CONFERENCE PAPER

Economics and Conservation in the Tropics:
A Strategic Dialogue

January 31 – February 1, 2008

The Economics of Managed Landscape Conservation

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Conservation Strategy Fund

Gordon and Betty MOORE FOUNDATION

RESOURCES FOR THE FUTURE

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Historically, both conservation research and policy have concentrated on primary forests. Increasingly, however, the focus is being broadened to include human-dominated landscapes, such as agroforestry systems, managed forests, hedgerows, and fallow lands. One reason is that considerable research has demonstrated that such landscapes can provide many of the same ecological services as primary forest, albeit often at lower levels: they can harbor biodiversity; sequester carbon; prevent soil erosion; and aid in flood control, water purification, and aquifer recharge (Daily 2003). In addition, some managed landscapes can provide corridors between patches of primary forests and can help to preserve such forests by diverting extractive activities, such as hunting and foraging (Gajaseni 1996). Finally, large tracts of undisturbed primary forest are becoming scarce and this trend will be difficult to reverse (Daily 2003).

Economics can help shed light on the factors that drive both the adoption of agroforesty systems and the retention of land in such systems. Most economic research has focused on the first issue (for a review, see Pattanayak et al. 2003). This paper focuses on the second, summarizing research led by a team at Resources for the Future (RFF) on the factors that drive land cover, and land cover change, in Latin American shade coffee areas (Blackman et al. 2008; Blackman, Ávalos-Sartorio, and Chow 2006). The remainder of the paper presents some background information about shade coffee, discusses our research, and offers some reflections on the prospects for this type of research to have real impacts on conservation policy.

Shade Coffee

Shade coffee, a mixed agroforesty system in which coffee bushes are grown in the shade of managed and/or native tree cover, is widespread in tropical countries. In northern Latin America alone (that is, the area encompassing the Caribbean islands, Mexico, Central America, and the Andean countries of South America) shade coffee covers 3.6 million hectares. This agroforestry system supplies many of the ecological services mentioned above. Of particular note is its capacity for harboring biodiversity. Shade coffee is generally grown at altitudes of

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500–1600 meters where tropical and temperate climate zones overlap. These areas are rich in biodiversity. For example, all 14 of Mexico's main shade coffee-growing regions have been designated biodiversity "hotspots" by the country's national commission on biodiversity (Perfecto et al. 1996).

Anecdotal evidence suggests that in Latin America, over the past decade, a significant fraction of the land planted in shade coffee has been converted to other human-dominated uses, such as pasture and row crops—a transformation that has generally entailed a loss of ecosystem services. A key driver of this change has been the so-called coffee crisis─the precipitous structural decline in international coffee prices that began in the late 1980s.

Research in Mexico and El Salvador

Our research used spatial regression analysis to explain land cover and land cover change in shade coffee-growing areas in Mexico and El Salvador. This work has entailed constructing a detailed geographic information system containing plot-level data on land cover and land cover change in shade coffee areas (the dependent variables), as well as geophysical, institutional, agronomic, and socioeconomic factors (the independent variables). A conventional land-rent model underpins the analysis. That is, we assume that land managers devote their plots to the land use, and associated land cover, that generates the highest present discounted net return.

In Mexico, our work focused on a 250,000-hectare study area in the state of Oaxaca, where coffee is overwhelmingly grown by poor small-scale farmers using densely shaded traditional systems. The study sought to explain patterns of clearing observed in 1993, at the onset of the coffee crisis. Two results stand out. First, in shade coffee forests, clearing was less likely to occur close to major cities, all other things equal—the opposite of the pattern in nearby natural forests, and indeed, the opposite of the pattern generally observed in natural forests. The reason is fairly obvious: shade coffee farmers locate near cities for the same reason conventional farmers do—to minimize costs of transporting inputs and outputs to market. Second, we found that clearing was less likely to occur in areas where grower cooperatives were thick on the ground. Here, too, the reason is straightforward: coffee farmers who join cooperatives tend to earn relatively high profits because they receive high prices for their coffee and pay lower input prices.

One policy prescription from these findings is that transportation investments, generally thought to exacerbate deforestation in natural forests, could in principal help stem tree cover loss in mixed agroforestry systems. The impact on tree cover of road building is likely to be complex, however. More and better roads will inevitably improve access to output and input markets for conventional agricultural goods and timber, as well as to markets for nontimber agroforestry crops. The net effect on tree cover is uncertain. Other means of improving market access, such as subsidizing or improving transportation services targeted specifically at producers of non-timber agroforestry crops, may have less ambiguous impacts. A second policy prescription is that promoting marketing cooperatives for non-timber forest products may also help stem the tree cover loss in mixed agroforesty systems.

RFF's second study of shade coffee focused on El Salvador, the most densely populated and severely deforested country in Latin America. Less than 10 percent of its natural forests survive, and the vast majority of remaining tree cover is associated with shade coffee. In El Salvador, RFF examined land cover *change* in the three main coffee growing regions (east, center, and west), which together comprise roughly 160,000 hectares, between 1990 and 2000. The study showed that during the 1990s, 13 percent of this area was cleared. The probability that any given plot was cleared depended upon its geophysical, socioeconomic, and other characteristics in ways that were complex and differed across the three coffee regions. For example, clearing was more likely in densely populated areas close to major cities in the west and center regions (where the most coffee is grown), but also in sparsely populated areas far from cities in the east region. This complexity reflects the fact that a variety of very different land uses were displacing coffee during the 1990s: urbanization associated with a booming housing market and rapidly increasing land prices drove deforestation in the west and center, while shifting subsistence agriculture and logging were important in the east.

