Changing Communities, Expanding Forests: How Constellations of Actors Change Land-Use and Forest-Cover in Southwest Costa Rica

by

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ABSTRACT

Changing Communities, Expanding Forests: How Constellations of Actors Change Land-Use and Forest-Cover in Southwest Costa Rica

A major environmental concern throughout the tropics is deforestation. While many forests are in a state of crisis, such an encompassing narrative can obscure significant instances where forest-cover expands. This research investigates the geography of forest regeneration in rural Costa Rica from a social and institutional perspective. Attracted to the Pacific coast, foreigners purchase farms, change the patterns of land ownership, and extensively promote secondary forest growth. Environmental change and a declining agriculture sector have forced peasants to sell or abandon land and diversify their livelihoods. Two conservation NGOs collaborate at an institutional level to promote reforestation and consolidate protected properties into the Mesoamerican Biological Corridor. Drawing on foreign funding, they serve as an avenue through which external visions of land management become reproduced locally. This case illustrates how the values and management decisions of a constellation of actors synergistically interlink to influence local land-use and ultimately join to expand forest-cover.

RESUMÉ

La déforestation est un enjeu majeur dans les tropiques. Toutefois, bien que de vastes étendues forestières soient réellement en péril, la domination d'un discours 'de crise' masque des exemples où le couvert forestier est en pleine expansion. Le présent mémoire de maîtrise s'intéresse à la géographie de la reforestation en zones rurales du Costa Rica, selon un point de vue social et institutionnel. Attirés par la côte Pacifique, des étrangers font l'acquisition de terres agricoles, contribuant à la transformation des systèmes de propriété et à la promotion de la regénération des forêts secondaires. Par ailleurs, les changements environnementaux et un secteur agricole en déclin forcent les agriculteurs locaux à vendre ou abandonner leurs terres et diversifier leurs sources de revenus. Deux ONG oeuvrant dans le domaine de la conservation assurent la promotion de la reforestation au niveau institutionnel et consolident des aires protégées dans le corridor Biologique Mesoaméricain. Appuyées par des fond étrangers, ces ONG mettent en lumière de nouvelles options de développement où les visions externes de gestion des terres trouvent des applications locales. Cette étude de cas illustre comment les valeurs et décisions d'une myriade d'acteurs sont interconnectées et influencent l'utilisation locale des terres, contribuant à l'expansion du couvert forestier.

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CHAPTER 1: INTRODUCTION

> [N]ature is something imagined and real, external yet made, outside history but fiercely contested at every turn. It is at once everywhere and nowhere, the foundation for all "life" and the elusive subject of theoretical and political debate.
>
> - Castree and Braun (1998, 3)

> The world functions largely in non-equilibrium, with its biological components being endlessly remixed in response to change, so that 'forests' ebb and flow.
>
> - Stott (1999, 41)

Forests throughout the tropics are threatened by unsustainable resource extraction, clearing for land speculation and cattle ranching, habitat fragmentation, and changing climate patterns. An extensive literature exists that explores the economic, political, environmental, and demographic forces that shape patterns of land-use and forest-cover. The deforestation narratives that emerge have become highly politicized and framed as an environmental crisis. Permeating both the popular media as well as the scientific community, these narratives have influenced the flow of funds from international funding agencies to on-the-ground forest conservation initiatives, forest livelihoods development projects, and scientific research programmes. However, as argued above by Stott (1999), reality is that forests ebb and flow. Against the background of wide-scale deforestation are important cases in which forests actually expand in size. These cases fail to receive the same attention and often become obscured by the more dominant narratives of destruction and irreversible environmental degradation. Yet, these counter-narrative cases are important in both nature and scale in the overall study of forest dynamics around the world.

The case study presented in this thesis investigates changing land-use and land-cover patterns in a river valley in Southwest Costa Rica and contributes to the literature on the geography of forest-cover expansion. It argues that forest-cover in the study area is influenced by macroeconomic forces operating at the national and international scales, and by the physical geography and in-migration of people and environmental groups at the local scale. Using political ecology as a theoretical framework, the research takes an actor-centred approach to the analysis, focusing on how constellations of actors act in different ways upon the landscape thereby transforming their local environment. The thesis argues that in order to understand how land-use and land-cover change at the local scale, we must investigate the linkages that form between actor groups. As noted by Castree and Braun (1998) in the quotation at the beginning of this chapter, 'Nature,' can not be separated from the sphere of human activity, history, and philosophy; often the natural environment becomes woven into political discourse and transformed into the object of fierce struggle. Given these political aspects of nature it becomes necessary to identify how actors take positions of power vis-à-vis environmental decision-making and resource management. The following case study and analysis of forest-cover change explores the issue by focusing on the constellation of actors that live in and use a local landscape. In particular, land-use decisions of new actors, the perceptions of nature they import, and the influence they have on other local actor groups is examined.

1.1 Research questions

The primary objective of this research is to **explore forest-cover change in the study area with the aim of understanding the driving forces, operational processes, and the**

environmental and social consequences of the observed change. In order to do this, the thesis asks **three main questions**. First, *is a turnaround in forest-cover, which the literature refers to as a forest transition, emerging within the research site?* Second, *if such a forest transition is occurring, what social, economic, and institutional factors drive this ecological change and how do these factors interlink?*

The thesis proposes that environmental change can not be understood in terms of a single causal factor or as the direct outcome of individual actions taken by individual agents. Rather, it is the combined effect of groups or constellations of actors that drives environmental change. In this case, it is argued that local environmental degradation associated with deforestation, combined with the debt crisis of the 1980s and the subsequent neoliberal restructuring of the Costa Rican agricultural sector, have left *campesinos*[1] struggling to make a living on their farms. Yet increasingly, their land-use and livelihood decisions are becoming interlinked with in-migrating foreigners and non-governmental organizations (NGOs) who, in most cases, support a transition away from agriculture and towards reforestation.

A third question arises and is addressed towards the end of the thesis. *Does this case study illustrate the beginning of a transition from a constellation of actors, operating in fairly independent ways upon the landscape, to a coalition of actors in which linkages between actor groups are strengthened and in which decision-making vis-à-vis reforestation becomes increasingly organized and co-ordinated?*

[1] *Campesino* is the Spanish word for peasant or small-scale farmer.

1.2 Theoretical Framework

Political ecology is a particularly useful theoretical approach for investigating the mechanisms and processes through which groups of actors transform their environmental surroundings. Originally fashioned as a way to examine resource access and utilization within a world-system framework (Biersack 1999), political ecology has both expanded in popularity as a useful tool for bridging political economy and environmental studies, and narrowed in scale of analysis, with a majority of subscribers using political ecology to measure the effects of global phenomena on very local people and places. It is a perspective that explores multi-level connections between local and global phenomena, paying particular attention to hierarchies of power (Adger et al. 2001). As a result, subscribers to political ecology feel that it fills a gap left by symbolic or historical ecology because these other 'ecologies' were "oblivious to local-global articulations as well as to linkages between the village and the nation-state" (Biersack 1999, 10). Beneath the political ecology umbrella, research addresses a broad range of topics including conflict over natural resources, trade and economy, local environmental knowledge, the influence of gender relations on land-use regimes, social institutions, social movements, and environmental history.

There has been some disagreement whether political ecology is best conceived as a grand theory that promotes multidisciplinary thinking or a research approach that 'cross-fertilizes' (Blaikie and Brookfield 1987: 24) between disciplines. Some describe political ecology as a "master narrative" or "grand theory" (Biersack 1999, 10) due to its capacity to address the evolution of capitalism, the individual histories subsequently produced, and

the effects these histories have had on both ecological and cultural systems. Others contend that it is best described as *an approach* to the study of society-environment relations that is supported by a diverse body of literature (Kull 2000). In this view, political ecology serves as a wide-ranging "confluence between ecologically rooted social science and the principles of political economy" (Peet and Watts 1996, 6), existing more as an intersection of common areas of inquiry rather than a coherent theory with a dominant meta-narrative. Kull (2000, 7-8) argues that this theoretical pluralism is the approach's *raison d'être*; studies that aim for mid-level theories have perhaps been the most successful because they have focused on specific relationships between specific variables and addressed their findings through a narrative embedded in a particular regional and historical context.

Rudel and Horowitz (1993) argue that political ecology serves as a useful approach for studying forest-cover change because it addresses the complexity in decision-making vis-à-vis forest clearing. Other theories, they argue, fail to fully address the complex set of circumstances facing migrants in rainforest areas and do not fully appreciate the process of alliance-building between actor groups that drives land clearing by combining capital and labour. Political ecology also serves as a useful tool to investigate the politics and social impacts of biodiversity conservation, and is discussed in this light by Escobar 1996, Brown 1998, and Zimmerer 2000.

The first key work to use the term political ecology was Blaikie and Brookfield's Land Degradation and Society:

> The phrase "political ecology" combines the concerns of ecology and a broadly defined political economy. Together this encompasses the constantly shifting dialectic between society and land-based resources, and also within classes and groups within society itself. We also derive from political economy a concern with the role of the state...[and] the tendency for accumulation by these dominant groups and marginalization of the losers (Blaikie and Brookfield 1987, 17).

The "marginalization of the losers" has both social and environmental consequences, as groups with less political power often occupy marginal land. Political ecology not only recognizes that most environmental issues are political (Kull 2000), but also actively analyzes conflict and negotiation that form between groups of land-users. In this respect, local environments are envisioned as a product of local response and resistance to the prevailing development policies of the place (Peluso 1992; Jarosz 1996; Klooster 2000*a*). Special attention is paid to power dynamics that exist between actor groups and, more specifically, how these power hierarchies influence land-use and resource management. This recognition and investigation of local resistance can provide at the theoretical level a counter-discourse to the hegemonic discourses that tend to dominate development and natural resource management (Jarosz 1996). While the Costa Rican case study presented here does not address the topic of resistance specifically, it does contend that local environments are politicized by the interplay between local actor groups and thereby become transformed. At the empirical level, studies that adopt a political ecology framework tend to draw on detailed data from field research to provide insight into the daily realities of local people and their local places. Following this lead, this thesis draws on field research that focused at a very local-scale in order to understand environmental change at this scale. Through a political ecology framework, this local-scale can be linked to macro-scale political economy in order to show how these national and

international forces can affect people's livelihoods and their day to day environmental decisions.

Escobar (1996) approaches the politics in political ecology from a poststructural perspective and calls for a discursive analysis of how nature is socially constructed and historically produced. Highlighting the politics of knowledge production he stresses that an analysis of material reality can not be separated from an investigation into the way society imagines and represents reality. Blaikie (1999, 144) also emphasizes political ecology's ability to offer a "critique of authoritative knowledge and unequal power, both discursive and material," and he argues that through this process the approach enables a more fruitful engagement between the natural and social sciences. While the Costa Rican case study presented in this thesis does not aim entirely to be a poststructural critique of human-environment relations, it does draw on notions such as narrative, discourse, and counter-narrative that are derived from poststructuralism. Specifically, the focus on forest-cover expansion acts as a counter-narrative diverging from and reflecting on the more dominant deforestation and environmental degradation crisis narrative.

Not everyone has flocked to this 'emblematic' approach, and it is important for any research to recognize critiques of the theoretical framework utilized. Some believe that political ecology has become so preoccupied with politics and discourse analysis that attention to ecology and natural science has suffered. Political ecology originally came about as a reaction to the neglect of politics within environmental research. This, some argue, resulted in an overreaction to the 'ecology without politics' of the human ecology and ecological anthropology practiced in the 1960s and 1970s. The result was the

creation of a "politics without ecology" in which political ecologists became so engrossed with the political-economic system that they missed other important factors that drive environmental change (Vayda and Walters 1999, 168). Vayda and Walters propose an alternative approach termed "event ecology" which considers ecology and specific instances of ecological change first and does not, in their mind, prejudge the importance of political factors (ibid., 169). Along these lines, the Costa Rican case study presented here shows how biophysical factors, local geography, and environmental change can influence certain land-use decisions taken by local residents and affect which actor groups move in or out of the local landscape.

1.3 Costa Rica: National Overview and Recent Changes to the Rural Economy

Located in Central America between Nicaragua and Panama, Costa Rica (Figure 1) has a population of 4.2 million. Historically, the country's economics, infrastructure, and politics have been strongly tied to the cultivation of coffee and bananas for export (Hall et al. 2000; Campbell 2002). Cattle ranching, introduced by the Spanish *conquistadors* in the 17th century, also became a dominant land-use throughout the country (Hall et al. 2000, 27). The national export-oriented agricultural sector diversified into sugar cultivation in the 1960s when the United States of America stopped purchasing from Cuba (ibid.). This export-centered economy resulted in the clearance of substantial areas of forest, and, as discussed in section 2.3, led to one of the highest deforestation rates in the world. An important shift in international earnings occurred in the late 1980s and early 1990s with the development of ecotourism. By 1993, tourism had surpassed both

coffee and banana exports as the most important source of foreign exchange (Campbell 2002, 33).

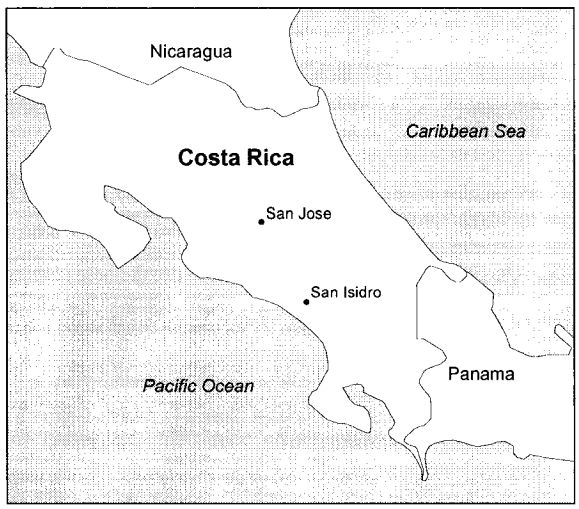

Figure 1: Costa Rica

Costa Rica is now considered a world leader in ecotourism development and management. With over 24 percent of the country protected (de Camino 2000, 12), Costa Rica also has taken a leading role in biodiversity conservation and drawn international attention from its various reforestation incentive programs, debt-for-nature swaps, and private sector and multilateral agreements. This complex history of land-use and deforestation, set against the emergence of a dominant conservation discourse, makes Costa Rica an ideal choice for the examination of tropical forest-cover change.

Costa Rica also provides an excellent location for exploring transitions within the rural agricultural economy. This is due to its history as a model social democratic welfare state with a stable democracy, substantial public-sector involvement in the national economy, and large number of government social programs. Throughout the 1950s, 1960s, and 1970s, the government set a series of tax breaks for investors, provided inexpensive credit

to agricultural producers, and artificially controlled low prices for inputs to attract industrial capital. A multitude of programs emerged that targeted rural areas and provided credit access to low-income groups, established a workers' savings program, provided 86 percent of the population with social security, expanded the postsecondary educational system, and created a social aid institute that set up preventative healthcare programs in communities and a hot meal program in rural schools (Edelman 1999, 61). The Costa Rican Development Cooperation, a public-sector holding company created in 1972 in order to guarantee national self-sufficiency, owned the national stock exchange and began building investments in sugar, fertilizer, cement, cotton, aluminium, and road and rail transportation (ibid., 63). By the late 1970s, an extensive system of agricultural cooperatives and public-sector extension organizations had developed with one third of all agricultural producers belonging to a cooperative (ibid., 54). The National Basic Grains Program subsidized producer prices and offered crop insurance for rice, beans, maize, and sorghum. By 1980, Costa Rica boasted health and social welfare indicators comparable to those of developed countries, an average life expectancy of 73.5 years, and an adult literacy rate of 93.1 percent (ibid., 2).

Then suddenly the next year, Costa Rica became the first Latin American country to default on its foreign loans. Many of these loans had been from international private banks and had financed the country's considerable social spending (O'Brien 1991; Wilson 1998; Edelman 1999). These loans often had variable interest rates that rose rapidly in 1979 when international oil prices jumped for a second time that decade (Edelman 1999, 74). This was coupled with a collapse in international coffee prices, and the combination of the two led to a drop of one-third in the country's terms of trade

between 1977 and 1981 (Wilson 1998; Edelman 1999). During this same period, Costa Rica's debt service quadrupled (Edelman 1999, 74). It faced inflation rates of almost 100 percent, unemployment doubled, and real wages fell drastically (ibid., 3). What followed were a series of IMF standby accords, World Bank structural adjustment loans, and USAID accords which aimed to liberalize the agricultural market, decrease state intervention in agriculture, encourage agro-exports, and improve the terms of trade between rural and urban areas (Moreno 1999). They required a rise in taxes, interest rates, and utility rates, lowered tariffs, devalued the currency, slashed public-sector spending, and reduced public sector employment and public sector wages (World Bank 1992; Edelman 1999). The U.S. sent US $592 million in aid and demanded the auctioning off state companies, greater roles for private banks, and the creation of new non-public organizations (Edelman 1999, 78). Newly created organizations, such as the Coalition for Development Initiatives (CINDE), were established by USAID as a private-sector alternative to government-run export and trade programs (World Bank 1992). CINDE served as an umbrella to a series of programs aimed at fostering foreign investment and non-traditional exports as well as a private agribusiness council. With a budget seven times larger than the equivalent Costa Rican governmental agency, the creation of CINDE created what critics call a parallel state (Wilson 1998, 121). A series of parallel private organizations deliberately duplicated existing public-sector research, extension institutes, and agricultural colleges, and made redundant export-oriented programs formally overseen by the Ministry of Agriculture. Similarly, new USAID funding to the NGO sector replaced government programs within the social assistance arena that had been terminated through the structural adjustment loan process (Wilson 1998; Edelman 1999).

Especially hard hit were the country's agricultural producers. It was argued that Costa Rica's historical reliance on the exportation of coffee, bananas, beef and sugar had made the country's economy vulnerable to fluctuations in the international market (World Bank 1992; Nygren 1995). The first World Bank structural adjustment loan stipulated the reduction and eventual elimination of crop price supports, subsidized production credit, subsidized consumer prices for basic grains, and restrictions formerly placed on foods and agricultural inputs (Edelman 1999, 80). The loan also pushed the Costa Rican government to create a new strategy for the agricultural sector in the mid 1980s termed *la agricultura de cambio* (Agriculture of Change) which refocused research, extension, and production on growing cut flowers, exotic fruits, coconut oil, tubers, nuts, cardamom, cacao, and winter vegetables for export (Nygren 1995; Edelman 1999). At the same time, food aid swept in from the U.S., dumping North American yellow maize and sorghum. The signed agreement prohibited Costa Rica from exporting these grains or any product derived from them (Edelman 1999). Credits for rice were restricted to irrigated cultivation, bean credits were slashed, price supports for yellow maize eliminated, and new export policies targeting non-traditional crops were implemented (World Bank 1992; Edelman 1999). These new export policies aimed to protect exporters from import tariffs and exchange restrictions, open access to international duty-free inputs, and remove "bureaucratic obstacles" (World Bank 1992, 3).

In the early 1990s, Costa Rica entered the GATT and the WTO, and the country's peasants were further affected. While more than 50 percent of the population continued to reside in rural areas, the number of people working in agriculture dropped, basic grain

production continued to fall, food imports increased, and *campesinos* increasingly found themselves purchasing food staples at market prices rather than at the government subsidized prices they used to pay (Edelman 1999, 183). One of the most striking outcomes of this crisis within the basic grain and domestic food staples sectors was an increase in land sale. In several areas of the country, small-scale farmers began to sell their land to transnational banana companies, large-scale export enterprises, and, most interestingly, to ecotourism and conservation projects (ibid.). This pattern of land sale resulting from the reduced capacity of *campesinos* to receive credit for, produce, and sell staple crops also was found within the study area described in chapters three and five. Furthermore, it is this sort of change in rural land-use, driven by the macro-economic policies discussed above, that highlights the importance and value of approaching the issue from a political ecology perspective.

1.4 Chapter Outline

In order to address the research objective and three research questions addressed in section 1.1, this thesis is divided into six chapters. Chapter one serves as an introduction to the research, identifies political ecology as a guiding theoretical framework, and provides a general overview of Costa Rica and the recent changes in its rural economy. Chapter two serves as the literature review for the thesis. In section 2.1, the relevant literature on land-use and forest-cover change is discussed with reference to both the deforestation crisis narratives and more complex readings of environmental change and human land-use. Actors as agents of land-use and land-cover change are discussed in section 2.2 and three categories are distinguished: households, the State, and organizations. Land-use and forest-cover is then addressed within the Costa Rican

context in section 2.3. Section 2.4 reviews a specific body of literature which identifies itself under the term land-use and land-cover change, or LUCC. Finally, in section 2.5, the theory of forest transition is introduced and explored with emphasis placed on examples from the tropics. Chapter three introduces the reader to the research site in Southwest Costa Rica, discussing the local geography, providing a history of human settlement and land-use, and introducing the local constellation of actors. Chapter four details the methodology employed in the study and discusses the analysis of both survey-based data and aerial photographs. The case study is explored in its entirety in chapter five. First, evidence is provided for the presence of a forest transition at the site through the use of air photo analysis in section 5.1.1. This is followed by section 5.1.2 which provides testimonies of land-cover change given by local informants. Then, in section 5.2, the main drivers of change are identified and discussed. These drivers are examined by their association with local actor groups, showing how campesinos, expatriates, and environmental organizations influence forest-cover respectively. The thesis concludes with chapter six by outlining the key findings and exploring an avenue for future research.

