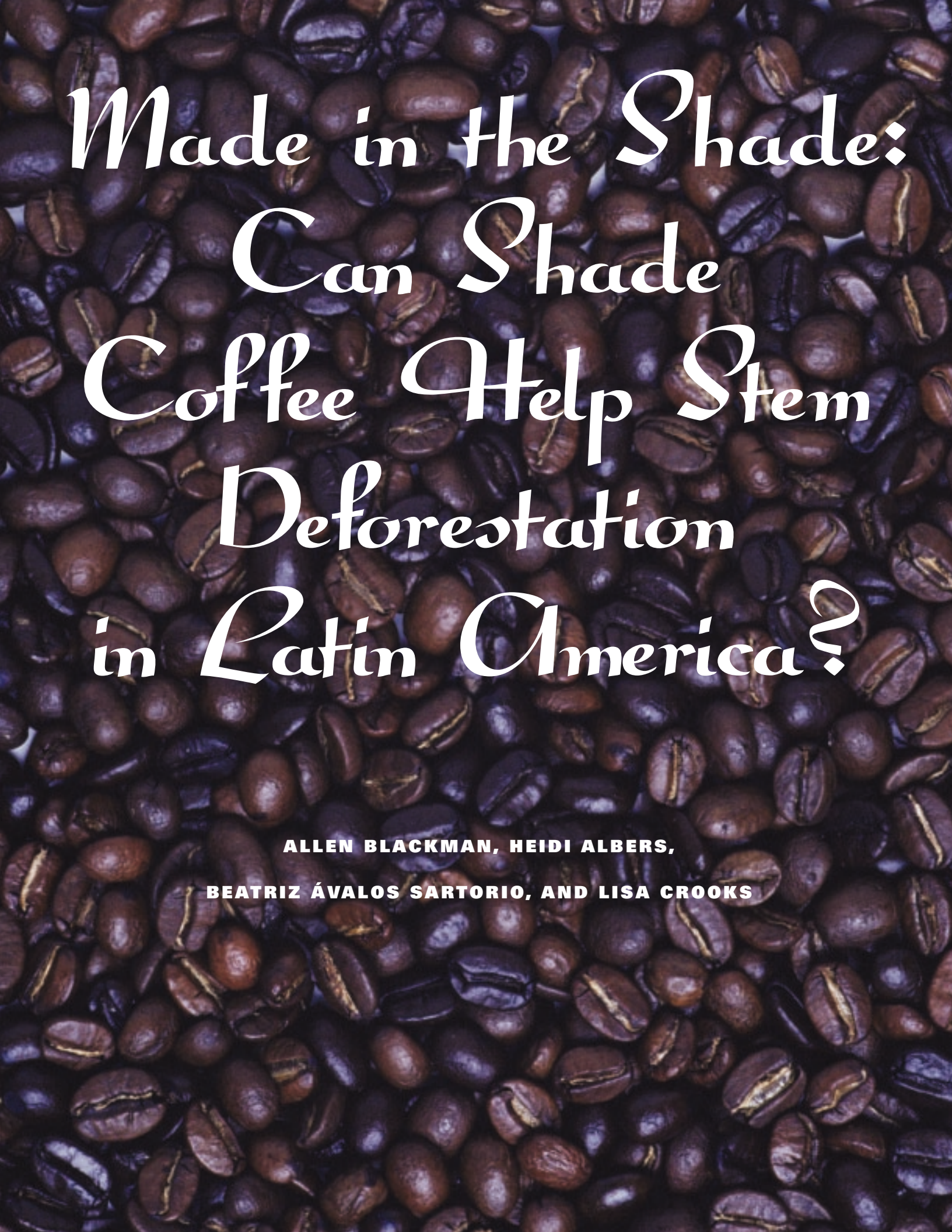

Made in the Shade: Can Shade Coffee Help Stem Deforestation in Latin America?

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Like petroleum, coffee is a widely traded global commodity, mostly consumed in developed countries and produced in developing countries. But while petroleum producers have recently seen international oil prices rise steeply, coffee growers have experienced the opposite. Structural changes in the coffee market during the 1990s—including the collapse of the international coffee cartel and greatly expanded production in Vietnam and Brazil—drove bulk coffee prices to a 100-year low in 2001. The ongoing "coffee crisis" has caused widely reported economic hardship in Latin America where small-scale farms predominate. Less well known is that the crisis has damaged forest ecosystems in this region. Why?

