Mesoamerica's Tropical Rainforests
Conflicts and Conservation

James D. Nations
Center for Human Ecology, P. O. Box 5210, Austin, Texas 78763

One hundred years from now, the second half of the 20th century will be known as that brief period of time when much of the earth's biological diversity was eradicated in the name of survival, progress, and profits. Paleontologists speak of the end of the dinosaur age as a period of massive extinctions, yet during that period—despite the assistance of asteroids and dust clouds—the planet lost an average of only one species every 1,000 years (Simberloff 1982). Today, human activities are eradicating plant and animal species at the rate of 1,000 per year. By the end of the century, this rate is expected to reach 10,000 species per year, or more than one per hour (Myers 1979a; Ehrlich and Ehrlich 1981; Wilson 1984:13).

If this prediction sounds unbelievable, keep in mind that these figures are not the armchair ruminations of outraged conservationists. They are the accepted estimates of some of the world's most eminent biological researchers. If their predictions hold true, by the time we finally make peace with our planet, our activities may have destroyed one-quarter of all the species of animals and plants that live on earth today (Barney 1980, 1:3).

Most of the species being eradicated are insects—chiefly beetles and butterflies—and most of them are restricted to small territories. But they are joined by a variety of birds, mammals, and reptiles, and by thousands of species of plants. The primary cause of this massive eradication of species can be defined in one phrase—loss of habitat. In turn, that phrase can be narrowed down to one word, deforestation, chiefly of the world's tropical rainforests, the areas we commonly think of as "jungles."

The reason that tropical forest destruction is so severe is simple: they are the world's largest depository of plant and animal species. Tropical forests are home to more than half of all the species on earth (NRC 1980:35; Ehrlich and Ehrlich 1981:159; OTA 1984; Myers 1984:50).

The ironic thing about this destruction is that we know very little about what we are destroying. Five out of six tropical species have never been seen by scientists. That amounts to at least two and one-half million unknown species, or about twice as many as taxonomists have described and named since Linnaeus began the process 230 years ago (Raven 1981:30). We're only now beginning to realize the potential that rainforest species hold for the well-being of humankind. Forty years ago, for example, the yam of the Mexican barbasco vine (*Dioscorea composita*) was known only as the source of a fish poison used by rainforest Indians to stun fish in rivers. Then, in the late 1930s, a chemistry professor, Russell Marker, gathered the plant in the rainforest of southeastern Mexico and isolated a steroid called diosgenin, which today is the active ingredient in oral contraceptives. Around the world, 80 million women now take oral contraceptives, and the barbasco vine has become the basis for a prosperous industry in Mexico (Myers 1979b:5; Djerassi 1984:127).

That's one minor example of the positive potential that hides in tropical rainforests, because rainforests are a liv-

ing chemical factory that we've only begun to examine (Schultes 179:264). So, when we say that during the next 20 years, human activities will destroy hundreds of thousands of species of plants and animals in these forests, how many new medicines, new food crops, natural insecticides, and oil-producing trees are we destroying? The answer is that we don't know. All we do know is that tropical rainforests and the species that live in them are being effectively eradicated in many of the world's tropical countries.

This is not to say that rainforests are doomed to disappear. The forests in some areas of the world are not yet in danger. In Africa, the rainforests of Zaire and Gabon should survive for many decades. And in South America, the rainforests of Guyana, Suriname, French Guiana, and of much of the western Brazilian Amazon should stand for at least another 50 years (NRC 1980; Raven 1981:30).

But things are not that bright throughout the rest of Latin America. In the eastern and central sections of the Amazon Basin, bulldozing, burning, and chemical defoliation wipe out huge areas of forest every dry season (Barrett 1980; Goodland 1980; Fearnside 1982). The situation in Mesoamerica—Mexico, Central America, and Panama—is the most alarming anywhere in Latin America. More than two-thirds of the region's original tropical broad-leaved forest have been cleared and burned, mostly during the past 40 years (Nations and Komer 1983a:232). Mesoamerica's tropical forest once stretched from Veracruz, Mexico to the Darién of eastern Panama. Today, only three large blocks of rainforest remain: (1) around 40,000 km^2 in the Guatemalan Petén and its adjacent flanks—the rainforest of southern Belize and the *selva Lacandona* of Chiapas, Mexico; (2) approximately 46,000 km^2 along the Miskito Coast of eastern Honduras and Nicaragua; and (3) about 21,000 km^2 in the Darién province of southern Panama. At current rates of clearing and burning in the region, the final third of Mesoamerica's tropical rainforest will be eliminated within 20 years, leaving only degraded remnants in parks and forest reserves. In sum, Mesoamerica is one of the most threatened tropical forest regions in the world.

These statistics lead us to ask some simple questions: Why should we care? What good are Mesoamerica's rainforests anyway? The answer is that the consequences of rainforest destruction are more severe than just the extinction of beautiful birds, new drugs, and new food plants. Rainforest clearing has repercussions on all sorts of human activities.

On a local level, destroying rainforest can increase flooding, cause soil erosion, and lead to the siltation of lakes and rivers. Rainforests normally act like a giant sponge; they absorb and recycle the precipitation that falls on them. If the forest is cleared, the torrential rains of the tropics hit the soil, run down the slope, and carry the soil with it. The result is increased flooding because there is no vegetation to absorb the rain, and massive soil erosion because the run-off carries the soil with it (Gentry and López-Parodi 1980; Myers 1984:261). Because the forest protects the soil from rain and run-off, one hectare (2.471 acres) of standing rainforest will lose only one kilogram of topsoil per year due to erosion. But when cleared of forest, that same hectare of land can lose up to 34 tons of topsoil (Goodland and Irwin 1975; Sanchez 1976; Tirado and Lugo-López 1984).

Downstream, this lost topsoil be-

comes silt that can wipe out fish populations, damage crops, and produce a variety of economic and ecological consequences for people who live from farming or fishing (Barrett 1980:215; Lovejoy 1973; Smith 1982; Goulding 1980; Bunker 1980:36-37). On a national level, this same siltation can cut the lifespan of hydroelectric projects in half by filling in the lakes that provide water used to generate electricity and irrigate agricultural land (Szekely 1976; Goodland 1979; Caufield 1982). Siltation caused by deforestation of the watershed that feeds the Panama Canal is producing topsoil accumulations up to 22 feet deep in Lake Alajuela, and dredging operations already close the canal for days at a time (Isaza and Moran 1981; USDA-AID 1980:68). Some researchers predict that by the time the Canal is fully transferred to Panama in 1999, it may have become a worthless ditch—with all sorts of consequences for Panama and for international trade (Wadsworth 1978:23).

