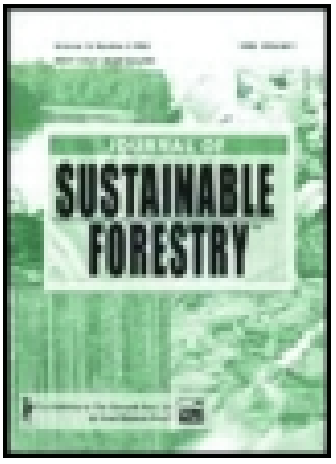

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Contextual Analysis of Agroforestry Adoption in the Buffer Zone of Podocarpus National Park, Ecuador

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Promoting sustainable agriculture and community development is an important strategy both to alleviate resource pressures on Ecuador's Podocarpus National Park (PNP) and surrounding forested areas in its buffer zone, and to aid local communities. However, the development and adaptation of agroforestry systems must take into account the wide array of contextual factors that influence land use. Included in this analysis is an evaluation of the larger inequalities that drive small farmers and rural people, who depend on natural resources for food security and livelihood, to put pressure on PNP and the surrounding landscape. Specifically, the drivers of intensive land cultivation (agroforestry, regenerative agriculture, and reforestation) and extensive land exploitation and abandonment are assessed. There are many reforms that would provide greater options and incentives for small farmers to participate in land intensification activities, alleviating resource pressure on PNP and the remaining forested areas surrounding the park. These include (a) institutional reform of property rights and land planning, (b) capacity building for community groups and institutional coordination to facilitate the dissemination of agroforestry techniques and better land management practices, and (c) increased benefits to farmers who invest in agroforestry systems and sustainable land management.

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INTRODUCTION

In the communities surrounding Podocarpus National Park (PNP), local and national non-governmental organizations (NGOs), government and research institutions, and local farmer organizations share a broad goal of conserving the environmental and social values that the park provides. Promoting community development and sustainable agriculture, to alleviate resource pressures on PNP and surrounding forested areas, has received attention as a strategy to help achieve this goal. Inherent in this approach is the belief that achieving conservation and development objectives in tandem will serve the interests of both conservationists and local communities and lead to greater overall success (Berkes, 2004; Romero & Andrade, 2004). Academic research has promoted agroforestry as a "'win-win-win' strategy by simultaneously promoting poverty reduction, economic development, and environmental sustainability in poor regions" (Perz, 2005, p. 263). The scientific and conservation communities, as well as national and international development organizations, have invested in sustainable agroforestry systems as a way to reduce demand by rural farmers for new land clearing and to reproduce characteristics of natural ecosystems (Rudel & Horowitz, 1993). These activities are supported by the idea of "productive conservation," the theory that conservation can occur while creating greater and more consistent incomes for rural farmers and reduce natural resource pressures in developing countries like Ecuador (Perz, p. 263). Anthropogenic pressures on protected areas demonstrate the need to develop local allies "where it really matters—on the ground" (Colchester, 2000, p. 1366). When conservation efforts generate public benefits to local communities, political and popular support can increase and communities can have greater incentives to act in the interest of conservation (McNeely, 1995). Capacity-building efforts by local resource managers to strengthen food security and market opportunities can encourage and facilitate sustainable land-use practices (see Wilkinson, this volume). However, in order to meet expectations, the development and adaptation of agroforestry systems must take into account the wide array of contextual factors that influence land use patterns in Ecuador (Clark, 2002).

This article (a) examines the social, political, and economic context of land use; (b) assesses the barriers to and drivers of agroforestry adoption for small farmers; and (c) makes recommendations specific to PNP to improve decision-making arrangements. Included in this analysis are an evaluation of the larger inequalities that drive small farmers and rural people to put pressure on PNP and the surrounding landscape. It addresses these elements

in order to consider the broader pressures on small farmers and place agroforestry adoption within its proper political-economic context. By examining land-use issues through this lens, the context of the problem is evaluated and recommendations are made to address the root causes of unsustainable land use at PNP.

METHODS

As a graduate student at the Yale School of Forestry and Environmental Studies, I participated in a Rapid Assessment field trip to Podocarpus National Park (PNP), Ecuador. The 10-day field trip took place from March 10–19, 2005. We traveled as a group of 12 students, two professors, and one teaching assistant. We spent the majority of our visit around Loja and the western communities bordering PNP with our hosts, Fundación ArcoIris (ArcoIris), a local NGO, and The Nature Conservancy-Ecuador (TNC). During our time in and around Loja, we met with the staff of ArcoIris and TNC, community leaders of the Únión Cantonal de Organizaciones Campesinos y Populares de Espíndola (UCOCPE) and other farmer cooperatives, representatives of the Municipal Government of Loja, the Ministry of the Environment, PNP officials, and biologists and anthropologists at the San Francisco research station. We also met with TNC and Conservation International (CI) representatives at each organization's Quito-based office. I used the policy sciences' interdisciplinary problem-solving approach for my analysis (Clark, 2002). This approach is problem oriented, contextual, and multimethod. Prior to and after the field trip, our class conducted extensive research on diverse natural resource and governance issues in Ecuador and met with Marc Stern, a Yale University PhD candidate with experience in the area.

