PROTECTION, PRODUCTION, PROSPERITY: COSTA RICAN FARMERS RESPOND TO THE WINDBREAKS PROJECT

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by
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The undersigned, appointed by the Dean of the Graduate School, have examined the thesis entitled

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And hereby certify that in their opinion it is worthy of acceptance.

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ABSTRACT

In 1991 and 1992, farmers in Monteverde, Costa Rica participated in a reforestation project that involved installing windbreaks. The project was implemented by a local conservation organization. This thesis aims to add to the body of social research that has been conducted on the relationship between the farmers, the windbreaks, and the local organization that implemented the project. It examines farmers' motivations for involvement in the Windbreaks Project, benefits and disadvantages of windbreaks, management of natural resources and assistance needed, opinions of past reforestation activities, and economic impacts of the windbreaks. Findings show that farmers indicated conservation benefits of the windbreaks as well as a wide range of techniques used in the management of natural resources. The most common among these included enclosing resources, avoiding damage to resources, and engaging in reforestation. Most farmers indicated positive opinions of the past reforestation activities and are willing to participate in future activities. However, some farmers lamented the Monteverde Conservation League's current lack of presence in the countryside. Communication between this local social organization and the farmers in the area around Monteverde needs to be reestablished prior to the implementation of any new reforestation activities.

Introduction

During the past several decades Costa Rican farmers have witnessed changing land use patterns, fluctuating political policies regarding agriculture and conservation, and varying levels of involvement from local, national and international conservation organizations. Farmers have participated in the opening (circa 1920) and closing (circa 1990) of the agricultural frontier. They have been impacted by structural adjustment programs that occurred during the 1980s and 1990s, which resulted in a reorientation of agricultural production from a largely national to a largely international market (Vivanco 2006:44).

Farmers have also been on the receiving end of international development aid projects, administered through Non Governmental Organizations (NGOs), which were implemented in response to the deforestation that occurred in Costa Rica primarily between 1920 and 1990. Reasons why the deforestation has occurred include: the need to increase the area available for dairy and beef cattle pastures, the need to increase the area available for coffee production and the need to obtain wood for use as fence posts and construction materials.

Historically, laws favoring "productive" uses (i.e. forest clearing for extractive agricultural practices) of land encouraged settlers to "improve" the land, because value was based on the amount of clear land; not on the amount of forested land (Vivanco 2006:32). Furthermore, governmental policies favoring agriculture over forest protection encouraged farmers and landowners to replace forest cover with agricultural land. This

encouragement appeared in the form of protected prices, exemptions for input duties, credit policies, and other subsidies (Brockett and Gottfried 2002). Such activities continued until 1996, when Forestry Law 7575 sought to preserve the country's remaining natural forests while encouraging rural residents to seek sustainable livelihoods through managed forestry activities (Ley Forestal 7575). The NGOs perceive deforestation as a barrier to both environmental and community integrity. They have used the international discourse on environmentalism in order to implement projects which have the potential to benefit both the human and natural systems that interact on the landscape.

Farmers are integral to the implementation of projects developed to reverse the negative impacts of deforestation. Their livelihood often predicates using the land in such a way that contributes to deforestation, particularly those farmers who clear forested land in order to replace it with coffee or pasture for dairy and beef cattle. Hence, their willingness to modify behavior is often because of a change in the way they make meaning of the activities that a project entails, as well as the organization or institution that is implementing the project.

Monteverde is located in the Tilaran Mountains in north central Costa Rica. It lies at the intersection of Guanacaste and Puntarenas provinces. The name "Monteverde" refers to a single village, but it is also the name given to the area that includes 27 villages. One way to measure the spatial area of Monteverde is to consider the "milkshed." Dairy production is one of the most important agricultural activities in this region that spans

100 km (60 mi) at its widest point (Griffith Peck and Stuckey 2000). More specific information about the setting for this thesis research is available in Chapter Three.

The Monteverde Conservation League (MCL) is one organization that is concerned with the impact of deforestation on both human and natural systems. Since its inception in the late 1980s, the MCL has carried out various reforestation activities including Forests on Farms, the Corridors Project, and the Windbreaks Project.

This study is concerned with the ways in which farmers perceive the impacts brought about by the Windbreaks Project. Windbreaks are an agroforestry practice that the MCL introduced to farmers in order to address some of the problems that resulted from the deforestation of mountainous landscapes.

Purpose

The purpose of this study is threefold. One is to understand how farmers benefit from using windbreaks as a conservation tool. Another is to understand how and why farmers practice conservation. And the third is to understand what farmers think of the reforestation activities carried out by the MCL.

The data comes from semi-structured qualitative interviews conducted in a face-to-face manner with informants. Responses to these topics contribute to a better understanding of the way farmers use and conserve natural resources in tropical areas. Responses also contribute to a better understanding of the relationship between farmers and the MCL.

This relationship is understood by analyzing the different meanings that the entities give to the windbreaks and to reforestation activities in general. To know the meanings is helpful for understanding the different ways of constructing knowledge, and for understanding how that knowledge is organized and disseminated.

Rationale

In order to understand the way farmers make meaning of the use of windbreaks, conservation, and conservation related activities, they need to express their thoughts about these topics in their own words. For that reason, the researcher used an open-ended qualitative approach to data collection rather than a quantitative approach, where use of language is more limited. Although ecological research has taken place in Monteverde for over twenty years, the amount of research oriented toward the social dimensions of the region is considerably more limited (Brenes 2005, Harvey Tucker and Estrada 2004, Harvey et al. 2000). Human livelihoods are an integral component of any agroecological landscape. Therefore, understanding the social dimensions of farmers in Monteverde is beneficial prior to working with them. The relationship between project participants and project implementers is an important aspect of the ways in which farmers perceive activities that originate from implementer organizations. Knowing farmers' attitudes about past and current activities helps understand their willingness to (or not to) participate in similar projects in the future. This study provides a better understanding of Monteverde farmers' environmental values. It does this by asking farmers to express their opinions about the MCL's past reforestation activities. It also asks them to describe the kind of assistance that they need for better management of natural resources on their

farms. An understanding of farmers' environmental values is helpful when designing integrated conservation projects that will be successful for farmers and for the landscape.

Background and Setting

Agriculture, Conservation, and Natural Resources in Monteverde

The vegetation cover in Monteverde ranges from dense tropical forest to cleared pastures. Throughout the region, there are lands in various stages of forest regeneration, including natural and planted forest patches, which are frequently interconnected with windbreaks. These windbreaks also serve as biological corridors for the movement of animals and the dispersion of plants. The windbreaks, along with living fences and isolated trees, make up an agroecological mosaic throughout Monteverde (Harvey et al. 2004). Dairy production, coffee cultivation, and raising cattle for beef are the main agricultural activities in the area. Where the climate is most pleasant, in the premontane humid forest life zone, it is not uncommon to see all three of these activities practiced on one farm (Clark Lawton and Butler 2000). However, in more moist highland areas only dairy farming is appropriate for the climate.

The local producers' and conservation organizations have played a major role in the creation of the present agroecological landscape. Ecologically, the Quakers were the first in the area to devote highland forest to a preserve. The area became the Monteverde Cloud Forest Preserve in 1972 (Vivanco 2006:60). Agriculturally, they were also the first to clear forest in large enough areas to have pasture for intensive rotational grazing diaries (Griffith et al. 2000). They protected the highland forest for its capacity as a

watershed in order to maintain a secure source of water for their dairy processing facility, known as the Cheese Factory. Soon after their arrival, because of the isolated location of Monteverde and the difficulty of transporting fresh milk to a market, the Quakers began making cheese. Eventually, the Quaker family herds alone could not produce enough milk. In the 1960s, the Monteverde Producers Cooperative began accepting Costa Rican farmers as milk providers and as members of the cooperative (Griffith et al. 2000). The members of this cooperative were some of the first in the area to engage in reforestation activities in cooperation with the Ministry of Agriculture.

Because of its plentiful natural resources and biodiversity, Monteverde has also become a destination for biologists and national and international tourists. During the 1960s biologists discovered that endemic species such as the Golden Toad (*Bufo peringlensis*) and the Resplendent Quetzal (*Pharomachrus mocinno costaricensis*) inhabited the area cloud forests. Both of these species are still considered charismatic species in the area – despite the fact that the former is now extinct. The use of the word "charismatic" is synonymous with the use of "keystone" or "umbrella" in establishing widespread public, institutional and governmental recognition of a species and its habitat. (These words refer to the concept that by protecting the particular species mentioned many other species will be protected in the process.) In recent years portions of the cloud forest as well as areas at lower elevations have been exploited by those involved in eco and adventure tourism. As a destination for national and international tourists, Monteverde alone receives about one fourth of the approximately one million tourists who visit the country each year. The influx of tourists, foreigners and workers has led to an increase in

the price of land (Weinberg Bellows and Ekster 2002). How the growth in tourism is affecting land use choices is still being determined.

The Monteverde Conservation League: Protect nature, enhance livelihoods

The Monteverde Conservation League's mission is, "to conserve, preserve and rehabilitate tropical ecosystems and their biodiversity" (www.acmcr.org). It implements this mission through activities such as land acquisition, environmental education, and reforestation. The statutes emphasize the importance of local people's needs of forest products. They also express a need for areas of experimentation in order to establish productive techniques. The intention is for people to learn from the areas of experimentation and to use forest products which come from cultivated trees. This prevents further destruction of existing natural forest areas (Archival data MCL 1988:7).

The MCL is also known as the entity that manages the Children's Eternal Rain Forest (CERF), a 22,000-hectare (54,340-acre) reserve that is the largest private reserve in the country. The CERF forms part of the 54,000-hectare (133,380-acre) Monteverde Reserve Complex (MRC) which also includes the Monteverde Cloud Forest Preserve (MCFP) and the Arenal National Park, the location of the Arenal volcano.

This area is located in north-central Costa Rica and provides important nesting habitat for a variety of large birds. The Resplendent Quetzal (*Pharomachrus mocinno costaricensis*) and the Three-wattled Bellbird (*Procnias tricarunculata*) perform yearly altitudinal migrations to both the Pacific and Atlantic slopes of the Continental Divide (Powell et al.

2000). The Bare-necked Umbrellabird (*Cephalopterus glabricollis*) needs dense forests on the Atlantic slope in order to survive (Wheelwright 2000). While forested areas inside the reserve are well protected, the forest fragments and buffer zones that provide appropriate habitat for birds at lower elevations are less well protected. With their bright plumage and large size, birds like the Bare-necked Umbrellabird and the Resplendent Quetzal do not cross open spaces, perhaps from fear of predators. Forested linkages and biological corridors enable them to pass from one area to another (Wheelwright 2000). However, certain species' use of the windbreaks depends on their length, width, tree species diversity and whether or not they are connected to forest fragments (Nielsen and DeRosier 2000).

The MCL concentrates its efforts on fulfilling its mission to "conserve, preserve, and rehabilitate tropical ecosystems and their biodiversity" through the purchase and management of the Children's Eternal Rain Forest. This organization has also ridden the wave of international interest in reforesting tropical areas, something that occurred during the early 1990s. Between 1989 and 1994 the MCL acquired funding from the European Economic Community, the Swedish International Development Agency, World Wildlife Fund, and the Government of the Netherlands. Part of the funding was used to purchase land for the CERF, mentioned above. The rest was administered through two national governmental organizations, the Ministry of Agriculture and Livestock (MAG) and the Forestry Development Fund (FDF). This funding was used to carry out reforestation projects on agricultural land.

One of the major reforestation initiatives was called the Windbreaks Project (WP). According to a study by Rojas (2006), the MCL utilized this agroforestry practice for two reasons. The first was to protect agricultural production from the impact of the wind. The second was to protect biodiversity by way of arboreal connections between forest patches. The MCL, as owner of the largest private reserve in the country, maintains a fierce dedication to the protection of its reserve and to the improvement of its status on the international conservation scene.

As will be revealed in this thesis, it is apparent that as the organization shifts its focus towards the international scene, the farmers who had been a part of past projects demonstrate feelings of uncertainty and abandonment which are the result of a disconnect between the realities of the farmers and the reality of the MCL. Acknowledging that these two entities are situated in disparate life-worlds provides a suitable framework for understanding the topic mentioned above as well as the ways that they make meaning of the Windbreaks Project. See Chapter 2 for further discussion on life-worlds.

Windbreaks: An Agroforestry Practice for Human and Natural Environments

Thomas K. Erdmann suggested that the accepted definition of agroforestry is "a collective name for land-use systems and technologies where woody perennials are deliberately used on the same land-management units as agricultural crops and/or animals, in some form of spatial arrangement or temporal sequence" (2005:275). The farmers are the key stakeholders in any agroforestry system (Erdmann 2005:275). But according to Fischer and Vasseur (2002), "there has been insufficient research on the

actual impacts of these projects on smallholders and of farmers' attitudes towards these systems."

Windbreaks installed by the MCL are biological corridors that are mutually beneficial for agriculture and wildlife, but they require maintenance from farmers. Windbreaks are also one of the five recognized agroforestry practices (Gold and Garrett 2008 in press) and are a technology used for soil conservation (Erdmann 2005:278).

The MCL staff will be able to use the findings from this study in future decision-making related to reforestation activities. Also, this work can contribute to the body of research in agroforestry by describing the social factors and economic outcomes of windbreaks in the lives of farmers. In their recommendations for further research, Arce and Long (1992) suggested that more investigation take place into the role that local social organizations play in the creation and dissemination of knowledge. I intend for this thesis to contribute to Rural Sociology by incorporating the above recommendation into the analysis of the relationship between farmers and the organization that helped install the windbreaks. This analysis will shed light on the kinds of activities that the MCL has been involved with in the past and those in which it is currently involved. Furthermore, the analysis will also present farmers' opinions of some of the MCL's activities and how these opinions affect the relationship between these two entities.

Review of Literature

Introduction

The literature review for this thesis is organized into part one and part two. Part one includes literature pertaining to conservation approaches to natural resource management, adoption diffusion studies, and agroforestry implementation. Part two includes literature pertaining to the role of life-worlds in the construction of knowledge and how this intersects specifically with the literature about the Monteverde Conservation League.

In part one, the literature pertaining to conservation approaches to natural resource management provides examples of research that has been valuable in the elaboration of theoretical perspectives on this topic. This literature corresponds to a paradigm shift in Rural Studies research which deviates from the traditional adoption diffusion way of understanding natural resource management in two consequential points. On one hand, researchers seek to understand natural resource management in not-strictly-quantitative ways. And on the other hand, researchers seek to understand the links between the socio-cultural, political and economic environments as they relate to natural resources (Milbourne Kitchen and Stanley 2006). The examples of literature selected for this section attempt to describe the role that difficult-to-quantify factors play in understanding the reasons for and the extent to which farmers practice conservation-oriented natural resource management. The next section in the literature review provides information about adoption diffusion studies. Specifically, this section highlights the concern with the shortcomings of traditional adoption diffusion methodology in understanding how

and why conservation practices are adopted. The third section in part one discusses agroforestry literature related to the implementation of reforestation activities. This section provides insight into the consequences of human management of natural resource systems on social systems.

In part two, the literature on life-worlds provides a foundation for interpreting the relationship between two distinct groups and the ways in which these groups construct knowledge. Also in this section is a review of the literature which describes historical and contemporary events that have helped give the Monteverde Conservation League (MCL) the position it has today. This section is helpful for understanding the life-world of the MCL.

Part One

Conservation Approaches

Environmental values and natural resource management

In an effort to consider other explanations, besides those emphasized in quantitative models in the adoption literature, for farmers' willingness to demonstrate conservation-oriented behavior, this section reviews studies that took a different approach. These approaches are largely qualitative and tend to focus more broadly on farmers' perceptions and/or values in order to understand what factors influence behavior. In contrast to the literature that comes from traditional adoption diffusion studies, the body of research on conservation approaches for understanding natural resource management is sensitive to local variations. It can provide perspectives that traditional adoption diffusion research

does not. The epistemology of this body of research encompasses a way of looking at the world that is not constrained by the hegemonic Cartesian reductionism such as that which dominates natural science research (Kloppenburg 1991). Instead, as was mentioned in the literature review introduction, the recent paradigm shift in the discipline of Rural Studies has called on researchers to attempt a more integrated understanding of the diverse components affecting behavior at the local level. One theoretical framework that is appropriate for this task is Political Ecology; thus, an author using this approach is mentioned in the literature review below.

Kloppenburg (1991) called for the "reconstruction" of agriculture in a way that recognizes farmers as producers of knowledge rather than simply recipients of information and technology. He argued that Rural Sociologists, as much as natural scientists, view farmers as producers of commodities. Kloppenburg (1991) suggested moving beyond this narrow-sighted worldview to better understand and validate farmers' role in knowledge generation and the ways in which this leads to environmentally conscious behavior.

A study by Nygren (2000) is concerned with the impact that external environmental discourses have on the ways the rural poor use forests as a source of natural resources. Nygren did a case study of one community in southern Costa Rica. She utilized a political ecology framework to evaluate the structural components and social constructions that influence the ways in which poor rural people perceive forested land. Through the use of oral histories the author discovered that rural people responded to the

call to colonize the agricultural frontier. When the agricultural frontier was still open, improving the land simply meant clearing the forest in order to make room for extractive agriculture. Once that was accomplished, the primary uses of land were either coffee production or pasture for beef cattle. However, due to the extensive nature of the latter, the rural poor people had less access to land and often only engaged in coffee production on a small scale. National and international discourse and prescribed land use strategies shifted and became more concerned with sustainability. In the process, rural peasants were left contemplating and reacting to the impacts that this shift had for the ways in which they guaranteed their livelihoods.

Milbourne et al. (2006) argued that people's meanings and the way they construct perceptions of their surroundings influence how they use them. This is particularly relevant to the authors' research on social forestry. Social forestry takes into account the biophysical characteristics of forests, but places particular focus on the socio-cultural, political and economic constructions of people's involvement with forests and forest resources (Milbourne et al. 2006). Although their research is focused on advanced industrialized countries, these ways of understanding are also relevant to less industrialized countries with forest resources as well.

A study by Dutcher et al. (2004) sought to fill the knowledge gap in landowners' willingness to create riparian forests by investigating their perceptions of these forests. This was done through semi-structured interviews about meaning of the landscape and perceptions of the landscape on an emotional level. The themes that emerged from those

interviews were then used to generate the content of a questionnaire. Of theoretical importance here is the discrepancy between one's expressed environmental concern and their actual conservation behavior (Kempton et al. 1995 in Dutcher et al. 2004). This discrepancy stems from societal constraints such as government policies, economic forces or inaccessible technology. This discrepancy also stems from social expectations and norms which may have regulative effects on behavior. Some of the results of this study included 1) landowners valued clean water for its inherent qualities, 2) they wanted to feel like they were managing the land correctly in their corner of the world, 3) they were confused by the shifting government policies, and 4) they were not fully convinced that riparian forests were necessary (Dutcher et al. 2004). In general, landowners recognized community water management as a reasonable alternative to the current individual-oriented management. However, one of the obstacles to improving the quality of the stream is that most respondents failed to take into account the extent to which their own actions led to the degradation of water quality. The authors recommended that landowners would best receive information about the importance of riparian forests if the information took into consideration their concerns. Landowners were concerned about flooding, farmers' economic interests, and reluctance of some people to give up an ordered landscape around the stream (Dutcher et al. 2004).

