UNIVERSITY OF CALIFORNIA

SANTA CRUZ

TRADITIONAL SHADE, RURAL LIVELIHOODS AND CONSERVATION IN SMALL COFFEE FARMS AND COOPERATIVES OF WESTERN EL SALVADOR

A dissertation submitted in partial satisfaction of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

ENVIRONMENTAL STUDIES

by

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June 2004

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Traditional Shade, Rural Livelihoods, and Conservation in Small Coffee Farms and Cooperatives of Western El Salvador.

by

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ABSTRACT

This research aimed to better understand on-farm and organizational relationships affecting shade tree biodiversity and household livelihoods in three small farmer coffee cooperatives of western El Salvador. The cooperatives were chosen based on their distinct characteristics, and their proximity to the protected area *Parque Nacional El Imposible (*PNEI). Fifty-one 1000 m^2 plots for agroecological research were randomly or systematically laid out in the three cooperatives. Data on social organization and livelihoods was collected through 52 household interviews, and at least 15 focus groups.

Household livelihoods of cooperative members relied mostly on agricultural work relating to coffee. Shade trees produced a diversity of products that were used both for household consumption and sales, which contributed considerably to the household economy. Member perceptions of their cooperatives were the result of a combination of factors, which include the origin, size, history and structure of each organization.

Complete tree inventories yielded a total of 169 tree species, of which 123 were adequately identified. Tree species richness was lower, but similar to that found on a recent study on the PNEI (total of 174 species in 28 plots). Only 24% of the 123 species identified were shared by the three cooperatives. A comparison between the sum of species found in the cooperatives and the forest (227) showed that the forest and the shade coffee plantations only share 16% of the species identified.

The levels of native tree biodiversity found in the cooperatives shows promise for conserving these species within shaded coffee plantations. Tree species richness was affected by a combination of biophysical factors (e.g. elevation and slope), as well as variables related to management, such as tree density. Dependence on tree products for livelihoods and cooperative types also influenced the levels of species richness.

An integration of the cooperatives into conservation strategies needs to ensure that these initiatives will not negatively affect their member's socioeconomic situation. Special attention should be placed on avoiding use restrictions of their shade tree resources. Despite some of the problems observed and issues expressed by their members, cooperatives seem to be a familiar form of organization that remains functional and respected by its members.

DEDICATION

I dedicate this dissertation to my late mother Isa Gamero de Méndez. Through her love of life and family, and her encouragement and understanding, she motivated me to pursue my dreams, to be generous to others, and to try to live life at its fullest.

ACKNOWLEDGEMENTS

This research project was only made possible through the collaboration of a great number of individuals and institutions. I owe thanks to the members of Cooperatives Las Colinas, La Concordia, and El Sincuyo in Tacuba, El Salvador. Their openness to collaborate, share their knowledge, and challenge me to make the research more directly useful to their livelihoods has been a key motivating force throughout the process.

Foremost, I am grateful to Stephen R. Gliessman, my thesis advisor and mentor at the Department of Environmental Studies at UCSC. Steve provided, and continues to provide, unconditional support to my academic and personal development. The members of my dissertation committee, Professors David Goodman and Greg Gilbert at the Department of Environmental Studies and Johnny Fox at the Department of Latin American Studies of UCSC, also provided valuable guidance and analytical advice throughout the investigation and the writing of the dissertation. John Beer, from the agroforestry area at CATIE, also provided advice on earlier phases of the project. The faculty of the Department of Environmental Studies deserve thanks for their contributions and commitment to interdisciplinary education.

Maybelyn Escalante, assistant researcher in the project between May and December 2001, provided exceptional assistance in conducting and coordinating field research, and in data processing and analysis. Field assistants Luis Ramírez, Mac Sandoval and Carlos Rodríguez were essential collaborators in tree identification and measurement, and soil sampling.

I am also grateful for the participation of Gustav Brandt Peterson of the University of Texas, Elizabeth Shapiro and Avery Cohn, both of Yale University who, through their graduate theses, greatly contributed to expand our knowledge of the social and agroecological dynamics of the coffee landscapes of Tacuba.

Most recently, the motivation to continue with interdisciplinary research for development has come through the formation of the Community Agroecology Network (CAN), which has been spearheaded by Robbie Jaffee and Steve Gliessman. I owe special thanks to Robbie Jaffee for her continuous support on both my personal and professional development since my arrival at UCSC.

