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Source: *Environmental Review: ER*, Vol. 11, No. 1 (Spring, 1987), pp. 55-71

Published by: Oxford University Press on behalf of Forest History Society and American Society for Environmental History

Stable URL: <http://www.jstor.org/stable/3984219>

Accessed: 25-07-2017 15:08 UTC

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# *Deforestation in Central America: Spanish Legacy and North American Consumers*

Norman Myers and Richard Tucker

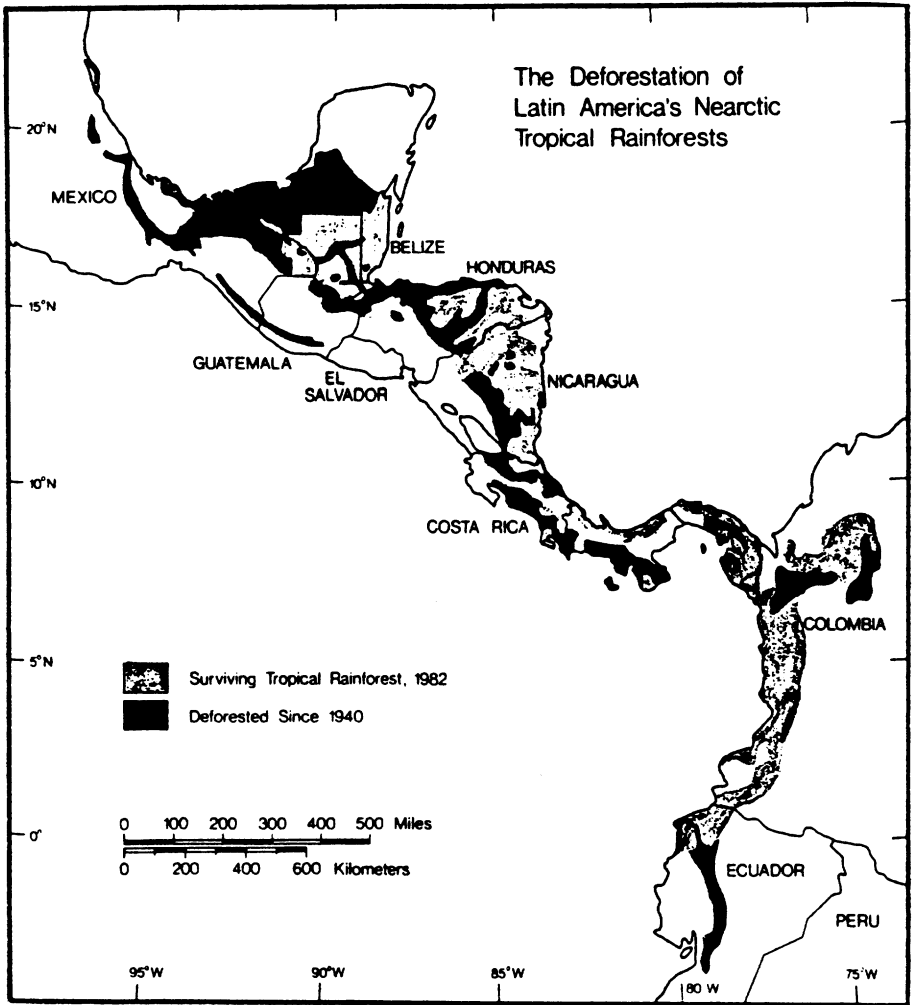
Deforestation has been accelerating alarmingly in Central America during the past three decades. If that process is not slowed, there will be little but scrub forest left by the end of this century. If important forest areas, particularly those that serve the major rivers and watersheds of the region, are not protected soon, no amount of social and economic reform will be able to provide for the many elementary needs of the region's increasing population.

The conversion from forest to other uses is not new in Central America; indeed, it has been occurring for many centuries and can be attributed to many causes. But, the greatest acceleration in deforestation has been in recent decades. The key to that process lies with the social and political fabric of the ruling oligarchies in the countries concerned and their control of the land and its resources. An analysis of the ecological dangers facing Central America, thus, must center on political and social factors. But it must first be grounded in the land and the vegetation patterns at stake.

The region discussed in this essay extends for about 2,200 kilometers from northwest to southeast,<sup>1</sup> but it is only 600 kilometers wide at its broadest point. The area totals more than 550,000 square kilometers, supporting about 30 million people.<sup>2</sup> Hence, it has an average density of more than fifty persons per square kilometer, one of the most densely settled areas on earth.

The topography and vegetation of Central America are defined by the great *cordillera*, a mountain spine that stretches its entire length. To the southwest lies the narrow, fertile Pacific littoral, and to the northeast are the Caribbean lowlands, an area that supports the major tropical forests of the region.<sup>3</sup> The processes of deforestation have taken very different forms in the hill region and in the lowlands.

Central America features both moist and dry forests.<sup>4</sup> Although they now cover only about 200,000 square kilometers, they were once much more extensive. Forests probably covered about 400,000 square kilometers in 1950; at the time of the European arrival in the early



Source: Nations and Komer, 1982.

sixteenth century, they embraced about 500,000 square kilometers. The region's forests rank among the floristically richest on earth, comparable even to the so-called Pleistocene refugia in Amazonia in terms of their abundance and diversity of plant species.

In few places, according to one authority, is there such great variety in "landforms, climate, vegetation, soils, and animal life as are found in Mexico and Central America." Because changes in relations between human communities and their natural settings happen in very specific locations, it is dangerous to attempt any broad characterization of the region as a whole. But local ecosystems are interlinked in many ways by both natural and institutional trends; hence for purposes of explanation,

the region can be divided into two contrasting natural areas: the cool tropical highlands and the warm tropical lowlands.