Unlike "sun" coffee grown elsewhere, a sizable percentage of Latin American coffee is grown under natural or managed tree cover, often in coastal areas that are quite rich ecologically but that face mounting population pressure. Because it preserves tree cover in these areas, shade coffee provides important environmental services including harboring biodiversity, sequestering carbon, and preventing soil erosion.

Unfortunately, in Mexico, as in other Latin American countries, the coffee crisis has jeopardized these environmental benefits. Faced with low prices, shade coffee growers have been forced to find alternative sources of income. Some have migrated to cities to find employment, abandoning their farms and leaving them vulnerable to encroachment by conventional farmers, ranchers, and loggers. Others continue to grow coffee but have cleared forest on and around their farms to sell the timber and plant conventional crops. Whatever the specific cause, ecological damage from deforestation in shade coffee regions has been significant, and some of it—notably species loss and soil erosion—may be irreversible or nearly so.

Policymakers are increasingly concerned about the environmental fallout of the coffee crisis. A number of international organizations have established high-profile programs to stem the loss of Mexican shade grown coffee. For example, Conservation International, Starbucks, and the World Bank have joined forces to promote shade coffee near the El Triunfo Biosphere Reserve in the state of Chiapas. In addition, the Commission for Environmental Cooperation, a tri-national organization set up under the North American Free Trade Agreement, has established a program to study and promote Mexican shade coffee.

The Oaxaca Project

Despite international efforts, deforestation in Mexico's shade coffee growing areas remains poorly understood. To help fill this gap, our research team (based at RFF and the Universidad del Mar, a public university in Oaxaca, Mexico) undertook a three-year study funded by the Tinker Foundation and the Commission for Environmental Cooperation. We focused on a 600,000-hectare subset of the Sierra Sur y Costa region in the state of Oaxaca where shade farms produce about one-fifth of Mexico's coffee. We addressed the following specific questions:

- Prior to the coffee crisis, what factors explained spatial patterns of deforestation in "shade coffee forests" (that is, forests in the altitude range where coffee grows) and how did these patterns differ from those in nearby natural forests?
- How much deforestation occurred in shade coffee forests after the onset of the coffee crisis between 1993 and 2001 and what factors explain spatial patterns of this deforestation?
- What drove growers to abandon shade coffee plantations, and how could abandonment be prevented?

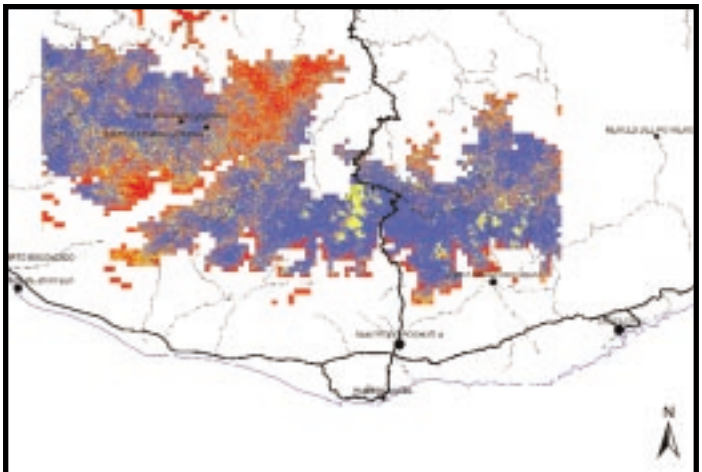
Before the Crisis: What Was Happening?

To answer this question, we assembled a geographic information system (GIS) with detailed data on: land cover (obtained from 1993 aerial photographs); institutional features (such as the percentage of coffee growers who belonged to coopera-

tives); geophysical attributes (for example, altitude, soil type, and distances to urban centers); socioeconomic characteristics (such as population and poverty levels); and the size of the farms. We used statistical techniques to determine which of these characteristics were associated with tree clearing.

We found that, in general, characteristics that tended to lower the profitability of shade coffee compared to the profitability of activities that require direct sunlight (like growing corn) promoted tree clearing. For example, we found that areas farther from cities were more likely to have undergone deforestation. Coffee farms far from cities are less profitable than those close to them because growers incur significant costs to transport goods over the areas' abysmal local roads.

We also found that clearing tended to occur in areas where few coffee growers were organized into marketing cooperatives, where coffee farms were small, where indigenous peoples were prevalent, and at lower altitudes. Coffee farms in areas that are underserved by marketing cooperatives are relatively unprofitable because growers receive lower prices for their beans and pay higher prices for farm inputs. Small farms tend to earn less because growers lack the bargaining power needed to negotiate advantageous prices with local buyers. Farms in indigenous areas often receive lower returns because growers do not have equal access to state-provided agricultural services. Finally, farms at low altitudes earn less because they produce lower-quality coffee.