CONTEXT CONSIDERATIONS FOR AGROFORESTRY ADOPTION

The social, political, and economic context of agroforestry in the buffer zone of PNP is influenced by stakeholder expectations and demands and the interaction among all participants, including NGOs, community organizations, and governmental organizations. A host of contextual factors, including historical, political, social, and economic forces, impinge upon communities' land-use decisions and local people's use of resources. The complexities of these factors influencing agroforestry adoption require analysis of the context (Clark et al., "Social Process," this volume) and a fuller evaluation of how the context affects current resource decisions (Clark, 2002; Cherney et al., "Understanding Patterns," this volume).

Agroforestry Arena

There are numerous participants (individuals, associations, and organizations) that affect and are affected by land use around PNP. Clark et al. (this volume), in their article on social process, identify some participants and describe their perspectives and other features of this social setting. Participants differ in terms of ethnicity, cultures, and values/interests. They also vary in their access to resources in the buffer zone around PNP and their attitudes toward conservation efforts (see Stern, 2002). Evaluations of social, economic, and other participant attributes allows for the development of a more fully contextual understanding of their role and influence over agroforestry adoption factors (Clark, 2002; Kant & Lehrer, 2004). Understanding these factors helps detect the presence of conflicting goals that can potentially lead to intractable outcomes. Participants active in the buffer zone arena are resource users, governmental organizations, and external agents such as large and small NGOs. It is important to understand these actors and their interactions.

Resource users

In the lands surrounding PNP, some users depend directly on the resources within the buffer zone and even inside park boundaries. Current and potential agroforestry users in PNP include recent colonists, long-term residents, and indigenous peoples. Wilkinson (this volume) describes each of these user groups' resource-use patterns. Land-use choices incorporate factors such as land quality, costs of capital and labor, expected increases in output from a variety of inputs, incentives of the land tenure system, and land planning policies. At PNP, individual's capacity and traditional knowledge are probably the most important factors (Stern, 2002). Individual decisions to adopt agroforestry practices are made by users in order to meet a variety of ecological, social, and economic needs. However, decisions to adopt agroforestry are not necessarily based on these factors. Stern found that adoption decisions were more strongly based on trust of the purveyors of the technology. Wilkinson (this volume) describes the direct and indirect ecological benefits of agroforestry adoption.

Social and economic outcomes from agroforestry can include greater agricultural and tree crop production, a more uniform distribution of work, and a safeguard against market fluctuations (Kant & Lehrer, 2004). On-farm agroforestry practice can increase total production output per unit area (Molua, 2005). This is due in part to wind and erosion protection for crops and livestock provided by trees. Moreover, providing small farmers with additional market opportunities increases farm prosperity and improves economic diversity of the farm (Molua).

Any analysis of whether the resource uses and users are compatible with the requirements of agroforestry systems must begin by examining the

factors that determine adoption by individual users. Several studies have evaluated household factors such as labor and capital assets (credit, off-farm income, and community organizations) and access to technical assistance to assess what variables have strong effects on the willingness to adopt agroforestry techniques and increase farm diversity (Mercer & Snook, 2004; Perz, 2005). Perz found that labor assets had the largest positive effect on the ability to increase agricultural diversity. However, when Mercer and Snook included the condition of the forest environment in adoption decisions, this variable had the largest effect, "indicating the strength of farmers' concerns for future generations in their current decision-making" (p. 249). An assessment by Coomes and Burt (1997) shows that "larger landholders tend to use potentially more sustainable as well as more lucrative agroforestry systems" (p. 40). In addition, the current state of the land has an effect on the decision to adopt agroforestry. Farmers whose lands include trees and other native plants, including primary and secondary forests, may be in a better position to adopt agroforestry practices (Vosti, Witcover, Oliveira, & Faminow, 1998). It is clear that even though individual dynamics are important, they cannot be considered in isolation from other factors (Mulder & Coppolillo, 2005).