A study by Jantzi, Schelhas and Lassoie (1999) sought to find out which factors influence conservation behavior of small forest plots in Costa Rica. The authors suggested that there is increasing evidence of the value of these small plots for both conservation and rural development. They found that people valued forest patches for watershed

protection, economic use, habitat preservation, and environmental services. Several indicators allowed researchers to analyze respondents in terms of high, medium and low conservation orientations; the orientations were then related to other variables. Other factors that influenced conservation-oriented behavior included past exposure to environmental degradation, exposure to conservation as a child, and affiliation with Christian religious ideals. The authors concluded that successful forest conservation must integrate economic incentives, community organizations which develop environmental norms and values, and technical assistance for farmers involved in forest patch conservation (Jantzi et al. 1999).

Schelhas and Pfeffer (2005) studied how residents adjacent to a large national park in Costa Rica constructed their forest values. The authors used schema theory and cultural models to analyze the complex socially constructed values and to have a better understanding of how these values related to behavioral outcomes. They concluded that the residents they interviewed had environmental and forest values that had been strengthened by the presence of the environmental discourse pervasive throughout Costa Rica. However, the residents were also concerned about their livelihood and expressed the need for a balance between forest resource use and conservation (Schelhas and Pfeffer 2005).

In a study by Thacher, Lee and Schelhas (1997), the authors sought to explain Costa Ricans' participation in agroforestry reforestation programs using a combination of the more traditional economic, demographic, and farm system variables. In addition, they

stated that there are other factors that will ultimately influence a farmer's decision to participate or not. Those factors will affect farmers' "perceptions of the economic and conservation value of reforestation versus the value of competing land use" (Thacher et al. 1997). Practically speaking, the question becomes: is the land worth more because it has trees? In this sample, 35% of farmers reported that concern for environmental degradation was a primary motive for participating in a reforestation program. Other motives included, compensating for past deforestation that they caused, producing timber products, and the least cited motive, obtaining cash incentives. The authors concluded that due to the long-term nature of the benefits that farmers may obtain through reforestation activities, agroforestry systems need to be integrated with alternative crops that provide multiple short term benefits as well (Thacher et al. 1997).

Adoption Diffusion

Shortcomings in literature on adoption of conservation practices

The adoption diffusion literature that has historically been integral to the discipline of Rural Sociology purports to aid in understanding why and the extent to which farmers include conservation practices as part of their daily actions. Although this thesis research is not a true adoption diffusion study, because there is a lack of information about the non-adopters of the Windbreaks Project (WP), the literature that has evolved from this area provides evidence for valuing difficult-to-quantify factors. Some of these factors include reason for involvement, way of finding out about project, type of benefits, and willingness to participate in future projects. These are some of the factors which were considered among the sample of WP participants. They are different from the "age and

education level" (Lockeretz 1990) variables that pervaded the methodology in earlier data collection in Rural Sociology. This section takes a critical approach to reviewing a portion of the literature on farmers' adoption of conservation-oriented actions.

In a study by Bultena and Hoiberg (1983), the results from research on 285 Iowa farmers suggested that 9 out of 10 (land tenure was the only factor not significant) factors from farm and farmer characteristics had explanatory significance as to which farmers adopted conservation tillage. The study emphasized that those who adopted conservation tillage were younger, better educated, farmed more acres, earned more, were less risk-averse, and farmed land with a greater potential for soil erosion (Bultena and Hoiberg 1983). According to the authors, these results are consistent with earlier research and are typical of farmers who are considered "early innovators" (Bultena and Hoiberg 1983).

Napier et al. (1984) did a similar study in Ohio with the guidance of diffusion paradigm and economic constraint models. In this study they found that economic constraint factors associated with structural conditions of farm enterprises were the best predictors of adoption of conservation tillage. The diffusion-type variables, such as exposure to information about the options that exist, were negligible in understanding farmers' adoption of conservation tillage. As a result, the authors proposed that future research should include farmers' social and psychosocial abilities to assume risk. Furthermore, they were unconvinced that information-based outreach programs to farmers affected their likelihood of adopting conservation tillage practices (Napier et al. 1984).

In another article, Napier, Camboni and Thraen (1986) used the same sample to try to predict attitudes toward environmental concern and thus, adoption of new farming technologies. What they found was that farmers who used a variety of institutions frequently as information sources, those more concerned about risk associated with a new technology, and those who used smaller tractors 10 years ago tended to be more concerned about environmental issues when making adoption decisions. Furthermore, in contrast to previous studies, the authors found that those who had larger acreages tended to show less concern about environmental issues than those who had smaller acreages. Again they concluded that future research should focus on farmers' risk orientations when adopting new technologies (Napier et al. 1986).

Several years later, Napier and Johnson (1998) studied the impacts of voluntary conservation initiatives. The initiatives emphasized information-education, technical assistance and economic subsidies. What they found is that willingness to participate was generally a prerequisite for effective implementation of conservation programs. Furthermore, education, information use, access to technical assistance, and access to economic subsidies did not significantly explain the variance in adoption of conservation practices. Thus, the authors concluded that the education-information-subsidy approach was not effective in motivating farmers to adopt conservation practices (Napier and Johnson 1998).

Similar research continued in 2001 when Napier and Tucker called for new theoretical perspectives in understanding the adoption of conservation practices. In this article, they

suggested that the failure to adopt conservation practices was due to socioeconomic reasons rather than a lack of technical solutions available. Using the vested interest perspective, models in this perspective suggest that if something is perceived to produce benefits it is evaluated positively, whereas that which is perceived to result in a loss will be evaluated negatively. This is significant because options that are viewed positively have a greater chance of being implemented than those which are viewed negatively. However, the regression results from this perspective explained only 3-19% of the variance among the three watersheds that were studied. According to the authors, this was not enough to be able to support the theoretical model used to predict adoption of conservation practices on a large scale (Napier and Tucker 2001).

Finally, in an article about sources and channels of water conservation in three Midwest watersheds, Tucker and Napier (2002) used a diverse theoretical approach. Components in this approach included diffusion, risk communication and farm structure theories. Results of the regression models explained very little of the variance in the use of conservation information sources. They discovered that the most used information sources were from government agencies and farm chemical dealers. The authors concluded that different theoretical models are needed to understand the factors influencing farmers' decision to use information to influence their behavior (Tucker and Napier 2002).

In general, the research behind this literature tends to be quantitative, with an emphasis on explanatory models. In his 1990 article, Lockeretz criticized the low explanatory

power of the majority of regression models used to predict farmer adoption behavior. He suggested that it is necessary to look beyond personal characteristics if none of those are satisfactory in explaining adoption. For example, he argued that external forces may have an impact on farmers' values prior to the time when data is collected on personal characteristics. One external force might be the local social environment and its tendency to promote or inhibit the use of conservation practices. Lockeretz called for studies that are exploratory in nature. However, he recognized the difficulty of this given the emphasis in the discipline of Rural Sociology on research that is strictly quantitative or that which is testing hypotheses (Lockeretz 1990).

Some researchers have heeded Lockeretz's call and have combined quantitative and qualitative data collection methods in order to better understand why farmers demonstrate conservation-oriented behavior. Parker, Moore and Weaver (2007), in their study of a watershed-level conservation project, posited that land tenure, farm type, and understanding of a farmer's self-image are three variables that are often not present when trying to understand how and why farmers demonstrate conservation-oriented behavior. They concluded that farmers in their study had social and economic realities that led them to participate in conservation-oriented activities and to become community leaders. These realities stemmed from the farmers' social embeddedness in the community. The authors of this study suggested that an analysis of the structure of the farming community and the social networks within it should be conducted prior to the development of watershed-level programs (Parker et al. 2007).

Agroforestry: A Natural Resource Management Practice

Agroforestry literature on the implementation of reforestation activities

As a land-use system, agroforestry, "involves the social and ecological integration of trees and crops" (Nair 1989 cited in Montagnini and Jordan 2005:189). This suggests that an intentional interaction between human and non-human actors is established in order to fulfill the objectives of agroforestry. Some objectives include conservation of biodiversity in degraded forest landscapes, rehabilitation of degraded pastures and cropland for the recovery of the soil's productive capacity, sustainable increase in the productivity of plants and animals, and sustainable increase in income to small farmers (Montagnini and Jordan 2005:187-205). In agroforestry systems, the multipurpose tree, that which has multiple benefits is preferred over trees which have only one use (Erdmann 2005:275). According to Gold and Garrett, agroforestry systems are composed of the following five practices: alley cropping, forest farming, riparian forest buffers, silvopasture, and windbreaks (2008 in press).

In the literature focusing on windbreaks, some authors describe windbreaks as having ecological benefits for habitat (Harvey 2000, Neilson and DeRosier 2000). In a Costa Rican study by Harvey, she reported that the 6-year old enclosed windbreaks she studied contained 83 species of trees (2000). In addition, those that were connected to forest fragments had a greater diversity of tree species than those which were not connected to forest patches (Harvey 2000). The results of another study in Costa Rica by Neilson and DeRosier indicated that 52 species of birds use planted windbreaks (2000). Furthermore,

the variety of bird species was greater in windbreaks that were connected to forest fragments that in unconnected windbreaks.

Other literature identifies economic benefits for those who make their living from the productivity of the land and the animals that thrive on it (Rojas Gonzalez 2006, Griffith et al. 2000). Rojas Gonzalez (2006) interviewed dairy farmers in Monteverde. Three of them indicated that the installation of windbreaks corresponded to a 12.5% increase in milk production between 1991 and 2006. One reason they gave for this increase was the cattle's tendency to shelter themselves in the windbreaks so that they put less energy toward retaining body heat and more toward milk production (Rojas Gonzalez 2006). Another reason for this increase is the protection that the windbreaks give to the pastures so that they retain more moisture and stay productive longer during the dry season (Rojas Gonzalez 2006). Griffith et al. (2000) indicated that windbreaks were one method for improving agriculture sustainability in the Monteverde region (2000). Windbreaks improve sustainability by reducing soil erosion, adding nitrogen to the soil (through the decomposition of leaves of certain native species), and increasing watershed protection (Griffith et al. 2000). Other economic benefits that windbreaks provide to farmers include fence posts and wood for lumber; these are two main reasons why farmers harvest the windbreak trees in Monteverde (Griffith et al. 2000).

The economic livelihood for many farmers in the area around Monteverde is based on milk production (Griffith et al. 2000). Many of those farmers sell their milk through the Monteverde Producers' cooperative. Others transform the milk into their own cheese and

cream products. Those products are available for purchase in local *tiendas* and the supermarket. In a recent study of the impact of the Monteverde Conservation League's Windbreak Project on the production of milk in the area, Rojas Gonzalez (2006) interviewed several producers who sold their milk at the Cheese Factory through the Monteverde Producers' cooperative. The purpose of the study was to find out, quantitatively, whether the installation of windbreaks on farms led to a change in milk production. Upon comparing data between 1991 and 2006, nine of the 17 respondents said that they had seen an increase in milk production. Only three of those had kept detailed quantitative data to measure changes in milk production, mentioned above. The other eight respondents said that they had observed a decrease in milk production. The author suggested some likely reasons for the decline in production. They were a decrease in the amount of available pasture or a reduction in the size of the herd. The author concluded that despite the lack of quantitative data most farmers reported benefits associated with the installation of windbreaks. Aside from those related to milk production, farmers cited other benefits similar to those reported by Fischer and Vasseur (2002). Those benefits included availability of fruit, leaves for forage, fuelwood, and timber (Rojas Gonzalez 2006).

Jones and Price (1985) used farming systems research methodology to understand the biological contributions of the trees to the farms and the farmers' motivations to plant. This early agroforestry research in Costa Rica revealed that farmers' motivations to plant trees stemmed from the desire for non-material outcomes such as protection of land and animals. Motivations to plant also stemmed from the need for material outcomes such as

the use of wood for building materials and posts. In their study, Jones and Price (1985) found several agroforestry combinations including coffee with shade trees, home gardens, and windbreaks. In the second year of the Central American Fuelwood Project, more farmers planted trees in windbreaks than in any other way, and without any financial incentives. Furthermore, some reasons for planting trees included the need for fuelwood, protection of the farm from the impacts of wind, the protection of soil and water resources, and the desire for trees to beautify the farm. Finally, the authors found that although respondents were generally satisfied with a combination of native and exotic trees in the agroforestry systems, they were skeptical of exotic pine trees, which are considered exotic species. Based on the effects that they saw on other farms, landowners tended not to plant these species (Jones and Price 1985).

In a study of smallholder perceptions of agroforestry projects in Panama (Fischer and Vasseur 2002), respondents reported several benefits as a result of having agroforestry systems on their land. Some of the benefits included improvements to their personal socioeconomic situation. Others included ecosystem benefits that farmers perceived the agroforestry systems as having. Of the socioeconomic benefits, farmers said that they benefited by being able to gather fruit, fuelwood, and wood for domestic consumption. However, most farmers stated that participating in an agroforestry project did not lead to an increase in income. With regard to the ecosystem benefits, farmers perceived agroforestry systems as being responsible for reducing soil erosion and increasing soil fertility. They also stated that having agroforestry systems in place were beneficial for climatic and hydrologic conditions (Fischer and Vasseur 2002).

The Agroforestry Outreach Project (AOP) originated in Haiti and enabled smallholders to plant and maintain fast-growing trees, which resulted in economic benefits for rural people in a country that had been and remains largely deforested (Murray and Bannister 2004). The authors were also highly involved in the orchestration and implementation of the AOP. They approached the project in such a way that short-term micro-economic incentives for participants took precedence over long-term macro-ecological goals. The result was the planting of more than 50 million trees and their subsequent use by rural people (Murray and Bannister 2004).

This project had several important characteristics that are relevant for other reforestation activities. One is that the project founders, thanks to an anthropological assessment of the conditions in Haiti, understood the situation regarding land and tree tenure and smallholders' participation in the market system (Murray and Bannister 2004).

Additionally, the project founders did three things to make the project a success. They opted to implement the project by way of NGOs rather than government agencies. They encouraged smallholders to provide nothing more than land and labor in exchange for the seedlings. And, they utilized an efficient seedling producing entity rather than relying on people to start the seedlings themselves. The final important characteristic discussed in this article includes farmers' ability to participate voluntarily in the tree-planting program, but maintain full management and decision-making responsibilities related to the maintenance and harvesting of trees (Murray and Bannister 2004).

Chokkalingam et al. (2005) evaluated forest rehabilitation projects in four Asian and two Latin American countries. Rehabilitation methods included those that involved trees, such as agroforestry practices, plantations, and assisted natural regeneration. From this assessment they concluded three factors which were highly interrelated among various project types and contributed to successful forest rehabilitation. The first was the strengthening of local organization and participation in projects. In addition to promoting appropriate strategies for technology transfer, agricultural and forestry policies should also aim to develop and strengthen local organizations. The second was a consideration of local socioeconomic needs among the approaches to forest rehabilitation. This is necessary in order to avoid depriving people of their original livelihoods. The third factor was institutional support and arrangements that are clear and appropriate. Some examples of this include non-controversial land-tenure status, accessible legal framework and policies, and coordination among organizations at various levels. Cooperation among various stakeholders and organizational levels leads to a greater probability for long-term success of the project (Chokkalingam et al. 2005).

The restoration of the Guanacaste tree to northwest Costa Rica was orchestrated in part by the efforts of Dr. Daniel Janzen. In 1991, Janzen gave a presentation to participants of the Pan American Furniture Manufacturers' Symposium on Topical Hardwoods. In it he insisted that in tropical areas, solutions to ecological problems have to be made based on site-specific criteria. This means taking into consideration the social, ecological and cultural aspects of the place and involving those entities in the solution design.

Although his work took place in a national park, Janzen indicated that farmers and locals still played a key role in restoration activities due to their knowledge of seedling propagation and construction skills. Other entities involved in restoration activities included international funding sources, the national government, entrepreneurs looking for ways to make wild lands productive, and the variety of wild and domesticated animals that disseminate tree seeds. The goal of the presentation was to encourage decision-makers to take into account the whole picture when involved in restoration activities regardless of geographical location (Janzen 1991).

Part Two

Life-worlds

Sociological literature on the construction of knowledge in life-worlds

The foundational literature on the construction of knowledge in life-worlds comes from Arce and Long's (1992) article "The Dynamics of Knowledge: Interfaces between bureaucrats and peasants." A life-world consists of the natural, social and cultural reality within which one finds oneself (Schutz and Luckmann 1973). In this article, the authors posited that knowledge emerges from a process consisting of social, situational, cultural and institutional factors. Furthermore, they maintained that it "is not an accumulation of facts, but involves ways of construing the world" (Arce and Long 1992). These assumptions have implications for the placement of knowledge within ontology, epistemology, and human nature subjective-objective dimensions (Burrell and Morgan

1979). These assumptions also have implications for the kind of methodology that is utilized to discover and analyze knowledge creation and its dissemination in life-worlds. Other authors incorporated Arce and Long's work on knowledge and life-worlds (Adger Brown and Tompkins 2006, Guivant 2003, Mahiri 1998). In their article on resource co-management, Adger et al. (2006) analyzed the cross-scale networks and linkages as well as the effects of differential levels of power in the management of marine resources in the Buccoo Reef area in the Caribbean. According to the authors, cross-scale networks are created by entities who wish "to further their own interests" through resource management (Adger et al. 2006). Guivant (2003) assessed Brazilian small farmers' perceptions of risk involved in the use of pesticides and agricultural chemicals. The work of Mahiri is mentioned below.

The life-world has a structural component known as "interface" which is essentially the common space where people from two different life-worlds are brought together and are expected to interact. According to Arce and Long (1992), an interface is "the face-to-face encounters between individuals with differing interests, resources and power." However, this is a rather vague definition since it implies that one needs to keep in mind the structural component in order to avoid assessing the interface strictly from a face-to-face point of view. From a research perspective, Arce and Long (1992) recommended assessing interface on the basis of the institutional and cultural framework of the situation while keeping in mind that there may be other actors and resources which are not present. Interface played a particularly important role between the subjects in this article as it was

the structural medium through which the government representative and local villagers negotiated their respective development needs.

One of the authors who utilized Arce and Long's work was concerned with the importance of interface. In his article on fuelwood use and policy formation in Kenya, Mahiri (1998) analyzed the political, regulatory, and assistance interfaces between rural people and service providers. He concluded that "scientific" experts should not automatically be given the last word simply because they may hold a more prestigious position according to societal perspectives (Mahiri 1998). Instead, there should be a balance between the presence and implementation of scientific knowledge and that of indigenous knowledge (Mahiri 1998).

The MCL has been carrying out conservation-oriented activities for 20 years (Vivanco 2006). During this time the organization has undertaken a variety of reforestation activities (Burlingame 2000). The following four sections represent a body of literature that provides the reader with background information about the history of the MCL and its activities. The sources of this literature include journal articles, books, newspaper articles, and third party websites.

History and development of the Monteverde Conservation League

Origins of the Monteverde Conservation League

The Monteverde Conservation League (MCL) was formed in 1986 when biologists and conservation-oriented residents, who were mostly not native to Costa Rica, thought that

deforestation and expanding agricultural production were threatening Pacific slope forest habitat (Vivanco 2006:63). The legacy of the organization as being founded by non-Costa Ricans has remained in the literature up until the late 1990s, when Evans (1999:27) described it as a Canadian-based organization. Regardless of its early beginnings, this organization has evolved over time and continues to maintain a presence as one of the leading conservation associations in the Monteverde zone.