I also appreciate the rich discussions and exchanges with my friends and fellow coffee researchers Christopher Bacon, Laura Trujillo, Carlos Guadarrama and Reinhold Muschler. I am also lucky to have been able to share and gain valuable insight, as well as much needed friendship, from the

environmental studies graduate group, and the Gliessman lab group at UCSC. These include Chris Bacon, Dorothy Overpeck, Rob Sirrine, Andrew Marshall, Ariane de Bremond, Rose Cohen, Erle Ellis, Joji Muramoto, Eric Holt-Gimenez, Roopali Phadke, Melanie Bojanowski, Marc Los Huertos, Phillip Fuyijoshi, Wes Colvin, Hilary Melcarek, Tim Vos, Suzanne Landgridge, Joan Brunkard, Mike Goodman, and Betsy Herbert.

My partner, Karen Nordstrom, provided much appreciated love and support in the final stages of the dissertation. In Santa Cruz, the friendship of Victoria Kove, Joyce Swenor, and others at Life Lab is also appreciated.

Doribel Herrador, Leopoldo Dimas, Ileana Goméz, Toty García, Nelson Cuéllar, Silvia de Larios, Susan Kandel and Herman Rosa all colleagues at the Salvadoran Research Program on Development and Environment (PRISMA), have contributed to expand my insight and knowledge on the broader implications of environment and development in rural landscapes.

Ruben Carballo and Hector Castaneda, from the Jardín Botánico La Laguna, were instrumental in tree species identification. Thanks are also due to the Research and Extension Units at the Salvadoran Foundation for Coffee Research (PROCAFE), which provided valuable field and laboratory support throughout the research.

Throughout my life and professional career my family has been a great source of support and inspiration. This includes my father Armando, who also provided financial support, my sisters Nuria and Patty, and my brother René. My nieces and nephews, Marcello, Paolo, Chele, Eduardo, Melissa, Mariel and Celine, have provided much love and entertaining moments.

Thanks are due to the staff of the environmental studies department, including Juanita Nama, Joyce Rice, Kristina Loften, and other office staff who have been very patient and supportive with the many requirements of an international graduate student. At the UCSC Graduate Studies Program, I also thank Bob Hastings for similar patience.

Financial support for the research was provided by the following: the Interamerican Foundation (IAF) Graduate Studies Fellowship; the Vavilov-Frankel Fellowship of the International Plant Genetic Resources Institute (IPGRI); the Department of Environmental Studies, the Center for Agroecology and Sustainable Food Systems (CASFS), and the Alfred E. Heller Chair in Agroecology, all at UCSC; The Mesoamerican Biological Corridor Fellowships Program; and The Conservation, Food and Health Foundation (CFHF).

CHAPTER 1: BACKGROUND

INTRODUCTION

In the last decades, Central America has experienced drastic changes in its social and political structures (Boyce *et al.*, 1994; Paige, 1997; Bulmer-Thomas, 1998). These socio-political changes have occurred parallel to an increase in the level of natural resource depletion and ecological deterioration (CCAD, 1998). As a result, new social and environmental realities have emerged that pose great challenges for traditional research and development strategies (Bryant & Bailey, 1997). In this context, there are at least two emerging factors that will play a vital role in the future negotiation of environmental solutions in Central America.

First, environmental conservation in poor and densely populated countries cannot entirely depend on models that restrict human use of natural resources (Milner-Gulland & Mace, 1999). The second key factor in Central American environmental governance concerns recent political and economic changes that have occurred in most Latin American countries. These transformations have resulted in new (and many times undefined) institutional structures. In this study, I examine these two issues in the following ways:

1. Exploring the potential of conserving biodiversity in shade coffee agroforestry systems.

2. Analyzing the effects of local organizations and their networks on rural livelihoods and environmental conservation.

My overall hypothesis for this research is that the two factors outlined above are greatly affecting the way in which rural communities in developing countries engage in socio-economic development and environmental conservation. I examine these issues through an analysis of three small-scale farmer coffee cooperatives in western El Salvador.

The rest of this chapter is divided into five main sections. The following section reviews literature on the potential of agriculture to become part of conservation and development strategies, with an emphasis on shade coffee agroforestry systems. The third section presents an introduction to analyzing the effects of institutional transformation and the specific role of local farmer organizations in response to these changes. The fourth section discusses the particular situation of shade coffee in El Salvador, with a focus on its conservation potential and on small-scale farmer cooperatives. The final sections present the research objectives, hypothesis, and action goals for the thesis.

