

---

# 13 Ecoregional Management in Southern Costa Rica: Finding a Role for Adaptive Collaborative Management

*John Schelhas*

## CONTENTS

Introduction.....	245
Site Description .....	246
Conservation Significance .....	246
Forest–People Interactions.....	247
Patterns and Relationships in Southern Costa Rica.....	249
Land Speculation .....	249
National and Global Cultural Change.....	250
Global Economic Change.....	250
Changing Forest Policies.....	251
Conceptual Models for Adaptive Management .....	252
Adding a Collaborative Component.....	253
Uneven Concentration of Power .....	254
Governance Changes and Economic Changes.....	254
Uneven Distribution of Costs and Benefits of Forest Conservation .....	254
Conclusions.....	255
Acknowledgments.....	256
References.....	256

## INTRODUCTION

Recent thinking in conservation biology stresses the importance of conservation at a regional scale that includes both protected areas and the lands that surround and connect them (Schelhas and Greenberg, 1996; Laurance and Bierregaard, 1997; Soulé and Terborgh, 1999). The need to develop governance systems that can incorporate the full diversity of landholders and interest groups that have decision-making power or an interest in regional land management is implicit in these

approaches (Cortner and Moote, 1999). This is the *collaborative* component of "adaptive collaborative management," which has received considerable attention in the literature in recent years (Sample, 1993; Western and Wright, 1994; Gunderson et al., 1995; Cortner and Moote, 1999). But it is also necessary to introduce state-of-the-art scientific knowledge into these collaborative processes to enable the *adaptive* management of regional ecosystems. Although "adaptive management" is a well established concept in ecology (Walters, 1986; 1997; Lee, 1993; Gunderson et al., 1995), there has been considerably less attention paid to it within the social sciences. Recent interest in collaborative approaches may have led some practitioners to believe that collaboration can substitute for social science. Yet, if larger landscapes in multiple ownerships are to be managed, it will be necessary to bring together an interdisciplinary understanding of both ecosystem processes at the regional landscape level and the human processes that increasingly are shaping these landscapes.

One approach to developing a science of human ecosystem interactions at the landscape level is formal modeling of relationships between social and economic factors and land cover patterns (Lee et al., 1992; Turner et al., 1996). Although formal modeling is an important tool, historical studies suggest that unpredictable exogenous variables such as changes in agricultural or wood product prices, or changes in laws and policies, can account for major changes in land use and cover (Turner et al., 1996). Since major social or economic reorientations and their impacts on land cover can often only be recognized in retrospect, a more diverse tool kit may be needed to capture new trends and ongoing processes for adaptive management. Conceptual modeling, which does not require quantitative data, can address this limitation and thereby complement (not replace) formal modeling. This chapter introduces the notion of conceptual modeling and makes a case for pluralistic modeling as a part of the adaptive collaborative management process. The chapter describes the situation related to the conservation of forests adjacent to La Amistad International Park on the Pacific slope of Costa Rica from the perspective of ecological anthropology, presents a conceptual model of land-use change processes for use in adaptive management, and discusses the potential for implementing a more collaborative approach to adaptive management at this site.

## SITE DESCRIPTION

### CONSERVATION SIGNIFICANCE

La Amistad International Park (PILA), which spans the border of Costa Rica and Panama, is one of the largest continuous forested areas and one of the largest protected areas in Central America (IUCN, 1992). The park was officially established in Costa Rica in 1982 (193,929 ha), and in Panama in 1988 (207,000 ha). In spite of its large size, the park has conservation limitations that stem from the fact that it comprises primarily higher elevation forests. Midelevation life zones are severely underrepresented in protected areas in Costa Rica, particularly on the Pacific slope (Powell et al., 1995/96; Guindon, 1996) because these are the areas best suited for growing Costa Rica's primary export commodity, coffee. The mid-elevation habitats adjacent to the Pacific side of PILA have been converted over the past 50 years

from continuous forest to a mosaic of remnant forests, second-growth forests, forest plantations, coffee plantations, annual crops, and pastures (Schelhas et al., 1997). This conversion is of conservation interest not only because it threatens species endemic to the mid-elevation zone, but also because seasonal altitudinal migrations are common among Costa Rican bird, insect, and perhaps mammal species (Stiles, 1988; Loiselle and Blake, 1992; Guindon, 1996). If one part of a seasonal altitudinal habitat gradient is lost, it is likely that some of the species that use this gradient will not be able to survive. Thus, forest loss and change in the mid-elevation zone can have ecological repercussions across the full altitudinal gradient.