Deforestation also changes microclimatic conditions by causing more extreme fluctuations in surface temperature, making cultivation areas hotter by day and colder by night (U.S. Interagency Task Force 1980:19). And, more seriously, tropical forest destruction can cause a decline in the amount of rain that falls. Studies in Panama and in the Amazon show that over half of the rain that falls on a tropical forest is water derived from the forest itself. The leaves of forest vegetation breathe out water vapor that is equivalent to thousands of gallons of water per acre per day. When the forest is cleared, that recycling system is destroyed, and the amount of rainfall can be cut in half, as it already has been in some deforested areas of Panama and Brazil (Salati, Marques, and Molion 1978; Barrett 1980:215; Leopoldo, Franken, and Matsui 1984; Myers 1984:280).

Deforestation is also leading to the loss of one of the most important resources in the tropics—the indigenous people who have made the forest their home for thousands of years. The loss of these groups is tragic—not just because they are losing their traditions and their lives—but also because you and I are losing the knowledge that these groups have developed and refined about our planet's most complex ecosystem.

Without a doubt, tropical forest peoples are the world's foremost tropical ecologists. No team of scientific researchers can match the knowledge of the rainforest that is controlled by an Amazon Indian or by a Lacandon Maya Indian. Like the case of eradicated species, we still don't know what we're losing when these people are pushed off their land by mining operations or cattle ranching or when they die from diseases introduced by road construction and logging teams.

We're only beginning to have some indication of the information that rainforest peoples could share with us, if we had time to collect that information. The list of what they've already given us is impressive. As an example: among the tropical forest plants that indigenous people have introduced us to are cacao for chocolate, brazil nuts, sweet potatoes, tobacco, avocados, vanilla, coffee, manioc, mangos, papaya, peanuts, cinnamon, bananas, and sugarcane (Myers 1979a:122; NRC 1980:44; Barrett 1980:216; Schultes 1979). Just one of these crops, manioc—which we know in the United States mainly in the form of tapioca—is the dietary staple for 300 million people in Africa and South America (Cock 1979:186; Schultes 1979:259).

We've also learned to use other materials from tropical forest peoples—materials like rubber, gum arabic for ink, pharmaceuticals, the glue for postage stamps, latexes for chewing gum and golf balls, and, again, human contraceptives. Rainforest tribes in South America have already led researchers to 268 different plants that can be used to control human fertility (Moreno Azorero and Schvartzman 1975). As the world's rainforest peoples are wiped out, this knowledge of the rainforest is also eradicated. So, in addition to being the brief period of history when much of the earth's biological diversity was eradicated, the second half of the 20th century will also be known as the period when we witnessed the disappearance or dispersal of people who knew the most about this biological diversity.

All of this information begs the question: If rainforests are so important, why are they being destroyed in the first place? In Mesoamerica, the causes of tropical forest destruction can be narrowed down to three stages.

The first stage is road construction. The outside world literally bulldozes its way into Mesoamerican rainforests in the form of road construction. Rainforest roads are built for a variety of reasons. Oil exploration and military control are two increasingly important reasons, but in most cases, rainforest roads in Mesoamerica are built for logging. Logging teams build roads to penetrate the rainforest and take out commercially valuable timber. In Mexico and Central America, this means mahogany and tropical cedar that ends up on the international market for use as office paneling, in boats, and as fine furniture.

To get these trees, tropical loggers carry out what they call "creaming" or "highgrading" the forest. Because tropical forests bear such an incredible diversity of plant life, you may find 200 different tree species on a one hectare plot (Whitmore 1980:309; Myers 1984:26). That means that you'll find only a few single individuals of any particular tree in any particular area. So loggers bulldoze roads through the forest, then spread feeder roads out from these major roads and send long drag lines to pull out the few trees per hectare that are commercially valuable.

You can predict that this process will destroy a certain amount of forest. Rainforest trees are tied to one another at the crown through an interconnected mass of vines and vegetation. So, when loggers pull down one mahogany tree, surrounding trees come down with it. Also, as that tree falls, it may wipe out trees that it lands on. In sum, felling a single commercially-valuable tree can cause the destruction of an average of 17 non-commercial trees (Ng 1982). Considering this and the areas cleared for roads, staging areas, and stacking areas, logging operations may end up destroying 30 percent of a forest where only a few trees per hectare are extracted (Whitmore 1980:311; Ranjitsinh 1979:193).

The problem with logging, though, is not so much what the loggers take out as what they leave behind—namely, the roads that they've built to enter the area. Roads introduce the second stage of rainforest destruction in Mesoamerica: colonization. Landless farm families from other regions of the country, or even from other countries, file down these logging roads and create new jungle settlements, where they clear the forest to raise subsistence crops like corn, beans, and manioc, and cash crops like coffee, cacao, and *chiles*.

This second stage of deforestation has a heavy impact on indigenous popu-

lations that live in the forest. The new immigrants sometimes show little regard for the area's Indian inhabitants. They push them off their traditional land, introduce diseases, and disrupt communities. Colonists also do not share the Indians' knowledge of the rainforest environment. As a result, they may end up destroying vast expanses of forest in trying to make it yield a living.

Some scientists, and many politicians, like to blame colonizing peasant farmers for the destruction of tropical forests in Mesoamerica. But that's like blaming soldiers for causing wars. Peasant farmers do much of the work in clearing and burning tropical forest, but they're simply pawns in a bigger man's game. To understand the role of peasant colonists in tropical forest destruction, we have to ask why they are in the rainforest in the first place. The answer to that question is that there's no land for them anywhere else. There are two reasons behind this situation.

The first reason is Mesoamerica's unequal land tenure system. Peasant families may be forced to colonize forest lands in the lowlands because the farm land that would support them is in the hands of a fraction of the region's population, frequently corporations or families who use it to produce commercial crops for export. In Latin America as a whole, a mere 7 percent of the population controls more than 93 percent of the arable land (Eckholm 1979:11).

In Central America itself, the percentages differ from country to country. In Guatemala, 2 percent of the landowners control 80 percent of the agricultural land, mostly in form of banana plantations, coffee fincas, and cattle ranches. Meanwhile, 83 percent of the rural population either owns no land or lives on plots that are too small to maintain a family (World Bank 1978:12, 19). In Nicaragua, until 1979, one percent of the population owned 50 percent of the farmland; the Somoza family alone controlled 23 percent of the nation's agricultural land (Molina 1980:34; Cultural Survival 1980:9). In El Salvador, 2 percent of the population owns almost all of the nation's fertile land and 57 of total national territory. Most of that land is dedicated to coffee, cotton, cattle, and sugarcane (Arnson 1980:2; LaFeber 1983:10, 252). Gross inequality of land ownership also characterizes Honduras, where five percent of the landholdings account for 60 percent of the nation's cultivated land (U.S. AID-Honduras 1982:37). Even in Costa Rica, the country considered to have the most equitable economic structure in Central America, three percent of the population owns 54 percent of the farm land (U.S. AID-Costa Rica 1982:6, 65).

