Alberto Garcia Cisneros	Distrito:	Pejibaye	☑ Activo	
Genero:	Masculino	Habitacion:	San Miguel	☐ Aprobados	
Cedula de Indentificad:	9-0089-0694	Socios de CoopeAgri	☑	☐ Presentados	
				Ano se entrada:	2007

Informacion por el Proyecto:

Region:	Valle	Area Total:	1.4757
Distrito:	Cajon	Ha Proyecto:	1.5
Ubicacion de Proyecto:	San Francisco	Uso Actual:	☐ Ganadaria
Plano:	SJ-7215-1974		☑ Cosechas por dinero
Folio Real:	1-224368-000		☑ Agriculuro Substencia
			☐ Horticultura
			☐ Forestales
			☐ Mineria

GPS Punto 1:	N09.32182	W083.60509
GPS Punto 2:	N09.32247	W083.60516
GPS Punto 3:	N09.32155	W083.60350

Actividades:

☑ Sistema Agroforestal — SAF con: ☑ Cafe, ☐ Silvopastoril, ☐ Cultivo no Perene, ☐ Bloques, ☐ Hileras

☐ Reforestacion comercial — ☐ Regeneracion Natural

Amarillon:	0	Amarillon:	0
Cedro Amargo:	600	Cedro Amargo:	0
Melina:	0	Melina:	0
Teca:	0	Teca:	0
Manzana Rosa:	0	Manzana Rosa:	0
Eucalipto:	0	Eucalipto:	0
Roble Sabana:	0	Roble Sabana:	0
Cipres:	0	Cipres:	0
Jaul:	0	Jaul:	0
Cortez Amarilla:	0	Cortez Amarilla:	0
Zota Caballo:	0	Zota Caballo:	0
Pilon:	0	Pilon:	0
Ira Rosa:	0	Ira Rosa:	0
Total arboles/ha/ha:	600		0

0

Arreglo

Arreglo - 2007:

Arreglo - 2008:

Appendix B

Preguntas para Reforestadores

(Fecha): _____

Nombre: _____
Genero: _____
Región: _____
Distrito: _____
Caserío: _____
Actividad: _____
Especies plantadas: _____
Total área en todas sus fincas: _____
Fuente de ingresos más importante: _____

1. ¿Por qué medio se informo de este proyecto?
   i. Radio ☐
   ii. Televisión ☐
   iii. CoopeAgri/reunión ☐
   iv. Gobierno (FONAFIFO) ☐
   v. Amigos ☐
   vi. Otra personas ☐
   vii. Prensa escrita ☐
   viii. Otra ☐

2. ¿Cual es la razón más importante por la cual usted esta participando en el proyecto? (marque con x todas las que correspondes)
   i. Es un servicio ambiental ☐
   ii. No esta utilizando su terreno ☐
   iii. Le da valor a la finca ☐
   iv. Otra fuente de dinero ☐
   v. Plantación con fines productivos madera ☐
   vi. Muy semejante a la opción primera ☐
   vii. Requiere de menos trabajo ☐
   viii. Aumenta la productividad las cosechas ☐
   ix. Aumenta biodiversidad ☐
   x. Protección de agua ☐
   xi. Tener un finca mas sostenible ☐
   xii. Otra ☐

3. ¿Considera usted que este proyecto puede ayudar al ambiente? Si ☐ No ☐
    - ¿De que modo? (marque con x todas las que correspondes solamente cuando la repuesta antes fue 'Si')
        i. Mejor calidad de agua en la propiedad/cuenca ☐
        ii. Asimilación de desechos ☐
        iii. Reducción de erosión ☐
        iv. Absorber dióxido de carbono mediante los troncos, ramas, y raíces de los árboles. ☐
        v. Contribuye a la biodiversidad ☐
        vi. Mejora el paisaje ☐
        vii. Disminuir posibilidades de inundaciones ☐
        viii. Disminuir sedimentación de los ríos y cauces ☐
        ix. No responde ☐
        x. Otra ☐

4. ¿Puede este proyecto mejorar su condición económica? Si ☐ No ☐
    - ¿Como? (marque con x todas las que correspondes solamente cuando la repuesta antes fue 'Si')
        i. Acceso a un préstamo/crédito ☐
        ii. Aumenta ahorros ☐
        iii. Mas seguro social ☐
        iv. Menos dependencia de envió de dinero del extranjero ☐
        v. Mas valor por su finca ☐
        vi. Otras fuentes de dinero (i.e. mercado de madera) ☐
        vii. No responde ☐
        viii. Otra ☐

