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RESTORATION AND RECLAMATION PROGRAMS:

REVERSING ECOSYSTEM DEGRADATION ON COFFEE FARMS IN LATIN AMERICA

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Based in New York City, the Rainforest Alliance was formed in 1986 as an international nonprofit organization dedicated to conserving tropical forests of the world. Rainforest Alliance works with a faction of conservationists in Latin America under the Conservation Agriculture Network (CAN), which places a high importance on commercial agriculture in rural communities. The ECO-O.K. Agricultural Certification Program is managed jointly by the Rainforest Alliance, in the United States, and a network of Latin American partner organizations in Brazil, Costa Rica, Ecuador, and Guatemala. The Rainforest Alliance is the international secretariat of the Conservation Agriculture Network and is directed by Chris Wille.

The ECO-O.K. program's goal is to retain or restore traditional coffee farms, which are often considered by ecologists to be the closest ecological approximation to untouched rainforests (http://www.si.edu/natzoo/zooview/smbc/Fxshtla.htm). This coalition of conservationists assists farmers in meeting stringent environmental standards, and promotes economically and environmentally viable alternatives to the destruction of Latin American ecosystems currently taking place. This mission is sought through research, education, and the formation of cooperative partnerships with local farmers, businesses, and governments.

The Rainforest Alliance is committed to raising environmental standards in agriculture by improving the social and environmental impacts of the coffee industry on local communities and ecosystems. The ECO-O.K. Program, based in New York City, is a joint collaboration between the Rainforest Alliance and a network of partner organizations located in Latin America, including the Fundacion Ambio in Costa Rica, the Fundacion Interamericana de Investigacion Tropical (FIIT) in Guatemala, and the Corporacion de Conservacion y Desarrollo (CCD) in Ecuador.

The ECO-O.K. Agricultural Certification Program encourages farmers to change their forms of production to less damaging tropical agricultural production. In order to gain certification, a farmer must follow the Rainforest Alliance guidelines for coffee growing, such as maintaining forest cover over the coffee plants and managing agrochemicals. The farmer, in turn, receives the ECO-O.K. "seal of approval" for their coffee crop. This labels their coffee as sustainably grown which may give them an edge over other coffee producers in the marketplace. The Rainforest Alliance's goal is to retain biodiversity, reduce pollution, conserve rich tropical habitats, and promote healthy environments for people to work in. The Conservation Agriculture Program conducts research concerning the environmental impacts of growing certain commodities (crops), then drafts standards for environmentally sustainable production. The development of guidelines is a participatory approach with inputs from scientists, industry, government, social activists, and environmentalists. These guidelines are continually updated and improved and present clear and objective standards against which a farm can be evaluated.

THE PROBLEM

The production of coffee, a long-time popular beverage and cash crop, makes up a considerable source of income for many tropical countries, especially in Latin America. Coffee is of special interest to conservationists because it grows mainly in Latin America's middle elevations, one the most biologically rich zones on earth (http://www.rainforest-alliance.org/hp.html).

Coffee is traditionally grown under a canopy of shade trees, providing a critical habitat for many species of wintering migratory birds, and safeguarding the abundant biodiversity intrinsic to rainforests. However, industrial coffee farms have increasingly replaced traditional coffee farms, leading to clearing of shade-grown coffee and converting to industrial sun-grown coffee. The percentage of coffee cropland planted under reduced-shade conditions ranges from 17% in Mexico to about 40% in Costa Rica and 69% in Columbia (http://www.si.edu/natzoo/zooview/smbc/Fxshtla.htm). This conversion corresponds to a dramatic decrease in overall tropical rainforest biodiversity.

BENEFITS OF TRADITIONAL COFFEE PRODUCTION

The traditional growth pattern of shade coffee trees in Latin America structurally resembles a forest profile. Coffee serves as the understory shrub layer, the next highest layer is a mixed cover of fruit trees, and above those levels stands the hardwood tree species, forming a forest-like profile. This arrangement produces a generally stable production system while providing protection from negative soil effects such as compaction and high erosivity, a moderation effect on microclimate (humidity and temperature), renewal of organic litter, and a healthy interaction of insects. Traditional coffee farms have been suggested as this area's most rich agroecosystem, both economically and environmentally (Otero 1984). More than 32% of the world's coffee is grown in Latin America, where it is the major source of foreign exchange (Perfecto 1996). The way coffee production is managed in the next years will determine the severity of impacts on tropical biodiversity.