INTEGRATING CONSERVATION AND DEVELOPMENT IN TROPICAL AGROECOSYSTEMS

Background

Terrestrial resource use, in its multiple forms, is still the basis of survival for rural populations in most developing countries. Restricting rural people's access to the resource base on which they depend for the sake of conservation has continually led to social conflict (Koziell & Saunders, 2001). Developing countries facing rural poverty and overpopulation need alternative options that integrate social development with environmentally sound natural resource management (Thrupp, 1993; Rocheleau, 1999). Agriculture represents one of the most widespread forms of natural resource use today, and one that has caused severe environmental degradation (National Research Council, 1990; National Research Council, 1993). However, not all existing agricultural systems have serious negative impacts on the environment. A number of agroecosystems have the potential to maintain minimum levels of resource degradation, and impacts on the surrounding landscape (Edwards *et al.*, 1990; National Research Council, 1993; Lockeretz, 1995). Integrating these types of agricultural systems into environmental conservation initiatives has become a recent priority for researchers and development workers in the developing world (Lockeretz, 1995; Collins & Qualset, 1999).

Ecosystem Services and Conservation in Shade Coffee Agroecosystems

In the Central American tropics, agroforestry systems[1], such as homegardens and shade coffee (*Coffea* spp.) have great potential to reduce resource depletion and become part of conservation strategies (Boyce *et al.*, 1994; Beer *et al.*, 1998; Lok, 1998). Research over the last two decades has documented the potential of shade coffee to provide environmental services, such as water, soil, and biodiversity conservation, as well as carbon sequestration. In this body of literature there is a stark contrast between the large amount of research done on biodiversity and soil conservation, in comparison to the much smaller number of studies focusing on water conservation and carbon sequestration. This initial section touches briefly on the state of research on the ecosystem services of water and soil conservation, and carbon sequestration. An in-depth review of these particular topics is beyond the goals and scope of this dissertation, but the sections point the reader to key publications on each of these subjects. Biodiversity conservation in shade coffee is reviewed in more depth, since it is at the chore of my research.

[1] Agroforestry is a land-use system incorporating trees with agricultural crops and/or animals, in which their ecological interactions are managed to obtain multiple social, economic and/or environmental products and benefits (adapted from Nair (1993) and Somarriba (1998).

Water Conservation

Examples of agroforestry's contribution to water conservation have been documented in various situations and systems. Specifically in shade coffee, (Jiménez, 1986) documented the potential to increase water infiltration through pruning management and shade tree selection in Costa Rica. (Babbar & Zak, 1995) reported higher N leaching and lower water infiltration in full sun coffee systems in comparison to shade coffee systems of the central valley of Costa Rica. Other types of agroforestry systems have yielded similar results. In the U.S.A., (Bharati *et al.*, 2002) reported higher infiltration rates in agroforestry areas for stream protection, in comparison to areas under annual crops. In the Himalayas, long-term field experiments have also shown higher water infiltration rates in agroforestry systems in comparison to treatments without trees (Narain *et al.*, 1998). Comparable results were reported by in cacao agroforestry systems of Costa Rica (Imbach *et al.*, 1989). However, these results have the limitation that they cannot be adequately extrapolated to the larger scales that are generally used for water management (i.e. watersheds and landscapes). It is in this respect where research on water conservation seems incomplete. According to (Jansson *et al.*, 1999), research has been limited by the high degree of complexity involved in adequately documenting hydrological flows at larger scales (e.g. landscapes). Nonetheless, researchers like Ewel (1999) claim that agroforestry systems can aid in the conservation of water resources in

tropical forest areas because of their structural similarity to natural forest ecosystems. This characteristic allows them to play a similar role to forests in local hydrological cycles. The conservation and use of water has become one of the most important environmental issues in the recent decades. This is leading to an accelerated increase on research that can properly analyze water dynamics in heterogeneous landscapes (Jansson *et al.*, 1999). In addition, there is a need for research to have an integrated approach to ecosystem service provision and conservation, which takes into account all services (i.e. water conservation, biodiversity conservation and carbon sequestration) (Rosa *et al.*, 2003b). Only through an integrated approach will we be able avoid implementing strategies that compromise one ecosystem service, in an effort to conserve another.