5. ¿Cree usted que por medio de este proyecto se puede desarrollar nuevos activos físicos o infraestructura en su comunidad en el futuro? Si ☐ No ☐
    - ¿Como? (marque con x todas las que correspondes solamente cuando la repuesta antes fue 'Si')
        i. Comprar equipo para ayudar su ingresos ☐
        ii. Mejora su casa (i.e. pared, piso) ☐
        iii. Provee mas servicios (i.e. agua, electricidad) ☐
        iv. Compra cosas personales (tele, radio, refríe) ☐
        v. Mejorar las escuelas ☐
        vi. Mejora carreteras/puentes ☐
        vii. Hospital mejor ☐
        viii. Provee nueva negocios/empresas ☐
        ix. No responde ☐
        x. Otra ☐

6. a) ¿Puede el proyecto mejoran su salud? Si ☐ No ☐

- ¿Como? (marque con x todas las que correspondes solamente cuando la repuesta antes fue 'Si')
    i. Agua potable ☐
    ii. Aire limpio ☐
    iii. Necesita menos químicos ☐
    iv. Reduce enfermedades ☐
    v. Aumenta medias de sanitarias ☐
    vi. Acceso a mas servicios de salud ☐

b) ¿Puede la educación (capacitación) del proyecto aumentar sus habilidades para mejorar su futuro? Si ☐ No ☐
- ¿Como? (marque con x todas las que correspondes solamente cuando la repuesta antes fue 'Si')
    i. Mas información técnica de los árboles plantados ☐
    ii. Acceso mas educación en el futuro ☐
    iii. No responde ☐
    iv. Otra ☐

7. ¿Hay otras personas en su comunidad u organizaciones que podemos encontrar y pueden ayudarle a mejorar su futuro antes de este proyecto? Si ☐ No ☐
- ¿Quien? (marque con x todas las que correspondes solamente cuando la repuesta antes fue 'Si')
    i. Sector Publico (i.e. FONAFIFO) ☐
    ii. Sector Privado (i.e. CoopeAgri) ☐
    iii. Sociedad Civil (i.e. no gobierno) ☐
    iv. Comunidad ☐
    v. Nadie ☐
    vi. Otra ☐
- ¿Cuál seria la ayuda que usted requiere para mejorar su futuro? (marque con x todas las que correspondes solamente cuando la repuesta antes fue 'Si')
    i. Equipo para su finca ☐
    ii. Acceso a otra cosas (i.e. para su casa, ingresos) ☐
    iii. Mas acceso a préstamo u otra servicios financiero ☐
    iv. Acceso mas fuerte con el mercado ☐
    v. Mas acceso a servicios publico (i.e. salud, educación) ☐
    vi. Aumenta conocimientos de PSA ☐
    vii. Asistencia Técnica ☐
    viii. Mas confianza en su comunidad ☐
    ix. Mas confianza con otra organizaciones ☐
    x. No responde ☐
    xi. Otra ☐

8. ¿De las preguntas anteriores, cual es la más importante (i.e. ambiente natural, financiero, infraestructura, relaciones con otras personas y organizaciones, salud u educación)? ¿Secundo? ¿Tercero? ¿Cuatro? ¿Quinto?
    i. Ambiento natural ☐
    ii. Financiero/ingresos ☐
    iii. Infraestructura ☐
    iv. Relaciones con otra personas y organizaciones ☐
    v. Salud/Educación ☐

9. ¿Cuales son según su criterio las acciones que lo vuelven a usted una persona más vulnerable? (marque con x todas las que correspondes solamente cuando la repuesta antes fue 'Si')
    i. Precios de café ☐
    ii. Precios de otras cultivos ☐
    iii. Menos transacción de otros países ☐
    iv. Familia mas grande ☐
    v. Cambio de clima ☐
    vi. Erosión de suelo ☐
    vii. Menos biodiversidad ☐
    viii. Nadie ☐
    ix. Otra ☐
    - ¿Puede este proyecto ayudar a reducir vulnerabilidades? Si ☐ No ☐