CHAPTER 2: LITERATURE REVEW: LAND-USE AND FOREST-COVER CHANGE

And so the forests began to fall, and shrouds of smoke covered the Amazon.
- Hecht and Cockburn (1990, 37)

The dynamics of increasingly internationalized political economies of food, agriculture, and emigration are likely to create unexpected opportunities for forest conservation and regeneration in long-settled regions where agriculture is marginal but where emigration, remittances, craft production, and other links to the global economy provide opportunities for the diversification of livelihoods.
- Klooster (2003, 235)

A tremendous body of literature has been written on land-use and land-cover change in the tropics. Much of the focus has been placed on deforestation, the economic, social, and political forces driving forest-cover loss, and the environmental degradation which ensues. As expressed in the quotation from Hecht and Cockburn (1990) above, this environmental degradation narrative is often essentialized as a crisis. Less emphasis has been placed on describing reforestation and afforestation trends or identifying drivers involved. The following literature review covers the topic of land-use and land-cover change by first addressing deforestation in section 2.1 before finally turning toward the emerging body of literature focused on the transition toward forest-cover expansion in section 2.5. Much of the literature covered in this review presents humans as integral components of the environment rather than existing as an entity apart from natural ecosystems. In tropical forested regions, rural communities play a central role in shaping patterns of vegetation-cover through their various land-use choices. However local livelihoods are not exclusive drivers of change. External actors often propel change

through their economic behaviour, their politics, and their ideology. This is particularly true as globalization continues to link rural areas both economically and politically to national and international places. This process is replicated within the field of conservation as both individual persons passionate about the environment and formally organized NGOs dedicated to environmental work become increasingly involved in promoting conservation-oriented land-uses and expanding territories of protected areas. What emerges is a more complete view of forest-cover change, as expressed above by Klooster (2003), driven by multiple drivers and agents and resulting in a complex geography of forest regeneration occurring alongside forest clearing.

Certain definitions of deforestation and reforestation have been put forward the United Nations Food and Agriculture Organization (FAO) and have become widely institutionalized within the international forestry community.[2] Yet recently these definitions have come under criticism from a number of academics, Non-governmental Organizations (NGOs) and Indigenous Peoples Organizations. One criticism is that deforestation is idealized and presented as an irreversible conversion from dense forest to

[2] The current definitions used are presented in the FAO's Global Forest Resources Assessment 2000 (widely referred to as FRA 2000) and are as follows:

- Deforestation [is] the conversion of forest to another land use or the long-term reduction of the tree canopy cover below the minimum 10 percent threshold... Deforestation implies the long-term or permanent loss of forest cover and implies transformation into another land use... Deforestation includes areas of forest converted to agriculture, pasture, water reservoirs and urban areas. The term specifically excludes areas where the trees have been removed as a result of harvesting or logging, and where the forest is expected to regenerate naturally or with the aid of silvicultural measures.... Deforestation also includes areas where, for example, the impact of disturbance, overutilization or changing environmental conditions affects the forest to an extent that it cannot sustain a tree cover above the 10 percent threshold (FRA 2000: 364)
- Reforestation [is] the establishment of forest plantations on temporarily unstocked lands that are considered as forest (FRA 2000: 364).
- Afforestation [is] the establishment of forest plantations on land that, until then, was not classified as forest. [It] implies a transformation from non-forest to forest (FRA 2000: 364).

low tree-cover. This representation does not recognize the complex temporal trajectories and spatially noncontinuous patterns of forest-cover change that occur in reality (Mertens and Lambin 2000). Furthermore, any consideration of the political economy of land-use practices, tenure, and social conflict existing as drivers of land-cover change are absent (Jarosz 1996). In contrast, a more inclusive definition of deforestation comes from Nygren (2000, 13) who argues the process is more than the act of felling trees: "It is a process of change in the people's land tenure and land-use systems, in their social stratification and power relations, and in their environmental perceptions and cultural constructions." Representing the main arguments put forward by critics of FAO's definition of reforestation, Lovera (2003) argues that much of what is defined as a reforested area under the definitions presented in FRA 2000 are in fact 'green deserts' of monoculture tree plantations devoid of local biodiversity: "According to the definition that was adopted [in 2001] by the UN Framework Convention on Climate Change, not only a monoculture eucalypt plantation counts as 'reforested' area, any orchard, garden, or other land with more than 10% tree cover can be counted as a 'reforested' (ibid., 1). Representing the main arguments put forward by critics, Lovera argues that this vision of reforestation disregards unsustainable consumption and production patterns and ignores the social, cultural, and ecological values of forests that should be integrated into forest management policies.

Due to the restricted nature of the definitions put forward by the FAO, and the fact that these have come under heavy criticism, the terms are used in a more generalized manner in the following chapters. 'Deforestation' is used to refer to a trajectory of change resulting in a reduction of forest-cover. 'Afforestation' and the terms 'forest-cover

expansion,' 'tree-cover expansion,' 'forest regeneration,' or 'forest regrowth' all refer to a trajectory of change resulting in the regrowth of scrub and secondary forest on land previously cleared for agriculture or pasture. 'Reforestation' is used to highlight instances when individuals actively plant trees and thereby distinguish these from cases of natural regeneration due to land abandonment.

2.1 Theories of Deforestation: From Crisis to Complexity

A certain vision has been created and sustained of Neotropical[3] rainforests as ecosystems existing in a pristine state, untouched through time until coming under the relatively recent attack of expanding human populations. Authors such as Denevan (1992) and Balée (1989), criticize this myth, arguing that forest ecosystems in Latin America were in fact used and managed extensively by pre-Columbian populations. Researchers have shown that Amerindians burned areas, actively selected for certain plant species and forest types, altered drainage patterns, and even improved soil fertility by adding ash, bones and other household waste in order to sustain their garden systems (Balée 1989; Dufour 1990; Hecht and Cockburn 1990; Denevan 1992). Societies living in forested areas continue to actively manage and manipulate the forest ecosystem by transporting plant species across large areas and into selected spaces along trails, creating anthropogenic resource islands in the process (Baleé 1989; Hecht and Cockburn 1990; Taylor 1990; Balée 1992; Posey 1992). This human driven process of forest manipulation and augmentation has been found in open savannah environments as well (Fairhead and Leach 1996).

[3] The Neotropics is a biogeographic region extending south from the Tropic of Cancer. The region includes southern Mexico, Central and South America, and the West Indies.

The human management of these systems has created a mosaic of vegetation in different stages of succession throughout the neotropics (Dufour 1990). Rather than viewed as pristine, untouched nature, neotropical forests are best understood as the product of historical, cultural, and socio-political forces (Baleé 1992). This literature on anthropogenic forests emphasizes humans as integral actors within ecosystems who actively transform their surroundings as they create their livelihoods. Challenging this notion of pristine nature has implications for how we address the problem of deforestation and forces us to recognize that a certain amount of modern-day forest clearing in fact occurs within already modified ecosystems.

The pristine myth has played a central role in constructing a deforestation crisis narrative in which human mismanagement of pristine forest resources results in a catastrophic land degradation scenario. This crisis narrative is clearly expressed in the following description of current extractive land-use in the Amazon:

> [T]wo D8 tractors with a 40,000 kilo chain...churn through the old growth dragging it down, ready to be fired at the end of the dry season. The huge dimension of the area and the ignorance of fire management by those consigning the acreage to flame prompts a firestorm...Into the air spew thousands of tons of carbon...The sky turns a dirty ochre and a soft ash mingles with the dust from the unpaved roads, giving the people on whom the powder settles a spectral aspect, and the landscape itself the patina of death (Hecht and Cockburn 1990, 48).

Representative of much of this crisis literature, Hecht and Cockburn frame deforestation in terms of a unidirectional and irreversible transition in land-cover and environmental health, writing that it is the "latest surge in a long epic of annihilation" (ibid., 63). When forests are cleared, soils quickly become exhausted, nutrients leached, micro-climates become drier and hotter deterring the succession of secondary forest, hydrological

regimes are altered, livelihoods affected, and social violence often erupts as indigenous forest dwellers clash with migrants, ranchers, and extractive enterprises (ibid.). Such environmental degradation is not confined to a local scale but extends globally: "[T]he kind of destruction practiced over the last quarter century impedes regeneration; the impacts are not confined to the cleared land, but are regional and global and extend through time" (ibid., 50).

Presented as a crisis, this narrative justifies intervention at the national scale through state legislation and enforcement, and at the global scale through international conservation movements, conventions, treaties, and 'sustainable development' initiatives (Blaikie 1999; Adger et al. 2001; Campbell 2002). While useful in drawing attention to the very real environmental threats facing tropical forest ecosystems, the narrative tends to present a deliberately oversimplified vision of these environments and of environmental change. Tropical forests are envisioned as the "lungs of the world," (Adger et al. 2001, 687) existing as stable, climax ecosystems essential to global ecological functions. While a powerful and emotive image, Stott (1999) argues the metaphor is misguided and manipulated, a product of a scientific, economic, and hegemonic myth-making process: "'Lungs', of course, *take in oxygen and give out carbon dioxide*, which is not at all what is envisaged by the 'Green' discourse" (Stott 1999, 42). Taking a relatively radical position, Stott dissects the historical origins and entrenched semiology of this Northern, Anglo-Saxon "tropical rain forest myth," arguing that it purposefully replaces ecological dynamics and evidence of the historical ebb and flow of forests with a false history. This argument is echoed in a less radical way by Leach and Fairhead's (1996; 2000) analysis of forest-cover change and ecology in West Africa. Their study shows how a politically

dominant deforestation discourse, promoted by generations of colonial administrators and outside experts, "occluded" the reality of forest expansion: "[E]arly foresters and botanists deemed actual savannas to be bio-climatically capable of supporting forest and thus assumed that forest had once existed, having since been savannized" (ibid. 2000, 45). Scientists faulted by viewing the landscape in the short-term and wrongly assumed that the transition in woodland habitat represented forest recession. Fairhead and Leach argue that "policy-makers have been reading environmental history backwards...[and this] degradation discourse has had material implications in the form both of policies and actions planned from it" (Fairhead and Leach 1996, 237). The authors provide evidence from four West African countries, drawing on both accounts from historians and local oral histories, to show how observed ecological change has born little resemblance to 'expert,' and 'scientific' readings. These promoted a vision of balanced climax vegetation, and areas that did not match were assumed to be degraded by human activity (Leach and Fairhead 2000). The political side of these ecology narratives is seen both in the material creation of a system of protected areas and in the international financing of national forestry activities and institutions. Authors such as Nygren (1995), who works in Costa Rica, and Jarosz (1996), who studies Madagascar, argue this crisis literature tends to addresses social causes of deforestation in terms of the destructive behaviour of growing populations of poor people. Proposed solutions call for the transfer of technical knowledge and environmental education from scientists and experts in a uni-directional fashion to local populations.

The literature has identified a number of agents, catalysts, and drivers of forest-cover loss, and there is considerable disagreement over the mechanisms involved (Perz and Skole

2003 b). Population pressure, firewood collection, slash and burn agriculture, the migration patterns of colonists, state-run resettlement programs, cattle ranching, logging, and the development of road infrastructure are cited most frequently as drivers of deforestation (Hecht 1992; Rudel and Horowitz 1993; Holl et al. 1995; Sambrook et al. 1999; White et al. 2001; Ochoa-Gaona 2001). Often slash and burn agriculturalists are targeted as the primary agents behind forest-cover loss. Poverty, over-population, and agricultural expansion combine to propel deforestation (see Mather and Needle 2000; Geist and Lambin 2001; Geist and Lambin 2002). This land degradation-deforestation hypothesis (Anelsen and Kaimowitz 2001) draws on the hollow frontier and peasant pioneer cycle theories (see Rudel and Horowitz 1993; Pichón 1997). However, it stresses the "unsustainable" nature of farming methods. The hypothesis makes the argument that while traditional swidden fallow systems may have been sustainable at one time, population growth, increasing population density, and the presence of severe social and biophysical limitations, such as land scarcity and reduced soil fertility, now compromise these agricultural systems and drive forest fragmentation to dangerous levels (Ochoa-Gaona 2001, 571). A certain narrative is dominant: farmers with low incomes who lack access to new technologies cultivate an area for a few years after which reduced soil fertility and increased problems with weeds and pests force the household to move further into the forest. In this literature, small-scale farmers engaged in shifting cultivation are attacked for having short time horizons and for ignoring impacts that lead to long-term land degradation (Angelsen and Kaimowitz 2001). However, this narrative represents a gross simplification of reality. "Not-so-simple" (Lambin et al. 2001, 263) explanations of forest-cover loss stress changing economic environments, infrastructural changes, government policies, settlement schemes, relative proximity of markets, availability of

non-farm employment opportunities, and the creation of linkages between the State or formal organizations and local-level actors (Rudel and Horowitz 1993; Lambin et al. 2001; Pichón 1997; Brown and Ekoko 2001). Indeed, political ecology has played an important role in building 'not-so-simple' accounts of environmental problems. The collective body of literature aligned with political ecology has attacked population-pressure-on-resources and market-mismanagement explanations of degradation, replacing these with an emphasis on poverty as a driving factor (Peet and Watts 1996).

It is important to recognize that in the majority of cases, drivers and catalysts differ regionally and often operate in combination (Adger et al. 2001). Explanations for land-cover change that tend to focus on a single catalyst, such as population density (Sambrook et al 1999) or agricultural expansion (Mather and Needle 1998) act as filters and often blur the important linkages and feedbacks that occur between drivers of land-use and land-cover change. In contrast, Rudel and Horowitz (1993) and Brown and Ekoko (2001) acknowledge the advantages of looking at social interactions between actors and the synergistic impacts these linkages create. Rudel and Horowitz were concerned with a gap in the traditional population-centered Malthusian and proletarianizaton literature that ignored diversity. In response, they put forward a growth coalition theory for deforestation to explain historical and geographical patterns of deforestation in the Ecuadorian Amazon. This theory of deforestation is perhaps one of the most useful because it combines migration, demographic, political, economic, and historical explanations into a comprehensive geography of land-use and forest-cover change. The authors focus attention on groups of actors and the networks that form between them, claiming that these mutual interactions serve as the main mechanisms for

deforestation. The term 'coalition' stresses these actor networks and implies a group in which activities and alliances occur in a coordinated and organized fashion.

Membership in a coalition influences decision-making vis à vis land-use and livelihoods: "Because smallholders decide to clear land before they actually do it, a search for the causes of tropical deforestation should begin with questions about decision-making" (Rudel and Horowitz 1993, 13). In the growth coalition theory, this decision-making is influenced by associations and alliances formed between actor groups. The model traces the decisions taken by poor colonists to follow a lead institution, such as an oil company or transnational fruit company, or some other patron into a block of forest. The relationship the colonist family (client) creates with the leader (patron) reduces risk and helps them carve out a livelihood along the frontier (ibid.). The infrastructural development associated with a lead institution, such as the construction of penetration roads, attracts free riders, and a growth occurs in the mix of actors settling in and transforming the area. Walker (2003) also notes this interaction. In Amazonian frontier zones, logging companies develop roads, and colonists "infill." The expansion of secondary road systems and agricultural land-use are outcomes of the interactions between loggers and colonists. A benefit of the growth coalition theory is that it combines aspects of the immiserization model (proletarianization and rural population growth lead landless peasants to cut down forest) and the lead institution model to explain geographical patterns of forest clearing as clearly argued by Rudel and Horowitz:

> Growth coalitions and lead institutions start the destruction of large forests. Population growth, proletarianization, and rising agricultural commodity prices continue the destruction in the now smaller, more fragmented forests (1993, 37).

In their Ecuadorian case study, alliances between priests, colonists, a regional development agency, and individual investors from the highlands formed to open up areas of the forest for settlement and agricultural development. Counter-coalitions formed between missionaries, indigenous Shuar people, and European foundations to secure title and access to land. Through this analysis, the authors also contribute to understandings of how ethnicity and international development politics can affect patterns of land-use and forest-cover change.

When discussing coalitions of actors, perhaps the first actor group that comes to mind is the "community." Agrawal and Gibson (1999) address community decision-making in the context of natural resource conservation, but turn their critical analysis onto the notion of "community" itself. The authors dissect the more traditional perception of communities as existing as small spatial units and homogenous social structures comprised of shared norms. Organic notions of community, they argue, ignore multiple actors with multiple interests, local politics, strategic interactions, layered alliances and institutional arrangements. In response, Agrawal and Gibson suggest a more political and institutional approach to understanding communities and the ways in which communities make decisions about the management of natural resources.

An historical perspective is critical for this coalition theory. Rudel and Horowitz were able to explain forest-cover dynamics in the Ecuadorian Amazon over a seventy-year period by using extensive interviews and personal histories during repeated work and research trips in order to capture the personal experiences of people living on the frontier. Through archival work and satellite imagery analysis, the authors were able to extend the

time span of this 'ground-truthed' knowledge. This historical approach to their study was essential for understanding how alliances between key actors and organizations formed and how these shaped the spatial patterns of forest clearing and settlement visible today. Furthermore, the approach allows Rudel and Horowitz to move away from a framed and simplified view of the rainforest and the human activities transforming it. A similar historical treatment of land-cover change addressed through aerial photographic imagery analysis was employed in the Costa Rican case study presented in this thesis and discussed in section 5.1.1.

Blaikie and Brookfield (1987) also employ a wider historical and geographical framework, and are considered by many as leaders in this approach. In their classic study of the political ecology of soil erosion, the two argue that because time lags exist between causation and consequence, an historical understanding is essential. Addressing deforestation in Madagascar, Jarosz (1996, 148) employs both an historical perspective and a materialist discourse analysis to reveal how explanations for deforestation are "socially and politically constructed to the advantage of powerful people." Framing her research under the umbrella of political ecology, she argues that "[h]uman activities shape, and are shaped by place and history; human identities and activities constitute the economic, political, and ideological processes which form and transform regions. In turn, the particular contextual details of place shape human activities" (ibid., 149).

A dominant preoccupation in the deforestation literature, as well as in the larger body literature on land-use and land-cover change, is which scale of analysis is the most preferable. Discussing macro-level analysis in research pertaining to natural resource

management, Hatch and Swisher (1999) emphasize the importance of understanding larger-scale phenomena. If the goal of both research and resulting policy is to ensure the sustainability of lower-level systems, or systems at the farm level, the functions and sustainability of higher-level systems, such as regional agroecosystems or broadly-based socioeconomic systems, must not be ignored: "[F]ailure in the higher-level system will mean failure for all of the lower-level systems" (ibid., 6). Helmut et al. (2002) also utilize the macro-scale in their cross-national study which incorporates 152 subnational case studies. They argue that while local-scale studies dominate the literature and provide rich information, it is necessary to generalize up. To do this, they scan their 152 selected case studies and extrapolate the proximate causes and underlying driving forces that appear across the sample.

The main critique of macro-scale analyses is that they erase valuable details and causal links that appear only at smaller scales. For instance, Nygren (1995; 2000) argues that population-centered explanations for deforestation (see Sambrook et al 1999) might hold to some degree at an aggregate level but seldom provide accurate explanations of, or predictions for, the causes of deforestation at the local level. In most Central American countries, she argues, deforestation is more related to the distribution of the national population and land tenure rather than population growth per se (Nygren 1995). She criticizes macro-level analysis for obliterating the heterogeneity of local contexts in a rigid core – periphery dichotomy: "No attention is paid to the dynamics between different interest groups in forest resource utilization and agricultural production on the micro-scale...The existing ecological, economic, social and cultural plurality is easily hidden" (Nygren 1995, 24-25).

For the case study presented in full in chapter five, the author uses both scales of analysis. This combination is important for the development of more complete explanations for land-use and land-cover patterns and how these change over time. While conducting research at the local scale reveals heterogeneity of drivers operating at the subnational level, analysis is incomplete without incorporating the macro-scale phenomena that influence these local drivers. These factors can be geographic, biophysical, social, economic, and political.

2.2 Actors as Shapers of Landscape: Households, the State, and Organizations

This section provides a brief discussion of three sets of actors commonly identified in the literature as shapers of the landscape. It is not the intent to present a comprehensive review of an enormous body of literature associated with each of these actors. Rather, three short overviews show how rural households, the State, and organizations can each influence patterns of land-use and trajectories of land-cover change.

Local-scale studies often use rural households as the main unit of analysis. Household characteristics such as farming background, demographic composition, number of household members with off-farm employment, farm size, and land tenure are important factors that influence on-farm land-use patterns (Pichón 1997). Walker (2003) is another author who focuses on the rural household and its structure. He calls for new investigations into household lifecycles and generational dynamics and how these influence household labour. His objective is to incorporate the effect of the individual

land-managing agent into a model of forest-cover change in the Amazon. Due to his focus on individual agents, Walker distinguishes his study from ones that see "regional landscapes emanating from market centres" (ibid., 381). The colonist farmer incorporated in his model is one who makes planned and calculated decisions based on labour availability, preferences, and foresight (ibid.). Not only does this study add to a greater understanding of the household and of household structure on land conversion, but it also advances modeling at the micro-scale which takes into account individual preferences and decision-making and treats individuals as rational rather than simply reacting to changing circumstances. Decision-making about land-use or alliances with other area actors often occurs at the household level. Therefore investigating the rural household is a necessary first step to understanding how wider-ranging interlinkages form with other actor groups including the State and formal organizations.

Scott (1998) explores both historical and present-day attempts by the State to order nature, society, and landscape. He describes this process as a social engineering of both society and nature in order to make that which is complex, obscure, and even chaotic easier to read, order and ultimately control. In other words, the State, its governmental bodies, and its legislation work to transform the national territory into what Scott refers to as a "legible" landscape. This process is "an attempt at domestication, a kind of social gardening devised to make the countryside, its products, and its inhabitants more readily identifiable and accessible to the center" (ibid., 184). People, their settlements and resource management systems, and the environments they inhabit are renamed and reconstructed to form a story that is more easily read; as they are renamed, these places and their inhabitants lose control over themselves and their destiny.

The emergence of scientific forestry managed by State agencies and regulated by new sets of legislation provides a useful example. In order for the State to regulate the harvesting of natural resources, and thereby profit from them, it redefines the forest in terms of its fiscal attributes and the resources destined for extraction. The creation of a legible forest not only necessitates spatial reorganization, but also involves the renaming and reclassification of its biological attributes: "The fact is that forest science and geometry, backed by state power, had the capacity to transform the real, diverse, and chaotic old-growth forest into a new, more uniform forest that closely resembled the administrative grid of its techniques" (ibid., 15). Missing from this reworked definition of the forest are the flowers, lichens, moss, shrubs, vines and fauna as well as traditional human resource use: "The forest as a habitat disappears and is replaced by the forest as an economic resource to be managed efficiently and profitably" (ibid., 14). It is thus stripped of its diversity and symbolic meaning and transformed into a series of legible tables and maps filed away in a state forester's office.