Land purchasing campaigns

Although their first major reforestation campaign would take place on the Pacific slope, the initiative to purchase and save rainforest land took place largely on the Atlantic slope. The MCL, with funds from school children in 900 schools in 44 countries including Sweden, Japan, Germany, Canada, and the United States began buying primary forest land and partially cleared subsistence farm land in order to save it from further deforestation (Gonzalez V. 2007).

According to a 1991 article in *Conservation Biology*, Sharon Kinsman played an instrumental role in this process when she gave a presentation about rainforests to a group of Swedish school children. The children then raised money through activities such as bake sales and selling artwork to purchase 10 hectares (24.7 acres) of rainforest. As word got out about this endeavor, children and adults in other countries began raising money (Kinsman 1991). By 1991, the MCL had received more than $1.5 million to use for purchasing rainforest land (Kinsman 1991). In honor of those who helped raise money for its purchase, the largest private reserve (22,500 hectares, 55,575 acres) in Costa Rica

is called the Children's Eternal Rain Forest (CERF). Money also went to squatters when the MCL bought their land at the rate of $25 per acre, which was intended to help them relocate to land that was further from the rainforest land that interested the MCL (Evans 1999:43).

National and international recognition for rainforest conservation efforts

Since the mid-1990s, the MCL has received recognition for its rainforest conservation efforts. In 1995, it helped found the Costa Rican Network of Private Natural Reserves. This network, composed of NGOs, ecotourism sites, agricultural producers interested in conservation on their farm, and individual landowners who support conservation, seeks to protect and encourage sustainable uses for the 100,000 hectares that are included (www.reservasprivadascr.org). In May 2007, the National Institute of Biodiversity (INBio) awarded their annual prize of merit in the conservation of Costa Rican biodiversity to the MCL. The representative from INBio described the MCL as "representative of an innovative model at the global level in terms of the conservation and assessment of tropical biodiversity" (*translation is mine*) (Gonzalez V. 2007).

Reforestation activities in surrounding communities

The Windbreaks Project, about which this thesis research is concerned, took place during the MCL's most active years of reforestation activity. This project, in collaboration with others between 1987 and 1994, resulted in the installation of 1000 windbreaks, which represented 450,000 trees on 220 farms in communities contiguous to the CERF (Technical Report No.13 n.d.). Although the nature of the activities changed, the MCL

continued planting trees. In 2007, the San Carlos Daily newspaper recognized the MCL for having planted 700,000 trees in its 21 years of existence (Quesada A. 2007).

Methods and Procedures

Research Problem

What are the social dimensions shaping Monteverde farmer participation in reforestation activities? For example, what are farmers' reasons for participating in past reforestation activities? Are farmers willing to participate in future reforestation activities? How did farmers find out about past reforestation activities? And what are farmers' opinions of the reforestation activities that the Montverde Conservation League has carried out? What are the economic impacts, such as quantifiable uses of windbreaks and change in farm productivity, of the Windbreaks Project for farmers who participated in this project? How do farmers practice natural resource management, such as soil erosion prevention, sustainable use of forests and water, rotational grazing of cattle in pastures, decreased used of chemical fertilizers and pesticides?

Research Objectives

There are three research objectives associated with this study.

1. To understand how farmers with different demographic characteristics (gender, age cohort –younger, middle-aged, elder) and farm characteristics (farm size, production type) benefit from using windbreaks as a conservation tool.
2. To understand the extent to which farmers with different demographic characteristics and farm characteristics practice conservation.

3. To understand what farmers with different demographic characteristics and farm characteristics think of the reforestation activities carried out by the MCL.

Site Description

The study site consists of 12 communities near Monteverde where the MCL installed windbreaks during the Windbreaks Project[1]. Those communities include: Los Cerros, Los Llanos, La Lindora, Santa Elena, Cerro Plano (in Puntarenas Province), and Las Nubes, Cebadilla, La Cruz, San Bosco, Cañitas, Los Tornos, and Gongolona (in Guanacaste Province). This area spans approximately 20 km (12 mi) along the western ridge (Pacific slope) of the Continental Divide and forms part of the Monteverde "milkshed" from which farmers supply milk to the Cheese Factory (Griffith et al. 2000). The topography in Monteverde is mountainous and elevation ranges from 920 m to 1380 m (3018 ft – 4526 ft). Climatically, the area is influenced by the moisture-laden trade winds that blow strongly from the northeast to the southwest, especially during the transition season from November to January. Two other seasons also occur in Monteverde. The wet season is between May and October and the dry season is from February to April (Clark et al. 2000). Three of the Holdridge life zones occur in the areas of Monteverde that are included in this research (Clark et al. 2000). The premontane humid forest at 700 – 1100 m includes Los Cerros, La Lindora, Cebadilla, La Cruz,

[1] Initially, two areas adjacent to the Children's Eternal Rain Forest in the area around Monteverde were chosen for research. One area was located on the Pacific slope of the Continental Divide in Puntarenas and Guanacaste provinces. The Windbreaks Project was implemented here. The other area was located on the Atlantic slope in Alajuela province, where other reforestation activities besides installation of windbreaks took place. However, due to low participation from respondents at the latter site, the responses from those interviewed there will not be considered in the analysis.

Cañitas, Los Tornos, and Gongolona. The premontane wet forest at 800-1500 m includes Los Llanos, Santa Elena, and Cerro Plano. Coffee, beef cattle and dairy cattle are appropriate for both of these areas. The lower montane wet forest includes Las Nubes and San Bosco where, due to high levels of rainfall, agriculture is rather limited to dairy production.

The community of Monteverde is an amalgam of human elements, which includes Costa Ricans (as business owners, tour guides, restaurateurs, hoteliers, landowners, etc.), tourists (national and international), biologists and other natural science researchers, non-native Costa Rican permanent residents, and some of the original Quaker settlers and their descendants. As early as the 1920s there were already a few Costa Rican farmers who were practicing subsistence agriculture and logging in the area (Vivanco 2006:31). In 1951, to escape the legal ramifications of not participating in the Korean War, pacifist Quaker settlers bought land and moved to Monteverde from Alabama, United States. The pull factors to this area included affordable land out of range of mosquitoes so as not to bother their dairy cattle, and the recent abolishment of the Costa Rican army. Some authors (Burlingame 2000, Vivanco 2006:33, Weinberg et al. 2002) point out the role that these people played in establishing a conservation ethic in the area, as the Quakers were the first to set aside forested land for watershed maintenance. In addition, their use of the English language facilitated the arrival of numerous North American (and other English-speaking) scientists who were interested in studying the biodiversity of tropical cloud forest ecosystems.

While the original economic base for the area was agriculture, particularly dairy farming, this has shifted in recent years as tourism, particularly ecotourism, has surpassed it to become the leading economic activity (Weinberg et al. 2002). The tropical ecosystems and charismatic species, the latter not always as abundant as promotional literature makes them out to be, became the enticing elements that bring tourists to this part of the country. As a result, the infrastructure (hotels, restaurants, souvenir shops, adventure excursion companies, transportation systems, a shopping center, etc.) to host approximately a quarter of a million tourists per year has developed and continues to do so.

Limitations of the study

The population studied in this thesis is farmers from 12 communities in Monteverde, Costa Rica, and results from the study can only be generalized to this population. In addition, the interviewer was not a native Spanish speaker, so even though the interviews were tape recorded in order to capture as much of the spoken language as possible, the outcomes may be somewhat different than if a native Spanish speaker had conducted the interviews and translated the responses.

Theoretical framework

Grounded theory techniques were used to analyze the qualitative data gathered during this study. According to Glaser and Strauss (1967:37), a basic question in grounded theory asks what is happening in the data. This technique is appropriate since it assumes that no grand theories or broad generalizations were made in terms of the findings in the data. Instead, this research is concerned with constructed knowledge in a confined

setting. By studying the data, the analyst discovered what is happening and how the findings of the data can be used to tell a collective story (Charmaz 2002:691). A content analysis of the data revealed patterns from which themes and relevant respondent typologies emerged. Participant observation and consideration of notes recorded in the field notebook were also used to enhance the capacity of grounded theory to serve as a research design.

In addition to grounded theory, content analysis of primary data sources was done to formulate and understanding of the MCL and to discover the different constructions of knowledge and means of dissemination of knowledge in life-worlds. The primary data sources included promotional literature, the official website, annual reports, bulletins, and archival data. Throughout the analysis of both farmers' responses and the information gathered from sources related to the MCL, findings in the data will be elaborated against theory from the literature on conservation approaches to natural resource management and the agroforestry literature on implementation of reforestation activities.

Given the circumstances which occurred surrounding the data collection process (see Methods section for more on this), I sought examples from the literature after the fieldwork was completed and during the data analysis phase, which would help to better understand the patterns that appeared in the data. This literature is concerned with the role that values and other difficult-to-quantify factors play in understanding how and why farmers practice natural resource management. The intent is that the literature and the data for this thesis are mutually beneficial. The relationship is such that the literature helps to better understand the phenomena occurring in my data and the findings of my

data are adding to knowledge generated from this type of research, given that the type of research I conducted is similar to that which is discussed in the literature.

Methods

Evolution of project

Two major changes relevant to the outcome of this research took place between its inception and the present. The first is that when I was preparing for the fieldwork and carrying out the data collection process I was pursuing a professional Master's degree, which does not require the student to write a thesis. Instead, I was doing the research as a program evaluation for the Monteverde Conservation League regarding the Windbreaks Project. However, once I finished the fieldwork and returned to the university, I made the decision to pursue a traditional Master's degree, thus to write a thesis based on the research that I did in Monteverde. Therefore, the data that is available for the analyses in the following chapter was influenced by the conditions in which the fieldwork was conducted.

The second change has to do with the kind of instrument used in order to collect the data. When I prepared the first proposal and the documents for the Institutional Review Board, I was approaching the research from a quantitative perspective, since that was the type of research in which I had training. However, upon arriving to Monteverde, talking to the staff of the MCL, and reading various archival documents regarding the MCL's activities, I realized that I was not the expert in the area of windbreaks or the MCL's reforestation activities. Hence, I decided not to use the questionnaire for quantitative research and

instead wrote open- and close-ended questions from which to conduct face-to-face interviews. Responses from these kinds of questions facilitated the expression of farmers' own voices. The justification for why this type of research contributes knowledge to the discipline is based on my interpretation of two articles by Lockeretz (1990) and Kloppenburg (1991). The former calls on researchers to take into consideration farmers' management strategies in addition to socioeconomic variables when trying to understand conservation behavior. The latter calls on Rural Sociologists in particular to consider the contributions that "local knowledge" can make both to ways of knowing and to communicating relevant information about the research respondents. Given that I had only one chance to do the fieldwork, I thought that the best way to address the items mentioned above was to seek open responses from each farmer's perspective rather than constrained responses from an imposed (extra local) set of options.

Research Design

As a result of the changes mentioned above, the research design emerged after arriving to the field site and before starting the data collection process. However, the overall research problem and research objectives remained the same, and the instrumentation evolved from a quantitative Likert-style questionnaire to a qualitative interview questionnaire.

Data collection

The information for this study came from face-to-face interviews with farmers who participated in reforestation projects in 1991 and 1992. According to the executive summary of the 1991 project, the average size of the farms was 30.24 ha (74.69 acres). The area reforested into agroforestry systems was 120 ha. (296.4 acres) and there were about 70,260 trees planted (Archival data MCL Executive summary 1991:2). From an initial list of 99 farmers who participated in the Windbreaks Project between 1991 and 1992 on the Pacific slope, I eliminated 15 names with the help of Yúber Rodriguez, the director of Environment and Human Development for the Monteverde Conservation League. Those names were eliminated based on Rodriguez's knowledge that the person was deceased, that s/he had sold the land and was no longer living in the area, and/or that his/her project had failed shortly after initiation. From that list of 84, I generated a selection of 68 names of people who were representative of the agricultural dimensions in Monteverde (diverse community; diverse farm size; diverse production type in that s/he had produced at least one of the following items: pasture, coffee, or *tacotal* -regenerating deforested land) and whom I could potentially interview.

Respondents were contacted either by telephone or in-person in order to schedule the interview; I conducted all interviews in a face-to-face manner. Most interviews were conducted in the respondent's home; a few were conducted outside, but still on the respondent's property; one was conducted in a coffee shop given that respondent's situation the day the interview was scheduled to take place. All interviews were conducted in Spanish. I asked for permission to tape record the interview and in all but

three cases the request was verbally granted. No written consent form was used. For the interviews that were not tape recorded, I took detailed notes in the field notebook in order to record those participants' responses. For the interviews that were tape recorded I transcribed and translated the responses into Word documents. For those that were not tape recorded, I translated the responses into Word documents for further analysis.

Interviews for this study were conducted between June and August 2007. Due to time constraints I did not carry out any pilot interviews to test the instrument. After transcribing and translating the interview content, I typed the responses into an excel file for ease of classification and analysis. I analyzed the data in multiple ways. Initially, I looked at the compiled responses to each question. During this step, multiple themes emerged, which I extracted and described. Then, I categorized respondents based on their demographic characteristics and farm characteristics in order to see the patterns present in the responses. The qualitative information in this thesis is accompanied by numerical information where the latter is appropriate.

Of those 68 people, four had sold their farm and moved away, one was deceased, another had health problems and did not want to be interviewed, and the remainder could either not be located or did not have sufficient time to be interviewed. After eliminating those respondents from the original list of 68, I obtained responses from 42 interviewees. These interviewees were representative of 12 out of 15 communities where the Windbreaks Project took place, accounted for the three types of farming indicated above, and owned farms ranging in size from .5 ha to 175 ha (1.24 acres to 432.25 acres). The

interviews ranged from 15 minutes to 1 hour. In addition to interviews, I received a tour of 14 farms (33%). This was a voluntary tour on the part of the farmer, but I gratefully accepted all of the invitations that my schedule allowed. The farm tours gave me a chance to see the windbreaks up close as well as to observe the various management techniques that farmers practiced. In addition, the tours gave me the chance to observe the social setting in which the farms were situated. Furthermore, many farmers were curious as to how I could help them, whether it was to locate trees to plant or to ask if financial support would be coming from the United States to help in their conservation efforts.

Instrumentation

The interview questionnaire for project participants consisted of 16 open-ended and yes/no questions. It was designed with the assistance of Yúber Rodriguez of the Monteverde Conservation League and Jere Gilles of the University of Missouri, Department of Rural Sociology. The items were chosen based on their appropriateness to answer the research questions in terms of the objectives and also for purposes of comparison. The 16 questions in the interview questionnaire were meant to encourage farmers to elaborate about the following topics: 1) reasons for involvement in the WP, 2) benefits and disadvantages of the windbreaks, 3) economic impact of the windbreaks, 4) management of natural resources, and 5) experience with the MCL. Demographic information included farmers' gender and age cohort. Item five was adopted from Fischer and Vasseur's article (2002). A complete list of the questions appears in appendix A.

Sample characteristics

From a total of 42 farmers, 39 (93%) were male and 3 (7%) were female, see table 3.1 in appendix B. This is representative of the gender of Costa Rican farmers at the national level (www.inec.go.cr). These numbers vary slightly at the provincial levels. For example in Guanacaste the percentages are 96% male and 4% female; in Puntarenas the percentages are 97% male and 3% female. Farmers were divided into age cohorts such that farmers less than 30 years old were considered younger, farmers between 30 and 59 years old were considered middle-aged and farmers 60 years old and older were considered elder, see table 3.1 in appendix B. The majority of farmers were in the middle-aged, 55% (n = 22 male and 1 female) and elder, 40% (n = 15 male and 2 female) age cohorts with only 5% (n = 2 male and 0 female) in the younger age cohort, see table 3.1 in appendix B. The respondents in the younger age cohort were sons of the farmers who accepted the windbreaks. These young men were responding in place of their fathers, who, for health reasons were unable to be interviewed.

The average farm size is 27.83 hectares (68.74 acres) which is somewhat smaller than the historical Monteverde average of 30.24 ha (Archival data MCL 1991). Farm sizes ranged from .5 to 175 hectares (1.23 to 432.25 acres). Thirty-one percent of farms were less than 11 hectares; 38% were between 11 and 25 hectares; 17% were between 26 and 50 hectares; 7% were between 51 and 99 hectares; 7% were 100 hectares or more, see table 3.2 in appendix B. At the time that the WP was carried out, 90% of the farms were described as pasture (for beef and/or dairy production), 5% as coffee farms, and 5% as *tacotal*. See table 3.3 in appendix B for information on historic farm production. Today,

farms consisting only of pasture, only of coffee and only of *tacotal*, which will be called reforestation, account for 33%, 2.5% and 2.5% respectively. In order to account for the changing production systems, I included two new categories that were not present in the data from 1991-1992. Home gardens account for 5% of farms in the sample. Diversified farms account for 57% of farms in the sample. Diversified farms include some combination of coffee, pasture for beef and/or dairy production, home garden and reforestation. See table 3.4 in appendix B. At least one farmer from all age cohorts is considered to have a diversified type of farm.

Findings

The responses to each question in the interview were classified in three ways. One was according to the respondent's gender and age cohort, i.e. the demographic characteristics. This was in conjunction with whether or not the respondent continued planting trees after the Windbreaks Project (WP). The second was according to the respondent's farm production type. And the third was according to the respondent's farm size. The second and third are the farm characteristics. Classifying the data in this way allowed me to observe the patterns which formed in the response variations.

The following sections are organized into six parts; each part has several sections. The first part discusses the WP, farmers' motivations for participating, and which farmers continued planting trees after the project. The second part discusses the benefits and disadvantages of the windbreaks and the use of exotic tree species. The third part discusses conservation, influences on conservation, natural resource management and assistance needed in natural resource management. The fourth part discusses opinions of past and participation in future reforestation activities. The fifth part discusses the economic impacts of the windbreaks, farm diversification, and tourism. The sixth part contains a content analysis of the Monteverde Conservation League which discusses its organizational structure, mission and objectives, reforestation activities, land-purchasing, and rainforest conservation.

Part One

Logistics of the Windbreaks Project and incentives involved

At the beginning of the Windbreaks Project (WP), all farmers were provided with incentives. Those incentives were in the form of tree saplings to plant, fertilizer to help them grow, and fencing wire and posts to protect them for the first three years –a mandatory protection period required by the Monteverde Conservation League (MCL). All incentives were delivered to the farmers. There was one exception in my study as one farmer mentioned that the fertilizer never arrived. The farmers were then responsible for planting the trees and caring for them indefinitely.

During the data collection process, several farmers gave me a tour of their farm. I observed that some farmers maintained the fencing around the windbreaks. In such cases there was an assortment of species thriving in these areas and farmers were proud to acknowledge this. On the other hand, there were farms where the fencing around the windbreaks had been removed and cattle were allowed to traverse between the trees. Based on the observations I made during farm tours, the diversity of tree species is less in windbreaks where cattle are allowed to pass. These observations should be considered anecdotal given that I do not have any numbers to attach to the frequency that windbreaks were enclosed or not.

In later years, other possibilities for financial incentives, such as the Payments for Environmental Services program, became available to farmers. However, only one farmer in my sample mentioned that he was participating in any kind of incentive

program currently. That could be due to real non-participation and therefore the idea is less relevant to farmers, or it could be due to the fact that my interview questions did not ask for specific information regarding farmers' participation in such incentive programs.