Prior to the 1990s, there was very little conservation biology research in southern Costa Rica. Consequently, little is known about biodiversity conservation issues in and around PILA. Recent research on birds, insects, trees, and mammals in this seminatural mosaic of forest and agricultural lands addresses this gap (Borgella, 1995; Daily and Erlich, 1995; Aldrich and Hamrick, 1998). Preliminary findings suggest that there are forest-dependent species inhabiting forest patches in the region and that ecological relationships among forest patches and the surrounding agricultural matrix are complex. However, no particular species or habitat of conservation concern has yet been identified on which to base the development of a landscape-level conservation plan involving forest corridors and/or stepping-stones. Major investment in any sort of formal biological corridor, along the lines of those being undertaken elsewhere in Costa Rica (e.g., La Selva, Talamanca, and Monteverde) would be unwise in the absence of a strong scientific rationale and a clear conservation objective. Nevertheless, it is reasonable to assume that the retention of forest patches and corridors on the private lands adjacent to PILA would have biodiversity conservation benefits and would also provide a wide range of other environmental and social benefits, including watershed protection, carbon sequestration, and provisions of forest products (Schelhas and Greenberg, 1996; Schelhas et al., 1997).

National-level maps of forest cover in Costa Rica generally show the area outside PILA as deforested. However, fine-scale mapping of forest patches from satellite images and air photographs (Figure 13.1) shows a network of forest patches interconnected by riparian forest corridors throughout the agricultural landscape adjacent to PILA (Wilson, 1998), that could serve as the foundation for regional, landscape-level forest conservation to complement and strengthen that in designated protected areas. Managing this landscape mosaic for biodiversity conservation, however, requires first understanding the social factors that are shaping it. This issue, and the application of an adaptive collaborative management approach, are the subject of this chapter.

### FOREST-PEOPLE INTERACTIONS

Since 1992, the author has been conducting research in southern Costa Rica under two NSF-funded projects.\* The first project is ecological and social research on forest patches. The second looks at the content and source of environmental values

\* "Research Training Group, Ecological and Social Science Challenges of Conservation" (BIR-9113293293 and DBI-9602244), and "Policy, Norms, and Values in Forest Conservation: Protected Area Buffer Zone Management in Central America" (SBR-9613493).

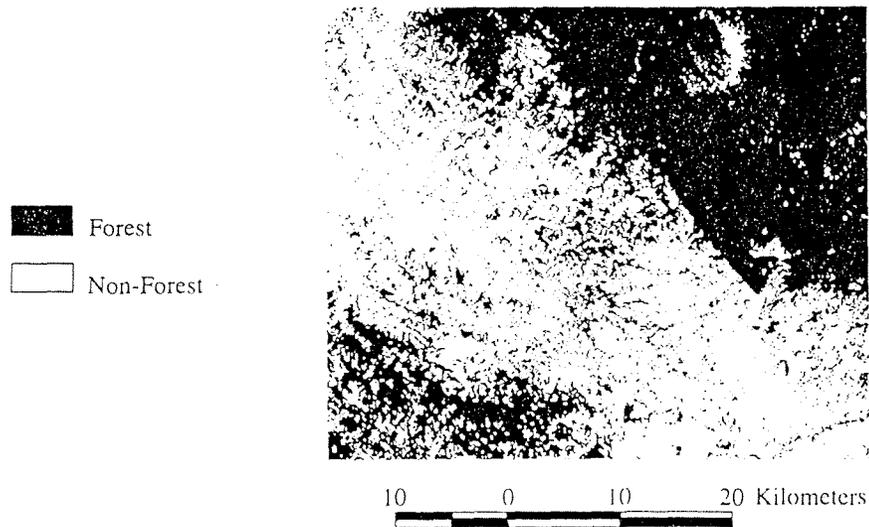


FIGURE 13.1 Fine-scale forest cover in southern Costa Rica (PILA boundary is the straight line to the right of the center of the figure). (After Wilson 1998.)

among rural landholders across individual, household, community, and national levels, as well as at related actual changes in amount and patterns of forest cover from satellite images.

The social research has generally focused on understanding farm household land-use choice behavior, including influences that are both economic and sociocultural. This research has found that farm-level land use is diversified to balance returns and risk; meet diverse needs for household products; meet sociocultural objectives; and provide environmental services (Schelhas, 1996a). Forests are a part of this diversified land-use mosaic for several reasons:

- They fill an economic niche in farming systems as a land use that accrues value over time while requiring low labor investments, once established. Thus, the research found forest more likely to occur when landholders are involved in highly remunerative off-farm labor, are older households, or otherwise have less labor available (Thacher et al., 1997). Forests may also be of significance to landholders as a complement to high-risk intensive agriculture (Schelhas, 1996b).
- Farm households often maintain forests as a source of materials such as timber, fuelwood, and vines for basketmaking (Schelhas, 1996a; Jantzi et al., 1998).
- One of the primary reasons given for farm forest conservation is for environmental services such as soil and water conservation (Thacher et al., 1997; Jantzi et al., 1999).