Governmental and other organizations

In PNP's buffer zone, many agents and organizations other than the direct user groups affect resource management. Kant and Lehrer (2004, p. 292) propose three categories of agroforestry-related organizations, those for (a) provision of resources, (b) management of production process of the system, and (c) appropriation of the outputs of the system. First are organizations providing resources that have significant direct effects on resource use. These organizations oversee the provisions of necessary inputs for agroforestry systems. Inputs include how land tenure is obtained, technical inputs such as the provision of planting materials, and technical capacity/knowledge (Kant & Lehrer). In PNP, some attention has been given to providing inputs for agroforestry systems. A variety of organizations—including Ecuador's government ministries that oversee agricultural and forestry practices (Ministry of Agriculture, Ministry of the Environment, and the Ministry of Social Welfare), research organizations (Technical University of Loja and San Fransisco Research Station), local government s(municipalities of Loja and Zamora), community organizations (e.g., UCOCPE), farmer-to-farmer networking initiatives (*campesinos a campesinos*), and local NGOs (ArcoIris, Nature and Culture, and others)—grant property rights and provide technical inputs. Wilkinson (this volume) details current efforts to improve agroforestry inputs around PNP and additional steps needed.

The second need that agroforestry-related organizations address is management. Management includes actions to ensure that agroforestry systems

have proper nutrients and water, pest management, and other steps to maximize production including the provision of labor and capacity. Around PNP, local NGOs and farmer-to-farmer networking provide management support of agroforestry systems. For example, ArcoIris and PROBONA, two local NGOs, provide land management support for a beekeeping project based in the forests around Vilcabamba.

The third need that may be addressed by agroforestry-related organizations is suitable organizational arrangements to provide access to and economic returns from agroforestry outputs. Lack of markets for agroforestry products and limited access to markets can make agroforestry systems unviable. Organizational structures that influence the economic returns of agroforestry outputs are complicated; they are "affected by an array of factors such as local traditions, interests of [representative organizations] and external agents, government policies about procurement prices of agriculture and forest products, general market conditions in the area, dynamics of the factors affecting demand and supply of the products and many contextual factors" (Kant & Lehrer, 2004, p. 295). Around PNP, local NGOs and community organizations provide support to small farmers in marketing a few select products from agroforestry systems, including honey and canna starch. Due to difficulties in transportation and communication, these examples are the exception, and it is difficult to identify comprehensive organizational support of agroforestry products.

External agent

In addition to these organizations, external agents active around PNP exert pressure on other participants and influence management practices of the overall agroforestry system, including market opportunities for agroforestry products and resource rules or norms (Kant & Lehrer, 2004). International treaties (e.g., the United Nations Convention on Biological Diversity), international NGOs (e.g., TNC and CI), and other national governments (e.g., German and Dutch programs such as Programa Podocarpus) are some of the external agents affecting agroforestry systems in areas surrounding PNP. In many cases, users, organizations, and external agents have competing and conflicting interests. However, the success of conservation efforts largely depends on balancing the needs of the stakeholders and on the complex interactions and cooperation among multiple stakeholders.

Land-Use Policy Prescription and Implementation

A decision-making process is an interaction among participants that shows outcomes. Cherney et al. (this volume) evaluate the decision-making process in PNP and the region by looking at the six functions or activities that make up any decision-making process—surveillance and planning,

promotion, prescription, implementation, appraisal, and succession. The prescription function of decision-making arrangements concerns the development of rules of resource use and sets strategic direction; the implementation function addresses how rules are put into effect. While it is valuable to evaluate all six functions, I focus here on prescription and implementation activities related to agroforestry. This review of these two decision-making activities highlights weaknesses that hinder sustainable land uses. My analysis provides a basis for exploring ways to improve the decision-making process.

A brief history of key natural resource and land-use prescriptions is essential at this point. Ecuador's settlement policies (i.e., prescriptions) tremendously affect resource decision process outcomes by influencing patterns of individual behavior. Settlement and land-use patterns around PNP have changed significantly during the past several decades. Current land-use patterns and distribution have been driven by a legal and social regime that encouraged the colonization of "unoccupied" territory and the conversion of forested land to productive use (Jones, 2000; Cesareo & Daly, 2004; Hite, 2004). Colonization policy and energy exploration have resulted in more than a five-fold population increase from 1950 to 1982 and a 3 to 6% annual increase from 1982 to 1990 in the Oriente (Jones; Hite).

The 1964 Amazon Homestead Act (Homestead Act) codified government settlement policy, making it a principal national policy objective (Jones, 2000; Hite, 2004). By working the land, converting forested areas to cropland or pasture, colonists were granted land titles—a practice sometimes referred to as "adverse possession" (Hite, 2004). It was also through this process that large plantations were divided into smaller farms (Cesareo & Daly, 2004). Although evidence of the hacienda system still exists in Ecuador's class and land-ownership structures, the Homestead Act served as a mechanism to alleviate poverty by transferring land to resident tenants (Hite).