WHY MODERNIZE COFFEE PLANTATIONS?

In the 1970's, methods of coffee production began to change rapidly, for a number of reasons. Modernized, also called technified, production began to replace traditional methods of planting, harvesting, and cultivation. The shift away from traditional coffee production usually involves removal of shade cover, plot management, and the use or increased use of agrochemicals (http://www.igc.apc.org/nrdc/nrdcpro/ccc/cptinx.html). Threats which encouraged the increased use of technology came from agronomic concerns, such as fears of diseases like coffee leaf rust (*Hemileia vastatrix*), also called la roya ("the rust") (http://www.igc.apc.org/nrdc/nrdcpro/ccc/cptinx/html). This disease spread alarmingly in India and Sri Lanka, according to historical records, and coffee production was stopped two decades after it came there, during the second half of the 19th century. Coffee leaf rust is a wind blown

spore and when it landed in the Americas on the East Coast of Brazil, this occurrence lead to changes in coffee production that have persisted to today. In much of South America, coffee leaf rust has not been as prolific as expected, most likely due to cooler temperatures in higher elevations, and long dry seasons typical in this region (http://www.igc.org.nrdc/nrdcpro/ccc/cptinx.html).

Modernization of coffee plantations are similar to transformations in the farming of corn, wheat, and rice during the Green Revolution. Technified coffee production involves utilizing higher-yielding varieties of coffee, along with the use of agrochemicals, and increases in the density of plants, from 1100-1500 per hectare in traditional plantations, to 4000-7000 plants per hectare in modernized farms (http://www.igc.org.nrdc/nrdcpro/ccc/cptinx.html).

GUIDELINES FOR AGRICULTURAL CERTIFICATION

The following guidelines are the cornerstone of the Rainforest Alliance program and apply to all crops in all involved countries.

1. **Protect Natural Ecosystems**

   New farms are planted on areas that have already been deforested, while forest fragments are conserved. Crops that are traditionally grown under shade, such as coffee, must have a mixed canopy cover of native trees. Reforestation activities occur along rivers, roads, and other areas not in production. All in all, the "footprint" of the farm is minimized to reduce the environmental impacts outside the farm boundary. The productive life of the coffee crop is extended due to protection by the overlying shade crop. For instance, air, soil, and leaf crop temperature extremes are reduced, which moderates the plants' habitat and forms a stable microclimate (Beer 1987). The shade layer trees also protect the coffee shrubs below from damage caused by heavy rain, wind, or hail, which could later lead to vulnerability to pests, disease, and parasitic plant infestations (Beer 1987).

2. **Conserve Wildlife**

   Biological corridors are established to conserve wildlife and their critical habitats, such as wetlands, dead trees, mangroves, and coral reefs. These corridors, along with officially designated parks, are not farmed and are only one facet of protecting threatened and endangered species. Hunting is not permitted, although exceptions are made for subsistence and regulated hunting. Commercial collecting of flora or fauna is also not permitted.

   Species composition on a traditional coffee farm will vary from site to site and according to country and ecological zone. Natural habitats in areas where plantations are generally located, such as pine-oak woodland and premontane tropical forest, are also the areas most likely to be degraded or fragmented (Perfecto 1996). The role of shade coffee as a haven for biodiversity becomes more important in areas more severely affected by deforestation. Various vegetative layers in the agroecosystem increase the structural complexity of traditional coffee plantations, but another benefit emerges as well: the canopy layer also sustains epiphytes, mosses and lichens. These plants then support a community of arthropods

and amphibians. The interactions between the creatures living in the strata of the coffee farm provide a diverse variety of foods for herbivores, frugivores, and nectarivores (Perfecto 1996).

Coffee plantations also provide shelter to numbers of migrant species during deforestation activities. One study found that shade coffee plantations support bird species that need a closed canopy forest (Wunderle and Waide 1993). Traditionally managed plantations also serve a role as a vital dry season sanctuary for birds lacking insects and nectar to eat during dry periods (Perfecto 1996). Finally, the use of insecticides and fungicides are known to decrease overall biodiversity in agroecosystems (Jepson 1989).