Soil Conservation

Agroforestry's potential for soil conservation has been one of the greatest concerns of researchers for over two decades (Nair, 1984; Nair, 1989; Nair, 1993; Young, 1997). The basic tenet is that tree litter, and other components of trees, such as *Rhizobium* bacteria in the roots of leguminous species, can contribute to the enrichment of soil organic matter and fertility (Nair, 1993). In addition, the size and deep rooted systems of trees aid in keeping soil in place, preventing surface and wind soil erosion, and are able to recycle

nutrients from sources that are deeper in the soil horizon (Narain *et al.*, 1998; Nair *et al.*, 1999; Méndez *et al.*, 2000). These hypotheses have been amply proven in many experimental settings of Central America and Africa (Jiménez, 2001), but fewer studies have been carried out on-farm. However, one study in Venezuela, which compared full sun with shaded coffee farms, showed lower surface erosion rates in both systems, as compared to annual crops, and a moderate increase in erosion control in the shaded coffee agroecosystem (Ataroff & Monasterio, 1997). The literature shows that field based measurements have provided consistent evidence of the soil conservation potential of agroforestry systems (see (Young, 1989; Young, 1997) for thorough reviews on agroforestry and soil management and conservation). However, and as in the case of water conservation, there is a need to research this potential at larger scales, and through integrated studies that include a broad range of ecosystem services.

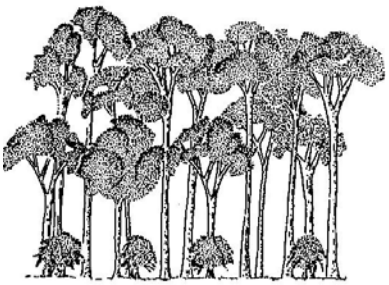
Carbon Sequestration

Increasing concerns about global warming have lead to a growing number of studies focusing on the potential of agroforestry systems to sequester carbon and contribute to mitigate greenhouse gas emissions (Beer *et al.*, 2003). According to (Pandey, 2002), agroforestry systems have the added advantage of potentially providing other ecosystem services besides carbon

sequestration (e.g. biodiversity and water conservation), while also producing agricultural and forestry products. Agroforestry systems have been shown to sequester carbon in soil and biomass in different eco-zones of the tropics. Studies in Costa Rica have documented soil carbon sequestration in silvopastoral systems (López *et al.*, 1999) and other agroforestry systems, such as shade coffee (Avila *et al.*, 2001). Similar research has also been carried out in India, México and the former Soviet Union (Pandey, 2002). Several studies have quantified carbon sequestration in different eco-zones and types of agroforestry systems (Avila *et al.*, 2001; Pandey, 2002; Beer *et al.*, 2003). Regarding future research and use of agroforestry for carbon sequestration (Rosa *et al.*, 2003b) discuss concerns about the capability of poor rural communities and farmers to be able to negotiate compensation schemes for sequestering carbon in their farms. So far, most programs involving compensation for mitigating gases have been carried out through governments or larger institutions, which have largely excluded the poorer sectors of society. (Pandey, 2002) also points to the need to integrate compensation mechanisms for carbon sequestration with the conservation of other ecosystem services.

Biodiversity Conservation

Numerous investigations in the last decades have analyzed the potential conservation of both plant and animal biodiversity in shade coffee agroecosystems. Within these publications there are several general reviews that assess the potential and limitations of biodiversity conservation in shade coffee agroecosystems. These include a key publication by (Perfecto *et al.*, 1996), which contributed to gain broader attention on the potential of coffee to conserve biodiversity. This study compared the contributions to biodiversity conservation of traditional or rustic shade coffee agroecosystems and un-shaded or simplified shade systems (see Figure 1.1). Through a review of studies on plants, arthropods, birds and other vertebrates, the authors concluded that much of the biodiversity of these organisms is lost when traditional shade coffee agroecosystems are transformed into simplified shade or full sun agroecosystems. A second important review was published by (Moguel & Toledo, 1999), and although it was centered in Mexico, it also provides a solid evaluation of conservation of different taxa in coffee agroecosystems. This publication is also important because it introduced a shade-based classification of coffee agroecosystems into the scientific literature. This classification has been widely used, with a wide variety of modifications, for research as well as certification purposes (Figure 1.1).



Rustic: Forest understory is cleared to plant coffee, but most of the trees in the mid and upper strata are left intact. Few other tree components are planted.

Traditional Polyculture: Forest is partially cleared to plant coffee, but some of the upper or mid canopy trees are left standing. Coffee is planted along with other useful tree and herbaceous species.

Commercial Polyculture: Forest is entirely cleared to plant coffee, along with selected shade trees, and other useful plant species.

Shaded monoculture: Forest is entirely cleared to plant coffee, along with single species of shade trees, usually a leguminous tree.