The highlands, or *tierra templada*, are dominated by a long string of volcanic cones and have relatively cool temperatures year-round and moderate rainfall concentrated in the warm months. An oak-conifer complex dominates the natural forest cover from Mexico southeastward into Nicaragua. In the warmer, wetter mountains of Costa Rica and Panama, an oak-laurel-myrtle complex is predominant. The soils of those hills, either the black-volcanic or alluvial river-basin type, have been richly productive for both forest and agriculture. They have supported relatively dense populations since before the Spanish invasions of the early sixteenth century. But in the twentieth century the soils have come under severe pressure from a dislocated population; as the soils increasingly wash downward into the lowlands, their movement threatens the viability of both the uplands and the coastal plains.

Moist tropical lowlands, the *tierra caliente*, lie along both the Caribbean and Pacific coasts, an area where dense tropical evergreen forests thrive in a frost-free setting. Supporting the great variety of species that typifies lowland tropical forests, the Caribbean lowland was home only to isolated Indian communities until well into the present century. On the wide alluvial levees, built-up by numerous short rivers, those communities had little contact with the hill civilizations in the watersheds above. Over the centuries, the human impact was far less intense in the lowlands. But in the twentieth century, plantation agriculture for export has displaced most of the original native population.

Central America also ranks among the least investigated of tropical floras. Scientists have not "botanized" the region with a fraction of the intensity as they have studied plant communities in the temperate zone.<sup>6</sup> About the size of France, the area probably has about 20,000 species of vascular plants, or three times more than in all of Europe. Whereas the flora of the European continent has been thoroughly documented, scientists believe they have defined and described less than half of the floras of Central America. Approximately 5,000 floristic publications have been issued on Europe, fewer than fifty on Central America.

The greatest concentration of endemic plants is in montane environments, such as the elevated sectors of Guatemala.<sup>7</sup> Although some areas over 3,000 meters in altitude account for less than 2 percent of the region's land area, they feature high levels of endemism. In mountainous sectors of Costa Rica, 50 percent of vascular plants are endemic, while in similar locales of Guatemala the proportion may reach 70 percent. To the extent that higher mountain zones can be protected from unplanned development, there is still hope of maintaining the biologic diversity of those forests.

But, in order to design policies that will maintain the diversity that is left, it is necessary to understand the full range of forces that have been working to deplete the forest cover of the region. They include patterns

of settlement and subsistence, the export economy, and the character of political power. Those factors have been operating through the entire course of modern history in Central America. The forest of today bears the marks of that history, one that stretches back even before the first Spaniards ever stepped off the boat.

At the time the first Europeans arrived, Central America supported a population greater than it would enjoy again until the nineteenth century. Settlement was concentrated in the Mayan lowlands of the Yucatan peninsula and in adjacent Guatemala and Honduras. During the Mayan period that fragile land of light soils and long dry seasons sustained both shifting agriculture and intensive terraced cultivation which slowly thinned the original forest. Though little of the forest was entirely removed, the Mayan lowlands were transformed by the fifteenth century to the point that the original cover was greatly altered.<sup>8</sup> But the lowlands were not the only location of dense pre-Hispanic population; the high hills of Guatemala, an area later planted to crops for distant markets, were also densely populated in 1500.<sup>9</sup> There are indications that land hunger and environmental degradation may have contributed to the ethnic conflict of the immediate pre-Spanish period.<sup>10</sup>

The Spanish conquistadores brought with them two contradictory influences for Central America's vegetation systems. The first, epidemic diseases, struck more virulently in the hot lowlands and worked in tandem with the early enslavement of the Indians to depopulate by as much as 90 percent most parts of the region within two generations.<sup>11</sup> As a result, large areas of cultivated land reverted to second-growth forest, a condition that lasted for about 300 years.<sup>12</sup> The slow recovery of population in the hills did not begin to effect a gradual re-clearing of the second-growth woodlands until much later.

Along with the introduction of disease, the Spaniards imposed Europe's money economy on Latin America, permanently orienting the region's fortunes to the export of primary products destined for metropolitan markets. The first cash crop grown for export to Spanish-dominated urban centers or to Europe gave a foretaste of processes that eventually led to the clearing of large forest areas in the nineteenth century. Only one of those crops, sugar, was entirely new to the region. By 1550 people began to clear the hill forests on the lower western slopes of the volcanic axis of Guatemala and El Salvador for sugar plantations.<sup>13</sup>

Those areas, far from the east coast where they might produce for export to Europe, were never in a position to compete with the sugar and slave islands of the Caribbean. By the late nineteenth century cane sugar from Cuba and neighboring islands and beet sugar from North America and Europe precluded any significant sugar cultivation in Central America. Hence sugar production did not become a major force in the conversion of forest to agriculture. In recent years, El Salvador has been the only country of mainland Central America to put significant amounts of land into sugar production. The landholding oligarchy in that nation had

20,000 hectares of land in sugar by 1965, the profits helping to maintain its domination of the country's economy.<sup>14</sup>

Three other plantation crops that found Spanish markets during the colonial period also were centered on the western slopes. Cacao, familiar to the pre-Conquest period, spread along the Soconusco coast of southern Mexico and into Guatemala.<sup>15</sup> But cacao production declined in that area by the late sixteenth century as the work force shrivelled and new centers of production in northern South America began to dominate the export trade. Two major dyestuffs completed the list of the region's major cash crops after the Conquest, indigo and cochineal, both in heavy demand in Europe. Indigo grew wild along the Pacific coastal plain of Guatemala and El Salvador, and the Spanish imported African slaves to cultivate and process the labor-intensive crop. To complement the blue indigo, Indians of the hill districts raised scale insects that produced the brilliant red cochineal dye. Neither of those dyes, however, was grown and processed in such a way as to deforest significant areas; both were intercropped with a variety of subsistence foods. Although they were plantation crops intended for foreign markets, their production systems were in harmony with the spectrum of natural vegetation around them. They stood in sharp contrast to the sugar plantations which required the clear-cutting of the original vegetation and the use of extensive amounts of fuel wood in order to boil the sugar juice into a transportable item.