Land Cover Changes 1993–2001 (Derived from Satellite Images)

- CLEARED IN BOTH YEARS
- FORESTED IN 1993, CLEARED IN 2001
- CLEARED IN 1993, FORESTED IN 2001
- FORESTED IN BOTH YEARS

Landsat images cover only the coffee-growing region, between 400 and 1,600 meters elevation

Having analyzed spatial patterns of clearing in shade coffee forests, we examined those in nearby natural forests and compared the results. We determined that, all other things being equal, clearing was less likely to occur in the shade coffee forests than in natural forests. In addition, we found that in natural forests, clearing tended to occur close to cities because conventional farms want to have easy access to urban markets.

After the Crisis: What Changed?

To address this question, we created new land cover data using satellite images of our study area from 1993 and 2001 and used this new data, along with the GIS described above, to analyze changes in forest cover during this time. We found that roughly 8,000 hectares of tree cover, representing three percent of the shade coffee forest in our study area, were lost during this period. As for spatial patterns of clearing, we found that during the coffee crisis, clearing in shade coffee forests tended to occur in areas where economically vulnerable small farms were prevalent. Clearing also occurred near cities, the opposite of the pattern that predated the crisis. The reason for this change may have been that when coffee prices plummeted, coffee growers near cities were more likely to clear land to raise conventional crops because markets were close by. Also, such growers may have been more likely to abandon their farms because the cost of migrating to a city was relatively low.

Stopping a Downward Spiral

By conducting interviews with growers and collecting agronomic data, we learned that a coffee grower's decision to abandon his or her farm is typically the last stage of a long downturn touched off by a decline in coffee prices. When prices decline, many growers migrate to cities after harvest season to supplement their incomes. In doing so, they forgo important farm maintenance, such as pruning coffee plants after harvest. When this occurs, the yields from coffee plants decline significantly in the next season. Lower yields imply growers will again need to find off-farm work and will again forgo maintenance. As a result, bad prices in one year can set in motion a downward spiral of falling incomes and yields. Eventually, coffee yields drop so low that growers are forced to clear trees to grow subsistence crops and, ultimately, to abandon their plantations.

We built a numerical simulation model to analyze the effect of a variety of popular policies on a grower's abandonment decision. These include: improving access to credit, establishing a price floor for coffee, paying the grower for the environmental services her coffee provides, and certifying her coffee as environmentally friendly so that it commands a price premium (a strategy that has shown considerable promise elsewhere but that is rarely used in our study area). We found that although all of these policies have the potential to prevent abandonment, whether they actually do depends on putting them in place quickly after a price shock. Once a downward spiral has begun, they will have little impact.

Conclusions and Extensions

The coffee crisis of the past decade has weakened the ability of Mexican shade coffee to serve as a bulwark against deforestation, according to our research. But there are steps that policymakers can take to reverse this trend. Our statistical analysis of land cover data indicates promoting coffee marketing cooperatives can help stem deforestation in shade coffee areas. It also suggests that road building and other investments that cut travel time will likely have countervailing impacts on deforestation. When coffee prices are strong, transportation investments promote shade coffee and, therefore, forest cover. However, when coffee prices decline, such investments may encourage coffee growers to abandon their land or to clear trees to plant conventional crops. In addition, our research shows that heavily indigenous shade coffee areas and those with many small farms are experiencing relatively rapid deforestation and therefore may be good targets for assistance. Finally, our numerical simulations suggest that often-used interventions like price supports and coffee certification need to be put in place expeditiously to make a difference.

Our team is pursing several projects that build on the Oaxaca study. One analyzes the effectiveness of a recent Mexican coffee price-support program in stemming the loss of shade coffee. A second project uses the empirical methods we developed in our Oaxaca work to analyze the impact of the coffee crisis on deforestation in El Salvador, a densely populated country that has already lost more than 95 percent of its original forest and where virtually all of the remaining tree cover is associated with shade coffee. ■

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Because coffee grown under tree cover provides important ecological benefits including harboring biodiversity and sequestering carbon, environmentally conscious consumers are willing to pay a price premium for it. Passing this premium on to growers can help ensure that they survive price shocks and maintain the tree cover on and around their farms. This compelling logic underpins ongoing efforts to certify coffee as "shade grown." RFF research suggests that in order to have the biggest environmental bang for the buck, such efforts should target small growers who are most vulnerable to price shocks and most likely to clear forest cover. To do so, however, stakeholders must find ways to lower the transaction costs involved in certifying thousands of small-scale growers.