- Farmers give a number of “cultural” reasons for forest conservation, including as a legacy for their children, caring for God’s creation, to maintain aesthetically pleasing environments, and to conserve wildlife and biodiversity (Thacher et al., 1997; Jantzi et al., 1999).
- It has become increasingly common in recent years to integrate a low and open canopy of nitrogen-fixing trees into coffee plantations, particularly those of small landholders, to minimize the use of agrochemicals (principally fertilizer by improving nutrient cycling) and thus minimize cash outlays, particularly when coffee prices are low (Schelhas, 1996a).

These are useful findings, but are limited by the fact that studies of individual and household behavior and values by themselves ultimately provide little insight into long-term land-use trends. The author argues here that developing a model of changing land-use patterns must go beyond individual decision making and biophysical models to also include attention to social structures and processes. The basis for such a model can be found in Rhoda Halperin’s book, *Cultural Economies Past and Present*. Halperin (1994) notes that broader patterns and relationships are more difficult to analyze and observe than individual behavior, but that this does nothing to diminish their explanatory power.

Halperin (1994) discusses the use of “formal processual models,” which are essentially ideal types that can be used as a standard of comparison. As such, they are very much like hypotheses for adaptive management. It is important to note that Halperin (1994, p. 252) emphasizes that these formal processual models are not commonsense understandings, which are culturally embedded and therefore often inaccurate. Rather, formal processual models develop a set of concepts that, when used analytically, illuminate the ways that economies function and how this differs cross-culturally by focusing on a set of economic processes in a generic model of the economy (Halperin, 1994, p. 51). Models are heuristic devices to help order data, and in formal processual models the units are complicated processes or sets of social relations (as opposed to formal atomistic models in which the units are individual actors) (Halperin 1994, p. 165). Formal processual models are perhaps best understood through examples, and one is presented here from research in Costa Rica.

## PATTERNS AND RELATIONSHIPS IN SOUTHERN COSTA RICA

### LAND SPECULATION

On frontiers, land as a source of exchange value is generally at least as important as land as productive resource (Moran, 1988; Schelhas, 1996b). There is now general agreement that the rapid expansion of the frontier and concomitant widespread conversion of forests to pastures that took place in Central America from the 1960s through the late 1980s was driven by much more than the “Hamburger Connection” or any other productive use of land (Edelman, 1995). Equally important to cattle markets was a process of land speculation, abetted by government policies, in which

land was cleared and kept clear of trees both as a part of a process of claiming public or absentee-owned lands for private benefit, and as a way of defending against these actions (Schelhas, 1996a).

What is perhaps most interesting here is that while the role of forest-to-pasture conversion in this process has diminished in recent years, the speculative process itself continues. What has changed is that now forests, rather than pastures, are the land use of choice for speculation. At first glance this may appear to be good, from a conservation point of view, since people are now conserving forests in the belief that they will add to increased land values more than would agricultural land uses. However, the long-term economic value and productivity of forests in Costa Rica is unclear, and the speculative retention and planting of forest may very well be on no firmer economic ground than was the cattle boom of the 1970s and 1980s. The hope and expectation that profits can be realized from forests and forested lands appear to be driven more by a combination of expatriate purchases of forested land and a boom in forest-associated ecotourism, both of which send a message that forests can be economically valuable, rather than on actual returns from forest-based enterprises. Like cattle pastures, forests will in the end provide attractive economic returns only in certain places under certain circumstances, if at all. Forest values can be expected to change as the trend toward speculation in forestlands matures.

#### NATIONAL AND GLOBAL CULTURAL CHANGE

Complementing the change in the relative value of pasture and forests, which was described above, has been an overall cultural change in the way land is viewed in Costa Rica. Prior to the 1980s the prevailing land *myth* in Costa Rica was that of a nation of small, independent farmers claiming land by working it (Biesanz et al., 1982). Since the 1980s, this myth has been supplanted by a new myth of Costa Rica as an ecological paradise (Boza et al., 1995). Evidence of this can be found in the national media. As a Costa Rican friend points out, where before, as TV stations signed off for the night, images of *campesinos*, coffee harvests, and oxcarts flashed across the screen, now images of Costa Rica's national parks, plants, and wildlife are seen. This new myth was manifested in interviews with rural landholders, who express diverse values — for heritage, community, and aesthetic values as well as for products and services — related to forests and biodiversity and, perhaps more interesting, seem to be reinterpreting many of their farming practices in conservation terms. For example, they sometimes describe coffee and fruit tree planting as reforestation (Jantzi et al., 1999; Pfeffer et al., 1999). This suggests a complex and dialectical relationship between environmental values and behaviors that invites better understanding through further research and observation.

#### GLOBAL ECONOMIC CHANGE

In addition to the influence of global cultural forces such as environmentalism, there are also influences from global market forces related to the liberalization of trade. Just as the process of forest-to-pasture conversion in the 1970s and 1980s was partially driven by international policies and market forces, so, too, are the more

recent land use trends. The decline of the cattle market in Costa Rica was the result of reduction of government incentives because of international and domestic environmental pressures, as well as changing international markets and trade relations (Lehman, 1992; Müller, 1998; Abler et al., 1999). Similarly, the rise in economic importance of forests has several international sources. These include the elevation of tourism, much of it ecotourism, to the place of number one earner of foreign exchange in Costa Rica in the early 1990s (Pratt, 1999), when it overtook traditional commodity exports such as bananas and coffee.