In the literature, Fischer and Vasseur (2002) advised against providing material incentives due to their potential to lead to a relationship of dependency. Vivanco (2006:100) also wrote about the relationship of dependency as it related directly to the MCL. He mentioned that once the reforestation projects no longer had funding, most farmers simply stopped reforesting. Therefore, it was relevant to find out that among the farmers in my sample 27 out of 42 (64%) did continue planting trees after the WP; see table 4.1 in appendix C. Of those, 19 farmers used their own resources for tree-planting; see table 4.2 in appendix C. Many farmers who did not continue planting trees after the WP stated their reason for not doing so. These reasons included no more space, no more need, and preference to let the forest regenerate.

Details on who continued planting trees

Along with gender and age cohort, respondents were classified based on whether or not they continued planting trees after the WP. Both younger men, one middle-aged woman and 13 middle-aged men, one elder woman and ten elder men did continue planting. Those who did not continue planting included nine middle-aged men, one elder woman and five elder men.

When classified according to farm production type, one coffee farmer, one home garden farmer, seven pasture farmers and 18 diversified farmers did continue planting trees. Six diversified farmers, seven pasture farmers, one reforestation farmer, and one home garden farmer were among those who did not continue planting. See table 4.3 in appendix C.

When classified according to farm size (in hectares), the following continued planting trees after the WP; nine farmers with farms less than 11 hectares, 12 farmers with farms 11 to 25 hectares, three farmers with farms 26 to 50 hectares, two farmers with farms 51 to 99 hectares, and one farmer with a farm 100 hectares or greater. There were 4 farmers in each of the following three farm-size categories, less than 11 hectares, 11 to 25 hectares, and 26 to 50 hectares, who did not continue planting trees. One farmer with a farm 51 to 99 hectares and 2 farmers with farms 100 hectares or greater did not continue planting trees after the WP.

Motivations for participating in the Windbreaks Project

In order to understand farmers' motivations for participating in the Windbreaks Project, one of the questions asked was why they got involved in this project. Most farmers stated multiple reasons for their involvement. One farmer did not respond to this question. A total of 55 responses fit into 15 categories. In this and subsequent sections the 'n' refers to the number of responses that are appropriate to what is mentioned. An overview of this section is that middle-aged and elder men, pasture and diversified

farmers, and farmers with small, medium and large farms were most commonly motivated to participate in order to protect their pastures.

Among those who did continue planting trees, the most common reason for involvement was to protect pastures (n=8; 14.5% of total responses). Four middle-aged men, one elder woman, and three elder men offered this response. The next three most common reasons for involvement were to protect cattle (n=4), because someone offered or recommended the trees (n=4), and for conservation or reforestation (n=4). Only the middle-aged and elder men offered these responses. Younger men (n=1) and middle-aged men (n=2) were involved to protect the farm from wind and to obtain posts, respectively. One middle-aged woman and one elder man were involved to protect the house from wind. One elder man was involved to protect water. See table 4.5 in appendix C for full response details.

For those who did not continue planting trees the two most common reasons for getting involved were to protect pastures and because someone offered trees. Both middle-aged men (n=2) and elder men (n=2) were involved to protect pastures, but only middle-aged men (n=4) were involved because someone offered trees. To protect cattle was a reason given by two elder men and for conservation or reforestation was a reason given by two middle-aged men. One elder female got involved for the aesthetic quality of the windbreaks and to protect the farm from the wind. See table 4.6 in appendix C for full response details.

When analyzed according to farm production type, the most common reason for involvement was to protect pastures (n=12; 21.8% of total responses). Five pasture farmers and seven diversified farmers offered this response. The next most common reason for involvement (n=8), because someone offered or recommended trees, was the only reason among the fifteen that at least one farmer from each production type category gave. Two other common reasons for involvement among pasture and diversified farmers were to protect cattle and for conservation or reforestation. While the former reason was equally stated between the two groups (n=3 respectively), only one pasture farmer but five diversified farmers stated that they got involved for conservation or reforestation. See table 4.7 in appendix C for full response details.

When looking at why farmers got involved in the WP by farm size, the first thing to notice is that the most common reason, to protect pastures (n=12; 21.8% of total responses), was given by respondents in four of the five categories. Among farmers with farms less than 11 hectares, two farmers gave this reason. Among farmers with farms 11 to 25 hectares, five farmers gave this reason. Among farmers with farms 26 to 50 hectares, four farmers gave this reason. And among those with farms 100 hectares or greater, one farmer gave this reason. Because someone offered or recommended trees, is the second most common response given by farmers with farms less than 11 hectares (n=4), farmers with farms 11 to 25 hectares (n=2), and farmers with farms 51 to 99 hectares (n=2). To protect cattle, for conservation or reforestation, and to protect the farm from wind were all responses given by farmers with farms less than 11 hectares,

with farms 11 to 25 hectares, and farms 26 to 50 hectares. See table 4.8 in appendix C for full response details.

As indicated from the discussion above, farmers got involved in the Windbreaks Project for a variety of reasons that fulfilled farm protection and beautification needs, farm productivity needs, conservation needs, or simply out of the convenience of someone offering trees to them. The following textual responses provide insight into why farmers got involved. For protection and material needs:

> Well, the reason was because this was a very windy place, we wanted to protect the pastures a little and also with the purpose that later on we would take posts for the farm because we planted tubu, a tree that is very good for posts. MV29

For farm productivity needs:

> Because, well, to improve the farm and for many things. Already the windbreaks have improved the farm, therefore you can plant coffee and the dairy cows are going to produce more because the wind isn't as strong as it was before. MV17

For conservation needs:

> More than anything, to try to reforest the country itself. Because really, the country is in a line of deforestation very grave, so we have to do something in order not to end up with an ugly desert. MV30

Out of convenience of someone offering trees:

> Well, in the first place it was because there was a lot of wind here, and later they offered the opportunity to help me as much with the trees as, well, with everything, wire. Thus, it seemed like a good idea. MV31

Part Two

Benefits of the windbreaks

Farmers mentioned a variety of benefits that the windbreaks have provided. In order to analyze these responses, I put the 83 total responses into 16 categories. There were production benefits, such as improve pasture, shelter for cattle, shelter for cultivation, shelter for coffee, shelter for animals, shelter (undefined), and source of shade. There were structural/material benefits such as decrease wind speed, source of posts, source of wood, shelter for house, and improvements to farm aesthetic quality. There were also conservation benefits such as add soil nutrients, incubators for other tree species, food/habitat for birds/animals/insects, and protection of watershed. See tables 4.9, 4.10, 4.11, and 4.12 in appendix C for response details on all of the benefits mentioned above.

In order to address one of the research objectives regarding how farmers with diverse demographic and farm characteristics use windbreaks as a conservation tool, the paragraphs in this section provide numerical and qualitative data on the conservation benefits mentioned above. Fourteen out of 83 responses were oriented toward conservation benefits, thus 16.9% of responses. There were no non-responders to this question. The findings indicate that middle-aged and elder men who did continue planting trees, middle-aged men who did not continue planting trees, diversified farmers, and farmers with smaller farms stated more conservation-oriented benefits of the windbreaks.

Among the farmers who did continue planting trees after the WP, some farmers did not indicate any conservation-oriented benefits of the windbreaks. These included the younger men and both the middle-aged and elder women. The farmers who did indicate conservation-oriented benefits of the windbreaks were middle-aged men and elder men. One farmer with each of the gender/age characteristics just mentioned stated that a benefit of the windbreaks was that they add nutrients to the soil. Also, middle-aged men (n=4) and elder men (n=2) stated that a benefit of the windbreaks was the food/habitat that they provided for birds, animals and insects. This was the most commonly stated conservation-oriented benefit. Only middle-aged men stated that benefits were windbreaks as incubators for other tree species (n=1) and to protect the watershed (n=1). See table 4.9 in appendix C for full response details.

Among farmers who did not continue planting trees, only middle-aged men stated conservation-oriented benefits. One stated that the windbreaks add soil nutrients; another stated that the windbreaks were beneficial as incubators for other tree species. Two farmers indicated that the windbreaks were beneficial for the food/habitat that they provided for birds, animals and insects. See table 4.10 in appendix C for full response details.

An assessment of the responses by farm production type indicated that farmers from all production types except home garden stated at least one conservation-oriented benefit of the windbreaks. For the most common response, windbreaks as habitat, one farmer from each production type, coffee, reforestation, and pasture, stated this as one of the benefits.

Five diversified farmers stated windbreaks as habitat as one of the benefits. One reforestation farmer and two diversified farmers stated that adding soil nutrients was one of the benefits. Two diversified farmers stated that windbreaks were beneficial as incubators for other tree species. Finally, one diversified farmer stated that the windbreaks were beneficial to protect the watershed. See table 4.11 in appendix C for full response details.

An assessment of the responses by farm size indicated that farmers with smaller farms stated more conservation-oriented benefits of windbreaks than farmers with larger farms. No farmer with a farm 100 hectares or greater stated any conservation oriented benefits. One farmer with a farm 51 to 99 hectares, along with one farmer with a farm less than 11 hectares, stated that windbreaks were beneficial as incubators for other tree species. Two farmers with farms 11 to 25 hectares and one farmer with a farm 26 to 50 hectares stated that windbreaks added soil nutrients. One farmer with a farm less than 11 hectares stated that the windbreaks were beneficial to protect the watershed. Eight farmers, four with farms less than 11 hectares, two with farms 11 to 25 hectares, and two with farms 26 to 50 hectares, thought that windbreaks were beneficial as food/habitat for birds, animals and insects. See table 4.12 in appendix C for full response details.

There are a few sources in the literature which are pertinent to the findings mentioned in the paragraphs above. Jones and Price (1985) indicated that among the agroforestry systems present in Costa Rica, home gardens are considered sustainable entities since they do not require large amounts of petroleum-based products. Although the home

garden farmers in my study did not state any conservation-oriented benefits, several diversified farmers stated conservation-oriented benefits. The presence of the diversified farm may be related to the farmers' tendency to find conservation-oriented benefits in the windbreaks. Also in the literature, Jantzi et al. (1999) found that a greater percentage of people with larger land-holdings (more than 16 hectares) exhibited a high conservation orientation, while those with smaller land-holdings (15 hectares or less) exhibited medium to low conservation orientations. The findings presented above indicated that the opposite is the case in my sample of farmers.

Farmers indicated several conservation-oriented benefits of the windbreaks including, for soil nutrition, protection of the watershed, incubators for other tree species, and food/habitat for birds, animals and insects. Below are some farmers' responses from the text, which provide insight into their perceptions of conservation oriented benefits associated with the windbreaks. For soil nutrition:

> These windbreaks produce a lot of foliage that enriches the soil. Yes, because the foliage from the trees falls to the ground and stays there. The wind doesn't beat the soil, therefore, the leaves stay. Before, if there was a leaf and the wind arrived, the wind would carry away the leaves. The wind erodes as much as the rain; therefore, it's worth it to plant wood because it's going to go on protecting and enriching it. MV10

For protection of the watershed:

> The protection of the watershed is also notable. The windbreaks can be in lines or in blocks, but when you see them in blocks it is to protect the springs, to ensure that the quantity of water will be the maximum possible during the dry season. MV32

As incubators for other tree species:

> …in the windbreaks themselves, other species of trees grow. There are other classes of trees there and the birds nest there, whereas before there was no place for them to do that. This is very nice. MV26

As food/habitat for birds, animals and insects:

> The benefits, well like the word windbreak says, it has protected the cultivated plants from the wind. For me it was a success because now there are very large trees and they have helped a lot so that the wind does not harm the coffee. Besides that, well, there are flowers, therefore insects, wasps, all of this helps. MV21

Disadvantages of the windbreaks

It is important to know the benefits of the windbreaks. It is also necessary, particularly for future reforestation projects, to know the disadvantages of the windbreaks, according to farmers. In order to analyze these, I classified the 42 responses into seven categories. Farmers could give multiple responses. However, most gave a single response and three did not respond to this question. See tables 4.13, 4.14, 4.15, 4.16 in appendix C for full response details. The most common response was none (n=16; 38%). Actual disadvantages named were that the trees take up too much space, the use of exotic species –particularly Casuarina (*Casuarina equisetifolia)*, and the amount of work that they take.

The most frequent response (n=7; 16.67%) from farmers who did continue planting trees after the WP was that there were no disadvantages of the windbreaks. However, this applied only to younger men (n=1), middle-aged men (n=3), and elder men (n=3). Among women, one elder woman did not answer the question and the middle-aged woman indicated that the disadvantage was the cost of and time spent caring for the windbreaks. One elder man stated this as a disadvantage also. Elder men (n=5) and two

middle-aged men said that the windbreaks take up too much space. They were referring to the loss of production space for agriculture. The use of exotic species, particularly the use of Casuarina, was a disadvantage for one elder man and one younger man, respectively. The majority of respondents who shared this opinion were middle-aged men with five stating that the use of Casuarina was a disadvantage and three stating that the use of exotic species in general was a disadvantage. Together, ten responses (23.8%) fell into these two categories. See table 4.13 in appendix C for full response details.

Among farmers who did not continue planting trees, the most common response was that there were no disadvantages of the windbreaks. Six middle-aged men stated this and three elder men stated it. One middle-aged man and one elder man indicated that the windbreaks take up too much space. One elder woman said that it was the use of exotic species that was a disadvantage and one middle-aged man said that it was the use of Casuarina that he did not like. See table 4.14 in appendix C for full response details.

An assessment of the responses by farm production type indicated that no disadvantage was the most common response (n=16; 38%). At least one farmer from each farm production type except coffee gave this response. Among diversified farmers, eight said that there were no disadvantages; six pasture farmers gave this response, one reforestation farmer and one home garden farmer. That the windbreaks take up too much space was a disadvantage voiced by seven diversified farmers and two pasture farmers. The use of exotic species was a disadvantage voiced by one coffee farmer, one pasture farmer and three diversified farmers. In addition one pasture farmer and six diversified

farmers stated that the use of Casuarina was a disadvantage. See table 4.15 in appendix C for full response details.

An assessment of the responses by farm size indicated that more than one farmer in every farm-size category except 51 to 99 hectares stated that there were no disadvantages of the windbreaks. Five farmers with farms less than 11 hectares, six farmers with farms 11 to 25 hectares, three farmers with farms 26 to 50 hectares and two farmers with farms 100 hectares or greater all gave this response. The cost and time to care for the windbreaks was a disadvantage only for farmers with farms less than 11 hectares (n=2) and for one farmer with a farm 11 to 25 hectares. That the windbreaks take up too much space was cited as a disadvantage by farmers with both small and large farms. Farmers with farms less than 11 hectares (n=1), farmers with farms 11 to 25 hectares (n=6), farmers with farms 51 to 99 hectares (n=1) and farmers with farms 100 hectares or greater (n=1), all considered the amount of space that the windbreaks take a disadvantage. The use of exotic species and the use of Casuarina were disadvantages stated by farmers with small and medium-sized farms. Farmers with farms less than 11 hectares (n=2), with farms 11 to 25 hectares (n=2) and with farms 51 to 99 hectares (n=1) indicated that the use of exotic species was a disadvantage. Those who stated that the use of Casuarina was a disadvantage (n=7) were farmers with farms less than 11 hectares (n=1), with farms 11 to 25 hectares (n=3), with farms 26 to 50 hectares (n=2), and with farms 51 to 99 hectares (n=1). See table 4.16 in appendix C for full response details.

Farmers indicated that disadvantages to the windbreaks were the cost and time it took to maintain them and that they take up too much space. Below are some responses on these topics from the text. These examples of text provide insight into farmers' perceptions of these disadvantages. The use of exotic species, particularly Casuarina, as a disadvantage is discussed in more detail in a later section. Windbreaks cost money and take time to maintain:

> …well, it does cost to care for them. They have a lot of pests, for example, the ants. Also, they need fences and one has to care for that part of the land in order to make the windbreaks. MV8

And:

> Well, disadvantages, we lose some pasture and add some work because we have to be cutting branches, because if not, they fall into the pastures. MV20

Windbreaks take space from production:

> The disadvantage is that they take up land that we could be using, they leave less space for production… MV11

And:

> Disadvantages, that there is not production, not agriculture. What you reforest, you can't use anymore. MV23

Use of exotic tree species

Twenty-nine percent (n=12) of farmers' responses mentioned the use of exotic tree species as a disadvantage of the Windbreaks Project. Some farmers referred to these species generally and others referred to a specific kind such as Casuarina or Cypress (*Cupressus lucitanica).* Authors Murray and Bannister used exotic species in their reforestation efforts in Haiti (2004). But, between 1980 and 1990 the AOP shifted

heavily towards using local native species. In the literature about this study, there was no evidence that the farmers who planted those species were dissatisfied with them. One explanation for this could be the difference in the socioeconomic situation between the average farmer involved in the project in Costa Rica compared to the average farmer involved in Haiti, as the farmer in Haiti is economically much poorer than the farmer in Monteverde. Another explanation could be the presence of natural forest. In general, Haiti suffers much more from deforestation than does Costa Rica. However, Jones and Price (1985) suggested that farmers had seen the negative impacts of exotic tree species, such as pine, on other farms and chose not to plant those kinds of trees.

In my study, the examples of text indicated that farmers did not like the exotics' loss of branches and needles. Farmers stated that the exotic species "sterilize" the soil, whereas native species "enrich" it.

One middle-aged man with a large pasture farm described the disadvantage of exotics as:

> The only disadvantage is in using exotic species; they don't behave like the native trees. The exotics extract nutrients and do not replace them with their foliage. Furthermore, wherever the little cedar branches and pine needles fall, they form a kind of blanket and the vegetation does not grow. MV1

About Casuarina, a younger man with a medium-sized diversified farm said:

> The Casuarina, everyone says that it is a failure because it sterilizes the land. Yes, it's a failure. The tree is not native and it sterilizes the land a lot. The branches and needles that it loses never work as fertilizer, they sterilize the land. MV33

In spite of the negative aspects of these trees, some elicited positive comments from farmers. One middle-aged man with a small pasture farm talked about the material uses he got from the trees:

> In each windbreak there are three species, so one is Cypress, a tree for wood. So after 14 years, we could take the wood from the trees to make this door. And this year, after 16 years of having planted the trees, my sons are building their houses, there is enough wood for that. MV41

There is some literature describing the species that were included in MCL reforestation activities. Griffith et al. (2000) indicated that the MCL acknowledged its use of exotic species for two reasons. One was because these species were approved for funding in reforestation projects. The other was that farmers wanted species that grew fast. Although they may have preferred to reforest with native species, less was known about the capacity of these species to withstand the tough climatic and pest conditions of the region (Griffith et al. 2000). There also tends to be focus placed on the organization's use of native species. Rojas Gonzalez (2006) reported that the MCL was a leader in providing native species for reforestation. Vivanco (2006:98) stated that the MCL tree nurseries grew six exotic species and 49 native species in the early 1990s. Despite the MCL's efforts to substitute exotic for native species in its reforestation activities, the exotics have left a negative lasting legacy among farmers in my study. Hence, the discontent with the use of exotic species is a theme that emerged strongly in the data.

Part Three

Conservation and natural resource management techniques

In this study, the diversity of farmers' responses with regard to management of natural resources suggests that conservation is an aspect of farm activities that they take into

serious consideration. The responses used in this section are helpful for understanding the extent to which farmers with different demographic and farm characteristics practice conservation through various natural resource management techniques. As such, this section is relevant to research objective number two. Due to the length of this section, examples of textual responses will be incorporated into the discussion along with the numerical data.

