A PLACE UNBECOMING: THE COFFEE FARM OF NORTHERN LATIN AMERICA*

ROBERT A. RICE

ABSTRACT. This article examines recent transformations of the coffee landscape of northern Latin America through the optic of "place as process." As coffee became the most important regional export crop, its "place" evolved. Coffee lands in northern Latin America now embrace 3.1 million hectares, often contiguous across international borders. Like many agricultural systems, coffee has succumbed to intensification, a process termed "technification" in the Latin American setting. The result is a landscape mosaic in which a traditional agroforest coffee system coexists with coffee lands transformed by modernization. The institutional forces behind this process, as well as some of its social and ecological consequences, are discussed. *Keywords: biodiversity, coffee, landscape, Latin America, place, shade.*

Coffee farms in Central America, Mexico, Colombia, and parts of the Caribbean provide a classic example of how the introduction of an exotic crop can, given suitable economic, social, and ecological conditions, result in the establishment, evolution, and expansion of a distinctive agricultural landscape. Agriculture often generates a specific space with characteristic features in far-flung regions, regardless of the characteristics of the actual site. Traditional coffee in northern Latin America qualifies as a commodity-defined physical and social landscape.[1] Whether in Antioquia, Colombia, or Chiapas, Mexico, the microclimatic conditions associated with the crop, the physiognomy of the shade trees, the general gestalt of the productive system itself, and the human–landscape interactions display a host of similarities. The labor regimes associated with its cultivation show distinct convergence as well.

The evolution of this system from country to country has taken a variety of paths, but the resulting agricultural setting is strikingly similar regardless of the actual coordinates. The "place" of coffee unfolded alongside the process of its becoming the regional export crop. Northern Latin America's coffee lands blanket 3.1 million hectares, often contiguous across international borders. Activities within the agroecosystem affect and reflect the livelihoods and economies of millions of Central American, Mexican, Colombian, and Caribbean people, as well as the consumption habits of millions more outside the region. The focal region in this study accounts for 30 percent of the world's coffee-producing area and 34 percent of global production (Tables I–III).

Traditional coffee lands often cross national boundaries and display an array of similar attributes. A distinct ambiance, definable in physical terms related to the coffee setting and the social interactions related to labor, evolved to become the coffee agroecosystem. A traditional coffee farm in many ways feels like a forest, albeit

* I would like to thank the reviewers and editors of the *Geographical Review* for their helpful comments and guidance. All expressed opinions and any errors, of course, are mine.

DR. RICE is a geographer at the Smithsonian Migratory Bird Center, National Zoological Park, Washington, D.C. 20008.

manipulated through human agency. Like many agricultural systems, coffee has succumbed to intensification. As with any landscape, the coffee landscape "is never *entirely* stable" but is "always in a state of becoming" (Mitchell 1996, 30). The "place" of coffee production has been contoured by forces leading to its "unbecoming" that traditional setting into which it evolved. The modern production system is referred

TABLE I—COFFEE PRODUCTION IN NORTHERN LATIN AMERICA AND THE CARIBBEAN (IN THOUSANDS OF METRIC TONS) AND POSITION WITHIN GLOBAL PRODUCTION, 1997

COUNTRY / REGION	PRODUCTION	PERCENTAGE OF WORLD TOTAL
Mexico	336	5.9
Central America	714	12.5
Costa Rica	143	2.5
El Salvador	146	2.6
Guatemala	216	3.8
Honduras	138	2.4
Nicaragua	59	1.0
Panama	12	0.2
Caribbean[a]	100	1.8
Cuba	18	0.3
Dominican Republic	38	0.6
Haiti	27	0.5
Jamaica	3	0.05
Puerto Rico	13	0.2
Trinidad and Tobago	1	0.02
Colombia	696	12.3
Venezuela	80	1.4
Regional total	1,926	33.9
World total	5,676	100.0

Source: FAO Production Yearbook 1997.

[a] Dominica, Guadeloupe, Martinique, Saint Lucia, and Saint Vincent all produced less than 1,000 metric tons during the 1980s.

to as a "technified" farm.[2] While being transformed into a different and more "modern" place, it has "unbecome" what it once was. For some countries, this undoing has occurred within a short time. For others, it is just beginning. For all, it is an example of place as process.

The theme of "place as [an] historically contingent process" (Pred 1984) has been examined theoretically via the marriage of time-place geography and structuration. "Place always involves an appropriation and transformation of space and nature that is inseparable from the reproduction and transformation of society in time and space" (p. 279). The transformation of nature in this case is key, as traditional coffee, with its mix of shade-tree species and its structural diversity, looks very much like a natural forest from above or afar. The production of space has nature as its "point of departure," with all things proceeding from the original backdrop (Lefebvre 1991, 30). Although traditional coffee in no way qualifies as natural forest—it is, after all, agri-

TABLE II—COFFEE PRODUCTION IN NORTHERN LATIN AMERICA AND THE CARIBBEAN, 1950–1997 (IN THOUSANDS OF METRIC TONS)

COUNTRY / REGION	1950[a]	1960[b]	1970[c]	1980	1990	1997	% CHANGE, 1950–1997
Mexico	63	157	182	228	440	336	433
Central America	189	341	308	605	680	714	278
Costa Rica	23	59	82	106	151	143	522
El Salvador	74	114	139	183	156	146	97
Guatemala	57	108	125	179	202	216	279
Honduras	13	28	39	71	118	138	962
Nicaragua	19	27	38	59	43	59	211
Panama	3	5	5	7	10	12	300
Caribbean	107	136	121	134	139	100	− 6
Cuba	31	37	29	21	27	18	−42
Dominican Republic	27	44	44	58	59	38	41
Haiti	35	35	31	39	37	27	−23
Jamaica	3	2	2	2	1	3	0
Puerto Rico	10	15	12	12	13	13	30
Trinidad and Tobago	1	3	3	2	2	1	0
Colombia	352	468	483	740	845	696	98
Venezuela	50	57	60	61	76	80	60
Regional total	761	1,159	1,154	1,768	2,180	1,926	153
World total	2,222	4,268	4,262	5,039	6,282	5,676	155

Sources: FAO Production Yearbook, 1950–1997.
[a] Average, 1948–1952.
[b] Average, 1961–1965.
[c] Average, 1969–1971.

cultural land—its forestlike ambiance and dynamics probably come as close as any commodity-production system to mimicking natural forest profiles and processes.

In this article I examine the transformation of the coffee landscape of northern Latin America by peering through this keyhole of "place as process." In particular, I analyze the ways in which labor and inputs have changed the coffee place of production. The suite of operations and "space" at this initial rung of the commodity's life cycle historically had few connections with international capital. The situation is in transition; it is unbecoming what it has been for scores of years. The transformation can be seen in production ideologies, coffee as habitat, and consumption of inputs in the form of agrochemicals.

A landscape interpretation of the recent changes in coffee production informs my analysis. As Carl Sauer stated, the content of landscape is "a land shape, in which the process of shaping is by no means thought of as simply physical" (1963, 321). A richer texture is obtained when one examines not only what landscape is but how it is presented and how it functions in society (Mitchell 1996, 30). In reading, decoding, and re-presenting landscapes, we can view them not only as history, wealth, or aesthetic, among other concepts (Meinig 1979), but as ideology as well, representing the dominant culture (Berger 1972; Cosgrove 1989). Given the agricultural setting and knowing the continual pressure to "modernize" agricultural production in re-

TABLE III—AREA DEVOTED TO COFFEE PRODUCTION IN NORTHERN LATIN AMERICA AND THE CARIBBEAN, 1950–1997 (IN THOUSANDS OF HECTARES)

COUNTRY / REGION	1950[a]	1960[b]	1970	1980	1990	1997	% CHANGE, 1950–1997
Mexico	157	316	339	455	669	615	291
Central America	469	567	655	776	755	878	87
Costa Rica	51	54[c]	95	82	95	93	82
El Salvador	121	130	124	185	173	167	38
Guatemala	162[c]	170	229	250	244	269	66
Honduras	63	107	101	125	144	233	270
Nicaragua	56	87	85	110	74	94	68
Panama	16	19	21	24	25	22	38
Caribbean	272	270	287	304	298	325	195
Cuba	89	60[d]	50	50	100	85	-5
Dominican Republic	76	100[c]	140	160	103	147	93
Haiti	30[d]	30	30	34	34	54	80
Jamaica	5[d]	7	6	5	6	6	20
Puerto Rico	62	63	51	45	46	30	–52
Trinidad and Tobago	10	10	10	10	9	3	–70
Colombia	647	818	817	1,084	1,000	1,041	61
Venezuela	322	330	287	253	282	302	– 6
Regional total	1,867	2,301	2,385	2,872	3,004	3,161	69
World total	5,270	9,963	9,014	9,847	11,501	10,667	102

Sources: FAO Production Yearbook, 1950–1997.