Organizations are also powerful agents that can play a central role in shaping the landscape. Keese (1998) draws particular attention to how NGOs influence development policy at the global level and local patterns of resource use at the grass roots level. Drawing on research from the Ecuadorian highlands, Keese makes the strong point that international NGOs directly modify local places. NGOs have become very popular in development policy, and bilateral and multilateral agencies increasingly use NGOs as the contact through which funds are channelled to a given project. He provides examples from Ecuador of how an international NGO changed land-use away from the cultivation

of traditional tubers and grains and promoted the planting of pasture for dairy production and the cultivation of vegetable crops for consumption and sale. Bebbington (1997), who also works in the highlands of Ecuador, provides evidence of relationships forged between indigenous farmers and NGOs which gave farmers greater access to other actors, institutions, and the market. This networking, Bebbington argues, allowed these farmers in this case to intensify their agricultural production and move out of a situation of poverty and environmental unsustainable production.

While not a comprehensive review, these examples of how households, the State, and NGOs can influence patterns of land-use inform the case study presented later in chapter five in two ways. First, these examples illustrate different scales of analysis ranging from the micro-scale household analysis, to the macro-scale examination of the State. NGOs occupy a 'middle ground' through their capacity to link international policy and funding to projects at the grass roots. Second, these cases provide further support for an actor-centered approach to studying land-use and land-cover change.

2.3 Deforestation and Reforestation in Costa Rica

This section provides contextual information about forest-cover dynamics specifically in Costa Rica. As mentioned in chapter one, Costa Rica has had a mixed history of severe deforestation combined with international conservation leadership, a paradox that makes Costa Rica an interesting case study.

The environmental crisis narrative in Costa Rica has been presented as a multi-faceted economic and environmental degradation crisis that is leading the country to slide towards an irreversible ecological breakdown (Carriere 1991, 186). Costa Rica has experienced one of the highest deforestation rates in the tropics, with estimates ranging from 30,000 to 50,000 ha /yr since 1965 (Thacher et al. 1997, 269). Other studies are more conservative, highlighting the fact that the deforestation rate has slowed significantly to roughly 16,000 ha / year in 1997 due mainly to government reforestation incentives which reached 140,000 ha between 1979 and 1997 (de Camino et al. 2000, 6). The implications of deforestation includes timber shortages and a projected $US 350 million in wood product import demands in this century, problems with soil erosion in 24 percent of the country, severe soil erosion in an additional 17 percent, increasing pressures on protected areas, implications for watershed protection, and rising threats to biodiversity (Thacher et al. 1997, 270).

Beef cattle production in Costa Rica has been blamed for much of the country's deforestation and forest fragmentation (de Camino et al. 2000; Hall 2000; White et al. 2001). Between 1979 and 1992, land-use was changed on 1,064,327 ha (20.8 percent of the national land area), with 23,000ha of natural forest being converted to pasture annually for expanding beef and dairy production (de Camino et al. 2000, 7). By the mid 1990s, cattle grazed on 2.2 million ha of land, representing 54 percent of all agricultural land and 44 percent of Costa Rica's total land area (Hall et al. 2000, 29). From a social and historical perspective, ranching generated little employment while simultaneously resulting in the concentration of land in the hands of wealthy landowners (Nygren 1995). Agrarian policy in the 1960s and 1970s was based on optimistic assumptions of

increasing US demand (Nieuwenhuyse et al. 2000) for beef. Government policies during this period favoured beef production and expansion through the creation of credit and subsidy incentives (Ibrahim 2000; de Camino et al. 2000) and tended to favour large farmers which further marginalized the small farmer (Nygren 1995). More than one-quarter of this newly created pastureland incorporated land classified as best suited for crop production. Once transformed into rangeland, these areas often become underutilized, compacted, and degraded (Ibrahim 2000, 426). However, fluctuations in the international beef market and the deterioration and erosion of soils under grazing pressure have led to the abandonment of cattle ranching in some areas of the country and an associated expansion of scrub and secondary forest growth on old pastures (Ibrahim et al. 2000; Leopold et al. 2001). Indeed, efforts have been made by government and international development and conservation groups to place these marginal pasture lands into forestry management or protection status (White et al. 2001; PROCIG 2001).

Costa Rica is one of the few Central American countries with a 30-year history of promoting reforestation through a series of traditional incentives, such as tax credits, direct payments, and subsidized loans, and by means of several innovative approaches such as a 5 percent fossil fuel tax, private sector investment, and the international sale of tradable carbon offset certificates (de Camino et al. 2000; Subak 2000; Thacher et al. 1997; Thacher 1995; Nygren 1995). Government incentive programs, starting in 1979, have evolved from tax subsidies directed at large landowners to a series of incentives that targeted smaller farmers. The first of these was the Certificate of Forestry Payment (CAF), a direct incentive paid to farmers who reforested their land. This was followed by CAFAs which targeted small farmers, provided funds before planting in order to cover

costs, and required the formation of farmer associations (de Camino 2000). However, studies have found that the rate of farmer participation in these programs was often low and long-term results uncertain (Thacher et al. 1997). In 1995, the third World Bank structural adjustment plan ended many of these subsidy and incentive programs. As a result, the country's forest policy shifted to an innovative Payment for Environmental Services which provide compensation to landowners with forested properties for services provided such as reducing greenhouse gas emissions, protecting watersheds, and conserving biodiversity (de Camino 2000). Costa Rica was one of the main advocates for the establishment of the Clean Development Mechanism in the 1997 Kyoto Protocol through which industrialized countries can invest in greenhouse gas emissions reduction in another country (Subak 2000). Several initiatives lie within the Payment for Environmental Services Program, including the innovative Private Forestry Project (PFP). In the PFP, landowners sign a contract with the Costa Rican government and are paid to maintain tree plantations or forest management and conservation for a set period of time (ibid.). Carbon sequestration then is monitored on the parcels of land registered in the program. Funding for this program comes from a variety of sources including the country's petrol tax, the investment in carbon offsets from a combination of foreign governments, such as Norway, and a consortium of foreign private-sector companies, and from the World Bank funded Ecomarkets project. Another innovative approach to forest protection that provided indirect financial incentives was an agreement between the Costa Rican National Institute of Biodiversity and the pharmaceutical company Merck to fund a national-level biological taxonomy of all flora and fauna. Within the project framework, local people from across the country were hired as parataxonomists.

Twelve percent of the national territory has been set aside in the system of national parks. An extensive system of wildlife refuges, forest reserves, biological reserves and other types of protected areas also exist, covering over 24 percent of the country (de Camino 2000, 12). It is interesting to note that eight different protected areas, ranging from nature reserves to national parks, were established directly through the lobbying of foreign organizations or individual expatriates (Campbell 2002). Campbell argues that the received wisdom of environmental degradation narratives played a central role in informing the national forestry legislation in the 1970s and the proliferation of national parks that followed. Park creation excluded local people through the lack of consultation and inadequate financial compensation for lost land. Furthermore, she argues, the park system is juxtaposed against high rates of degradation outside park boundaries. Squatting and illegal logging within protected areas are prevalent and represent serious threats to the country's biodiversity.

A major problem for biodiversity conservation is that 93 percent of the world's land area, and much of the global biodiversity, lies outside formal government-administered parks (Langholz et al. 2000, 1736). This has initiated a search for new approaches to biodiversity conservation. To address this problem, Costa Rica established one of the first and most advanced Private Wildlife Refuge Programs in the Tropics. Legal designation was given in 1992, and by 1997 a total of 22 refuges were registered; these protected over 6,000 ha of mostly primary forest and wetlands (ibid., 1737). An additional 211 private reserves existed in 1997 that did not participate in the program. Under the program, landowners must follow a government-approved management plan. Incentives received are exemption from property taxes, access to technical assistance, and

assistance in dealing with squatter invasions (ibid.). The Langholz study made an interesting discovery about incentives. They found that the most common reasons given by participants for joining the program was increased protection of the property from poachers and squatters and the associated publicity that they hoped would aid the promotion of their reserves as ecotourism destinations. However, respondents said the most important motive was that the designation of their properties as refuges kept land-use decisions out of the hands of local governments who were often pro-development. Most participating refuges were located along coasts, covering land zoned as the Maritime Terrestrial Zone which the government can rent as highly valuable concessions. Finally, Langholz et al. found that an unintended consequence of the Private Wildlife Refuge Program is land concentration by the wealthy who rank among the 8 percent of the landholding population that own 67 percent of all private lands (ibid., 1741).

2.4 Land-Use and Land-Cover Change (LUCC)

While much of the literature already discussed in sections 2.1 and 2.2 covers land-use and land-cover change, it is important to note that a separate body of literature exists under this specific label. This literature tends to approach the subject from a remote sensing and modeling perspective. Contributions to this body of literature recognize the complexity of land-cover change, and try to push past simple binary statistical analyses of forest versus non-forest: "Land-cover changes are most often noncontinuous in space, leading to complex landscape mosaics and mixtures of cover types. They are also reversible...[and] can be linear...or cyclical" (Mertens and Lambin 2000, 467). To capture the complexity of trajectories of change, Mertens and Lambin use a multivariate spatial model analysed

over a sequence of observation years. Their objective is to identify areas of high probability of deforestation in and around a reserve in Cameroon. The ability to visually demonstrate how patterns of land-cover change over time is a very powerful tool, and the approach of using models allows for the creation of multiple predictive scenarios. Mertens and Lambin, for instance, can test how distances from roads, towns, and forest edges, combined with varying soil aptitudes, effect forest fragmentation. Yet while this kind of study captures the dynamic nature of land-cover change and models the probability of certain trajectories occurring, it does not capture or predict the effects political or cultural forces have on forests. For instance, it would be difficult to assign a numerical value to the community-level institutions that regulate forest-use or to the change in environmental awareness that may alter extractive land-use practices. (For a study that does analyse these factors see Klooster 2003.)

There have been a number of articles recently published on the subject generated in part out of a series of workshops organized by the Land-Use and Land-Cover Change project (LUCC), a joint project between the International Geosphere-Biosphere Programme and the International Human Dimensions Programme on Global Environmental Change. The objective of the project is to promote and improve on a regionally-based interactive modelling of the interactions that exist between land-use and vegetation-cover with a specific aim to improve means of projecting land-uses and covers (Veldkamp and Lambin 2001). In addition to biophysical variables, the project identifies the need to include socio-economic drivers of change as well as institutional drivers such as international environmental treaties that may have an increasingly significant role in influencing global patterns of land-cover (ibid.). Three recent publications attempt to identify this

overarching set of drivers and variables. Geist and Lambin (2001 and 2002) draw on 152 different case studies to identify five broad clusters of driving forces or social processes that underlie four sets of proximate causes. These underlying driving forces cover demographic, economic, technological, policy and institutional, and cultural factors. The four proximate causes are infrastructure extension, agricultural expansion, wood extraction and "other factors" which include pre-disposing environmental factors, biophysical drivers, and social trigger events like economic shocks and social displacement. After identifying these underlying driving forces and proximate causes, the articles explore interlinkages and feedbacks between the factors within each set as well as between sets. Geist and Lambin (2001) then take this theorizing on causation to construct tandems, or "simple two-factor cause connections" which are used in part to explain patterns of land-cover visible on the ground (Geist and Lambin 2001, 86). Similarly, Lambin et al. (2001) argue that rich case studies provide empirical evidence that can be collated and used to explore the existence of wider regional trends. In this article, the authors extend this comparative, cross-national approach to environments such as rangelands and to processes such as agricultural intensification, urbanization, and globalization.

These papers contribute to understandings of land-use and land-cover change by stressing the presence of multiple driving factors and underlying causes. The research draws on multi-disciplinary research, and promotes a systems dynamics model of land-cover change. Furthermore, these studies replace *linear relationships* between a few key variables with the notion of *synergies* between causes and drivers (Geist and Lambin 2002). However, a question arises whether this framework is too generalized to provide

accurate predictive models that could be fitted exactly to every place. As recognized by the authors, the idea that policy, culture, and institutional tandems can be generalized and applied at the level of 'the tropics' is unrealistic due to national and subnational differences. For this reason, the authors propose, as a more feasible and regionally-based project, the formulation of a "collection of specific models which represent the particular interactions between a reduced set of dominant driving forces" (Geist and Lambin 2001, 98). The research presented in this case study from Costa Rica, and discussed in chapters five and six, does not follow a multi-national comparative analysis focused on creating global predictive models. However, it does draw from this LUCC literature the notion of synergistic interlinkages driving land-cover change and applies this idea to the micro-scale.

2.5 Forest Transition

Turning now to the theory of forest transitions, the following section explores how forest-cover and human economic activity combine to first drive forest clearance and then to initiate a process of recovery. The LUCC literature, while providing detailed analysis of the causes and drivers of deforestation, fails to fully address the causes and drivers of forest-cover expansion. During an initial period of development and demographic expansion, settlers clear the land for agricultural expansion and extract timber resources for fuel and construction materials. Industrialization and urbanization follow as the country modernizes, and land-use systems change accordingly. Economic development, combined with agricultural intensification, leads farmers living in marginal areas to abandon land and move to urban centres. A "turnaround" in forest-cover occurs as

reforestation becomes more prevalent than deforestation (Mather and Needle 1998; Rudel 1998). Until recently, this dynamic received little attention. This is especially true for literature addressing tropical environments in which the majority of contributing authors emphasized deforestation and overlooked processes leading to the regrowth of secondary forest vegetation (Klooster 2000*b*; Rudel et al. 2002).

The idea of forest-cover following a U-shaped curve as countries modernize draws on the notion of an environmental Kuznets Curve (EKC) in which a relationship between income per capita and environmental degradation is hypothesized (Stern et al 1996; Perz and Skole 2003*b*). At low development levels, the quality and degree of environmental degradation is limited by simple technology and a subsistence economy. As economic development of industrialization occurs, rates of resource depletion exceed regeneration and levels of waste production and pollution increase. As development continues, improved technology, environmental awareness, and enforcement lead to a levelling and eventual decline of environmental degradation (Panayotou 1993 in Stern et al. 1996). Taking a more institutional approach to describing forest transition, Grainger (1995) separates the turnaround into two components. The first is the *land-use* component which incorporates agricultural intensification, industrialization and urbanization. The second is classified in terms of *forest-use*. Technology combines with changes in attitude toward the value of forests, increased recreational use, and the establishment of institutions to either manage or conserve forest resources.

The forest transition literature can be divided into two groups. One set examines the historical turnaround in forest cover in Europe or North America, while the second

applies the theory to other parts of the world. In Europe, technological modernization combined with changes in land and forest tenure to drive a transition from net deforestation to net afforestation and reforestation. Political changes also played a role as the state increased its legislative authority and technical control over forest resources (Mather 2000). As early as the mid 17th century, Denmark began to adopt "scientific forestry" systems from Germany (ibid., 37). Similarly, in Switzerland, rapid population growth and associated demand on wood resulted in heavy forest clearing which the traditional communal land management systems failed to regulate. Modernization of the economy and agriculture combined with the intervention of government reforestation and forest legislation helped create a turnaround in the late 19th century (ibid., 39). Forestry schools were established and coal replaced wood as the primary fuel source. Two forests transitions occurred in France according to Mather et al. (1999). This second transition is important as it demonstrates that a turnaround can reverse. Without this insight, it would be easy to romanticise forest transitions and assume they represented an inevitable process of environmental 'improvement.' In the French case, a decrease in the population following the Black Death resulted in the first forest expansion (ibid.). During the second transition, declining population and agricultural intensification took more passive roles. More influential during this transition was the political and cultural climate in which Enlightenment notions of rationality and progress aided the state in enforcing new forest management regimes.

Several hypotheses exist that emphasize one fundamental underlying factor or another as serving as the primary driver for forest transitions. A scarcity hypothesis for forest transition argues that deforestation results in a wood shortage that, in turn, drives up

prices and motivates people to plant wood lots and establish plantations (Rudel 1998). An industrialization hypothesis also exists in the literature and is tied to central place theory. In this explanation, industrialization leads to a decline in population growth rates and thus reduces pressures on forests. After a time lag of 15 – 20 years, the lack of children to inherit farms causes the aging parents to reduce cultivation, abandon land, or sell to larger farmers. In this case, labour costs per hectare can increase and persuade larger operators to abandon agriculturally marginal areas (ibid.). Furthermore, a clustering of new industrial jobs occurs which also reduces the relative value of labour in peripheral areas. Agricultural intensification also is often singled-out as the primary driver. This argument puts forward that a "progressive adjustment of agriculture to land capability" occurs that results in a "better spatial fit" (Mather and Needle 1998, 117). Initially, land is settled randomly and without accounting for land-quality variations. Over time, successive adjustments occur with increasing awareness and differentiation between low, medium, and high land quality (ibid.). The notion of agriculture intensifying on a smaller area of more suitable land completely ignores the reality of social inequality. In many places, the majority of agriculturalists do not have the luxury of this "better spatial fit," and are forced to work very marginal lands without few resources to invest in expensive farming technology or chemical inputs. Perhaps a more useful agricultural driver of forest transition is smallholder portfolio diversification (Rudel et al. 2002). Generally, such livelihood diversification[4] adds new non-farm

[4] A *livelihood* is defined by Ellis (2000) as comprising the "assets (natural, physical, human, financial and social capital), the activities, and the access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household" (ibid.,10). He highlights the distinctions between three main sources of income: *Farm income* refers to specifically to income generated from 'own-account' farming, including that which is produced and consumed as well as any income generated from agricultural goods sold. *Off-farm income* refers to income derived from wage labour within the agricultural sector but not on the individual's or household's own farm. *Non-farm income* refers to any

sources of income to the household while allowing for the transfer of some labour resources away from farming and the placement of land formally under cultivation into fallow.

A rapidly expanding volume of case studies is being published that examines forest transitions in tropical contexts, identifies the relevant drivers, and investigates how such a turnaround in forest-cover in the less developed world might compare to forest transitions that occurred in North America or Europe (Rudel 1998; Perz and Skole 2003*b*). This new direction of research counters entrenched notions of wide-scale, continuous, and irreversible deforestation in the tropics.[5] Essential to the study of tropical forest transitions is the recognition of the extent of secondary forest vegetation within tropical areas (Dufour 1990; Baleé 1992; Guariguata and Dupuy 1997; Moran et al. 2000; Perz and Skole 2003*a*; Walker 2003). Forest clearance occurs concurrently with field abandonment as part of the same "decision-making calculus" (Walker 2003, 376) and the resulting secondary forests are important socioeconomic resources which are widely used (Moran et al. 2000). Specifically identifying forest transitions in tropical countries, several key studies look at Republic of Guinea, Puerto Rico, Mexico, and the Amazon (Fairhead and Leach 1996; Rudel 1998; Klooster 2000*b*; Rudel et al. 2000; Rudel et al. 2002; Klooster 2003; Perz and Skole 2003*b*). These cases are particularly interesting

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income generated from outside the agricultural sector including rural-to urban transfers and international remittances. Finally, Ellis defines *rural livelihood diversification* as "the process by which rural households construct an increasingly diverse portfolio of activities and assets in order to survive and to improve their standard of living" (Ellis 2000, 15). These terms are used throughout this Costa Rican case study to describe local rural households, their land-use choices, and their interactions with other area actors.

[5] Through the emphasis placed on forest dynamics, this literature links to recent literature that emphasizes disequilibrium and ecological flux over older notions of equilibrium and homeostasis as discussed by Kottak 1999 and Zimmerer 2000.

given the more dominant and highly politicized narrative of large-scale deforestation, environmental degradation and biodiversity loss. Similarly, they are important because of the concern with biodiversity loss and global climate change (Rudel 1998; Rudel 2001; Perz and Skole 2003*a*, 2003*b*). The fact that tropical forests are such vital reservoirs of biological and genetic diversity, and have important functions for surface and atmospheric carbon exchanges, necessitates a close examination of the processes and rates of forest recovery in these areas. Rudel (2001) cautions that the carbon sequestration implications of a forest transition depend on a two-fold process: first is the establishment of protected areas, extractive reserves, or carbon sequestration trading schemes between countries, and second is the changes in the relative rates of return within the agriculture sector, the profitability of which would dictate the extent of peripheral lands abandoned.

What emerges from this literature is a sense of complexity, with forest transitions arising out of an "ensemble of activities" and place-specific factors (Rudel et al. 2002, 100). For instance Rudel et al. (2002) found that cattle ranching was mediated by ethnicity in the Ecuadorian Oriente. When an economy centered on the production of a certain citrus crop collapsed, indigenous Shuar allowed their fields to revert to forest. Yet elsewhere, in Guatemala, the labour-saving and lucrative nature of cattle production was shown to dissuade reforestation and drive a move away from cardamom agroforestry production (Taylor 2003). Biophysical factors must also be considered as mediating factors. In the Ecuadorian Oriente, the common practice of tethering cattle is not often carried over to sloped land as landowners fear that the cattle will be strangled in the ropes. Landowners tend to allow pastures on these steepest areas to grow back into forest, a decision which highlights how topography can influence land-use and vegetation dynamics (Rudel et al.

2002). Size and shape of forest patches, soil chemistry, degree of soil compaction, incidence of insect pests, and the presence of tree species whose seeds are dispersed by wind are only a few of the local-level factors that influence patterns of regrowth (Guariguata and Dupuy 1997; Moran et al. 2000; Rudel et al. 2002; Perz and Skole 2003*b*). At larger regional scales, external influences such as road building schemes and capital investment appear as influential factors that can impede forest recovery (Moran et al. 2000).

Fairhead and Leach (1996; 2000) provide an important contribution to the forest transition literature in their historical study of tree-cover expansion in the Republic of Guinea. The authors discovered that existing forest fragments in fact had been created by local people and were not, as previously assumed by colonial administrators and resource management experts, remnants of some old forest expanse. Drawing on a combination of oral testimonies and satellite imagery, the authors show that in the past there was much more savannah. Over time, local people cut grassland around villages in order to harvest thatch and create a fire-break to protect the houses. Villagers planted forest islands and transformed these into productive agroforestry systems. The authors also reveal that these forest patches served as fortifications to protect villages from enemy attack and slave traders.

In the case of Puerto Rico, the exceptional political and economic relationship with the United States is responsible for driving a forest transition on the island. An agricultural labour shortage in rural areas developed as new economic opportunities for Puerto Ricans in the urban labour markets on the US mainland opened (Rudel, Perez-Lugo and Zichal

2000). In this paper, the authors explain the Puerto Rican forest transition as an outcome of international politics and regional geography. Moreover, they move away from describing forest-cover change in terms of broad demographic change and industrialization, and concentrate instead on the impact of a very regional geography.