Farmers mentioned a total of 75 responses to the question: How do you practice natural resource management on your farm? Two farmers did not respond. In order to analyze these responses they were put into 33 categories based on the nature of the management technique. For example, there are four categories that indicate use of resources. Seven categories indicate what farmers avoid doing because it is damaging to the natural resources. Four categories indicate enclosures of certain resources. Three categories refer to taking care of natural resources. Four categories refer to reforestation. Four categories refer to planting trees. Two categories refer to preserving and protecting natural resources. Two categories refer to not cutting trees. And there are three individual categories because they do not pertain to any others.

Among farmers who did continue planting trees after the WP all of the responses (n=3) from younger men indicated that they understand management of natural resources as using them. They use posts from the windbreaks, recycle water for the farm, and use cow dung as fertilizer for the farm. The middle-aged woman tended to practice natural resource management by way of avoiding that the resources are damaged. For example

she prevents cattle from entering any water resources and the natural forest, and avoids pesticide contamination in the coffee fields. This middle-aged woman also plants trees around the spring. The quote below is what she said about natural resource management on her farm:

> …around some (springs) we have planted trees. We always take care that in the natural forest the cattle never pass through the creeks, that they don't go there to drink and that they don't get into the forest so that the trees can grow. We also take care not to let the pesticides contaminate anything. MV8

Four middle-aged men who did continue planting trees mentioned that they avoided burning or having fire. One stated that he avoiding letting the cattle into water resources and one stated that he avoided erosion. Middle-aged men's responses were most highly concentrated around enclosing natural resources including springs (n=3), windbreaks (n=2), natural forest (n=2) and trees in general (n=1). Other natural resource management techniques that middle-aged men practice included planting trees (n=3), using water for the farm (n=2), letting the spring and steep areas reforest, (n=2) and (n=1) respectively. As the number of responses indicates, many farmers indicated that they practice more than one technique in the management of natural resources. The following comment from a middle-aged man with a large diversified farm illustrates this point:

> Well, when talking about natural resources, we're talking about water, for example, that's what stands out the most. We have springs, and we're using them. We use them for the cattle and also for the coffee. Luckily, in this farm, the springs are protected by natural forests that somehow remained even when people cut so many trees. Luckily some trees were left, only there, but at least a little around each spring. However, I think I should invest in protecting them by planting trees, because there are two and they are partly exposed. We take care never to have fire and do not allow the cattle to enter the area where the springs are. MV4

An elder woman who did continue planting tress after the WP indicated that leaving the natural forest, rather than cutting it, was her technique for managing natural resources. Among the elder men, their responses were diverse. One stated that he used the manure from his dairy in the biodigestor; another said that he avoided the cattle entering the windbreaks; and another said he avoided using chemicals. Two elder farmers considered enclosing natural forest and one considered enclosing windbreaks as their natural resource management techniques. Letting steep areas reforest and leaving the natural forest were strategies for one and two elder farmers respectively. Only one elder farmer stated that planting trees was part of his management of natural resources. Another elder farmer had a different approach; he said, “I manage like this, if I don't need wood, I don't cut trees. If I need it, I plant a tree in place of the one I cut; therefore, within some time there is again a tree there,” MV10.

See table 4.17 in appendix C for full response details.

Among farmers who did not continue planting trees after the Windbreaks Project one middle-aged and one elder man indicated that their natural resource management techniques included obtaining posts from windbreaks or forest patches. There was a concentration of middle-aged men who avoided that cattle get into water resources (n=1), avoided cattle in the windbreaks (n=1), avoided cattle in the natural forest (n=1) and avoided burning or using fire on their farm (n=2). Another area of concentrated responses was that of reforestation techniques. One middle-aged man let the spring

reforest, one let the steep areas reforest, one left the natural forest, and one left the natural windbreaks.

The elder women stated three techniques that she practiced in the management of natural resources. She enclosed the natural forest, enclosed the spring, and she planted trees around a spring. Among the elder men who did not continue planting trees, three indicated that they do not cut trees, including natural trees. Below is a textual response from an elder man about how he makes the difference between cutting planted trees and natural trees:

> Well there are trees there; I don't cut trees because it is very prohibited to cut natural trees on the property. There are trees that I think should be used because the time comes when they die and I think you should be able to use them for wood. If they are planted, I don't have to ask for permission to cut them and if they are natural trees then I have to request permission. MV22

Finally, one elder man indicated that his natural resource management techniques included practicing rotational grazing on his medium-sized pasture farm:

> We rotate the cattle because that increases the yield of the pastures and the cattle fatten quicker. The cattle are all together and I have divided the farm into various paddocks in order to be changing them every 8-15 days. MV28

See table 4.18 in appendix C for full response details.

An analysis of the responses by farm production type indicated that there is no management technique that farmers in all five production types practice. However, neither of the two home garden farmers responded to this question. The coffee farmer indicated that avoiding fire and enclosing trees were aspects of his natural resource management techniques. The reforestation farmer also stated that he avoided fire, and he

left the natural forest and enclosed it on his land. Pasture farmers' responses were concentrated in the following category groupings: avoid (n=6), enclose (n=3), take care of (n=2), reforestation (n=2), and plant trees (n=2). Furthermore, one pasture farmer indicated that he did not cut trees that were around the springs and another stated that he practiced rotational grazing on his dairy farm.

By farm production type, the diversified farmers had responses in 24 out of 33 categories. Among the use categories, farmers considered using posts for the farm (n=3), using water for the farm (n=3), and using manure as fertilizer (n=1). Only diversified farmers responded that avoiding cattle in water resources (n=3) was one of their management techniques. Another avoided cattle in the natural forest, two stated that they avoided fire, one avoided pesticide contamination, and one avoided chemical use.

Diversified farmers had a high concentration of responses among the techniques related to enclosing. Four enclosed natural forests, two enclosed windbreaks, and four enclosed springs as part of their natural resource management techniques. One diversified farmer said his natural resource management techniques were, "I don't allow any animals to enter the areas of natural forest, nor can they enter any of the windbreaks. All of them are totally enclosed with permanent fencing, therefore the animals cannot enter," MV13.

In addition, the reforestation and plant trees categories also had several responses from diversified farmers. For example, three said that they let the spring reforest, three said that they left the steep areas reforest, and two said that they left the natural forest. In

addition, four stated that they plant trees around springs; three stated that they plant trees in general, and one plants trees if he cuts one. Not cutting trees/natural trees (n=4) was another common response by diversified farmers. See table 4.19 in appendix C for full response details.

Overall, farmers with small farms indicated a greater frequency of responses about natural resource management techniques. When considering the four use categories, no farmer with a farm less than 11 hectares practices use of natural resources as a management technique. One farmer with a farm 11 to 25 hectares, one with a farm 26 to 50 hectares, and one with a farm 100 hectares or greater all stated that they used posts from windbreaks or forest patches. Use of water for the farm was a management technique indicated by one farmer with a farm 11 to 25 hectares, one with a farm 51 to 99 hectares and one with a farm 100 hectares or greater.

Among the seven categories that consider avoiding damage to natural resources, the most common responses were avoid cattle in water and avoid fire. For example, one farmer with a farm less than 11 hectares, one with a farm 51 to 99 hectares and one with a farm 100 hectares or greater stated that avoiding cattle in water sources such as springs and creeks was part of his natural resource management techniques. Farmers' avoidance of burning and/or using fire was a response present in four of the five farm-size categories. One farmer with a farm less than 11 hectares, two farmers with farms 11 to 25 hectares, two farmers with farms 51 to 99 hectares and one farmer with a farm 100 hectares or greater all stated this as part of their natural resource management techniques.

Only small and medium-sized farmers considered enclosing natural forests, windbreaks and trees as part of their management techniques. Four farmers with farms 11 to 25 hectares stated that they enclosed natural forest, while one farmer with a farm less than 11 hectares and one farmer with a farm 26 to 50 hectares did. Four farmers with farms 11 to 25 hectares stated that they enclosed springs, while one farmer with a farm 26 to 50 hectares stated the same. Two farmers with farms less than 11 hectares and two with farms 11 to 25 hectares stated that they enclosed windbreaks as part of their natural resource management techniques.

Only two small farmers with farms less than 11 hectares stated that they take care of trees, while one farmer with the same farm size indicated taking care of the natural forest. Leaving the natural forest alone was a management technique according to three farmers with farms 11 to 25 hectares and one farmer with a farm 26 to 50 hectares. Planting trees around the spring was a management technique for three farmers with farms 11 to 25 hectares and one farmer with a farm less than 11 hectares.

The following textual response is from an elder man with a diversified farm 11 to 25 hectares who considered planting trees around the spring an important aspect of his natural resource management techniques:

> At this time, what I'm doing is closing parts of the pasture, closing a part this year and planting trees, closing another part the next year and planting trees. It helps me eliminate the pasture so that what is left is woodland which is protecting the spring. Nobody is helping me plant any trees in order to protect the water. I have to do it with the savings that I have.

> Everything is enclosed, everything, first it was the forests so that the cattle do not enter. MV38

See table 4.20 in appendix C for full response details.

As the responses in this and other sections indicated, water was commonly mentioned as a natural resource to be used, but also protected. In the Monteverde Zone, water comes from springs, many of which begin in forested areas. The water then flows to streams and rivers where it is extracted and used for municipal purposes, including homes and businesses, and agricultural purposes. The proportion used for each purpose, however, is unknown, as much agricultural use in rural areas is not documented (Welch, J., 2008). Water, whether it was for protection of or use of, came up in responses to four of the interview questions, none of which were using any term related to water or directly asking about it.

As the textual examples indicated, farmers that I interviewed for this study understood natural resource management in a variety of ways including use, protection, and just letting the natural environment return to certain areas. This reflects the study by Schelhas and Pfeffer (2005) who determined that farmers in another part of Costa Rica expressed environmental values, but were also concerned about their livelihood. As a result, they wanted to balance the need for conservation with the need to use resources (Schelhas and Pfeffer 2005).

Assistance needed in the management of natural resources

Although the data revealed that farmers are managing natural resources on their own, without any assistance, it is still relevant to ask what kind of assistance would help them in that management. The Monteverde Conservation League (MCL) staff requested that this question be present in the interview schedule. The responses to this question may prove helpful to the MCL when the organization decides on future projects.

Although farmers had the option of stating multiple responses to this question, most did not. There were four farmers who did not answer the question. The total number of responses was 41. No assistance needed was the most common response. It was cited 13 times by farmers, thus it was 31% of responses. The remaining responses focused on economic assistance, technical assistance, and reforestation assistance. They are presented and discussed below in relation to demographic and farm characteristics.

Among the farmers who did continue planting trees, one middle-aged woman, one middle-aged man and one elder man stated that technical assistance would be beneficial. As this middle-aged man put it, farmers are abandoned when it comes to receiving assistance:

> It would be good, something to help, in that aspect, because farmers, we are totally abandoned in the area of someone to help us, to give us an idea of how we could do something. Many times we, you can say that this area is not very good for animals, it could be reforested or it could be that this section of natural forest lacks some fencing, someone that is helping farmers in this way, farmers more than anything because there are many farmers who do not have windbreaks. MV13

The findings in the data on natural resource management revealed that there were several farmers who indicated that they were enclosing areas of forest and areas around springs. According to the data below, there are others who would be more willing to enclose forest areas if they had the resources to do it. Economic assistance for the maintenance of fences was the most frequently requested type of assistance. Among farmers who did continue planting trees, one middle-aged man, one elder woman and two elder men mentioned this kind of assistance. An elder man expressed his response this way, "To have help maintaining the fences would be good, because if the cattle get in among the trees they can damage them, cut them, eat them," MV42.

Two middle-aged men stated that economic assistance to reforest more would be helpful. In the literature, Griffith et al. (2000) stated that the cost of installing windbreaks on one farm was $800. There were no numbers for the cost of reforestation in blocks rather than in lines.

Another kind of assistance requested by middle-aged (n=1) and elder men (n=2) respectively included assistance to reforest around springs. And one middle-aged man stated that assistance to him would be in the form of access to trees. See table 4.21 in appendix C for full response details.

Among those who did not continue planting trees after the WP the most common response, besides none, was economic assistance for the maintenance of fences. Three middle-aged men and one elder man offered this kind of response. Other single responses from middle-aged men reflected their need for access to trees and trees for

wildlife. An elder woman stated a need for technical assistance about attracting tourism to her farm. See table 4.22 in appendix C for full response details.

An analysis of the responses by farm production type indicated that there is no kind of assistance needed that was common among farmers in all five production types. The coffee farmer did not know what kind he needed. One home garden farmer did not respond and another stated that he needed technical assistance and access to trees. The reforestation farmer needed economic assistance for the maintenance of fences. The example of text below is from the reforestation farmer who traded productive agricultural activity on his farm for reforestation:

> It would be for a person who has a farm and who is practicing conservation, well if there is some kind of financing to help the farmers that would be very very important. I only wonder if, if a person who is so interested in maintaining the forest in a way that allows it just to grow, could have some kind of support which would permit him/her to be more efficient in continuing to take care of the forest. (INTER: What kind of support would it be?) Well, wire, for fencing and it could be posts, so that instead of cutting trees one could buy posts, and it could also be the economic means to go around and clean the edges of the forest in the summer so that if a neighbor burns it won't spread to the forest. MV15

In addition, three pasture farmers and four diversified farmers mentioned a need for economic assistance for the maintenance of fences. Other kinds of economic assistance that diversified farmers mentioned, included economic assistance to reforest more (n=2) and a need for Payments for Environmental Services (n=1). Two diversified farmers mentioned a need for assistance with fencing around natural forest areas. One mentioned a need for reforestation with native species. One mentioned a need for better communication with government and organizations. The following textual example illustrated what this farmer meant by better communication:

> The assistance would be very basic. We need it a lot, the farmers need it a lot, and the government allocates some, but it stays there. The farmers would like everything, like technology that doesn't arrive all the way to the farmer because it stays there turning circles in the capital. Yes, and financing too, that I don't know about because there are many forms that are very difficult, so difficult that the farmer throws them away, and nothing arrives, they have to limit themselves there. What there could really be, well, is not just pure talk, there is a lot of government, a lot of institutions, but they spend their life really busy doing nothing. This is very difficult, if there was a mentality in the government to help, well yes, there are some institutions that help, but there are more that stay amongst themselves. MV10

Finally, one pasture farmer stated that he had a need for assistance to plant trees for wildlife. He thought that was one area of weakness that the MCL demonstrated in the Windbreaks Project. He responded:

> I always thought that the League, when it began this project, would have some sort of little failure. I thought a lot about the windbreaks, that of course they have helped a lot, the trees for wood, for posts, and some trees like pine and Casuarina that weren't useful for practically anything, well they worked as windbreaks. But they didn't think about trees that give fruit for the birds. Therefore, I think that part could be better, trees that produce quite a bit of fruit for the birds and the animals because in this zone, at least I, here, didn't plant any because I think that there weren't any, or almost not, or I don't know if the opportunity to improve on this exists. MV19

See table 4.23 in appendix C for full response details.

An analysis of the responses by farm size indicated that most responses were concentrated among farmers with small farms. The need for economic assistance for the maintenance of fences was mentioned eight times. It was the only type of assistance mentioned by at least one farmer from each farm size. Three farmers with farms less than 11 hectares and one farmer with a farm 11 to 25 hectares mentioned a need for technical assistance. Three farmers with farms 11 to 25 hectares needed assistance for reforestation around springs. One farmer with a farm less than 11 hectares said this about

technical assistance and access to trees, “The work that the trees demand is not much, just a little, I would do it, I can plant them and give them all of the care. Getting the trees is one of the most difficult aspects and also technical assistance about planting the trees,” MV25. See table 4.24 in appendix C for full response details.

Influences on conservation

In the literature on conservation, environmentalism, and natural resource management in Costa Rica, it is frequently recognized that Costa Rica and nature go hand in hand (Schelhas et al. 1997; Vivanco 2006:3; Schelhas and Pfeffer 2005). Part of this is due to the national and international efforts to dedicate a large portion of the land area to parks and reserves. However, these efforts have not always taken into consideration the livelihood needs of the human actors that are involved in these land transformations. Thus, in another body of literature (Jantzi et al. 1999; Nygren 2000), the authors included this topic as relevant for understanding the extent to which external influences affect farmers’ conservation decisions.

There is no numerical data behind the following textual responses. But I include them as anecdotal indications of societal actions that help shape these farmers’ worldviews about changing societal- and self-importance placed on conservation.

> Before people just cut trees and left the soil bare and unprotected, the steep areas too. It's a shame that in this time people didn't do anything to protect these lands. There was erosion, too, and sadly we lost soil. It was about the beginning of the 1970's that people began to think about protecting the land, about caring for the environment. Whereas before, the people really didn't think about protecting the land, it was not worth it, now people think a lot about it. MV4

> I think of more benefits of reforestation that are not only economic, but environmental as well. For example, carbon fixation, we know that the farms which have more forest are going to fix more carbon dioxide, which is a worldwide concern, and if one can dedicate a small part, then that is contributing. The consciousness of the people, of society has changed from what used to be protection of natural resources and I think part of this is from having seen the benefits of reforestation. MV32

Part Four

Opinions of past reforestation activities

In order to address research objective number three, the information presented in this section is relevant for better understanding what farmers think of past reforestation activities carried out by the MCL. Most farmers gave only one response; however, some gave multiple responses and two did not respond at all, leaving a total of 42 responses. The most common response (n=17; 41%) was that the past activities were good. Some farmers who answered in this manner then went on to specify a positive aspect of the activities. Others, in addition to saying that the activities were good, also went on to talk about something that might have improved the activities.

Among farmers who did continue planting after the WP, their most common response, not counting good, was lamenting the fact that the reforestation activities did not continue. One younger man and three middle-aged men responded in this way. The young man's reply below represents someone with mixed feelings toward the MCL and the past activities. He said, "Oh, very good. We have always profited from this project because it helped lower the wind speed. Moreover, it's too bad that they have not helped more in this countryside, it's like they just left," MV33.

Two elder men had mixed opinions regarding the discontinuation of activities and another elder man commented that he never received the fertilizer that the MCL promised him. One middle-aged woman and one middle-aged man indicated that the activities were good because they brought benefits to people and to the environment. In addition, three middle-aged men and one elder man spoke about benefits that the activities had for people. Two middle-aged men stated that the past activities were good because they improved the aesthetic quality of farms in the area. See table 4.25 in appendix C for full response details.

Among farmers who did not continue planting trees after the WP half of the responses (n=8) were simply, good. Two middle-aged men stated that it was too bad the project did not continue. The other three responses from middle-aged men were single responses in which one farmer said that Casuarina was not good for much. One said that the reforestation activities improved the aesthetic quality of the farm and one said that now there was a need for fruit trees for human consumption. One elder woman lamented that the activities ended, but she said that they improved the aesthetic quality of the farm. One elder farmer said that there was a need to protect the fauna in addition to the forests:

> And we shouldn't just protect the trees; we also have to protect the fauna. The fauna is, in a zone like Monteverde that has tourism, is something very important. It could arrive one day that the young people are not going to know the animals. And in Monteverde there are certain hunters, people who dedicate themselves to hunting and I think that these people need to be supervised more. MV22

See table 4.26 in appendix C for full response details.