There is little, if any, comprehensive government land planning in these areas (see Bernardi, this volume). Instead, the new frontier has been made accessible to settlers primarily through oil and timber extraction activities and accompanying road building. Settlers are then rewarded with property rights for land clearing in these newly accessible areas (Pichon, 1992). Wunder (2000) cites other "colonization pull-factors" from oil exploration, including non-agricultural employment opportunities and the provision of social infrastructure such as schools and health care.

Each association and organization active in PNP and its buffer zone has its own goals and strategy for influencing how resources should be allocated. These organizations and other elements of Ecuadorian society are part of larger institutions that govern the overall society through norms and rules (prescriptions). These "institutions are [ideally] humanly devised constraints that structure human interaction, made up of formal constraints (rules, laws, constitutions), informal constraints (norms of behavior, conventions, and self-imposed codes of conduct), and their enforcement characteristics,"

notes Berkes (2004, p. 623; see also Kant & Lehrer, 2004). Rules alter the costs and benefits (market and nonmarket) of different resource use options and in this way, influence individual choices and patterns of interaction. It is important to realize, however, that the "rigor of a rule is determined not by traditions or laws alone, but by how these institutions are interpreted by individuals and the society as a whole" (Kant and Lehrer, p. 291).

At least four Ecuadorian government ministries influence national land-use policy implementation and directly or indirectly affect the activities of farmers and settlers. These ministries include the Ecuadorian Institute of Agrarian Development (IERAC), the Ecuadorian Institute of Energy and Mines (INEMIN), the Ministry of the Environment, and the Ministry of Social Welfare. Institutional lack of coordination between agencies responsible for implementing natural resource law is lacking, which leads to conflicting policies, conflicting implementation, and uncertainty for resource users (see Fiallo & Naughton-Treves, 1998; Cherney et al., this volume). In addition, energy development is given precedence over agricultural, environmental, and other land uses because the national government considers it to be a "national priority" (Tello, Fiallo, & Naughton-Treves, 1998).

The context for agroforestry adoption is complex and dynamic. Understanding the social process—that is, the arena and its key participants, namely resource users, representative organizations, and external agents—is key to orchestrating successful agroforestry. Understanding the decision process—that is, the prescriptions that regulate a people's current use of natural resources and their interactions with each other—is no less important.

THE CHANGING CONTEXT FOR AGROFORESTRY

Successful agroforestry projects require certain kinds of social interactions, including supporting prescriptions and implementation patterns. These have to come together in appropriate land settlement policies, markets, and individual choices that must all work in tandem to create conditions for the successful adoption of agroforestry systems. Agroforestry adoption in the areas surrounding PNP is a long-term development strategy for many resource users, government organizations, and external agents. If successful, this strategy can alleviate pressure on natural resources, increase plant diversity and habitat, and improve the livelihoods of rural resource users. According to Ferraro (2001, p. 992), social and decision process changes that include "new technologies, markets, and attitudes, take many years to develop and slowly work their way through societies." A more thorough analysis of the factors that influence agroforestry adoption in PNP's buffer zone requires a consideration of historic trends (the "what") and the reasons or conditions behind these trends (the "why"; Clark, 2002). Trends and conditions of land settlement, market access and risk, and community organization are central and discussed below in turn.

Land Settlement

Settlement of the forested areas of the frontier in eastern Ecuador, including the lands surrounding PNP, can be attributed to a government political strategy to alleviate population pressures in developed areas, address problems of rural poverty, expand the country's agricultural sector, and establish "live frontiers" to improve national security along its borders. By directing migration into remote areas, the government has been able to postpone large-scale agrarian reform needed in the more populated areas of the country. However, in frontier areas, the government is underattending to the long-term social and economic needs of rural colonists and has failed to promote organized settlement. "Haphazard occupation" of remote areas does little to promote environmental and agricultural sustainability and has contributed to land-use extensification found throughout the lands surrounding PNP (for a definition of extensification, see Wilkinson, this volume). Land-use patterns in the settled areas of Ecuador directly impact the frontier. The land-use pattern begins with "excessive" forest clearing in order to obtain rights to the land—rights to claim the land for "productive" use and eventually rights to land title (Pichon, 1992). As unsustainable agricultural practices in settled areas degrade the lands, farm abandonment and new land clearing occur: "what happens in the settled agricultural areas of the country is at least as important for reducing resource degradation as what is done in the marginal lands of the frontier" (Pichon, 1992, p. 670).