In sum, one-half of the rural families in Mesoamerica either own no land or own too little to support a family (Eckholm 1979:9; Lassen 1980). To support themselves, these families serve as day laborers harvesting coffee, picking cotton, or cutting sugarcane. Or, if they're lucky, they eventually migrate to the rainforest to claim their own plot of land.

They do this both legally and illegally. Governments sometimes promote the colonization of rainforest areas because doing so temporarily defuses demands for land reform in other areas of the country (Eckholm 1979:29; Leonard 1985:102, 169). In a related move, governments may also promote colonization to demonstrate sovereignty over areas that are populated only by Indians. In South America, this has happened in Brazil, Venezuela, and Colombia. In Mesoamerica, it has taken place in Costa Rica and especially along

the border of Mexico and Guatemala. This is the oil-rich region of the Chiapas-Guatemala border, and each country accuses the other of trying to steal its oil. In Guatemala, the combination of government-sponsored colonization and the need to establish sovereignty led to the resettlement program of the Franja Transversal del Norte. Across the border in Chiapas, these same forces are leading to the colonization of the last remaining rainforest in Mexico, an area called the Marques de Comillas, where thousands of peasant colonists are now being settled to raise corn and cattle (Plan Chiapas 1983).

The second major factor that brings colonists into the rainforest is population growth. Overall, Mesoamerica's population is growing as fast as Africa's. The region has an average rate of increase of 2.9 percent per year, giving it a doubling time of 24 years (Leonard 1985; Latin American Times 1984:24). Over the next 20 years, more than 90 percent of Mesoamerica's population growth will take place in areas that are covered by rainforest or were formerly covered by rainforest (Teller 1981; Teller et al. 1979). It seems obvious, then, that even a massive redistribution of land in Mesoamerica will not be able to provide future generations of farmers with sufficient land as long as population growth remains that high. We can also assume that as long as there is rainforest land left to colonize, landless families will continue to migrate into those forests and clear it to support their families. For the majority of Mesoamericans, this is the only way they'll ever be able to own their own land.

No matter why it takes place, colonization in Mesoamerica consistently leads to a third and final stage of tropical deforestation. This is the expansion of commercial export crops into the rainforest, and this is basically the driving force behind deforestation. During this final stage, land that has been cleared by colonists is absorbed by a second wave of landowners who follow behind the pioneer front, buying up small landholdings to combine them into large plantations for the production of export crops. In Mesoamerica, the most dominant and most destructive of these export crops is beef cattle (Parsons 1976:126; DPN 1978,II:B-55; Nations and Komer 1983a, 1983b).

Cattlemen obtain the land of colonist families in a variety of ways. Farm families may willingly sell the land they've cleared when weeds, insects, and declining fertility overpower their hand-labor farming methods. Because they don't have money for fertilizers and because no extension agents are on the spot to teach them how to raise crops on a sustained-yield basis, they sell their land to the cattlemen and move on to clear new forest. In some areas of Mesoamerica, cattlemen themselves buy tropical forest land and allow colonists to settle on it. The colonists get the right to clear the forest and plant crops in exchange for leaving the cleared land planted in pasture two or three years later (Merkel 1981; CIES 1979).

In other cases, colonization and cattle production are combined. In the Darién region of southern Panama, for example, colonists settle on national land, clear it, and burn it, and then sell it for $80 a hectare to week-end cattle ranchers from Panama City. These new landowners aren't interested in producing cattle as much as they're interested in holding onto the land as a hedge against inflation (Chapin 1980; Heckadon 1981; Raven 1980; cf. Fearnside 1983:143).

Colonizing families also get involved in the rainforest cattle industry. They sometimes find that they can obtain bank loans to produce cattle, but not to raise corn and beans. So, they clear the land, raise calves, and sell these calves to ranchers who fatten them and sell them on national or international markets. The way grain prices are structured, a family can make more money raising two and a half calves per year than they can raising food such as corn and beans (Price and Hall 1983:44-46).

No matter how the land is originally cleared, the end result is the same. After seven to ten years of mediocre beef yields, erosion, weeds, and loss of fertility prompt the cattlemen to search for new pasturelands (Fearnside 1979, 1980, 1983). They move farther into the forest and clear more land, and repeat the cycle until the forest is gone. This has already happened in El Salvador, and is happening fast in Chiapas, Honduras, Guatemala, Nicaragua, Costa Rica, and Panama (Nations and Komer 1983a:15).

The tragedy of the process of converting rainforest to pasture is apparent on several levels. First is the pathetic yield that cattle ranching produces on cleared rainforest land. The average stocking rate on cleared Mesoamerican rainforest lands is one head of cattle for every 1.6 hectares of pasture. The average yield is approximately 10 kilograms of beef per hectare [9 pounds of beef per acre] (Duayhe 1979; Myers 1981; Price and Hall 1983; Redclift 1981:233). Just as a comparison, on the same amount of land and without permanently destroying the rainforest, a Lacandon Maya farmer can produce six tons of shelled corn per hectare, and another several tons of root crops and tree crops (Nations and Nigh 1980). Yet cattle production is replacing the Lacandon Maya farming system because it's tied into the national economy, the banking system, and land speculation.

Transforming forest into cattle pasture also fails to aid the colonists who live in rainforest cattle areas. In the first place, raising cattle requires less labor than most other production systems, so few jobs are created (Tosi 1972:8; Fearnside 1983:75; Price and Hall 1983). In southeastern Mexico, tropical cattle ranching requires an average of only one worker per 100 hectares of pasture (Romanini 1978:4). "The International Labor Office estimates that cattle raising requires only six worker-days per hectare, while rice needs 60, beans 37, potatoes 120, and coffee 130" (CEPAL, 1980:175, cited in ICAS 1982:10). But more important is the fact that the beef produced on this land is exported out of the area, either to the middle class consumers in Mesoamerican cities or to other countries.