An analysis of responses by farm production type indicated that only pasture (n=2) and diversified farmers (n=4) had mixed opinions of past activities regarding their discontinuation. Furthermore, three diversified farmers lamented that the activities ended. One pasture farmer and three diversified farmers said that the activities were good because there were benefits for people. This diversified farmer described how the MCL recognized people's needs:

> It was very good because they explained a lot. Either they came to the farm or we would go to meetings where all of the people who were working on projects like this would get together. They recognized people's interest in planting trees, so it's one thing to reforest, but it's another thing to be able to recognize people's interest. MV42

Finally, one coffee farmer, one pasture farmer, and two diversified farmers commented that the activities were good because they improved the aesthetic quality of their farms. See table 4.27 in appendix C for full response details.

An analysis of responses by farm size indicated that an equal number of farmers with both small and large farms stated mixed opinions about past activities due to the MCL's inability to continue the activities. Two farmers with farms less than 11 hectares, one farmer with a farm 11 to 25 hectares, one farmer with a farm 51 to 99 hectares and two farmers with farms 100 hectares or greater shared this opinion.

A medium-sized farmer with a farm 26 to 50 hectares stated that the activities were good, but that there was a need for fruit trees for human consumption, "I think that here, what is needed is to reforest, but with fruit trees so that humans can consume the fruit. They have

planted enough trees for wood, now it would be fruit trees like orange, avocado and mango," MV30.

Farmers with small and medium-sized farms, including two with 11 to 25 hectare-farms and one with a 26 to 50-hectare farm said that it was too bad that the activities ended. Two farmers with farms less than 11 hectares and two with farms 11 to 25 hectares said that the activities were good because they benefited people. One farmer with a farm less than 11 hectares thought that the activities were good because they improved the aesthetic quality of the farm. Three farmers with farms 11 to 25 hectares thought the same. One of them describes the activities like this:

> For me it was excellent, very good what they did. Because here, the zone, not only my farm, but the zone itself, improved a lot. The soil here in the zone improved a lot with the windbreaks and it looks prettier. Before it looked more deforested and now it is prettier, like more trees. MV19

See table 4.28 for full response details.

Ways of finding out about the Windbreaks Project

In addition to farmers' opinions of past MCL-led reforestation activities, another interview item asking how farmers found out about the WP was used to understand the relationship between farmers and the MCL. Four farmers did not answer this question leaving 38 as the total number of responses. Three of the eight response categories involved the MCL. The most common response (n=15; 40%), when asked how farmers found out about the Windbreaks Project (WP), was that someone from the MCL contacted us. The following paragraphs analyze the findings in more detail.

Among those who did continue planting trees after the WP, at least one farmer from each gender and age-cohort said that they found out about the WP because someone from the MCL contacted them. One younger man, one middle-aged woman, four middle-aged men, one elder woman, and one elder man all said that they found out this way. Five middle-aged men and one elder man said that someone offered them trees. Two middle-aged men and one elder man said that they contacted the MCL on their own. Two elder men and one middle-aged man said that they found out through someone else's project. And two elder men found out from the Santa Elena Cooperative. See table 4.29 in appendix C for full response details.

Among those who did not continue planting trees after the WP, half of farmers found out because someone at the MCL contacted them. Included here were three middle-aged men, one elder woman and three elder men. Two middle-aged men found out because someone offered them trees. One elder man did not remember how he found out. See table 4.30 in appendix C for full response details.

When analyzed by farm production type, the findings show that one reforestation farmer, six pasture farmers and eight diversified farmers found out because someone in the MCL contacted them. One coffee farmer, one home garden farmer, one pasture farmer and five diversified farmers said that they found out because someone offered them trees. Four farmers, three with pasture farms and one with a diversified farm, said that they found out from someone else's project. Two diversified farmers said that they found out by going to a meeting that the MCL organized. And two other diversified farmers said that they

found out from the Santa Elena Cooperative. See table 4.31 in appendix C for full response details.

When analyzed by farm size, the findings show that small farmers found out about the project from someone in the MCL. Four farmers with farms less than 11 hectares and eight farmers with farms 11 to 25 hectares found out this way. Two farmers with farms 26 to 50 hectares and one farmer with a farm 51 to 99 hectares found out this way as well. Someone offered us trees is the way eight farmers found out about the project. This was the only way of finding out that included at least one person from each of the farm-size categories. Both small and large farmers found out by contacting the MCL on their own. This includes three farmers with farms less than 11 hectares and one farmer with a farm 100 hectares or greater. Farmers with small and medium sized farms found out about the WP from someone else's project. This includes one farmer with a farm less than 11 hectares, two farmers with farms 11 to 25 hectares and one farmer with a farm 26 to 50 hectares. See table 4.32 in appendix C for full response details.

According to farmers' responses, the MCL has disseminated knowledge about windbreaks and reforestation. The MCL communicated this knowledge in a way that was accessible to farmers. Furthermore, the MCL was sufficiently embedded in the local social environment to enable farmers to approach the organization when they were interested in taking part in reforestation activities.

Participation in future reforestation activities

During the interviews, I asked farmers if they would be willing to participate in future reforestation activities that the MCL initiates. Two farmers did not answer this question, but 35 out of the 40 farmers who did said that yes, they would be willing to participate in future reforestation activities. From the other five, some reasons they gave for not participating included no space, too expensive, and take care of what I already have. Despite the disconnect emergent between farmers and the MCL in the years since the WP, the findings mentioned above suggest that farmers may be able to narrow this gap as long as their needs are considered in future reforestation projects.

Part Five

Economic impacts of the windbreaks

In order to better understand the economic impact of the WP, I asked farmers what they thought was the economic value of the windbreaks. I also asked whether or not having windbreaks had led to a positive, negative or no change in the farmer's income. The results to these two questions make up the discussion in this section. With regard to the economic value, most farmers gave more than one response. One farmer did not answer the question. There were 58 total responses. Overall, 17 responses (41%) referred to the value of the posts that the windbreaks produce. Farmers also considered the windbreaks as having a lot of value, as improving the pasture and cultivated areas, as protecting cattle, and as a source of wood. The value of the posts was also the only aspect that some farmers could quantify.

Among farmers who did continue planting after the WP at least one person in each gender/age cohort said that the value was for posts. Two younger men, one middle-aged woman, seven middle-aged men, and four elder men shared this opinion. Middle-aged men (n=5) and elder men (n=2) responded that the value was a lot. Middle-aged men (n=3) and elder men (n=4) also responded that the windbreaks' value was in improving the pastures. One middle-aged man and two elder men said that the windbreaks improved cultivated areas. Another value that one middle-aged woman and one elder man stated was that of the windbreaks for increasing soil fertility. See table 4.33 in appendix C for full response details.

Among farmers who did not continue planting trees after the WP five middle-aged men and two elder men said that the economic value of the windbreaks was a lot. Two middle-aged men and one elder female said that the value was for posts. To protect cattle was the value of the windbreaks for two middle-aged men and one elder man. One middle-aged man valued the windbreaks for their improvement to the farm's aesthetic quality. Another middle-aged man, who is also a reforestation farmer, valued the windbreaks as an investment in this explanation:

> Yes, because when you plant a windbreak, in fact, you have to make an investment, but it is important to recognize that it will give benefits. I want to say that for many farmers it is difficult to reforest with the high costs of management, materials, tools, everything is very expensive. Also, to control the ants so that the little trees can grow, everything requires expenses. In order to have all of them grow, you have to think about fertilizer, which is also expensive. MV15

One elder man said that the windbreaks were valuable for their improvement to the pasture and another did not know what the value could be. See table 4.34 in appendix C for full response details.

In an analysis of the responses by farm production type one coffee farmer, five pasture farmers and eight diversified farmers said that the value was a lot. Often the word "calculate" was associated to the farmers' response to the question of economic value, as this middle-aged man with a large pasture farm put it:

> The value, well…I haven't calculated, it's a lot because the cows don't suffer, that's the truth, well, they seek shelter in these parts, especially in December and January, the months when the wind is blowing here. Yes, they produce more milk because the trees protect them; I don't have calculations. MV7

The farmer who provided the text above was also among the three pasture farmers and one diversified farmer who said that the value of the windbreaks was the shelter they provided for the cattle.

Two home garden farmers, two pasture farmers, and 13 diversified farmers stated that the value was for the posts. This younger diversified farmer explained how having the windbreaks for posts prevents him from having to obtain posts from natural trees. He said, "We don't have to think about going to cut a tree, maybe at the edge of the creek, in order to make a post, nor do we have to think about buying posts because from the windbreaks themselves we can obtain them," MV14.

One home garden farmer, four pasture farmers and three diversified farmers said that the windbreaks improve the pasture. Three responses were from diversified farmers who said that the windbreaks improve cultivated areas. One pasture farmer and one diversified farmer said that the windbreaks are valued for their improvement to aesthetic quality of the farm. Two diversified farmers said that the windbreaks increase soil fertility. Among the single responses, one diversified farmer said that the windbreaks were valuable for connecting forest patches. He explained, "If Monteverde did not have forests, then there would not be tourism. Therefore, the value is in the natural forest or in the windbreaks that connect the areas of natural forest," MV23. See table 4.35 in appendix C for full response details.

In an analysis of the economic value of the windbreaks by farm size, the findings indicate that at least one farmer in each farm-size category said that the value was a lot. Most of the farmers who said that the value was for posts had farms 11 to 25 hectares (n=9). But five farmers with farms less than 11 hectares, two with farms 51 to 99 hectares and one with a farm 100 hectares or greater also said this.

Mostly small farmers said that the windbreaks improve pastures. Four with farms less than 11 hectares and two with farms 11 to 25 hectares said it, while only one with a farm 26 to 50 hectares and one with a farm 51 to 99 hectares said it. Four farmers also said that the value of the windbreaks was the wood they produced. One of these had a farm less than 11 hectares, two had farms 11 to 25 hectares, and one had a farm 26 to 50 hectares.

For some farmers, the economic value of the windbreaks was in the shelter they provided for cattle. One farmer with a farm 11 to 25 hectares, two with farms 26 to 50 hectares and one with a farm 100 hectares or greater shared this sentiment. Improvement to the aesthetic quality of the farm was a value of the windbreaks for one farmer with a farm less than 11 hectares and another with a farm 51 to 99 hectares.

Finally, three responses from small farmers indicated that the value of the windbreaks was in improving the cultivated areas. One farmer with a farm less than 11 hectares shared this. One elder diversified farmer with a farm 11 to 25 hectares provided two examples of how the windbreaks improve cultivated areas when he said, "One economic benefit is that, in the case of the coffee field, if there were no windbreaks, and it was really windy, the harvest would only be about a third of what it is. And all of the fruit trees, if they were not protected from the wind, the fruit would fall," MV42. See table 4.36 in appendix C for full response details.

When asked if the windbreaks led to an increase, decrease, or no change in income, 30 farmers (71%) said that the income increased. Eight farmers did not respond to this question. Four farmers said that their income did not change.

Another way to measure the economic impacts of the windbreaks is to consult the data from dairy farmers. The literature review in this thesis cited authors who discussed diary farming in Monteverde. Griffith et al. (2000) and Rojas Gonzalez (2006) suggested that

the windbreaks have a positive economic impact for farmers because of increased milk production. While Griffith et al. (2000) did not provide any quantitative data. Rojas Gonzalez (2006) indicated that 53% of the 17 farmers she interviewed said that that milk production increased. Furthermore, three of those farmers indicated that it increased 12.5% in the 15 years since they installed windbreaks on their farm in 1991. In my sample, no farmers could state the percent increase in milk production. However, 27% of farmers who had a dairy (6 out of 22) made a direct indication that the windbreaks led to an increase in milk production.

The only economic value of the windbreaks that farmers could quantify was the value of posts. While 17 farmers stated that the value of the windbreaks was in posts, only eight provided the data necessary to calculate a monetary value. The number of posts used per farmer per year ranged from 75 to 600. And according to farmers the price per post ranged from $4.00 to $6.00. The average price used in the calculation was $5.17. Considering the eight farmers who provided quantitative estimations, the average number of posts used per farmer per year is 272. Therefore, the average value of the posts is $1,406.24 per farmer.

Windbreaks and farm diversification

When the Windbreaks Project was implemented in 1991 and 1992, the records from the MCL show that farms consisted of three production types: pasture, coffee, *tacotal*. In the sample of farmers interviewed during the 2007 fieldwork, I discovered that 33%, 2.5%, and 2.5% of farms, respectively, had these three production types. Furthermore, another

5 % of farms were actually home garden production type. The most prevalent farm production type was designated “diversified” with 57% of farms falling into this category. Diversified means that there was a combination of activities including pasture (for dairy or beef cattle), coffee production, reforestation, and home garden.

The question that comes to mind is what role the presence of windbreaks may play in the likelihood of having a diversified farm. In the literature on this topic, Simons and Leaky (2004) noted that agroforestry systems do play a role in forest conservation when farms can be diversified. Given the high percentage of diversified farms, I selected examples of text and provided details from participant observations related to a variety of representative situations.

One beef cattle farmer on a diversified farm said that he has the windbreaks because they enable diversification on his farm, “I thought that we needed more productivity on the farm in the diverse activities that we do, thus it was necessary to have something that would enable one to produce more. That is precisely why we have the windbreaks,” MV32. This farmer also had an area dedicated to reforestation and a garden where he and his family cultivated vegetables for their own consumption.

Other farmers are in similar situations with regard to diversification. For two farmers who divided their pastures with windbreaks, one had been planting vegetables such as garlic, beans and corn and the other planted fruit trees. On two other farms that I visited, farmers were involved in multi-cropping. One had beans, corn and squash growing

between young coffee trees. Another was producing bananas among chemical-free coffee plants. Both farms also had dairy production.

In Monteverde, such activities would not be possible without the windbreaks. One elder woman's daughter told her, "Mama, if you're thinking about making a garden, you're going to have to put windbreaks, because there the wind is hard on everything," MV27. Since installing the windbreaks, this farmer has been able to start a medicinal herb garden with a group of local women. Another way farmers are diversifying is through tourism-related activities. Tourism is discussed in the following section.

Tourism impacts on farmers in Monteverde

Although some authors describe tourism in Monteverde as ecotourism (Weinberg et al. 2002), there are farmers who were interviewed for this research that described it more appropriately as adventure tourism or agritourism. This is not surprising, since in reality Monteverde actually has all three. As this section points out, several men and women that I interviewed are diversifying their livelihoods in hopes that tourism, regardless of its classification, will bring increased prosperity to their farm.

In order to systematically assess the role that tourism plays for the farmers in my sample, I extracted all of the text that was relevant to this theme. In addition, I referred to the entries in my field notebook to locate any relevant comments that farmers made after the interview or any observations that I had about the influences of tourism on a particular farm.

In this section, the use of age and gender is not meant to have explanatory value; these criteria are used simply to represent the various responses to tourism by stratified rather than general means. With regard to the gender representation, there is at least one respondent in each gender/age category. For example, one of the younger farmers made a comment about tourism in that he said about ten years ago there was a shift from an ecotourism focus to an adventure tourism focus in Monteverde. This has also been acknowledged in the literature, as Weinberg et al. (2002) documented an impressive list of zip line and canopy tour opportunities that attest to this shift. Geographically the farms relevant to this topic are located in eight of the 12 villages where farmers were interviewed. Some of the activities were already established, as was the case for one middle-aged man and one middle-aged woman. They were benefiting from activities such as providing horseback rides through forests and pastures on their own farms or others'.

Another middle-aged man and his wife maintained a café and souvenir shop along the road entering Monteverde from the west. I went there occasionally when I was in the area conducting interviews to seek refuge from the rain. While I was there, I noticed that several tourists stopped by as well. Some were individuals; others came as part of an all terrain vehicle tour. Others disembarked from the tour bus for a break on their way out of town. Aside from hand-crafted and manufactured souvenirs and food and beverages for sale, there were several hummingbird feeders set up on the back balcony to entertain

curious visitors for free. Complementing those feeders were the flowering plants in the yard to attract pollinators.

An elder woman was in the beginning stages of trying to attract tourists to her farm. She belonged to a group of elders who wanted to establish a medicinal plant garden and agreed to provide the land if others were willing to work on the project together. In addition she wanted to build trails in the forest, so she met with a local naturalist who helped shape her understanding of what tourists expect:

> (Our acquaintance) said that we have to make signs near the trees that are very old describing when the tree flowers, what kind of fruit it has and the harvest period. The tourists like it a lot when these things are explained. So we have to take the trails past the trees that are important and the trails shouldn't be straight, but should have curves. MV27

Efforts like that mentioned above challenge the normative idea that tropical forest nature should be without people (Vivanco 2006:23).

Elder men were also involved in tourism. One said he was willing to sell land at a high price in Monteverde, thanks to the influence of tourism. With that money he would be able to buy a farm twice as big, further from Monteverde, at a lower elevation. Another said that although he had had requests from people to buy, he was unwilling to sell a part of his land. This man wanted to reforest his land and pass it on to his son who would use the trees to make souvenirs out of wood.

One elder man built cabins on his small farm and kept an area of forest where visitors could walk on maintained trails. He was pleased to show me the furniture that his son

made for the cabins and when we walked along the forest trails he told me the story about a puma that had been sighted on his property a few years ago.

Finally, another farmer described the importance of forest for Monteverde and commented on the direct role that forests play in the adventure tourism sector:

> Yes, the tourism is paying me now. The area that wasn't useful for anything before is now pure forest. If Monteverde didn't have forests, then there would not be tourism. Therefore, the value is in the natural forests and in the windbreaks that connect the areas of natural forest. Tourism is nothing if we lose the forests. People come to Monteverde because of the forests. We do not use the forest, but SkyTrek canopy tours does, and that allows the forest not to be mistreated. Nothing more than small trails through the forest, trails of wood and stone right on the farm. There are also towers from where the zipliners leave. MV23

Despite my skepticism about the sustainability of tourism in a rather remote place like Monteverde, it pervades the local social environment and may be partly responsible for the increasing acceptance and desirability of forest cover. A similar phenomenon is taking place in an area southwest of Monteverde. Kull et al. (2007) describe this as globalization influenced by neo-liberalism. They suggested that smallholders are able to find off-farm work which decreases their obligation to make their living from the land using extractive practices. According to Lambin et al. (2001), land-use and land-cover change are influenced by individual and social responses that "follow from changing economic conditions mediated by institutional factors." They suggested that an integration of natural and social sciences is necessary along with an improved understanding of global factors to address the complex realities of land-use and land-cover change (Lambin et al. 2001). Whether or not the increase in forest cover will result

in an increase in biodiversity and a decrease in inappropriate agricultural practices in Monteverde is still to be determined.

Part Six

Content analysis of the Monteverde Conservation League

In this thesis, the interface between the MCL and the farmers is underlying more than it is obvious. Farmers acknowledged that they were more aware of the MCL in the past than in the present. Currently, most farmers in my sample seemed to have little contact with the MCL. The result is a disconnection between the farmers' needs and the needs of the MCL. Meanwhile, the primary literature about the MCL suggests that this entity is a conservation organization that was involved in reforestation activities in the past. But its focus is now more on the maintenance of the Children's Eternal Rain Forest (CERF) to increase its status on the national and international conservation scene.

The following sections provide information about the structure and objectives of the organization as well as information about the kinds of activities in which it has been involved. I reviewed primary data sources including promotional literature, the official website, annual reports, bulletins, archival data, and notes from personal communication. These sources represent a body of knowledge that informs the reader about the organization.