Timber cutting in its own right caused very little deforestation in the colonial period. In the sixteenth century dyewoods were extracted in small amounts from the tropical coast of Belize, as they were from the northeastern coast of Brazil. Although that was a very limited trade, within a few decades dyewood from easily accessible locations was nearly eliminated from the Belize coast; thus it became the first tropical species of Central America to be severely depleted.<sup>16</sup> By the late seventeenth century, English loggers controlled timber exports from Belize, and that trade remained its major export commodity for three centuries, the first and longest-lasting British influence in Central America. When dyewood exports declined, mahogany harvesting for the furniture industry of eighteenth-century Europe began to replace it.<sup>17</sup> The mahogany trade lasted into the twentieth century with far greater consequences for the depletion of the forest.

But all of those export crops, it is clear, were limited in scale and in their impact on the region's forest cover. The return of agricultural land to second-growth forest was undoubtedly far greater than the extent of forest cleared for those crops.<sup>18</sup> That contrast was heightened after the first half-century of colonial rule when the deterioration of Spain's metropolitan economy contributed to a decline in Central America's exports that lasted for roughly two centuries. The entire region south of Mexico's central valley became a backwater, producing little more than enough to sustain its mixed populace until sometime after the 1820s.<sup>19</sup> Only a much fuller integration into the world capitalist system,

dominated by Britain in the nineteenth century, brought new life to the region's economy. That shift also accelerated deforestation.

In short, the second-growth forest cover advanced from the early colonial period until the late seventeenth century as the population collapse led to the abandonment of arable land. But the forest returned to biotic patterns that fell short of the original cover. Advanced forms of secondary forest differ from the true primary type in terms of its biomass, productivity, physiognomy, species composition, and community dynamics. Those circumstances apply to nearly all of Central America's mature forests today.<sup>20</sup>

A third and far more extensive round of deforestation resulted from the great political upheavals of the early nineteenth century. Europe's Napoleonic Wars completed the weakening of Spain's hold on its New World colonies, and by the early 1820s a series of bloody struggles ended in independence for most of Central America, but at a high price. The conflicts weakened the region's economy even further, and it was another thirty years before political stabilization led to new investment on a large scale. That investment would center on plantation cropping which displaced wide reaches of forest.

The new regimes of Spanish America were determined to infuse new dynamism into a regional economy that had been in the doldrums for nearly two centuries. Because the upper classes were eager to purchase luxury goods from France and industrial products from England, they made a determined effort to attract foreign capital to develop their commercial economy. As an ideological rationale, they seized upon classical economic theory and Positivism, Europe's newly dominant ideologies of liberal capitalism, which emphasized that private property in land and international free trade were the keys to progress.<sup>21</sup>

Throughout the colonial period Spanish law had protected the remnant Indian population by reserving large areas, especially in the mountains, as communal lands. Despite widespread encroachment on those lands by Spanish speakers, many of the areas remained in Indian hands. Those safeguards were gradually eliminated after independence, forcing Indians into increasingly marginal forest lands where their struggle for subsistence resulted in widespread deforestation and soil erosion. By the late nineteenth century a series of revised land laws had turned the former communal lands into private ownership<sup>22</sup>, thus paving the way for aggressive hacienda builders to purchase large areas of hill land on which to grow coffee, the next of the region's great export crops.

Two types of coffee economy evolved in Central America, both of them converting hill forests into plantations. In Costa Rica, isolated from Atlantic markets, coffee exports began in 1832. Small-scale planters were able to prosper in the country's central valley surrounding San Jose, the capital.<sup>23</sup> As the plantations expanded, they moved up the hillsides, displacing some of the finest forests of the region, first in the

areas of rich volcanic soil and subsequently in the adjacent dark-red alluvial soils as well. Although those lands were no longer available for other forms of production, Costa Rica's economic base was fairly equitable by Central American standards, at least until recent years.

In stark contrast, forest clearing for coffee production in Guatemala and El Salvador was controlled from the beginning by the small hacienda-owning oligarchy which had profited from cash crops in the western hills before independence. The burgeoning income from coffee exports exacerbated the unequal distribution of property and accelerated the dispossession of the campesinos from their ancestral lands.<sup>24</sup> By the late nineteenth century the extension of railroads into the interior enabled the landlords to entrench their control over the fertile soils and further weaken the peasants' subsistence base.<sup>25</sup>

Much of the coffee production from the hill country was destined for England, whereas the United States became the chief consumer of bananas, the great plantation crop from the tropical lowlands in the twentieth century. When bananas joined the list of the region's major exports, the conversion of forests to export-monoculture cropping in the tropical lowlands was vastly accelerated. Beginning in the 1890s several American companies began producing bananas in Honduras for buyers in the United States. Samuel Zemurray, Minor Keith, and their competitors struggled for control of the rich north-coast region and of the Honduran and Costa Rican governments. The United Fruit Company and its major rivals controlled nearly one-million acres of Honduras by 1914, and additional major purchases were made after the First World War.<sup>26</sup> Ultimately, United Fruit bought out all of its major competitors except for Standard Fruits, and by the 1930s it dominated major sectors of several Central American economies. Despite the ravages of Sigatoka and Panama disease, which forced the companies to abandon many of their plantations on the Caribbean and open new lands on the Pacific coast, banana production continued to expand at the expense of the lowland rain forest.<sup>27</sup>

By the late 1940s the ruling circles of the Central American countries recognized that they were being severely victimized by the sudden fluctuations in cash-crop export earnings on world commodity markets. Since that time they have sought additional plantation crops to diversify their exports. The result has been still more forest zones turned over to monocropping for sale to foreign markets. Most notably, cotton joined the list of major plantation crops as it spread across low-lying areas on the Pacific coast that previously had supported either forests or food growing. One of the most dramatic examples is the Pacific coast of El Salvador, an area that had been thinly populated before 1950 because of malaria outbreaks. Once DDT eliminated the threat in the coastal zone, cotton production expanded from 1,144 hectares in 1935 to 110,792 hectares in 1965. Similar changes occurred along the Pacific coast of Guatemala and Nicaragua. Growers exported most of the new production to the booming textile industry in Japan and western Europe. The



consequences for Central America included extensive deforestation, rapid soil depletion,<sup>28</sup> and the steady shrinkage of land that might otherwise have provided food for the growing peasant population.

