Can Shade-Grown Coffee Help Conserve Tropical Biodiversity? A Market Perspective

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Abstract
This paper studies the market for shade-grown coffee as an approach to tropical biodiversity conservation. Shade-grown coffee farms provide important habitat for a wide array of biodiversity. In particular, recent studies show that these farms serve as habitat for sixty-six species of neotropical birds that are listed as threatened or endangered by the IUCN and CITES. Initial sections of this paper provide a brief history of shade-grown coffee, describe the ecological aspects of the production process, and examine the current market for shade-grown coffee. Results are then reported from an original study of consumer behavior in the market for shade-grown coffee. The study suggests that consumers are not willing to sacrifice coffee taste for environmental concern. Income, choice of retail venue, and degree of environmental concern are influential factors when deciding to purchase shade-grown instead of conventional gourmet coffee. Finally, even in cafés where shade-grown coffee was actively marketed, the majority of consumers not purchasing the coffee were unaware of the shade-grown option.

Introduction
Tropical deforestation is a well-known cause of biodiversity loss. Traditional conservation efforts focus on the establishment of national parks and protected areas. These efforts, however, often fail to protect tropical biodiversity outside the boundaries of these areas. For example, laws that protect biodiversity and foster habitat protection typically do not govern agricultural ecosystems, yet landscapes with different agricultural practices can support substantially different levels of species diversity. The absence of government regulations in such areas has lead to the adoption of private mechanisms for protection of biodiversity. One form of a private mechanism is a market for goods and services that promotes habitat conservation and tropical biodiversity. The expanding market for shade-grown coffee provides an example.

Since the 1930s, biologists have noted similarities in the density and diversity of bird species in traditional (or shaded) coffee farms and in undisturbed rainforests. These similarities extend beyond bird species and include a wide variety of tropical biodiversity from trees and epiphytes to small mammals, reptiles, amphibians, and arthropods (Moguel and Toledo 1999). While shade-grown coffee farms support a surprisingly high level of biodiversity, more modern production practices do not. Modern production is based on direct-sun cultivation, which removes the biodiversity-rich tree canopies and increases the use of agricultural chemicals. These techniques increase coffee production, but result in a substantial decrease in habitat for biodiversity.

Efforts are underway to identify and certify coffee cultivated in shade-grown production systems. In addition to preserving tropical biodiversity, these efforts seek to provide a financial incentive to farmers who continue growing shade-grown coffee. This incentive is a price premium that consumers appear increasingly willing to pay for shade-grown coffee.

This paper explores consumer behavior and attitudes related to shade-grown coffee and the potential for shade-grown coffee to help conserve tropical biodiversity. The next sections provide a brief history of shade-grown coffee, describe biological aspects of the production process, and examine the current market for shade-grown coffee. Data collection and results of an original study of consumer behavior are then
reported. Finally, these results are discussed in concluding sections.

History of shade-grown coffee
Early production of coffee necessitated removal of only the forest understory, not the entire forest canopy. Coffee in Latin America historically thrived under the shade of forest-like tree canopies that protected coffee bushes from direct sunlight. For more than 200 years, nearly all coffee produced in Latin America grew under shade conditions.

In the 1970s, many Latin American governments sponsored coffee “technification” programs to boost coffee production, protect against crop loss from disease, and facilitate general economic development. Technification eliminates or reduces the tree canopy and decreases the species diversity previously supported by shade trees. Often accompanying this conversion increased reliance on chemical inputs, such as fertilizer, insecticides, herbicides, and fungicides (Rice and Ward 1996).

Through technification, shade-grown coffee plants are also replaced with smaller coffee hybrids that can tolerate direct sunlight. These new hybrids increase the density of coffee bushes from 1,000 to 2,000 plants per hectare to 3,000 to 7,000 plants per hectare. The hybrid varieties can yield up to 30% more coffee per bush when supplied with sufficient fertilizer (Rice and Ward 1996).

During the 1970s and 1980s, the U.S. Agency for International Development spent more than $80 million in Latin America promoting coffee technification (Rice and Ward 1996). Currently, 30 to 40% of all coffee from Latin America is “technified”. Figure 1 shows the proportion of shaded and technified regions in Central American countries.