The forest transition literature is not without critique or calls for refinement. One such critique is that the theory ignores differences in types of forests in favour of an overwhelming focus on overall succession or recovery. The vegetation structures, species diversity, and capacity to sequester carbon differ significantly between primary and secondary forests, as do their economic uses (Perz and Skole 2003*b*). Additionally, forest transition theory tends to focus on the general change from net forest-loss to net forest-gain. This, Perz and Skole argue, glosses over the short-run fluctuations in forest-cover that come from swidden-fallow land-use systems and the medium-run dynamics that arise from regional boom and bust cycles of agricultural expansion and economic development. Their study in the Amazon found that land-cover change in settled subregions (which they use as a proxy for an advanced forest transition phase) did not occur linearly, and evolved as a series of "short-term forest transitions episodes" (Perz and Skole 2003*b*, 289). Along similar lines, the classic forest transition theory assumes a state of stability after the transition. In his cross-national analysis, Rudel (1998) found that contrary to generalized notions of modernization and urbanization leading to a turnaround in forest cover in the countryside, affluent countries can in fact experience a decline in forest-cover and were not "immune" to economic pressures to clear land and exploit forest resources (Rudel 1998, 549). Viewed at the temporal scale of medium-run dynamics, forest regrowth may be followed by new agricultural expansion (Perz and Skole 2003*b*).

These critiques lead to a call for some refinement of the forest transition theory, especially in light of the growing case studies emerging from the less developed world. Perz and Skole (2003*a*) also argue that there is a need for more subnational case-studies that use a wider range of local variables in assessing and modelling forest transitions. In their study in the Brazilian Amazon, the authors divide the study area into three subregions that then are used as proxies for different stages along the forest transition curve. Research at this subnational and local scale reveals important heterogeneity. In contrast, cross-national studies tend to favour population size and income as key variables and omit other factors such as differing land-use practices which have been shown to affect forest regrowth (ibid., 28). They argue that the very use of countries as units of analysis obscures the heterogeneity visible at the intra-country level. While Helmut et al. (2002) do incorporate a wide spectrum of variables and drivers in their cross-national study, they do so only for the purpose of investigating land-use and forest-cover loss. Therefore, their multiple-causation framework is not applied to cases of forest-cover expansion.

In light of this call for the refinement of forest transition theory and the need for more case study analysis of heterogeneity at the subnational level, the traditional assumptions about depopulation and rural out-migration as driving forest recovery must also be reassessed. Looking at Mexico, Klooster (2000*b*) argues depopulation provides a limited explanation for increased tree-cover. Agricultural abandonment in this case occurred simultaneously with increases in production and trade of agricultural goods between Mexico and the U.S. Subsidies and green revolution crop varieties were not equally

distributed across all agricultural areas of the country. Less productive regions suffered from price ceilings for maize and beans which discouraged subsistence production. A shift from agricultural expansion to abandonment did occur at the site, but the population did not thin. In fact, in one community, the population increased. Instead, cyclical emigration, reliance on remittances, and the intensification of pottery production served as drivers. Merely using population size as an explanatory variable disregards the national political economy and regional differences.

It is important not to assume that processes such as rural-to-urban migration will be replicated in Latin American or Southeast Asian countries as they previously occurred Europe or North America. Fewer manufacturing jobs have been created in Latin America and Southeast Asia, and service sector jobs are relatively poorly paid (Rudel et al. 2002). In addition, urban livelihoods are more precarious in these countries (ibid.) and rural households more often pursue a diverse strategy which does not lead to mass, one-way migrations to urban centres. Household members often opt instead to migrate seasonally. Or, urban migration may occur in a way that maintains close economic ties to the rural household through remittances. Also important is the increasing role of international migration in determining land-use and land-cover back in the rural home (Klooster 2000*b*; Klooster 2003; Taylor 2003).

2.6 Conclusion

Out of the literature reviewed in this chapter, a number of key elements take a central role in informing the following case study. Authors such as Baleé (1989), Denevan (1992),

and Fairhead and Leach (1996) show how forest ecosystems sometimes are more 'cultural' than they are 'natural.' Not only do these studies raise a critique of the history we attach to tropical forests, but they also stress the importance of viewing forests in terms of ecological and land-use dynamics. As Stott (1999, 41) points out, "'forests' ebb and flow." These studies also highlight the importance of bringing an historical perspective to environmental research. Human-environment interactions serve as the main focal point for political ecology, a theoretical approach that raises important questions about power relations between actor groups and how these relations influence resource management decisions at the local level (Peluso 1992; Blaikie 1999). In this manner, political ecology links the micro-scale with the macro-scale and offers a valuable framework for investigating how regional, national, and international politics and economics shape local trajectories of change.

House-hold level analysis serves as an optimal approach for investigating local daily realities. However, households do not operate in isolation. Often coalitions develop between rural households and other key actors such as lead institutions or NGOs. Authors that address the ideas of coalitions, networks, and synergies are Rudel and Horowitz (1993) and Bebbington (1997). Taking the notion of synergies to a broader scale, Geist and Lambin (2001; 2002) address feedbacks between underlying drivers and proximate causes of land-cover change. Economic, technological, and policy and institutional factors are underlying driving forces that appear in their framework. Yet these forces are often mitigated by the State which, according to Scott (1998), is a powerful actor that shapes land-use and affects land-cover in ways that make natural resources more easily managed and exploited. In the case of Costa Rica, Wilson (1998)

and Edelman (1999) chronicle how the State reacted to the 1980 debt crisis describe the effects the subsequent agrarian policies had on small-scale farmers.

Authors such as Perz and Skole (2003*a*) have called for more studies at the subnational level that reveal local-level complexities and change mechanisms. Similarly, authors such as Rudel et al. (2002) and Klooster (2000*b*) highlight place-specific factors and show that simplistic models of population increase or agricultural intensification do not offer complete explanations for forest-cover change. However, a gap exists in this literature. The classic literature tends to explain a turnaround in terms of broad economic, technological, and population change. Even in some of the more recent additions to the literature, forest transitions are often explained in terms of agricultural abandonment and the associated out-migration of the rural population. Yet relatively little mention is made of the potential role of in-migrating actors, be they individuals or organizations. A recent article by Jones et al. (2003) does discuss rural in-migration but not in the context of forest transitions. Addressing the southern United States, the authors investigate how an in-migration of urban residents to scenic rural areas resulted in an increase of local environmental values and a greening of local economies. However, changes in land-cover were mixed. In some instances, the in-migration resulted in the loss of agricultural and forest land to development. The study contributes the notion of what the authors term 'green migration,' a process echoed in the Costa Rican case study presented next.

The case study presented in the following chapters address this gap in the tropical forest transition literature and explores how new foreign landowners and environmental NGOs can influence forest-cover expansion. It contends that patterns of land-use and land-cover

are best understood as the products of a complex interaction between human actors and their environments. Household level analysis is incorporated to better understand how trajectories of change develop at the local-scale. An historical approach is adopted through the analysis of aerial photographs to avoid viewing the landscape as a static entity. Using political ecology as a guiding framework, the thesis seeks to understand how groups of actors interact and how broader economic, biophysical, geographic, and environmental policy factors influence land-use choices. Finally, the thesis draws on the idea of synergistic relationships forming between groups of actors and influencing their land-use decisions. These elements are combined to address the issue of forest dynamics in a rural Costa Rican setting and, in particular, to explore the reasons why local forest-cover may be expanding.

CHAPTER 3: BACKGROUND TO AREA AND SITE DESCRIPTION

The natural landscape of this zone is characterized by its heterogeneity which consists of a mix of diverse fragments of conserved forests (principally on the steepest slopes or the ridges of the highest hills), numerous areas of secondary forest growth in different stages of succession, and many areas in pasture and under cultivation (mostly in lowland areas). Many forest plantations of teak and Melina have been established, and this type of land-cover is common on the coastal plain.

- ASANA and The Nature Conservancy 2000

The crisis of the agricultural sector is a total crisis.

- Ulises Blanco, Cost Rican peasant union leader, June 1988
(quoted in Edelman 1999, 25)

3.1 Geography and Local Environment

This chapter contextualizes the case study in three sections. Section 3.1 provides a description of the geography and local environment. Section 3.2 summarizes the social history of the site, discussing human settlement and land-use. Section 3.3 reviews the main actor groups who live in the area and who are the focus of analysis in chapter five. Because this area has not been widely studied in the past, there is little in the scientific literature that provides background information. This section therefore draws on such literature as available, locally produced reports, and first-hand observation by the author.

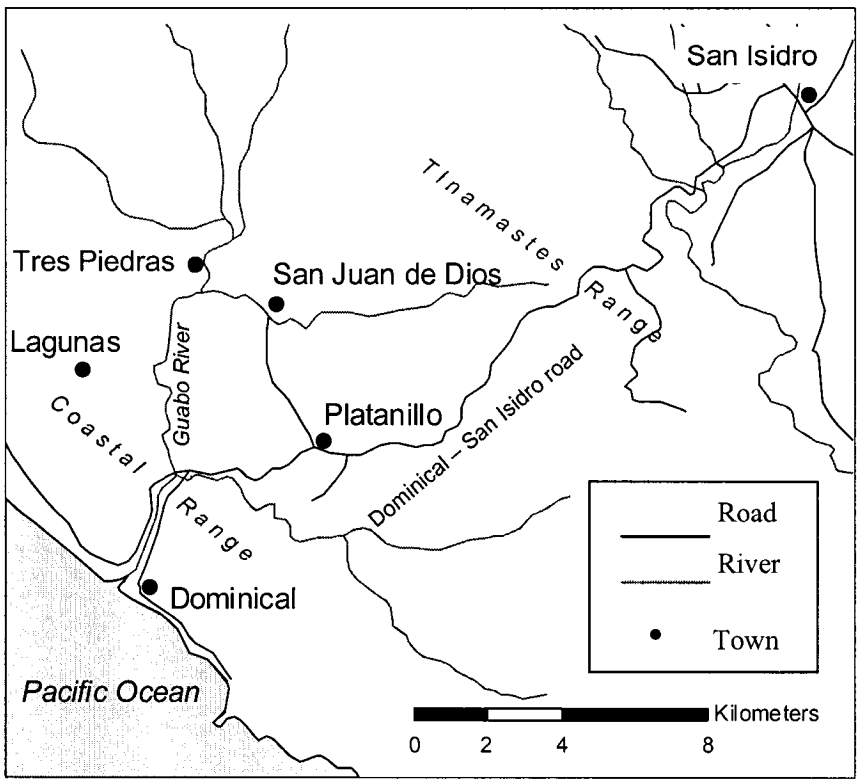


Figure 2: Guabo Valley Research Site, Costa Rica

A shown in Figure 2, the Guabo River valley is located in Southwest Costa Rica positioned between the Fila Costeña (Coastal Range) and the Fila Tinamastes (Tinamastes Range). It incorporates the Guabo River and the communities of Tres Piedras and San Juan de Dios. The closest urban centre of any significant size is San Isidro de General which lies on the Pan-American Highway. The area receives an average rainfall of 4400 mm. [6] and has temperatures ranging from 21° C. to 35.5° C. It is categorized as a Seasonal Tropical Moist Lowland Forest and has a marked dry season lasting four to five months (ASANA and The Nature Conservancy 2000, 1). Elevations range between 100 and 500 meters above sea level with slopes ranging between 10° and

[6] Average annual rainfall data was provided by ASANA, a local NGO, and recorded at Hacienda Barú starting in 1981.

50° (Carl Leopold, pers. comm., March 27, 2001). Much of this steep land has been cleared for pasture, and consequently soil erosion has become a serious environmental problem. Soils in the Southwest range from Entisols and Inceptisols on newer deposits to Alfisols, Ulitsols, and Oxisols on the older deposits (Krishnaswamy and Richter 2002: 245). A recent study conducted by a local environmental NGO and The Nature Conservancy characterizes the Guabo Valley and neighbouring areas along the coast and Coastal Range as relatively unfertile (ASANA and The Nature Conservancy 2000). The recommended land-use put forward by the report is forestry and forest conservation. Similarly, a report published by the Central American Geographic Information Project (PROCIG) mapped land-use capacity and classified the Guabo Valley and immediate surrounding areas as having strict limitations on agricultural cultivation. The report finds that the area is predominantly suited for forestry or conservation[7] (PROCIG 2001).

Forest-cover in the region is fragmented with forest patches found most often on the steepest slopes or ravines where clearing has been impossible or along streams. In many cases these patches are left intact intentionally by farmers. They comprise old-growth primary forest remnants, secondary forests on formally abandoned pastures and agricultural fields, riparian forest strips, timber plantations, isolated shade trees in pastures or fields, nitrogen-fixing tree species left in agricultural fields, fruit trees, and living fences (Schelhas et al. 1997; ASANA and The Nature Conservancy 2000). The

[7] Four land-use capacity classes lie in this area. Class 4 designates land with limitations on agriculture. Semi-permanent or permanent vegetation-coverage is recommended. Any cultivation must be managed under strict soil and water conservation schemes due to the presence of steep terrain, high soil erosion, moderate drainage, fine soils, and a seasonal climate with periods of heavy precipitation and periods of very dry weather. Classes 6 and 7 designate areas recommended for forestry use only with increasing limitations respectively. Finally, class 8 categorizes areas recommended solely for forest restoration and protection (PROCIG 2001).

distance from a stream that the farmer can cut is dictated by Costa Rican law and depends on the inclination of the slope. On flat land, the regulations for leaving vegetation cover can be as little as 10 meters on each side of a stream. On steeper slopes, it can be as much as 50 meters (Jack Ewing, pers. comm., Jan 9, 2003). Larger fragments of primary and secondary forest are found on fallowed or abandoned farmland and on private protected properties.

Several large tree plantations exist in the lowlands near the coastal town of Dominical and stretching up the western slopes of the Coastal Range. These are private plantations of predominantly teak (*Tectona grandis*), an exotic species, and pochote (*Bombacopis quinata*) which is a tree indigenous to the drier region in the north of the country and not well suited to this wetter southern zone. Top quality Teak is cultivated and sells for approximately $US 2.00 per board foot in the coastal town of Dominical, fetching higher prices in the regional urban centre of San Isidro (Jack Ewing, pers. comm. January 9, 2003; Arno Finkeldey, pers. comm. July 4, 2001). Teak is a quite profitable long-term investment in the area, especially given recent declines in prices for both cattle and traditional crops such as maize, beans and rice. A number of cattle ranchers in the coastal communities of Hatillo, Matapalo and Las Nubes are converting their pastures to Teak plantations (Jack Ewing, pers. comm. January 9, 2003). While these plantations increase the percentage of tree cover in the region, they do not support local biodiversity and, in many cases, accelerate soil erosion on steep slopes (PROCIG 2001). A local environmental NGO is interested in promoting increased planting and marketing of native hardwoods. The group argues that this is preferable to planting exotic species, such as teak, and is more environmentally sustainable than cattle ranching.

The Guabo River Valley lies within the Paso de la Danta Biological Corridor (CBPD) which was established through the efforts of *La Asociación de Amigos de la Naturaleza del Pacífico Central y Sur* (ASANA), a local NGO. The CBPD covers approximately 800 km^2 and was incorporated into the Mesoamerican Biological Corridor in 1999 (ASANA and The Nature Conservancy 2000). Lying within the three national conservation areas of Osa (ACOSA), Amistad Pacífico (ACLAP) and Pacífico Central (ACOPAC), the CBPD is comprised of National parks, formally recognized private wildlife refuges, and informally protected privately owned land (ibid.). Smaller forest patches on local farms are also incorporated in the corridor through registration in national and international funded payment for ecological services programs. This area is considered one of the zones with the highest biodiversity in Central America and lies in a transition zone between the dry tropical forest to the northeast and the humid lowland tropical rainforests of the Osa Peninsula to the southwest (Skutch 1971; ASANA and The Nature Conservancy 2000). This biological richness and the presence of a wide range of endangered or endemic fauna have attracted environmental NGOs to the area.

3.2 Human Settlement and Land-use

In order to have a more complete understanding of land-use practices today, it is important to provide a brief historical context for the study area. First, a brief history of regional colonization patterns is given. No information is written specifically on the Guabo Valley because of its peripheral nature. But the pattern of colonization and agricultural clearing follows the regional pattern, occurring 10 to 20 years later according

to local residents. Emigration by colonists out of Costa Rica's Central Valley in search of new and more productive land started as early as 1850 (Sandner 1962). When noted naturalist and ornithologist Alexander Skutch came to Costa Rica, and traveled to the Southwest of the country in the mid1930s, most of the country's approximately 1 million inhabitants still lived in the Central Valley and along the major rail lines between San Jose and the ports of Puntarenas and Limón (Skutch 1971). At this time, about two thirds of the country were still covered in forest with small agricultural clearings connected by foot and horse trails (Skutch 1971). In 1936, construction of the Interamerican highway commenced in order to connect the town of Cartago in the Central Valley with the southern regional urban centre of San Isidro. This road accelerated the number of settlers moving into the southern portions of the country.

Settlers cleared land by cutting down the large trees and then burning the dried underbrush. Newly cleared land was fertile and yielded good crops. Maize, beans, rice, sugar cane, plantains, and cassava were the most common crops cultivated (Skutch 1971). Surpluses of beans and rice occasionally were sold to towns in the interior, however high transportation costs meant that the only reliable cash crop was tobacco (ibid.). Traditionally, colonists practiced the traditional hillside agroforestry *frijol tapado* system in which beans are planted in one to two-year old secondary forest vegetation that is slashed and mulched over the broadcast seeds (Rosemeyer et al. 1999). This system of shifting cultivation is still employed today locally by a limited number of small-scale farmers. Over half of the cleared areas previously planted with crops were placed in fallow to allow the land to rejuvenate. As a result, the forested landscape was

transformed into a mosaic of primary forest, secondary forest, scrub, pasture, and cultivated hillsides.

Between the 1940s and 1950s, the wave of colonists had moved into the southern and western reaches of the Valle del General and were pushing southeast from the town of San Isidro by foot and horseback into the forests at the base of the Talamanca and Coastal ranges (Sandner 1962) and into remote frontier areas such as the Guabo Valley. This migration was encouraged by the government of Costa Rica in an attempt to relieve population pressure in the Central Valley and promote coffee production at higher elevations (Sick 1998). Export revenues from coffee played a central role in the Costa Rican economy, and the government provided new colonists with access to land, invested in local infrastructure, and constructed a coffee-processing factory.

3.3 Local Actors

Local actors can be divided into three broad categories: local farmers practicing a mixed milk-beef husbandry combined with very small-scale agricultural production, new expatriate residents, and environmental NGOs.

3.3.1 Local Farmers

Within the local farmer category, a further distinction can be made between those *campesinos* who reside locally, and richer absentee landowners. Communities in the valley consist of widely dispersed houses with a very limited degree of community governance. San Juan de Dios, Tres Piedras, and Tierras Morenas are the 3 main valley

communities as shown in the map in Figure 2. Infrastructure is minimal, and there are no paved roads. The only phone available is located at the store in San Juan. Bus service to San Isidro connects only twice a week to San Juan, and few area residents own private vehicles. While San Juan and Tierras Morenas have basic stores, some communities in the valley have none. Communities are loosely governed by a regional *Asociación de Desarrollo* (development association) which holds a public meeting once or twice a year (Jose Maria, pers. comm., February 27, 2002). The *Junta Directiva* (or head committee) meets more often and consists of seven elected officials. These associations are loosely territorially fixed, with several communities lying within their region of authority. Residents of a community are represented in the association at the household level through the membership of an individual household member and his or her attendance at the general assembly. If a household that lies outside the designated area under the authority of an *Asociación,* they can simply join by attending the annual meeting. Other sub-committees form to focus on particular projects. Usually there are committees for the church, school, community social plaza, road maintenance, and aqueduct system (Jose Maria, pers. comm., February 27, 2002).

Due to the varied terrain and steep hillsides, large-scale intensive agricultural production is impossible in areas such as the Guabo Valley. Rice, maize, beans, plantains, and pejibaye (a type of palm) are the most common crops cultivated locally (Sick 1998; ASANA and The Nature Conservancy 2000). Families often have a small garden around the house with fruit trees and a very limited range of vegetables and tubers for household consumption. Households often keep some small stock such as chickens and pigs. Many families also own a mixed milk and beef cattle herd. Farmers with larger herds and more

resources transport and sell live animals in the weekly cattle *feria* (market) in San Isidro. Several families also make cheese for sale locally. In the more elevated areas, coffee is cultivated for the market. However, these areas lie at coffee's lowest elevational limit, and the quality of the crop is relatively poor. In the past, families sold surpluses of their crops in the regional market in San Isidro. In contrast now, many households can no longer make a living from agriculture due to reduced soil fertility, an increase in the number of pest and fungus outbreaks, changing rain patterns, poor market prices, and decreased government subsidies. These changes are discussed in greater detail in section 5.2.1.

3.3.2 Expatriate Residents

Over the past 10 to 15 years, there has been a steady influx of foreigners buying land in the region and engaging in land speculation and real estate development. Expatriates come predominately from the United States and Canada, however a number of Europeans and South Americans also have purchased land. The influx of foreigners also has created new employment opportunities for local *campesinos* in the tourism industry, housing construction, and property management. Tourism is Costa Rica's primary industry, and the Pacific Coast has become a very popular destination. Affordable land prices make the Southwest Pacific Coast attractive for foreigners interested in buying a second residence in Costa Rica. As a result of the boom in real estate, land prices have started to rise. How these expatriates influence local patterns of land-use, land-cover, and livelihoods will be discussed in greater detail in Chapter five in section 5.2.2.