Thus, economic development in Central America has meant increasing wealth for the landowning elites and is linked to dependency on markets in the affluent industrialized countries. At the same time, the great majority of the region's population has become increasingly marginalized, barely subsisting on the degraded hillsides. For the last three decades the most widespread force behind the degradation of land has stemmed from two closely related trends: the land hunger of the campesinos, and the expansion of cattle raising in response to the booming export market for beef, especially in the United States. Until the consumption of beef in that country began a downturn beginning in 1980, the pressure of cattle raising on Central American forests was felt over a wider ecological spectrum than any of the vegetation crops.

Shortly after the end of the Second World War, public health programs succeeded in controlling pandemic diseases in Central America. The appalling mortality among children was sharply reduced in just a few years. As a result, the population explosion that had begun early in the century accelerated further, with the growth rate soaring to 3.5 percent annually in much of the region by the early 1960s.<sup>29</sup> In some places the growth rate has receded, thanks to broad-scale family planning activities. But figures for Guatemala, Honduras, and Nicaragua are still well above 3 percent. The region's population problems include not only the outburst of numbers, but the disproportionate total of "parents of the future" as revealed by the "youthful profile" of the demographic pyramids. The region is not likely to approach zero population growth until about a century from now.

Those figures are often cited as the central cause of today's pressure on the land. In the last three decades large numbers of peasants have found themselves landless in their traditional territories. In order to survive they have migrated to plantations looking for wage labor or to urban slums.<sup>30</sup> Still others have moved onto the remaining "free" or unoccupied public lands, including large tracts of moist lowland forest that until recently was only thinly populated by peasants whose legal rights were insecure. Hacking away at the forest fringe, the campesinos plant maize and beans for two to four years until soil fertility declines and weeds encroach; then they move farther into the forest to repeat the same process.

This is not the relatively stable cycle of shifting cultivation that Central American Indians had traditionally practiced. It is a less stable and more destructive form, an itinerant agriculture of a unidirectional type whose practitioners have little understanding of the ecological requirements of their new locations.<sup>31</sup> The results, accumulating from the stripped soils on thousands of tiny plots, is the accelerating erosion of hillsides and the downstream siltation of river beds and coastal mangrove

swamps.<sup>32</sup> The victimized peasants—who in turn victimize the land—do not benefit in the long run; consequently, they pose an increasing political threat to landlords and governments alike.

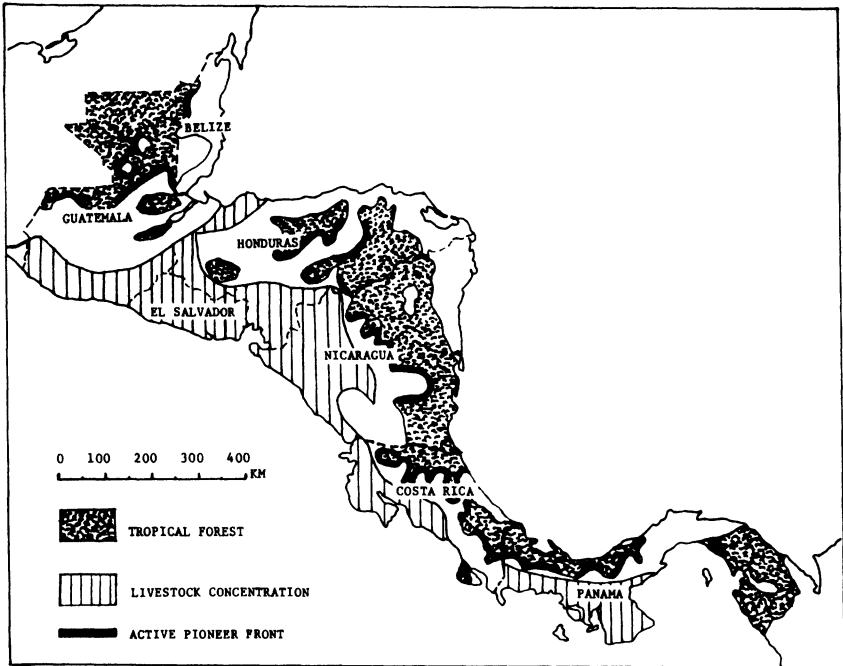
The rise in sheer population numbers by itself is not the cause of that sobering environmental trend. In this era of rapid, but unbalanced commercial development, the dynamics of deforestation lie in land-tenure systems and their unequal distribution among the population. Where few people own most of the land, the majority have no alternative but to pursue ecologically damaging forms of cropping.

The most extreme example of the distorted land-tenure system in Central America was in Nicaragua where, until the 1979 revolution, the Somoza family alone owned about one quarter of the country's agricultural land.<sup>33</sup> In the immediate aftermath of the revolution, the new government redistributed about 10,000 square kilometers of the family's holdings to landless peasants, thereby momentarily relieving pressure on Nicaragua's biotically-rich Atlantic coast forest, one of the largest in Latin America north of Amazonia. But the story of that forest is by no means complete. The present Nicaraguan government, facing peasant demands for fertile land, plans to encourage agricultural settlements on sizable sectors of the eastern region, including part of the Miskito Forest.<sup>34</sup>

The unequal distribution of land in prerevolutionary Nicaragua continues in other parts of Central America. In Guatemala, 2.2 percent of the population owns 70 percent of the agricultural land, the great bulk of it in the form of cattle ranches. In all of Central America there are approximately 400,000 farms, 90 percent of them smaller than fifty hectares; the remaining 10 percent of the farms account for three-quarters of all pasture land and support two-thirds of the cattle. More than half of Central America's rural families either own no land or have too little to support themselves.<sup>35</sup>

Governments in the region began to respond to that socio-economic pressure when increasing numbers of squatters began to invade untilled areas of latifundia or public lands. Several countries passed laws giving squatters title to plots in public forest lands if they planted crops. That process legitimized the traditional campesino attitude toward the land—a subsistence-based rather than a commercial view—which asserts that any land newly tilled belongs by right to those who subdue it.<sup>36</sup>

Other Central American countries have acted more cautiously. But, like governments elsewhere, they have encouraged peasants to convert forests to agricultural land for its potential monetary rewards. Following a major road-building program that opened new areas to the reach of market influences in the 1950s and 1960s<sup>37</sup>, governments encouraged peasants to clear forests as a basis for establishing large commercial farms. The Franja Transveral del Norte of Guatemala, which embraces about 8,800 square kilometers of Pacific coastal tropical lands, has been largely transformed into cash-crop production since the 1950s. The low-land forests of eastern Honduras are being converted in similar fashion.