The El Salvador results have a number of policy implications. First, they suggest that a rapid policy response is needed to stem further clearing. Second, this response must be carefully targeted and tailored to take into account differences in the drivers and characteristics of clearing. For example, policies aimed at stemming land use change in the west and center need to focus on reining in urban development, while that in the east needs to focus on shifting agriculture. Finally, given that urbanization and skyrocketing land prices are driving most of the clearing, market-based forest conservation approaches, such as payments for environmental services (PES) and coffee certification programs, are not likely to be effective when used in isolation—that is, absent complementary command-and-control policies. It is hard to imagine PES or certification programs that could provide financial incentives on par with the land market. In the next section, we discuss our specific recommendations for trying to stem clearing of shade coffee in the medium term.

Policy Impacts

By way of conclusion, this last section offers several reflections—admittedly based on intuition and anecdotes rather than hard evidence—about the prospects for economic research like ours to have a real impacts on policy. I start with a caveat: understanding the impact that economic research has on policy is inherently difficult because impacts occur with lags and in unexpected ways, and because most researchers have neither the resources nor the incentives to overcome these obstacles, particularly when the lead researchers and the study area are in different countries. Hence, the discussion in this section is necessarily based on intuition and anecdotes rather than hard evidence.

That said, my first point is that the chances that the political dynamic that determines whether environmental economic research will have an impact—the push and pull among interested parties such as regulatory agencies, local governments, landholders, and NGOs—may be more likely to generate a positive outcome in the case of research on mixed agroforesty systems. In general, environmental economic research is apt to have real impacts when a well-organized group of stakeholders has a vested interest in championing it. This is likely to be true in the case of mixed agroforesty systems because, by definition, the managers of these systems have a vested interest in trumpeting research premised on the idea that their farms have social benefits. For example, our research on shade coffee in El Salvador quickly came to the attention of the principal coffee grower trade associations who appear to be using it to lobby for financial assistance and other concessions. It is perhaps not surprising that in this political process, the subtleties of our research were lost. The most important message was simply that land in shade coffee was quickly being converted to other uses and that this conversion was bad for the environment.

A closely related point is that political considerations create key barriers and opportunities for impacts. For example, in El Salvador, at least two political factors limit the policies that can be used to stem clearing in coffee growing areas. The first is that the coffee growers carry serious political "baggage." Historically, they have been rich and powerful and have relied on the labor of poor, landless peasants—a situation that helped precipitate El Salvador's bloody civil war. This legacy constrains current efforts to conserve shade coffee. For example, several government officials told us that any further national policies to provide financial assistance to growers would be a political non-starter given the widespread perception that growers had already benefited too much from government largess. A second constraint on shade coffee conservation policy in El Salvador is the economic and political power of the developers responsible for the lion's share of the clearing in shade coffee areas. Interviewees told us that developers would undercut any efforts to curtail such clearing by enforcing land use restrictions. On the other hand, in Oaxaca, the political dynamic of coffee-sector policy making was very different. There, shade coffee growers were overwhelmingly poor and small-scale and pro-coffee policies were seen as having a favorable, not an unfavorable, distributional impact.

Like political context, institutional capabilities can also severely constrain policy options. For example, in El Salvador, developers are ostensibly required to obtain permits from the Ministry of the Environment and Natural Resource (MARN) to clear tree cover. However, MARN simply does not have the resources to conduct a detailed review of permit applications and more or less automatically approves the vast majority that are submitted.

To have an actual impact in the short or medium term, policy prescriptions derived from environmental economic research must accommodate such political and institutional constraints. We tried to do this in our El Salvador project. For example, one of our recommendations was that given the inability to enforce land use restrictions in the short-to-medium term, regulators could create incentives for land developers to clear and build in a manner that minimizes environmental degradation by retaining as much tree cover as possible, avoiding ecologically sensitive areas, and retaining corridors between forested areas, etc. A second recommendation was to aid efforts to increase the return to coffee by helping improve coffee quality and marketing, and a third was to put more resources into building regulatory capacity.

Finally, lack of requisite data limits what economic research can contribute. Our research projects in Mexico and El Salvador each entailed several years of effort, and in each case the majority of that effort was devoted to acquiring and cleaning data, most notably land cover data derived from remote sensing images. Even so, given time and budget constraints, we were forced to rely on data that was older than we would have liked. As a result, in El Salvador, for example, we were not able to say anything about land cover change over the past seven years. The general problem of acquiring land cover data is well-known.

In addition to the data we collected, which is similar to that used in most spatial econometric analyses of land cover, several other types of data would help make our research more policy relevant, but are quite scarce. The design of conservation policies for managed landscapes, like those for natural forests, should ideally take into account three factors: the risk of clearing, the benefits of reducing this risk, and the costs of various interventions that will accomplish that goal. Together, these data would enable policy makers to calculate the net expected bang for the buck of possible interventions across space. The first factor—the risk of clearing—is an output of econometric analysis such as that described above. Data on the benefits, and to a lesser degree, costs of interventions, are hard to come by, particularly in developing countries.

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