3. **Conserve Water Resouces**

Permanent changes in natural hydrologic systems, for instance altering a stream course or lowering the water table, are not made. Buffer zones are restored or retained along rivers, lakes, and springs. Water used in processing is filtered before being returned to nature and chemical runoff and sedimentation are reduced. Fuels are managed carefully to prevent water contamination and water is recycled wherever possible.

4. **Conserve The Productivity Of Soils**

Crops are located according to soil classification maps and through the study of potential use. Other soil conservation measures include planting windbreaks when necessary, establishing cover crops, and planting along topographic contours. Shade trees' root nodules fix nitrogen into usable form for the coffee plants and using only small amounts of necessary fertilizers and pesticides promotes beneficial soil organisms interactions, as does the increased soil organic material content on the site (Beer 1987). Allowing an increased variety and amount of shade trees on site provides the needed soil mulch, which keeps moisture on the soil during dry periods. Soil organic material is replenished from the shade trees during pruning or from natural leaf fall.

5. **Minimal And Strictly Managed Use Of Agrochemicals**

In general, Integrated Pest Management (IPM) techniques are put in place. Chemicals are properly registered for the particular crop and are approved by the United States EPA and other national agencies. Best Management Practices (BMP) are applied in transport, storage, and application of agrochemicals. A complete record of chemical use and inventory is available to inspectors, while training and safety equipment is provided to chemical applicators and handlers. Fortunately, coffee seems to be a plant naturally resistant to herbivores, possibly due to its young leaves containing large amounts of alkaloids and older leaves being tough (Frischknecht 1986). Weed growth is suppressed under a canopy of shade trees since photosynthesis is reduced, as is transpiration and metabolism (Beer 1987). Since a much lower level of chemical inputs is used in traditional production systems, amounts of labor and capital inputs are much lower than in modernized production systems (Perfecto 1996). Modern and semi-modern production uses 19% and 25% of its expenses on chemical applications while traditional production assigns only 2% (Perfecto 1996).

6. **Complete, Integrated Management Of Wastes**

The overall management plan's goal is to promote waste reduction, reuse, and recycling. There are no unmanaged wastes or landfills on farms and solid waste traps are located at packing stations. Organic wastes are used as much as possible to enrich soils on the farm.

7. **Fair Treatment And Good Conditions For Workers**

At least the minimum local wage is paid and the Rainforest Alliance complies with all local labor laws. Safe and sanitary working conditions are offered, as well as other benefits such as access to potable water, showers and sanitary facilities, buffer zones in place around housing areas, adequate ventilation in working areas, and training provided to workers.

8. **Maintain Good Community Relations**

Negative impacts in the community are minimized. Local employment and environmental education offered to both workers and their families aids the people in the community, while the watersheds and community forests are protected as part of the environmental benefits. The fundamental question regarding the type of management system at a coffee farm is whether the owner of the plot has the educational and resource means to cultivate the site without using shade. Economically, there is an additional risk in the trade of cash crops in that if the market value of the coffee product falls, the farmer may no longer be able to finance the inputs on the site, and may have to abandon the farming project (Beer 1987).

Diversification of crops acts as a buffer for small producers from risks associated with international market fluctuations, effects of poor weather, or changes in societal structure. Coffee grown under shade will survive an economic setback much better than a monocultural, modernized system of the same crop. (Beer 1987) Other plants grown in the shade coffee mixture represent "standing capital" and will also provide a variety of products that a farmer can use for food, or sell in the marketplace for income. For instance, profits from timber harvests derived from shade trees can be quite substantial. Studies focused on Costa Rican timber practices using *Cordia alliodora* used as shade planted in densities of 120-290 trees per hectare, can produce 6-15 cubic meters of commercial wood (Somarriba 1990). Harvesting these quantities of timber harvest also helps shield farmers against unpredictable market events and provide meaningful economic returns to the coffee growers.