Central American cattle raising and forest elimination. Source: Parsons, 1976.

They have come under increasing pressure from peasants displaced by the mechanization of export-crop production in southern Honduras and from an influx of political refugees from El Salvador and Nicaragua.<sup>38</sup> The Honduran government, together with large commercial farmers, is establishing export plantations of cotton, bananas, and palm oil. Those plantations in the fertile bottom lands almost always result in increased and unregulated squatter farming in the marginal hills nearby.<sup>39</sup>

Since 1960, however, the most important source of forest clearing in Central America has been the expansion of cattle ranching on private estates. For centuries large landowners have allowed peasants to grow maize and beans on plots of forest the peasants had cut. Until the advent of bulldozers that was the major method used to clear the forest. But marginal hill lands with poor soils are often unsuited for permanent cultivation; by the third or fourth years after the trees are cut, the soil loses its fertility or washes away, weeds invade the clearings, and second-growth grasses become dominant, making the degraded land suitable only for cattle grazing. That is precisely the hacienda owners' intention. Cattle replace the campesinos, who in turn move on to clear other plots on the receding forest frontier.<sup>40</sup> That trend would not have been so pronounced without the Hispanic cattle-baron culture and the pressure of beef markets north of the Rio Grande.

Under Central America's Spanish colonial heritage—enshrined in the culture of the hacendados—the inequitable land-tenure systems were made worse by national oligarchies who placed great social prestige on cattle raising. That has been true since the first Spanish conquerors brought cattle from Spain for the production of hides, tallow for candles, and beef. Faced with few natural enemies, the cattle multiplied dramatically by 1550, running half wild through the savannah lands of northern Mexico<sup>41</sup> and in the hill regions of southern Mexico and Central America. The indigenous people, already under siege from European epidemic diseases, had no way of protecting their crop lands from the ravages of the feral cattle. Many Indians deserted their lands and faced death by hunger as well as disease, thereby making it easier for a new creole, landlord class to consolidate the haciendas that dominated the later colonial period.<sup>42</sup>

As the hacienda owners gradually expanded their power over the countryside, they were able to force peasants onto less-fertile, more-erosive hill lands. The new owners turned the prime lowlands into cattle production for lucrative international markets. Costa Rica is a case in point. Although for many years it had the most equitable land-holding system of all the Central American republics, even there the power of the international market was dramatically evident. Beginning in the late nineteenth century, profits from coffee production made it possible for a small handful of landlords to force nearly three quarters of the peasants into the status of agricultural laborers. By the 1950s the large landholders were in a position to bring beef cattle onto land that had once supported food production or forests.<sup>43</sup>

Beef production in Costa Rica has been dominated by about 2,000 ranchers who hold an average of 750 hectares and control more than half of all agricultural land in the country.<sup>44</sup> The government has directed more than half of all agricultural credit during the last twenty years to the livestock sector. A man who owns land and cattle gains both social standing and political power. Ranchers include many professional persons, notably government officials, who retire to their country estates on weekends to ride horseback and enjoy the life of gentlemen stock raisers.

While the small-scale peasant must make the most intensive use of his small holding, the "prestige rancher" is often content to utilize his land in extensive fashion, which usually means inefficiently and wastefully. Many of the large landholders feel little incentive to intensify their cattle-raising methods. That is so because they believe there is still plenty of untouched forest beyond their present estates. Therefore, those who control the largest amounts of agricultural land are those with the least motivation to use it efficiently. Moreover, their privileged position in the political structure makes them unlikely to encounter serious opposition.

Before the revolution in Nicaragua the Somozas and other large landholders were deeply involved with cattle raising. Between 1960 and 1979, beef production increased almost three times and beef exports five and a half times. Under the revolutionary regime, however, beef exports

have dropped precipitously and local consumption has begun to increase as the new government has struggled to revise land-use and export-commodity policies. But for Central America as a whole, cattle raising accelerated rapidly after 1950, and especially between 1960 and 1980.<sup>45</sup> At those rates of converting forest to grassland for cattle, virtually all of the remaining primary forest in the region would disappear by the mid-1990s.

The demand for beef *within* the region was not the stimulus for the burgeoning activities of cattle ranching after 1960. The majority of the beef produced in Central America did not find its way onto the tables of local citizens. Rather the expansion stemmed the demand generated by international trade, notably in the form of the fast-food sector in the United States, with a small but increasing amount going to the countries of western Europe. For two decades after 1955 beef exports soared from 20,000 to almost 150,000 tons a year, most of it shipped to the United States.<sup>46</sup> In fact, until 1979 beef represented the most dynamic sector of Central America's trade with the outside world.

Why was there such a demand for Central American beef in the United States? Beef produced in the United States had become increasingly expensive because of declining supplies of home-grown stock and because of an almost insatiable American appetite for beef. The United States, with one twentieth of the world's population, is the world's biggest producer and consumer of beef, and through the 1970s, it was also the biggest importer, accounting for about one third of all beef in international trade. The average American consumed less than 40 kilograms of beef in 1960, but that figure rose to more than 60 kilograms by 1976.<sup>47</sup> In the same period, few items in the American shopping basket increased in price more than beef.