Ushaded monoculture: Forest is entirely cleared to plant coffee, without shade trees.

Figure 1.1 Shade-based classification of different coffee agroecosystems modified from Moguel and Toledo (1999). Diagrams modified from Gobbi (1999).

Biodiversity conservation of insects in shade coffee

Several researchers have analyzed the levels of insect biodiversity in different types of coffee agroecosystems. These studies have mostly represented comparisons of diversity and abundance of insects in plantations with different types of shade. The results of this research are consistent in showing that insect biodiversity is reduced incrementally as you transform forest ecosystems to shade coffee, and that it continues to decrease as the levels of shade tree density and cover decrease (Greenberg *et al.*, 1997b; Perfecto, 1997). (Nestel *et al.*, 1993) showed a decrease in species diversity of macro-Coleoptora in full sun coffee systems when compared to shaded monoculture coffee agroecosystems. Similar results were found when measuring the biodiversity of three major taxonomic groups (Coleoptera, non-formicid Hymenoptera, and Formicidae) (Perfecto *et al.*, 1997) and butterflies (Mas & Dietsch, 2003) in Mexico, and ants in Panama (Roberts *et al.*, 2000).

Biodiversity conservation of mammals and primates in shade coffee

Research on mammal and primate biodiversity conservation in shade coffee is scarce. (Gallina *et al.*, 1996) compared the incidence of mammalian species in commercial and rustic coffee plantations. They found a total of 24 species of mid-sized mammals, and diversity decreased in the commercial plantations as management intensity was increased. Examples of the mammals found in these coffee plantations include opossums, squirrels,

rodents, rabbits, bats, and three small cats. In a unique study, (Williams-Guillen & McCann, 2002) found that coffee plantations with shade dominated by *Inga* spp were able to sustain a healthy howler monkey (*Alouatta palliata)* population, near the *Mombacho* volcano in Nicaragua.

Biodiversity conservation of trees in shade coffee

Most of the research on arthropod, insect, bird and mammal species has also documented tree species richness in coffee plantations. This has been done in an effort to understand the effects of different types of shade tree diversity, density and ground cover on the biodiversity of these other organisms. However, there has been less of a focus on the conservation of native tree species in shade coffee plantations. (Moguel & Toledo, 1999) reported that native tree species richness in rustic coffee agroecosystems of Mexico ranges between 90 and 120 species. In El Salvador, a total of 235 tree species (both native and exotic) were found in a nation-wide botanical inventory (Monro *et al.*, 2001). Somarriba (2004) reports finding between 19 and 77 tree species in studies on shade coffee plantations of Costa Rica, Nicaragua, and El Salvador.

Biodiversity conservation of birds in shade coffee

Studies on bird biodiversity in coffee plantations have recorded the presence of birds from different types of habitats (Greenberg *et al.*, 1997a; Moguel, 1999). Most of the research shows that bird biodiversity in shade coffee is

lower than that in forest ecosystems, and that specialized forest species are very rare (Greenberg *et al.*, 1997a; Wunderle, 1999). Differences in species richness between different types of plantations have not yielded consistent results. In Guatemala, there were differences between full sun and different types of shade systems, but no such differences were found in the coffee plantations studied in Chiapas, Mexico (Greenberg *et al.*, 1997a; Greenberg *et al.*, 1997b). The number of species found in shade coffee plantations ranges from 40 species in shaded monocultures of Jamaica (Johnson, 2000), 65 and 73 species in full-sun and shade plantations of Guatemala (Greenberg *et al.*, 1997a), to 105 species in coffee plantations of Chiapas, Mexico (Greenberg *et al.*, 1997b).

Biodiversity research, conservation and coffee management

As can be observed by the overview presented above, research has been successful in documenting the biodiversity of different types of organisms in coffee plantations. What remains to be analyzed is how the biodiversity found in coffee can become part of broader conservation strategies, and how shade coffee farmers are to manage their plantations for this purpose. One recent effort in this direction is the development of a coffee plantation management index, based on species richness of butterflies (Mas & Dietsch, 2003). This tool could provide guiding principles for plantation managers to follow in order to conserve species of conservation importance.