3.3.3 Environmental NGOs

Expatriates are not the only external actors moving into and transforming the local landscape. Two environmental NGOs have been established by groups interested in conserving local forest and marine biodiversity. The Tropical Forestry Initiative (TFI) is a non-profit organization formed by a group of North Americans from mixed academic and professional backgrounds. Established in 1992, TFI has been working to recover abandoned pasture on their 145 ha farm and, in the process, use plantations of native species in a catalytic technique to "jump-start" forest succession (Leopold et al. 2001). Like much of the surrounding area, the land was initially deforested and cleared in the 1950s for cattle pasture with clearing continuing through the 1960s and 1970s. Elevations on the property range from 100m at the Guabo River and community of Tres Piedras to 300m at the other end of the property which lies in the community of Lagunas on the Coastal Range. Primary forest comprises approximately 30 ha (20 percent) of the property. The rest of the property lies in recently abandoned grass pasture, partial scrub growth, and secondary forest (TFI 2000). In addition, the organization aims to promote reforestation by demonstrating the economic potential of planting and selectively harvesting mixed stands of native hardwoods (Arno Finkeldy, pers. comm., July 4, 2001).

Over the course of several years, TFI has established a large nursery where they raise over 40 species of native hardwoods (Leopold et al. 2001). They have reforested large sections of the TFI property and engage in ecological monitoring both on the property and in other restoration sites including a nearby coastal wetland site. Growth rates for planted trees range from 1.2 to 3.1 meters in height per year, with some species, such as

Schizolobium parahybum, *Terminalia amazonia* and self-seeded *Vochysia ferruginea*, exceeding 10 cm dbh in five years (Leopold et al 2001, 247 – 248). In one extreme case, self-seeded *Vochysia* reached 18 meters in eight years (Arno Finkeldey, pers. comm. March 27, 2001). Within five years of planting, most reforested plots achieved crown closure (Leopold et al. 2001). Recovery of the site is monitored using a series of permanent plots (20m x 20 m) established in representative areas and modelled after the Man and the Biosphere Biodiversity Program (Leopold et al. 2001). The group conducts faunal censuses to monitor biodiversity change, focusing recently on amphibians and reptiles. Bird surveys have identified 119 species in the reforested sites and shown that a number of birds, such as scarlet macaws, are returning as a result of increased forest-cover throughout the area (TFI 2000). In addition, due to tree planting, a nearby stream that used to run dry during summer months now flows for 12 months. TFI points to these micro-scale changes as indications of the ecological benefits associated with their forest restoration activities. Environmental education serves as another objective for the group. Several of the TFI board members are affiliated with universities in the United States, and they use the project as a base for annual tropical ecology courses.

La Asociación de Amigos de la Naturaleza del Pacífico Central y Sur (ASANA) is the second environmental NGO active in the area and is based near the coastal town of Dominical. Unlike TFI, which was initiated by a group of foreigners and continues to be administered externally in the United States, ASANA is a local Costa Rican initiative. Founded in 1987 by a group of Dominical residents concerned by high rates of deforestation and increased poaching, ASANA played a central role in the establishment of the Paso de la Danta Biological Corridor. The CBPD now serves as a main focal point

for ASANA. Conservation objectives for the corridor are to form links between regional protected areas, to protect local threatened plant and animal species, protect regional watersheds, and help reduce high levels of soil erosion that threaten river and mangrove habitats as well as local coral reefs (ASANA and The Nature Conservancy 2000). ASANA is headquartered at Hacienda Barú, a 330 ha former cattle ranch that is now registered in Costa Rica's National Private Wildlife Refuge Program. The NGO runs numerous community conservation and environmental education programs which have been incorporated into the biological corridor.

3.4 Conclusion

The objective of this chapter is to present the geographical and historical context of the study site and briefly introduce the constellation of actors living in the area. Important to recognize is the relatively recent arrival of these actors to the region and to the Guabo Valley. The area was a forest frontier as late as the 1950s, and the subsequent land clearing and human settlement have had significant ecological impacts. Yet it is this deforestation that has attracted new actors such as environmental NGOs. Actors in the Guabo Valley do not live and make land-use decisions in isolation from each other. Professional collaborations exist between TFI and ASANA, and other types of relationships are forged between the three different actor groups. The nature of these networks, and their implications for local forests, are discussed in more detail in chapters five and six. Now, before turning to examine these issues, the methodology employed for this study is reviewed in chapter four.

CHAPTER 4: METHODOLOGY

In order to assess whether a forest transition is occurring and what factors might drive the turnaround, fieldwork was undertaken in two valley communities, San Juan de Dios and Tres Piedras depicted in Figure 2. For the most part, a qualitative approach was taken to the research which drew on ethnographic, survey, and participatory methods. These approaches suited the research because they help uncover complexities at a very local scale, revealing details that would be lost in a remote sensing or modeling analysis. In addition, the approach chosen was suited to uncovering the interlinkages that exist between actors and that help drive land-cover change. In addition, since very little descriptive information previously existed on the region in the scientific literature, a remote sensing study would have had little contextual substance. Most of the data presented in Chapter five were collected using key informant interviews, as outlined in section 4.2.1, a household census, and a semi-structured survey, both of which are outlined in section 4.2.2. In order to first visualize patterns of forest-cover and then support oral testimonies of land-cover change provided by informants, aerial photographs were used. These photographs are discussed in sections 4.2.4 and 4.3 and information on the imaging analysis is provided.

4.1 Site Selection

The Guabo River Valley in Southwest Costa Rica is an area where small-scale producers are adjusting to macroeconomic changes in the agricultural sector and local-level changes in land ownership. In addition, the author had previous contact with TFI, visiting initially in 1993 and following the progression of the project over the years. When the author

returned in 2001 to do fieldwork, TFI was in its ninth year of working to reforest one of the largest properties in the valley. Moreover, the NGO had formed institutional linkages with another NGO, and with the Paso de la Danta Biological Corridor project. Therefore, the presence of these two NGOs collaborating within a biological corridor offered the potential of providing an interesting micro-scale case study of how a turnaround in forest-cover could be driven in part from outside intervention. The proximity to the coastal town of Dominical, and to the predominately expatriate community of Lagunas, provided the opportunity to investigate how the arrival of new residents and the development of a flourishing real estate market could change local land-use.

4.2 Data Gathered and Research Methods

Data were gathered during two field trips. The author spent June through August 2001 living in the community of Tres Piedras. A second trip was made in February and March 2002 for the purpose of conducting additional interviews and accompanying community members to a capacity building artisan workshop. Throughout field research, the author engaged in participant observation and kept a field journal to record informal conversations and observations. Fieldwork was divided into several phases, drawing upon multiple methods. The first three weeks the author spent familiarizing herself with valley communities and with the NGO projects. In addition, the author assisted with work in the TFI tree nursery, and accompanied project staff when they delivered trees to new area residents reforesting recently purchased properties. In the second phase of research, two different semi-structured surveys were conducted with area households.

The first was a household census, and the second was a survey focused on household livelihood diversification. A third and final phase of the research involved data analysis.

4.2.1 Key Informant Interviews

In-depth interviews (Appendix 1) were conducted with key informants in both NGOs. These interviews were conducted in person and were aimed at collecting detailed information through the use of an interview guide with a list of open-ended questions and key issues (Lofland and Lofland 1995). These key informant interviews were conducted throughout both research trips with *campesinos*, real estate agents, and expatriate residents. During the second research trip, interviews were conducted with seven absentee landowners that do not live locally but maintain farms and visit on a regular basis. Information was also collected from neighbours on an additional six landowners who were unavailable for interviews or have moved away permanently from the valley yet retained local landholdings.

4.2.2 Semi-Structured Household Census and Livelihood Diversification Survey

The second phase of field research involved interviewing households using semi-structured questionnaires. The questionnaire for the household census was extensive because very little background data were available for the local area (Appendix 2). It was designed to gather descriptive information about land holdings, land-use, use of on-farm forest resources, household information, perceptions about environmental change, and interaction with environmental groups. Conversations were allowed to carry beyond the

specific questions, enabling the collection of additional information on land-use and local perceptions of environmental change. Because the study area has a small population of highly dispersed households, the decision was taken to census all households in two communities: San Juan de Dios and Tres Piedras. As discussed in chapter three, the communities are widely dispersed, with only a few houses concentrated in what could loosely be called a 'town.' The community 'centres' were approximately three kilometres apart, while the households stretched over an area approximately ten kilometres long. All interviews were conducted in Spanish; however one assistant spoke English and helped with some translation when necessary. A total of 45 households were surveyed, representing all households residing permanently in the sample area. Of these, 20 households were interviewed in San Juan de Dios, and 25 in Tres Piedras.

Houses were visited during the afternoon when residents would be finished with their daily work. Generally, whichever head of household was at home at the time was chosen to interview, regardless of their gender. In a few cases, other family members provided additional information "from the sidelines." A total of 29 men and 16 women were interviewed. The average age of Respondents was 43.66. Number of years of formal education averaged 4.5. Fewer women are represented in this census because they often felt too shy to feel comfortable doing the interview. Specifically, the younger wives would claim to know few details about the farm and would ask the author to come back another day in order to talk to their husbands. This gender split was considered to be acceptable because it was not the intent of the study to force people to participate in the census or livelihood survey.

During the second trip, a semi-structured questionnaire was designed to gather specific information on household livelihood diversification (Appendix 3). Due to the time constraints of this second research trip, a field assistant administered this survey. Over a week-long period, the assistant interviewed a total of 38 households in both Tres Piedras and San Juan de Dios. These household represented *all* households present in the valley and available to interview during the week.

4.2.3 Participatory Techniques

Participatory techniques were employed from time to time during both research trips. During the first trip, the author collaborated with two North Americans who worked for TFI. Together, we designed and conducted a local workshop in which both NGOs were invited to present their projects to the communities. The biological corridor was presented and discussed, and people received information on how they could register forested areas of their farms in ecological service payment programs. A follow-up meeting occurred a week later in order to discuss the creation of a women's artisan group and how a partnership might be created with the NGOs. During the second research trip, the author accompanied two TFI staff and nine members of the artisan group on a three-day workshop with a successful women's artisan co-operative located near the Monteverde Cloud Forest Biological Reserve. Upon return to Tres Piedras, the author attended the group's weekly meetings and helped arrange a small workshop on group organization and accounting. These workshops are not described in great detail in the discussion and analysis section of the thesis but help inform section 5.2.3. Participant observation also served as a valuable way of engaging with the local community outside

the more formal interview setting. This added interaction between researcher and informants generated additional opportunities to discuss people's perceptions of forest-cover, land-use, and the regional economy.

4.2.4 Aerial Photography

Local environmental groups described the area as suffering from extensive erosion and, in many cases, being severely degraded. However, many parts of the valley seemed quite forested, and household census results indicated that some local people believed forest-cover to be expanding. It therefore was important to get a sense of the presence and patterns of forest patches in order to better engage with local informants in meaningful discussions about deforestation and what seemed to be a new trend of forest regrowth. This was accomplished by flying over the study region in an ultralight plane and taking photographs of the landscape below. These images were labelled with the names of the communities and specific farms visible in each photograph.

In order to get a sense of changes in forest cover over time, aerial photos were obtained from the Instituto Geográfico Nacional de Costa Rica (IGNCR) for 1973, 1992, and 1997. These images varied in scale and were 1:50.000 for 1973, 1:60.000 for 1992, and 1:40.000 for 1997. The analysis of these air photos represents the third phase of the research.

4.3 Analysis

Results are discussed by theme in Chapter five, drawing on the interviews, participant observation, and aerial photograph analysis as appropriate. Responses to the household census were recorded using a small tape recorder. Later, responses to certain key questions about land-use and forest-cover were transcribed to capture the respondents' detailed perceptions and testimonies on changes in the rural economy and the associated effects on livelihoods and the environment. Responses to the livelihood diversification survey, as well as key informant interviews, were written by hand. Data from both the household census and livelihoods survey were also organized into an excel database. Appearing in chapter five, these results are either presented as descriptive statistics or as full quotations. When specific comments from key informant interviews are quoted in the thesis, the real name of the informant is referenced. However, quotations from the household census and livelihood survey are referenced by household interview number or a pseudonym respectively. Both the census and survey were voluntary and anonymous, designed as such with the hope that informants would be more willing to participate in the study and be more comfortable if they knew that their names would not be recorded.

Change in forest-cover over a twenty-five year period was examined using the aerial photographs obtained from the IGNCR. Because each photograph was at a different scale, the first step of analysis was to bring each image to the same scale and compensate for distortion. The 1992 image was selected for the base image and the other two photographs registered to it. This was done by identifying common landmarks on the base photo, placing a tag for each, and creating an eight parameter (translation, rotation,

scaling, shear, each in x, y dimension) transform from these tag points. Once the images were matched, a common area was delineated on each image. Within this area, forest was segmented into forest and non-forest by means of manual tracing combined with image thresholds. This segmenting procedure used MNI Display, a brain-imaging software tool developed at the McConnell Brain Imaging Centre of the Montreal Neurological Institute (http://www.bic.mni.mcgill.ca/software).[8] Ratios of forest to non-forest were then calculated in order to determine change in forest-cover over the time period. Results from this imagery analysis are presented in section 5.1.1.

The methods chosen were suitable for this research because of its very nature as a case study. Case studies demand in-depth exploration usually at the local scale, and the use of semi-structured questionnaires enabled the collection of such detailed information. The advantage of using semi-structured questionnaires for both the census and the livelihoods survey, as opposed to structured questionnaires, was that the chosen method offered respondents the opportunity to add additional information if they desired. This was essential given the lack of available published information on the Guabo Valley and immediate surrounding areas. The addition of aerial photograph analysis provides an historical dimension to the study, a perspective essential in the move away from observing forest-cover at a single point in time and towards a fuller appreciation of forest-cover dynamics.

[8] In brain imaging, this segmenting technique is used to delineate certain structures of the brain (see Tomaiuolo et al. 1999).

CHAPTER 5: FOREST TRANSITION CASE STUDY: ANALYSIS AND DISCUSSION

Antes aquí la mayoría era puro pasto y ahora no. Ahora hay más bosque porque mucha gente ha vendido propiedades a Norte Americanos.
Before, most of this area was all pasture and now it is not. Now, there is more forest because many people have sold properties to North Americans.
- household interview # 32, Tres Piedras, August 2001

[Hay] mucho más briñon ahora que antes. No hay gente para que trabajar y no hay animales.
There is much more scrub now then before. There is no one to work [the land] and no livestock.
- "Marie," Tres Piedras, June 2001

The whole country is for sale.
- real estate agent, Dominical, July 2001

The following chapter explores whether a forest transition is occurring in the Guabo Valley and, if so, what factors are responsible for this turnaround. Section 5.1 presents evidence of forest-cover change from analysis of aerial photographs and from testimonies of change given by local informants. Then, the drivers behind change are documented in more detail in section 5.2. This section draws on statements provided by local informants in both the household census and livelihood diversification survey, from key informant interviews, and from informal discussions with valley residents. The discussion on drivers is further subdivided by actor group. Section 5.2.1 addresses how *campesinos* and their land-use choices affect local forest-cover. In particular, changes in farming choices are discussed in section 5.2.1.1, and rural out-migration and livelihood diversification are discussed in 5.2.1.2. Section 5.2.2 explores how in-migrating expatriates change land-use, and section 5.2.3 looks at the influence NGOs have on the local landscape.

Starting in the 1940s, when colonists first moved to the Guabo Valley, deforestation on the region's steep slopes resulted in a number of environmental changes. Clearing land for agricultural use and later for cattle led to soil erosion and diminished soil fertility. Reduced tree-cover altered the local micro-climate, and affected the local hydrology as small streams began to run dry during summer months. More recently, low prices for agricultural goods, fluctuating and unreliable markets, high cost of inputs, and the increased occurrence of insect and fungus blights created further barriers for local *campesinos* struggling to meet subsistence needs or compete with farmers elsewhere in the country that had mechanized production. These environmental and economic changes have been identified as driving forces influencing the abandonment of agriculture and ranching as primary forms of livelihood in both the literature addressing land-use and land-cover change as well as forest transition.

In June 2001, when fieldwork began, forest patches were still being cut in the Southwest part of Costa Rica. However, in the Guabo Valley and surrounding areas, patterns of scrub and secondary forest expansion seemed to be emerging. Unique to this case are several driving factors not widely addressed in the literature. A steady in-migration of expatriates began in the early 1990s and consequently affected local patterns of land-ownership and land-use. These new residents imported a powerful set of perceptions of nature and of 'proper' land-use and resource management. The establishment of two environmental NGOs and a segment of an international system of biological corridors also fostered favourable conditions for forest recovery and protection.

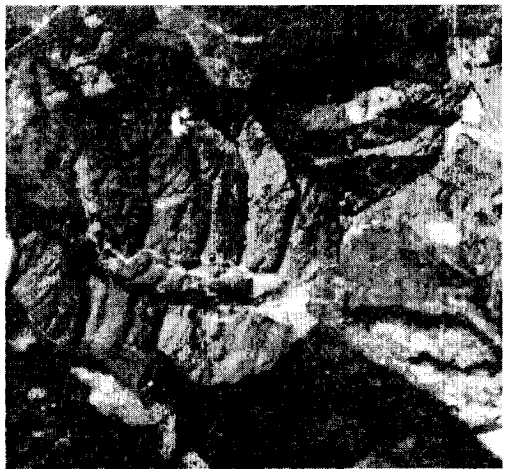
5.1 Forest Transition: the 'Evidence'

Evidence of recent forest-cover change comes from two sources. Analysis of air photos for the years 1973, 1992, and 1997 show forest-cover loss followed by forest-cover gain in certain areas of the research site. Testimonies of change made by local informants both in a household census and in livelihoods survey help confirm this transition.

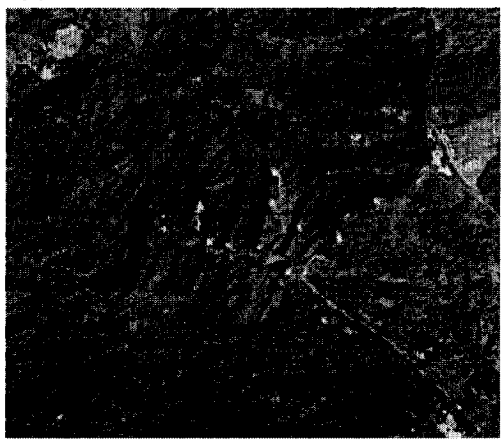
5.1.1 Aerial Photographs

When compared visually, aerial photographs confirm patterns of deforestation followed by forest-cover expansion indicative of a forest transition. Large forest patches are visible in 1973, many of which are connected by forested corridors. The 1992 photo shows a substantial decrease in forest-cover accompanied by increases in land under pasture. Patches of forest become smaller and increasingly more fragmented, and the connectors between larger blocks of forest, in many cases, disappear. Some sections of the landscape that were predominately forested in 1973 appear completely denuded and eroded in 1992. Tree-cover remains on the very steepest slopes where clearing was impossible and along most streams. This pattern of fragmented vegetation cover remains visible in the 1997 image with several notable exceptions. While the trend for 1973 and 1992 is deforestation, substantial regrowth of scrub and taller trees appears to have occurred by 1997 in the communities of Tres Piedras and Lagunas, and along the road between the communities of San Juan de Dios and Platanillo. Figure 3 illustrates this change in the community of Lagunas. This five-year time period seems too short for any significant change to occur. However, trees native to this part of Costa Rica have annual growth rates ranging from 1.2 to 3.1 meters. Some tree stands measured by biologists

working in the Guabo Valley have reached crown closure within five years (Leopold et al., 2001). While these pockets of scrub and secondary forest expansion appear across the area, they tend to be located most often in areas in where foreigners have purchased land and NGOs have become active.



1992



1997

Figure 3: Forest-Cover Change for Lagunas, 1992 and 1997 source: IGNCR

Table 1 summarizes the specific changes in vegetation-cover in the three communities of San Juan de Dios, Tres Piedras, and Lagunas. The study site is divided by community, and the presence of NGOs or North American land-owners is noted in the column on the right.

Place	Year	Description of Change	Presence of NGOs or Foreigners
San Juan de Dios	1973	• Large forest patches on either side of road from Platanillo to San Juan including parts of the Joaquin ranch • Approximately 2/3 of area owned by San Juan absentee land owners covered in large and connected forest patches • Cleared around the town	No
	1992	• Forest patches on Platanillo road thinned by 1/2 or 1/3 • Large patches in absentee land owner area mostly cleared from approx 2/3 coverage to less than 1/2 ; the steepest slopes left under vegetation cover • Further clearing around the town	No
	1997	• Increase in forest on Platanillo road until the Joaquin ranch which remains cleared with severely eroded slopes. • No change in absentee land owner area • No change around town	Yes
Tres Piedras	1973	• Large forest patch in the approximately 100 hectare triangle where the Río Caña Blanca and the Río Guabo merge; only the tip closest to the merge is cleared • Large forest patches on both sides of the Río Guabo stretching downstream • Less than 1/2 of the farm that TFI buys in 1992 is forested • Small forest fragments stretching toward the community of Tierras Morenas • Large forest patches in Tierras Morenas	No
	1992	• Forest patch between the rivers reduced by 1/2 • Reduction of forest cover downstream along the Río Guabo • Forest cleared in most areas of the TFI property over the 19 year period • Significant clearing traveling towards Tierras Morenas with patches becoming very small and fragmented • Extensive forest clearing in Tierras Morenas	Yes • A North American buys 100 ha. • TFI buys 145 ha.
	1997	• 80 ha reforested between rivers • no noteworthy change seen downstream along the Río Guabo • TFI farm reforested • No change traveling toward Tierras Morenas • No noteworthy change seen in Tierras Morenas	Yes

Lagunas	1973	• Overall area is approximately 1/2 forested • Mostly cleared along Lagunas road with forest patches becoming smaller and more fragmented closer to the bottom of the road and the intersection with the Dominical road • patches of forest stretching down slope of coastal range towards Hacienda Barú and the coast • Distinct ridges partially cleared but surrounded by continuous forest on 3 sides • Large cattle ranch in Lagunas predominantly in pasture; 3 distinct forest patches with large trees; forest cover becomes continuous sloping down toward the Río Guabo	No
	1992	• General thinning of forest • Further clearing and fragmentation of forest west of Lagunas road • Clearing on coastal slope stretching down to Hacienda Barú • Distinct ridges cleared • Cattle ranch converted into a Teak and Pochote plantation with government incentives in the 1980s (500-600 ha)	Yes
	1997	• Significant increase in scrub and secondary forest throughout area • Area west of road and down the Coastal Range almost entirely covered in vegetation • Significant reforestation on coastal slope • Distinct ridges covered in vegetation • No distinct change in vegetation-cover in Teak and Pochote plantation • New housing sites and driveways visible	Yes

Table 1: Evidence of Forest Transition in Study Area from Air Photo Analysis

As shown in the table, San Juan de Dios exhibits the least amount of forest regeneration in 1997. One reason for this is the presence of seven cattle ranches owned predominately by absentee landowners. These tend to be the largest farms, with herd sizes in some cases reaching 150 animals. The increase in forest-cover southeast of San Juan de Dios along the Platanillo road can be attributed to the purchase of land by foreigners. Similarly, two areas of significant tree-cover expansion cover farms purchased and deliberately reforested by expatriates. The most visible regrowth occurred in Lagunas, one of the most popular communities for expatriates moving to the area (Figure 3). The December

1997 aerial photograph was the latest image available from the Costa Rican National Geographic Institute. When field research was conducted in 2001, the overall trend of forest-cover expansion in Lagunas and in parts of Tres Piedras and San Juan de Dios seemed to persist. Additional foreigners had purchased land in the three communities, *campesinos* were found to be diversifying into non-farm economic activities, and an increasing number of local people had begun migrating on both a temporary and permanent basis outside the local area in search of salaried employment.