Two-thirds of Central America's farm land is now devoted to livestock production rather than to producing food for the region's expanding population (Parsons 1976:124). In Costa Rica alone, 82 percent of the productive land is now in pasture (ICAS 1982:10). In the selva Lacandona of Chiapas, Mexico, more than 80 percent of the land cleared from rainforest is dedicated to cattle pasture (Lobato 1981:21). Despite this huge investment of land in beef cattle production, Mesoamerica's per capita beef consumption is only 13.7 kilograms per year (Nations and Komer 1983a). By contrast, here in the United States, we eat three times that much, and our house cats eat more beef in a year than most individuals in Mexico and Cental America.

Meanwhile, beef production continues, and rainforests continue to fall, because beef production is concentrated

in the hands of a small percentage of the population. This group is making good profits, and they will continue production as long as the market holds up, even if it's at the expense of rural families and tropical forests.

Mesoamerican cattlemen have several incentives to expand their production into the rainforests. In the first place, they have a lucrative foreign market for the beef they produce. Unfortunately, because cattlemen are able to sell their beef internationally at a good price, the local price of beef frequently rises beyond the reach of many Mexicans and Central American families, so that only the urban middle-class can afford a steak dinner.

The lucrative foreign market means income for the individuals who own beef cattle lands, and it means income for the Mesoamerican nations as a whole. The fact that there is money to be made attracts commercial bank loans and international assistance (Sims 1961:10). The World Bank and the Inter-American Development Bank have provided loans to expand the cattle industry in every Central American nation except El Salvador (Shane 1980). The Organization of American States, the Pan American Health Organization, the U.S. Agency for International Development, and the U.S. Department of Agriculture provide technical assistance to control cattle pests such as ticks, vampire bats, screwworms, and hoof and mouth disease (Rourk 1969; Nelson 1973). All of this financial and technical assistance is geared to the fact that, along with coffee, cotton, bananas, and sugar, beef is now one of the major

TABLE 1. Central American beef production, consumption, and exports 1959–1984 [in thousand metric tons, carcass weight (with bones)].

Date	Production	Consumption	Total Exports	Percent Exported
1959	124	113	11	9
1960	130	111	18	14
1961	145	125	21	15
1962	145	113	31	21
1963	152	110	42	28
1964	154	115	39	25
1965	170	136	35	21
1966	156	111	46	29
1967	167	109	59	35
1968	183	115	68	37
1969	233	148	86	37
1970	252	136	116	46
1971	282	177	107	38
1972	292	162	131	45
1973	281	161	121	43
1974	285	167	118	41
1975	297	178	119	40
1976	330	194	137	42
1977	339	210	129	38
1978	391	236	152	39
1979	400	240	163	41
1980	355	246	110	31
1981	355	254	101	28
1982	353	262	91	26
1983	336	257	79	24
1984	341	261	80	23

Source: various documents, USDA Foreign Agriculture Service.

TABLE 2. Mexican beef production, consumption, and exports 1960–1984 [in thousand metric tons, carcass weight (with bones)].

Date	Production	Consumption	Total Exports	Percent Exported
1960	354			
1961	375	339.3	35.7	9.52
1962	396	357.5	38.6	9.75
1963	428	381.8	46.2	10.79
1964	440	407.7	32.3	7.34
1965	463	432.2	31.0	6.70
1966	469	430.5	38.8	8.27
1967	474	444.3	30.2	6.37
1968	500	454.6	45.7	9.14
1969	534	485.2	49.5	9.27
1970	590	538.8	52.1	8.83
1971	581	532.9	48.6	8.36
1972	592	534.2	58.3	9.85
1973	744	706.1	38.5	5.17
1974	844	824.7	19.6	2.32
1975	889	875.4	14	1.57
1976	986	963.3	23.3	2.36
1977	1,040	1,011.0	30.1	2.89
1978	1,054	1,010.0	29.7	2.82
1979	946	948.0	6	0.63
1980	1,065	1,065.0	1	0.09
1981	1,129	1,137.0	1	0.09
1982	1,200	1,201.0	0	0.00
1983	975	969.0	8	0.82
1984	1,060	1,036.0	25	2.36

Source: various documents, USDA Foreign Agriculture Service.

foreign exchange earners for the Central American nations.

The next question is who is purchasing all this beef? The answer is very close to home. Ninety-five percent of Central America's beef exports go to the United States. Despite periodic cut-offs, U.S. companies buy and import between one-fourth and one-third of all the beef produced in Central America. During 1984, we imported 176 million pounds of Central American beef—one-fourth of all the beef the region produced. That doesn't count the live cattle we imported from Mexico for fattening in Texas feedlots. Incidentally, the role of beef exports in rainforest destruction in Mexico is a bit more indirect. There, the beef raised on cleared rainforest land goes to Mexico City, while the cattle raised in the more arid, northern states of Mexico are those exported—frequently on the hoof—to the United States (Yates 1981:91, 97).

The next question is why would the United States—which is already the world's largest consumer and producer of beef—need to buy more beef from Mesoamerica? The answer to that question is hidden in the dramatic rise of the American fast-food industry. During the 1960s, cattlemen in the United States took advantage of the availability of cheap feed grains like corn and sorghum and began producing grain-fed cattle, which produce higher profits than grass-fed beef (Koch and Algeo 1983). As domestic cattlemen switched to producing the finer cuts of beef, U.S. companies had to look elsewhere to find sources of what they call "canner" and "cutter" grades of meat.

That move by U.S. cattle producers coincided with the blossoming of the

U.S. fast-food industry, which, in turn, was put into motion by various other changes in American society. The U.S. now has 53,000 fast-food restaurants, and we eat one-third of our meals outside the home. Within five years, we're expected to be eating one-half of our meals away from home. Many of these meals are based on beef, and much of that beef is of the lean, lower-grade type which is raised on grass, not grains (Nations and Komer 1983a:18).

To meet the new demand for cheaper cuts of beef during the 1960s, the U.S. increased its beef imports from Australia & New Zealand, Ireland, Dominican Republic, and Haiti, and it is important to point out that these countries still supply 75 percent of our beef imports. But U.S. beef importers added Central America to its sources because of its proximity, and because the area is free of hoof-and-mouth disease. U.S. law prohibits beef imports from countries infected with hoof-and-mouth disease. The fact that South America is infected with this disease has helped keep the Amazon rainforest from being turned into a cattle ranch for the United States. We do import cooked and canned beef from South America, but no fresh or frozen beef. Instead, South America exports beef to Western Europe, which is also infected with hoof-and-mouth disease (Simpson 1981:13; Simpson and Farris 1982).