Ecological aspects of shade-grown coffee
As early as 1932, Ludlow Griscom of the American Museum of Natural History noted similarities in the density and diversity of bird populations found in traditional coffee farms and undisturbed rainforests (Bray 1999). More recent studies of neotropical birds show similar results. For example, the Smithsonian Migratory Bird Center documented 150 bird species in shade-grown coffee farms (Van der Voort and Greenberg 1997). Other studies demonstrate a strong link between shade-grown coffee farms and endangered neotropical birds. In Latin America alone, sixty-six threatened or endangered species of neotropical birds (as listed by the World Conservation Union (IUCN) and the Convention on International Trade in Endangered Species (CITES)) have been observed in shade-grown coffee farms (Dietsch 2000).

Shade-grown coffee farms also provide habitat for other forms of tropical biodiversity. For example, in Chiapas, Mexico shade-grown coffee farms support as much as 74% of the bat biodiversity of neighboring
rainforests (Estrada and Coates-Estrada 1993). In Costa Rica's Central Valley, a single tree in a shade-grown coffee plantation can support 30 species of ants and 126 species of beetles, a species richness and diversity rivaled only by trees in undisturbed forests. In the same study, a nearby tree contained a similar number of ant and beetle species (27 and 100, respectively), yet only 18% of the ant species and 14% of the beetle species found on this nearby tree were also found in the first tree (Perfecto et. al 1996). Other taxonomic groups, including small mammals, bats, and primates in Mexico find parallel trends (Tangley 1996). A review by Moguel and Toledo (1999) supports these broad trends by demonstrating high levels of tree, epiphyte, mammal, bird, reptile, amphibian, and arthropod diversity on traditional shade-grown coffee farms in Mexico.

In contrast, the removal of the tree canopy for sun-tolerant coffee and the increase in chemical inputs reduces the flora and fauna that previously occupied this agricultural ecosystem. In Costa Rica, ant biodiversity has exhibited a sharp decrease as agricultural practices intensify (Perfecto and Snelling 1995; Perfecto and Vandermeer 1994). In Colombia and Mexico, 94 to 97% fewer bird species are found in technified coffee farms than in shade-grown coffee farms (Van der Voort and Greenberg 1997). Studies in Panama, Mexico, Colombia, and the Caribbean show a 60 to 80% difference in bird species found in the two production systems (Petit 1998).

From a landscape perspective, shade-grown coffee farms often comprise the majority of remaining forest-like cover in highly deforested regions. For example, only 2% of El Salvador's original rainforest remains, while shade-grown coffee farms represent 60% of the country's remaining forest lands (Rice and Ward 1996). Thus, shade-grown coffee farms serve as important habitat between undisturbed islands of biodiversity.

The market for shade-grown coffee

While efforts to market shade-grown coffee are underway, little is known about existing and potential consumer demand. In general, demand for instant and ground coffee has declined for several years, while total coffee sales have remained stable. This trend is due primarily to growth in specialty coffee sales (Rice and McLean 1999) (see Table 1 for a description of the various coffee classifications). The specialty coffee market has grown dramatically in the past decade from $1 billion per year in 1990 to $3.3 billion per year in 1998 (Rice and Ward 1996, SCAA 1999). In the coming decade, specialty coffee sales are expected to continue increasing by an estimated 20 to 25% per year (Rice and McLean 1999).

Initial marketing efforts for shade-grown coffee have targeted consumers in specialty coffee markets. Exact sales of shade-grown coffee are not currently tracked by any organization. Estimates of current annual sales are between $15 to 30 million, with future sales projected around $100 million (Rice and McLean 1999, CEC 1999).

