

Volume 34, 2011

**Papers of the
Applied Geography Conferences**

**Editor:
Jay Lee**

SUSTAINABLE DEVELOPMENT IN THE GALÁPAGOS: THE ROLE OF COFFEE PRODUCTION ON SAN CRISTÓBAL ISLAND

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1. INTRODUCTION

The Galápagos, an island group famous for its fauna and flora, also supports human populations. The archipelago's unique ecosystem has been of interest to scientists, tourists, and local residents for decades. A substantial body of work studying the Galápagos provides valuable information about the biological aspects of the islands. Most of this research focuses on the animals, plants and marine organisms (Santander *et al.*, 2008). Little research however, has been conducted with the human inhabitants who became part of the island's history beginning in the fifteenth century. Recently, sustainability with an emphasis on the human inhabitant has become a focus for island management (Heynen *et al.*, 2006).

The limited number of studies conducted concerning island residents has almost exclusively addressed the issues of tourism and fishing (González *et al.*, 2008). Currently lacking in the Galápagos literature are studies about the social and ecological processes which are key components in maintaining a healthy ecosystem and a just social arena (Berkes, 2004). As Gardner, the head of restoration at the Charles Darwin Research Station said in an interview, "With 30,000 people now living in the Galápagos, ecosystem planning must address human needs..." (Vince 2011, 1384).

Conservationists and developers have often been at odds in the Galápagos. However, the Ecuadorian government and conservationists are beginning to work toward human and biological integration, and in 2003, they endorsed The Galápagos Regional Plan to try to achieve a balance between economic growth and biodiversity conservation (González *et al.*, 2008). The plan was created to balance the archipelagos' species and ecosystems with the islands' human populations (Ospina 2006). These groups are working with the concept of sustainable development. When one uses the phrase "sustainable development," this often sparks debate, as researchers struggle to define the essential features of the phrase (Rademacher, 1999). There is no single unanimous approach to "sustainable development" (Ciegis *et al.*, 2009). The concept of sustainable development has different meanings depending on the context (Pierantoni, 2004).

Recognizing the diverse array of opinions, this study adheres to the definition from the Brundtland Report (WCED, 1987): "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." This is the most commonly accepted definition, incorporating the complexities of the concept in the economic, social and environmental realms (Ciegis *et al.*, 2009). The study presented here explores how the production of coffee (*Coffea arabica*, Rubiaceae) in the Galápagos fits into, or conflicts with, the above listed sustainable development categories: 1) economic, 2) social and 3) ecological.

One of the major threats humans have brought to the islands is the introduction of exotic species (Vince, 2011). Despite the large presence of introduced species, there are only a few studies about the non-native flora, most of which focus on eradication (Jäger *et al.*, 2007). This study however, fits into a new realm of thought which looks at an invaded ecosystem as a hybrid. Gardner said, "As scientists and conservationists...It's time to embrace the aliens"

(Vince 2011, 1383). This paper aims to look at how the propagation of an exotic species, may indeed be 'embracing an alien.'

The Galápagos island of San Cristóbal has impressive local flora, and fauna, and breathtaking views. Off the tourist route however, the island has vistas that reflect human inhabitants: poverty, cultivation, rural shacks and garbage dumps. When considering sustainable development in an already altered landscape, incorporating anthropogenic systems makes sense. Utilizing a case study on the Island of San Cristóbal, this research examines the production of coffee, within the framework of sustainable development.

2. STUDY AREA

2.1 PHYSICAL CHARACTERISTICS

The Galápagos Archipelago consists of seven major islands, 11 small islands, and 120 islets and rocks, all located 960 km (600 miles) west of mainland Ecuador (González *et al.*, 2008) (Figure 1). The island of San Cristóbal, the focus of this study, measures 55,800 hectares (Baine *et al.*, 2007), with rich soils in the humid volcanic highlands (Toral-Granda and Martinez, 2008). One of the reasons why the archipelago warrants global attention is because the island group contains one of the world's highest concentrations of endemic species (Jäger *et al.*, 2007). In recognition of the unique value of the Galápagos, Conservation International recognizes it as a Conservation Hotspot, the World Wildlife Fund designated it as a Global 200 Marine Eco-Region, the World Heritage List includes the islands, and UNESCO has declared it one of their Biosphere Reserves (Toral-Granda and Martinez, 2008).