The beef imported into the U.S. from Central America arrives on refrigerated ships of the Coordinated Caribbean Transport or Pan American Shipping Line, loaded in piggy-back, refrigerated trailers. It is unloaded in Miami, Philadelphia, and New York, where it's purchased by beef brokers and packing plants. These middle men sell it to other meat product manufacturers and to fast-food restaurants. Most of it goes into luncheon meats, frankfurters, chili, beef stew, soups, sausages, t.v. dinners, baby foods, and pet foods, but some of it is mixed with fatter, U.S. produced beef and ends up as ground meat on supermarket shelves (Nations and Komer 1983a).

Some of the fast-food restaurants admit that they use imported beef: Burger King, A & W Root Beer, Jack-in-the-Box, Roy Rogers, for example. Others, notably McDonald's and Wendy's, apparently don't (Shane 1980; Nations and Komer 1983a). But there are problems in determining what's imported beef and what isn't. Once it's been inspected by U.S. Department of Agriculture officials at the port of entry, foreign beef is no longer required to be labeled "imported." It simply becomes another grade of U.S. domestic beef. So some fast-food franchises can claim that they use only domestic beef in their products and be accurate, though not truthful.

I want to stress that the problem of rainforest destruction for beef production does not revolve solely around the U.S. fast-food industry. The U.S. market for imported beef helped push the Central American cattle industry into rainforest areas, but the problem is now larger than that. In fact, U.S. imports of Mesoamerican beef are actually declining, mostly in reaction to increased concerns about the health implications of a diet rich in red meat (This Week 1982:239). But beef *production* is only slightly down in Mesoamerica, and beef consumption is higher than it has ever been. Today, most of the beef produced in Mesoamerica is consumed in Mesoamerica.

It is important to point out again, though, how unevenly that beef consumption is spread around. The urban middle-class in Panama City,

Tegucigalpa, and San José, Costa Rica eats a great deal of beef now, including Big Macs and Super-Gigante *hamburguesas*, but the rural farm families who make up over half of Central America's population are not benefiting from this industry. Instead, they are continuing to scratch out a meager living in an increasingly degraded environment, and they are continuing to expand in number.

Now, what would you predict, if you looked at an area where the majority of the farm land is in the hands of a wealthy elite and large corporations, where export production is increasing, per capita food production is declining, where the ecosystem is being severely degraded, and where the population is doubling every 24 years? What you get is Mesoamerica and the economic, nutritional, and political battles that the region is involved in today.

So what can we do about it short of sending in the troops and trying to maintain the status quo? The answer is not to ban beef imports from Mexico and Central America and hope that the rainforest grows back. That's not going to happen. What we can do, though, is expand research on intensifying production on the land that's already been cleared. Studies have already shown that beef production in Latin America could be increased 10 times without clearing another tree (Parsons 1976). Systems like rotational grazing systems, improved breeding, and forage feeding can produce higher yields of beef without degrading the environment and without destroying the national income that results from selling beef. But the practice of clearing tropical forest to raise beef for seven to ten years and then abandoning the land to weeds and erosion has got to be eliminated.

Just for starters, we can work toward ending international subsidies for beef production in rainforest areas. Despite their claims to the contrary, the World Bank and Inter-American Development Bank are still paying for forest clearing to produce cattle (World Bank 1983:25; World Bank 1984:122; Leonard 1985:412 ff.). There are positive steps happening on that front, though. Environmental groups like the Natural Resources Defense Council and the National Wildlife Federation have banded together to work toward coercing these development banks into putting stricter environmental reviews into their loan precedures (Committee on Banking 1984).

An even more important step is to take the money that is now subsidizing beef production and use it instead to intensify food production in Mesoamerica. Our challenge is to improve the lives of rural families by allowing them to increase agricultural production on land that's already cleared. If we hope to preserve any of the region's biological diversity, we have to provide these families with the technical and financial support they need to produce food and cash crops without having to continually clear more forest.

Fortunately, some good progress is also being made toward these goals. One of the most promising techniques is the tropical *chinampa* being developed in Mexico. To create chinampas, the farmer digs narrow trenches on at least three sides of a small cultivation plot in an area where water is available year round—either in a very wet area or near a river or lake. He adds the excavated soil to the plot to elevate and fertilize it, then plants his crops in this mud-rich area. He periodically dredges the mud from the trenches to renew the plot's fertility, so that he can produce food crops, cash crops, and trees year round

without the use of chemical fertilizers or machinery. One plot 2,000 meters square can feed a family of five year round and give them an income to boot (Coe 1964; Gómez-Pompa et al. 1982; Gómez-Pompa 1978; Gómez-Pompa and Venegas 1976; Gliessman et al. 1978).

That's one example of the kind of system that will have to be taken from the experimental stage to wide-scale use if Mesoamerica's population is expected to feed itself without destroying its natural ecosystems. Another good example is agroforestry. This is a system in which the farmer *plants* trees with his crops, rather than clearing the trees in order to plant crops. Some of the best research on agroforestry is being conducted at CATIE in Turrialba, Costa Rica, where foods crops and fuelwood crops are being grown in layers with lumber trees and cash crops such as coffee (CATIE 1979). Incidentally, one of the prime sources of new ideas in agroforestry systems is the traditional agriculture of indigenous populations. The Lacandon Maya, for example, maintain a system of traditional agroforestry that allows them to produce crops on a single plot of cleared rainforest for five to seven years. Then, rather than abandoning the plot, they plant it in tree crops and continue to harvest it as it regrows in natural forest species (Nations and Nigh 1980).

Because agroforestry combines crop production with the advantages of a standing forest, it is one of the main hopes for the tropics. Agroforestry systems can also be combined with cattle production, using forest grazing systems with nitrogen fixing trees such as *Leucaena* (NAS 1977). By expanding intensive agricultural systems like these, and other systems such as aquaculture, we can help rural communities produce higher food yields, help improve their living conditions, and simultaneously work for the conservation of the tropical forest environment. The author's message here is simple: in order to conserve Mesoamerica's tropical forest, we must put most of our emphasis on other issues—issues such as tropical agriculture, international trade, and the financial decisions of national governments and multilateral development banks. The key to tropical forest conservation actually lies outside the rainforest itself.

That's not to say, however, that parks and other conservation units should be neglected. The creation of more and larger national parks must continue concurrently with increased emphasis on countering the trends that threaten tropical forests. Costa Rica deserves recognition for setting the example of how to create a successful system of national parks and forest reserves. Costa Ricans have incorporated 19 percent of their national territory into protection units (U.S. AID-Costa Rica 1982:3; Gonzáles 1979; Nature Conservancy 1984). That's the equivalent of our declaring the state of California a national park.

