Forest Transitions in Mexico: Institutions and Forests in a Globalized Countryside*

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Forest-transition theory suggests that economic development eventually leads to forest recovery, but there is great uncertainty about the existence, the characteristics, and the mechanisms of forest transitions that might be occurring under current socioeconomic conditions. A case study in a small region of highland Mexico finds agricultural abandonment and forest regeneration, but also forest degradation due to woodcutting. A discussion locates those findings in the international political economy of agriculture and emigration in Mexico, which are substantially different from the conditions associated with forest recovery in developed countries. Although regional forest transitions are possible in marginal agricultural areas such as that studied here, their environmental implications depend on the evolution of social institutions coordinating rural people's environmental actions. **Key Words: agricultural abandonment, deforestation, institutions, migration, political ecology.**

Introduction

The forest-transition concept is a promising area for theory-building in the human dimensions of global environmental change. It indicates a potentially positive relationship between development and forest cover, with important implications for models of global change and the creation of policies that might catalyze forest conservation and recovery. If it is correct, it suggests that "development"—however defined—is a solution to problems of deforestation. Such a theory is of great interest to geographers on all sides of debates about modernism and the role of global theories in understanding local places. Through an analysis of case-study research and a discussion of Mexican agricultural policy, this article examines the utility of forest-transition theory in understanding forest change in the increasingly globalized countryside of developing countries.

Furthermore, this analysis contributes to calls for research that improves understanding of the driving forces of land use as they operate through land managers, that clarifies the land-cover implications of land-use decisions, and that leads to the development of predictive models of land-use change (Turner et al. 1995). Ideally, such research should capture the political ecologies of globalization and transnationalism, including current forms of market integration, patterns of peripheral industrialization, and the impact of immigration and other forms of cultural and economic connections between local places and the global economy (Bebbington and Batterbury 2001).

This article is organized as follows. First, it reviews the literature on the forest transition and disaggregates it into several key issues, especially the need to study patterns of land use and forest use separately. Second, it examines forest change, agricultural decline, migration, and craft production in a case study in the Lake Pátzcuaro Basin, which is part of the Purépecha region,[1] a long-settled forest region in highland Michoacán, Mexico. Third, it considers the regional and national political economy of agriculture and migration. This section shows the broader implications of the case study, as well as indicating important differences between the current development situation and the conditions leading to previous forest transitions. Finally, a discussion draws out implications for forest-transition theory, especially the need to better understand institutional[2] evolution in order to predict environmental outcomes.

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Disaggregating Forest-Transition Theory

The forest-transition model suggests that as countries undergo a process of development, forest cover follows a U-shaped curve. At first, deforestation is rapid, but as the country develops, deforestation slows and finally reverses. The theory holds that modernization leads to increased agricultural productivity and improved urban labor opportunities. These changes, however, are spatially concentrated and lead to spatially uneven patterns of development. Industries concentrate in the cities. Agriculture, meanwhile, intensifies in regions where large expanses of arable and irrigable lands respond to mechanization and chemical inputs. Conversely, where topography, soils, and water constraints limit the application of new agricultural technologies, agriculture becomes increasingly marginal. Small farmers in these marginal areas abandon their lands, rural households re-establish themselves in the cities, forests regenerate on the abandoned fields, and national forest area increases.

Forest-transition theory is clearly illustrated by several developed countries, such as the United States, Portugal, and Denmark (Grainger 1995; Rudel 1998; Mather and Needle 1999). Several questions arise about the relevance of those experiences for countries currently experiencing deforestation, however. Might there be forest transitions in developing countries as well? "The recent historical experience with forest transitions in Japan, Puerto Rico, and South Korea raises hopes among some analysts that, as urban-industrial expansion spreads to countries in the tropics, peasants will leave the land for the cities, enabling a turnaround in forest cover trends" (Rudel 1998, 546; see also Turner et al. 1995, 38; Rudel, Perez-Lugo, and Zichal 2000). Even if there are forest transitions in developing countries, however, will they resemble the ones already observed? With its emphasis on a seemingly unilinear and homogenous process called "development," the forest transition implies a teleological tendency, an assumption that the future of "underdeveloped" countries will emulate the history of "developed" ones. Several researchers, however, argue that if there are forest transitions in developing countries now, they will be unlike those observed in developed countries because different international patterns of urbanization and industrialization lead to forms of migration in which remittances and temporary labor help maintain rural households (Rudel, Bates, and Machinguiashi 2002).