Organizational structure of the Monteverde Conservation League

The organization has a board of directors which includes the president, secretary, treasurer, first, second, and third vocals (those who vote in place of a non-present voting member) and, first and second fiscal officers. This group oversees the staff members such as the executive director, the director of environment and human development, accountants, outreach coordinator, and administrative assistants. The staff members just mentioned spend their time in the main office in Monteverde and in the field. There are also other staff members in charge of forest and facility maintenance, as well as monitoring and protection of the CERF. Contrary to the origin of the founders, the majority of the staff now is Costa Rican. According to the 2006 Annual Report, there are 30 paid employees (Annual Report MCL, 2006). In addition there were 60 ordinary active members in 2007, down from 81 in 2006 (Annual Report MCL, 2007).

It is possible to become a member of the MCL. There are three kinds of membership. Active members pay the annual membership fee, attend the annual meeting, may vote, may be elected to the Board of Directors (from here on, the Board), and may be asked to carry out certain duties or responsibilities. Inactive members also pay the fee and can attend the meeting, but they have only a voice, not a vote, and they may not be elected to the Board. However, they may be asked to carry out certain duties or responsibilities. Contributing members contribute economically and intellectually to the MCL and they may be asked to carry out certain duties or responsibilities, but they do not have a vote at the meetings and they cannot be elected to the Board. In order to become a member of the MCL, one must send a letter of interest to the Board. S/he must also send three

supporting letters written by active members. The Board then decides how to proceed with an interview of the potential member. (The information for this section was provided by Giselle Rodriguez via e-mail correspondence.)

The main office in Monteverde is responsible for the office in La Tigra de San Carlos on the Atlantic slope, the Finca Stellar (an experimental farm), the Bajo Del Tigre visitor's center, and the San Gerardo and Pocosol biological stations. There are also sister offices in the United States, Japan, Sweden, Germany, Canada, and England. These sister offices are primarily responsible for fundraising, outreach about the Children's Eternal Rain Forest, and hosting leadership and staff from the Costa Rica offices.

Mission and objectives of the Monteverde Conservation League

These objectives are meant to enhance the organization's mission and are publicized through its annual report. The objectives are:

1) The conservation, defense, and recuperation of the nation's natural resources, including its soils, water, air, flora, and fauna.
2) The recovery and protection of the physical, biological, and cultural environment.
3) The search for an adequate equilibrium and healthy coexistence between human beings and nature (Annual Report MCL 2006).

Finally, there are values and principles which recognize that humans must be part of a successful management plan where natural resources and ecosystems are concerned. Biodiversity is considered flora, fauna, and human racial and cultural variations. Natural heritage must be passed on to future generations. Seeking collaboration from national

and international institutions and individuals is essential to seeing that the previous values and principles are upheld (Annual Report MCL 2006).

Changing requirements of land-purchasing campaigns

Soon after the land-purchasing campaign began in 1989, the amount needed to buy one acre of rainforest was $50 (Tapir Tracks 1989). In honor of its 20th anniversary, the organization has launched a campaign to expand the protected areas of the CERF by purchasing more land contiguous to the earlier rainforest boundaries. However, this requires donors to be more generous today than they were two decades ago as it takes $1000 or more to buy an acre of rainforest (Promotional material MCL 2007).

Societal recognition for rainforest conservation efforts

After the Payments for Environmental Services program began in Costa Rica, the MCL began receiving payments in 1997 for the thousands of hectares they had under protection (Muñoz 2007). In 2000, the MCL received recognition for "improving the quality of life in defense of the inhabitants of the Republic" (Rodriguez, G. 2008). The year 2007 was a busy one for the MCL. In May, the organization received an award from the National Institute of Biodiversity for its efforts in the conservation of biodiversity in Costa Rica. In August 2007, the MCL hosted a representative from the United Nations Education, Scientific, and Cultural Organization (UNESCO). The purpose of this visit was to improve the MCL's chances of having the Children's Eternal Rain Forest declared a UNESCO World Heritage Site. In September the Children's Eternal Rain Forest became part of the Agua y Paz Biosphere Reserve. And finally, in November 2007, the MCL

became a recognized member of the International Union for the Conservation of Nature. In keeping with their objectives, the MCL has also put efforts into developing a balance between humans and the natural environment that surrounds them, particularly through their work with reforestation activities.

Reforestation activities

During the Windbreaks Project, the MCL maintained two tree nurseries which were located in the villages of Cerro Plano and San Luis (Archival data MCL 1991). Those nurseries no longer exist. Although there was some initial experimental plantation of *Casuarina equisetifolia* and *Cupressus lucitanica*, most of the experimentation seemed to take place on the actual farms where the windbreaks were installed. On the Atlantic slope, a tree nursery was established in 1995 to provide saplings for the reforestation projects taking place in that area. That nursery, located adjacent to one of the entrances to the CERF is still in operation. Its trees are available to those who participate in reforestation projects and to private individuals who would like to procure saplings for their own property. Experimentation regarding rates of tree growth and ideal placement of trees that began about 10 years ago continues today (Alvarado 2007). During an interview, one member of the MCL Monteverde staff in charge of facility maintenance and seed collection to me that he expects future activities to focus on reforesting steep slopes, particularly those which have water sources (Trejos 2007).

Conclusion

Based on the information presented above, conclusions can be made about the various questions in the opening section of the Methods and Procedures chapter. The concluding remarks in this chapter focus on summarizing the findings of the three research objectives.

1. To understand how farmers with different demographic characteristics (gender, age cohort –younger, middle-aged, elder) and farm characteristics (farm size, production type) benefit from using windbreaks as a conservation tool.

As shown in the beginning of the previous chapter, farmers installed windbreaks on farms in Monteverde for a variety of reasons, but with the expectation that they would reap benefits at some point. The data in this thesis revealed that farmers acknowledged having received a combination of benefits including structural/material, production, and conservation. Farmers expressed structural/material benefits as construction and fencing resources, shelter for house, and aesthetic quality. Production benefits were expressed in the form of shelter for cultivation and for cattle and for improved pastures. With regard to conservation benefits, farmers acknowledged that they had benefited from the windbreaks as habitat for wildlife, for the proliferation of native tree species, for added soil nutrients, and to protect the watershed. Most commonly expressed was that windbreaks were beneficial as habitat for wildlife. This response was expressed by middle-aged and elder men who were farmers with small to medium diversified farms.

These findings diverge somewhat from research by Jantzi et al. (1999), who found that larger farmers were more oriented toward conservation activities than smaller farmers.

Harvey et al. (2004) suggested that while windbreaks and forest connections do provide important sources of habitat, they are not natural and should not be promoted in place of natural forest landscapes. The farmers' responses in this thesis indicated that farmers do benefit from using windbreaks as a conservation tool. Furthermore, most are receptive to participation in future reforestation activities. The MCL, as a local social organization, can use this information to further its understanding of farmers' motivations and needs. It can appropriately design future reforestation projects which reflect this understanding.

2. To understand the extent to which farmers with different demographic characteristics and farm characteristics practice conservation.

Most farmers' responses about the management of natural resources had a conservation orientation. In this thesis, farmers expressed their management techniques in 33 ways. For ease of analysis the techniques were minimized into general groupings. As such, the techniques are classified as using resources, avoiding damage to resources, enclosing, and reforesting, among others. Using natural resources, including water for the farm and trees for posts, as a management technique was most prevalent among younger men, diversified farmers, and farmers with medium to large-sized farms. Avoiding damage to resources, including keeping cattle out of springs and avoiding fire, was practiced by a middle-aged woman and middle-aged men, pasture and diversified farmers and farmers with small and large farms. Enclosing resources, including natural forests, creeks and springs, was practiced largely by middle-aged men, diversified farmers, and farmers with small farms. Reforestation of steep areas and keeping the natural forest were techniques that middle-aged and elder farmers used, diversified farmers used them, and farmers with small, medium and large-sized farms.

The management of trees and forests is a theme that appears in almost all of the above techniques. Farmers' responses indicated that they value these resources and many are ensuring the prosperity of trees and forests by enclosing them. Through these activities, farmers illustrated that they were being stewards of the resources that enable their area to thrive ecologically and socially. The presence of forest reserves is considered one of the driving forces of economic activity in Monteverde. The stewardship tendencies shown by farmers in this study diverge from findings by Schelhas and Pfeffer (2005). Based on research in another area of Costa Rica, they indicated that some rural people considered the presence of a national park as something foreign that was imposed on them and threatened their livelihoods. However, these rural people also expressed their disagreement with extreme degradation of water resources and wildlife that they had seen in the past. The fact that farmers in Monteverde are practicing stewardship of natural resources has policy implications for future incentive and reforestation projects. Furthermore, farmers expressed a need for economic assistance in the maintenance of fences around forests and water resources. An organization such as the MCL can consider these needs when planning to meet conservation and social goals in the future.

3. To understand what farmers with different demographic characteristics and farm characteristics think of the reforestation activities carried out by the MCL.

Based on farmers' responses about past reforestation activities of the MCL, most farmers, including at least one from all gender/age cohorts, thought the activities were good and that there were benefits for people and the environment. Diversified and pasture farmers and those with small to medium-sized farms expressed these opinions. Although the

positive responses outnumbered the negative ones, it would be remiss to continue without pointing out the mixed opinions farmers had about the past activities. Some younger and middle-aged men, pasture and diversified farmers, and farmers with small, medium and large-sized farms expressed disappointment about the MCL for not continuing with the reforestation activities that began in the late 1980s. The farmers' disappointment likely stems from being uninformed about the MCL's current goals and the way the organization is structured to fulfill them. While the MCL was an apparent part of the farmers' life-world in the past, the organization has retreated from that position, leaving skepticism and ignorance in its place. Outreach to farmers once again will improve this organization's standing in the community of land use decision-makers. As one group of land use decision-makers, farmers are helping protect the agroecological landscape that is part of a productive and prosperous future in Monteverde.

Appendix A

Monteverde Costa Rica 2007 Interview questionnaire English

1) Why did you get involved with the Windbreaks Project administered by the Monteverde Conservation League?
1a) How did you find out about the Windbreaks Project?
1b) Who planted the trees?

2) What kinds of benefits have the windbreaks provided?

3) What are the disadvantages of the windbreaks?

4) What is the economic value of the windbreaks with respect to their benefits?

5) As a result of having the windbreaks on your farm, would you say that your income has: __increased __stayed the same __decreased
5a) Do you think that the quality of your farm has improved as a result of having planted the windbreaks? Yes or no?

6) How do you practice natural resource management on your farm?

7) What type of assistance would help you in the management of natural resources on your farm?

8) After the MCL Windbreaks Project, did you continue to plant trees on your own?
8a) With your own resources?
8b) If not, why didn't you continue?

9) What do you think of the reforestation projects that the MCL has carried out in the past?

10) If the MCL initiated another reforestation project in the future, would you participate?
10a) If no, why not?

Appendix B

The following tables are arranged in order of appearance in Chapter 3.

Table 3.1 Number and Percent of Farmers by Gender and Age Cohorts

	Younger	Middle	Elder	Total
	Less than 30	30 to 59	60 and up	
3 Female	0	1	2	3
39 Male	2	22	15	39
Total	2	23	17	42
%Total	5%	55%	40%	100%

Table 3.2 Number and Percent of Farms by Size (in hectares)

	Less than 11	11 to 25	26 to 50	51 to 99	100 and up	Total
Number	13	16	7	3	3	42
Percent	31%	38%	17%	7%	7%	100%

Table 3.3 Farm Production Type, 1991 -1992

	Coffee	Pasture	Tacotal	Total
Younger	0	2	0	2
Middle	1	19	2	22
Elder	1	14	0	15
Female middle	0	1	0	1
Female elder	0	2	0	2
Total	2	38	2	42
% Total	5%	90%	5%	100%

Table 3.4 Farm Production Type, 2007

	Coffee	Home Garden	Reforestation	Pasture	Diversified	Total
Younger	0	0	0	0	2	2
Middle	1	1	1	8	11	22
Elder	0	1	0	5	9	15
F middle	0	0	0	0	1	1
F elder	0	0	0	1	1	2
Total	1	2	1	14	24	42
% Total	2.5%	5%	2.5%	33%	57%	100%

Appendix C

The following tables are arranged in order of appearance in Chapter 4.

Table 4.1 Number and percent of farmers who did and did not continue to plant trees after the Windbreaks Project

	Continued	Did not continue	Total
Younger less than 30			
Female	n/a	n/a	n/a
Male	2	0	2
Middle 30 to 59			
Female	1	0	1
Male	13	9	22
Elder 60 and up			
Female	1	1	2
Male	10	5	15
Total	27	15	42
%Total	64%	36%	100%

Table 4.2 Use of own resources (in number and percent) among farmers who did continue to plant trees after the Windbreaks Project

	Yes	No	Total
Younger less than 30			
Female	0	0	0
Male	2	0	2
Middle 30 to 59			
Female	0	1	1
Male*	10	1	11
Elder 60 and up			
Female	1	1	2
Male^	6	1	7
Total	19	4	23
%Total	70%	15%	85%
*2 no response			
^2 no response			

Table 4.3 Number of farmers, by farm production type, who did and did not continue planting trees after the Windbreaks Project

	Coffee	Home Garden	Reforestation	Pasture	Diversified	Total
Yes	1	1		7	18	27
No		1	1	7	6	15
Total	1	2	1	14	24	42

Table 4.4 Number of farmers, by farm size (in hectares), who did and did not continue planting trees after the Windbreaks Project

	<11	11 to 25	26 to 50	51 to 99	100 to 100+	Total
Yes	9	12	3	2	1	27
No	4	4	4	1	2	15
Total	13	16	7	3	3	42

Table 4.5 Frequency of responses about reasons for involvement in the Windbreaks Project for those who did continue planting after WP

					1* nonres	
	Did Plant	Did Plant	Did Plant	Did Plant	Did Plant	
	M-Younger	F-Middle	M-Middle	F-Elder	M-Elder*	Total
To protect farm from wind	1		2			3
To protect house from wind		1			1	2
To obtain posts	1		2			3
To decrease wind speed	1					1
Someone offered trees or recommended that I plant			2		2	4
To protect pastures			4	1	3	8
To protect water					1	1
To have wood			1			1
To protect cattle			3		1	4
Shelter for animals		1				1
Shade or protection for coffee			1			1
For conservation or reforestation			2		2	4
To obtain benefits or more productivity			3			3
For the aesthetic quality of the windbreaks						0
To see what it was like						0
Total	3	2	20	1	10	36

Table 4.6 Frequency of responses about reasons for involvement in the Windbreaks Project for those who did not continue planting after the WP

			^1 nonres	
	Not Plant	Not Plant	Not Plant	
	M-Middle	F-Elder	M-Elder^	Total
To protect farm from wind	1	1		2
To protect house from wind			1	1
To obtain posts				0
To decrease wind speed			1	1
Someone offered trees or recommended that I plant	4			4
To protect pastures	2		2	4
To protect water				0
To have wood				0
To protect cattle			2	2
Shelter for animals				0
Shade or protection for coffee				0
For conservation or reforestation	2			2
To obtain benefits or more productivity	1			1
For the aesthetic quality of the windbreaks		1		1
To see what it was like			1	1
Total	10	2	7	19

Table 4.7 Frequency of responses about reasons for involvement in the Windbreaks Project by production type

				*1 nonres	^1 nonres	
	Coffee	Home Garden	Reforestation	Pasture*	Diversified^	Total
To protect farm from wind				3	2	5
To protect house from wind		1		1	1	3
To obtain posts					3	3
To decrease wind speed					2	2
Someone offered trees or recommended that we plant	1	1	1	3	2	8
To protect pastures				5	7	12
To protect water					1	1
To have wood				1		1
To protect cattle				3	3	6
Shelter for animals					1	1
Shade or protection for coffee					1	1
For conservation or reforestation				1	5	6
To obtain benefits or more productivity				1	3	4
For the aesthetic quality of the windbreaks					1	1
To see what it was like				1		1
Total	1	2	1	19	32	55

Table 4.8 Frequency of responses about reasons for involvement in the Windbreaks Project by farm size (in hectares)

		`1 nonres			*1 nonres	
	<11	11 to 25`	26 to 50	51 to 99	100 to 100+*	Total
To protect farm from wind	1	3	1			5
To protect house from wind	2		1			3
To obtain posts	1	1	1			3
To decrease wind speed		1		1		2
Someone offered trees or recommended that we plant	4	2		2		8
To protect pastures	2	5	4		1	12
To protect water		1				1
To have wood	1					1
To protect cattle	2	3	1			6
Shelter for animals	1					1
Shade or protection for coffee					1	1
For conservation or reforestation	2	2	1		1	6
To obtain benefits or more productivity	2	2				4
For the aesthetic quality of the windbreaks		1				1
To see what it was like			1			1
Total	18	21	10	3	3	55

Table 4.9 Frequency of responses about stated benefits of the windbreaks by gender and age cohort for those who did continue planting trees after the Windbreaks Project

	Did Plant	Did Plant	Did Plant	Did Plant	Did Plant	
	M-Younger	F-Middle	M-Middle	F-Elder	M-Elder	Total
Conservation Benefits						
Food/habitat for birds/animals/insects			4		2	6
Add soil nutrients			1		1	2
Incubators for other tree species			1			1
Protect watershed			1			1
Production Benefits						
Shelter for cattle	1	1	3		4	9
Improved pasture	1		5		4	10
Shelter for cultivation					4	4
Source of shade	1		1			2
Shelter for coffee			1		1	2
Shelter for animals						0
Shelter (undefined)			1	1		2
Structural/Material Benefits						
Source of posts	2		2			4
Decrease wind speed			3			3
Source of wood			1			1
Shelter for house		1			2	3
Aesthetic quality					1	1
Total	5	2	24	1	19	51

Table 4.10 Frequency of responses about stated benefits of the windbreaks by gender and age cohort for those who did not continue planting trees after the Windbreaks Project

	Not Plant	Not Plant	Not Plant	
	M-Middle	F-Elder	M-Elder	Total
Conservation Benefits				
Food/habitat for birds/animals/insects	2			2
Add soil nutrients	1			1
Incubators for other tree species	1			1
Protect watershed				0
Production Benefits				
Shelter for cattle	2		1	3
Improved pasture	2		2	4
Shelter for cultivation	1	1	2	4
Source of shade			1	1
Shelter for coffee	1			1
Shelter for animals			2	2
Shelter (undefined)				0
Structural/Material Benefits				
Source of posts	4		1	5
Decrease wind speed	4			4
Source of wood	3			3
Shelter for house				0
Aesthetic quality	1			1
Total	22	1	9	32

Table 4.11 Frequency of responses about stated benefits of the windbreaks by farm production type

	Coffee	Home Garden	Reforestation	Pasture	Diversified	Total
Conservation Benefits						
Food/habitat for birds/animals/insects	1		1	1	5	8
Add soil nutrients			1		2	3
Incubators for other tree species					2	2
Protect watershed					1	1
Production Benefits						
Shelter for cattle				6	6	12
Improve pasture				2	12	14
Shelter for cultivation		1		3	4	8
Source of shade					3	3
Shelter for coffee	1		1		1	3
Shelter for animals				1	1	2
Shelter (undefined)				1	1	2
Structural/Material Benefits						
Source of posts		1		4	4	9
Decrease wind speed				6	1	7
Source of wood			1	2	1	4
Shelter for house					3	3
Aesthetic quality				1	1	2
Total	2	2	4	27	48	83