One of the other positive signs is the Biosphere Program of UNESCO. Biosphere reserves are designed to have an unviolated core of natural vegetation surrounded by concentric rings of land with increasingly more intensive human use (OTA 1984:165-166; Houseal, MacFarland, Archibold and Chiari 1985:11). Indigenous peoples are encouraged to utilize the outer rings of the reserve and to help protect the permanent core in the center. The best examples in Mesoamerica are the Mapimí and La Michilía Biosphere Reserves in Mexico and the Río Plátano Biosphere Reserve in eastern Honduras (Halffter 1980, 1981a, 1981b; Glick and Betan-

court 1983). Indigenous people who live in the reserve have been included in its planning and operation so that they have a stake in its success. They serve as the primary guards of the buffer zone between the pristine forest in the core and the destructive human activities outside the reserve. Reserves based on this model have also shown promise in Panama and Costa Rica, and the Montes Azules Biosphere Reserve in Chiapas, Mexico will most likely follow this pattern.

The crucial point here is that local people must be included in the development of these conservation units, and those areas must contribute to the welfare of surrounding populations, if we expect them to survive. If people have to farm inside national parks to stay alive, you can bet that they'll do so.

Our challenge, then, is the difficult task of combining conservation with the sound development of surrounding areas. In Panama, the Kuna Indians of the Comarca de San Blas are providing another good example of how this can be done. On their own the Kunas declared their tribal lands—more than 3,100 km^2 of rainforest—a natural forest reserve to be protected as forest forever. The Kunas are now getting technical and financial support from international organizations, but they are the main force behind the program, because they know that this plan will produce jobs and income for the Kuna community, while it simultaneously helps preserve their cultural identity and their rainforest environment (Chapin and Breslin 1984).

These solutions are only first steps. There is still a long way to go. But by supporting the right to exist of the remaining rainforests and rainforest peoples, we can help assure the survival of this vital ecosystem and the cultural survival of the people who live within it. At the same time, we'll be protecting the health of our planet.

Those of you in this room can help achieve these goals by learning about ecological problems like tropical deforestation and by supporting organizations that are dedicated to conservation and sound development. Join organizations like the World Wildlife Fund, the Sierra Club, the National Wildlife Federation, Friends of the Earth, Greenpeace, Audubon, Earth First!, The Conservation Foundation, the Nature Conservancy—whichever group fits your particular bias. Support organizations like Survival International, the Anthropology Resource Center, and Cultural Survival that are dedicated to indigenous human rights.

Finally, find out how your career fits in. Those of you who are scientists, writers, photographers, social scientists, geographers, anthropologists, economists, whatever—you can use your skills and your position to publicize the plight of natural ecosystems like tropical rainforests and the people who live in them. Short of nuclear war, the most crucial problems we'll face during the rest of our lives are ecological problems like food production, population growth, and ecosystem destruction. These problems are incredibly complex, but there are none that are more important. My challenge to you is that it is to our advantage, both as individuals, and as fellow members of the human species, to understand these problems and to work together toward solving them.

Literature Cited

Arnson, C. 1980. Background information on the security forces in El Salvador and U.S. military assistance. Resource, March, 1980. Washington, D.C.: Institute for Policy Studies.

Barnery, G. O. (Study Director). 1980. The Global 2000 Report to the President. A Report prepared by the Council on Environmental Quality and the Department of State. Washington, D.C.: U.S. Government Printing Office.

Barrett, S. W. 1980. Conservation in Amazonia. Biological Conservation 18: 209-235.

Bunker, S. G. 1980. Forces of destruction in Amazonia. Environment 22(7): 14-20, 43-43.

Cahn, R. and P. Cahn. 1983. International parks: experts meet at Bali on mutual problems. Audubon, March, 1983: 136-140.

CATIE. 1979. Proceedings of the Workshop on Agro-Forestry Systems in Latin America. Turrialba, Costa Rica: Centro Agronomico Tropical de Investigación y Enseñanza.

Caufield, C. 1982. Brazil, energy and the Amazon. New Scientist, October 28, 1982: 240-243.

CEPAL, et al. 1980. Tenencia de la Tierra y Desarrollo Rural en Centroamérica. EDUCA, San José, Costa Rica: CEPAL, FAO, OIT, SIECA, OCT, OEA.

Chapin, M. 1980. Comments on the Social and Environmental Consequences of the El Llano-Cartí Road, Republic of Panama. In-house Report to U.S. Agency for International Development. Washington, D.C.

Chapin, M. and P. Breslin. 1984. Conservation Kuna-Style. Grassroots Development: Journal of the Inter-American Foundation 8(2): 26-35.

CIES. 1979. Reporte Final de Actividades, Fideicomiso de la Selva Lacandona. San Cristóbal las Casas, Chiapas, México: Centro de Investigaciones Ecológicas del Sureste.

Cock, J. H. 1979. Cassava Research. Field crops research 2: 185-191. Amsterdam: Elsevier Scientific.

Coe, M. D. 1964. The Chinampas of Mexico. Scientific American 211(1): 90-98.

Committee on Banking. 1984. Draft Recommendations on the Multilateral Banks and the Environment. Hearings Before the Subcommittee on International Development Institutions and Finance of the Committee on Banking, Finance and Urban Affairs, House of Representatives, 98th Congress, Second Session, September 11 and 13, 1984. Serial No. 98-113. Washington, D.C.: U.S. Government Printing Office.

Cultural Survival, Inc. 1980. Nicaragua. Cultural Survival Quarterly 4(4): 8-9. Cambridge, MA.

Djerassi, C. 1984. The making of the pill. Science 84 5(9): 127-129.

DPN. 1978. Potencial de Desarrollo Agropecuario y Rehabilitación de Tierras en la Costa Atlántica-Nicaragua. 6 volumes. Tecnoplan, S.A., Managua, and Tahal Consulting Engineers, Ltd., Tel Aviv for the Dirección de Planificación Nacional, República de Nicaragua.

Duayhe, C. 1979. Bajo rendimiento de ganado por hectárea. Uno Más Uno. February 20, 1979. Mexico City.

Ehrlich, P. and A. Ehrlich. 1981. Extinction: The Causes and Consequences of the Disappearance of Species. New York: Random House.

Estado de Chiapas. 1983. Plan Chiapas. Tuxtla Gutiérrez, Chiapas: Gobierno Constitucional de los Estados Unidos Mexicanos, Gobierno Constitucional del Estado de Chiapas. Imprenta Madero, S. A. May, 1983.

Fearnside, P. M. 1979. Cattle yield prediction for the Transamazon Highway of Brazil. Interciencia 4(4): 220-225.