Analysis of the aerial photographs supports visual observations of forest-cover loss followed by regrowth. The three images depicted in Figure 4 show the same zoomed-in section of the larger area analysed with MNI Display. Forested areas appear as shaded areas, and non-forest appears as white. In the area depicted, certain distinctive bends along the Guabo and Caña Blanca Rivers have been identified with arrows. Part of the community of San Juan de Dios covers the right side of the images, and the community of Tres Piedras covers the left side. Ratios of forest to non-forest were calculated for the entire area segmented with MNI Display in order to determine change in forest-cover over the time period. In 1973, there was 60 percent forest-cover. This dropped to 53 percent in 1992 and jumped to 63 percent coverage by 1997. The upper right and lower left portions of the images in Figure 4 most clearly show this trend.

1973

1992

1997

Figure 4: Forest Coverage for 1973, 1992, and 1997 source: IGNCR segmented with MNI Display

The manually segmented forest areas were further analysed through a rough estimate of vegetation-cover change within young forest patches as compared to change in the older forest blocks. This was calculated based on image intensity thresholds. Young forest appears as a lighter grey tone than the darker grey of older forest with taller trees. As shown in Table 2, areas covered in younger growth steadily increases over the selected time period while older forest decreases in area from 1973 to 1992. These trends support the hypothesis that forest was cleared for agriculture and cattle ranching but later some of this cleared land either was abandoned, purposely placed in fallow, or reforested.

Year	Young Forest (% of total area)	Old Forest (% of total area)
1973	3	57
1992	20	34
1997	28	35

Table 2: Percent Forest-Cover Divided by New and Old Forest Patches

5.1.2 Testimonies of change

In the household census, *campesinos* were asked if they planted or maintained forest patches on their properties. Seventy-five percent of households reported having patches of forest on their properties while 73 percent of households reported planting trees on their farm. Some forest patches are kept because they cover slopes that are too steep to clear for pasture. Twenty respondents said they had actively planted woodlots as an investment in timber that would be harvested at some time in the future. Five respondents said they had planted trees *para conservación* (for conservation). These respondents had planted trees along streams and around springs and were generally concerned about deforestation at higher elevations that resulted in several streams running dry in the summer months. Informants also were asked what changes had, in their opinion,

occurred in the region's forests since they had lived there, and to identify the causes of these changes. Thirty-one households responded that they had noticed a change in the forest. Twenty-nine respondents provided detailed information about the nature of the changes that had occurred. Of these, 16 reported an increase in forest-cover, while 14 reported a decrease. Two respondents reported both increases and decreases had occurred. Those that reported an increase in forest-cover also described a cooling of temperatures in the immediate area and a return of wildlife. Nine households related the expansion of forest patches directly to the influx of foreigners who buy land and reforest, and 3 attributed the change to the struggling agriculture sector. Six respondents credited increases in local forest-cover to a combination of reduced timber harvest and forest clearing, increased tree planting by local residents, and a rise in environmental awareness.

In the livelihoods survey, respondents were asked specifically about land-cover on their own properties and how it had changed over the past ten years. Twenty-nine out of a total 38 informants responded to this question. Six respondents reported no change, and 8 reported an increase in *briñon* (the local word for overgrown scrub in the early stages of secondary forest succession). Increases in *briñon* were attributed to a lack of labour to clear land resulting from out-migration of *campesinos* to the United States, and to the shift towards off-farm and non-farm salaried employment which reduced labour availability on-farm and led to an increase of over-grown pastures. Respondents also attributed this greening trend to the sale of farms to foreigners who reforest the properties.

Interestingly, 15 respondents reported decreases of *briñon* on their properties over the past ten years. Of these, 13 had increased the area under pasture and 2 had placed more

land in crop production. These landholdings are in the communities of San Juan de Dios and Tres Piedras and represent areas of continued forest patch thinning visible in the 1992 and 1997 aerial photographs and outlined in Table 1. The specific reasons why some farmers choose to invest in cattle will be discussed in more detail in 5.2.1.1. Such land-use decisions seem to go against the greater regional trend of a diminishing agricultural sector accompanied by a shift to increased reforestation and the development of areas of tourism and residential land-use. However, these respondents were concentrated in the community of San Juan de Dios.

5.2 Drivers of Change

This following section addresses the set of biophysical, social, economic, and institutional drivers that shape patterns of land-use and forest-cover in the research site. The argument is made that these drivers are heavily influenced by local geography as certain powerful actors are attracted to the nearby Pacific Coast and Costal Range. Additionally, it is suggested that these drivers act in combination and result in feedbacks between different actor groups. There are three categories of drivers directing the forest transition at the study site. The rural Costa Rican economy is in a state of flux in which agricultural production and the national market for agricultural goods are struggling. Throughout the country, *campesinos* find it increasingly difficult to ensure the subsistence needs of the household and compete with the influx of internationally grown crops. Serving as the second driver of change is the influx of expatriates and associated shift in land-use towards real estate development, tourism, and reforestation. Finally, NGOs play important roles in expanding conservation territories and ultimately aiding forest

regeneration through the linkages they build with *campesinos* and with new expatriate residents.

5.2.1 Campesinos

As discussed in Chapter three, significant changes have occurred in the Costa Rican rural economy as a result of the neoliberal policies imposed with the post-debt crisis structural adjustment loans. Also influential was the Costa Rican government's push for an 'agriculture of change' which promoted export-oriented production and favoured non-traditional crops (Edelman 1999). In the study area and surrounding region, coffee and cattle remain lucrative but, like basic grains, they are in decline (ASANA and The Nature Conservancy 2000). Specifically, small coffee producers are vulnerable to the large fluctuations in global coffee prices. At the local level, small-scale farmers in the Guabo Valley, with its steep terrain and poor roads, can not compete with large-scale dairy and beef operations located in parts of Costa Rica with better infrastructure and more suitable land. According to Jack Ewing, the president of ASANA, increasing costs of labour, transportation, veterinary care and medication, and other inputs make it difficult for local Costa Rican ranchers to compete internationally with producers in other Latin American countries with lower production costs. Additionally, high land values driven by foreign buyers attracted to the Pacific Coast has made much of the local area too valuable to keep in pasture (Jack Ewing, pers. comm., June 17, 2003).

A recent study conducted by ASANA and the Nature Conservancy for the CBPD biological corridor found that a substantial shift had occurred in the local economy as

campesinos moved out of agricultural and livestock production and towards non-farm activities such as salaried employment, small business, construction, and tourism. The report also found this change in livelihoods to be coupled with an expansion of the forestry sector, an extension of forested areas under private conservation management, tourism development, and residential use (ASANA and The Nature Conservancy 2000).

5.2.1.1 Farming

Numerous socio-economic changes negatively affecting small-scale farmers are exacerbated by a number of biophysical constraints. As discussed in Chapter three, the physical geography of much of the area makes it unsuitable for agricultural land-use. Actual land-use conflicts in numerous cases with the recommended land-use categories mapped and reported by PROCIG. Specifically, these are areas under cultivation that are designated strictly for forestry or conservation purposes (PROCIG 2001). Locally, residents complain that rain patterns are no longer predictable, temperatures are rising, there are more extreme weather events, and the number of insect and fungus attacks on both crops and pasture is steadily increasing: "There has been a lot of change. There is no longer a fixed season. Fifteen years ago, there were good summers with four or five months of dry weather. Now in almost all the months in the summer it rains" (household #19, Tres Piedras, July 2001). Traditionally, *campesinos* could plan on producing two harvests a year; in March they harvested maize and rice, and in September or October they harvested maize and beans. As rain patterns and seasons become less predictable, farmers can no longer be certain that they will have a successful crop. While I was in Tres Piedras, most farmers had lost their bean harvest to rot. These lost harvests and the

inability of the farmer to plan planting negatively affect household self-sufficiency and lower rural incomes.

Reduced soil fertility caused by local deforestation patterns adds an additional burden for *campesino* households. Ninety-three percent of informants (42 individuals) interviewed in the household census discussed declines in crop production. Of these, 21 informants linked these declines to soil fertility, making comments that the soil was tired, or that the land does not give as it did in the past. The only way they can meet household consumption needs and produce a surplus for sale is to purchase expensive fertilizers, herbicides, and pesticides, which is prohibitively expensive for many families. "It costs to sell beans. It costs to sell maize. The prices are very low. It is cheaper to buy beans in the store than to grow them and try to sell them yourself" (household #7, San Juan de Dios, July 2001). Ten informants also blamed increases in pest and fungus attacks for their reduced agricultural output.

When asked what changes in agriculture had occurred, and to list the causes of these changes, informants most often blamed economic constraints of reduced market prices for agricultural goods and the withdrawal of government support. Of the 42 respondents that discussed changes in agricultural production, 19 blamed low prices and government policies. These two causes are clearly shown in the following statements:

> Our government has opted for free market trade. [Here] there are many taxes on fertilizers, herbicides, and on all that we consume and eat. Therefore, we can not work anymore. Our crops come out very expensive [as compared to those from other countries]. Therefore, the government prefers to import from other countries. The *campesino* is thrown away" (household #15, Tres Piedras, July 2001).

Another local farmer provided a similar critique of the reduced financial support and change in government policy:

> The last few governments ended the support we received from the Consejo Nacional de la Producción [the semi-autonomous Costa Rican state commodities board]. It started that they did not buy [our] rice. They buy only mechanized [rice] and modified seeds. Then it was maize – the maize that was planted here, since the beginning, since this place has been America (*desde que fue America*) has to disappear because now people are only buying genetically modified seeds … This seed does not do that well in this zone because the cob rots a lot. This is not national. The government buys beans from Argentina. There have been many changes in agriculture, and we can no longer work (Don Rigo, March 2, 2002).

This farmer summarized his frustration by adding "the farms that I have do not guarantee me anything…the last three governments have incarcerated us…we are slaves" (Don Rigo, March 2, 2002). Upset with the elimination of government subsidies and regulated prices for agricultural goods, the portrayal of the *campesino* as "thrown away" or "incarcerated" expresses a general feeling of vulnerability and marginalization due to the repeatedly conveyed by other local residents. Later in the interview, Don Rigo argued his only recourse was to leave the area travel to the USA, earn money, and return to Costa Rica to buy cattle, pay off his debts, improve the farm, and buy a car. Like other area residents who would discuss their desire to work in the USA, he does not want to emigrate permanently. Rather, Don Rigo sees temporary migration as one of his best chances to accumulate capital that he can reinvest in his farm. Like others, he feels that raising cattle is the most lucrative choice, but stressed the need to purchase a car. In an area with extremely limited bus service, residents with vehicles have an important advantage in transporting goods to the San Isidro market.

Faced with these various constraints, *campesinos* in the Guabo Valley and surrounding areas have several land-use choices. They can focus on cattle production, a decision which maintains or extends the total area under pasture, or they can make a series of choices that favour the expansion of tree-cover. These changes are shown diagrammatically in Figure 5 with four avenues of change depicted.

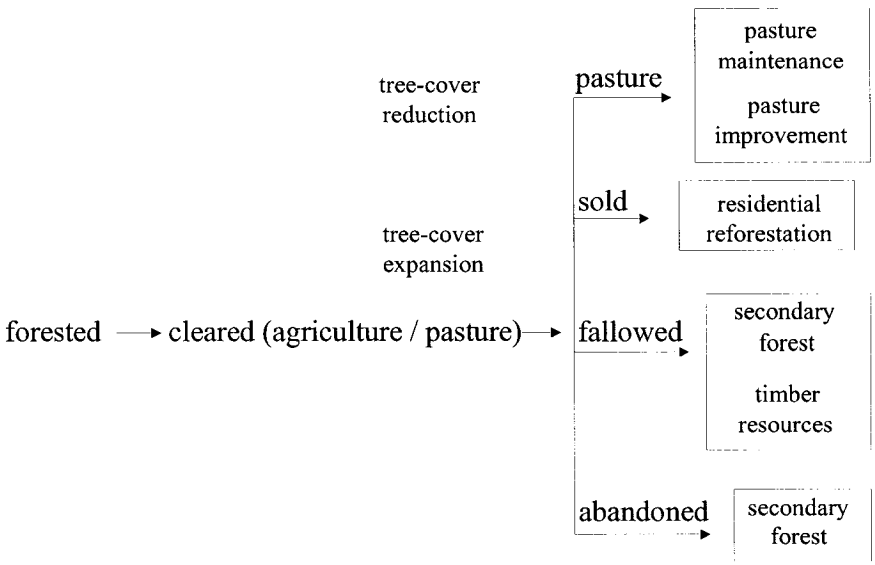


Figure 5: Land-Use Chronology

While cattle production may be in decline in some areas, it was found to be increasing in certain areas of the Guabo Valley. Cattle herds in the study area in 2001 averaged 20 head with a median of 6. Respondents with the largest herds reported owning 80 animals. Some households only had two. Land in the valley is less attractive to the majority of foreign buyers looking to invest in real estate and tourism development because the area lacks infrastructure and easy access to the beach. Therefore, local *campesinos* have fewer opportunities here to sell their land to a foreigner as compared to *campesinos* living in Lagunas, Platanillo, or coastal communities. However, there has been a modest increase

in land-sale in the valley, resulting in pockets of forest-cover expansion. This trend and its implications will be discussed in more detail in section 5.2.1.2.

The primary reason for the local expansion of cattle production is the failure of crop production due to the biophysical and socio-economic reasons already discussed. This leads to a common feeling that "land is no longer good for agriculture. People are changing and do not work in agriculture. They are changing to cattle because it is what does the best" (household #42, Tres Piedras, August 2001). But in order to make this a profitable choice, they must invest in improvements to their pastures. In both the household census and livelihood diversification interviews, informants reported increased problems with jaragua (*Hyparrhenia rufa*), a forage introduced from East Africa in the 1940s and used extensively since. Jaragua must be burned every second year in order to control slime mould that attacks the roots of the grass. However, new strict laws against burning prevent this type of pasture management. Those who could afford to make improvements, planted brizanta (*Brachiaria brizantha*) which is less vulnerable to attack, higher in protein, and is better suited to wetter conditions (Omar Mena, pers. comm., March 2, 2002; Jack Ewing, pers. comm. July 23, 2003).

If farmers choose to expand the area under pasture, their decision can have an effect on local livelihoods and, in particular, on off-farm employment opportunities. *Campesinos* that focus on raising cattle employ their neighbours as *peones* (day labourers hired on a temporary basis) to clear land and maintain pastures. However, informants complained that richer cattle men, who were most often absentee landowners, have improved the type of forage in their pastures and now hire less *peones* (household #37, August 2001). In the

past, *peones* maintained pasture by chopping and then burning. New legislation against banning the use of fire means that people often use chemical herbicides to clear scrub. As a result of decreased crop production on farms, and the shift to cattle production that requires fewer labourers, there is an overall decline in availability of local off-farm employment. Therefore while new investments in cattle ranching create the conditions for an expanse in area under pasture management in certain areas of the valley, as visible in the 1992 and 1997 aerial photographs depicted earlier in Figure 4 and detailed in Table 1, it seems possible this change can have the reverse effect in other areas where poorer farmers live: "People [here] work as *peones* on cattle ranches, [and] those people can afford to leave some of their land forested" (household #32, Tres Piedras, August 2001).

The photographs in Figure 6 and Figure 7 illustrate this difference in tree-cover between areas dominated by smallholdings and those dominated by larger cattle farms. Owners of small farms, who can not make the necessary improvements to their cattle production, have started to reduce their herds to meet household costs. According to Maricel, a local resident, there exists a downward cycle in which many *campesinos* are caught as they struggle to maintain their families on the farm. People often sell livestock to pay their daily living expenses or to pay for school fees. The reduction of the herd size results in less work for neighbours who previously were hired on the farm. Without the income from a sizable cattle herd, or from the salary earned by working for a farmer with cattle, families can enter a cycle in which they continually sell stock to meet household needs. Finally, they sell their last few animals and buy a motorcycle to travel to Lagunas or Dominical and work for a business or for a 'Gringo' (Maricel Gamboa Calvo, pers. comm. March 5, 2002). This positive feedback cycle has implications for the amount of

land in scrub or secondary forest, whether deliberately placed in fallow or simply abandoned due to lack of capital and labour resources.

Figure 6: Forest Patches on Small Farmer Landholdings

Figure 7: Land-cover on an Absentee Landowner Cattle Farm

When asked about increases in the area of their farm in *briñon*, the following respondents elaborated on the reasons behind the expansion of scrub and secondary forest-cover:

> There is more *briñon* now because I abandoned the coffee plantation. There was no one to pick the coffee ("Fernando," San Juan de Dios, June 2002).
>
> There is more *briñon* now because people are going to the US and are selling the farms to Americans ("Lucy," Tres Piedras, June 2002).
>
> There is more *briñon* because now people work outside the farm more. Therefore, they abandon a bit of the farm ("Deni," Tres Piedras, June 2002).

Through these statements, a more complex picture of land-cover emerges in which multiple factors drive agricultural land-use change. Simplistic scenarios that treat agricultural abandonment and subsequent forest regrowth solely in terms of one driving factor are not sufficient. Rather, as local informants indicate, a more heterogeneous set of factors are responsible. A shift to non-agricultural jobs, migration, land sale, and the reduction of available farm labour seem to combine to foster turnarounds in forest-cover in this case. At least four farms in the study site were found to be abandoned due to the fact that the owners were either too old to work the land, or had left the area permanently.

Forest-cover expansion on smaller farms whose owners do not have the necessary resources to expand their cattle production was found to sometimes be an intentional land-use change decision. For instance, household interviews indicate that *campesinos* actively plant areas as wood lots as an investment for future harvest. This is especially true for families that have started to diversify into other economic activities and have "idle" land (Figure 5). *Campesinos* also place parts of the farm into fallow to make the property attractive to foreign buyers (ASANA and The Nature Conservancy 2000; Jack Ewing, pers. comm. June 17, 2003).

5.2.1.2 Rural Out-Migration and Livelihood Diversification

Combined, these socio-economic and biophysical constraints on farming serve as a primary factor driving rural out-migration. However, out-migration in this region of Costa Rica is a multi-faceted phenomenon. In Tres Piedras and San Juan de Dios, households in distress choose between three different paths. The first option is to stay on the farm but diversify the livelihood portfolio into more non-farm economic activities. The second choice families can make is to send one or two family members away in order for them to send back remittances. Finally, some households find it too difficult to maintain the farm and opt to sell and move permanently from the area. Migrating out of the valley and selling the family farm and inheritance is a risk. Similarly, sending a member of the household to the United States as an illegal migrant is both risky and initially extremely expensive. For these reasons, many families continue to live locally but must find some way to compensate for declining agricultural incomes. Furthermore, for many families the farm is their only means of subsistence and the children's

inheritance (ASANA and The Nature Conservancy 2000; household informants, pers. comm. 2001, 2002).

In the livelihood diversification survey, informants were asked about off-farm and non-farm employment. Of the 38 households interviewed in Tres Piedras and San Juan de Dios in June 2002, 31 had on average 2.13 family members with salaried off-farm or non-farm jobs. In one case, 8 members of the household worked outside the family farm. Fifteen households reported members of the family working off-farm as *peones*. Other salaried employment includes the management of expatriate properties, road and house construction, retail, domestic service, and employment at the lumber mill in Barú. In the survey, respondents were asked to list the number of women employed. Women worked in 14 households and were primarily involved in domestic service, retail, a local artisan group, and worked as teachers or cooks in local schools. In one case, a woman was employed by the Tropical Forestry Initiative to assist in running the NGO's tree nursery and on-site daily operations.

The family employed by TFI serves as a unique case. They work full-time for the NGO and watch over another property owned by an expatriate. Two sons traveled to the United States, one to study and the other to work. The third son has his own construction business and hires neighbours on a temporary basis as labour. The family sold land on several occasions but reinvested in a property in the beach town of Matapalo. Their future aim is to rent cabins on the property to tourists. No other family in the valley has been able to diversify so widely into non-farm activities, and their close association to the

NGO is the main reason for their success. Yet the fact that one family has benefited the most by the presence of the NGO has led many neighbours to become resentful.

Survey respondents were asked to comment on how employment had changed in the last 15 years. Of the 38 households interviewed, 20 responded to a question about change in on-farm employment. Eight-five percent of these respondents currently work less on-farm than they did the past, suggesting that these families must be diversifying the household portfolio to include income from other sources. Sixty-eight percent of respondents reported that fifteen years ago, in the mid 1980s, off-farm or non-farm employment opportunities were very limited. When asked about current opportunities in the off-farm and in the non-farm sectors, 30 percent of the respondents felt that few existed, and 65 percent felt that more opportunities existed. Five percent reported no change (N = 37 for both questions regarding off-farm and non-farm employment). Eighty-four percent of all informants linked an increase in non-farm employment opportunities directly to the influx of foreigners and the development of the tourism industry. Eleven respondents specified that these new opportunities were not distributed equally, and only those living closest to foreigners were able to find jobs. Consequently, a geography of livelihood diversification emerges that mirrors the pattern of expatriate land-ownership and real estate development. As *campesinos* start to diversify their livelihoods, they devote less time and labour to farming resulting in the expansion of areas under scrub, brush, and secondary forest on their lands. Eventually, this increase in forest-cover on farms makes the properties more attractive for foreign buyers.