[a] Average, 1948–1952.

[b] Average, 1961–1965.

[c] Extrapolated.

[d] Estimated.

cent decades (Goodman, Sorj, and Wilkinson 1987), the landscape-as-ideology approach allows for a recasting of the transformation.

Les Rowntree points out that studies of landscape as ideology have concentrated on urban or suburban settings (MacDonald 1985; Hopkins 1990; Knox 1991; Rowntree 1996). My study, in contrast, offers an example of landscape as ideology in a rural, agricultural setting. In this case, the dominant culture is an imported one linked to a productionist ideology. Its roots extend back into the Corn Belt and public-research matrix of the North American heartland, taking sustenance from regional research centers, themselves immersed in the waters of agricultural intensification. The backbeat and harmonies supporting the refrain of modernization derive from the green revolution hymnal. Modern agricultural mentality has been likened to that of industry (Levins and Vandermeer 1990; Matson and others 1997), and, as such, the goal of increased productivity is met through technological innovations.[3] The costs of such innovations, as the modernization of coffee demonstrates, extend beyond the price tag of the technology itself. These costs—the ecological and the socioeconomic—can be read in the changing coffee landscape.

The introduction of coffee and its spread throughout the region began in the early 1700s, and by the mid-1800s most countries were becoming economically linked to the commodity. The end product has been a traditional agroecosystem that produces high-quality coffee, due to the combination of high elevations and the "wet method" process of washing the beans. Except for seasonal water-contamination problems associated with the washing, the system historically degraded the natural environment only minimally. Over the past thirty years, however, the coffee sector of much of northern Latin America has undergone tremendous change, particularly in production. The physical space and setting of the coffee agroecosystem, molded by the process of deciphering the demands of this African shrub, have been greatly affected by recent agricultural modernization.

The rapidity with which the changes to the coffee agroecosystem have occurred makes the process intriguing. What took more than a century to "become" is "unbecoming," or becoming something distinct, very quickly. The widespread and fast-paced nature of the changes deserve attention for the consequences they may provoke in the social and natural landscapes. Because the changes are related to agricultural technology that has proven effective under ideal circumstances, either in distinct latitudinal settings or under experimental conditions—and therefore is quite alluring to farmers—the transformation is occurring simultaneously in far-flung areas of northern Latin America.

The Establishment of Coffee in Northern Latin America

Coffee (*Coffea arabica*) evolved in the highland forest regions of Ethiopia and the Sudan. It was introduced into the Western Hemisphere in the 1700s, when the French brought the shrub to its island colonies in the Caribbean. The plant spread to other islands, to the Central American isthmus, and to the mainland of South America. Initially viewed as a curiosity, coffee was quickly folded into the Liberal agenda of the 1800s. It served as a path to development (Williams 1994).

Ecologically, coffee found a home in the mid- and high-elevation mountainous zones of tropical America. Rainfall patterns, temperature regimes, volcanic soils, and the availability of labor—immediately or, in some cases, as a result of social policies (Williams 1994)—dovetailed to provide the essential ingredients for successful production. Governments in the region created incentives geared toward promoting coffee as the new cash crop (Domínguez 1970; Solis 1979; Kauck 1988; Lindo-Fuentes 1990; Williams 1994): monetary rewards for maintaining coffee land, tax holidays, relief from obstacles to importation of machinery, provision of information on cultivation and processing methods, and distribution of free seedlings. Some countries even held contests of various kinds to encourage production. Legislation aimed at securing a labor force proliferated alongside these incentives. The result was the expansion of coffee in the physical landscape, as well as its growing dominance within each country's social relations of production.

In El Salvador, a legislative decree in 1847 linked issues of labor and taxation to the general public good and economic growth. Incentives benefiting those involved in the emerging coffee sector included a ten-year holiday from serving on local councils for anyone who managed more than 15,000 producing coffee trees and exemption from military service for ten years for all coffee workers. Moreover, all imports bought with coffee revenues would enjoy a 4 percent import tax reduction (Lindo-Fuentes 1990, 117).

Guatemalan incentives predated independence from the Spanish Crown. In 1792 Spain lifted a ban on the importation of tools and utensils needed in coffee mills (Domínguez 1970, 3). In 1834 the secretary of the treasury instituted a land-grant program to promote production, in which 1.38 hectares were given to any individual who wanted to grow the new crop. By the following decade, institutionalized price guarantees by the Coffee Development Commission further blessed coffee as the new hook upon which to hang economic hope. The commission also acquired pulping machinery from abroad and published instructional materials on the cultivation of coffee (Domínguez 1970, 8–10). Although historical documents show that larger holdings in Guatemala benefited disproportionately during the expansion years (Williams 1994, 64), the government recognized the importance of small producers, as is illustrated by its promise to import depulping machines for the exclusive use of small growers (Domínguez 1970, 13–14).

The state enjoyed clerical blessings in support of its encouragement of coffee production. In 1857 the Catholic Church restructured the tithe expected from coffee growers. In order "to protect and encourage" newly introduced coffee lands, and because the church was interested in the long-term "public wealth," the tithe was reduced from 10 percent to 1 percent for a period of ten years (Domínguez 1970, 15). The obvious rationale was that money saved from lower tithes could be invested in production and hence generate even more wealth.

Coffee provided a hopeful foundation from which to catapult the nascent Latin American economies into the upper stratum of development. The Liberal project that gained a political footing throughout the region saw coffee as the vehicle to national wealth. Coffee plantings began to dot the countryside, displacing cattle, sugarcane, and subsistence crops. It also moved into lands never before used in agriculture. Photographs taken by the famed photographer and pioneer Eadweard Muybridge in the 1870s document the burgeoning coffee economy of Guatemala. They depict scenes in which coffee was introduced on extant agricultural holdings or lands newly cleared of forest cover. Some images show what are obviously mature forest trees left intact in areas prepared for coffee, the unshaded areas between these large trees to be filled in later as shade cover was adopted (Figures 1 and 2).

The production of coffee exploded during the nineteenth century. Between the 1870s and the first decade of the twentieth century, such countries as Guatemala, El Salvador, and Nicaragua saw production increase more than 350 percent. In Costa Rica, where coffee took hold much earlier, this same period shows a 275 percent increase in production (Williams 1994, 267–268). The coffee area in Costa Rica grew from a mere 345 hectares in 1838 to 20,000 hectares by 1890 (Dunkerley 1988, 20). Colombia's export-oriented coffee sector was established in about 1808 in the department of Santander (Ferré 1991, 167). One hundred years later, Colombia held a firm second place in global production, surpassed only by the behemoth Brazil (Ukers 1922, 273 ff.).

FIG. 1—Clearing ground for coffee on Las Nubes farm, Guatemala. Note that the larger forest trees were left standing but that most of the forest was cleared initially. (Photograph by Eadweard Muybridge, 1876. Reproduced courtesy of the Department of Special Collections, Stanford University Libraries)

FIG. 2—A coffee plantation San Isidro, Guatemala, showing the patio where beans are dried in the sun. Around the facility the diverse shade cover can be seen. (Photograph by Eadweard Muybridge, 1876. Reproduced courtesy of the Department of Special Collections, Stanford University Libraries)