An equally important economic trend has been the demand in developed countries for sustainably grown forest products. A number of sustainable forestry operations in Costa Rica have developed, and the U.S. and European markets for sustainably grown timber is expanding (Jenkins and Smith, 1999). A number of small farmers in southern Costa Rica are trying to tap into international demand for organic beans and organic and shade-grown coffee in an effort to garner premium prices for their crops by exploiting these niche markets. The potential of niche markets for sustainable or "green" forest products is increasing landholder interest in tree and forest conservation. Whether this continues will depend on the development of profitable and accessible markets for these products.

A third trend is the rise of plantation agricultural and *maquiladora* factories that produce everything from clothing to computers and related job growth in these sectors. Nontraditional exports are increasing more rapidly than traditional ones (Proyecto Estado de la Nación, 1996), and in 1998 the computer industry surpassed tourism as the number one earner of foreign exchange in Costa Rica (Pratt, 1999). As indicated above, there is evidence that involvement in well-paid\* off-farm employment has a positive influence on forest retention on farms (Thacher et al., 1997). This is a hypothesis that should be examined over time, because, if free trade does what it has promised (bring about widespread economic growth and prosperity by stimulating nontraditional agricultural exports and industry), there may be a large-scale regeneration of forests similar to what occurred in the northeastern United States or Puerto Rico earlier (Williams, 1989; Franco et al., 1997; Koop and Tole, 1997). An alternative hypothesis is that, if trade liberalization fails to deliver benefits that exceed costs for the rural poor, there could be a return to shifting agriculture for subsistence production at the expense of forests.

#### CHANGING FOREST POLICIES

Another important trend has been changing forest policies in Costa Rica. While many of the government policies that promoted unproductive deforestation in the past have changed (Watson et al., 1998), broader changes in the political process provide new cause for concern. Costa Rica has a tradition of alternating between its two major political parties in presidential elections. (Costa Rica elects a new president every 4 years, under a system that prohibits a president from running for

\* Poorly paid off-farm employment may result in a simultaneous shortage of land and labor that can lead to intensive farming without the investments in resource management required for sustainability (Collins, 1987).

reelection.) Frequent changes of government, combined with a rise in technocratic policy making, have led to almost annual changes in forest policies. The result is that new policies are changed before they have time to filter into public consciousness, and the operative effect is that the only thing that landholders have confidence in is that forest and land-use policies *will* change. This uncertainty, in turn, creates a climate in which long-term forest land use and conservation are perceived as risky because of uncertainty about what future forestry practices will be permissible or favored. This suggests that too frequent policy adjustments may produce perverse results, and should serve as a cautionary note for adaptive management and any other process that frequently reevaluates and recommends changes in policies.

An additional issue is the recent dominance of an economic approach to environmental policies, emphasizing transfer payments by the government to individual landholders for conserving forests or reforestation. However sensible these payments may appear when the economic costs and benefits of forest conservation are analyzed (Kishor and Constantino, 1993), the author's interviews reveal hints that farmers participating in these programs may feel that they are caring for forests more for the government than for themselves, which *may* foreshadow an erosion of the local social and cultural mechanisms that promote forest conservation. This is exacerbated by the fact that the Costa Rica government, forced to reduce government expenditures on core services such as education and health care by austerity measures imposed by the international lending agencies, has proved unable to sustain reliably many of the incentive programs promoting forest conservation (Rohter, 1996; Escofet, 1998; Dulude, 2000). The result may be the worst of both worlds — a shift in attributed responsibility for forests from individuals to the government, combined with ineffective government forest conservation efforts. If the government is unable to sustain its financial incentives promoting forest conservation, it may be better off relying on social and cultural means rather than allowing forests to be eroded by short-term transfer payments.

### CONCEPTUAL MODELS FOR ADAPTIVE MANAGEMENT

The above processes can be converted into hypotheses about the changing relationships between people and forests adjacent to one sector of La Amistad National Park, in Costa Rica. These hypotheses suggest important questions that should be asked in research and observation of forest-people relationships in Costa Rica. A set of hypotheses would include:

1. Speculative land markets drive land-use choice in Costa Rica as much as productive land-use value. Much of the recent interest in forestlands is speculative, and therefore may not be sustained.
2. Costa Rica is undergoing a cultural shift in national identity from that of an "agrarian democracy" to one of an "ecological paradise." The results of this are a mixed amalgam of increased valuing of trees and forests and reinterpreting existing land-use practices in favorable ecological terms.