Two Components of the Transition: Land Use and Forest Use

To escape the teleological tendency while attempting to learn from past experience, it is useful to consider the issue of mechanisms: What specific aspects of "development" led to forest transitions in the past? Grainger (1995) indicates the utility of disaggregating the forest transition into two main components, with different mechanisms for each. In a *land-use* component, clearing forests for agriculture stopped and agricultural abandonment set in. In a *forest-use* component, forest mining was replaced with sustainable forest management and protection.

Mechanisms for the land-use component included agricultural intensification on the nation's best lands, industrialization, and urbanization. With industrialization and urbanization, the amount of work available in cities increased. Agricultural intensification, meanwhile, drove down the price of agricultural products and decreased the competitiveness of small-scale agriculture in marginal areas. As a result, rural households in marginal areas abandoned their small farms and sought a better life in the city.[3]

Mechanisms for a forest-use component included technological innovations that substituted fossil fuels for firewood, changes in attitude about the recreational and conservation values of forests, and improvements to forest-management technologies. More importantly, there were significant changes to the national institutions of forest management. As wood and/or forested lands become depleted, the public became concerned about the scarcity of industrial resources and the disappearance of recreational opportunities. Governments responded by creating national forest areas, establishing forest-management laws, and funding forest-management bureaucracies. As the value of timber increased due to increasing scarcity, some landowners also began to plant trees and to protect their forests. In other areas, forests regenerated

spontaneously on abandoned agricultural lands (Rudel 1998; Mather and Needle 1999).

To summarize, the forest-transition concept raises some empirical questions: Are forest transitions taking place in developing countries under current conditions of development and differing styles of migration? What are the specific patterns of change to land use and forest use in settled areas of marginal agriculture, where theory predicts forest transitions are most likely? There are also several theoretical questions: What mechanisms—such as resource-management institutions—are involved in forest transitions? Little is known about the evolution of resource-management institutions, especially at a local level. What conditions encourage local institutional innovation? What conditions discourage it?

Cross-national research with nationally aggregated data is unlikely to answer these questions. Developing-country forest transitions would start in particular regions and spread unevenly throughout the nation (Rudel 1998, 546). Subnational research in Ecuador, for example, revealed recent forest recovery amidst complex socioeconomic changes (Rudel, Bates, and Machinguiashi 2002). Addressing forest-transition questions requires subnational research.

A Regional Forest Transition in the Purépecha Region of Mexico?

Mexico appears to be a reasonable place in which to consider the possibility of forest transitions, at least in nonfrontier regions. Once predominantly agricultural, Mexico is now a highly urbanized, upper-middle-income country by World Bank standards. Agriculture now comprises only 5 percent of Mexico's gross domestic product and employs only 20 percent of the workforce. Furthermore, the country's net migration rate is −2.77 per 1,000, indicating a much higher rate of emigration than in Ecuador, where researchers observed net reforestation in one region, and a slightly higher rate than Puerto Rico, where forest area has increased substantially[4] (Rudel, Perez-Lugo, and Zichal 2000; CIA 2001; Rudel, Bates, and Machinguiashi 2002).

In Mexico, the forest-transition question contains compelling implications for biodiversity, carbon emissions, and regional soil and water conservation. Deforestation decreases Mexico's biodiversity, which is especially outstanding among the pines, oaks, and associated species in the highland forests (World Bank 1995). Deforestation also leads to decreased infiltration, greater runoff, and soil erosion in mountainous watersheds, with lost soil deposited in dams, rivers, lakes, and coastal wetlands. In addition, deforestation contributes an estimated 30 percent of Mexico's carbon emissions. If forests were stable or growing, moreover, they could store substantial amounts of carbon (Masera, Ordoñez, and Dirzo 1997).