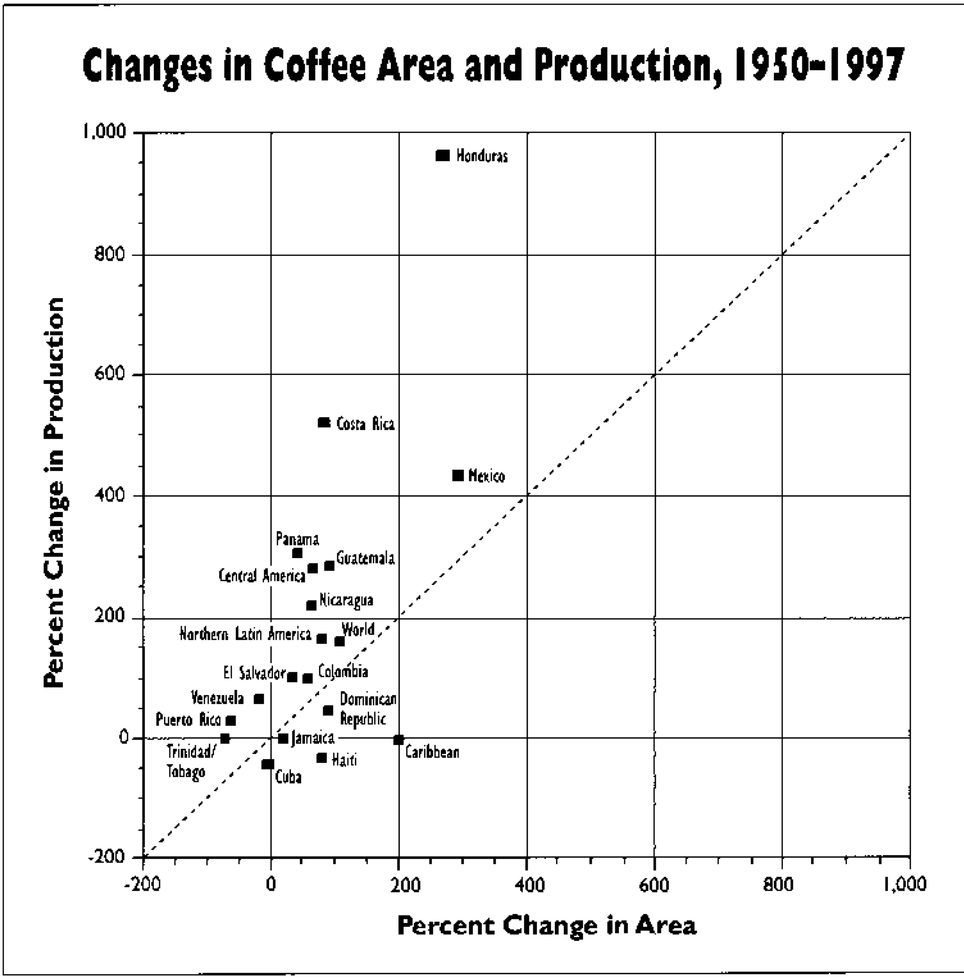

FIG. 3—Changes in coffee area and production in northern Latin America and the Caribbean, 1950–1997. *Sources: FAO Production Yearbook*, 1950–1997.

The importance of the position of northern Latin America in the global coffee market emerges by examining the region's percentage of world production by country, as well as production and area changes since 1950 (Tables I–III). In terms of quality, the 33 percent accounted for by the region underestimates the importance of these countries. Producers in most of these areas not only cultivate coffee at higher elevations, they also process their coffee with the wet (or "washed") method. Both factors are key ingredients in the quality of coffee and its ultimate market price.

A scatter plot of percent change in area harvested against percent change in production (both since 1950) provides a graphical analysis of the degree to which coffee production technology has changed (Figure 3). Were production tied simply to area, individual countries and the regions plotted in the graph would fall on or near the dashed line. They do not. Rather, most of the points fall well above the line, showing that changes in production have far outstripped changes in area harvested. The principal factor behind these differences is intensification, or "technification." Some countries, especially those in the Caribbean region, show little or even negative percent changes in area and/or production for the coffee sector. Those limited changes reflect economic shifts via national policy decisions to other crops or sectors (tourism, industry, and so forth) after World War II.

The changes in the coffee landscape in the late twentieth century rival those of any since the introduction of the crop. Just as the curious African shrub became part of the Liberal economic plan, the recent transformation coincided with neoliberal economic policies favoring, among other things, the modernization of agricultural production. Moreover, concomitant emphasis on trade quotas institutionalized by the International Coffee Organization's agreement (which started in the post–World War II years and continued until the late 1980s) has forced producing countries to seek greater national production. Quotas assigned to these countries have been tied to previous production performance. The essence of the agreement—its focus on production—shifted the emphasis from quality to quantity, a move shadowed by a similar shift in the labor process.

Traditional versus Modern Production

A push to technify coffee has greatly affected its "place." Estimates are that around 67 percent of the 3.1 million hectares of coffee land in northern Latin America have been affected by intensification (technified or semitechnified). On average, 26 percent of the coffee lands in the region have been transformed to the modern system (Table IV). In more and more countries in northern Latin America, coffee production in the latter half of the twentieth century progressively came to resemble an industrial process. At the same time, production was standardized. These changes took place with amazing rapidity over the course of only two or three decades.

The transformation is from a traditional, shaded coffee system to a less shaded or often shadeless coffee system (Table V). The regular rows of coffee in the modern system not only make for a more easily managed crop but also symbolically bring order to an otherwise poorly understood matrix of ecological dynamics and interactions affecting production.

In the 1950s attempts were made to persuade growers to "renovate" their holdings. Producers ignored these efforts for the most part. With coffee exports booming and demand exploding during the years immediately after World War II, farmers had little reason to change. A few progressive or innovative "early adopters" modernized holdings by removing or reducing shade cover and introducing agrochemicals in the 1950s, but that the sector generally did not respond to the efforts is evident in articles found in local coffee journals (Rice 1990).

The landfall of coffee leaf rust in Brazil in 1970 changed all this. This fungal disease (*Hemileia vastatrix*), known in Spanish as *la roya,* provided the impetus needed for the modernization of many coffee lands throughout Central America, the Caribbean, and Colombia. Efforts to control the spread and impact of the disease became

TABLE IV—COFFEE AREA AS A FUNCTION OF TECHNOLOGY LEVEL IN SELECTED COUNTRIES OF NORTHERN LATIN AMERICA AND THE CARIBBEAN (IN THOUSANDS OF HECTARES)

COUNTRY	LEVEL OF TECHNOLOGY			TOTAL COFFEE AREA	PERCENT TECHNIFIED
	Traditional	Intermediate	Technified[a]		
Mexico	64.9	489.7	114.4	669.0	17
Central America					
Costa Rica	10.8	54.0	43.2	108.0	40
El Salvador	152.4	0.0[b]	13.2	165.6	8
Guatemala	110.1	85.6	49.3	245.0	20
Honduras	30.0	100.0	70.0	200.0	35
Nicaragua	53.0	14.0	27.1	94.1	29
Caribbean					
Dominican Republic	77.2	0.0[b]	25.8	103.0	25
Haiti	30.6	0.0[b]	3.4	34.0	10
Colombia	357.3	N.A.	791.9	1,149.2	69
Venezuela	97.2	121.5	24.3	243.0	10
Total	983.5	864.8	1,162.6	3,010.9	26.3[c]

Sources: For Mexico, Nolasco 1985; *FAO Production Yearbook* 1991; for Costa Rica, Instituto del Café de Costa Rica 1993; for El Salvador, Valdivieso 1993; for Guatemala, Alvarado 1993; for Honduras, Fundación Banhcafé 1993; for Nicaragua, Gariazzo 1984; for the Dominican Republic, Verangis 1993; for Haiti, USAID 1990; for Colombia, FEDERACAFE 1993; for Venezuela, *FAO Production Yearbook* 1997; Chaparro 1998.

[a] Although "technified" does not necessarily equate with "shadeless" production, it does imply a reduced shade cover (and usually a species-poor one) in conjunction with high-yielding varieties of coffee and relatively high levels of agrochemicals.

[b] The amounts are probably greater than 0.0, but no reliable data are available.

[c] The average for the region, calculated from country averages in the last column. The percentage calculated on the basis of the region's technified area is 38.6.

wrapped up in a push to technify coffee farms. A technified coffee farm differs sharply from a traditional shade coffee holding, much as a row crop or collection of hedgerows contrasts with a forest. Production is intensified. The intensely managed landscape is often open to the sun. By contrast, a diverse array of tree species providing a forestlike shade for the coffee bushes below dominates the traditional system. Whereas a traditional shade system harbors trees that may reach a height of 25 meters or more, the shade component of a modern system (provided it has one) stands at most some 5 to 8 meters tall. The spate of modernizing efforts during the last twenty years or more has rendered a coffee landscape characterized by a patchwork of traditional and technified holdings.

Traditional shade coffee exhibits tremendous species diversity, approaching 60 to 70 percent of that found in natural forest in the same area (Vandermeer and Perfecto 1995). The plant community itself displays relatively high numbers of trees and a species richness not generally encountered in agricultural lands (Rice 1990; Herzog 1994; Escalante 1995). In Nicaragua's southern coffee district of Carazo, more than twenty-five species of shade trees were found in traditional coffee farms (Table VI). In Venezuela, some shade coffee systems include upwards of 350 shade trees per hec-

TABLE V—DISTINGUISHING CHARACTERISTICS OF TRADITIONAL AND TECHNIFIED COFFEE-PRODUCTION TECHNOLOGIES

CHARACTERISTIC	TRADITIONAL	TECHNIFIED / INTENSIFIED
Varieties	Arabiga (tipica), borbón (bourbon), maragogipe	Caturra, catuaí, Colombia (in Colombia), Garnica (in Mexico), catimor
Height	Tall (3–5 m)	Short (2–3 m)
Amount of shade	Moderate to heavy, covering 60–90% of the ground area	None to moderate, covering up to 50% of the ground area
Shade trees used	Tall (25 m) natural forest species, fruit trees, bananas	Short (5–8 m), selected leguminous species (heavily pruned)
Number of coffee plants per hectare	1,000–2,000	3,000–7,000, with up to 10,000 in some areas
Number of years until first harvest	4–6	3–4
Plantation life span	30 years or more	12–15 years
Use of agrochemicals	None to low	High
Pruning	Sometimes not pruned at all; otherwise, individualized treatment of plants	Standardized stumping back after the first or second year of full production
Labor requirements	Seasonal, for harvest and pruning (31 person-days per *manzana*)[a]	Year-round maintenance, with higher demands at harvest (107 person-days per *manzana*)[a]

Sources: MIDINRA 1987, 1988; Junguito and Pizano 1991.