A growing number of households send the head of the household or one of the eldest sons illegally to the United States of America. Of the 38 households interviewed in June 2002, 10 had family members working in the USA. During the research trip in Febuary and March of 2002, 5 men left from Tres Piedras and San Juan de Dios for the USA within a two-week period. This is a substantial number of people given that only 45 families reside within the two communities. However, this choice has a significant cost and risk, and is not an option for the poorest households. In addition, the out-migration of labour affects the capacity of the household to sustain on-farm production and ultimately influences the amount of land placed in fallow (Figure 5). However, some families feel like they have no other choice:

> Walter had to go. There is no work here and he does not own a car or motorcycle to travel to Lagunas to work for Gringos. He sold his horse to pay for food (Maricel Gamboa Calvo, Tres Piedras, March 5, 2002).
>
> It is very hard to make a living with small properties. It is better to sell to foreigners. There is no government help. It used to be rare for people to go to the US. Now there are many people from here in the US...There are some people who live off of the money sent by family (household # 15, Tres Piedras, July 2001).

Unlike selling land and diversifying into non-agricultural livelihoods, having one family member successfully send remittances enables the family to reinvest in the farm. If this decision is successful, the family will likely try to invest in cattle or more lucrative crops.

Some households, however, do choose to move permanently from the area. One informant estimated that in the past 10 years, at least 10 families have left San Juan de Dios. The man continued that if the immediate surrounding communities of Magnolia, La Reina, and La Perla were included, at least 35 families left during this period. While an estimate, this number indicates a substantial out-migration of people given the overall

small population of the valley and surrounding hillsides. When asked why people wanted to leave, the informant responded that local employment opportunities were very limited. He followed this by saying that only landowners with large cattle farms would want to stay (Don Paco, pers. comm. San Juan de Dios, Feb 26, 2002). *Campesinos* who want to leave will take advantage of the higher land prices and sell. They move to areas where land is cheaper, or the older residents, who no longer are able to work the farm as before, "retire" to the urban centers (Jack Ewing, pers. comm. May17, 2002). This trend also seems to extend to owners of large cattle ranchers, the majority of whom are part of the older generation: "It is difficult to work on large farms with cattle, and for this reason older people like me are thinking of selling the farms" (Omar Mena, pers. comm. March 2, 2002).

During the time of the study (2001- 2002), 18 different properties were for sale or had recently sold either to Costa Ricans or to foreigners as shown in Table 3.[9] Four of these were abandoned farms and covered in scrub and secondary forest, the owners having moved away to either San Isidro or to the capital, San Jose. In one case, the owner of a small farm exchanged it for another outside the valley near San Isidro where he now works.

[9] Total areas for each category in Table 3 are best approximates. In cases where the owner had moved permanently and neither he/she nor close relatives were available to interview, neighbours were asked to provide estimates for the property sizes.

Status	Number of Properties	Approximate Area (hectares)
Farms for Sale	7	378.8
Abandoned Farms for Sale	4	50.4
Property exchanged for another outside the valley	1	8.4
Farms Sold	4	181
Lot and House Sold	2 (but remain uninhabited)	1

Table 3: Guabo Valley Properties For Sale or Sold

The recent report conducted for the Paso de la Danta Biological Corridor (CBPD) links out-migration to the new real estate development boom. The fact that *campesinos* can sell their land at relatively high prices creates a disincentive to continue to work in agriculture. There is a process of deliberate land 'abandonment' throughout the biological corridor aimed at making properties more attractive to foreigners. This, the report concludes, facilitates biodiversity conservation but concurrently leads to the demise of the small farmer way of life and to the disappearance of community and agricultural organizations (ASANA and The Nature Conservancy 2000).

5.2.2 Influx of Expatriates

Question: Since you remember, have you noted any changes in the forest?

Answer: "There is less forest. But in a few places, farmers have sold and secondary forest is forming on these properties. The causes of this change is land sale to foreigners...because of what we were talking about earlier – because of difficulties with selling the traditional products (crops) of the area...because there is no market, and therefore we do not know what to do, how to live, how to maintain the family. It is difficult. Therefore, people sell the land."

- (Household #8, San Juan de Dios, July 2001).

In the early 1990s, two North Americans purchased large farms and proceeded to subdivide the properties. A booming real estate market developed, launching a second

wave of land speculation and subdivision, and drastically altering communities and patterns of landownership in certain areas. Over the past 10 years, 32 foreigners have purchased land in Lagunas , 30 in Platanillo, and an additional 14 along the road between Platanillo and San Juan de Dios in the Guabo Valley (South Coast Realty, pers. comm. May 27, 2003). This transition is most evident in communities on the Coastal Range, such as Lagunas, that have aesthetic views of the coast and mountains, and along the coast where land is zoned for hotel, bar, and restaurant development. Properties tend to be smaller, generally 10 acres (4.0 ha) or less, and subdivision more prevalent in these high-value areas. Many buyers come looking for a five-year investment. They buy a farm, put in road access, electricity, and water, and several housing sites. This basic infrastructure greatly increases land value, and the investor can turn a profit through subdivision (South Coast Realty, pers. comm. March 1, 2002). The second wave of buyers tends to build homes for personal use. Some move permanently to Costa Rica, and others use the house for part of the year and rent to tourists for the other months. In several cases, this second wave has further subdivided properties. The president of ASANA estimated 50 percent of landowners in the biological corridor are non-Costa Ricans, and that this percentage of expatriates continually increases (Jack Ewing, pers. comm. May 17, 2002). South Coast Realty sells on average 10 to 12 properties through their office each year (South Coast Realty, pers. comm. May 27, 2003), and they are one of 7 realtors with offices in Dominical. Other companies, such as Century 21, have started constructing planned gated communities. In all cases, the change in land ownership combined with a shift from agricultural production to recreational land-use, drastically alters residential patterns, local livelihoods, and forest-cover. Figure 8 illustrates the 'new' residential landscape accompanied by emerging secondary forest

vegetation. Additional evidence of this change in landownership, and the resulting implications for local land-cover is found in the CBPD report. Primary economic activities for Barú and Lagunas are listed as reforestation, wood harvest and processing, the management of foreign-owned properties, and construction, clearly indicating how the influx of foreigners has prompted the diversification of local livelihoods away from farming (ASANA and The Nature Conservancy 2000, 44).

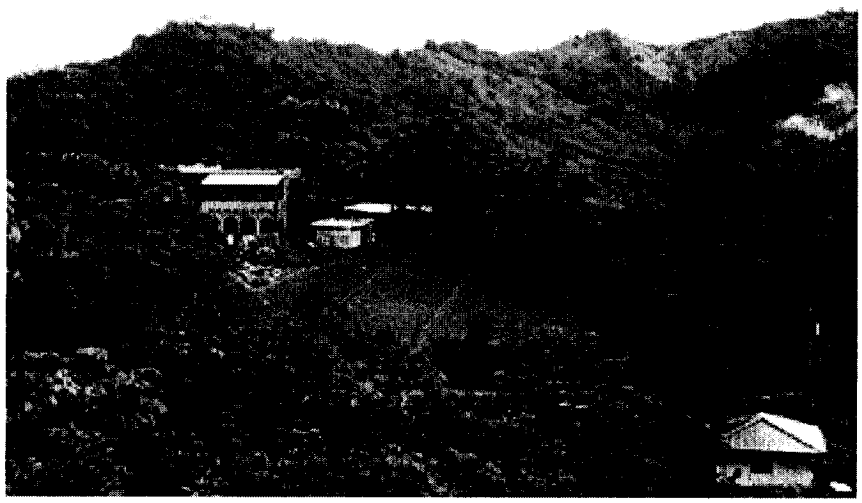


Figure 8: Reforested Slopes at a New Real Estate Development Project in Lagunas

For the newcomers, there is a sense of wanting to live in a 'tropical paradise.' The buyers change land-use accordingly to fit their perceptions of a Costa Rican 'jungle' landscape. The steepest sections of the properties are planted for erosion control and allowed to naturally grow back into secondary forest. Around the house itself, the new owners plant ornamentals and native fruiting trees in order to attract local wildlife. Some foreigners come with the specific conservation goals in mind. One new arrival to the town of Lagunas commented that she came here to "do something – to help nature and not sit in

the States and give donations to the Nature Conservancy" (Ursula, pers. comm. Lagunas, July 18, 2001). In terms of biodiversity conservation, this reforestation strengthens the biological corridor by increasing the total number of forest patches in the area and creating small corridors on farms that lie between privately owned forest reserves and National Parks. However, underlying this transition is a shift in which *campesinos* become marginalized as a group and outsiders take their place as the decision-makers most influential in shaping patterns of land-use.

While the influx of foreigners results in a "greening" of Lagunas, the change in landownership is not without its negative impacts. Ecological disturbances from real estate development include soil erosion resulting from road construction and the levelling of housing sites, the resulting destruction of corals as this sediment washes into the ocean, the disturbance and clearing of mangroves and wetlands for coastal resort and residential development projects, and the contamination of rivers due to increased levels of sewage and lack of environmental regulations (Walter Odio, pers. comm. July 4, 2001). Additionally, some residents of Lagunas complain of water shortages during the summer due to their neighbours watering lawns and filling swimming pools.

Further inland, property prices decrease and infrastructure lags. Fewer foreigners buy land in these areas, and those who do, are attracted by the opportunity to reforest larger tracts of land. As more small-farmers, frustrated with the weakened agriculture sector, choose to diversify their livelihood portfolios, migrate temporarily, or leave permanently, an increasing number of properties are placed for sale in Tres Piedras, San Juan de Dios, and along the road leading out of the valley. We therefore can hypothesize that patterns

of land-use and vegetation cover-change similar to those seen in Lagunas also might develop in more remote areas such as the Guabo Valley as the numbers of foreigners purchasing land increases. A number of informants, including several *campesinos*, a North American who had recently purchased a property in San Juan de Dios, and expatriates involved in the real estate industry in Dominical, reported that the majority of landowners in the Guabo Valley now want to sell their farms. Table 4 illustrates landholdings purchased by foreigners in Tres Piedras and San Juan de Dios and how land-use changed accordingly[10]. In all but one case, the new owners increased forest-cover on the properties. It is interesting to note that not all the new owners are North American. In another case, and one not listed here, a Costa Rican doctor purchased an 18 hectare abandoned cattle farm in San Juan de Dios with the primary objective of reforesting the property. This is the fourth farm he has purchased and reforested.

Landowner	Area (hectares)	Previous Land-Use	Current Land-Use
Tres Piedras			
Tropical Forestry Initiative (TFI)	145	cattle farm	reforestation
Peter Valtin	100	cattle farm	reforestation, vacation home
"El Cubano"	18	cattle farm	cattle farm (improved pasture)
"El Boliviano"	32	unknown	cattle farm, 2/3 in secondary forest
San Juan de Dios			
"El Venezolano"	28	cattle farm	Tourism development
"El Gringo"	9	cattle farm (lay idle for 8 years)	residence, farm

Table 4: Guabo Valley Land-Use Change Following Purchase by Foreigners

[10] Names that appear in column 1 are for the most part nicknames used by the individuals and their neighbours.

The case of Peter illustrates well how forest-cover expands substantially with a change in land-ownership. He purchased 100 ha from a local rancher who wanted to turn a profit on a relatively unprofitable section of his cattle farm. Peter and his family spend on average one month a year on the property. They have planted a mix of native tree species and allowed forest to regenerate on 80 percent of the property. Their farm manager and another neighbour cultivate plantains and keep cattle on the remaining 20 percent. Peter's restoration efforts were conducted in collaboration with The Tropical Forestry Initiative which is located nearby. Together, the two properties represent over 225 ha of pasture reforested by North Americans in Tres Piedras. Over the past 10 years, Peter has observed a local increase in forest-cover and associated return of wildlife but notes deforestation continues further inland along the Tinamaste and San Antonio Ranges (Peter Valtin, pers. comm. June 17, 2002).

Land-use on Peter's farm is typical of those foreigners who come to Costa Rica with the objective of placing larger tracks of land under informal and private conservation management. Local *campesinos* recognize how the landscape changes as a result of the influx of conservation-oriented outsiders: "Farms that I knew as cattle farms have been reforested. Look at [Hacienda] Barú...look at how pretty it is. Those that have bought land have planted. They prefer forest to cattle. The landowners have changed" (household #4, San Juan de Dios, July 2001). Another informant commented that there had been a general change in attitude among local people. Hunting has decreased substantially, and those that continue to hunt now are harassed by their neighbours. As a result, she now sees birds that she never had seen in the area before. However, when asked her opinion on land-sale, she said it was very sad. She lamented that people were

selling something of great value: "Money can be wasted, but land always retains value" (Doña Luz Alfaro Quezada, February 25, 2002).

5.2.3 NGOs and Conservation Territories

NGOs affect land-use and land-cover in the study area directly through the purchase of land, ecological restoration, and the establishment of biological corridors, and indirectly through environmental education, community conservation initiatives, and ecotourism promotion. In addition, they channel funds from both national and international sources that target reforestation on private land. They connect external interests to local places and serve as an avenue through which external perceptions of land-use become infused into the local landscape. Both organizations receive funding from external sources, including the US Forestry Service, UNDP, the World Bank, and The Nature Conservancy, as well as from private donations. Through these activities, and the networks built with outside agencies, it can be argued that TFI and ASANA have emerged as powerful actors that facilitate an expansion of conservation territories within the area. Therefore, both politically and ecologically, they are central in driving what Grainger (1995) terms the forest-use component of a forest transition whereby conservation and forest management replace forest clearing and agricultural land-use.

In the case of TFI, the group purchased a farm and physically planted trees in many plots, studying these against plots left to self seed. They have called their approach "jump-starting" forest succession (Leopold et al. 2001). Often new expatriate residents hire TFI to design a planting scheme for recently purchased properties. In addition, TFI has been

hired to conduct ecological restoration of larger sites along the coast. Through these linkages with other actors, the NGO mediates much of the expatriate tree planting in the region. In the case of ASANA, 5 different properties have been designated forest reserves and participate in the national Private Wildlife Refuge Programme. At least one 112 ha farm has been donated by its North American owner to the corridor. Both the physical planting and restoration work done by TFI, and the consolidation of protected areas facilitated by ASANA, serve to directly expand forest-cover and increase areas under conservation land-use. Through these activities, the NGOs act as important drivers of a local forest transition. Depicted in Figure 9 is TFI in 2001. It shows a forested landscape in the foreground existing in contrast to the cleared slopes in the distance.

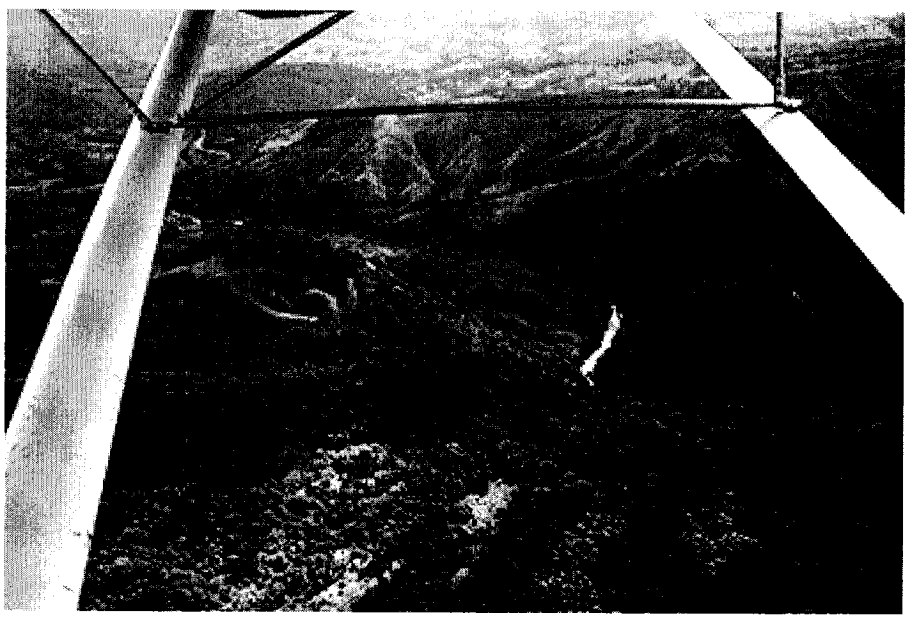


Figure 9: NGO-Driven Conservation Landscapes, Guabo Valley

Of the two NGOs, ASANA is more involved in community conservation efforts. The group works in 52 communities within the biological corridor raising awareness about the corridor, promoting environmental education in schools, leading local school groups on

trips to the forest reserves, and working in partnership with a number of communities on watershed protection. It also initiated a now well-established sea turtle conservation project and hatchery and assists *campesinos* form citizen vigilante groups that patrol for hunters and poachers. By interacting with communities through these projects and initiatives, ASANA hopes to increase environmental awareness and better environmental management throughout the region.

ASANA addresses economic incentives through the promotion of ecotourism. Hacienda Barú, one of the 5 local forest reserves, has a well-established set of treks and canopy tours. In 2002, plans were underway to donate most of the Hacienda to ASANA in addition to all proceeds generated from trail fees. Other ranches in the area also offer accommodations and ecotours. Within the biological corridor, ecotourism is being promoted as an environmentally sustainable and financially profitable land-use option that provides jobs for local people outside the agricultural sector and supports regional conservation efforts. ASANA also administers funds from Costa Rica's gas tax which provides economic incentives for landowners to preserve forest patches on their farms. In addition, ASANA was one of four organizations in Costa Rica to meet the necessary requirements to manage World Bank ecomarket funds that go to pay local farmers for ecological services such as carbon sequestration. Farmers that are interested in registering forest patches on their properties can approach ASANA who will help them obtain title for their land and complete all the administrative and legal work required to enter the payment program (Franklin Sequeira, pers. comm., July 16, 2001).

TFI strongly believes economic incentives must exist for *campesinos* to become interested in reforestation. Several years ago TFI helped form a local Forestry Association of local farmers who were interested in conserving existing forest patches on their farms and managing these stands through selective harvest. The group fell apart shortly after it was created due to lack of organization, but TFI still searches for ways to promote the sustainable harvest of valuable native timber species. They recently purchased a portable saw mill, plan to train an operator, and re-establish the local forestry group. In 2001, TFI made a renewed effort to increase their interaction with the local communities in Tres Piedras and San Juan de Dios. Linkages were formed between the two NGOs and a group of women interested in forming an artisan group using non-timber forest products. The women received assistance in networking with clients and with other women in Costa Rica engaged in artisan co-operatives. In return, both TFI and ASANA gained a new venue through which they could promote reforestation and the biological corridor. Marketing their crafts enabled the women to diversify their livelihoods, and within a few months the group was selling jewellery and carvings in a number of coastal resort towns. For most group members, this project represented the first time they had earned money, and it made them feel financially independent. Furthermore, their weekly meetings became an important social and supportive gathering for the women.

In conclusion, both TFI and ASANA indirectly influence land-use and land-cover by creating linkages with local *campesinos*, as well as with new expatriate residents, and these linkages ultimately promote forest regeneration. These organizations also serve as a port through which external ideas, as well as concrete financing, are funnelled into local communities. Just as the influx of expatriates affects forest-cover in those areas where

foreigners are most likely to concentrate, the presence of the NGOs also seems to drive forest expansion around areas where the groups are most active.

5.3 Conclusion

This chapter set out to explore whether a forest transition is occurring in the Guabo Valley and surrounding areas. Both aerial photographs and data collected from household surveys indicate that a forest transition is starting in certain pockets within the study area. This transition is driven by a struggling rural economy and agriculture sector, the influx of new expatriate residents purchasing land and changing land-use to favour expanded tree-cover, and the presence of environmental NGOs working to promote forest conservation. Rather than working in isolation, these drivers of change influence each other. For instance, a struggling rural economy leads *campesinos* to let part of their farms grow into scrub and secondary forest while they go in search of alternative forms of employment. As the vegetation-cover expands, the land becomes more attractive to foreigners. This set of interactions that form between drivers and between actor groups is an important component of the forest transition and a focus of discussion in chapter 6.

The thesis has looked at groups of individuals coming into or moving out of an area but more or less working in a very individual manner. Are we now seeing the formation of a coalition of actors in which decision-making will become increasingly organized and coordinated in terms of driving a turnaround in forest-cover?

CHAPTER 6: SUMMARY AND IMPLICATIONS

The overall objective of this research was to contribute to an understanding of how a forest transition unfolds within a tropical rural setting, and what combination of biophysical, economic and social drivers are responsible. In this case, a turnaround in forest-cover seems to be emerging as a result of a combined set of drivers widely acknowledged and discussed within the forest transition literature. These include biophysical constraints on farming such as reduced soil fertility, steep terrain, increase in fungus and pest attacks, and changes to both the micro-climate and regional rain patterns. Political and economic changes within the agricultural sector have created constraints for *campesinos* and led many to reduce and even abandon cultivation. Finally, demographic changes representative of an aging farming population with fewer heirs in addition to increased rural-out migration creates optimal conditions for the expansion of scrub and secondary forest.

The very notion of a transition implies an historical process of change and takes us from viewing forest-cover in snap shots to recognizing dynamics, flux, and trajectories of change (Fairhead and Leach 1996; Stott 1999; Perz and Skole 2003*b*). A political ecology framework is well suited to the study of forest transitions because it provides a useful theoretical context for the linkage of social, political, and ecological drivers of change and helps explain how these drivers combine at the temporal scale. Furthermore, political ecology provides the analytical tools necessary for deconstructing the politics embedded in land-use decision-making, revealing how both local-level and macro-level power hierarchies influence land-cover.