Nationally aggregated deforestation statistics, however, indicate continued forest loss. Data from the early 1990s report deforestation rates somewhere between 0.8 percent and 2 percent. Proximate causes include expansion of croplands and pastures, logging, woodcutting, and forest fires (World Bank 1995; Masera, Ordoñez, and Dirzo 1997). These data indicate much lower rates of deforestation in the mountain highlands than the tropical lowlands; however, they do not preclude regional forest transitions, especially in long-settled highland areas such as the Purépecha region.

Agriculture goes back several thousand years in the Purépecha region. Although it was originally a maize-centered horticulture, the species used changed after Spanish occupation and the introduction of the plow. In the 1940s, researchers described a predominantly agricultural region that was roughly self-provisioning in maize, beans, and squash, with wheat an important cash crop. Lumbering, carpentry, and pottery production were also important supplements to agriculture (West 1947; Brand 1951). Human habitation has left profound impacts on the vegetation. State forest inventory data suggest 45 percent deforestation between 1960 and 1990 (Toledo, Alvarez-Icaza, and Avila 1992). Closer analysis, however, suggests that the perception of deforestation and the data that support that perception are both exaggerated (Klooster 2000).

In Mexico, half of the national land area and 80 percent of the forests are common-property territories. This section of the article summarizes previously published research in two of those communities, located on the north shore of Lake Pátzcuaro, in the Purépecha region[5] (Figure 1). The 2,000 residents of San Jerónimo own a 3,000-ha territory, while 4,250 people in

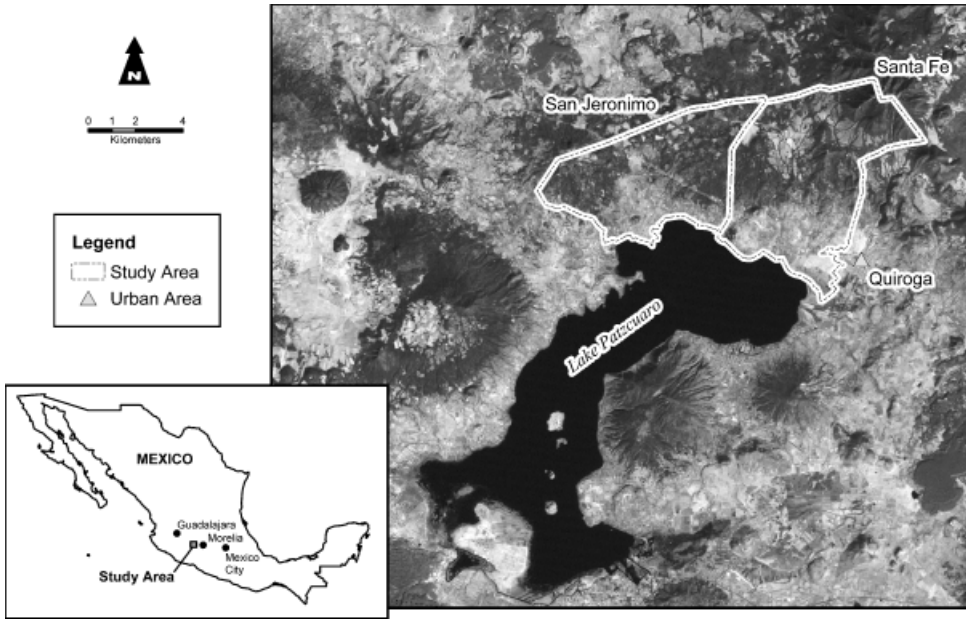

Figure 1 *Location of the case-study communities against a backdrop from the Landsat Enhanced Thematic Mapper (band 3) from the spring of 2000, the dry season.*

Santa Fé own a 5,000-ha territory. Both are *comunidades indígenas*, a land-tenure category recognizing the communal properties granted to Indian villages during colonial times. These communities are surrounded by small private properties and *ejidos*, which are collective land grants. Altitudes range from 2,000 to 3,000 meters above sea level. Soils are volcanic. Winters are dry and frosts are frequent. Both community territories are roughly 40 percent covered in pine and oak forests, interspersed with maize fields and unimproved rainy-season grazing lands.