[a] A *manzana* equals 0.69 hectare.

tare, and, where banana plants were included, the total number of "trees" exceeded 500 (bananas accounted for more than half of these) (Escalante 1995). Moreover, such shade systems have value from the perspective of global warming, providing intriguing opportunities for carbon fixing (Fournier 1995; Marquez Barrientos 1997).

A shade coffee environment historically used few inputs from outside. The agroforestry system created by managing a diverse shade cover above the coffee layer imparts to the farm an unmistakable (agro)forest aura. Most ecologists agree that it engenders an ecological balance and stability not enjoyed by simpler monocultural production systems. Economic damage from insect pests and disease may indeed be reduced in such circumstances, due to the species richness in both plants and animals. The shade coffee environment may act more like a habitat, and the ecological stability may in fact derive from the diversity of all the organisms present and the "complexity of their components" (Otero 1984).

An intensified coffee farm contrasts greatly with a shade coffee farm, not only in the general gestalt of the system but also in terms of chemical and labor inputs (Table V). Of course, the most striking difference visually relates to the shade canopy. Shade has long been a hotly debated topic among coffee specialists. From a strictly agronomic perspective,

> Shade protects against the evil effects of strong winds; it softens the lash of hail and harsh deluges of rain, and absorbs excess moisture; it blankets against freezes. Where heavy dews are important in the life-histories of diseases and pests, coffee under shade has fewer hours of dew on it than coffee in the sun. In regions where certain minor-element deficiencies are readily apparent in sun-grown coffee, they are much less severe and may even not be seen at all under shade. (Wellman 1961, 335)

Shade also acts to buffer drastic changes in temperature and humidity. Temperature fluctuated less in a shade coffee environment in experiments conducted in the 1930s in Africa, averaging 4.5°C lower at midday and 2.2°C higher at night when compared with sun coffee (Kirkpatrick 1935, fig. 32). Shade also dampens the daily fluctuations associated with relative humidity (Rice, field notes).

Ecologically, shade cover relates positively with a number of "ecological services." An overstory layer works as a "shock absorber" against abrupt environmental events like sudden downpours, which can occur after an extended dry season. As in a true forest situation, both water and wind erosion are inhibited by the canopy: Layered foliage intercepts rain and disrupts winds that might otherwise wash or blow away precious topsoil. The leaf litter associated with a canopy provides a layer of mulch, facilitating infiltration, preserving soil moisture, and adding organic matter to the soil. Many shade trees used with coffee, belonging to such genera as *Inga, Erythrina, Albizzia,* or *Gliricidia,* fix atmospheric nitrogen, which means that the coffee plants need not continually compete with shade-tree species for this element.

Cultural practices (agronomic operations) and labor requirements within traditional coffee holdings pivot around the harvest period. Some labor is required at other times of the year, such as the annual pruning of coffee bushes, the annual or biennial pruning of the shade trees, and other practices that help maintain a farm's production. The actual labor, however, is quite specific in time and space. Under normal circumstances in traditional coffee-farming operations, the coffee plants are pruned after the harvest. A typical pruning regime begins with walking the farm and inspecting each coffee bush.

A shadeless or near-shadeless technified farm, in contrast, resembles a factory in the field. The rows are often spaced a little farther apart than in the traditional setting, but the coffee plants within each row are much closer together. Coffee-plant density increases up to tenfold (Table V). In contrast to traditional cultivation techniques, individual bushes receive little attention. In fact, the usual pruning of coffee occurs either at the level of an entire "block" or area of the farm, or on the basis of rows. Whether by rows or by blocks, coffee shrubs are pruned via a "stumping back" method, in which the trunk of each plant is cut at about 35–40 centimeters above ground level. The remaining stumps then sprout new shoots, which are examined and thinned the following year to encourage new growth. The "scientific pruning" alluded to in the U.S. Agency for International Development (USAID) documents on technification also translates into a more intensified pruning regime for the shade trees, resulting in a shade-tree component much shorter (often only 5–8 meters in height) than that found traditionally.

TABLE VI—SHADE TREES USED IN COFFEE PRODUCTION IN THE SOUTHERN UPLANDS REGION OF NICARAGUA[a]

COMMON NAME	USE	SCIENTIFIC NAME	FAMILY
Aceituno	Shade only	*Simarouba glauca*	Simaroubaceae
Aguacate	Fruit	*Persea americana*	Lauraceae
Anona	Fruit	*Annona spp.*	Annonaceae
Caimito	Fruit	*Chrysophyllum cainito*	Annonaceae
Cedro	Timber	*Cedrela mexicana*	Meliaceae
Chilamate	Shade only	*Ficus glabrata*	Moracea
Citrus	Fruit	*Citrus spp.*	Rutaceae
Copel	Shade only	*Ficus spp.*	Moraceae
Genízaro	Timber	*Pithecellobium saman*	Leguminaceae
Guabillo	Fruit	*Inga spp.*	Leguminaceae
Guachipelín	Timber	*Diphysa robinoides*	Leguminaceae
Guácimo	Shade only	*Guazuma ulmifolia*	Sterculiaceae
Guanacaste	Timber	*Enterolobium cyclocarpum*	Leguminaceae
Guayacán[b]	Timber	*Tabebuia guayacan*	Bignoniaceae
Hule	Shade only	*Hevea brasiliensis*	Euphorbiaceae
Jobo	Fruit	*Spondias mombin*	Anacardiaceae
Laurél	Timber	*Cordia alliodora*	Boraginaceae
Madero negro	Timber	*Gliricidia sepium*	Leguminaceae
Mamey	Fruit	*Pouteria sapota*	Sapotaceae
Mora	Shade only	*Chlorophora tinctoria*	Moraceae
Palo de leche	Shade only	*Ficus spp.*	Moraceae
Pochote[b]	Timber	*Bombacopsis quinatum*	Bombacaceae
Quitacalzón	Shade only	*Astronium graveolens*	Anacardiaceae
Zapote	Fruit	*Manilkara zapota*	Sapotaceae

Source: Rice 1990, 146.

[a] All species serve as fuelwood.

[b] These species are used in traditional coffee farming but were not found in the 1987 survey of traditional farms conducted by the author as part of his fieldwork.

The intensification process affects the social as well as the physical settings associated with coffee. The "labor landscape" reveals additional tasks that reshape its composition, while the tasks performed have their own impact upon surface (and subsurface) characteristics. In Colombia, the coffee sector was transformed from a traditional/technified split of 76 percent/24 percent in 1980 to 68 percent/32 percent in 1994 (FEDERACAFE 1985, 1994). Labor demands grew in concert with the changes, even though the total coffee area actually decreased slightly. Between 1970 and 1995, the period of intense modernization of the coffee lands, the demand of the coffee sector for labor increased 68 percent, from 435,000 to 729,000 full-time equivalents (Libreros D. 1995). It is worth noting that this 68 percent increase in demand for labor occurred with only a 27 percent increase in coffee area (Table III) and contributed to a 44 percent increase in production (Table II).

Tending the traditional coffee plantation is more akin to gardening than to farming. Older campesinos who have worked for decades in coffee cultivation explain how, in pruning coffee in a traditional setting, they walk the shaded rows searching for bushes in need of some care. With a pair of hand shears, workers clip lateral branches or upright shoots on individual coffee shrubs. Traditional pruning can differ from farm to farm, country to country. A technified system knows no such variation. Workers prune whole rows or blocks with small handsaws, cutting all bushes alike. In some cases, this operation is carried out with the aid of hand-held, gasoline-powered weed cutters fitted with a heavy-duty rotary saw blade. The standardized treatment emerges in stark relief as one watches the workers walk down the rows of coffee, toppling all bushes just below knee height above the ground. The modern treatment has spread throughout the region, homogenizing much of the production process.

Technified farms require chemical inputs not normally used in traditional systems. The application of chemical fertilizers, insecticides in liquid, powdered, or crystallized form, herbicides to control weeds (which proliferate in the reduced shade), and fungicides to arrest fungal diseases requires much more labor during the nonharvest period than coffee has traditionally demanded. Although the increased pruning labor is normally carried out by men, women and children are often incorporated into the application of chemicals. This is especially true in the case of fertilizers and certain insecticides like nematocides, applied in measured quantities around the base of each coffee plant.[4]

The partial or complete removal of shade trees undoubtedly alters the ecological services performed by agroforestry systems. In areas of heavy seasonal rainfall, where coffee is grown on highly broken terrain with the substrate an easily eroded volcanic soil, the shade canopy protects the soil layer from the impact of raindrops. Moreover, leaf litter aids in gradual infiltration and retards overland flow. Once incorporated into the top layer of mineral soil, nutrients within the organic matter are recycled into the coffee itself or into the shade component. Removal of the shade cover reduces the leaf-litter component (Rice 1990) that acts as mulch to retain soil moisture, inhibits erosion, and serves as a major contributor to general soil fertility. Breaking the natural cycle of incorporation of organic material into the ground (and opening the system to solar insolation) requires the use of synthetic fertilizers to provide nutrients. Groundwater contamination has been identified as a possible consequence of fertilization associated with the modernization process (Reynolds 1991). From the standpoint of these physical traits, then, altering the shade cover not only leads to the "unbecoming" of a traditional system, it can also "uncouple" the processes linked to ecological services that have been in place for generations.