FIGURE 1
THE GALÁPAGOS ISLANDS

2.2 HISTORICAL AND CURRENT CULTURE

The presence of humans and the cultural history of the Galápagos influence the current landscape. Particularly affected are the forest conditions in the highlands of the inhabited islands (González *et al.*, 2008). The Incas first discovered the Islands in the fifteenth century. In 1535 Fray Tomas de Berlanga came upon the islands. In the seventeenth and eighteenth centuries buccaneers used the islands for stowing ships and gathering resources. Whalers and fur sealers began to exploit the island resources during the nineteenth century (Baine *et al.*, 2007; Toral-Granda and Martinez, 2008).

Ecuador formally annexed the archipelago in 1832 and settlers began to establish small colonies on a few of the islands. However, because of the isolation and lack of fresh water few people remained in these villages (Bremner and Perez, 2001). As time passed,

people began to establish more permanent settlements, and by 1950, the government registered 1,346 people in the Galápagos. In 1973 Ecuador formally incorporated the archipelago as the 22nd province of the country and around 30,000 residents now reside in the islands. Permanent residents live on five of the islands: Santa Cruz, San Cristóbal, Isabela, Floreana and military personnel live on Baltra (Taylor *et al.*, 2003).

The rising number of people began exacting a toll on the islands and the surrounding ocean (Bremner and Perez, 2001). As more humans arrived, the Galápagos shifted from a place of colonization to a place in need of protection. In 1959 Ecuador established the Galápagos National Park to protect the areas where settlers had not yet colonized. The Charles Darwin Foundation, which works with the federal government, was also established in order to include scientists in the conservation effort (González *et al.*, 2008).

The Ecuadorian government in conjunction with the Charles Darwin Foundation approved the *Special Law for Galápagos* in 1998. Lawmakers designed the legislation to promote conservation of biodiversity and sustainable development for the province of the Galápagos. One element was to control human immigration (Baine *et al.*, 2007). In 1986 Ecuador extended protective status beyond the land mass to the ocean, and the government created the Galápagos Marine Reserve (Bremner and Perez, 2001).

2.3 GALÁPAGOS LIVELIHOODS AND ECOSYSTEM THREATS

The Galápagos depend economically on activities that are now posing threats to the ecosystem: fishing and tourism. In 2001 the IUCN Red List of threatened species included the entire endemic flora of the islands (McFarland and Cinfuentes, 1996), and in 2007, UNESCO added the archipelago to the World Heritage Sites in Danger list (González *et al.*, 2008). As a consequence, the local residents, the park and the Ecuadorian government are looking for sustainable alternative livelihoods. In order to effectively propose new possibilities, it is important to understand the historical context of economic ventures in order to comprehend the current cultural and economic landscape.

Tourist capital drives most of the economy for the islands with 40 percent of the Galápagos population working in the tourism sector. In an effort to protect the islands, the Galápagos National Park strictly regulates tourist activities (Toral-Granda and Martinez, 2008). However, despite these controls, the islands suffer from the waste tourists produce, the drain on the fresh water supply, and disruption to the ecosystem (Baine *et al.*, 2007; Taylor *et al.*, 2003).

Furthermore, any economy mostly dependent on one source of income can suffer with any disruption to it. For the Galápagos, this risk is increased because it caters to a limited clientele. It is a specific group who can afford the high expenditures of Galápagos travel. If they no longer include these islands on their destination list, or reduce their travel in general, then the island economy will suffer (Baine *et al.*, 2007). Although Galápagos tourism has been a growth market, with the global recession tourist destinations worldwide are experiencing decline (Selmer and Waldstrom, 2007).