3. The Costa Rican economy is shifting under trade liberalization to greater orientation toward export production (both industrial and nontraditional agricultural products). To the extent that export industries provide large numbers of well-paying jobs (by Costa Rican standards), Costa Rican forests will recover substantially, particularly on lands that are marginal for agriculture.
4. Frequent changes in forest policy may create uncertainty about future returns from forests that discourages forest management regardless of the substance of the policies.
5. Economic mechanisms to promote forest conservation may undermine sociocultural mechanisms.

These hypotheses that can help form a conceptual model for adaptive management and orient long-term research to produce the cumulative learning that will provide the basis for natural resource management in the future. Such an approach would differ substantially from the fragmented and *ad hoc* way that forest policy and management have been approached in the past.

Although this chapter has emphasized "formal professional models," the larger point is that there is a need for pluralism in the development of models for adaptive management. It is unlikely that one will be able to develop "super-models" that rigorously include all the different scientific approaches — quantitative and qualitative — that can inform forest management and policy. However, the example above found that models of process have important nodes of articulation with individual choice models (e.g., off-farm employment and changing forest cover) and one can expect there to be important and instructive linkages between other models. A more realistic goal than a single model may be a disciplinary pluralism that promotes the development of many different conceptual and formal models, rather than the development of a single model, and allows managers and scientists together to sort out the lessons that these models provide. For example, in the Costa Rican case, the conceptual model interfaces well with economic and policy models (Lutz and Daly, 1991; Kishor and Constantino, 1993; Abler et al., 1999) and would be complemented by ecological models as well.

Finally, while it is suggested here that multiple scientific models have a very important role to play in adaptive management, it is equally important to include models held and developed by residents of the region — including farmers, land managers, and business people (i.e., "folk models"). Thus it is argued that the use of participatory processes is important, and that making models through participatory processes is complementary to scientific models. This leads to the collaborative component.

### ADDING A COLLABORATIVE COMPONENT

There are few, if any, examples of collaborative natural resource management from southern Costa Rica, and the author does not have much to report regarding the use of collaborative approaches in the region adjacent to PILA in southern Costa Rica beyond his involvement in several Participatory Rural Appraisals. Perhaps the lack of collaborative approaches is more logical than it seems. There appear to be several

reasons collaborative approaches to forest management in southern Costa Rica are problematic, and understanding these is perhaps the first step to beginning to think about how a collaborative component might be added to the adaptive management component whose development was outlined above.

#### UNEVEN CONCENTRATION OF POWER

One issue is the fact that Costa Rica has been historically characterized by a concentration of power at the two extremes — the individual/farm household level and the national government level. It is also true that national government agencies dealing with natural resource management on private lands have been historically weak. Community, provincial, and regional organizations and institutions in Costa Rica are relatively undeveloped, even in contrast to other Central American countries. Although Costa Rica is a long-standing democracy, the lack of intermediate organizations and institutions has in general made it difficult to develop the nested hierarchies of institutions that are needed to support farmer organizations and community-based conservation and sustainable development at the watershed and ecoregional levels (Ostrom, 1990; Uphoff, 1993; Pritchard et al., 1998). Coto Brus, where the author's group is working, is particularly disadvantaged in this regard because it is a relatively isolated region with a near total lack of conservation or development projects and a very low level of services from government ministries or NGOs.

#### GOVERNANCE CHANGES AND ECONOMIC CHANGES

Costa Rica has been influenced by the recent worldwide trend toward devolution of government power, and there is an ongoing effort to transfer national government power and responsibilities down to the municipal level. Perhaps not surprisingly, as in many other places, the central government is transferring the responsibilities but not the money and other resources to local governments. Local governments must raise the money through the implementation of a new property tax. Increasing property taxes are generally considered to be a detriment to forest management (GAO, 1978; Coughlin, 1980; Greene, 1994). It is not clear that adequate allowances are being, or can be, made in the new tax codes to provide incentives to maintain land in forests as property taxes are instituted. This will depend on how forest conservation is prioritized at the community and municipal levels relative to development or meeting municipal financial needs. Thus, it is possible that strengthening local institutions in combination with the institution of property taxes could have a deleterious effect on forestland uses and conservation. Even if a mechanism such as easements were regarded as a viable option in this area, there is a very serious question of who would manage and enforce the easements (see Gustanski and Squires, 1999). Paradoxically, the apparent road to collaboration via devolution is paved with pitfalls.

#### UNEVEN DISTRIBUTION OF COSTS AND BENEFITS OF FOREST CONSERVATION

The way forest values are traded off with other values is fundamental to the amount of support forest programs have from local residents and decision makers (Satterfield and Gregory, 1998). Focus group interviews in one community in Coto Brus suggest

that awareness of environmental problems is widespread, but people not directly involved in conservation committees may not rank them as highly in importance as other concerns (Schelhas, 1996c). This may be because many of the costs and benefits of forest conservation accrue across different levels of the global to local continuum. For example, conservation of Costa Rica's biodiversity is perhaps of greatest interest at the national and global levels. This is *not* to say there is no local interest in biodiversity conservation — focus group and interview results have indicated that there is — but at the local level it is more likely to conflict with human livelihoods and development aspirations. In another example, soil and water conservation, which research indicates is the biggest motivations for forest conservation in southern Costa Rica, splits costs and benefits between upstream and downstream landholders and communities. Only by developing a full set of nested institutions can these conflicts between levels and places be addressed.