The end result of these production changes is a physical setting as much transformed as its labor setting. Tradition yields to modern ways. A shade system has been transmogrified into something less shaded. The structural diversity of the forestlike setting is compressed in height to something only slightly taller than the coffee plants themselves. The species diversity of the plant community has been converted into a monocultural (or, at best, a species-poor) system. Chemical inputs have gone from being virtually nonexistent in traditional coffee to being a major component of production in intensified production systems. Labor demands for the technified system are greater, with standardized operations homogenizing practices across borders.

THE ROLE OF INSTITUTIONS IN LANDSCAPE TRANSFORMATION

Such landscape transformations do not occur in a vacuum. Farmers are generally conservative by nature, especially where significant changes in production processes are concerned. Before taking any steps toward change, producers need concrete proof—often from neighbors—showing the benefits of change. Conversely, projects that include credits as incentives for any changeover can persuade growers. In most Central American and Caribbean countries, and in Mexico and Colombia, institutional links to national or international projects have figured heavily in facilitating the technification process and its associated landscape transformations.

Multilateral funding agencies such as the World Bank or the Inter-American Development Bank historically shunned promoting the expansion of commodity areas like coffee. This hands-off policy generated an incontrovertible "black list" of agricultural crops for which these institutions would not provide funding (Soto-Angli 1993; Verangis 1993). Such has not been the case for bilateral agencies.

For Central America, USAID has been the principal player in coffee technification. In response to the coffee leaf rust scare, in 1978 USAID launched a program called PROMECAFE, a Spanish acronym for "Coffee Improvement Project," out of the offices of the Inter-American Institute for Cooperation in Agriculture in Costa Rica. The project had at its core the explicit aspiration and initial motivation to modernize coffee production (Hernández Navarro 1995). By their own account, officials within PROMECAFE have evolved through and toward a series of definitions for "modern" agriculture as it relates to coffee. At its initiation, PROMECAFE promoted the intensification of coffee along the lines established by USAID and its consultants. In the 1980s technification was defined and rationalized:

> "Technification" refers to the combination of measures, including scientific pruning, shading, application of fertilizer, insecticides and fungicides, planting high-yielding rust resistant varieties as soon as they become available, and increasing the number of plants per manzana [1 manzana = 0.69 hectare], so that average yields will increase from 7–10 quintales [1 quintal = 100 pounds] "dry bean" to 30–35 per manzana. (USAID/ROCAP 1981, 52)

> Existing coffee plantings are typically old, low-density plantings which suffer from disease and insect problems, lack proper nutrition, are unpruned and heavily shaded. These conditions and practices greatly restrict yields and reduce productivity. In order to effectively utilize proven production practices which consistently yield 30 or more cwt. per manzana, it is necessary to completely remove the present plantings and introduce new varieties and a technical package of inputs and procedures which farmers—through extension, education and training—can readily employ. (USAID 1989, 19)

Between 1978 and 1997, USAID established and implemented at least eight projects that either were aimed specifically at or converged logically with the coffee-technification process in Central America and the Caribbean. Over the course of some nineteen years, USAID funneled nearly $81 million into these projects, aiming to affect more than 300,000 hectares of coffee land and half a million producers in the region (USAID/ROCAP 1981; USAID 1990, 1991, 1992).

In Mexico, however, it was not USAID but the now-defunct national coffee institute, INMECAFE, that promoted changes in coffee production. Over the past three decades Mexico has seen a 73 percent expansion in the area devoted to coffee, from 356,000 hectares in 1970, to 497,500 hectares in 1980, to the current 615,000 hectares. According to Margarita Nolasco, the majority of producers operate at an intermediate level of technology (1985). She attributes this swollen "middle" to the credit policies of the Mexican government, whereby producers can attain funds if they adhere to lending rules that oblige them to employ nominal levels of modern production techniques.

Certain areas of Mexico, such as the southern states of Chiapas and Oaxaca, hosted much of the expansion that took place in the 1970s. Together, Chiapas and Oaxaca accounted for nearly 54 percent of the national expansion (INMECAFE coffee census of 1982, cited in Nestel 1988). In Chiapas much of the coffee was established as shadeless holdings, only to be reformed to moderate levels of shade when growers encountered production problems associated with complete shadelessness (Rosset 1996). INMECAFE concentrated its efforts in certain areas more than others (INMECAFE 1990; Rice 1997).

INMECAFE closed its doors in 1990, but interest in technifying or renovating Mexico's coffee sector did not wither. Rather, the Mexican Coffee Council took up the modernization banner when it was established in 1993. Part of the council's objective is to "study, design, and propose policies directed at fomenting the productivity and modernization of the sector" (SAGAR 1996, 2). A portion of this effort may be realized within Mexico's overall Alliance with the Countryside program to reactivate its agricultural sector. The Coffee Program 1995–2000 forms a fundamental plank of this program, in which Mexico seeks to technify more than 337,000 hectares (55 percent of the national coffee area) under the management of some 189,000 producers (SAGAR 1996). In explaining the plans to representatives from other coffee-producing countries in 1997, the executive president of the Mexican Coffee Council, Rubén Castillo, stated that "we are not going to increase the [coffee] area, but we are going to optimize the production per hectare" (La Jornada 1997, 8). The environmental impact of such changes in a crop that is grown principally beneath a shade cover has been pointed out (Hernández Navarro 1995; Griswold and Ward 1996).

The mentality of technification permeates the collective psyche in a number of intangible ways. It shows how a landscape is represented and how it functions—in this case for further change—giving credence to the idea that the ideology represented by the physical and labor changes diffuses and is adopted by individuals managing the land (Mitchell 1996). During the early 1980s, when Nicaraguan planners saw coffee technification as the path to securing foreign exchange, the literature from government offices connected with the coffee sector, as well as analyses of production techniques, fixed on technification as modern, prestigious, and unquestionably the only avenue with any promise. Signs placed on highways in rural areas urged growers to "technify your *cafetal*," while government assessments of the benefits of technification (based only on higher yields) showed the reduced-shade system to be more profitable (MIDINRA, cited in Rice 1990, 149). Such constant and official urgings to technify eventually had an effect at the local level. In Guatemala, where similar programs have been in operation for more than ten years, a "keeping-up-with-the-Joneses" mentality has crept into the coffee sector. For example, producers in the town of San Antonio Aguas Calientes, near Antigua, report that growers from the neighboring settlement of Alotenango ridicule them for not using agrochemicals on their coffee.[5]

Consumption Transformed: Agrochemical Use

Consumption here refers to the increase in agrochemical use accompanying the technification process. In essence, via human agency, the landscape is taking in—consuming—relatively high doses of agrochemicals. More obvious, farmers' consumption patterns vis-à-vis inputs have been transformed via the technification of coffee.

High levels of agrochemical inputs are at the core of technification. Supplying nutrients, whether from organic soil amendments or from the litterfall-decomposition-uptake cycle characterizing agroforestry regimes, has been appropriated. In Colombia in the first half of the 1990s, an annual average of 286 thousand metric tons of fertilizer (urea, formula, and potassium chloride) were sold by the coffee growers' federation to its constituents (FEDERACAFE 1994). Assuming that all these fertilizers were applied on coffee, every technified hectare of coffee in Colombia (755,000 hectares in 1994) received an annual average dose of 379 kilograms of fertilizer during those years.[6]

For Costa Rica, where modern production techniques predated the regional technification efforts that began in the 1970s, the quantities of agrochemicals applied to coffee lands can also be calculated. Recent data show that Costa Rica has 107,000 hectares of coffee in production. Of this total, 42,800 hectares are classified as technified and 53,500 hectares as semitechnified. Costa Rica's technicians in the Institute of Coffee (ICAFE) consider the remaining 10,700 hectares to be managed traditionally (Rojas Rojas 1996). ICAFE's recommended dose of chemical fertilizers ("formula") is 1,200 kilograms per hectare per year and of urea, 250 kilograms. Calculating the use of these and other inputs (such as nematocides, foliar fertilizers, and fungicides) at the national level reveals the chemical dependency of technification. Assuming that traditional areas use no agrochemicals, that semitechnified areas use half the recommended dosage, and that technified areas comply fully with the recommended dosage, approximately 83,000 metric tons of "formula" fertilizer and 17,000 metric tons of urea are applied to coffee lands each year in Costa Rica. Nematocides, one of the most toxic of agrochemicals, exceed 1,700 metric tons per year, and some 120,000 liters of the herbicide paraquat settle onto coffee lands each year.[7]

These figures speak volumes about Costa Rica's devotion to high-tech coffee production. In fact, in many countries of the region, technicians, consultants, and coffee associations aspire to the "Costa Rican" or "Tico" (the nickname for a Costa

Rican) model. It is, akin to the general technification process, a transporting of a Costa Rican place to areas outside Costa Rica.[8] For fertilizer use, this translates into an average of 1,950 kilograms of fertilizer (urea, formula, and calcium carbonate) being applied to each hectare every year (Rojas Rojas 1996)[9]—five times the amount of fertilizer applied per hectare in Colombia.