Efforts have been made to estimate the potential market for shade-grown coffee. A 1999 phone survey conducted by the NAFTA Commission for Environmental Cooperation (CEC) estimated that roughly one-in-five consumers in North America are "very interested" in purchasing shade-grown coffee from Mexico. In addition, this study found that 42% of consumers in Canada, 36% in Mexico, and 22% in the United States are willing to pay one dollar more per pound for Mexican shade-grown coffee. A 1996 study by the Smithsonian Migratory Bird Center found that 41% of respondents indicate a willingness to pay an extra dollar or two per pound to purchase "sustainable" coffee, while 23% indicate a willingness to pay "whatever it costs" to buy sustainable coffee. Only 8% of the respondents indicate that they would not be willing to pay more for a sustainable coffee (Rice and McLean 1999).

Table 1. Characteristics of different types of coffee (Rice and McLean 1999).

<table>
<thead>
<tr>
<th>Characteristics of Coffee Types</th>
<th>Taste</th>
<th>Packaging</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial ground and instant coffees</td>
<td>Inferior taste</td>
<td>Tin can and glass jar</td>
<td>Low</td>
</tr>
<tr>
<td>Premium coffees (mass-marketed)</td>
<td>Somewhat better taste</td>
<td>Packaged in cans (more upscale image)</td>
<td>Somewhat higher price</td>
</tr>
<tr>
<td>Specialty coffees (also called gourmet, made from highest quality beans)</td>
<td>Superior taste</td>
<td>Vacuum-packed bags or whole bean bins</td>
<td>Considerably higher price</td>
</tr>
</tbody>
</table>

Data collection

This research analyzes survey data collected in two cafés in the Washington, D.C. area in the spring of
1999. These cafés, Savory Café and Atomic Café, were involved in efforts to test the market for shade-grown coffee in the Washington, D.C. area. The cafés in this study vary with regard to location and clientele. Sustainable Harvest Coffee Company coordinated the market test.

The two cafés sold cups of shade-grown coffee and similar-tasting, gourmet coffee. Both caffeinated coffees came from Latin America and shared the same roaster. Consequently, this study examines consumers' choice between a higher-cost, shade-grown coffee and a lower-cost, gourmet substitute. The price premium and overall price for both coffees remained constant throughout the study period, but differed at each café (Table 2). Data collection began several months after a publicity campaign about shade-grown coffee.

After direct observation of a coffee purchase, an in-store, written survey was administered to both purchasers and non-purchasers of shade-grown coffee. The survey instrument asked questions about respondents' coffee consumption habits, general demographic background, and their opinions about social and environmental matters. The surveys for both purchasers and non-purchasers were identical, except that the survey for purchasers asked about their motivations for purchasing shade-grown coffee, while the survey for non-purchasers posed a hypothetical (contingent purchase) question about respondents' willingness to purchase shade-grown coffee at different price premium levels. Each survey required approximately ten minutes to complete. Data collection was done periodically over a three-month period. A total of 226 surveys were collected. The combined response rate was 67.3%.

Results

Purchasers and non-purchasers of shade-grown coffee share many of the same preferences with regards to the characteristics that affect their coffee purchase (Figure 2). For both groups, the most important characteristic is taste. The only statistically different characteristics between the two groups are the importance of organic and shade-grown certifications. In other words, people who purchase shade-grown coffee are more likely to identify these certification programs as being important than people who do not purchase shade-grown coffee.

Purchasers of shade-grown coffee also tend to have higher aver-
age incomes, higher general environmental beliefs (as measured by the New Ecological Paradigm scale, see Dunlap et al. 1992 for further discussion), and are more likely to belong to an environmental organization (Table 3). Purchasers and non-purchasers are statistically similar in a number of different demographic categories including age, size of household, gender, marital status, and education. In addition, both purchasers and non-purchasers are statistically similar with regard to the amount of bird watching they enjoy and whether they had ever visited a tropical forest. On average, both groups "occasionally" enjoy bird watching, while 58% of purchasers and 52% of non-purchasers previously visited a tropical forest.

This study also assessed actual and hypothetical purchases of shade-grown coffee. A subset of non-purchasers was asked whether they would have purchased shade-grown coffee at a lower price premium. The survey randomly assigned lower values for the premium. As expected, responses to this hypothetical question show a decreasing willingness to purchase shade-grown coffee as price rises (Table 4). For example, at Savory Café, almost 50% of the respondents replied no to a $0.50 price premium, while 10% of the respondents replied "no" to a $0.20 price premium.