Debates on shade coffee's role in conservation

The literature on coffee and biodiversity conservation has also received critiques from researchers who are calling for caution in promoting shade coffee's role in biodiversity conservation. Specifically, these arguments show concern for the possibility that these agroecosystems might be perceived as good substitutes for natural forests, which then might lead to increased deforestation (Rappole *et al.*, 2003). These critiques are valid, and caution is in order when addressing the complexities present in the interfaces between conservation, agriculture and development. However, it is important to remember that a potential increased replacement of natural forests for shade coffee, at a global scale, will be strongly affected by the contexts of specific localities, regions and countries (Rosa *et al.*, 2003a). For example, in deforested countries where most remaining forests are protected, and the potential expansion of protected areas is limited, it makes sense to integrate shade coffee with conservation efforts (e.g. El Salvador). In contrast, in countries rich in un-protected natural forests, the integration of shade coffee into conservation initiatives should be parallel to strategies that prevent the substitution of natural habitats.

LIVELIHOODS, LOCAL ORGANIZATIONS AND CONSERVATION

The literature reviewed above shows the great potential that shade coffee agroecosystems have for conserving different types of ecosystem services. However, in order to use this information as a basis for conservation and development initiatives, complementary research on social, economic and political issues needs to be undertaken for specific regions, countries or localities.

According to Fernandez & Muschler (1999), there is a lack of information on the social, economic and political contexts that could affect the integration of Central American coffee farmers into conservation initiatives. Although there is a growing body of work analyzing shade coffee as part of alternative agro-food systems (Nigh, 1997; Whatmore & Thorne, 1997; Rice, 2001; Bray *et al.*, 2002; Raynolds, 2002), fewer studies have linked the socio-economic dynamics of farmers and their households with the potential to be part of initiatives seeking to conserve and provide ecosystem services.

Recent studies in rural Latin America have shown the importance of local organizations on both rural people's livelihoods as well as environmental conservation (Bebbington, 2000; Bebbington & Batterbury, 2001). The following paragraphs introduce the current state of local organizations in Latin America as affected by global change, and highlights important factors for an

analysis of organizations, livelihoods and the environment. A conceptual review of these topics is presented in Chapter 2.

Modifications in Central American state agencies and institutions have affected the direction of environmental policy and agricultural development programs (Acevedo *et al.*, 1995). Recent developments include severe cuts in government investment for agricultural programs, and restructuring of state institutions (PRISMA, 1995; Cuellar *et al.*, 2002). This in turn has resulted in changes in the nature and role of non-government and local organizations (Bebbington & Thiele, 1993). In El Salvador, the national agricultural extension agency has been increasingly reduced since the mid 90's. Personnel cuts of up to 50% have been implemented in most local extension agencies throughout the country (PNUD, 2001). As a result, rural development support has shifted almost entirely to the non-government sector, including national and international NGOs, as well as local organizations (farmer cooperatives, local development associations, etc.). Examples of severe downsizing or disappearance of agricultural state agencies, with similar shifts of economic and technical resources to NGOs, have also been documented in Mexico and the South American Andes. These transformations have opened both opportunities and challenges for local indigenous organizations, as they have begun to access these previously unavailable resources (Bebbington, 1996a; Porter, 2000). Thus,

local organizations are now playing increasingly important roles in conservation and development initiatives in the rural landscapes of Central America.

The newly acquired roles of local organizations in environmental and agricultural development, demonstrate the need to acknowledge and include them as important actors in agricultural and conservation research and policy (Bebbington & Thiele, 1993). This points to the need to examine these organizations when analyzing the environmental dynamics, including biodiversity conservation, in countries that have undergone institutional changes, as the ones outlined in the previous paragraphs. In doing this, it is important to include both the characteristics and capacities of the organization, as well as the nature and reach of its networks. This analysis is central to the objectives of my thesis, and one that is thoroughly discussed in Chapters 2 and 3.

COFFEE AND ENVIRONMENT IN EL SALVADOR

El Salvador is one of the smallest and most densely populated countries of Latin America. With average population densities of over 200 inhabitants per km^2 and only 2% of its original forest cover, the country's natural resource base has reached a critical level of degradation (CCAD, 1998). The most serious effects from deforestation are increased levels of soil erosion and a threat to the maintenance and replenishment of potable water supplies (Barry & Rosa, 1996). In addition, populations of native plant and animal forest species have greatly suffered from loss of habitat. The latter has placed biodiversity conservation at the forefront of El Salvador's environmental agenda, due in large part to pressure from national and international environmental organizations. The mounting strength of the Salvadoran environmental movement has been largely responsible for placing environmental issues as priorities in current state policy.