By contrast, a country such as Venezuela has remained relatively free from the influences of technification. Around 80–85 percent of its coffee area is shaded, mainly with trees such as *Inga spp.* or *Erythrina spp.* Less than 20 percent of the coffee land is managed in the open sun. Moreover, the country weighs in with a relatively frugal landscape, using few agrochemical inputs on its 243,000 hectares of coffee. About 10 percent of Venezuela's 52,000 coffee producers are considered technified in their management practices. Another 50 percent use basic chemical fertilizers sparingly, applying some 250 kilograms of urea and/or formula fertilizer to each hectare annually. The remaining 40 percent use nothing on their coffee (Chaparro 1998).

Preliminary data analysis from my current study in Guatemala's coffee sector suggests that modern production techniques—at least in the use of chemical fertilizers—have made inroads on coffee lands managed by small producers. Focused on smallholdings, the data reveal that growers use an average of 545 kilograms of chemical fertilizer (again, urea, formula, and additives such as ammonium sulfate) on each hectare of coffee. Fertilizer costs eat up 6.75 percent of the total family income. If the cost of other chemical inputs, such as insecticides and herbicides, is added, the percentage of total farm income spent on these inputs rises to 8 percent, revealing that 84 percent of the chemical input costs come solely from the purchase of fertilizers. It is worth pointing out that Guatemala's National Coffee Growers' Association (ANACAFE) has received substantial funding from USAID over the past two decades, much of it directed at a program that provides small coffee producers with credits to technify their holdings.

Shade Coffee as Habitat

When examining traditional agroecosystems as potential habitat or as refuges for biodiversity, it is worth distinguishing two types of biological diversity, managed and associated. Managed biodiversity includes the shade trees, the particular variety of coffee a farmer chooses to plant, and any other plants that constitute the planned part of the coffee agroecosystem. But species count is only one aspect of managed biodiversity. It is also critical to know how biodiversity is managed and what the structural diversity of the managed component is. From the perspective of birds, say, a forestlike structure attracts forest species. If the management techniques of the farmer include allowing epiphytic plants such as bromeliads and orchids to grow and remain on shade-tree limbs and trunks, the physical niches (and probably the ecological niches) increase accordingly.

Just as important, but less understood, is associated biodiversity, the assemblage of organisms present in an agroecosystem because of managed biodiversity. Most of the work on biological diversity in agroecosystems has concentrated on the managed organisms and how they interact to affect production. Less research has been conducted on the unplanned or associated biodiversity and how it influences production (Vandermeer and Perfecto 1995). Less understood still are the general ecological or environmental functions served by these in the overall maintenance of biodiversity. But the basics of traditional agroecosystems are slowly being deciphered.

Recent studies in northern Latin America bestow a newfound function on traditionally managed shade coffee systems (Estrada and others 1993, 1994; Perfecto and Vandermeer 1994, 1996; Perfecto and others 1996, 1997; Greenberg and others 1997). Aside from its obvious and intentional role as an economically active land use, traditional shade coffee agroecosystems serve as habitat. No one involved in these studies would suggest that shade coffee systems could or should replace natural forest. Shade coffee is, after all, an "artificial forest," a managed system quite distinct from natural forest. Some data do suggest that when an area is devoted to coffee production, the ways in which a farmer manages it can result in its having a relatively high degree of biodiversity. Few are the crops that lend themselves as readily as coffee to economic and environmental benefits.

Insects find niches in the managed shade trees and the epiphytes that live upon them. In traditional shade coffee in Costa Rica, ecologists have found levels of insect diversity principally in beetles and ants, that, on a per tree basis, rival the insect diversity of undisturbed tropical forests (Perfecto and others 1997). Avian diversity soars when a mixture of native shade-tree species prevail—especially, it seems, if they are managed at forestlike heights. One research group reports a marked contrast between the avian communities associated with a low-stature, monotonous shade cover in Guatemala and those in a species-rich and structurally diverse shade cover in Chiapas (Greenberg and others 1997). A conspicuous absence of certain bird guilds (nectarivores, frugivores, and omnivores) is related to the shade-management regime. Not only do such studies position traditional tropical agroecosystems in a better light in terms of biological conservation, they also bring into sharp relief the potential loss that can occur with agricultural intensification. Above all, traditional land uses should be considered as potential conservation tools by national decision makers and planners in biodiversity-threatened countries.

The economic benefits of a shade coffee system extend beyond the coffee harvest. Many coffee producers throughout Central America, Colombia, Mexico, and the Caribbean maintain a mix of useful trees used as shade for coffee. Depending on local ecological conditions, the local history of growing practices, and the grower, a "coffee farm" may in fact have a useful array of noncoffee products (Table VI). On Guatemala's Pacific slope, descending from the colonial town of Antigua toward the piedmont city of Esquintla, coffee growers intersperse citrus, bananas, and a popular palm (*pacaya*) among the coffee bushes. These and other fruits offer a ready source of food and/or income when harvested, often during periods that do not overlap with the coffee harvest itself.

Some of my own recent work in Guatemala, in which small coffee farmers responded to surveys, shows that the noncoffee products—firewood, construction material, and fruits, mainly—account for about 7 percent of farm family income through sales (exchange value). But such products are not simply sold locally for money; consumption of them also has value. A load of firewood or an avocado obtained from the coffee farm is a load of firewood or an avocado not purchased, so it represents "income." When the value of those products consumed by the farm family (use value) is calculated and added to the exchange value, the proportion of the farm income climbs to nearly 12 percent. These data are preliminary and based on only some seventy interviews. Moreover, the calculations are based on 1997–1998 interviews, in which farmers report on the previous year's situation. Due to the high coffee prices during that time, total family income was also relatively high. Hence the proportion of family income represented by the use and exchange of these noncoffee products is lower than in an average coffee-price year, making the importance of these noncoffee products during "normal" years even greater.

Emerging Markets

Current trends are well established. Significant areas are affected by the intensification process, with some countries displaying a greater commitment to modern production techniques than others. The place traditionally known as coffee reflects a process wedded to a productionist ideology. But, as with many processes, not all interests march to the same drummer. Voices rise up in environmental chants, urging producing countries toward ideas and ideals defined—once again, as with an exogenous productionist, green revolution ideology—from outside. Yet these responses have their own ideological core. The ideology that affects the morphology of landscape is beginning to shift from the green revolution of high crop yields and agricultural industrialization to the green revolution of biodiversity issues, habitat protection, and environmental well-being. Within the last three years, market and consumer interest (mostly from the industrialized coffee-consuming countries) in the shade coffee issue—mainly from the perspective of coffee-as-habitat—has introduced some intriguing dynamics into the production and trade of coffee. As noble as ultimate goals may be, these trends fit well into what has been termed "manifest ecological destiny" (Schroeder and Neumann 1995).

Emerging markets are making connections between conservation and consumption. Consumers have formed coalitions to address the issue of shade coffee as habitat and are putting pressure on the industry at all points along the commodity chain.[10] Marketers now distribute coffees touted as shade grown. Certified organic coffee is the fastest-growing part of the specialty coffee market. International conservation nongovernmental organizations have well-established departments of rain-forest or tropical-products enterprise, often with special attention given to nontimber forest products. International environmental groups concentrating on migratory-bird issues routinely publish information about the benefits of shade coffee as a bird habitat and urge their members to buy shade-grown coffee.

In response, some countries have launched initiatives to address specific aspects of coffee's environmental impacts, such as Costa Rica's recent program to retrofit all of its processing plants to decrease water contamination along natural waterways. A 1998 Global Environment Facility (GEF) initiative on shade-coffee certification in El Salvador seeks to promote that country's coffee as "biodiversity friendly." Another GEF project in Chiapas, Mexico, attempts the same. Guatemala's ANACAFE now promotes sustainable coffee, pointing to the substantial proportion of that country's coffee lands that maintain some level of shade cover.