9. **Conduct Environmental Planning And Monitoring**

Before deforested sites are chosen as prospective coffee farms, an environmental impact study (EIS) is performed. After the EIS has been completed, all farms are mapped and a management plan is designed for that specific site. Each management system is site-appropriate according to farm size, sales, and ecological resource attributes. Continued progress is monitored and, once certified, farmers must demonstrate compliance with Rainforest Alliance standards. Moving away from a focus on maximum yields allows farmers to concentrate on sustained yields over the long run.

SITE SELECTION

The selection of sites by the Rainforest Alliance varies greatly between crops. For coffee, shade farms are sought that have a high species diversity and are already well managed. These sites are then chosen to act as models for the industry. On the other hand, in the case of banana farms, the farms with the worst deforestation and pollution are chosen first.

The program is voluntary; that is, farmers decide whether or not to participate in the certification process. Although some farms are denied access to the program, those that can meet over 80% of the program's objectives are granted a one-year certification. Reasons for denial include using a particular prohibited chemical or not meeting the other certification criteria. Farmers who are turned down are motivated to apply at a later date and are still able to improve their practices while waiting to meet the certification standards. It is expensive for farmers to make the required improvements of their practices, but many join because of the benefits that certification offers. Incentives to farmers include technical assistance, the ECO-O.K. label status, and the chance to improve the management and sustainability of their farm. All farms in the program are re-evaluated annually and must show improvement over the previous year.

THE CERTIFICATION PROCESS

The certification process begins with a preliminary site visit, after which the CAN staff decides what changes must be made in order for the farm to meet ECO-O.K. guidelines. Within 6 weeks, a detailed report is written and sent to the producer. After a detailed review of farm operations and interviews with farm workers and managers are performed, two or three CAN technicians conduct an evaluation. Based on the certification criteria, a report is prepared that analyzes the farm against these criteria, then sent to the farm within another 6 weeks. A committee of CAN representatives makes a determination based on the evaluation report, deciding if the farm can achieve certification status. Farmers are then sent written notification of their approval and a certificate bearing their standing. A contract with the Rainforest Alliance is agreed upon by the farmer and governs the use of the ECO-O.K. Seal, promotion in the market, and details the handling of certified products.

Evaluations are conducted once a year. The Rainforest Alliance also has the right to perform random audits of the farm to check progress of the certified farms. Conservation Agriculture Network staff approves all materials bearing the ECO-O.K. certification mark, including brochures and packaging.

EVALUATION OF SUCCESS

The ECO-O.K. Program's environmental standards define clear and objective criteria against which a particular farm site can be evaluated. These standards are revised continually and improved in response to changes in technology and expertise. In the past few years, the

Rainforest Alliance's ECO-O.K. Program expanded its range to five agricultural crops in nine countries. The Program has begun to certify oranges in Costa Rica, shade coffee in Guatemala, and has developed guidelines for cocoa, sugarcane, and vanilla, as well as non-forest crops like Brazil nuts. These crops are among the species most important in the area economically, socially, and environmentally.

The ECO-O.K. Program is one of only a few partnerships between the coffee industry, environmentalists, and consumers. In 1995, the Program won the distinguished Peter F. Drucker Award for Nonprofit Innovation. Selection criteria for this award are that the program or project must have specific and measurable outcomes, serve as a model that can be replicated by other organizations, further the mission of the organization, and exemplify innovation by demonstrating a new scope of performance. This annual award is given in recognition of a project or program that makes a difference in the lives of the people it serves (http://www.pfdf.org/award/index.html).

The ECO-O.K. program objectives have remained fairly constant over time. The Rainforest Alliance, as part of the Conservation Agriculture Network, intends to transform entire agricultural industries in order to restore and improve remaining forests, streams, and wildlife, and to promote healthy communities. From its start, this goal was seen as a way to minimize the impact of agribusinesses on the planet while providing incentives to farmers who went beyond what is expected of them. The value of this program depends on its credibility. The entire process, from farm to the finished product, is documented and consistent.

Financial restraints are the program's primary limitation since private foundations sponsor it so; much of the staff's time is spent fundraising. There are four full-time staff working on the ECO-O.K. program in addition to ten people working in the region and many volunteers and consultants. Of the five groups in the Conservation Agriculture Network, only the Rainforest Alliance is located in the United States. Of the total net assets in 1997, $894,141, the ECO-O.K. program brought in $295, 049 in revenue. The total area of land that is certified under the ECO-O.K. program is 24,368 hectares, with 2213 of those hectares comprising coffee farms. These farms are located in Guatemala, Panama, and Nicaragua.