———. 1980. The effects of cattle pastures on soil fertility in the Brazilian Amazon: consequences for beef production sustainability. Tropical Ecology 21(1): 125-137.

———. 1982. Deforestation in the Brazilian Amazon: How fast is it occurring? Interciencia 7(2): 82-88.

———. 1983. Land-Use trends in the Brazilian Amazon region as factors in accelerating deforestation. Environmental Conservation 10(2): 141-148.

Gentry, A. H. and J. López-Parodi. 1980. Deforestation and increased flooding of the Upper Amazon. Science 210(19): 1354-1356.

Glick, D. and J. Betancourt. 1983. The Río Plátano Biosphere Reserve: Unique resource, unique alternative. AMBIO 11(3-4): 174-179.

Gliessman, S. R., R. García Espinoza, and M. Amador Alarcon. 1978. Módulo de Producción Diversificada: Un Agroecosistema de Producción Sostenida para el Tropica Húmedo de México. H. Cárdenas, Tobasco: Colegio Superior de Agricultura Tropical.

Gómez-Pompa, A. 1978. Vino nuevo en odre viejo. Mazingira 5. Oxford: Pergamon Press, Ltd.

Gómez-Pompa, A., H. Luis Morales, E. Jiménez Avilla, & J. Jiménez Avilla. 1982. Experiences in Traditional Hydraulic Agriculture. Chapter 14 in: Kent V. Flannery, editor, Maya Subsistence: Studies in Memory of Dennis E. Puleston. New York: Academic Press.

Gómez-Pompa, A. & R. Venegas. 1976. La Chinampa Tropcial. INIREB Informa, Comunicado No. 5 sobre Recursos Bióticos Potenciales del País. Xalapa, Veracruz: Instituto de Investigaciones sobre Recursos Bióticos, A. C.

González, R. 1979. Establecimiento y desarrollo de reservas forestales en Costa Rica. Agronomía Costarricense 3(2): 161-166.

Goodland, R. J. A. 1979. Environmental Optimization in Hydrodevelopment of Tropical Forest Regions. In: R. S. Panday (editor). Man-Made Lakes and Human Health, Faculty of Medicine, University of Suriname, October 23-25, 1977. Paramaribo, Suriname.

GOODLAND, R. 1980. Environmental Ranking of Amazonian development projects in Brazil. Environmental Conservation 7(1): 9-26.

————, and H. S. IRWIN. 1975. Amazon Jungle: Green Hell to Red Desert? An Ecological Discussion of the Environmental Impact of the Highway Construction Program in the Amazon Basin. New York: Elsevier Scientific Publishing Co.

GOULDING, M. 1980. The Fishes and the Forest: Explorations in Amazonian Natural History. Berkeley: University of California Press.

HALFFTER, G. 1980. Biosphere reserves and national parks: complementary systems of natural protection. Impact of Science on Society 30(4): 269-277.

————. 1981a. The Mapimi Biosphere Reserve: Local participation in conservation and development. AMBIO 10(2-3): 93-96.

————. 1981b. Conservation, Development and Local Participation. Chapter 26 in: V. Di Castri, F. W. G. Baker, and M. Hadley, editors, Ecology in Practice: Ecosystem Management. Dublin: Tycooly International Publishing for UNESCO, Paris.

HECKADON, S. M. 1981. La colonización Campesina de Bosques Tropicales en Panamá. Estudios Rurales Latinoamericanos 4(3): 287-306.

HOUSEAL, B., C. MACFARLAND, G. ARCHIBOLD, and A. CHIARI. 1985. Indigenous cultures and protected areas in Central America. Cultural Survival Quarterly 9(1): 10-20.

ICAS. 1982. Land tenure and rural development in Costa Rica. Mesoamerica 1(19): 8-10. San José, Costa Rica: Institute for Central American Studies.

ISAZA, A. C. and B. MORAN. 1981. Importancia del Manejo de la Canal de Panamá. Panamá: Dirección Nacional de Recursos Naturales Renovables. Booklet, 12 pp.

KOCH, R. M. and J. W. ALGEO. 1983. The beef cattle industry: changes and challenges. Journal of Animal Science 57 (Suppl. 2): 28-43.

LEFEBER, W. 1983. Inevitable Revolutions: The United States in Central America. New York: W. W. Norton & Company.

LASSEN, C. A. 1980. Landlessness and Rural Poverty in Latin America: Conditions, Trends and Policies Affecting Income and Employment. Rural Development Committee, Center for International Studies, Cornell University. Ithaca, New York.

LATIN AMERICAN TIMES. 1984. Population developments in Central America. The Latin American Times, No. 63. December 19, 1984: 24-25. London.

LEONARD, H. J. 1985. Central American Regional Environmental Profile. Draft Version. Washington, D.C.: The Conservation Foundation for U.S. Agency for International Development.

LEOPOLDO, P. R., W. FRANKEN, and E. MATSUI. 1984. Hydrological aspects of the tropical rain forest in Central Amazon. Interciencia 9(3): 125-131.

LOBATO GONZÁLEZ, R. 1981. La Reserva de la Biósfera "Montes Azules": Estado Actual y Perspectivas. Tomo 2, pp. 5-44 in: Alternativas para el Uso del Suelo en Areas Forestales del Trópico Húmedo. Publication Especial No. 27, Estudios del Acuerdo sobre Planificación y Uso de Recursos Forestales Tropicales, México-Alemania. México, D.F.: Instituto Nacional de Investigaciones Forestales.

LOVEJOY, T. E. 1973. The Transamazonica: highway to extinction. Frontiers, Spring, 1973.

MERKEL, A. 1981. Management of Honduran Forest Resources. Chapter 3, draft version, U.S. AID Honduras Country Environmental Profile. Tegucigalpa, Honduras: U.S. Agency for International Development.

MOLINA, J. C. 1980. Nicaragua: La revolución agraria en marcha. Agro-Noticias, No. 14, Lima, Peru.

MORENO AZORERO, R. and B. SCHVARTZMAN. 1975. 268 Plantas medicinales utilizadas para regular la fecundidad en algunos países de Sudamerica. Reproduccion 2(2): 163-183.

MYERS, N. 1979a. The Sinking Ark: A New Look at the Problem of Disappearing Species. New York: Pergamon Press.

————. 1979b. Tropical moist forests: we all gain or loose together. Reports 8(3): 305. International Development Research Center, Ottawa.

————. 1981. The Hamburger Connection: How Central America's forests become North America's hamburgers. AM:BIO 10(1): 3-8.

————. 1984. The Primary Source: Tropical Forests and Our Future. New York: W. W. Norton and Co.