10. ¿Si usted no estuviera participando por medio del Pago de Servicios Ambientales (PSA) y no recibiera ninguna retribución económica siempre participaría?
    Si ☐ No ☐

    - ¿Cuál de las siguientes alternativas escogería; si usted va a realizar su proyecto con recursos propios? (solamente un respuesta solamente cuando la repuesta antes fue 'Si')
        i. Sistema Agroforestal ☐
        ii. Regeneración Naturales ☐
        iii. Reforestación Comercial ☐
        iv. Protección de bosque ☐
        v. Ninguna ☐
        vi. Otra ☐

11. ¿Cuales serian los principales logros que usted espera de este proyecto? (¿Primero? ¿Secundo? ¿Tercero? ¿Cuatro? ¿Quinto?)
    i. Mas ingresos ☐
    ii. Aumento del bienestar ☐
    iii. Reducción de la vulnerabilidad ☐
    iv. Mejora de la seguridad alimenticia ☐

v. Uso mas sostenible de la base de recursos naturales ☐

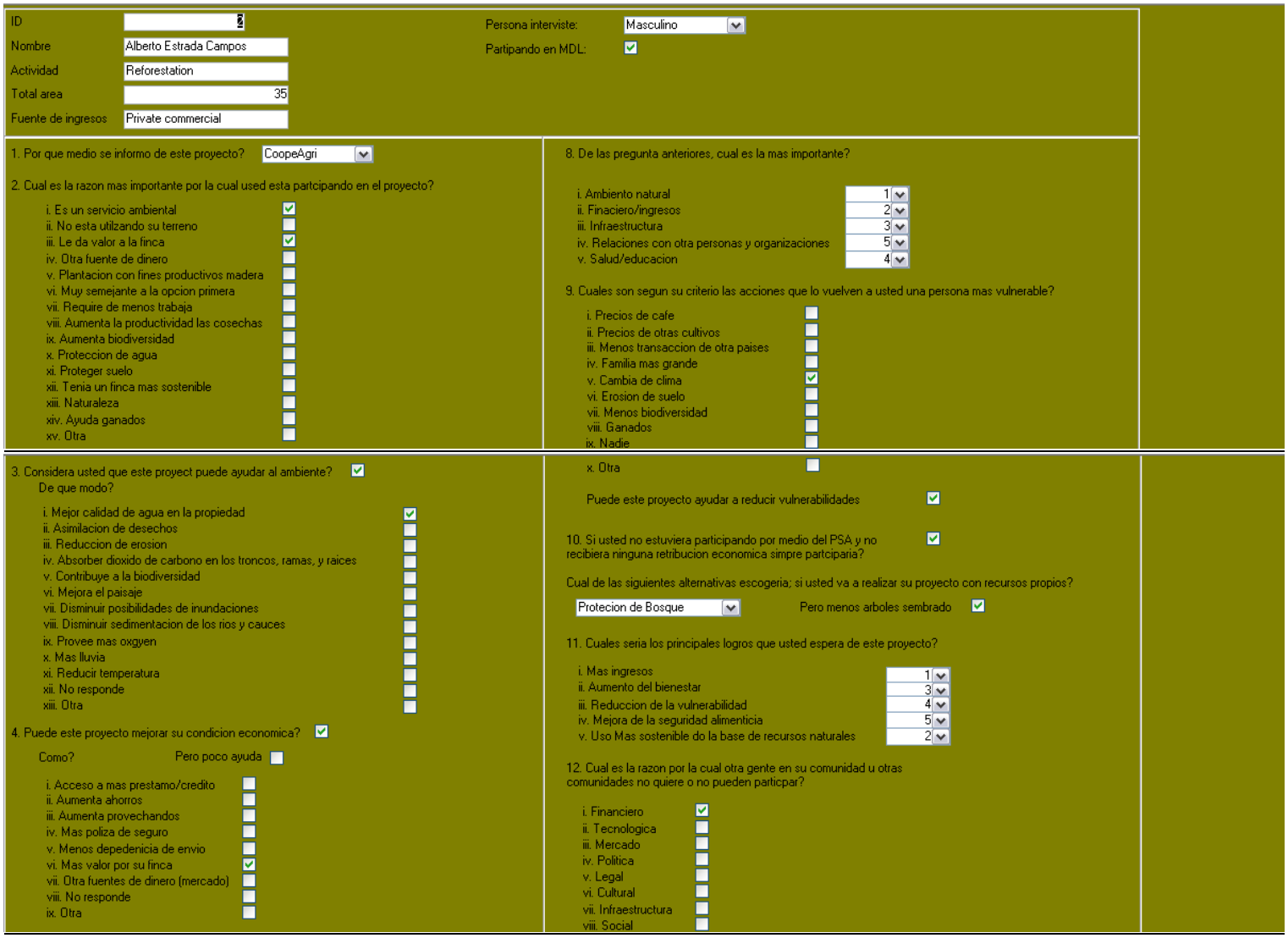
12. ¿Cual es la razón por la cual otra gente en su comunidad u otras comunidades no quiere o no pueden participar? ¿Cuál es las barreras? (marque con x todas las que correspondes)
    i. Financiero ☐
    ii. Tecnológica ☐
    iii. Mercado ☐
    iv. Política ☐
    v. Legal ☐
    vi. Cultural ☐
    vii. Infraestructura ☐
    viii. Social ☐
    ix. No responde ☐
    x. Otra razón ☐