The subtext to all these initiatives is the same: Return to or maintain shade-grown coffee to protect the environment. Although these developments are scattered, they do represent a nascent call for land stewardship dictated from outside the coffee-producing region. To the extent that coffee lands in the region revert to shade use and (possibly) reduced agrochemical use, it will represent another phase in the process of the coffee place. Moreover, if and when such initiatives generate meaningful change in the way coffee is managed, the coming years may allow for a re-presentation of how landscape can be read as ideology.

Conclusion

The place of coffee in northern Latin America has come under tremendous pressure to change its traditional aspects in recent years. Its "unbecoming" can be seen simply as the latest stage in a process that affects places where human agency shapes the land. Nature has been appropriated in ways heretofore not seen in the coffee sector. The shaded, forestlike environment has given way to the more "modern," yield-maximizing model of management. The transformation of the physical landscape is obvious. A species-rich, structurally diverse agroforestry setting finds itself changed into a relatively depauperate system—in terms of both managed and associated biodiversity—more in line with conventional agricultural goals of production at any cost. Accompanying this more visible alteration of the coffee farm are some less obvious transformations, including significant changes in the social organization of production and the indirect functions or "ecological services" provided by the traditional setting.

What is unclear is the long-term social impact of technification. The process seeks to increase yields, but, without the relative security provided by the risk-averse management strategies involved in the shaded, traditional coffee system, growers who technify—especially small producers with few resources other than their small coffee holdings—place themselves at economic risk. Higher costs of production and greater risk (due to a less diverse system) for smaller landholders could lead to a transformation in the land-tenure structures in some or all of the countries of northern Latin America. Fluctuating international coffee prices, insect or pest problems, or policy shifts in countries that place their coffee growers at a disadvantage may work toward consolidation of coffee lands, much as green-revolution technologies in basic grains tended to engender consolidation of agricultural lands.

By contrast, policies that protect and encourage a shaded coffee environment play a key role in habitat protection, biodiversity maintenance, and rural development (Rice and Ward 1996). Initiatives currently under way to explore ways in which "biodiversity-friendly" coffee can be developed at a national level spell potential economic rewards for good land stewards—a category into which many small producers currently fall. Although larger producers who have long enjoyed their position within a sector that is not concerned with the environmental aspects of coffee may not warm to the idea of reestablishing ecologically beneficial shade levels, the governments of northern Latin America may find that the prospect of ecologically friendly coffee serves at least two purposes. First, coffee with specific shade composition and management can promote biodiversity. Because many of these producing countries harbor high levels of biodiversity, the incorporation of shade coffee into national environmental plans should prove attractive. Second, the prospect of premium prices (or direct government incentives) associated with shade coffee can direct capital to the rural sector and dovetail with community development plans. Addressing these aims simultaneously with a single crop poses intriguing options for policymakers, allowing them a role in future landscape, conservation, and community development processes.

Notes

1. The term "traditional" poses some challenges, because coffee is not native to the Americas and because it did not always start out beneath a shade cover. Introduced in the late 1700s and early 1800s, it often replaced then-traditional crops such as sugarcane or nopal cactus (used to produced cochineal dye). Regardless of its initial agroforest status, by the turn of the twentieth century the commonplace for coffee production was a relatively diverse shade complex (Rice 1990). Following Christine Padoch and Wil de Jong (1987), I use the term to refer to a system that utilizes local products and local techniques in the production process.

2. Though cumbersome, no term describes the productionist origins of the transformation from traditional to modern cultivation practices as well as "technify" (from the Spanish, *tecnificar*). In this article I use "intensify" (and its derivatives) interchangeably with "technify."

3. It is an ideology based on absolute faith in technological solutions, with homage paid to the idol of ever-higher yields. A fundamental platform of this ideology has long been that natural processes can be replaced or sidestepped via new technologies. Until the recent and reluctant acceptance of alternative strategies, such as integrated pest management, the ideology represented by the intensification of coffee production ignored ecological relationships and the local ecological community as being important to the success of what occurs in an individual field.

4. An interesting twist on the standardization of these types of practices is evidenced by the measured application of some of these chemicals. In parts of Central America, the accepted standard has become "*una medida bayer*" (one bayer measurement) or "*dos medidas bayer,*" depending upon what chemical input is involved. "Bayer" derives from the small plastic measuring spoon provided by Bayer chemical representatives to measure out agrochemicals for backpack sprayers.

5. There is a noteworthy parallel here with John Berger's analysis of publicity and glamour (1972). When the concept of "prestige" is substituted for "glamour," the "publicity" of agricultural modernization—propelled by corporate advertising, roadside billboards, extension agents, consultants, pamphlets by producer organizations, and the like—creates what I would call a desire to be "modern" and, consequently, prestigious within the rural community. Whether it occurs in the midwestern grain states of the United States or the remote coffee areas of Latin America, the desire to be "modern" or "professional" (as it is sometimes portrayed) results in unquestioned acceptance of the fundamental ideology.

6. Coffee growers have been known to buy agrochemicals intended for coffee and apply them to food crops like corn, beans, or rice.

7. All statistics were calculated from information provided by ICAFE's Edgar Rojas Rojas, April 1996.

8. In the coffee zones of northern Latin America it is not uncommon to hear a farm referred to as having been modeled on the "Tico" or "Costa Rican" production model. This shorthand terminology is understood to mean that the farm in question is highly productive, uses scant or no shade cover, and consumes high levels of fertilizers.

9. Unlike Colombian data, where total fertilizer volumes within the coffee sector are available, these data are based on calculations of fertilizer use. They were obtained by incorporating the doses recommended by ICAFE with the hectares of technified and semitechnified coffee. The figure of 1,950 kilograms, like the corresponding Colombian figure, is determined only for that coffee area receiving agrochemicals. Calculations are based on the assumptions mentioned in the text.

10. The Northwest Shade Coffee Campaign, founded in 1996 in Seattle, Washington, is a coalition of coffee-industry interests (roasters, importers, brokers, retailers, and so forth) and the Seattle chapter of the Audubon Society. The Web site for the campaign is [http://www.seattleaudubon.org/Coffee/home.html].

References

Alvarado, J. 1993. Letter to the author. 2 September.

Berger, J. 1972. *Ways of Seeing.* New York: Viking Press.

Chaparro, L. 1998. Telephone interviews with and letters and documents to the author. May and June.

Cosgrove, D. 1989. Geography Is Everywhere: Culture and Symbolism in Human Landscapes. In *Horizons in Human Geography,* edited by D. Gregory and R. Walford, 118–135. Totowa, N.J.: Barnes and Noble Books.

Domínguez, M. 1970. The Development of the Technological and Scientific Coffee Industry in Guatemala, 1830–1930. Ph.D. diss., Tulane University.

Dunkerley, J. 1988. *Power in the Isthmus: A Political History of Modern Central America.* New York: Verso.

Escalante, E. E. 1995. Coffee and Agroforestry in Venezuela. *Agroforestry Today,* July-December, 5–7.

Estrada, A., R. Coates-Estrada, and D. Meritt Jr. 1993. Bat Species Richness and Abundance in Tropical Rain Forest Fragments and in Agricultural Habitats at Los Tuxtlas, Mexico. *Ecography* 16 (4): 308–318.

———. 1994. Non Flying Mammals and Landscape Changes in the Tropical Rain Forest Region of Los Tuxtlas, Mexico. *Ecography* 17 (3): 229–241.

FAO [Food and Agriculture Organization]. 1950–1997. *FAO Production Yearbook.* Rome: Food and Agriculture Organization of the United Nations.

FEDERACAFE [Federación Nacional de Cafeteros de Colombia]. 1985. *Conferencia Cafetera de 1985: Informe del gerente general.* Bogotá: FEDERACAFE.

———. 1993. *Congreso Nacional de Cafeteros: Informe del gerente general.* Bogotá: FEDERACAFE.

———. 1994. *Congreso Nacional de Cafeteros.* Bogotá: FEDERACAFE.

Ferré, F. 1991. *La aventura del café.* Paris: Ferré.

Fournier, L. A. 1995. Fijación de carbono y diversidad biológica en el agroecosistema cafetero. Paper presented at the XVII Simposio sobre Caficultura Latinoamericana, San Salvador, El Salvador, 23–27 October.

Fundación Banhcafé. 1993. Letter to the author. August.

Gariazzo, A. 1984. *El café de Nicaragua: Los pequeños productores de Matagalpa y Carazo.* Managua: INIES/CRIES.

Goodman, D., B. Sorj, and J. Wilkinson. 1987. *From Farming to Biotechnology: A Theory of Agro-Industrial Development.* Oxford and New York: Basil Blackwell.

Greenberg, R., P. Bichier, A. Cruz Angón, and R. Reitsma. 1997. Bird Populations in Shade and Sun Coffee Plantations in Central Guatemala. *Conservation Biology* 11 (2): 448–459.

Griswold, D., and J. Ward. 1996. Mexico's Mistaken Coffee Policy. *Journal of Commerce,* 6 November, §A, 7.