The Ecuadorian government's natural resource policies emphasize resource exploitation over investment in sustainable forestry and agricultural practices. The government's perception of a limitless frontier "contributed to the dismissal of investment in an appropriate knowledge base to manage forestry resources as both unnecessary and costly," according to Pichon (1996, p. 348). The resulting policy structures have promoted the view of a vast frontier, which has greatly impacted the attitudes of rural people who depend on natural resources for their livelihood. The forested frontier in Ecuador is effectively a free good. Hardin's 1968 "tragedy of the commons" model addresses the possibility of depletion for open-access resources such as Ecuador's frontier forests (Mulder & Coppolillo, 2005). The model explains the primary "social dilemma" of open-access resources, namely that "an individual's decision to maximize short-term self-interest leads to a situation in which all other participants in that person's community are left worse off than feasible alternatives" (Mulder & Coppolillo, p. 131). The lack of government regulation and the land tenure regime has created an open access resource structure where individuals must appropriate and clear lands before someone else claims them (Pichon, 1992). Ecuador's extensive land base and its land-clearing requirements have created a situation in which the attitudes and practices of rural people make it difficult to encourage sustainable agroforestry practices.

Significant incentives for further colonization and land clearing include tenure regimes, land abundance, and decreases in land productivity. Small farmers lacking land title are less likely to take into account the "long-term effects of cultivation practices" (Pichon, 1996, p. 358). Land abundance also creates incentives to bring more land into "productive use" rather than invest in yield-enhancing technologies to meet the need for increased food production. This is especially true in many areas surrounding PNP where the technical means to intensify land use are not readily available to resource- and labor capital-poor small farmers. Given these circumstances, new colonization is a predictable outcome to declines in soil quality and decreases in agricultural productivity. As Pichon aptly stated, "lacking incentives that encourage sustainable land uses, poor farmers are under heavy pressure to respond by mining the natural resource base rather than by making long-sighted investments" (Pichon, 1996, p. 347).

Market Access and Risk

The willingness and ability of farmers to adopt agroforestry systems is based upon their attitudes and perceptions, costs, benefits, feasibility of alternatives, and perceived risks. How people respond individually to different resource strategies constitute patterns of interaction that ultimately determine resource outcomes (Kant & Lehrer, 2004). Land use around PNP reflects individual choices to practice either land intensification or land extensification (for a comparison of these practices, see Wilkinson, this volume). Farmers in southern Ecuador make decisions based upon self-sufficiency and market needs: They may either invest in necessary technical and labor inputs for land intensification, or invest in clearing new areas that are either part of the farmer's existing land holding, adjacent to it, or in new locations (Pichon, 1996). These activities are attempts to increase or keep farm productivity constant and potentially to expand household market opportunities.

What are the factors that affect land-use decisions, leading some farmers and communities to choose land intensification and others to choose land extensification? A better understanding of the willingness and ability to adopt sustainable practices is imperative to "achieving the full potential of agroforestry" (Mercer & Snook, 2004, p. 251). Because land clearing is a requirement to claim land informally and formally on the frontier, settlers are not in a position where they may initially develop sustainable agroforestry systems or "internalize long-term forestry rents" (Pichon, 1992. p. 668). Therefore, under Ecuador's current institutional framework, adopting agroforestry systems is only possible after settlers clear and begin to work the land.

As noted earlier, agroforestry systems can provide financial gains to small farmers, who receive value from tree products in the system and increases in agricultural production from contributions to improved soil quality and protection from wind and other elements. However, a critical

influence on the adoption of agroforestry practices is how the farmer perceives its profitability (Current, Lutz, & Scherr, 1995). For small farmers to invest in sustainable land intensification strategies, such as agroforestry, they must be able to gain access to information, technology, human resources, and markets for agricultural- and forestry-related goods. Current opportunities for market access in PNP are limited. Sufficient access requires established links between rural and urban areas, subsistence and market production, and on- and off-farm employment (Perz, 2005). Transportation is a key issue for all aspects of access. Transportation connecting the neighboring communities of PNP is unreliable and incomplete and creates a significant barrier to the success of agroforestry (see Bernardi, this volume).

It is also important to recognize that farmers exhibit risk-minimizing behavior (Pichon, 1992; Current et al., 1995; Perz, 2005). Individual trends and collective patterns of farmers show that land-use strategies hope more to "stabilize family security than to maximize profits" (Pichon, 1996, p. 357) showing a "subsistence first" tendency (Perz, p. 270). Agroforestry adoption can be a slow process due to farmers' concerns about ensuring food security and avoiding what they may perceive as risky new technology. Significant agroforestry adoption, beyond the use of a few trees, has usually been shown to require 5 to 10 years, taking place after farmers gain familiarity and understand the benefits (Current et al.). This is especially true in the frontier environment that characterizes many of the communities surrounding PNP. Even in the more accessible areas further west of PNP, food security remains the main priority for farmers (UCOCPE, personal communication, March 12, 2005). Farmers in frontier communities must allow for risks and unpredictable situations. In this context, changing from traditional cultivation techniques or techniques that farmers are personally familiar with to new agroforestry techniques may prove to be a difficult decision for small farmers (Pichon, 1996).