The results suggest that the market for shade-grown coffee can be broken into three segments:

**Group A:** Coffee consumers who currently purchase shade-grown coffee (current market).

**Group B:** Coffee consumers who currently do not purchase shade-grown coffee and indicate that they are unlikely to do so in the future even at lower prices.

**Group C:** Coffee consumers who currently do not purchase shade-grown coffee, but indicate that they would purchase the coffee at or below current store prices (area of potential market growth).

The number of people who currently purchase shade-grown coffee (Group A) is small relative to the total population of specialty coffee purchases. During the study period, purchases of shade-grown coffee comprised only 5.2% of the entire decaffeinated coffee purchases. Excluding the consumers who were not aware that shade-grown was being sold that day (69.2% of all the non-purchasers), shade-grown purchases comprised 15.1% of the total.

The study examined the motives of purchasers. For consumers in Group A, the perception that shade-grown coffee "maintains the health of tropical ecosystems" was the primary reason why purchasers indicated that they purchased shade-grown coffee. In fact, more than 80% of this group listed this reason as the most important reason for their decision. Other reasons for purchasing shade-grown coffee included preference for the taste of shade-grown coffee, a sense of "moral satisfaction" only gained by purchasing the coffee, and the perceived benefits to birdwatchers. Each of these three reasons is significantly less important than maintaining the health of tropical ecosystems and each is statistically indistinguishable in preference from one another.

This study also examined the motivations of non-purchasers. The study queried non-purchasers who indicated that they would not purchase shade-grown coffee in the hypothetical question (Group B). These individuals were asked to select all of the reasons why they would not purchase shade-

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**Table 3. Statistical comparison of similarities and differences of coffee patrons.**

<table>
<thead>
<tr>
<th>Differences &amp; Similarities</th>
<th>Purchasers</th>
<th>Non-Purchasers</th>
<th>t-stat</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Differences</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organic certification an important characteristic</td>
<td>32%</td>
<td>13%</td>
<td>-2.031</td>
<td>0.045</td>
</tr>
<tr>
<td>Shade-grown certification an important characteristic</td>
<td>45%</td>
<td>8.30%</td>
<td>-4.614</td>
<td>0.000</td>
</tr>
<tr>
<td>Average 1998 income</td>
<td>$85,000</td>
<td>$67,091</td>
<td>-1.64</td>
<td>0.104</td>
</tr>
<tr>
<td>Membership in service organization</td>
<td>56%</td>
<td>37%</td>
<td>-1.65</td>
<td>0.103</td>
</tr>
<tr>
<td>Membership in environmental organization</td>
<td>48%</td>
<td>20%</td>
<td>-2.69</td>
<td>0.009</td>
</tr>
<tr>
<td>Environmental concern (sum of NEP scores - out of 25)</td>
<td>21.04</td>
<td>19.42</td>
<td>-2.02</td>
<td>0.047</td>
</tr>
<tr>
<td><strong>Similarities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average age (years)</td>
<td>38.3</td>
<td>38.6</td>
<td>0.13</td>
<td>0.897</td>
</tr>
<tr>
<td>Average size of household</td>
<td>2.17</td>
<td>2.13</td>
<td>-0.12</td>
<td>0.906</td>
</tr>
<tr>
<td>Gender (male)</td>
<td>52%</td>
<td>66%</td>
<td>1.17</td>
<td>0.245</td>
</tr>
<tr>
<td>Married</td>
<td>52%</td>
<td>47%</td>
<td>-0.41</td>
<td>0.684</td>
</tr>
<tr>
<td>At least BA/BS degree</td>
<td>92%</td>
<td>86%</td>
<td>-0.03</td>
<td>0.976</td>
</tr>
<tr>
<td>Beyond BA/BS degree</td>
<td>56%</td>
<td>45%</td>
<td>-0.71</td>
<td>0.482</td>
</tr>
<tr>
<td>Frequency of bird watching (occasionally or frequently)</td>
<td>56%</td>
<td>38%</td>
<td>-1.56</td>
<td>0.123</td>
</tr>
<tr>
<td>Visited a tropic forest</td>
<td>58%</td>
<td>52%</td>
<td>-0.48</td>
<td>0.63</td>
</tr>
</tbody>
</table>
grown coffee. Of these respondents, 37.9% indicated that they needed additional information, 31.0% stated that they could not afford shade-grown coffee, 24.1% did not place importance on how coffee is grown, 13.8% preferred the other coffees at the café, and 10.3% did not like the taste of shade-grown coffee.