The second largest revenue earning activity on the islands is fishing, with lobsters becoming the focus in the 1960s. Originally boats came from the mainland, after fisherman had already over fished the mainland coasts. Sea cucumber also proved lucrative, and in the 1980s and 1990s lobster and sea cucumber fishing generated a "gold-rush" scenario for the islands (Bremner and Perez, 2002). Although customers in island restaurants and tour boats consume a portion of the fish, seafood companies export the majority of the catch. Fishermen and conservationists are now observing the depletion of ocean resources. Because of a lack of lobster and sea cucumber, fisherman now harvest shark fins. The latter activity has become a concern for conservationists around the world (Taylor *et al.*, 2008).

In an effort to curb the extraction of ocean resources, part of the *Special Law for Galápagos* requires that fishermen use only traditional techniques with no industrial fishing within the reserve. Although regulations require all fishermen to be licensed, adhere to a quota, and only fish during certain months of the year, officials rarely enforce these regulations (Baine *et al.*, 2007). Many of the islands' poorest families are dependent on fishing, exacerbating tensions between fishermen, tourists and conservationists (Taylor, *et al.*, 2008).

Although fishing is now popular, most early migrants originally worked in agriculture and cattle ranching. The humid highlands served as the first areas of settlement, because these plots have fresh water and fertile volcanic soil. Although now reduced, agriculture is still the main form of income for eight to ten percent of the population. Currently 7,892 ha of the 55,800 ha are under cultivation (Taylor *et al.*, 2003). Understanding the history of and degradation from tourism and fishing provides context for the current and potential role of coffee.

3. METHOD

To learn about the entire coffee production system starting from the person planting the seed all the way to the eventual consumer, this study draws on information from participants involved with every stage of the process. Interviewees included small farmers, hired farm workers, plantation harvesters, transporters, plantation owners, company coffee buyers, restaurant owners, shop vendors in San Cristóbal and Quito, biological station workers, researchers for the Charles Darwin station, conservation organizers, fisherman, and tour boat workers. A total of 52 people were interviewed, many two to three times over two summer field seasons in 2007 and 2008. All interviews were conducted in people's homes, fields or place of business. Interviews were semi-structured and informal, obtaining qualitative information. The interviews began with basic questions about coffee history, production, harvesting and economics. The questions then followed the lead of the informant and allowed their knowledge and interests to guide the discussion, a method outlined by Bernard (2006). The research is also based on participant observation for picking and processing coffee beans.

4. RESULTS

4.1 GALÁPAGOS COFFEE INDUSTRY

Coffee was introduced in Ecuador in the nineteenth century and was an important export until the 1970s. Coffee began to lose prominence in the 1980s, because of low prices globally. Since 1997, coffee has declined even further. In 1997, 709,000 quintales were exported and in 2002, only 200,000. Currently, in terms of world coffee production, Ecuador now accounts for only about 1%. However, despite these numbers, coffee is still one of Ecuador's main exports with 150,000 citizens directly involved in coffee production (Duicela *et al.* 2004). Small landholders are the primary coffee producers and Latin America accounts for 60 percent of global output (Perfecto *et al.*, 2005). Although coffee prices have dropped, consumption of specialty coffees is expanding (Baffes *et al.*, 2004). During the last decade people have been choosing coffees that incorporate new channels of production, marketing, and consumption. These aspects include: exotic geographic locations, organic cultivation, shade growth, and fair trade practices. Coffee consumers are willing to pay a premium for social and environmental reasons, as well as taste (Fleischer, 2002).

The environmentally and socially responsible planting practices have benefits to the grower beyond consumer preference. Organic, shade coffee, although providing lower yields, can be cheaper to produce, because the farmer does not need to purchase chemicals. Furthermore, organic shade coffee promotes soil fertility for long term investment value. By cropping under legume shade trees, nitrogen is naturally 'fixed' and made available to the coffee plants: the soil remains fertile without adding fertilizer (Richardson *et al.*, 2004). Since shade coffee grows under a structurally and floristically diverse canopy of trees, it creates a habitat that allows for a diversity of flora and fauna, particularly birds and insects (Perfecto and Armbricht, 2003). Fruit trees make for good shade species because they often have leafy canopies while also producing useful fruit (Perfecto *et al.*, 2005).

