Forest Transition and Fuzzy Environments in Neoliberal Mexico

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Although deforestation remains a continuing threat to both the natural world and its resident human populations, a countervailing land cover dynamic has been observed in many nations. This process of landscape turnaround, the so-called forest transition, holds the potential of regenerating ecosystem services by sparing land from agricultural activities and abandoning it to forest succession.

forest transition land sparing NAFTA Mexico deforestation

1. Introduction

The conversion of native forests is one of the most important processes contributing to the current global environmental crisis. It accounts for 38% of the carbon emissions from agriculture, which contributes ~25% of greenhouse gas (GHG) emissions to the atmosphere [1]. In addition, deforestation and forest degradation are the primary drivers of species extinctions on land and the loss of livelihood for the millions of people who rely on the ecosystem services provided by forests [2][3]. It should come as no surprise that measuring this environmental transformation and understanding its proximate and underlying causes now comprise a major interdisciplinary research area. Although deforestation remains a continuing threat to both the natural world and its resident human populations, a countervailing land cover dynamic has been observed in many nations. This process of landscape turnaround, the so-called forest transition (FT), holds the potential of regenerating ecosystem services by sparing land from agricultural activities and abandoning it to forest succession.

Specifically, FT provides a critical empirical foundation for greenhouse gas (GHG) emissions policy based on carbon sequestration and is therefore highly consistent with the goals of the United Nations Program on Reducing Emissions from Deforestation and Forest Degradation, or UN-REDD [4][5]. Recently, controlling anthropogenic greenhouse gas (GHG) release to the atmosphere with forest-based policy has been widely adopted by signatories to the Paris Climate Treaty, particularly by nations with large forests and dynamic agricultural economies, such as those found throughout the global south. FT, although first observed in the global north, is increasingly affecting forests wherever they are found.

Mather [6] and Walker [7] use the terms forest areal transition and landscape turnaround, respectively, in referring to shifting trends in the national land covers of Europe, North America, and the Pacific Rim, from a period of forest decline to one of net expansion. Their original formulations rested on a hypothesized relationship between land

cover dynamics and long-run structural changes in a national economy, with agricultural development driving deforestation, after which industrialization sparks rural-to-urban migration as farmers abandon their fields to take manufacturing jobs in cities. Intensifying this process of abandonment are technological changes that reduce the demand for farmland by raising agricultural productivity, which is further enhanced as communication networks reveal regional comparative advantages and production shifts from marginal to fertile areas. Technological changes also attenuate forest exploitation by providing new energy sources and building materials as substitutes for fuelwood and timber. Finally, as consumer preferences for natural amenities develop with rising incomes, state environmental policies reinforce the recovery of natural areas in the interest of conservation. The sum total of all these effects is that the pressure on forests is reduced and that formerly exploited lands are abandoned to forest succession, the foundational FT process [6][7].

Critics of the early formulation, which draws a correspondence between dynamics in a national economy and regional landscapes, point to its congruence with developmentalist thinking and the apparent restriction to an isomorphic pattern with necessary “stages”, also known as the Rostow paradigm of growth [8]. This critique questions the alleged spontaneity of forest recovery in the face of industrial capitalism, arguing that FT necessarily requires state intervention in resource exploitation by the private sector and does not proceed by a natural succession of preordained stages [9]. It also points to the impact of institutions, trade, and historical contingency on FT, given that alleged necessary conditions do not always lead to the expected outcome [8][10][11][12]. Behavioral contingency plays a role as well, given the wide variety of skills individuals possess and the great diversity in their preferences for production and consumption.

More recent critiques call attention to scale and foundational issues of measurement and definition [13]. As for scale, there is no a priori reason to restrict FT to the nation-state given that processes of forest recovery occur not just at the macro-scale but also in highly localized settings [14][15][16]. In fact, aggregate deforestation might conceal regional FT as a function of the biome [15][17][18]. As for the issue of measurement, ecologists have pointed to the false dichotomy between conservation and agriculture inherent in FT theory, which is based on an agriculture–forest binary equating forests with conservation and agriculture with degradation [19][20]. Many landscapes are highly fragmented, with matrices combining agriculture and forest as opposed to distinct partitions into two categories, as noted at the outset. Further, the forest itself may provide agricultural values either by grazing or by the substitution of trees producing commodities for those of the original biome. In such landscapes, ecosystem services are more likely to be provided by a matrix of agroecological land use than by native forests. This framing, compatible with the whole landscape approach [21], recognizes a persistent rurality in which indigenous and other rural people do not abandon marginal lands but instead adapt their practices to the agroecological environment [22][23][24]. In these cases, small-scale sustainable agriculture can contribute effectively to an ecosystem services conservation strategy in the absence of a stylized FT.