The Land-Use Component of the Forest Transition Is Present

Black and white photographs from 1942, 1960, and 1990 reveal a landscape of partial agricultural abandonment. Field margins and fence lines are less distinct now than in the past. In 1998 and 1999, site visits to old maize fields that were clear of trees in photographs of 1960 or 1974 found many of them covered with vigorous stands of pine and oak trees with diameters of 20 to 30 cm at breast height. Crumbling stone fences and old plow furrows provide frequent evidence of an agricultural history for areas that now support dense stands of trees. Government-assisted tree planting was successful in a few areas, especially near the towns, but most forest regeneration was spontaneous. In other areas, scrub, brush, and xerophytic vegetation colonizes abandoned agricultural fields. Maize farming continues, but in a smaller area than before.

Informants from the studied communities confirm findings from remote sensing and site visits. Their statements indicate a clear perception that forests are regenerating on abandoned agricultural lands (Klooster 2000). In these case-study communities, a shift from agricultural expansion to agricultural abandonment is under way; the land-use component of a forest transition appears to be present.

Forest-transition theory suggests an obvious potential mechanism for this land-use change: rural depopulation, as households emigrate permanently to the cities. But these communities are not emptying out. From 1950 to 1999, the population in Santa Fé increased substantially, from 2,162 to 4,247. In San Jerónimo, population increased slightly during the same time period, from 1,537 to 1,962 (Klooster 2000; INEGI 2001).

Not rural depopulation, but rather a changing array of rural economic activities, explains land-use change. According to a 100-percent census conducted in 1997 and 1998 by personnel of local health clinics, almost 90 percent of Santa Fé workers consider pottery-making or marketing as their primary activity (cited in Klooster 2000). In contrast, just under 3 percent list agriculture as their primary activity, although about one-half continue to grow at least some of their own food. In San Jerónimo, a third of the workers weave figures from straw for sale to tourists, and nearly half earn their income outside of the community as day laborers, schoolteachers, and temporary emigrants to the U.S. and Mexican cities. Although farming continues as a secondary or tertiary activity for many residents of San Jerónimo, it is now the primary activity of a mere 4 percent. Furthermore, data on population and economic activities in San Jerónimo probably underrepresent the importance of remittances from abroad and the frequency of temporary, cyclical, and recurrent emigration. Of 866 houses in San Jerónimo, only 466 are actually inhabited, with the rest either in ruins or in a nearly permanent state of construction by people planning to retire there after working in the United States (Klooster 2000).

This distribution of economic activities reflects a progressive decline in the importance of agriculture. Due to pests, soil fertility,[6] frosts, dry spells, hail, and windstorms, most of the Purépecha region has always been somewhat marginal for agriculture. At the same time, declining prices, increased availability of subsidized tortillas and maize from elsewhere, and the growth of off-farm income-generating alternatives have further decreased the economic viability of agriculture over the last forty years and have pushed area residents to intensify other income-earning options. Once the central activity of household livelihood strategies, agriculture is now a supplement to a diverse portfolio of craft production, petty commerce, sporadic wage labor, and remittances from temporarily absent household members.

Villagers of San Jerónimo, for example, associate the beginning of land abandonment with *la norteada*, a local name for the WWII-era U.S. "Bracero" program that brought temporary laborers to work in U.S. agriculture and changed local perceptions of labor opportunities elsewhere (Klooster 2000). Similarly, although pottery production has been a part of household economies in Santa Fé for a very long time (West 1947), villagers there attribute agricultural abandonment to the intensification of pottery at the expense of agriculture. They perceive agriculture to be decreasingly viable because of risks of crop failure, declining soil fertility, a lack of plow and pack animals, the increasing difficulty in excluding free-ranging cattle from crops as neighbors abandon nearby fields, the distance of available fields from town, long delays between planting and harvest, and the costs of plowing, planting, fertilizing, and weeding the crop. In contrast, pottery-making permits people to work indoors in the presence of family and yields money returns much more quickly and with less initial investment. Even lacking capital for the purchase of glazes or firewood, potters can sell unfired or once-fired pottery to other family workshops in town. Despite drought and frost, pottery always yields some return within a week or two. By 1970, 80 to 90 percent of households already included pottery production in their economic activities, and this has held steady or increased since then (Gortaire 1971; Klooster 2000).