Differentiated by its place of origin, organic status, shade grown cultivation, and wet processing, Galápagos coffee is one of Ecuador's most famous specialty beans, grown mostly

on the island of San Cristóbal with a lesser amount on Santa Cruz (Itow, 1995). The most common species planted as a shade tree is a fruit producing legume, guayaba machete (*Inga spectabilis*), which fixes nitrogen and contributes fertility to the soil. Planters also intersperse the coffee plants with other fruit trees such as guava (*Psidium guajava*), oranges (*Citrus* spp.), sapote (*Pouteria sapota*) and avocado (*Persea Americana*), all of which are potentially marketable. Furthermore, the Charles Darwin Station is considering the native endemic *Scalesia pedunculata* as a shade plant for coffee plantations (Vince, 2011). Because of the isolation of the islands, many insects that invade mainland coffee plantations have not arrived. Thus, agriculturalists easily conform to island law which prohibits pesticide use, because farmers do not have to control for certain pests.

As a specialty coffee, Galápagos is one of the highest priced coffees in Ecuador and most coffee producers export the majority of their beans (Duicela *et al.*, 2004). In an effort to capitalize on their environmental status and geographic location, posters advertising the coffee, represent the *Coffea* plants as part of the natural eco-system. Poster designers picture coffee plants along with panels containing sea lions, frigate birds, and shaded forest.

Coffee producers also promote the mystique of the location. Examples include packages that have the phrase "From the mountains of the Enchanted Islands" pictured with an emblematic tortoise. Another brand uses the fame of Darwin's work. On the bag the company writes "The species evolve... we keep their essence." Furthermore, a specialty coffees book has the phrase in reference to the Galápagos coffee that: "In a cup, one can taste the mysteries of the Pacific Ocean and those of life itself; past, present and future" (Duicela *et al.*, 2004).

Although not the intention, organic shade grown coffee has the inadvertent bonus of helping to control other exotic species. One of the most problematic invasive species on San Cristóbal is the blackberry (*Rubus glaucus*). Settlers originally brought the berries to the islands for the fruit. Because of the numerous seeds, effective dispersal and ability to colonize, the berries are rapidly out competing the native vegetation. These plants grow throughout the highlands in the National Park and in abandoned farms. The berries grow in disturbed sunny areas, thus discarded farm land is ideal for colonization (Richardson *et al.*, 2004). When people care for their fields, and plant shade trees for the coffee plants, this in turn reduces the amount of land to which the berry can spread.

4.2 COFFEE ON SAN CRISTÓBAL

On San Cristóbal, with high coffee prices, environmental benefits of organic production, and the crop already planted, it would seem that local farmers would take advantage of this situation. However, locals allow their fruit to rot on the bushes. Outside of homes made of scrap wood and patched roofs, coffee plants hang with ripe berries that drop, wasted, to the ground. This raises the question of why those who are struggling economically would allow a readily available resource to go unexploited. The answer is partly due to the general abandonment of entire farms as people migrate to the coast for fishing and tourism jobs. However, there are still functioning farms in which farmers specifically neglect the coffee. Given the high price and the demand for specialty coffee, this seems contradictory. People used to harvest their coffee, until about 15 years ago when coffee production and harvesting became less profitable. In order to explain why people who need money would let a profitable crop be discarded, it is necessary to understand the processing and marketing on this island.

A family harvests the coffee from its farm and sells the harvested fruit to a transporter for \$2.50 a bucket (US\$ is the currency used in Ecuador). The transporter pays for a car to take the coffee from the family farm to the location where berries are processed. At the inception of this research, only one plantation and processing company existed on San Cristóbal, ProCafé.

ProCafé acquired the coffee plantation initially started by Manuel J. Cobos. Cobos arrived in the islands in 1860 and by 1879 had established a plantation in the highlands of San Cristóbal (Torral-Granda and Martinez, 2008). Part of Cobos' legacy was a productive coffee plantation. The company grows and harvests its own coffee, hiring most of its workers from the

mainland. ProCafé pays the harvester's passage, later deducting the amount from the workers' salary. Pickers earn \$2.50 a bucket plus room and board, and receive a work visa valid during the harvest season (August-September and January-February).