But the question of the likelihood of this happening remains. Most of the success stories in the literature are examples where economic dependence on forest products — often nontimber forest products — is strong. This is not the case in Costa Rica. Economic returns from forests through ecotourism, small- and large-scale timber cutting, and nontimber forest products are low and received by relatively few people. Although there is considerable evidence that rural people value forests, including their local forests, forest values in southern Costa Rica are grounded in less tangible ecosystem services values, particularly watershed values. Interestingly, many of the communities, for example, Siete Colinas and Alpha (Jantzi et al., 1999; O'Connor, 1998), in which forests are currently being protected in the belief that this will maintain local water supplies are soon going to be tied into an expanded aqueduct system that is bringing water from high in the mountains. It remains to be seen whether dispersed and intangible forest values can be significant enough to promote the development of and participation in institutions for forest conservation.

The above discussion of collaborative issues suggests additional hypotheses for adaptive collaborative management. These include:

1. Nested-level hierarchies of governance are necessary for successful ecoregional forest management.
2. Devolution of forest decision making authority in Costa Rica, in combination with the implementation of property taxes, is both increasing and decreasing incentives for forest management. The results, in terms of changes in forest cover, will depend on the way that differential assessments for forestlands are implemented and on the economic value of forests themselves.
3. Strong local forest conservation mechanisms are unlikely to develop in an agrarian economy in the absence of a significant economic value for forest products.

#### CONCLUSIONS

The adaptive component of managing land use adjacent to protected areas must be pluralistic in including different types of scientific models that focus on patterns and

relationships, as well as on individual behaviors. This chapter has used an example based on Halperin's notion of formal processual models for understanding forest and tree use and conservation on privately held farms in southern Costa Rica — a model that is distinctly nonquantitative — to illustrate this point. Both the human-forest interactions and the forest cover-biodiversity relationships are highly complex at the regional level. Conceptual modeling to specify important relationships can provide some propositions for adaptive management and policy making, and also identify important research questions that can help fill in critical gaps in the knowledge for long-term adaptive and collaborative management of regional human-occupied ecosystems.

The prospects for the development of *comprehensive* formal models that cross disciplines appear dim. A better approach may be to use a suite of *partial* models systematically — formal quantitative, conceptual, and folk — and seek linkages among them. These can be used to develop the hypotheses on which to base adaptive management and research. Collaborative processes are fundamental to this, yet there are significant obstacles to implementing them in southern Costa Rica. By making these obstacles explicit, the collaborative and adaptive approaches can be merged to inform and improve efforts to develop the art and science of adaptive collaborative management in southern Costa Rica and elsewhere.

### ACKNOWLEDGMENTS

The author thanks Charles Geisler and Jeff Langholz for their thoughtful comments on an earlier draft of this chapter.

### REFERENCES

- Abler, D. G., Rodriguez, A. G., and Shortle, J. S., 1999. Trade liberalization and the environment in Costa Rica. *Environ. Dev. Econ.*, 4(3), 357-373.
- Aldrich, P. R. and Hamrick, J. L., 1998. Reproductive dominance of pasture trees in a fragmented tropical forest mosaic. *Science*, 281(5373), 103-105.
- Biesanz, R., Zubris Biesanz, K., and Hiltunen Biesanz, M., 1982. *The Costa Ricans*. Prentice-Hall, Englewood Cliffs, NJ.
- Borgella, R., 1995. Population Size, Survivorship, and Movement Rates of Resident Birds in Costa Rican Forest Fragments. M.S. thesis, Cornell University, Ithaca, NY.
- Boza, M. A., Jukofsky, D., and Wille, C., 1995. Costa Rica is a laboratory, not ecotopia. *Conserv. Biol.*, 9(3), 684-685.
- Collins, J., 1987. Labor scarcity and ecological change, in *Lands at Risk in the Third World: Local-Level Perspectives*, Little, P. D., Horowitz, M. M., and Nyerges, A. E., Eds., Westview Press, Boulder, CO, 19-37.
- Cortner, H. J. and Moot, M. A., 1999. *The Politics of Ecosystem Management*, Island Press, Washington, D.C.
- Coughlin, R. E., 1980. The economic impact: differential assessment and the conversion of land to urban uses, in *Property Tax Preference for Agricultural Land*, Roberts, N. A., and Brown, H. J., Eds., Allanheld, Osmun, Montclair, NJ, 43-64.
- Daily, G. C. and Ehrlich, P. R., 1995. Preservation of biodiversity in small rainforest patches: rapid evaluations using butterfly trapping. *Biodiversity Conserv.*, 4, 35-55.