2. Forest Dynamics in Latin America

Mather [6] and Walker [7] documented FT in much of the global north and argued there was no guarantee it would occur where nations were still experiencing high rates of deforestation, such as in the global south. Nevertheless,

research has now documented FT in a wide variety of settings [25][26][27][28]. For example, Grau and Aide [27] point to 18 Latin American cases occurring between 1996 and 2008. Most of them—incipient and highly localized—involve relatively small areas, with half covering less than 5000 km^2 and only three exceeding 100,000 km^2. In addition to the reduced extent, the identified FTs are recorded for periods of short duration and do not necessarily reflect long-term dynamics associated with structural changes in an economy. Only two FTs appear to be occurring at a national scale, one in Puerto Rico and the other in El Salvador.

Puerto Rico is a commonwealth of the US, where manufacturing is heavily subsidized and emigration to the United States is unrestricted [7]. Here, annual rates of forest recovery from 1940 to 1990 have been estimated at between 9% [7] and 0.63% [29]. The other macro-scale FT is occurring in El Salvador, where civil war displaced a large part of the rural population in the 1980s [30]. Since 1990, forest covers have expanded by 7% in El Salvador's closed forests and 30% in its open forests [30]. The Brazilian Legal Amazon provides another relevant example given the area covered, ~5 million km^2. Here, Perz and Skole [31] reported declining rates of deforestation, with an increasing expansion of secondary forests for the period 1986–1992. Net secondary forest gain represents only 1% in the aggregate, but in old settlement areas of the lower basin, it reaches 25%. Finally, regional FT over a large area is occurring in the Atlantic Rainforest biome of Brazil, as documented by [17].

FTs in Puerto Rico, El Salvador, and Brazil reflect histories of agricultural land abandonment, where country-specific contingencies have managed to push and pull people from rural areas, with significant depopulation in the countryside [30][32]. Studies of Latin American FTs at more localized scales have emphasized the impact of changing livelihood strategies on household mobility [16][33][34]. For example, Rudel et al. [35] used remotely sensed and household data to investigate FT in the Peruvian Amazon. Schmook and Radel [36] took a similar approach to the southern Yucatan in Mexico. Results from both studies confirm an incipient FT in each case but diverge in their explanations. In Yucatán, out-migration and non-farm job opportunities appear to be driving a decline in deforestation. By contrast, out-migration does not appear to promote FT in the Peruvian Amazon, where household decisions about land use and livelihood diversification play key roles.

These Latin American examples suggest that landcover change dynamics sometimes, but not always, follow an FT narrative in which rural out-migration and forest recovery are linked to changes in national and global economies [15][37]. The researcher's work provides an additional case study for Mexico, specifically in the highlands of Michoacán, where previous research has explored how landscape processes are linked to economic dynamics occurring at various scales, from global to local. Much of the researcher's work suggests an FT may be underway as agricultural abandonment leads to spontaneous forest regeneration [25][38], while other observations suggest drastic forest loss due to illegal logging and conversion to export-oriented avocado orchards [39].

3. Forest Transition in Mexico

Mexico presents a useful case for addressing forest transition. Of particular note is the process of neoliberal reform that it has experienced since the 1980s with the General Agreement on Trade and Tariffs (GATT, 1985), which was followed by the North American Free Trade Agreement (NAFTA) in 1994 and, most recently, the United States–

Mexico–Canada Agreement (USMCA) in 2020. These reforms affected land tenure and market access for smallholder farmers throughout Mexico. Land tenure was impacted by the ejidos, the publicly held properties created during the land reforms of the Mexican Revolution. Although private farm properties have long existed in Mexico, they expanded significantly following Amendment 27 to the Mexican Constitution in 1992, which allowed for the privatization of ejidal farm parcels under strict guidelines [40]. In addition to this, trade liberalization essentially thrust Mexico into the global economy by reducing tariffs on imports and eliminating subsidies to production from the parastatal sector [41][42].