This case study is part of a larger response to the call for additional research on tropical forest transitions. Perz and Skole (2003*a*) specifically call for additional sub-national case studies, arguing that these expose important inter-regional heterogeneity and thus enrich the greater collection of national case studies. Forest dynamics are better understood at this scale because short-term and medium-term dynamics become visible. This view is echoed in Rudel et al. (2002) in their call for place-specific research: "Enumeration of these place-specific factors underscores the conjunctural nature of forest transitions and implies that...they will take place in incremental and variable fashion, one small region at a time" (ibid. 100). Yet the political economy operates at a larger-scale, driving development policy, labour migration patterns, and the flow of remittances, and international conservation initiatives to name a few (Rudel et al. 2000; Brown and Ekoko 2001; Campbell 2002; Perz and Skole 2003*b*; Klooster 2003). Therefore, locally-based investigations of forest transition need to be placed within a larger context.

Taking a case-study approach and focusing on local-scale analysis, this research identified several driving forces responsible for the expanding forest-cover that have not been sufficiently addressed in the literature. One such factor is the in-migration of expatriates attracted by the political security of the country and local real estate development opportunities available. Moreover, the presence of the CBPD biological corridor is influential. Following from Zimmerer's (2000) critique of nature-society hybrids, the CBPD exists as a conservation territory that serves as an institution uniting a number of powerful local and external actors in an organized and coordinated effort to promote reforestation and forest conservation. The specific concurrence of these local contextual elements, such as the in-migration of foreigners and the establishment of the

CBPD biological corridor, are unique and therefore can not be modeled on a large scale and applied to forest transition cases throughout the world. In other words, it would be unrealistic to over-generalize these particular conditions. What can be extrapolated from this case study and applied broadly to forest transitions in the tropics is the influence and transformative role of certain powerful actor groups which not only have linkages with external actors, such as government ministries and international funding agencies, but also seem to be creating synergistic relationships (Brown and Ekoko 2001) with other groups within the locally-based constellation of actors.

6.1 Implications for Costa Rica and Broader Implications

It seems clear that the study site is experiencing a turnaround in forest cover associated with a forest transition. Changing markets, a decrease in agricultural production, and new opportunities for local *campesinos* to diversify into non-farm economic activities have led to increases in land placed in fallow and farm abandonment. These drivers of change have been identified in the literature as responsible for producing forest transitions throughout the tropics. Much of this literature on forest transitions proposes models driven by economic change, industrialization, and urbanization. Most published case studies relate land abandonment and subsequent secondary forest regrowth to peasant out-migration, industrialization and agricultural intensification. However, the Costa Rican case study shows how external actors moving into an area can also drive a turnaround, making this case unique. The in-migration of foreigners and organizations buying land, reforesting areas, and the formation of linkages with other actors are important processes fuelling the transformation of the local landscape and has not been adequately addressed

in the forest transition literature to date. Drawing on the notion of growth coalitions, this study highlights the importance of looking at constellations of actors and the process through which more powerful actor coalitions begin to form. What is important to investigate in order to understand trends in forest-cover expansion is the politics surrounding the local actors and their interactions with each other.

As more areas in Costa Rica suffer from soil erosion, loss of soil fertility, changing climate, and increased pests, and as more small farmers get pushed out of the agriculture sector due to the lack of government support, weak national markets, and high costs for inputs, the question arises whether we can expect forest recovery at the national scale. This could occur through continued land sale and rural out-migration as described in the classic forest transition literature. Or, the turnaround could occur through a less standard set of processes in which *campesinos* deliberately place farmland and pasture into fallow, either to increase soil fertility or for harvest at some future date. In this scenario, it is likely that households remain on the farm but rely more heavily on non-farm sources of income, temporary migration, and remittances. What is evident in the Guabo case is that a combination of the two trends develops. As a result, this case provides further support to claims that an intersection of driving forces gives rise to complex forest transitions.

This case study also comments on the importance of local scale analysis within a more global outlook. For instance, the fact that a forest transition is being driven by the local influx of new residents illustrates how this kind of landscape change can not be explained only in terms of sweeping regional macro-economic forces. Yet even though this is happening at the local scale, the influx of external and foreign actors clearly illustrates

how global movements of people can have local economic and ecological impacts. In this sense, the case study contributes to the larger body of literature using a political ecology framework of analysis in which a major concern is linking global phenomena with local people and places (Kull 2000; Adger et al. 2001).

The influx of foreign nationals is not limited to the study area. Throughout Costa Rica, expatriates are investing in and developing real estate. Therefore, understanding how the in-migration of these new actors in the Guabo Valley case affects the land-use decisions of other actor groups is important to understanding landscape transformations elsewhere in Costa Rica where similar shifts in land ownership are occurring. While expatriate land-uses vary in the degree to which they favour residential development, resort development, or conservation, throughout the country noteworthy shifts do occur away from crop production and pasture management (ASANA and The Nature Conservancy 2000; de Camino 2000). Furthermore, the country's lucrative ecotourism market will most likely serve as an additional factor in maintaining a longer-term turnaround of forest-cover as the economic returns from ecotourism will likely be greater in marginal areas than returns offered from agriculture. Increasing the amount of forested land held privately has important implications for biodiversity conservation and protected area management. However, it is important to note that financial benefits from ecotourism will not distribute evenly over the rural society. Romanticised claims of economic diversification and biodiversity conservation driven by ecotourism development must be approached cautiously.

It is probable that we will continue to see forest transitions due to urbanization, industrialization, world-wide changes in agricultural production and distribution, the economic success of ecotourism, the influence of national and international conservation incentives such as payments for ecological services and debt-for-nature swaps. The fact that these expatriates not only physically expand forested areas through the purchase and reforestation of land, but also import a powerful set of perceptions and preconceptions of what the landscape should look like is also important to consider within the forest transition debate.

Within this greater context, the Guabo Valley case study presented here attempts to discuss forest transition in light of the unique combination of actors and drivers present locally. This approach steps away from explaining change based on predictive models imported from places. The daily reality in the Guabo Valley is that local people can not make a living farming, they struggle at making a living raising cattle, and rising land prices driven by in-coming foreigners provides an opportunity to sell land and look for other livelihood means. A consequence of this inversion was summarized by one local campesino when he stated tongue in cheek "Soon there will be no Costa Ricans left in Costa Rica. Americans are buying all the land, and all the Costa Ricans are going to New Jersey!"

6.2 Key Findings and Future Direction

For the most part, local actors made independent land-use decisions until recently. However, there now seems to be a shift towards increased interaction between actor

groups. If a high level of coordination between these actors develops, then we can begin to talk about a coalition of actors driving land-use and land-cover change instead of a less organized constellation of actors. Figure 10 illustrates interactions that occur between local actor groups, representing them as a series of feedbacks that transfer both land and funds into forest conservation management. This idea of a coalition of actors draws from Rudel and Horowitz's (1993) growth coalition theory for how actors combine labour and capital to clear forest for settlement and development. The question arises from this Costa Rican case study whether a growth coalition could form to drive a turnaround in forest-cover.

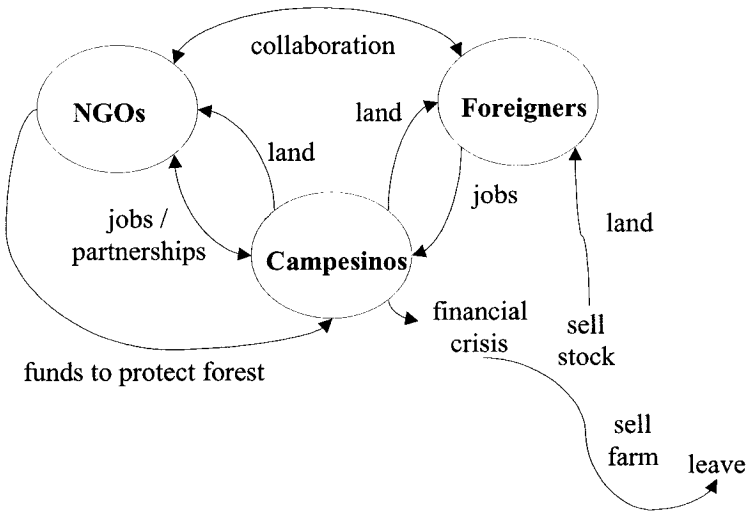


Figure 10: Feedbacks Between Actors

NGOs and foreign residents collaborate in two principal ways to forward conservation efforts at the regional level. New expatriate landowners often seek consultation from TFI on planting projects for their new properties or for larger-scale ecological restoration efforts. These individual reforested properties combine on a larger scale to strengthen the biological corridor as more and more foreigners purchase and reforest land. This

collaboration between NGOs and expatriates serves as a powerful alliance; as the number of individual expatriates who establish linkages with these organizations and with the corridor increase, we can begin to talk about a coordinated set of interests and actions. NGOs also create connections with *campesinos*. ASANA is perhaps slightly more successful in this endeavour because of its community-oriented programs and the fact that it coordinates activities in a wider geographical area. ASANA has direct links with *campesinos* through payment for ecological services programs and through its efforts to consolidate small forest patches on farms into the biological corridor. Through these community-focused initiatives, the group channels funds from government and international donors to local people in effect linking the two groups into a set of coordinated exchanges and decision-making. TFI's involvement with the women's artisan group follows a similar path but to a less coordinated end. However, mutual exchanges did exist as the women received assistance from the NGO and TFI found a small yet important avenue through which it could begin to engage in 'community outreach.' By aiding the women in meeting potential expatriate and tourist buyers, the collaboration also promoted a new flow of income from the non-agricultural sector into a number of *campesinos* households. Finally, by hiring several local people, TFI supports the general diversification of rural livelihoods to incorporate non-farm sources of income that is already occurring locally.

The majority of *campesinos* in the study area engage less and less in agriculture and cattle production due to the constraints on both the production and the marketing of agricultural goods. Peasants either enter a financial crisis, sell their land and leave permanently, or they stay and diversify into off-farm and non-farm activities. Richer farmers are able to

make the necessary investments and remain in the agricultural sector. In cases where the farmer does enter a financial crisis, a transfer of land can occur out of agricultural use and into alternative land-uses such as conservation. Foreigners not only buy up this available land, most often converting it to residential or conservation land-use, but also their interest in real estate investment helps drive up land value thus furthering the incentive for farmers to sell. This increase in land value provides extra incentives for local *campesinos* to sell land, furthering the transfer of landownership to the 'foreigners' group. Expatriates also provide non-farm employment to area residents thereby advancing the general trend of livelihood diversification with increased emphasis on wage labour. This livelihood diversification can be seen both as a driving force of land-use change as well as a response to a turnaround in forest-cover. As herd sizes decrease, pasture is abandoned. This combined with reduced agricultural production leads to more scrub growth and regenerating secondary forest.

Both Rudel and Horowitz (1993) and Brown and Ekoko (2001) discuss how ties between networks of land users shape forest resources. Brown and Ekoko make an important distinction between interaction and synergy. The authors define interactions as reciprocal encounters consisting of transactions, shared projects, or negotiations. Synergy, on the other hand, implies coordinated action and functional relationship. Drawing from systems thinking, Brown and Ekoko write that "synergy is represented as a reinforced result that occurs when two or more processes interact so that the product of their efforts is greater than the sum of their separate effects" (ibid., 270-271). In other words, synergies can be viewed as interactions toward an end. Applied to human land-use and its effect on forest-cover, this end is either net forest loss or net forest gain. Rudel and

Horowitz's (1993) growth coalition theory for forest-cover change applies this synergistic relationship to actor groups that coordinate efforts in their land-use strategies. Rudel and Horowitz (1993) take the idea of actor coalitions and present it as a direct driver of forest-cover loss. Following their lead, it would perhaps then be useful to apply the notion of actor synergies or actor coalitions in future forest transition studies.

The findings presented in this thesis stress the importance of considering interactions between the members of a constellation of actors, and point to the development of synergies between these groups. In particular, the Costa Rican case illustrates that directly coordinated efforts between NGOs and foreigners, combined with the economic linkages created between these two groups and local *campesinos* through employment or through financing reforestation, represent increased synergy between actor groups. Ultimately, this relationship works to promote forest recovery either directly, through land purchase and reforestation, or indirectly through fallow or farm abandonment. As these relationships become stronger or more institutionalized, constellations could transform into coalitions. Understanding the nature of this shift would serve as a valuable contribution for future studies of forest transitions, and more place-specific studies are needed in this endeavour. The ultimate goal would be to create a more complete list of causal drivers, a list which is currently dominated by more traditionally conceived and accepted forces of change such as urbanization and agricultural intensification. While these drivers help explain large-scale processes of change, they can falter at the micro-scale. A further step would be to employ more of an historical perspective to this endeavour and explore these forest transition actor synergies in a temporal dimension.

As shown in Figure 10, this case study stresses the importance of moving away from simply describing specific individual actions on the environment in isolation. *Campesinos* entering a financial crisis and allowing secondary forest to expand on their properties is only half the story. The presence of, and interaction with, expatriates and NGOs closes the loop. Only by recognizing that feedbacks between actors serve as drivers in and of themselves, does a more complete picture of forest transition emerge. Within both the LUCC literature and the forest transition literature, authors engage in debates over which drivers of change hold the most explanatory power. Social forces, household structure, agricultural practices, market influences, technological change, and migration patterns are all contested. A question arises whether a useful aim would be to reconcile these drivers, identifying which was the most prevailing, for the purpose of constructing predictive models that could be applied to other places. Yet what individual case studies show us is that forest transitions evolve in multiple ways. The disagreement over mechanisms of change is not, therefore, a problem. Rather it serves a purpose and enriches our understandings of the 'ebb and flow' of both actors and forests.

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APPENDICES

1. Key Informant Interviews

Maricel Gamboa Calvo, local resident, Tres Piedras, March 5, 2002

Jack Ewing, president of ASANA, Hacienda Baru, May 17, 2002 (e-mail)
January 9, 2003 (e-mail)
June 17, 2003 (e-mail)
July 23, 2003 (e-mail)

Arno Finkeldy, TFI board member, Lagunas, Costa Rica, July 4, 2001

Jose Maria, Asociación de Desarrollo, Tres Piedras, February 27, 2002

Omar Mena, local rancher, San Juan de Dios, March 2, 2002

Walter Odio, ASANA board member, San Isidro, July 4, 2001

Carl Leopold, TFI president, Cornell University, March 27, 2001 (phone interveiw)

Doña Luz Alfaro Quezada, local resident, Tres Piedras, February 25, 2002

Don Paco, local resident, San Juan de Dios, February 26, 2002

Don Rigo, local resident, Tres Piedras, March 2, 2002

Franklin Sequeira, ASANA executive director, Hacienda Baru, July 16, 2001

South Coast Realty, Dominical, March 1, 2002
May 27, 2003 (phone interview)

Ursula, expatriate resident, Lagunas, July 18, 2001

Peter Valtin, expatriate resident, Tres Piedras Costa Rica / San Francisco USA,
June 17, 2002 (e-mail)

2. Household Census: Tres Piedras and San Juan de Dios, Costa Rica July-August, 2001

THE FARM

What is the size of the property?
¿Cuál es el tamaño de su propiedad?

How old is the property?
¿Cuántos años tiene la propiedad?

Do you have a title deed?
¿Tiene Ud. una escritura?

How does someone obtain a title deed?
¿Cómo se obtiene una escritura?

Do you know an organization in the region that helps people get title to their land?
¿Conoce Ud. a alguna organización que ayude a la gente obtener escrituras?

What do you grow on your farm?
¿Qué cosechas tiene en su finca?

Do you sell any of your crops in the market or are they for household consumption?
¿Vende sus cosechas en el mercado o son para auto consumo?

Do you have any cattle? How many animals?
¿Tiene ganado? ¿Cuánto ganado tiene?

Do you have any forest on your property?
¿Tiene bosque en su finca?

What is the percentage of your property in agriculture, in pasture, and in forest?
¿Cuál es el porcentaje de su terreno que esta utilizado para la agricultura, el pasto, y bosque?

Have you made any changes on your farm recently?
¿Ha hecho algunos cambios recientes en su finca?

Why did you make these changes?
¿Por qué hizo estos cambios?

What changes will you make in land use in the next few years?
¿Qué cambios va a hacer en el uso de terreno en los próximos años?

Why?
¿Porqué?

Have you sold any land?
¿Ha vendido algún terreno?

How many hectares?
¿Cuántas hectareas?

Did you sell this land to a Costa Rican?
¿Ha vendido este terreno a una persona Costarricense?

If a foreigner buys land here, do they continue in agriculture or do they change the use of the land in some way?
¿Si un extranjero compra terreno aquí, continua usando el terreno para la agricultura o cambia el uso del terreno?

FOREST

Do you walk in the forest?
¿Ud. camina en el bosque?

Do you use any resources from the forest?
¿Utiliza Ud. algunos recursos del bosque?

Did you use resources from the forest before that you do not use now?
¿Utilizaba recursos del bosque en el pasado que no utiliza ahora?

Do you harvest any trees?
¿Corta Usted árboles?

Which species?
¿Qué clase de árboles?

How many trees do you cut a year?
¿Cuántos árboles corta cada año?

For what use?
¿Para qué uso?

Have you participated in any reforestation program?
¿Ha participado en algún programa de reforestación?

Have any of your neighbours participated?
¿Han participado algunos de sus vecinos?

Have you planted any trees on your property?
¿Ha sembrado árboles en su propiedad?

What species?
¿Qué clases de árboles?

For what use?
¿Para qué uso?

Since you remember, have you noted any changes in the forest?
¿Desde que se acuerda, ha notado cambios en el bosque?

If yes, what do you think are the causes of this change?
¿Si así es, cuáles son las causas de ese cambio?

Since when did they occur?
¿Desde cuándo ocurren?

Since you remember, have you noted changes in the agriculture of the area?
¿Desde que se acuerda, ha notado cambios en la agricultura?

If yes, what do you think are the causes of this change?
¿Si así es, cuáles son las causas de ese cambio?

Since when did they occur?
¿Desde cuándo ocurren?

Have you noted any other changes in the natural environment of the region?
¿Ha notado algunos otros cambios ambientales en la región?

Since when did these changes occur?
¿Desde cuándo ocurren?

HOUSEHOLD INFORMATION

Number of family members?
¿Cuántos son en la familia?

Where is the family originally from?
¿Dónde creció Ud.?

When did you move here?
¿Cuándo se vino a vivir aquí?

Why did you move here?
¿Por qué se vino a vivir aquí?

Age and gender of informant?
¿Edad y sexo?

What was the last grade in school or high school you completed?
¿Hasta que grado en la escuela o el colegio cursó Ud.?

How many household members work on the farm?
¿Cuántos miembros de la familia trabajan en la finca?

How many household members work off-farm?
¿Cuántos miembros de la familia tienen empleo afuera de la finca?

What kind of work do they do?
¿Qué clase de empleo?

RELATIONSHIP WITH NGOs

Do you know of the organization called Tropical Forestry Initiative?
¿Conoce Ud. la organización que se llama Iniciativa Bosque Tropicales?

Do you know of the organization called ASANA?
¿Conoce Ud. la organización que se llama ASANA?

Have you heard of the farm called Finca Los Arboles?
¿Conoce Ud. Finca Los Arboles?

Do you know the people who are involved in these organizations?
¿Conoce Ud. a la gente de estas organizaciones?

Have you ever been to the farm?
¿Ha ido Ud. a la finca?

Have you bought trees from the farm?
¿Ha comprado árboles de la finca?

Have you received any information from these organizations?
¿Ha recibido alguna información de estos grupos?

If a environmental or conservation organization came to your community, what services would you like them to provide for the community?
¿Si viniera aquí una organización que trabaja en el medio ambiente o conservación, qué servicios le gustaría que provean para la comunidad y para la naturaleza?

Have you ever participated in an environmental or conservation organization?
¿Ha participado Ud. con alguna organización ambiental?

What are the most serious environmental problems here?
¿Cuáles son los problemas ambientales mas graves aquí?

What are the causes of these problems?
¿Cuáles son las causas de estos problemas?

What does the community need in order to come to a solution?
¿Qué necesita la comunidad para llegar a una solución?

Who here has the power to make decisions that affect the community and the natural environment?
¿Quién tiene el poder aquí de tomar decisiones que afectan al medio ambiente?

Have you ever heard of the Corredor Biológico Paso de la Danta?
¿Conoce Ud. el Corredor Biológico Paso de la Danta?

3. Livelihood Diversification Survey

How many members of the family work outside the farm?
¿Cuántos miembros de la familia trabajan afuera de la finca?

What type of work do they have?
¿Qué clase de empleo tienen?
- Day labourer / **Peon**
- Construction / **Construcción**
  road / **de caminos**
  houses / **de casas**
  other / **de otra (¿qué es?)**
- Farm Management / **Manejo de fincas o casas de otra persona**
  Is this person a foreigner? / **¿Es esta persona un gringo?**
- Furniture maker / **Mueblista**
- Production and sale of wood / **Producción y venta de madera**
- Other / **Otra (¿Cuál ?)**

Do any of the women of the house work?
¿Trabajan algunas de las mujeres de la casa?
- Are members of the artisan group / **Son miembros del grupo de artesanía**
- Work in a foreigner's house / **Trabajan en la casa de un gringo**
- Other / **Otra (¿Cuál?)**

Is there a member of the family that works in another part of Costa Rica?
¿Hay un miembro de la familia que este trabajando en otra parte de Costa Rica?

Is there a member of the family that works in the U.S.A?
¿Hay un miembro de la familia que esta trabajando en Los Estados Unidos?

Has the family always worked on and off the farm?
¿Siempre ha trabajado la familia en la finca y también afuera de la finca?

In the past, did the family work more on the farm?
¿En el pasado, trabajaron más en la finca?

Do you have more or less scrub growth now than 10 years ago?
¿Tiene más briñon o menos briñon ahora que hace 10 años?

Do you have any problems maintaining the pasture? What are they?
¿Tiene algunos problemas para mantener el pasto? ¿Cuáles son?

In the last 15 years, has there been
¿En los últimos 15 años, ha habido
more work / **más empleo**
less work / **menos empleo**
no change / **no cambio**
Could you explain why?
¿Podría explicar porque?

Were there any opportunities to work outside of the farm 15 years ago?
¿Habían oportunidades de empleo afuera de la finca hace 15 años?

What are the opportunities to work outside of the farm now?
¿Cuáles son las oportunidades de empleo afuera de la finca ahora?

Do you feel that the employment opportunities have changed since the arrival of more foreigners in the region?
¿Cree Ud. que las oportunidades de empleo han cambiado desde que hay más gringos en esta región?