Coffee is one of the most extensively produced and economically important agricultural commodities in Latin America (Rice & Ward, 1996). In El Salvador, coffee holds considerable economic importance as the country's leading export crop. In 1997, coffee exports generated 30.2% of total foreign exchange, which represented 21.3% of GNP (PROCAFE, 1998). Between 1970 and 1997, the coffee sector generated an average of 147,000

permanent jobs per year, incorporating an estimated 15% of the economically active population of rural areas (Perez, 1996; PROCAFE, 1998). In the case of El Salvador, where environmental degradation has reached critical limits, shaded coffee has also become an important component of the environment. During the country's civil war between 1980 and 1992, El Salvador did not undergo the level of transformation from shaded to full-sun coffee production as other countries in the Central American region (Galloway & Beer, 1997). As a result, an estimated 90% of the country's coffee is still under some kind of shade management. Taking as a basis the classification proposed by Moguel and Toledo (1996), the most prevalent shade management systems are traditional polycultures or traditional shade[2], commercial polycultures and technified shade. Compared to other shade types, traditional shade is widely viewed as having a structure and management with a high potential for biodiversity conservation and the provision of other ecosystem services (Perfecto *et al.*, 1996; Méndez *et al.*, 2002). Very few examples of rustic shade or full sun coffee can be found in El Salvador (Gobbi, 2000).

[2] "Traditional shade" or "Traditional polyculture" has been increasingly used in the literature in reference to coffee farms with the following characteristics: high diversity of shade tree species, reduced use of external inputs, use of old coffee varieties at low densities, and high labor inputs (Galloway & Beer, 1997; Moguel & Toledo, 1999). The term does not imply the exclusive use of indigenous practices, but includes adoptions and adaptations of technologies over time. Within this definition there are variants of traditional management that depend on the specific ecological and socioeconomic characteristics of each region or country.

Due to the disappearance of forests in El Salvador, shaded coffee farms have become important providers of ecosystem services such as water, soil and biodiversity conservation (PRISMA, 1995; Cuellar *et al.*, 1999; Rosa *et al.*, 1999; Monro, 2002). For this reason, several state institutions and NGOs have initiated projects that integrate shaded coffee into the country's environmental management and conservation efforts. Shortly after its creation, the Ministry of Environment sponsored the first Central American Conference on Sustainable and Biodiversity Friendly Coffee, held in San Salvador in December 1997, with support from the World Bank, the Smithsonian Migratory Bird Center and the Rainforest Alliance. This event resulted in certification guidelines for biodiversity friendly coffee (ECO-OK), and an announcement of the approval of a World Bank pilot project (based in El Salvador) on "coffee and biodiversity" in Central America.[3] Although this project promised to contribute greatly to the incorporation of shaded coffee into environmental programs, it remains to be seen what impact it will have on the country's coffee farmers.

Approximately 78% of El Salvador's coffee farms are smaller than 7 ha, covering an estimated 40% of the total area under coffee cultivation (PROCAFE, 1998). In contrast to larger holdings, most of these small farms

[3] The author participated in the conference on "Biodiversity Friendly and Sustainable Coffee Production" as part of an agroforestry team from the Tropical Agriculture Research and Education Center (CATIE), in Costa Rica.

contain a diverse canopy of shade trees, and use very small quantities of potentially contaminating agricultural inputs (Galloway & Beer, 1997). This makes them ideal for supplying environmental services, such as water infiltration (PRISMA, 1995) and conservation of flora and fauna (Moguel & Toledo, 1999). Few studies have documented faunal inventories in small farms, mostly due to the difficulty of sampling in such small areas (Komar, 2000). Perhaps for this reason, the World Bank's Coffee and Biodiversity project largely ignored small coffee farms in its research activities.[4]

Due to their likelihood of traditional shade use, small coffee farms and cooperatives are an attractive sector to incorporate into conservation efforts. According to Gobbi (2000), certifying small farms under traditional shade as biodiversity friendly coffee (ECO-OK) represents the most attractive investment when compared to other types of shade management. However, he also notes that the required investment is usually beyond the means of this type of farmer, and that some outside subsidies might be necessary to promote small farm integration. Experiences with organic coffee have also demonstrated that to successfully integrate small farmers into alternative markets requires site-specific support on management and strengthening of local organizations (Bray *et al.*, 2002). Thus, any attempts to incorporate

[4] In the period between Dec. 1999 and March 2000 the author conducted interviews with the project coordinator and staff, and carried out tree inventories and bird biodiversity data collection in 4 coffee farms.

small farmers into conservation-oriented strategies need to start by acquiring knowledge on the social and ecological dynamics of farming communities and their organizations.