Table 4.12 Frequency of responses about stated benefits of the windbreaks by farm size (in hectares)

	<11	11 to 25	26 to 50	51 to 99	100 to 100+	Total
Conservation Benefits						
Food/habitat for birds/animals/insects	4	2	2			8
Add soil nutrients		2	1			3
Incubators for other tree species	1			1		2
Protect watershed	1					1
Production Benefits						
Shelter for cattle	4	5	2	1		12
Improve pasture	5	6	1	1	1	14
Shelter for cultivation	2	2	4			8
Source of shade				1	2	3
Shelter for coffee	1	2				3
Shelter for animals			1		1	2
Shelter (undefined)		1	1			2
Structural/Material Benefits						
Source of posts	2	4	1	1	1	9
Decrease wind speed	4		1	1	1	7
Source of wood	1	2			1	4
Shelter for house	2	1				3
Aesthetic quality	1	1				2
Total	28	28	14	6	7	83

Table 4.13 Frequency of responses about stated disadvantages of the windbreaks by gender and age cohort for those who did continue planting trees after the Windbreaks Project

			*1 nonres	`1 nonres	^1 nonres	
	Did Plant	Did Plant	Did Plant	Did Plant	Did Plant	
	M-Younger	F-Middle	M-Middle*	F-Elder`	M-Elder^	Total
None	1		3		3	7
Cost/work time to care for them		1			1	2
Take up too much space			2		5	7
Casuarina	1		5			6
Use of exotic species			3		1	4
Time lapse between planting and using trees					1	1
Expensive fertilizer						0
Total	2	1	13	0	11	27

Table 4.14 Frequency of responses about stated disadvantages of the windbreaks by gender and age cohort for those who did not continue planting trees after the Windbreaks Project

	Not Plant	Not Plant	Not Plant	
	M-Middle	F-Elder	M-Elder	Total
None	6		3	9
Cost/work time to care for them	1			1
Take up too much space	1		1	2
Casuarina	1			1
Use of exotic species		1		1
Time lapse between planting and using trees				0
Expensive fertilizer			1	1
Total	9	1	5	15

Table 4.15 Frequency of responses about stated disadvantages of the windbreaks by farm production type

		`1 nonres		^2 nonres		
	Coffee	Home Garden`	Reforestation	Pasture^	Diversified	Total
None		1	1	6	8	16
Cost/work time to care for them				2	1	3
Take up too much space				2	7	9
Casuarina				1	6	7
Use of exotic species	1			1	3	5
Time lapse between planting and using trees					1	1
Expensive fertilizer				1		1
Total	1	1	1	13	26	42

Table 4.16 Frequency of responses about stated disadvantages of the windbreaks by farm size (in hectares)

	`2 nonres		*1 nonres			
	<11`	11 to 25	26 to 50*	51 to 99	100 to 100+	Total
None	5	6	3		2	16
Cost/work time to care for them	2	1				3
Take up too much space	1	6		1	1	9
Casuarina	1	3	2	1		7
Use of exotic species	2	2		1		5
Time lapse between planting and using trees		1				1
Expensive fertilizer			1			1
Total	11	19	6	3	3	42

Table 4.17 Frequency of responses about natural resource management techniques by gender and age cohort for those who did continue planting trees after the Windbreaks Project

					^1 nonres	
	Did Plant	Did Plant	Did Plant	Did Plant	Did Plant	
	M-Younger	F-Middle	M-Middle	F-Elder	M-Elder^	Total
Use posts from windbreaks/ forest patches	1					1
Use water for farm	1		2			3
Use manure as fertilizer	1					1
Use manure for biodigestor					1	1
Avoid cattle in water		1	1			2
Avoid cattle in natural forest		1				1
Avoid cattle in windbreaks					1	1
Avoid fire			4			4
Avoid erosion			1			1
Avoid pesticide contamination		1				1
Avoid chemical use					1	1
Enclose natural forest			2		2	4
Enclose windbreaks			2		1	3
Enclose trees			1			1
Enclose spring			3			3
Take care of trees			1			1
Take care of natural forest						0
Take care of spring					1	1
Let spring reforest			2			2
Let steep areas reforest			1		1	2
Left natural forest				1	2	3
Left natural windbreaks						0
Plant trees			3		1	4
Plant tree if cut one					1	1
Plant trees in steep area						0
Plant trees around spring		1	1		1	3
Preserve native tree species			1			1
Protect spring with windbreaks			1			1
Not cut trees/natural trees			1			1
Not cut around spring						0
Trees fix CO2			1			1
Remove exotic trees					1	1
Rotational grazing						0
Total	3	4	28	1	14	50

Table 4.18 Frequency of responses about natural resource management techniques by gender and age cohort for those who did not continue planting trees after the Windbreaks Project

	*1 nonres			
	Not Plant	Not Plant	Not Plant	
	M-Middle*	F-Elder	M-Elder	Total
Use posts from windbreaks/ forest patches	1		1	2
Use water for farm				0
Use manure as fertilizer				0
Use manure for biodigestor				0
Avoid cattle in water	1			1
Avoid cattle in natural forest	1			1
Avoid cattle in windbreaks	1			1
Avoid fire	2			2
Avoid erosion				0
Avoid pesticide contamination				0
Avoid chemical use				0
Enclose natural forest	1	1		2
Enclose windbreaks	1			1
Enclose trees				0
Enclose spring	1	1		2
Take care of trees			1	1
Take care of natural forest	1			1
Take care of spring				0
Let spring reforest	1			1
Let steep areas reforest	1			1
Left natural forest	1			1
Left natural windbreaks	1			1
Plant trees				0
Plant tree if cut one				0
Plant trees in steep area			1	1
Plant trees around spring		1		1
Preserve native tree species				0
Protect spring with windbreaks				0
Not cut trees/natural trees			3	3
Not cut around spring			1	1
Trees fix CO2				0
Remove exotic trees				0
Rotational grazing			1	1
Total	14	3	8	25

Table 4.19 Frequency of responses about natural resource management techniques by farm production type

		`2 nonres				
	Coffee	Home Garden`	Reforestation	Pasture	Diversified	Total
Use posts from windbreaks/ forest patches					3	3
Use water for farm					3	3
Use manure as fertilizer					1	1
Use manure for biodigestor				1		1
Avoid cattle in water					3	3
Avoid cattle in natural forest				1	1	2
Avoid cattle in windbreaks				2		2
Avoid fire	1		1	2	2	6
Avoid erosion				1		1
Avoid pesticide contamination					1	1
Avoid chemical use					1	1
Enclose natural forest			1	1	4	6
Enclose windbreaks				2	2	4
Enclose trees	1					1
Enclose spring				1	4	5
Take care of trees				1	1	2
Take care of natural forest				1		1
Take care of spring					1	1
Let spring reforest					3	3
Let steep areas reforest					3	3
Left natural forest			1	1	2	4
Left natural windbreaks				1		1
Plant trees				1	3	4
Plant tree if cut one					1	1
Plant trees in steep area				1		1
Plant trees around spring					4	4
Preserve native tree species					1	1
Protect spring with windbreaks					1	1
Not cut trees/natural trees					4	4
Not cut around spring				1		1
Trees fix CO2					1	1
Remove exotic trees					1	1
Rotational grazing				1		1
Total	2	0	3	19	51	75

Table 4.20 Frequency of responses about natural resource management techniques by farm size (in hectares)

	`2 nonres					
	<11`	11 to 25	26 to 50	51 to 99	100 to 100+	Total
Use posts from windbreaks/ forest patches		1	1		1	3
Use water for farm		1		1	1	3
Use manure as fertilizer				1		1
Use manure for biodigestor		1				1
Avoid cattle in water	1			1	1	3
Avoid cattle in natural forest	1	1				2
Avoid cattle in windbreaks		2				2
Avoid fire	1	2		2	1	6
Avoid erosion				1		1
Avoid pesticide contamination	1					1
Avoid chemical use	1					1
Enclose natural forest	1	4	1			6
Enclose windbreaks	2	2				4
Enclose trees	1					1
Enclose spring		4	1			5
Take care of trees	2					2
Take care of natural forest	1					1
Take care of spring		1				1
Let spring reforest			1	1	1	3
Let steep areas reforest	1	1		1		3
Left natural forest		3	1			4
Left natural windbreaks					1	1
Plant trees	2	2				4
Plant tree if cut one			1			1
Plant trees in steep area			1			1
Plant trees around spring	1	3				4
Preserve native tree species	1					1
Protect spring with windbreaks			1			1
Not cut trees/natural trees	2	1			1	4
Not cut around spring			1			1
Trees fix CO2	1					1
Remove exotic trees		1				1
Rotational grazing			1			1
Total	20	30	10	8	7	75

Table 4.21 Frequency of responses about type of assistance needed to help in the management of natural resources by gender and age cohort for those who did continue planting trees after the Windbreaks Project

					^1 nonres	
	Did Plant	Did Plant	Did Plant	Did Plant	Did Plant	
	M-Younger	F-Middle	M-Middle	F-Elder	M-Elder^	Total
None	1		5		2	8
Windbreak trees for wood	1					1
Technical assistance		1	1		1	3
Technical assistance about tourism						0
Economic for maintenance of fences			1	1	2	4
Economic to reforest more			2			2
Economic –PES					1	1
Access to trees			1			1
Reforestation around springs			1		2	3
Fencing natural forest areas			2			2
Reforestation with native species			1			1
Better communication with gov/organizations					1	1
Trees for wildlife						0
Don't know			1			1
Total	2	1	15	1	9	28

Table 4.22 Frequency of responses about type of assistance needed to help in the management of natural resources by gender and age cohort for those who did not continue planting trees after the Windbreaks Project

	*2 nonres		^1 nonres	
	Not Plant	Not Plant	Not Plant	
	M-Middle*	F-Elder	M-Elder^	Total
None	2		3	5
Windbreak trees for wood				0
Technical assistance	1			1
Technical assistance about tourism		1		1
Economic for maintenance of fences	3		1	4
Economic to reforest more				0
Economic-PES				0
Access to trees	1			1
Reforestation around springs				0
Fencing natural forest areas				0
Reforestation with native species				0
Better communication with gov/organizations				0
Trees for wildlife	1			1
Don't know				0
Total	8	1	4	13

Table 4.23 Frequency of responses about type of assistance needed to help in the management of natural resources by farm production type.

		`1 nonres		*2 nonres	^1 nonres	
	Coffee	Home Garden`	Reforestation	Pasture*	Diversified^	Total
None				6	7	13
Windbreak trees for wood					1	1
Technical assistance		1		1	2	4
Technical assistance about tourism					1	1
Economic for maintenance of fences			1	3	4	8
Economic to reforest more					2	2
Economic –PES					1	1
Access to trees		1			1	2
Reforestation around springs				1	2	3
Fencing natural forest areas					2	2
Reforestation with native species					1	1
Better communication with gov/organizations					1	1
Trees for wildlife				1		1
Don't know	1					1
Total	1	2	1	12	25	41

Table 4.24 Frequency of responses about type of assistance needed to help in the management of natural resources by farm size (in hectares)

	`2 nonres				^2 nonres	
	<11`	11 to 25	26 to 50	51 to 99	100 to 100+^	Total
None	4	5	3	1		13
Windbreak trees for wood				1		1
Technical assistance	3	1				4
Technical assistance about tourism		1				1
Economic for maintenance of fences	1	2	3	1	1	8
Economic to reforest more	1	1				2
Economic –PES		1				1
Access to trees	1	1				2
Reforestation around springs		3				3
Fencing natural forest areas	1	1				2
Reforestation with native species	1					1
Better communication with gov/organizations			1			1
Trees for wildlife		1				1
Don't know	1					1
Total	13	17	7	3	1	41

Table 4.25 Frequency of responses about opinions of past MCL reforestation activities by gender and age cohort for farmers who continued planting trees after the Windbreaks Project

					^1 nonres	
	Did Plant	Did Plant	Did Plant	Did Plant	Did Plant	
	M-Younger	F-Middle	M-Middle	F-Elder	M-Elder^	Total
Good	1		3	1	4	9
Too bad they did not continue	1		3			4
But it ended					2	2
Never received fertilizer					1	1
Casuarina not good for much						0
Need to protect fauna						0
Benefits for people and environment		1	1			2
Benefits for people			3		1	4
Benefits for environment			1			1
Improved aesthetic quality of farm			2			2
Allowed for cultivation					1	1
Need fruit trees for human consumption						0
Total	2	1	13	1	9	26

Table 4.26 Frequency of responses about opinions of past MCL reforestation activities by gender and age cohort for farmers who did not continue planting trees after the Windbreaks Project

			^1 nonres	
	Not Plant	Not Plant	Not Plant	
	M-Middle	F-Elder	M-Elder^	Total
Good	5		3	8
Too bad they did not continue	2			2
But it ended		1		1
Never received fertilizer				0
Casuarina not good for much	1			1
Need to protect fauna			1	1
Benefits for people and environment				0
Benefits for people				0
Benefits for environment				0
Improved aesthetic quality of farm	1	1		2
Allowed for cultivation				0
Need fruit trees for human consumption	1			1
Total	10	2	4	16

Table 4.27 Frequency of responses about opinions of past MCL reforestation activities by farm production type

		`1 nonres			^1 nonres	
	Coffee	Home Garden`	Reforestation	Pasture	Diversified^	Total
Good		1	1	7	8	17
Too bad they did not continue				2	4	6
But it ended					3	3
Never received fertilizer				1		1
Casuarina not good for much				1		1
Need to protect fauna					1	1
Benefits for people and environment				1	1	2
Benefits for people				1	3	4
Benefits for environment					1	1
Improved aesthetic quality of farm	1			1	2	4
Allowed for cultivation				1		1
Need fruit trees for human consumption					1	1
Total	1	1	1	15	24	42

Table 4.28 Frequency of responses about opinions of past MCL reforestation activities by farm size (in hectares)

	`1 nonres				^1 nonres	
	<11`	11 to 25	26 to 50	51 to 99	100 to 100+^	Total
Good	5	6	5	1		17
Too bad they did not continue	2	1		1	2	6
But it ended		2	1			3
Never received fertilizer	1					1
Casuarina not good for much		1				1
Need to protect fauna		1				1
Benefits for people and environment	1			1		2
Benefits for people	2	2				4
Benefits for environment		1				1
Improved aesthetic quality of farm	1	3				4
Allowed for cultivation		1				1
Need fruit trees for human consumption			1			1
Total	12	18	7	3	2	42

Table 4.29 Number of farmers and ways of finding out about the Windbreaks Project by gender and age cohort for those who did continue planting trees after the Windbreaks Project

					*3 nonres	
	Did Plant	Did Plant	Did Plant	Did Plant	Did Plant	
	M-Younger	F-Middle	M-Middle	F-Elder	M-Elder*	Total
Cheese Factory	1					1
Someone from MCL contacted us	1	1	4	1	1	8
Someone offered us trees			5		1	6
Went to a meeting by MCL			1			1
Contacted MCL on own			2		1	3
From someone else's project			1		2	3
From Santa Elena Cooperative					2	2
Don't remember						0
Total	2	1	13	1	7	24

Table 4.30 Number of farmers and ways of finding out about the Windbreaks Project by gender and age cohort for those who did not continue planting trees after the Windbreaks Project

			^1 nonres	
	Not Plant	Not Plant	Not Plant	
	M-Middle	F-Elder	M-Elder^	Total
Cheese Factory	1			1
Someone from MCL contacted us	3	1	3	7
Someone offered us trees	2			2
Went to a meeting by MCL	1			1
Contacted MCL on own	1			1
From someone else's project	1			1
From Santa Elena Cooperative				
Don't remember			1	1
Total	9	1	4	14

Table 4.31 Number of farmers and ways of finding out about the Windbreaks Project by farm production type

		`1 nonres		*1 nonres	^2 nonres	
	Coffee	Home Garden`	Reforestation	Pasture*	Diversified^	Total
Cheese Factory				1	1	2
Someone from MCL contacted us			1	6	8	15
Someone offered us trees	1	1		1	5	8
Went to a meeting by MCL					2	2
Contacted MCL on own				1	3	4
From someone else's project				3	1	4
From Santa Elena Cooperative					2	2
Don't remember				1	0	1
Total	1	1	1	13	22	38

Table 4.32 Number of farmers and ways of finding out about the Windbreaks Project by farm size (in hectares)

	`2 nonres	*1 nonres			^1 nonres	
	<11`	11 to 25*	26 to 50	51 to 99	100 to 100+^	Total
Cheese Factory		1	1			2
Someone from MCL contacted us	4	8	2	1		15
Someone offered us trees	2	2	1	2	1	8
Went to a meeting by MCL	1		1			2
Contacted MCL on own	3				1	4
From someone else's project	1	2	1			4
From Santa Elena Cooperative		2				2
Don't remember			1			1
Total	11	15	7	3	2	38

Table 4.33 Frequency of responses about the economic value of the windbreaks by gender and age cohort for those who did continue planting trees after the Windbreaks Project

	Did Plant	Did Plant	Did Plant	Did Plant	Did Plant	
	M-Younger	F-Middle	M-Middle	F-Elder	M-Elder	Total
A lot			5		2	7
Value is for posts	2	1	7		4	14
Improve pasture			3		4	7
As an investment						0
Source of wood			1	1		2
Improve cultivated areas			1		2	3
Aesthetic quality	1					1
Protect house					1	1
Protect cattle			1			1
Increase soil fertility		1			1	2
As forest patch connections					1	1
Don't know						0
Total	3	2	18	1	15	39

Table 4.34 Frequency of responses about economic value of windbreaks by gender and age cohort who did not continue planting trees after the Windbreaks Project

			^1 nonres	
	Not Plant	Not Plant	Not Plant	
	M-Middle	F-Elder	M-Elder^	Total
A lot	5		2	7
Value is for posts	2	1		3
Improve pasture			1	1
As an investment	1			1
Source of wood	2			2
Improve cultivated areas				0
Aesthetic quality	1			1
Protect house				0
Protect cattle	2		1	3
Increase soil fertility				0
As forest patch connections				0
Don't know			1	1
Total	13	1	5	19

Table 4.35 Frequency of responses about economic value of windbreaks by farm production type

					^1 nonres	
	Coffee	Home Garden	Reforestation	Pasture	Diversified^	Total
A lot	1			5	8	14
Value is for posts		2		2	13	17
Improve pasture		1		4	3	8
As an investment			1			1
Source of wood				3	1	4
Improve cultivated areas					3	3
Aesthetic quality				1	1	2
Protect house					1	1
Protect cattle				3	1	4
Increase soil fertility					2	2
As forest patch connections					1	1
Don't know				1		1
Total	1	3	1	19	34	58

Table 4.36 Frequency of responses about economic value of windbreaks by farm size (in hectares)

					^1 nonres	
	<11	11 to 25	26 to 50	51 to 99	100 to 100+^	Total
A lot	4	6	2	1	1	14
Value is for posts	5	9		2	1	17
Improve pasture	4	2	1	1		8
As an investment		1				1
Source of wood	1	2	1			4
Improve cultivated areas	1	2				3
Aesthetic quality	1			1		2
Protect house		1				1
Protect cattle		1	2		1	4
Increase soil fertility	1		1			2
As forest patch connections		1				1
Don't know			1			1
Total	17	25	8	5	3	58

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