In his detailed description of the neighboring town of Quiroga in 1945, Brand (1951) confirms the importance of locally produced foodstuffs, including maize produced in Santa Fé and San Jerónimo. Since then, the importance of local food self-sufficiency has decreased. Local shops began to sell government-subsidized maize in the villages, and now residents frequently purchase maize with money earned in off-farm activities. As a result, the agricultural frontier has contracted, despite steady or growing populations (Klooster 2000).

The Forest-Use Component of the Forest Transition Is Absent

Even while abandoning some agricultural lands, resident rural populations in these towns continue to make use of the forest as a source of fuel for cooking and, in Santa Fé, for pottery production. Although propane and electricity are easily available in the region and some households use these fuels for part of their cooking, they have not chosen to substitute these fuels for firewood, due to cost and the specific cooking requirements of the local

cuisine (Masera, Saatkamp, and Kammen 2000). Nearly all potters reject fossil fuels in order to avoid depending on a monetized production input the cost of which fluctuates with international exchange rates and world energy prices. Furthermore, most potters lack the capital necessary to build a gas-fired kiln (Klooster 2002).

Potters in Santa Fé prefer pine firewood for hardening their pots and fixing the lead-based glazes that give their ceramics color and shine. Some 450 kilns in the village are in use twice a month, requiring some 2,000 m^3 of fuel per year. Although commercial logging and woodcutting is officially banned in the Lake Pátzcuaro Basin, this legal institution is not enforced against small-scale woodcutters, and virtually all of Santa Fé's pottery fuel comes from the adjacent forest.

Three sources of data reveal the impact of this biomass demand on the forest. First, local forest inventories reveal that forests in Santa Fé are much poorer in pine than are forests in San Jerónimo. Furthermore, the forests most accessible to the potters of Santa Fé are generally less dense than forests in San Jerónimo. Second, when examined under a mirror stereoscope, aerial photographs from 1960, 1974, and 1990 show a progressive thinning of the section of pine/oak forest separated by the Santa Fé/San Jerónimo border, and this thinning is most pronounced on the Santa Fé side. Third, participant observation and interviews with key informants confirm what forest inventories and remote sensing imply. As I accompanied woodcutters from Santa Fé across the border into San Jerónimo, they told me that woodcutting has progressively decreased the availability of pine firewood in Santa Fé's accessible forests, so that Santa Fé potters no longer find all the pine fuel they need in their own territory and increasingly cross into the territory of neighboring San Jerónimo (Klooster 2000, 2002). Forest inventories, aerial photographs, and participant observation suggest that demand for wood leads to an expanding process of forest thinning and pine depletion: the forest-use component of the forest transition is absent.[7]

Institutional Aspects of Forest Use

Forest-transition theory suggests that institutional and technological mechanisms lead to changes in forest use and protection, but these institutional changes have not occurred in the case-study communities. Common-property tenure rules, for example, recognize strong household rights to lands currently planted, but when trees grow on old fields, they revert to common ownership. In addition, restrictive Mexican forest regulation applies to reforested areas without distinction to their former use or the rights of former usufruct holders. Together, these institutions discourage tree-planting by individual households. Similarly, other than a ban on selling the community's wood to outsiders and a ban on cutting trees in a few areas where community reforestation efforts on former agricultural lands was uncharacteristically successful,[8] there are no self-imposed restrictions on woodcutting in Santa Fé. Woodcutters who flout these rules or who cross into San Jerónimo to cut wood have no reason to expect sanctions, either from neighbors or from the government forest bureaucracy (Klooster 2002).