- Dulude, J., 2000. Pioneer program in peril, *Tico Times*, February 4, VI(5), available online at <http://ticotimes.co.cr>
- Edelman, M., 1995. Rethinking the Hamburger thesis: deforestation and the crisis of Central America's beef exports, in *The Social Causes of Environmental Destruction in Latin America*, Painter, M. and Durham, W. H., Eds., University of Michigan Press, Ann Arbor, 25-62.
- Escofet, G., 1998. Suspensions of forest incentives blasted, *Tico Times*, 42(1483), 1, 8.
- Franco, P. A., Weaver, P. L., and Eggen-McIntosh, S., 1997. Forest Resources of Puerto Rico, 1990, Resource Bulletin SRS-22, Southern Research Station, USDA Forest Service, Asheville, NC.
- GAO, 1978. Effects of Tax Policies in Land Use, CED 78-97, General Accounting Office, Washington, D.C.
- Greene, J. L., 1994. State tax systems and their effects on nonindustrial private forest owners, in *Proceedings of the 1994 Society of American Foresters/Canadian Institute of Forestry Convention*, Society of American Foresters, Bethesda, MD.
- Guindon, C. F., 1996. The importance of forest fragments in the maintenance of regional biodiversity in Costa Rica, in *Forest Patches in Tropical Landscapes*, Schelhas, J. and Greenberg, R., Eds., Island Press, Washington, D.C., 168-186.
- Gunderson, L. H., Holling, C. S., and Light, S. S., 1995. *Barriers and Bridges to the Renewal of Ecosystems and Institutions*, Columbia University Press, New York.
- Gustanski, J.A. and Squires, R. H., 1999. *Protecting the Land: Conservation Easements Past, Present, and Future*, Island Press, Washington, D.C.
- Halperin, R. H., 1994. *Cultural Economies Past and Present*, University of Texas Press, Austin.
- IUCN, 1992. *Protected Areas of the World: A Review of National Systems*, Vol. 4: *Nearctic and Neotropic*, IUCN, Gland, Switzerland.
- Jantzi, T., Schelhas, J., and Lassoie, J. P., 1999. Environmental values and forest patch conservation in a rural Costa Rican community. *Agric. Hum. Values*, 16, 29-39.
- Jenkins, M. B. and Smith, E. T., 1999. *The Business of Sustainable Forestry: Strategies for an Industry in Transition*, Island Press, Washington, D.C.
- Kishor, N. K. and Constantino, L. F., 1993. *Forest Management and Competing Land Uses: An Economic Analysis for Costa Rica*, The World Bank, Washington, D.C.
- Koop, G. and Tole, L., 1997. Measuring differential forest outcomes: a tale of two countries, *World Dev.*, 25(12), 2043-2056.
- Laurance, W. F. and Bierregaard, R. O., 1997. *Tropical Forest Remnants: Ecology, Management, and Conservation of Fragmented Communities*, University of Chicago Press, Chicago.
- Lee, K. N., 1993. *Compass and Gyroscope: Integrating Science and Politics for the Environment*, Island Press, Washington, D.C.
- Lee, R. G., Flamm, R., Turner, M. G., Bledsoe, C., Chandler, P., DeFerrari, C., Gottfried, R., Naiman, R. J., Schumaker, N., and Wear, D., 1992. Integrating sustainable development and environmental vitality: a landscape ecology approach, in *Watershed Management: Balancing Sustainability and Environmental Change*, Naiman, R. J., Ed., Springer-Verlag, New York, 499-521.
- Lehman, M. P., 1992. Deforestation and changing land use patterns in Costa Rica, in *Changing Tropical Forests: Historical Perspectives on Today's Challenges in Central and South America*, Steen, H. K. and Tucker, R. P., Eds., Forest History Society, Durham, NC, 58-76.
- Loiselle, B. A. and Blake, J. G., 1992. Population variation in a tropical bird community: implications for conservation. *BioScience*, 42(11), 838-845.
- Lutz, E. and Daly, H., 1991. Incentives, regulations, and sustainable land use in Costa Rica. *Environ. Resour. Econ.*, 1, 179-194.