REFERENCES CITED

Beer J, 1987. Advantages, disadvantages and desirable characteristics of shade trees for coffee, cacao, and tea. Agroforestry Systems 5: 3-13.

The Peter F. Drucker Award for Nonprofit Innovation. "About the Drucker Award" <http://www.pfdf.org.award/index/html >1998 (Accessed 5/17/98)

Frischknecht PM, 1986. Purine alkaloid formation in buds and developing leaflets of *Coffea arabica*. Phytochemistry 5: 613-617.

Jepson PC, ed. 1989. Pesticides and non-target invertebrates. Wimborne, Dorset: Intercept, 1989.

Otero E, 1984. An effort to control and possibly eradicate coffee rust in Nicaragua, in Robert H. Fulton (ed) Coffee Rust in the Americas, p. 93-104. American Phytopathological Society, St. Paul, MN.

Perfecto, Ivette et al. Shade Coffee: A Disappearing Refuge for Biodiversity. BioScience vol. 46 no. 8, September 1996.

Rice, Robert A. and Justin R. Ward. "Coffee, Conservation, and Commerce in the Western Hemisphere" <http://www.igc.org/nrdc/nrdcpro/ccc/cptinx.html> 1996 (Accessed 4/24/98)

Somarriba, E 1990. Sustainable timber production from uneven-aged shade stands of *Cordia alliodora* in small coffee farms. Agroforestry Systems 10: 253-263.

Smithsonian Migratory Bird Center. "Why migratory birds are crazy for coffee". <http://www.si.edu/natzoo/zooview/smbc/Fxshtla.htm> 1997. (Accessed 4/24/98)

Rainforest Alliance homepage. <http://www.rainforest-alliance.org/hp.html >(Accessed 4/24/98)

Wunderle JM, Waide RB, 1993. Distribution of overwintering nearctic migrants in the Bahamas and Greater Antilles. Condor 95: 904-933.

THE ECO-O.K. PROGRAM GUIDELINES *NINE BASIC CRITERIA*	**FOR AGRICULTURAL CERTIFICATION** *EXAMPLES OF CRITERIA*
1) PROTECT NATURAL ECOSYSTEMS	• No deforestation • Conserve forest fragments • Crops traditionally grown under shade must have a mixed canopy cover of shade trees
2) CONSERVE WILDLIFE	• Establish biological corridors • Protect critical and endangered habitats • Special measures required to protect threatened and endangered species
3) CONSERVE WATER RESOURCES	• Do not alter stream courses, lower water tables or make other permanent changes in natural hydrologic systems • Provide buffer zones along rivers, lakes, springs • Reduce sedimentation and chemical runoff • Filter water used in processing before returning it to nature • Manage fuels and lubricants to prevent water contamination

5) MINIMAL AND STRICTLY MANAGED USE OF AGROCHEMICALS	• Use Integrated Pest Management techniques • Chemical properly registered for the crop and approved by the U.S. EPA • Best Management Practices used in transport, storage and application • Complete records for use and inventory • Safety equipment and training provided to applicators/handlers
6) COMPLETE AND INTEGRATED MANAGEMENT OF WASTES	• Management plan to promote Reduction, Reuse, and Recycling • Managed landfills • Organic wastes utilized to enrich soils—on farm is possible
7) FAIR TREATMENT AND GOOD CONDITIONS FOR WORKERS	• Comply with local labor laws • At least minimum wage as required by local law • No racial discrimination—respect of different cultures • Housing available for workers on farm • Provide appropriate training for workers
8) MAINTAIN GOOD COMMUNITY RELATIONS	• Control contamination and other negative impacts • Protect watersheds and community forests • Provide environmental education to workers and families • Provide local employment • Farms contribute to local economy
9) CONDUCT ENVIRONMENTAL PLANNING AND MONITORING	• New farms should have an environmental impact study • All farms should have a management plan and map • Farms should have a monitoring system appropriate to its size, sales, and ecological resources at stake • Certified farms must be able to demonstrate compliance with the standards and continued progress