According to the theory of institutional choice (Ostrom 1990, 210ff.), groups of people are most likely to engage in the collective action of crafting novel institutions when they are motivated by perceptions of increasing scarcity and a vision of the potential benefits from change.[9] For San Jerónimo and Santa Fé, however, porous community borders and limited resource-management options dissipate these motivations to invest in new institutions (Klooster 2002). As already noted, Santa Fé potters cut much of their fuelwood in San Jerónimo, but this is just one example of the problem of porous borders. The forests of San Jerónimo also suffer occasional nighttime incursions from timber smugglers, who fell the largest and most accessible pine trees and carry them off to regional sawmills. Santa Fé has also experienced tree theft from its territory. Until the early 1980s, woodcutters from a neighboring town routinely entered Santa Fé's territory to cut pine for local carpentry workshops (Gortaire 1971; Zárate 1993). Currently, Santa Fé woodcutters leave their own territory and cut in San Jerónimo's territory with impunity, and in this way they are able to avoid the local consequences of pine scarcity (Klooster 2002).

The Lake Pátzcuaro Basin logging ban reinforces this situation. By denying communities like San Jerónimo the opportunity to benefit from logging their own forests, it also

removes economic incentives for them to actively protect their forests from outsiders. At the same time, the logging ban allows exceptions for sanitary cuts to remove diseased and fire-damaged trees. This lubricates corruption between the forest bureaucracy and sawmill owners at the same time that it disempowers community forest owners. In other words, a macroinstitutional framework of national forest laws that empower foresters at the expense of communities, a general lack of support for the protection of common-property territories, and the specific Lake Pátzcuaro logging ban all represent barriers to the evolution of an improved set of institutions at the community level (Klooster 2002).

Finally, there is a technological barrier. Neither local forest knowledge and cutting techniques nor the conventional Mexican practice of scientific forestry provide an adequate social and ecological framework for improving forest management for fuelwood production in these communities. Neither resource-management system suggests compelling alternatives to current methods of cutting (Klooster 2002). These barriers to institutional evolution inhibit the changes to resource-management institutions that could lead to tree-planting and better forest management.

National Context of the Case-Study Findings

The evidence from a case study of two communities suggests that at least the land-use component of a forest transition is present. Data from elsewhere in the Purépecha region also indicates agricultural abandonment. In the county of Erongarícuaro across the lake from Santa Fé, for example, the area planted in maize decreased sporadically from 2,736 ha in 1982 to 1,436 in 1988 (Carney 1992). More recently, Works and Hadley (2000) took repeat photographs of Robert C. West's 1948 to 1970 landscape photography in the region. Their analysis revealed many abandoned corn and wheat fields reverting to shrubs, pastures, and sometimes trees. Yields for rain-fed corn rarely pass one ton/ha in this region, compared to eight to twelve tons/ha in high-productivity areas of Mexico, and the area planted in maize declined 50 percent from 1969 to 1993. Although some of these maize fields were certainly converted to avocado orchards in areas where climatic conditions favor the tree, abandoned agricultural areas are common (Carabias et al. 1994; Chapela 1994). Land-cover changes in the case study, therefore, apparently reflect the situation of the Purépecha region more generally.

More intriguingly, the mechanisms implicated in the case study echo national circumstances. In agriculturally marginal areas such as the Purépecha region, partial agricultural abandonment is a logical outcome of internationalized agricultural policies. Credit, technological investment, price ceilings, and other aspects of Mexican agricultural policy have long favored intensification in irrigated areas at the expense of rain-fed agriculture (Barkin 1990; Gledhill 1995; Cornelius and Myhre 1998). Tortilla subsidies increased steadily during the 1970s, national production of maize stagnated, and imports rose. Since 1986, however, just before Mexico entered the General Agreement on Tariffs and Trade, maize prices have declined by more than half. A 2.5-ha plot with a good harvest earned 90 percent of a minimum salary in 1987, but only 40 percent of a minimum salary in 1995 (Appendini 1998). The North American Free Trade Agreement reinforced these tendencies.