Hernández Navarro, L. 1995. Café con aroma de burocracia. *La Jornada* [Mexico City], 14 March, 11.

Herzog, F. 1994. Multipurpose Shade Trees in Coffee and Cocoa Plantations in Côte d'Ivoire. *Agroforestry Systems* 27: 259–267.

Hopkins, J. S. 1990. West Edmonton Mall: Landscape of Myths and Elsewhereness. *Canadian Geographer* 34 (1): 2–17.

INMECAFE [Instituto Mexicano del Café]. 1990. *El cultivo del cafeto en México.* Jalapa, Mexico: Instituto Mexicano del Cafe.

Instituto del Café de Costa Rica. 1993. Letter to the author. 7 July.

La Jornada. 1997. Se espera aumentar la exportación mexicana de café para el año 2000: Ocho millones de sacos anuales, la meta. *La Jornada* [Mexico City], 22 February, §C, 8.

Junguito, R., and D. Pizano. 1991. *Producción de café en Colombia.* Bogotá: FEDESARROLLO / Fondo Cultural Cafetero.

Kauck, D. 1988. Agricultural Commercialization and State Development in Central America: The Political Economy of the Coffee Industry from 1838 to 1940. Ph.D. diss., University of Washington.

Kirkpatrick, T. W. 1935. The Climate and Eco-climates of Coffee Plantations. *Studies on the Ecology of Coffee Plantations in East Africa* 1: 1–66.

Knox, P. L. 1991. The Restless Urban Landscape: Economic and Sociocultural Change and the Transformation of Metropolitan Washington, DC. *Annals of the Association of American Geographers* 81 (2): 181–209.

Lefebvre, H. 1991. *The Production of Space.* Translated by Donald Nicholson-Smith. Oxford, England, and Cambridge, Mass.: Basil Blackwell.

Levins, R., and J. H. Vandermeer. 1990. The Agroecosystem Embedded in a Complex Ecological Community. In *Agroecology,* edited by C. R. Carroll, J. H. Vandermeer, and P. M. Rosset, 341–362. New York: McGraw-Hill.

Libreros D., E. 1995. Telephone and personal interview with and fax and letter to the author. New York, September.

Lindo-Fuentes, H. 1990. *Weak Foundations: The Economy of El Salvador in the Nineteenth Century.* Berkeley: University of California Press.

MacDonald, K. 1985. The Commercial Strip: From Main Street to Television Road. *Landscape* 28 (2): 12–19.

Marquez Barrientos, L. I. 1997. Validación de campo de los métodos del Instituto Winrock para el establecimiento de parcelas permanentes de muestreo para cuantificar carbono en sistemas agroforestales. Licentiate thesis, Universidad del Valle de Guatemala.

Matson, P. A., W. I. J. Parton, A. G. Power, and M. J. Swift. 1997. Agricultural Intensification and Ecosystem Properties. *Science,* 25 July, 504–509.

Meinig, D. W. 1979. The Beholding Eye: Ten Versions of the Same Scene. In *The Interpretation of Ordinary Landscapes: Geographical Essays,* edited by D. W. Meinig, 33–48. New York: Oxford University Press.

MIDINRA [Ministerio de Desarrollo Agropecuario y Reforma Agraria]. 1987. *Perfil del Programa de Renovación de la Caficultura en Región IV.* Jinotepe, Nicaragua: MIDINRA.

———. 1988. *Costos de producción y presupuesto de financiamiento, ciclo 86/87.* Managua: MIDINRA.

Mitchell, D. 1996. *The Lie of the Land: Migrant Workers and the California Landscape.* Minneapolis: University of Minnesota Press.

Nestel, D. 1988. Comparative Ecology of Monocrop and Polycrop Coffee Systems in Veracruz, Mexico. Ph.D. diss., University of California, Berkeley.

Nolasco, M. 1985. *Café y sociedad en México.* Mexico City: Centro de Ecodesarrollo.

Otero, G. R. 1984. An Effort to Control and Possibly Eradicate Coffee Rust in Nicaragua. In *Coffee Rust in the Americas,* edited by R. H. Fulton, 93–104. Saint Paul, Minn.: American Phytopathological Society.

Padoch, C., and W. de Jong. 1987. Traditional Agroforestry Practices of Native and Ribereño Farmers in the Lowland Peruvian Amazon. In *Agroforestry: Realities, Possibilities, and Potentials,* edited by H. L. Gholz, 179–194. Dordrecht, Netherlands: Martinus Nijhoff.

Perfecto, I., and J. Vandermeer. 1994. Understanding Biodiversity Loss in Agroecosystems: Reduction of Ant Diversity Resulting from Transformations of the Coffee Ecosystem in Costa Rica. *Entomology (Trends in Agricultural Science)* 2: 7–13.

———. 1996. Climatic Changes and the Indirect Loss of Ant Diversity in a Tropical Agroecosystem. *Oecologia* 108 (3): 577–582.

Perfecto, I., R. A. Rice, R. Greenberg, and M. Van der Voort. 1996. Shade Coffee: A Disappearing Refuge for Biodiversity. *BioScience* 46 (8): 596–608.

Perfecto, I., J. Vandermeer, P. Hanson, and V. Cartín. 1997. Arthropod Biodiversity Loss and the Transformation of a Tropical Agroecosystem. *Biodiversity and Conservation* 6 (7): 935–945.

Pred, A. 1984. Place as Historically Contingent Process: Structuration and the Time-Geography of Becoming Places. *Annals of the Association of American Geographers* 74 (2): 279–297.

Reynolds, J. 1991. Soil Nitrogen Dynamics in Relation to Groundwater Contamination in the Valle Central, Costa Rica. Ph.D. diss., University of Michigan.

Rice, R. A. 1990. Transforming Agriculture: The Case of Coffee Leaf Rust and Coffee Renovation in Southern Nicaragua. Ph.D. diss., University of California, Berkeley.

———. 1997. The Land Use Patterns and the History of Coffee in Eastern Chiapas, Mexico. *Agriculture and Human Values* 14: 127–143.

Rice, R. A., and J. Ward. 1996. *Coffee, Conservation, and Commerce in the Western Hemisphere.* Washington, DC: Smithsonian Migratory Bird Center / Natural Resources Defense Council.

Rojas Rojas, E. 1996. Letter to and telephone interview with the author. April.

Rosset, P. M. 1996. Letter to the author. 5 September.

Rowntree, L. B. 1996. The Cultural Landscape Concept in American Human Geography. In *Concepts in Human Geography,* edited by C. Earle, K. Mathewson, and M. S. Kenzer, 127–160. Lanham, Md.: Rowman and Littlefield.

SAGAR [Secretaría de Agricultura, Ganadería, y Desarrollo Rural]. 1996. *Mexico cafetalero: Estadísticas básicas.* Mexico City: SAGAR and the Consejo Mexicano del Café.

Sauer, C. O. 1963. The Morphology of Landscape. In *Land and Life: A Selection from the Writings of Carl Ortwin Sauer,* 315–350. Edited by J. Leighly. Berkeley, Calif.: University of California Press.

Schroeder, R. A., and R. P. Neumann. 1995. Manifest Ecological Destinies: Local Rights and Global Environmental Agendas. *Antipode* 27 (4): 321–324.

Solis, I. 1979. *Memorias de la Casa de Moneda de Guatemala y del desarrollo económico del país, Tomo III–B.* Guatemala: Ministerio de Finanzas.

Soto-Angli, J. 1993. Interview with the author. Washington, D.C., 15 May.

Ukers, W. H. 1922. *All about Coffee.* New York: Tea and Coffee Trade Journal Co.

USAID [U.S. Agency for International Development]. 1989. *Guatemala Project Paper: Small Farmer Coffee Improvement.* Washington, D.C.: AID.

———. 1990. *Haiti Project Paper: Coffee Revitalization.* Washington, D.C.: AID.

———. 1991. *U.S. Overseas Loans and Grants and Assistance from International Organizations.* Washington, D.C.: AID.

———. 1992. *El Salvador Project Paper: Coffee Technology Transfer.* Washington, D.C.: AID.

USAID/ROCAP [U.S. Agency for International Development / Regional Office on Central America and Panama]. 1981. *ROCAP Project Paper: Regional Coffee Pest Control.* Washington, D.C.: AID.

Valdivieso, P. 1993. Letter to the author. 25 October.

Vandermeer, J. H., and I. Perfecto. 1995. *Breakfast of Biodiversity: The Truth about Rain Forest Destruction.* Oakland, Calif.: Food First Books.

Verangis, P. 1993. Interview with the author. Washington, D.C., 15 July.

Wellman, F. L. 1961. *Coffee: Botany, Cultivation, and Utilization.* London: Leonard Hill Press.

Williams, R. G. 1994. *States and Social Evolution: Coffee and the Rise of National Governments in Central America.* Chapel Hill: University of North Carolina Press.