- ¿Cual es la solución? (marque con x todas las que correspondes)
    i. Ampliar área de PSA a zonas de protección. ☐
    ii. Hacer el contracto mas flexible ☐
    iii. Hacer el proceso de PSA mas ágil y flexible ☐
    iv. Aumentar pago financiero a los campesinos con propiedades menores a un hectárea ☐
    v. Mas educación sobre este proyecto ☐
    vi. Mejorar acceso a la mercado ☐
    vii. Que la empresa CoopeAgri R.L. desarrolle su propio proyecto ☐
    viii. Otra

13. ¿Tiene otra información sobre este proyecto que usted quiera compartir?

Appendix C

Database for the Social Benefits of Project



ID: 2
Nombre: Alberto Estrada Campos
Actividad: Reforestation
Total area: 35
Fuente de ingresos: Private commercial
Persona interviste: Masculino
Partipando en MDL: ☑

1. Por que medio se informo de este proyecto? CoopeAgri

2. Cual es la razon mas importante por la cual used esta partcipando en el proyecto?

- i. Es un servicio ambiental ☑
- ii. No esta utilzando su terreno ☐
- iii. Le da valor a la finca ☑
- iv. Otra fuente de dinero ☐
- v. Plantacion con fines productivos madera ☐
- vi. Muy semejante a la opcion primera ☐
- vii. Require de menos trabaja ☐
- viii. Aumenta la productividad las cosechas ☐
- ix. Aumenta biodiversidad ☐
- x. Proteccion de agua ☐
- xi. Proteger suelo ☐
- xii. Tenia un finca mas sostenible ☐
- xiii. Naturaleza ☐
- xiv. Ayuda ganados ☐
- xv. Otra ☐

3. Considera usted que este proyect puede ayudar al ambiente? ☑
De que modo?

- i. Mejor calidad de agua en la propiedad ☑
- ii. Asimilacion de desechos ☐
- iii. Reduccion de erosion ☐
- iv. Absorber dioxido de carbono en los troncos, ramas, y raices ☐
- v. Contribuye a la biodiversidad ☐
- vi. Mejora el paisaje ☐
- vii. Disminuir posibilidades de inundaciones ☐
- viii. Disminuir sedimentacion de los rios y cauces ☐
- ix. Provee mas oxgyen ☐
- x. Mas lluvia ☐
- xi. Reducir temperatura ☐
- xii. No responde ☐
- xiii. Otra ☐

4. Puede este proyecto mejorar su condicion economica? ☑

Como? Pero poco ayuda ☐

- i. Acceso a mas prestamo/credito ☐
- ii. Aumenta ahorros ☐
- iii. Aumenta provechandos ☐
- iv. Mas poliza de seguro ☐
- v. Menos depedenicia de envio ☐
- vi. Mas valor por su finca ☑
- vii. Otra fuentes de dinero (mercado) ☐
- viii. No responde ☐
- ix. Otra ☐

8. De las pregunta anteriores, cual es la mas importante?

- i. Ambiento natural 1
- ii. Finaciero/ingresos 2
- iii. Infraestructura 3
- iv. Relaciones con otra personas y organizaciones 5
- v. Salud/educacion 4