At the same time, off-farm income-earning activities are increasingly important. On average, off-farm work generates more than half of farm households' incomes in Mexican common-property agricultural communities (de Janvry and Sadoulet 2001). The political economy of agriculture in Mexico appears to favor agricultural abandonment in marginal areas such as highland Michoacán because members of households with poor lands can find off-farm work and then buy maize, instead of growing it themselves.

Agricultural policies and off-farm work opportunities have not, so far, driven Mexicans out of the countryside completely, however. Although many Mexicans do emigrate permanently, much migration is temporary and recurrent, or cyclical. Perhaps one million of the 24 to 27 million Mexicans living in towns smaller than 2,500 emigrate temporarily each year (Cornelius and Myhre 1998). Their emigration subsidizes rural livelihoods (Massey et al. 1998). Rurally rooted transnational migrants spend significant

portions of their income on remittances to households back home. After stints of labor in Mexican cities and the U.S., they return with money to invest in housing and local public works such as churches and plazas and to spend on religious celebrations that forge important reciprocal relationships. In agriculturally marginal regions of Mexico, apparently prototypical "peasant communities" of small-scale farmers now produce only a fraction of the corn and beans they consume locally. The bulk of their rural livelihood comes from beyond the borders of their community (Gledhill 1995; Kearney 1996).

Meanwhile, rural Mexicans continue to use the forest. Even relatively high-income rural households continue to cook with wood, in defiance of typical models of fuel substitution (Masera, Saatkamp, and Kammen 2000). Furthermore, in the same way that remittances and savings from work elsewhere facilitate the continuation of Mexican rural communities, so, too, do forest-based activities such as legal logging, unsanctioned tree-cutting for informal lumber markets, and forest-dependent crafts such as the wood-fired production of pottery.

Wood scarcity has not, so far, led to technological and institutional innovations that stop forest mining and support forest conservation, and so the forest-use component of the forest transition has not occurred in the case-study communities. Nor is one evident in the Purépecha region, where forests supply wood to more than a thousand band-saw workshops, sawmills, wood chippers, and more than 9,000 small pottery and carpentry workshops (Masera, Masera, and Navia 1998). Because of this demand for wood and the way in which it is met by uncoordinated woodcutting in poorly protected forests, increasing forest cover from agricultural abandonment accompanies decreasing forest quality (see also Works and Hadley 2000, 153).

Conclusion

Forest-transition theory suggests that as countries progress along a trajectory of development, deforestation will cease and forests will recover. It invites an interpretation that "the best—and probably the only—way to attain a decent environment in most countries is to become rich" (Beckerman 1992, 482). But the preceding analysis is less sanguine. Deforestation decline does not guarantee eventual recovery, reforestation can accompany declining forest quality, and agricultural abandonment implies soil depletion and genetic erosion of cultivars.

More critically, the case study suggests that "development" is neither necessary nor sufficient to cause a forest transition. Observed land-cover changes partially resemble forest transitions observed in currently developed countries, but the mechanisms involved are different. The increasing internationalization of agriculture, which discourages small farmers from producing grains for local markets, creates a different context for forest transitions than those that occurred during historically observed processes of social and economic change in Europe, the U.S., and elsewhere. In particular, Mexican patterns of emigration confound expectations of a straightforward forest transition because they maintain rural populations.

On the other hand, case-study findings of agricultural abandonment, tree-cover expansion, and forest degradation show the value of examining forest change in nonfrontier regions of marginal agriculture, where some sort of forest transition might be occurring. In addition, these land-cover findings contribute to geographical understandings of the complex ways in which transnational migration and other aspects of global economic integration transform rural places (Bebbington and Batterbury 2001).