Community Organization

Effective community organizations can greatly facilitate partnerships between farmers, technical extension agents, and rural resource managers. In addition, agroforestry systems require continual adaptation and feedback learning processes, in which community groups can assist significantly (Cardoso, Guijt, Franco, Carvalho, & Ferreira Neto, 2001). Community organizations can provide a platform for farmer involvement in decision making, improve communication between remote areas, and facilitate agroforestry product marketing. As local farmer organizations around Loja build institutional capacity, they are gradually developing a significant voice in natural resource project development. Although UCOCPE is located outside of the PNP buffer zone, this farmer collective organization provides an example of this trend. UCOCPE formed in 1981 as a union of community organizations and now develops

methodologies and proposals to meet their own households' food security, natural resource, and product market goals (Luis Ordonez, personal communication, March 17, 2005). Increasing native plant diversity, working with specific threatened native species, and marketing organic coffee are some of their resource strategies (UCOCPE, personal communication, March 12, 2005).

Government and local NGOs have invested in on-farm conservation programs in the region. On-farm conservation programs may provide capital, technical resources, and training to rural farmers to help provide assistance for agroforestry adoption. Some examples of past on-farm conservation programs in which UCOCPE farmers participated include: (a) 1994—Community Forestry Development (*Desarrollo Forestal Campesino* [DFC]), a nationwide reforestation program; and (b) 1996—a Canadian-sponsored organic farming certification program. The DFC program began by promoting large-scale planting of eucalyptus and pine. However, the DFC realized through its initial experience that communities wanted agroforestry systems, not just reforestation for trees' sake. The reforestation focus shifted to one of community development and capacity building; subsequently, the DFC concentrated on developing silvopastoral systems (see Leahy, this volume), living fences, home gardens that diversify and improve family diets, and *campesino-a-campesino* training (UCOCPE, personal communication, March 12, 2005). The goal of this farmer-to-farmer training was to install technical capacity within the community by reinforcing the training of community leaders (L. Ordonez, personal communication, March 17, 2005). Oscar Ordonez of ArcoIris related that farm-to-farm training programs contribute to the solidity of community organizations and raise local self-esteem (personal communication, March 17, 2005). The Canadian organic coffee certification program lasted 3 years, but the benefits to farmers involved in the program have been sustained. Certified organic coffee farmers are receiving a premium of at least $15 per 50 kilos of coffee this year (UCOCPE, personal communication, March 12, 2005).

In addition to resource inputs, on-farm activities require the development of partnerships between resource users and their representatives and the acting institutions: "although they may be easily overlooked, these collaborative aspects are a fundamental element of a successful on-farm conservation initiative" (Jarvis et al., 2000, p. 108). Building partnerships between management authorities and communities can minimize resource conflicts by empowering community members, contributing to colearning, adapting projects to a community's needs, and legitimating conservation goals (Brechin, Wilshusen, Fortwangler, & West, 2003). For example, in the region west of PNP the Ministry of Social Welfare sponsors a local NGO called Prolocal, which partners with UCOCPE to improve food security and community natural resource management. The relationship between UCOCPE and Prolocal is an active partnership. Prolocal facilitates co-management arrangements and self-direction with UCOCPE (UCOCPE, personal communication, March 12, 2005).

RECOMMENDATIONS

Comprehensive land-use reform is challenging and must address both existing government strategies and incentives and promote agricultural research and extension. It is important to recognize that the forces driving colonization of forested regions are maintained by many influential government incentives. This can be especially difficult because the "explicit linking of agroforestry and reforestation policy options with existing agricultural activities by small farmers in these areas is seldom made" (Pichon, 1992, p. 672). A holistic systems approach to land management must be taken in order to realize the biodiversity, soil, and forest conservation goals of agroforestry. This requires that explicit links be made between benefits of agroforestry to society and the environment and the economic benefits of local communities (McNeely, 2004).

Agroforestry projects are long-term solutions that begin at the individual farm level (Ferraro, 2001). There are a range of reforms that would provide greater options and incentives for small farmers to participate in land intensification activities, alleviating resource pressure on Podocarpus National Park (PNP) and the remaining forested areas surrounding the park. These reforms include (a) institutional reform of property rights and land planning; (b) capacity building for community groups and institutional coordination to facilitate the dissemination of agroforestry techniques and better land management practices; and (c) increased benefits to farmers that invest in agroforestry systems and sustainable land management.