Because of escalating costs, Americans looked elsewhere for beef at "reasonable" prices. Central America proved to be a ready supplier, even though its cattle are raised on grass rather than grain, thus making the beef very lean. As a consequence, the region was unable to meet the United States' demand for juicy steaks. Its beef was very suitable for a single sector of the beef market in the United States, the fast-food trade. According to the Meat Importers Council of America, virtually all Central American beef made its way into hamburgers, frankfurters, chili stew, "T.V. dinners," baby foods, luncheon meat, and other processed foods for humans, as well as some products for the pet trade. Of those items, hamburgers were easily the leading category, accounting for more than one-third of the sales to the fast-food industry in the 1970s.

Faced with inflationary price surges, the United States repeatedly stepped up beef imports. Although the country purchased virtually no beef abroad in 1960, it imported roughly 10 percent of its annual consumption by 1979; of those imports, 17 percent came from tropical Latin America, and three-quarters of that—more than 100,000 tons—from

Central America. Thus arose the "hamburger connection," a phenomenon that linked consumer lifestyles in North America with deforestation in Central America.

Since the late 1950s, the area of human-created pasture land in Central America and the number of beef cattle has more than doubled. The expansion has occurred almost entirely at the expense of primary forests, of which two-thirds have now been cleared. Costa Rica is a vivid example of the process and its link to the United States convenience-food trade.<sup>48</sup> The cattle-raising areas of Costa Rica accounted for only one-eighth of the country in 1950, whereas they now amount to more than one-third. The country's cattle herds totalled around 950,000 in 1960; they had reached 2.3 million in 1980. Beef production more than tripled during the same period, yet consumption in Costa Rica itself actually declined by more than 40 percent, to a mere 15.4 kilograms per year, or less than an average American cat received. Almost all of Costa Rica's extra output was exported—more than two-thirds of its total production; that contrasts with an average of one-third for Central America as a whole.

In the early 1980s that trend finally began to reverse as United States' consumption of beef began to fall. Although total consumption fell only slightly, that was enough to cause major cuts in imports from the south. Beef exports from Central America, including Panama, peaked at 162,000 metric tons in 1979 and represented 40 percent of the region's total production. The export figure dropped to 110,000 tons (31 percent) in 1980 and to an estimated 61,000 tons (19 percent) in 1985. Total production fell from 400,000 tons in 1979 to 318,000 tons in 1985.<sup>49</sup> Although the connection between North American hamburgers and deforestation in Central America is greatly reduced for the present, its twenty-year history is a salient reminder of how marketplace pressures from the developed world have influenced the environment, most notably tropical forests, in the developing world.

If Central America's forests disappear within the foreseeable future, not only local peasants but national economies and their development strategies will suffer further environmental degradation. River basins and watershed systems are already being devastated. Hydropower dams which provide nearly all of the region's electricity are being silted up, and Honduras has experienced severe hurricane damage because of the loss of forest cover.<sup>50</sup>

Central Americans are not the only ones in danger, because other human communities, notably in North America, will also suffer in the long run. Central American forests, with their exceptionally rich biotic diversity, contain many genetic resources of great value to modern agriculture, medicine, and industry. For example, in 1978 a wild variety of perennial maize was discovered in a forest of southern Mexico.<sup>51</sup> This new strain would enable the maize-growing industry, through cross-breeding, to avoid the seasonal costs of ploughing and sowing, and the wild germplasm offers resistance to several viruses that attack commercial

maize.<sup>52</sup> The economic benefits of this botanical discovery could eventually measure in the billions of dollars.<sup>53</sup> And, according to South Carolina botanist Monie S. Hudson, who specializes in medicinal applications of phytochemicals, a screening program to evaluate 1,500 tree species in Costa Rican forests reveals that about 15 percent might have potential in the treatment of cancer.<sup>54</sup>

It is clear that both Central and North Americans have contributed to the depletion of the forests and the consequent disruption of natural resource systems. In Central American countries where land is still very unevenly distributed, landowners with economic links to international markets continue to benefit from the status quo, whereas the campesinos are almost exclusively the losers.<sup>55</sup> This intensifies political pressures almost as much as ecological pressures.

It is also clear that Central American landed and political elites and North Americans must cooperate if the problem of cattle destruction in the forests is to be controlled. Everyone stands to gain through sustained-yield forestry management practices. The United States' contribution rests with enhanced environmental constraints for aid programs and development loans through its influence with the Agency for International Development, the Inter-American Development Bank, and the World Bank. All three agencies in the past have funded the expansion of cattle-ranching interests in Central America. Some measures along those lines are being undertaken already. The situation to this point serves as a paradigm of interdependent resource relationships within the international community.

#### Notes

<sup>1</sup>For purposes of this paper the Central American region is defined as the six republics of Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica, and Panama.

<sup>2</sup>Robert C. West and John P. Augelli, *Middle America: Its Lands and Peoples*, 2nd ed. (Englewood Cliffs, NJ, 1976), especially chapter 13.

<sup>3</sup>*Ibid.*, chapter 2.

<sup>4</sup>This discussion is based on Philip L. Wagner, "Natural Vegetation of Middle America," and Robert C. West, "The Natural Regions of Middle America," in *Natural Environment and Early Cultures*, ed. Robert C. West, vol. 1, *Handbook of Middle American Indians*, genl. ed. Robert Wauchope (Austin, TX, 1964), 216-64, 363-83. See also Marc J. Dourojeanni, *Renewable Natural Resources of Latin America and the Caribbean: Situation and Trends* (Washington, DC, 1980).

<sup>5</sup>West, "Natural Regions," 363.

<sup>6</sup>For a detailed account of this question, see W. G. D'Arcy, "Endangered Landscapes in Panama and Central America: The Threat to Plant Species," in *Extinction is Forever: The Status of Threatened and Endangered Plants of the Americas*, ed. Ghilleen T. Prance and Thomas S. Elias (New York, 1977), 89-104.

<sup>7</sup>F. D. Bowers, "High Elevation Mosses of Costa Rica," *Journal of Hattori and Botanical Laboratory* 33 (1970), 7-35; and Thomas T. Veblen, "The Urgent Need for Forest Conservation in Highland Guatemala," *Biological Conservation* 9 (January 1976), 141-54.