Finally, the preceding analysis reiterates the importance of local social institutions in understanding the evolution of forest use and forest conditions. Under conditions in which the viability of small-scale agriculture declines but rural populations continue to make use of forest lands, institutional aspects of forest management are central to understanding how these complex drivers actually affect land-use and land-cover change. Even though many people live in agriculturally marginal areas of rural Mexico, use forests for livelihood and subsistence needs, and would collectively benefit by creating local institutions leading to tree-planting and better forest management, this does not often occur. In the case study, for example, a different set of usufruct rules

governing abandoned maize fields in common-property territories might encourage local tree-planting and forest protection. Similarly, a different set of local rules governing the location and type of trees that woodcutters allow themselves to cut could enhance forest productivity. Unfortunately, the institutional parameters of a regional logging ban, lack of state support for protecting community boundaries, and inadequate forest-management options dissuade local people from trying to craft more appropriate land-use rules and customs. This research, therefore, confirms the critical need for a theory of institutional evolution in the broader project of understanding the role of people in global environmental change (Young et al. 1999).

The dynamics of increasingly internationalized political economies of food, agriculture, and emigration are likely to create unexpected opportunities for forest conservation and regeneration in long-settled regions where agriculture is marginal but where emigration, remittances, craft production, and other links to the global economy provide opportunities for the diversification of livelihoods. Such areas are increasingly common throughout the developing world, even in countries much lower in development rankings than Mexico. The social and environmental implications of those opportunities will depend on the existence—or evolution—of institutions that coordinate people's behavior in socially and environmentally beneficial ways. ■

Notes

[1] In the context of this article, the Purépecha region includes the Lake Pátzcuaro Basin and the Meseta Tarasca of the state of Michoacán.

[2] In the context of resource-management studies, institutions should be thought of as the "systems of rules, decision-making procedures, and programs that give rise to social practices and guide interactions among the occupants of relevant roles. Unlike organizations, which are material entities that typically figure as actors in social practices, institutions may be thought of as the rules of the game that determine the character of these practices" (Young et al. 1999, 11).

[3] In addition, there may be biophysical driving forces—such as soil degradation, pest ecology, and local climate changes—that lead to agricultural abandonment and affect the chances of forest regeneration (Turner et al. 1995). But forest-transition theory rarely encompasses such factors.

[4] Ecuador's rate is –0.55 per 1,000, Puerto Rico's is –2.13 per 1,000, and Haiti's is –2.64. In contrast, Jamaica's rate is –7.52 and the Dominican Republic's is –3.81 per 1,000. In the U.S., the net migration rate is + 3.5 per 1,000 (CIA 2001).

[5] Methods utilized included participant observation with woodcutters and foresters, interviews with elders and village authorities, and the analysis of secondary data, including aerial photographs.

[6] The disappearance of maize/wheat/leguminous-fodder rotations, decreases in the sizes of herds, intensification of soil use, and the abuse of chemical fertilizer might have contributed to declines in soil fertility, but this is difficult to confirm. Oral histories link chemical fertilizer use with soil-fertility declines, however.

[7] Furthermore, although vigorous forest regrowth does occur on many of the abandoned fields in the communities' territories, natural reforestation does not always take place. Thirteen percent of Santa Fé's and 19 percent of San Jerónimo's territory consists of abandoned and eroded agricultural areas. These areas contain xerophytic vegetation and areas of bare soil, and they suffer from sheet and gully erosion (Klooster 2000).

[8] For many years, the Mexican government has responded to concerns about deforestation and desertification with various reforestation programs, especially in degraded areas of common-property lands. Few seedlings survive for very long, however. Like unsuccessful top-down reforestation efforts elsewhere, the Mexican programs suffer from a dearth of meaningful local participation, a programmatic focus on the number of seedlings planted without attention to survival rates, and an ignorance of local land-tenure institutions. Small areas of successful tree plantations in Santa Fé and San Jéronimo were exceptional in the survival rates of seedlings, in the degree of community participation, and in the institutional context of tree planting (see Klooster 2002).

[9] Institutional-choice theory also indicates the importance of institutional capacity, which is a history of successfully resolving collective-action problems through local institutional innovations. Santa Fé has significant institutional capacity. For a discussion, see Klooster (2002).

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