9. Cuales son segun su criterio las acciones que lo vuelven a usted una persona mas vulnerable?

- i. Precios de cafe ☐
- ii. Precios de otras cultivos ☐
- iii. Menos transaccion de otra paises ☐
- iv. Familia mas grande ☐
- v. Cambia de clima ☑
- vi. Erosion de suelo ☐
- vii. Menos biodiversidad ☐
- viii. Ganados ☐
- ix. Nadie ☐
- x. Otra ☐

Puede este proyecto ayudar a reducir vulnerabilidades ☑

10. Si usted no estuviera participando por medio del PSA y no recibiera ninguna retribucion economica simpre partciparia? ☑

Cual de las siguientes alternativas escogeria; si usted va a realizar su proyecto con recursos propios?

Protecion de Bosque — Pero menos arboles sembrado ☑

11. Cuales seria los principales logros que usted espera de este proyecto?

- i. Mas ingresos 1
- ii. Aumento del bienestar 3
- iii. Reduccion de la vulnerabilidad 4
- iv. Mejora de la seguridad alimenticia 5
- v. Uso Mas sostenible do la base de recursos naturales 2

12. Cual es la razon por la cual otra gente en su comunidad u otras comunidades no quiere o no pueden particpar?

- i. Financiero ☑
- ii. Tecnologica ☐
- iii. Mercado ☐
- iv. Politica ☐
- v. Legal ☐
- vi. Cultural ☐
- vii. Infraestructura ☐
- viii. Social ☐

5. Cree usted que por medio de este proyecto se puede desarrollar nueva activos fisico u infraestructura en su comunidad en el futuro? ☑

Como?

- i. Compra equipo para ayudar su ingresos ☑
- ii. Mejora su casa ☐
- iii. Provee mas servicios ☐
- iv. Compra cosas personal ☐
- v. Escuela mejor ☑
- vi. Mejora careteras/puentes/calles ☐
- vii. Hospital mejor ☐
- viii. Provee nueva negocios/empresas ☐
- ix.No responde ☐
- x. Otra ☐

6a. Puede el proyecto mejoran su salud? ☐

Como?

- i. Agua potable ☐
- ii. Aire limpio ☐
- iii. Necesita menos quimicos ☐
- iv. Reduce enfermedades ☐
- v. Aumenta medias de sanitarias ☐
- vi. Acceso a mas servicios de salud ☐
- vii. Pcyhologica ☐
- viii. No responde ☑

ix. No responde ☐
x. Otra ☐

Cual es la solucion?

- i. Ampliar area de PSA a zonas de proteccion ☐
- ii. Hace el contracto mas flexible ☐
- iii. Aumentar pago finaciero a los campesinos con propiedades menores a un hectarea ☑
- iv. Mas educacion sobre este proyecto ☐
- v. Mejorar acceso a la mercado ☐
- vi. Que empresa CoopeAgri R.L. Desarrolle su propio proyecto ☐
- vii. Hacer el proceso de PSA mas agil y flexible ☐
- viii. Mas recursos ayudar gente obtener titulo ☐
- ix. Otra ☐

13. Tiene otra informacion sobre este proyecta que usted quira compartir?

-Has more incentive to plant more trees
-The current payment for trees can not replace the current land values

6b. Puede la educacion del proyecto aumentar sus habilidades para mejorar su futuro? ☑

Como?

- ix. Mas informacion tecnica de los arboles plantados ☑
- x. Acceso mas educacion en el futuro ☑
- xi. No responde ☐

7. Hay otras personas en su comunidad u organizaciones que podemos encontrar y pueden ayudarle a mejorar su futuro que no conocias antes? ☑

Quien?

- i. Sector Publico ☑
- ii. Sector privado ☐
- iii. Sociedad Civil ☐
- iv. Comunidad ☐
- v. Nadie ☐
- vi. Otra ☐

Cual seria la ayuda que usted requiere para mejorar su futuro?

- i. Equipo para su finca ☐
- ii. Acesso a otra cosas ☐
- iii. Mas acceso a prestamo u otra servicios financiero ☐
- iv. Acceso mas fuerte con el mercado ☐
- v. Mas acceso a servicios publico ☐
- vi. Aumenta conocimientos de PSA ☑
- vii. Asistencia tecnica ☐
- viii. Mas confianza en su comunidad ☐
- ix. Mas confianza con otra organaciones ☑
- x. No responde ☐
- xi. Otra ☐