<sup>8</sup>For a recent overview of the pre-Hispanic Mayan lowlands, see B. L. Turner II, "Prehistoric Intensive Agriculture in the Mayan Lowlands," *Science* 185 (July 12, 1974), 118-24; and Turner, "Geography and Prehistory in Southern Mesoamerica," in *Historical Geography of Latin America*, ed. William V. Davidson and James J. Parsons (Baton Rouge, 1980), 9-16.

<sup>9</sup>For an account of settlement in the region from the perspective of ecology, see Joseph A. Tosi, Jr., and Robert F. Voertman, "Some Environmental Factors in the Economic Development of the Tropics," *Economic Geography* 40 (July 1964), 189-204.

<sup>10</sup>Veblen, "The Urgent Need for Forest Conservation in Highland Guatemala," 148.

<sup>11</sup>William M. Denevan, ed., *The Native Population of the Americas in 1492* (Madison, 1976), 1-34.

<sup>12</sup>For example, see Carl O. Sauer, *The Early Spanish Main* (Berkeley, 1966).

<sup>13</sup>For the economy and ecology of cash-crop production in the colonial era, see Murdo J. MacLeod, *Spanish Central America: A Socioeconomic History, 1520-1720* (Berkeley, 1973).

<sup>14</sup>Walter LaFeber, *Inevitable Revolutions: The United States in Central America* (New York, 1983), 131, 174-75; and Joseph Grunwald and Philip Musgrove, *Natural Resources in Latin American Development* (Baltimore, 1970), chapter 12.

<sup>15</sup>Thomas T. Veblen, "Forest Preservation in the Western Highlands of Guatemala," *Geographical Review* 68 (1978), 427.

<sup>16</sup>Arthur M. Wilson, "The Logwood Trade in the Seventeenth and Eighteenth Centuries," in *Essays in the History of Modern Europe*, ed. Donald C. McKay (New York, 1936), 1-15; Norman Ashcraft, *Colonialism and Underdevelopment: Processes of Political Economic Change in British Honduras* (New York, 1973), chapters 3 and 4; and Narda Dobson, *A History of Belize* (Trinidad and Jamaica, 1973), chapters 4, 8, and 14.

<sup>17</sup>F. Bruce Lamb, *Mahogany of Tropical America: Its Ecology and Management* (Ann Arbor, 1966), 1-21; and Tom Gill, *Tropical Forests of the Caribbean* (Washington, DC, 1931), chapters 5 and 6.

<sup>18</sup>For an attempt to quantify those changes for one area, see R. M. Keogh "Changes in the Forest Cover of Costa Rica Through History," *Turrialba* 34 (1984), 325-31.

<sup>19</sup>Stanley J. Stein and Barbara H. Stein, *The Colonial Heritage of Latin America: Essays on Economic Dependence in Perspective* (New York, 1970), chapter 4.

<sup>20</sup>D'Arcy, "Endangered Landscapes," 89-104; and Norman Myers, *Conversion of Tropical Moist Forests* (Washington, DC, 1980), 131-35.

<sup>21</sup>E. Bradford Burns, *The Poverty of Progress: Latin America in the Nineteenth Century* (Berkeley, 1980), chapters 1 and 2.

<sup>22</sup>Thomas E. Skidmore and Peter H. Smith, *Modern Latin America* (New York and Oxford, 1984), 39-56.

<sup>23</sup>Ciro F. S. Cardoso, "The Formation of the Coffee Estate in Nineteenth-Century Costa Rica," in *Land and Labour in Latin America: Essays on the Development of Agrarian Capitalism in the Nineteenth and Twentieth Centuries*, ed. Kenneth Duncan and Ian Rutledge (Cambridge, 1977), 165-201.

<sup>24</sup>David J. McCreery, "Coffee and Class: The Structure of Development in Liberal Guatemala," *Hispanic American Historical Review* 56 (1976), 438-60.

<sup>25</sup>Ralph Lee Woodward, Jr., *Central America: A Nation Divided* (New York, 1976), chapter 6.

<sup>26</sup>LaFeber, *Inevitable Revolutions*, 42-46. Banana plantations generally had to move to virgin soil after eight to ten years. For details, see Charles David Kepner, Jr., and Jay Henry Soothill, *The Banana Empire: A Case Study in Economic Imperialism* (New York, 1935); and Stacy May and Galo Plaza, *The United Fruit Company in Latin America* (Washington, DC, 1958).

<sup>27</sup>Thomas P. McCann, *An American Company: The Tragedy of United Fruit* (New York, 1976), 14-83; May and Plaza, *United Fruit Company*, 73-96; and Charles D. Kepner, Jr., *Social Aspects of the Banana Industry* (New York, 1936), 46-65.

<sup>28</sup>Robert G. Williams, *Export Agriculture and the Crisis in Central America* (Chapel Hill, NC, 1986), 48-51, 113-17. See also Grunwald and Musgrove, *Natural Resources in Latin American Development*, 430-46; and William H. Durham, *Scarcity and Survival in Central America: Ecological Origins of the Soccer War* (Stanford, CA, 1979), 32.



<sup>29</sup>For demographic analyses of two parts of the region, see Robert Wasserstrom, "Population Growth and Economic Development in Chiapas, 1524-1975," *Human Ecology* 6 (1978), 127-43; and Durham, *Scarcity and Survival in Central America*, chapter 2.

<sup>30</sup>Increasing landlessness is linked to the unmanageable urbanization in the region, a problem this paper does not attempt to cover. For a new case study of the urban end, see David DeVoss, "Mexico City's Limits," in *Bordering on Trouble: Resources and Politics in Latin America*, ed. Andrew Maguire and Janet Welsh Brown (Bethesda, MD, 1986), 13-54.

<sup>31</sup>For a careful analysis of the distinction and its damaging impact on forest cover, see R. F. Watters, *Shifting Cultivation in Latin America* (Rome, 1971).