Property Rights and Land-Use Planning

Different patterns of intensification and extensification are found throughout the PNP region, as described by Wilkinson (this volume). Aside from the biophysical characteristics of the landscape, Ecuador's property rights regime is mainly responsible for these patterns. At the national level, this system should be improved to provide tenurial security and remove incentives for land clearing. However, recognizing the possible political infeasibility and prohibitive costs of such an action, in the short-term it may be more beneficial to focus on specific community actions around PNP (Ferraro, 2001).

On the western side of PNP, where colonization has already occurred and most of the land has been cleared, the focus should be to secure land tenure for current residents. Many of the long-standing residents we spoke with who are involved in community development projects in the region had title to their land. Agroforestry projects will not succeed unless farmers have incentive to invest in their land and are confident they will benefit from activities in the long-term. Generally, rent-maximizing behavior takes place when farmers have security in their investment: "many of the worst excesses of degradation have occurred precisely because stakeholders were

unsure of their rights or had not power to enforce them" (Mulder & Coppolillo, 2005, p. 152). Recently abandoned land in this area also has reforestation and agroforestry potential. Abandoned lands should be consolidated with current private or public holdings to protect second growth forest from suburbanization and fragmentation. Easements or other incentives could encourage owners to return abandoned land to forests or sustainable agroforestry systems.

On the eastern side of PNP, which is still largely forested, steps should be taken to close the agricultural frontier. Policies to improve security and quality of life in already-settled areas—including securing land tenure, increasing market access, and providing financial incentives to invest in sustainable land intensification activities—will encourage farmers to shift towards a more long-term approach to their holdings (Pichon, 1996). Community development and conservation activities should maintain a proactive presence in the eastern region. Government and NGOs could significantly lessen the ecological impact of new colonists by engaging in strategic land settlement planning. Working to secure land tenure for new colonists in designated settlements would direct new colonists to the most ecologically suitable sites and encourage agroforestry practices. In addition, clearly establishing the eastern boundaries of PNP and buffer zone should be a high priority to make certain that new colonists are aware of the park and new settlements occur outside of part boundaries. Another important consideration is the indigenous communities in this area (see Wilkinson, this volume). The Shuar southeast of PNP have applied for land tenure. Working with the Shuar and other indigenous communities to secure land title could help control colonization and land clearing on their historic lands.

Organizational Capacity Building and Institutional Coordination

Progress is being made in community capacity building efforts around PNP. Partnerships with organizations like UCOCPE, west of PNP, are encouraging because they have improved cooperation and trust between community groups and other representative organizations. In order to become self-sustaining, agroforestry initiatives need to be structured in ways that empower community organizations and encourage capacity building. UCOCPE's and others' experiences can help inform the design of such a participatory process (for a more detailed description of "what worked" and "what's needed," see Wilkinson, this volume). Valuable lessons that can inform future efforts are being learned through these partnerships (for more on prototyping see Cherney et al., this volume). Information may be obtained and disseminated locally, nationally, and even internationally. For example, a website launched by Rainforest Alliance in 2001 called Eco-Index (http://www.eco-index.org) provides a searchable database of conservation projects in Central America and Mexico (Jukofsky, 2001). Such a site could be expanded to Latin America

and include lessons learned from agroforestry initiatives. Functional and realistic monitoring and evaluation can inform the development of effective agroforestry projects. Communities must be involved in the process of setting goals, developing appropriate techniques, and collecting data if monitoring and evaluation is to be successful.

Through partnerships, conservation projects demonstrate their aim to change from "their traditional role as exogenous structures imposed upon local people to endogenous ones that sustain themselves from within" (Mulder & Coppolillo, 2005, p. 45). These connections will not be held together by force, compulsion, or contract, but through common values and an understanding that some tasks, which could never be accomplished independently, can be accomplished through effective partnerships (Meadows, Meadows, & Randers, 1992). Partnerships facilitate a more informed, adaptable management process. McNeely (2004) argues that adaptive management, which involves careful planning, associated research, systematic monitoring, and an active process of feedback to management, is the most effective way to facilitate successful agroforestry adoption. By engaging in adaptive practices with resource users, projects integrate the "invaluable" knowledge farmers have about their systems and aid in the development of "locally-validated agroforestry [techniques]" (Cardoso et al., 2001, p. 236).