In addition to its own fruit, ProCafé also purchases beans from the local farmers for \$5.00 a bucket. These berries need to be brought to the processing plant, most often by a middleperson or transporter. Unless the transporter has a car, he or she pays \$10 for the taxi each way. The middle person comes every day to the farms during the harvest season paying the farmer \$2.50 a bucket. One family discussed the idea of taking their own coffee directly to ProCafé on a burro in order to earn the whole \$5.00. However, the animal was unable to carry enough weight to make the trip of value. The coffee producers process the coffee in the wet method, removing the pulp (which the company uses as organic mulch for their own plants), fermenting the beans, rinsing and then laying the seeds out to dry. The company then ships the dry beans to their mainland factory for roasting, packaging and exporting.

Family farmers find it difficult to hire people to pick their coffee, and the coffee must be brought to ProCafé the same day it is picked. The person transporting the coffee will only come if there is enough coffee harvested. Unless there are enough people to pick a substantial amount of coffee, it is not feasible for the farmer to try and pick beans at all. Because the farmers' coffee is purchased for \$2.50 a bucket, and pickers are paid \$2.50, based on costs of production, the farmers' net earnings are too low to hire harvesters.

Two introduced species, a fly and an ant, neither of which attack the plants, but do bite people, further deter potential harvesters. The biting fly (*Simulium bipunctatus*) was accidentally introduced by a resident in a banana cutting about 15 years ago. These insects live in the highlands, and their painful bites make picking uncomfortable. People cover themselves with handkerchiefs and screened hats for protection. The exotic "little fire ant" (*Wasmannia auropunctata*) also lives in the coffee fields. These crawl under clothes and inflict a stinging bite. One woman said: "I went to pick one day but I was bitten by the flies and the ants, so I didn't go back the next day. The money isn't worth it." Thus, the biting insects coupled with low payments, make it almost impossible for small farmers to exploit their coffee plants. The result is that potential profit lies rotting on the ground.

However, in 2008, the market structure begins to shift, renewing the possibility of small holder coffee production as a viable option. In 2008 a competing coffee company, the Noboa group begins to make its presence known on the island. The new coffee company functions differently than ProCafé.

Noboa does not have a plantation on the island, instead purchasing all of its coffee from family farmers. The major distinctions between the two companies for the farmers are that, 1) Noboa picks up the coffee itself eliminating the transporter commission, and 2) Noboa pays \$7.00 a bucket to the farmer at his/her farm. This means that every bean is now worth more than twice as much as it was previously, and effected immediate changes for anyone with producing plants. An example of the shift was with the San Cristóbal Biological station of Jatun Sacha. Part of the station's land is an abandoned coffee plantation which the station had never harvested. Noboa brought pickers to the station and Jatun Sacha paid the harvesters \$3.00 a bucket, with the station earning \$4.00 profit for each bucket. The station earned over \$270.00 that afternoon, which was then put towards conservation work.

Harvesters earning \$3.00 instead of \$2.50 per bucket, results in a substantial increase given the Ecuadorian economy. However, money does not solve the problem of the biting insects. The flies are found in most highland areas on the island, affecting the harvesting of all crops. However, they have the most affect on coffee harvesting, as this is one of the few cash crops and thus requires the hiring of external pickers. The harvesters wore ski masks and bandanas to cover their faces, long sleeves and long pants for their extremities, and each brought a bottle of repellent for any exposed skin. However, the pickers all agreed that the increased money made it worth the discomfort. Noboa traveled through the highlands offering farmers this same deal.

For people who already had coffee planted and beans rotting, this situation provided an immediate opportunity for change. And, many agriculturalists who had abandoned their

coffee plants and allowed blackberries to invade, now had an incentive to rework their fields. Various families on the island stated their plans to revitalize their coffee fields with the advance funding of Noboa. One family explicitly stated that they were changing four hectares from monocrop sugar to agroforestry: organic, shade coffee.