<sup>32</sup>H. Jeffrey Leonard, *Natural Resources and Economic Development in Central America: A Regional Environmental Profile*, (draft manuscript, International Institute for Environment and Development, Washington, DC, 1985), 168-96.

<sup>33</sup>James D. Nations and Daniel I. Komer, "Rainforests and the Hamburger Society," *Environment* 25 (April 1983), 212-30.

<sup>34</sup>Joseph Collins, *Nicaragua: What Difference Could a Revolution Make?* (San Francisco, 1985), 79-96. For the ecology of the Miskito Indians' homeland in a time of intense turmoil, see Will Baker, "Divided They Fall," *Whole Earth Review* 45 (March 1985), 51-63; and Bernard Nietschmann, *Between Land and Water: The Subsistence Ecology of the Miskito Indians, Eastern Nicaragua* (New York and London, 1973).

<sup>35</sup>J. L. Posner and M. F. McPherson, "Agriculture on the Steep Slopes of Tropical America: The Current Situation and Prospects," *World Development* (May 1982), 341-54.

<sup>36</sup>T. Edmond Downing and E. Jean Matteson, *Squatters: A Form of Spontaneous Colonization in Costa Rica* (San Jose, Costa Rica, 1965), 5-18; and Jeffrey R. Jones, "Colonization in Central America," (unpublished paper, copy in possession of the authors, 1986), 6-7.

<sup>37</sup>Williams, *Export Agriculture*, 20-24, 91-93.

<sup>38</sup>Durham, *Scarcity and Survival*, chapter 1. For the background of El Salvador's overflow population, see David Browning, *El Salvador: Landscape and Society* (Oxford, 1971).

<sup>39</sup>Jones, "Colonization," 13-26.

<sup>40</sup>Joseph Tosi and R. Voertmann, "Some Environmental Factors in the Economic Development of the Tropics," *Economic Geography* 40 (July 1964), 189-205; and Parsons, "Forest to Pasture," 126-28.

<sup>41</sup>Richard J. Morrisey, "The Northward Expansion of Cattle Ranching in New Spain, 1550-1600" *Agricultural History* 25 (July 1951), 115-21.

<sup>42</sup>Francois Chevalier, *Land and Society in Colonial Mexico: The Great Hacienda* (Berkeley, 1963), 84-117. For the role of cattle in southern Mexico in modern times, see Robert Wasserstrom, *Class and Society in Central Chiapas* (Berkeley, 1983), especially chapter 6. Similar processes occurred throughout the hill regions of Central America, a very different setting. See Carl L. Johannessen, *Savannas of Interior Honduras* (Berkeley, 1963), 36-47.

<sup>43</sup>Mitchell A. Seligson, "Agrarian Policies in Dependent Societies: Costa Rica," *Journal of Interamerican Studies and World Affairs* 19 (May 1977), 212-30.

<sup>44</sup>P. F. Bartlett, *Agricultural Choice and Change: Decision Making in a Costa Rican Community* (New Brunswick, NJ, 1982), chapter 1; Billie R. DeWalt, "The Cattle Are Eating the Forest," *Bulletin of the Atomic Scientists* 39 (1983), 18-23; George Guess, "Pasture Expansion, Forestry and Development Contradictions: The Case of Costa Rica," *Studies in Comparative International Development* 14 (1979), 42-55; and Norman Myers, *The Primary Source: Tropical Forests and Our Future* (New York, 1984), 132-33.

<sup>45</sup>DeWalt, "The Cattle are Eating the Forest," 18, 19, 22; Norman Myers, "The Hamburger Connection," *Ambio* 10 (1981), 3-8; James D. Nations and Daniel I. Komer, "Indians, Immigrants and Beef Exports: Deforestation in Central America," *Cultural Survival Quarterly* 6 (Spring 1982), 8-12; James J. Parsons, "Forest to Pasture: Development or Destruction?" *Revista Biologica Tropical* 24 (1976), 121-38; and Douglas R. Shane, *Hoofprints on the Forest: Cattle Ranching and the Destruction of Latin America's Tropical Forests* (Philadelphia, 1986), 88-99.

<sup>46</sup>USDA, Foreign Agricultural Service, *World Livestock and Poultry Situation* (Washington, DC, 1985).

<sup>47</sup>For further details, see D. B. Agnew, *The Outlook for Hamburger, Livestock, and Meat Situation* (Washington, DC, 1979), 26-28; Myers, "The Hamburger Connection," 3-8; Shane, *Hoofprints on the Forest*, 100-8; and J. R. Simpson and D. E. Ferris, *The World's Beef Business* (Ames, IA, 1982).

<sup>48</sup>Dewalt, "The Cattle are Eating the Forest," 21; and Guess, "Pasture Expansion," 13-26.

<sup>49</sup>Edward C. Wolf, "Managing Rangelands," in *State of the World 1986: A World Watch Institute Report on Progress Toward a Sustainable Society*, ed. Lester R. Brown et al. (New York, 1986), 70-72.

<sup>50</sup>Leonard, *Natural Resources and Economic Development*, 177-86.

<sup>51</sup>H. H. Iltis, J. F. Doebley, R. M. Guzman, and B. Pazy, "Zea diploperennis (Gramineae), New Teosinte from Mexico," *Science* 203 (1979), 186-88.

<sup>52</sup>L. R. Nault and W. R. Findley, "Primitive Relative Offers New Traits to Improve Corn," *Ohio Report* 66 (November/December 1981), 90-92.

<sup>53</sup>A. C. Fisher, *Economic Analysis and the Extinction of Species* (Berkeley, 1982); and Norman Myers, *A Wealth of Wild Species: Storehouse for Human Welfare* (Boulder, CO, 1983), 13-26.

<sup>54</sup>For details, see Myers, *A Wealth of Wild Species*, 105-14.

<sup>55</sup>For an overview of the international timber trade, see Ivan M. Elchibegoff, *United States International Timber Trade in the Pacific Area* (Stanford, CA, 1949), chapter 15.