Community agroforestry organizations are based at the local level and have a limited ability to address wide-ranging regional problems. Currently, agroforestry promotion falls between several national ministries. By clarifying institutional responsibilities and coordinating goals in reference to agroforestry and forest protection, one ministry may be able to fulfill this role. However, the instability at the higher levels of Ecuador's government (see Cherney et al., this volume) is an important consideration. Long-term financial and institutional support is needed to bring together the activities of local groups at the regional and national levels (Mulder & Coppolillo, 2005; for more on achieving a balance between centralization and decentralization, see Cherney et al., this volume). The national government must be careful not to adversely affect successful local institutions, but rather to work beyond the local level "in assuring legitimacy of local users, introducing new technology and training where necessary, settling disputes that cannot be resolved locally, monitoring resources at a broader scale than just the local project area, and buffering local common-property institutions from destabilizing events, such as a market collapse, migration, or warfare" (Mulder & Coppolillo, p. 153).

Increasing the Benefits of Agroforestry (Reducing Barriers)

Agroforestry techniques are unlikely to be developed and disseminated widely around PNP unless individuals and representative organizations derive financial and social benefits from the potential values of agroforestry

systems. The benefits derived from agroforestry must offset, to some degree, their opportunity costs—the foregone returns from alternative activities such as land clearing that are typically lucrative in the short-term. Providing incentives for landowners to invest in sustainable land improvement and rehabilitation can positively influence current extensification practices (National Research Council, 1993). Wilkinson (this volume) discusses practical incentives such as small, in-kind contributions and availability of seedlings that will reduce initial barriers to agroforestry adoption by risk-adverse farmers. These types of incentives can be provided and maintained by regional or local organizations. In addition to providing incentives in the form of technical and material assistance, farmer and small business initiatives need to be strengthened. ArcoIris is gaining valuable experience in this area with its *Bosques y Miel* product from a beekeeping project in Villacalamba; learning from this effort can help guide future projects (O. Ordonez, personal communication, March 17, 2005; see Cherney et al., this volume).

Providing incentives for initial agroforestry adoption, however, must be accompanied by strengthening the linkages between small farmers and markets for its long-term success (National Research Council, 1993, p. 177). Agroforestry initiatives, beyond self-sufficiency practices such as home gardens, require markets in order to maintain the economic feasibility of agroforestry products. However, economies and product demand are never fixed. Small farmers must have reliable, timely, and continuous access to market information and price fluctuations, which requires both access to information and physical access to markets (see Cherney et al., this volume; Bernardi, this volume). A centralized government ministry dedicated to the promotion of agroforestry adoption (discussed above) could facilitate the dissemination of such information and lobby for national and regional market reforms on behalf of rural farmers.

Payments for environmental services can also add economic value for farmers using agroforestry practices. Conservation International (CI) is currently using an incentive-based conservation model that provides payments to landowners who keep their land forested (S. Vasconez, personal communication, March 18, 2005). This payment program could be expanded to encourage agroforestry adoption on existing farms. For risk-averse farmers adopting agroforestry techniques, "nonstochastic payments also help to diversify the household portfolio and reduce exposure to risk" (Ferraro, 2001, p. 998). The National Forestry Financial Fund in Costa Rica is one example of a government program that works with private landowners to provide conservation funding. The funding comes from both international donors and national funding such as a fuel tax and payments from hydroelectric plants (Ferraro). Redondo-Brenes (this volume) explores a similar nascent payment for environmental services initiative in the PNP region. Conservation payment "permits more precise targeting actions and rapid adaptation over time; [and] strengthens the links between individual well-being, individual

actions, and habitat conservation, thus creating a local stake in ecosystem protection" (Ferraro, p. 998). As a way to encourage agroforestry adoption, the costs for such conservation payments are not exorbitant because they only need to provide funding to close the gap between values gained from traditional agricultural enterprises and agroforestry activities, or funding for the provision of social values on private lands. However, because of the number of small landholders in the PNP area, the organization of conservation payments would involve a tremendous amount of administrative oversight.

CONCLUSIONS

Rural farmers and settlers make choices based upon their social, political, economic, and ecological context. Ecuador's property rights system and lack of comprehensive land planning provide direct incentives for patterns of land clearing, extensification, and abandonment found around PNP. In addition, the perception of a "limitless frontier" has postponed large-scale agricultural and land-planning reform and has led to increased "difficulties faced by settlers regarding land titles, credit, and marketing, as well as the increasing land tenure conflicts among settlers and between them and indigenous populations" (Pichon, 1992, p. 667). Secure property rights and market systems will help farmers and settlers consider long-term rents and invest in sustainable agroforestry practices. Revision of land settlement policies is needed at a national level. Furthermore, the development of community-based farmer collectives can facilitate agroforestry adoption by increasing farmer access to technology, training, inputs, and markets for agroforestry products. However, larger-scale planning is needed to disseminate new technology and provide financial inputs and market connections beyond the local scale. Ultimately, by recognizing how social, political, and economic pressures affect individual choices and collective patterns of interaction, organizations will be better equipped to address the root of environmental problems.

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