Trade liberalization in Mexico and neoliberal reforms more generally have tracked an autonomous process of agricultural intensification, which began with the green revolution in the 1960s with new varieties of wheat and maize. Also in evidence is a multidecadal process of land cover dynamics. An examination of total forest change magnitudes at a national scale reveals overall declines in deforestation rates through much of the time period until 2013, when rates began to rise once again (see **Figure 1**). The rate of deforestation between 1985 and 1992, 0.53% yr^{-1}, declined to 0.11% yr^{-1} for the period 2002–2014. Of particular interest for this study are the forest cover dynamics revealed when the data are disaggregated by forest biomes. As the figure shows, deforestation rates in tropical humid biomes have steadily declined throughout the time period, and an apparent FT is underway in Mexico's temperate forests, which increased their extent from 341,805 km^2 in 2002 to 351,562 km^2 in 2018, for an annual rate of transition of 610 km^2 yr^{-1}. Unfortunately, deforestation rates in tropical dry biomes show a pronounced rise across the time period, a trend that parallels deforestation patterns across the global south [18][43][44]. The dramatic and continually high deforestation rates in tropical dry biomes clearly explain the total deforestation rate trends on a national scale.

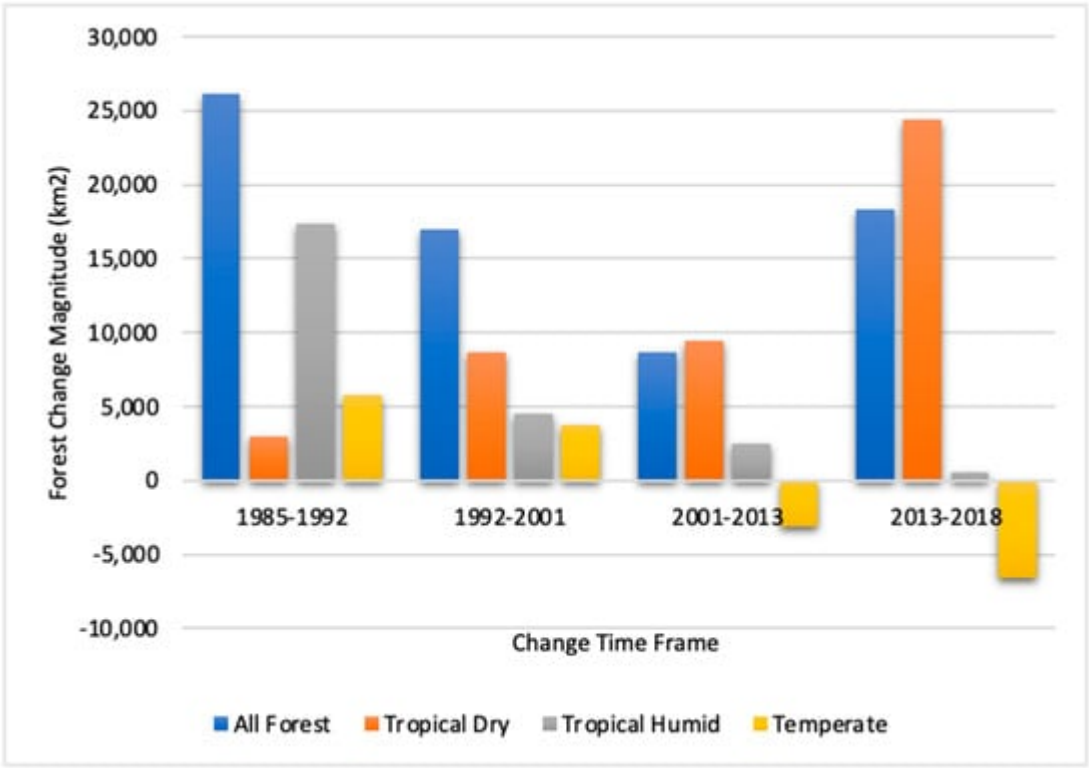

Figure 1. Forest change magnitudes 1985–2018 km^2 [45]. Five study sites in PLW, located in Michoacán state, central Mexico.

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