5. DISCUSSION

5.2 HOW SAN CRISTÓBAL COFFEE FITS SUSTAINABLE DEVELOPMENT

In considering the WCED (1987) definition of sustainable development does coffee production in San Cristóbal fit? Through the utilization of previously planted land, shade grown Galápagos coffee production can potentially act as an alternative to fishing and tourism while helping to prevent the spread of blackberry. One way in which this can work is that during some of the times of year when fishing is illegal, fishermen could hire themselves out as coffee pickers and make legal earnings. Furthermore, as lobster and sea cucumber are declining, those who have abandoned their farms can return for part of the year to their previously planted land and work again with their own coffee plants. In terms of gender, while fishing is dominated by men, women are actively involved in agriculture. Women constitute 30 percent of the pickers at ProCafé. Thus, although picking is still dominated by males, females in the household can supplement the family earnings and relieve some of the economic pressure on the fishermen for the household income.

Moreover, as people question tourism in the Galápagos, because of ecological impacts and the precariousness of dependence on a whimsical market, people are looking for sustainable alternatives (González *et al.*, 2008). Furthermore, although tourism serves as the islands' largest employer, most of the capital is spent on ships and airlines and not on the island itself (Taylor *et al.*, 2008). Not only can coffee production allow for more economic diversification, it can provide work for people on the island itself instead of residents leaving their homes for extended periods of time. Cultural identity, sense of place, and relationship to the proximal environment have been identified as essential for building resilience and ensuring sustainability (Berkes, 2004). Cultural identity can be strengthened through a connection to the land and the immediate environment. Successful farming can in many ways engender this sentiment (González *et al.*, 2008). Furthermore, since farming is family oriented, in contrast to tourism where people leave their spouses, parents and children for months at a time, an agricultural endeavor can connect people to each other as well as the land.

In terms of ecological benefits, organic, shade coffee encourages the habitat of birds and insects as well as increasing organic produce production from fruiting shade trees (Perfecto and Armbrecht, 2003). Moreover, although this is an introduced exotic, tending already planted coffee fields can help protect against other exotics, most specifically, blackberry. Abandoned farms have become centers of blackberry establishment. These open disturbed sites provide a place from which the berry can invade neighboring properties and the National Park. Agriculture that focuses on shade can limit the spread of an invasive (González *et al.*, 2008).

In contrast to the positive aspects of coffee production in the Galápagos, barriers exist. Some of these obstacles include the issues of non-native species, fishing attitudes, entrenchment of tourism, and the loss of profit to middlemen. Conservationists and developers are now promoting agroecosystems, especially those that have high levels of biodiversity, such as shade coffee fields (Vandermeer and Perfecto, 1997). However, biological invasions are now viewed as one of the main threats to global diversity (Richardson *et al.*, 2004). For the inclusion of any introduced species in a field, the farmer must take into account the original ecosystem, especially one as fragile as that of the Galápagos. Even though the coffee and shade plants discussed in this paper already grow on the island, it is important to look at the effect these plants' dispersal mechanisms have on the island. Invasive agroforestry species regenerate from seed and heavy seed production causes more potential invasion (MacDougall and Turkington, 2005). Coffee does not have high seed production, with just two large seeds per fruit (Jäger *et al.*, 2007). Furthermore, introduced species such as, guayaba machete (*Inga*

spectabilis), help maintain nitrogen rich soil while also growing edible fruit with single large seeds (Hejda and Pyšek, 2006). Since coffee and guayaba have not become invasive thus far, it appears that they will not do so in the future. However, it is important to note that not all species are so benign.

Another non-native species which grows in the Galápagos and is sometimes used as a shade tree is the invasive species, guava (*Psidium guajava*). The impact of introduced guava on native vegetation has been documented as problematic in the Galápagos Islands. Each fruit has numerous seeds, and the tree invades disturbed forest and out-competes endemic plant species, much like blackberry (Richardson *et al.*, 2004). Thus, the planting of specific shade plants should be encouraged, while others discouraged.

Furthermore, in terms of prestige and profit, fishing has traditionally been men's coveted form of work. To own a boat and work as a fisherman is a source of pride, in addition to the lure of port life itself. A large muscled fisherman statue in the middle of town exemplifies the masculine attitude towards fishing. On the other hand, working in the highlands is considered old fashioned. In order to re-introduce farming as desirable employment, the economic prospects must be comparable. Furthermore, efforts would have to be put forth in schools and in the port area to promote coffee farming as a legal, stable option, especially for men. Efforts would need to be made targeting not only fishermen, but also those working in tourism. Despite the time away from family causing disruption to the island social system, tourism is one of the most lucrative endeavors in the islands.