Despite the great number of small coffee farms in El Salvador, in-depth information on their agroecological, social, and economic characteristics is scarce. Except for descriptive assessments, no studies have analyzed the structure or tree species composition of small farms under traditional shade. Thus, the claims that traditional shade is similar to local forest ecosystems have been largely based on superficial observation. In addition, very little is known about the management rationale behind traditional shade and the problems or advantages associated with this practice (other than lower coffee yields per ha).

Any attempts to integrate the small farm coffee sector into a broader environmental agenda needs to start by better understanding the reality of these farmers. This information can be gained by focusing on the relationship between the coffee agroecosystem and the household. What are the survival strategies of these farmers? How important is the shaded coffee agroecosystem for household survival? More specifically, what are the direct benefits from the shade canopy to the household? Answering these questions can provide insight on what motivates farmers to use traditional

shade, and what type of support they might need in order to maintain or expand it.

Information on the nature and role of local farmer organizations and cooperatives in El Salvador is also relatively absent. The capacity to organize and the services that organizations can provide are an important factor related to the social and economic development of small farmers (Bebbington, 1996b; Bray *et al.*, 2002). This is especially important given the nature of coffee, which requires farmers to negotiate its commercialization with a diversity of actors (e.g. larger farms, intermediaries, and processors). Recent studies in Mexico (Porter, 2000; Bray *et al.*, 2002), and the South American Andes (Bebbington, 1997) have shown the importance of organization as a means of improving marketing and commercialization of small farm products. In this context, it is important to evaluate relationships between livelihood strategies the use of traditional shade, and different types and levels of organization.

Due to El Salvador's high level of deforestation, shaded coffee farms have been identified as being important for providing and maintaining ecosystem services associated with natural forests (especially biodiversity and water conservation). The general objective of this research is to better understand on-farm social-ecological relationships that result in the use of

environmentally sound shade management (traditional shade) by small coffee farms or cooperatives. Beyond the farm, the study will examine the influence of different types of cooperatives, and their networks on the incidence of this type of shade management. The conservation focus of this research is limited to an assessment of traditional shade's potential role in biodiversity conservation strategies, with an emphasis on the conservation of native tree species.

RESEARCH OBJECTIVES

1. Characterize the different types of shade on the coffee farms in the study area as a deliberate management strategy.
2. Assess the role and importance of shade tree products and other benefits to the livelihood strategies of farm households.
3. Determine the effects of different types of farmer cooperatives on shade management.
4. Evaluate the environmental conservation potential of small coffee farms, with an emphasis on conservation of native tree species.

RESEARCH HYPOTHESIS

1. Small coffee farms using traditional shade contain a high diversity of native trees, arranged in a similar vertical structure to the local, natural forest.
2. Shade management, on the farms of small-scale farmer cooperatives, is a heterogeneous management practice largely determined by each organization's and household's livelihood strategies.
3. Local organizations that are linked to alternative marketing strategies (organic, fair trade, etc.) strongly support traditional shade management.

ACTION-RESEARCH GOALS

As stated in the preface, this thesis was motivated by a desire to use interdisciplinary research as a tool to promote local development, agroecological management of coffee plantations, and conservation of the landscape. As such, this investigation aimed to take research into action (or conduct action research) by providing support, training and empowerment to farmers throughout the research process. According to Greenwood & Levin (1998), "Action research (AR) is social research carried out by a team encompassing a professional action researcher and members of an

organization or community seeking to improve their situation. AR promotes broad participation in the research process and supports action leading to a more just or satisfying situation for the stakeholders." Three action goals were defined from the onset of the research:

1. The action-research process would provide information, which could be used by small-scale farmer cooperatives to better conserve their natural resources and improve the agroecological management of their plantations.
2. The action-research process would support small-scale farmer cooperative households in their efforts to improve their livelihood strategies, and to develop and expand their social and marketing networks.
3. Action-researchers and their collaborators would provide direct advising, infrastructure, training and logistical support to farmers in their development, conservation and productive activities.

A direct and tangible result of this process was the creation of Advising and Interdisciplinary Research for Local Development and Conservation (ASINDEC for its name in Spanish), a local non-profit foundation for participatory research, education and empowerment to support and improve household livelihoods, strengthen local organizations and their networks and conserve the landscapes of the coffee farmers and communities that

collaborated in this study. See Appendix 1 for a complete description of ASINDEC, its vision, strategies, achievements and current activities.

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