- Moran, E., 1988. Social reproduction in the agricultural frontier, in *Production and Autonomy*, Bennet, J. W. and Bowen, J. R., Eds., University Press of America, Lanham, 199–212.
- Müller, E., 1998. Land use policy and secondary forest management in the northern zone of Costa Rica, in *Ecology and Management of Tropical Secondary Forest: Science, People and Policy*, Guariguata, M. R. and Finegan, B., Eds., CATIE, Turrialba, Costa Rica, 11–18.
- O'Connor, K. A., 1998. Riparian Land Use and Riparian Land Use Change in a Rural Community in Costa Rica, M.S. thesis, Cornell University, Ithaca, NY.
- Ostrom, E., 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*, Cambridge University Press, Cambridge.
- Pfeffer, M., Schelhas, J., and Day, L., 1999. Forest Conservation, Value Conflict, and Interest Formation in a Honduran National Park, unpublished manuscript.
- Powell, G. V. N., Bjork, R. D., Rodriguez, S. M., and Barborak, J., 1995/96. Life zones at risk: gap analysis in Costa Rica, *Wild Earth*, 5(4), 46–51.
- Pratt, C., 1999. Intel ousts tourism as top earner, *Tico Times*, 43(1521), 1, 8.
- Pritchard, L., Jr., Colding, J., Berkes, F., Svedin, U., and Folke, C., 1998. The Problem of Fit between Ecosystems and Institutions, IHDP Working Paper No. 2, International Human Dimensions Programme on Global Environmental Change, Bonn, Germany.
- Proyecto Estado de la Nación, 1996. *Estado de la Nación en Desarrollo Humano Sostenible*, Lara Segura, San José, Costa Rica.
- Rohter, L., 1996. Costa Rica chafes at new austerity, *New York Times*, September 10.
- Sample, V. A., 1993. Building Partnerships for Ecosystem Management on Forest and Range Lands in Mixed Ownership, Forest Policy Center, Washington, D.C.
- Satterfield, T. and Gregory, R., 1998. Reconciling environmental values and pragmatic choices, *Soc. Nat. Resour.*, 11, 629–647.
- Schelhas, J., 1996a. Land use choice and forest patches in Costa Rica, in *Forest Patches in Tropical Landscapes*, Schelhas, J. and Greenberg, R., Eds., Island Press, Washington, D.C., 258–284.
- Schelhas, J., 1996b. Land use choice and change: intensification and diversification in the lowland tropics of Costa Rica, *Hum. Organ.*, 55(3), 298–306.
- Schelhas, J., Ed., 1996c. An Interdisciplinary Analysis of Sustainable Landscape Management in Siete Colinas, Coto Brus, Costa Rica, Department of Natural Resources, Cornell University, Ithaca, NY.
- Schelhas, J. and Greenberg, R., 1996. *Forest Patches in Tropical Landscapes*, Island Press, Washington, D.C.
- Schelhas, J., Jantzi, T., Kleppner, C., O'Connor, K., and Thacher, T., 1997. Meeting farmers' needs through forest stewardship, *J. For.*, 95(2), 33–38.
- Soulé, M. E. and Terborgh, J., 1999. *Continental Conservation: Scientific Foundations of Regional Reserve Networks*, Island Press, Washington, D.C.
- Stiles, F. G., 1988. Altitudinal movements of birds on the Caribbean slope of Costa Rica: implications for conservation, in *Tropical Rainforests: Diversity and Conservation*, Almeda, F. and Pringle, C. M., Eds., California Academy of Sciences and Pacific Division, American Association for the Advancement of Science, San Francisco, 243–258.
- Thacher, T., Lee, D. R., and Schelhas, J. W., 1997. Farmer participation in reforestation incentive programs in Costa Rica, *Agrofor. Syst.*, 35, 269–289.
- Turner, M. G., Wear, D. N., and Flamm, R. O., 1996. Land ownership and land cover change in the Southern Appalachian Highlands and the Olympic Peninsula, *Ecol. Appl.*, 6(4), 1150–1172.

- Uphoff, N., 1993. Grassroots organizations and NGOs in rural development: opportunities with diminishing states and expanding markets, *World Dev.*, 21(4), 607–622.
- Walters, C., 1986. *Adaptive Management of Renewable Resources*, Macmillan, New York.
- Walters, C. J., 1997. Challenges in adaptive management of riparian and coastal ecosystems, *Conserv. Ecol.*, 1(2), 1, available at <http://www.consecol.org/vol1/iss2/art1>.
- Watson, V., Cervantes, S., Castro, C., Mora, L., Solis, M., Porras, I. T., and Cornejo, B., 1998. *Making Space for Better Forestry: Costa Rica Country Case Study*, IIED, London.
- Western, D. and Wright, R. M., 1994. *Natural Connections: Perspectives in Community-Based Conservation*, Island Press, Washington, D.C.
- Williams, M., 1989. *Americans and their Forests: A Historical Geography*, Cambridge University Press, Cambridge.
- Wilson, C. L., 1998. A Comparative Analysis of Tropical Forest Fragmentation Patterns Using Aerial Photograph Interpretation and Satellite Image Processing Techniques, M.S. thesis, Cornell University, Ithaca, NY.

# **Biological Diversity**

## ***Balancing Interests Through Adaptive Collaborative Management***

***Edited by***

**Louise E. Buck • Charles C. Geisler  
John Schelhas • Eva Wollenberg**

2001



CRC Press

Boca Raton London New York Washington, D.C.