In order to compete economically with fishing and tourism, the role of middle persons in coffee production needs to be reduced. If the growers started cooperatives and pooled their resources, they could eliminate the profit lost to those working as transporters, processors and sellers. Eventually, if locals processed their own coffee and created their own label they could raise their profits without increasing their volume. There is revenue to be made as ProCafé currently earns about \$1.5 million from its Galápagos coffee. However, although the park already has strict guidelines for property limitations, if success grew too large, people might be tempted to exploit land that is part of the National Park. Both the park and community organizations would have to strictly enforce land use regulations, ensuring that coffee farmers could only utilize land that has already been cultivated.

6. CONCLUSIONS

In answering the question about whether coffee production on San Cristóbal fits into the "sustainable development" definition, the answer is partially it does, and partially it does not. Looking at the three aspects defined earlier, economic, ecological and social, the study comes to the conclusions listed in this section:

1) Economic: Because more than one coffee company now works on the island, those individuals who already have coffee plants can reap immediate profit. For those who already planted the crop, but have stopped caring for the coffee plants, they can now re-vamp the fields. For these two groups, the economic benefits are almost immediate. For those who already work in agriculture, if they switch from monocrop agriculture to agroforestry coffee, they can increase their present earnings. In polycropping, these farmers also gain the advantage of maintaining soil fertility for future generations. Moreover, if communities join together to form their own cooperatives, profits would rise. However, there are other groups on the island for whom it may not be economically appealing. Both fishing and tourism earn more money, even if these activities take an environmental toll on the surrounding ecosystem. Although coffee production can supplement fishing income, it appears that most people would still prefer to risk fishing illegally in order to earn higher profits. For coffee on San Cristóbal to truly fit the definition of sustainable development then it needs to fully meet the economic needs of all who could be involved.

2) Ecological: A coffee landscape is not the natural Galápagos ecosystem and introduced species are controversial. However, the reality of the Galápagos landscape includes

anthropogenic effects. Coffee producers currently grow organic, shade coffee. Thus, farmers do not add chemicals to the environment. And, if planted with non-invasive, shade trees, the increased covered area could prevent the spread of blackberry. About 3% of the land that does not fall within park boundaries is planted with coffee. ProCafé currently has 1,000 ha, with 400 ha planted with coffee, and of the 7,892 ha being cultivated by small farmers, about 20% of that is coffee. However, if proven successful, coffee production could also encourage encroachment onto National Park Land, and other natural areas. In relation to the marine environment, if fisherman were to switch to coffee picking and/or production during the restricted times of year, it could help with the future of the marine ecosystem. This would encourage healthy populations of fish, lobster and sea cucumber for future fishing generations.

3) Social: Family coffee farms can keep people connected to each other and the land. A connected social network, especially in reference to place, builds strong community and a sense of responsibility to the land. Thus, for those who already have coffee plants and are involved in agriculture this strengthens present ties. If communities encourage young people to remain in the highlands instead of migrating for a life in the port or on the ships, this further increases incentive for ethical treatment of the land.

Currently tensions on the island exist between fishermen and the National Park. If people choose to work in legal occupations during the times of year when they are currently fishing illegally, this could improve island relations. In order for this shift to occur, local schools, the government, conservation organizations and development groups would need to promote agriculture as a worthwhile endeavor on the island. For those deciding between livelihoods from coffee, tourism or fishing, the decision is not simple. Many individuals have become accustomed to life in the port with its increased amenities and excitement. Also, people are becoming more attached to the lifestyle that involves increased contact with tourists.

In conclusion, aspects of coffee production on San Cristóbal do fit into a move toward sustainable development. On a small scale, for individual families, organic shade grown coffee is already having an effect for their present needs without diminishing the possibilities for future generations. However, there are numerous economic, ecological and social shifts that would need to take place in order for this industry to work on a larger scale on the inhabited Galápagos Islands in order to truly fit the definition of sustainable development.

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