Non-purchasers who indicated a willingness to purchase shade-grown in the future (Group C), represent the potential market growth for shade-grown coffee. Despite the publicity efforts, 60.6% of the non-purchasers indicated that they were not aware of the concept of shade-grown coffee. In fact, despite advertising within the store (including price-board listings, sales-counter information, and table brochures), 69.2% of the non-purchasers indicated that they were unaware that shade-grown coffee was being sold that day. However, when asked whether they would have purchased shade-grown coffee if they had been aware that it was being sold that day, 67.2% indicated that they would have purchased it with the full price premium.

When combined with Group A, this result suggests that roughly half of the sample population would purchase shade-grown coffee with the current price premiums. This result implies that the market for shade-grown coffee has significant growth potential at current prices. At lower prices, the growth potential may even be greater. This, however, will depend on the elasticity of demand for shade-grown coffee.

Reasons for caution
While the above results appear promising for the potential market for shade-grown coffee, several areas of caution exist. For example, the statement that roughly half of the sample would purchase shade-grown coffee with a full price-premium makes three important assumptions. First, consumers must be aware of shade-grown coffee. Second, consumers must go to retail venues where shade-grown coffee is being sold. Third, consumers must remember to purchase it. To satisfy these three assumptions would likely require a large-scale marketing effort. To date, the organizations involved in marketing shade-grown coffee have not had the necessary resources to launch such an effort.

Additionally, the results suggest that the difference between stated preferences and actual behavior is significant. Whether half of the non-purchasers would actually purchase shade-grown coffee seems unlikely. As stated previously, 67.2% of non-purchasers indicated that they would have purchased shade-grown coffee with its full price premium had they been aware it was being sold that day. Yet, shade-grown coffee comprised only 5.72% of the coffee purchases observed. Given the number of repeat customers at these cafés, a substantial increase in purchases should have been observed, because, as the study progressed, an increasing number of customers became informed about the environmental benefits of shade-grown coffee. Therefore, a change of behavior should have been observed as these initial non-purchasers transformed their stated behavioral intentions to actual purchases of shade-grown coffee. During the tenure of the study, however, only a slight increase in the number of shade-grown purchases was observed, certainly nothing close to shade-grown coffee comprising one-half of all caffeinated coffee purchases.

Implications
This research has several potential implications for the future production and marketing of shade-grown coffee. First, the research clearly indicates that the concept of shade-grown coffee needs additional publicity, and retail venues that currently sell shade-grown coffee need to better inform their customers about the shade-grown option.

Second, these results support the idea that shade-grown coffee must have a high quality taste and that taste cannot be sacrificed for environmental concerns. As discussed earlier, both purchasers and non-purchasers of shade-grown coffee indicated that taste was the most important characteristic of their coffee purchases.

Third, income level, choice of retail venue, and degree of environmental concern appear to be influential factors when deciding to pur-
to be given to how the free-rider issue related to shade-grown coffee. Economic theory suggests that individuals will not fully express their true demand for public goods, such as the environmental benefits from shade-grown coffee. Instead, consumers will avoid paying the price premium and rely upon others to provide the desired ecological benefits ("free ride"). Consequently, public goods tend to be funded below the socially desirable level.

**Conclusion**

It seems premature to determine whether a private market will encourage wide-scale production of certified shade-grown coffee and, thus, enable substantial conservation of biodiversity. Certainly, current levels of consumption are insufficient to achieve conservation on a broad scale. However, as marketing efforts and consumer demand continue to increase, markets for shade-grown coffee may contribute substantially to tropical biodiversity conservation.

**Literature cited**


Griswold, David. *Personal communication*, (July 17, 1999).