NATIONAL ACADEMY OF SCIENCES. 1977. Leucaena: Promising Forage and Tree Crop for the Tropics. Washington, D.C.: National Academy of Sciences.

————. 1980. Research Priorities in Tropical Biology. Washinton, D.C.: National Research Council, National Academy of Sciences.

NATIONS, J. D. and D. I. KOMER. 1983a. Rainforests and the Hamburger Society. Environment 25(3): 12-20.

————, ————. 1983b. Central America's tropical rainforests: positive steps for survival. AMBIO 12(5): 232-238.

————, and RONALD B. NIGH. 1980. The evolutionary potential of Lacandon Maya sustained-yield tropical forest agriculture. Journal of Anthropological Research 36(1): 1-30.

NATURE CONSERVANCY. 1984. Costa Rica. The Nature Conservancy News 34(1).

NELSON, M. 1973. The Development of Tropical Lands: Policy Issues in Latin America. Baltimore: Johns Hopkins University Press, for Resources for the Future, Inc.

Ng, F. S. P. 1982. Ecological Principles of Rain Forest Conservation. Paper presented at the symposium, The Tropical Rain Forest: Ecology and Resource Management, Leeds, U.K., April 14-18, 1982.

Office of Technology Assessment. 1984. Technologies to Sustain Tropical Forest Resources. Washington, D.C.: Office of Technology Assessment, Congress of the United States.

Parsons, J. J. 1976. Forest to pasture: Development of destruction? Revista de Biologia Tropical 24 (Supl. 1): 121-138.

Price, T. and L. Hall. 1983. Agricultural Development in the Mexican Tropics: Alternatives for the Selva Lacandona Region of Chiapas. Cornell/International Agricultural Economics Study, A. E. Research 83-4. Ithaca, New York: Department of Agricultural Economics, New York State College of Agriculture and Life Sciences, Cornell University.

Ranjitsinh, M. K. 1979. Forest destruction in Asia and the South Pacific. AMBIO 8(5): 192-201.

Raven, P. H. 1980. Research, tropical ecology, and the future of Panama. Annals of the Missouri Botanical Garden 67: xvi-xxii.

———. 1981. Tropical rain forests: A global responsibility. Natural History 90(2): 28-32.

Redclift, M. R. 1981. The Mexican food systems (SAM): sowing subsidies, reaping apathy. Food Policy 6(4): 231-235.

Romanini, C. 1978. Agricultura Tropical en Tierras Ganaderas, México, D.F.: Centro de Ecodesarrollo, Instituto Nacional Indigenista.

Rourk, J. 1969. The Beef Cattle Industries of Central America and Panama. FAS M-208, June, 1969. Washington, D.C.: U.S. Department of Agriculture, Foreign Agriculture Service.

Salati, R., J. Marques, and L. C. B. Molion. 1978. Origem e distribuicao das Chuvas na Amazonia. Interciencia 3: 200-205.

Sanchez, P. A. 1976. Properties and Management of Soils in the Tropics. New York: John Wiley and Sons.

Schultes, R. E. 1979. The Amazonia as a source of new economic plants. Economic Botany 33(3): 259-266.

Shane, D. R. 1980. Hoofprints on the Forest: the Beef Cattle Industry in Tropical Latin America. Washington, D.C.: U.S. Department of State.

Simberloff, D. 1982. Big advantages of small refuges. Natural History 91(4): 6-14.

Simpson, J. R. 1981. An Assessment of the United States: Meat Import Act of 1979. Economic Information Report 152. Food and Resource Economics Department, Agricultural Experiment Station, Institute of Food and Agricultural Sciences. Gainesville: University of Florida.

Simpson, J. R. and D. E. Farris. 1982. The World's Beef Business. Ames, Iowa: Iowa State University Press.

Sims, G. J. 1961. Central America builds up its livestock industry. Foreign Agriculture 25(6): 9-10.

Smith, Nigel J. H. 1982. Rainforest Corridors: The Transamazon Colonization Scheme. Berkeley: University of California Press.

Szekely, F. 1976. Impacto ambiental de las grandes presans en el Trópico. Ciencia y Desarrollo No. 11. Mexico, D.F.

Teller, C. H. 1981. The demography of malnutrition in Latin America. Intercom: The International Populatin News Magazine 9(8): 8-11. Washington, D.C.: Population Reference Bureau, Inc.

Teller, C., R. Sibrian, C. Talavera, V. Bent, J. del Canto, and L. Saenz. 1979. Population and nutrition: Implications of sociodemographic trends and differentials for food and nutrition policy in Central America and Panama. Ecology of Food and Nutrition 8: 95-109.

This Week. 1982. U.S. market for meat imports from Central America shrinking. This Week: Central America and Panama 5(30): 239. Guatemala, Guatemala.

Tirado, G. and M. A. Lugo-López. 1984. Erosion on the hillsides of the Dominican Republic. Journal of Agriculture of the University of Puerto Rico 68(1): 117-119.

Tosi, J. 1972. Los Recursos Forestales de Costa Rica. San José: Centro Científico Tropical. Mimeo.

U.S. Agency for International Development. 1982. Costa Rica Country Environmental Profile: A Field Study. San José, Costa Rica: U.S. Agency for International Development.

U.S. Agency for International Development. 1982. Honduras Country Environmental Profile. McLean, Virginia: U.S. Agency for International Development.

U.S. Interagency Task Force. 1980. The World's Tropical Forests: A Policy, Strategy, and Program for the United States. Report to the President by a U.S. Interagency Task Force on Tropical Forests. Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Agriculture. 1980. Forestry Activities and Deforestation Problems in Developing Countries. Report to the Office of Science and Technology, Development Support Bureau, Agency for International Development, PASA No. AG/TAB-1080-10-78. Washington, D.C.: Forest Products Laboratory, United States Department of Agriculture.

Wadsworth, F. 1978. Deforestation: Death to the Panama Canal. pp. 22-25 in: Proceedings of the U.S. Strategy Conference on Tropical Deforestation. Washington, D.C.: U.S. Department of State and U.S. Agency for International Development.

Whitmore, T. C. 1980. The Conservation of Tropical Rain Forest. Chapter 17 in: Michael E. Soulé and Bruce A. Wilcox, editors, Conservation Biology: An Evolutionary-Ecological Perspective. Sunderland, Massachusetts: Sinauer Associates, Inc.

Wilson, E. O. 1984. Million-Year histories: species diversity as an ethical goal. Wilderness 48(165): 12-17.

World Bank. 1978. Guatemala: Economic and Social Position and Prospects. Washington, D.C.: The World Bank.

———. 1983. Staff Appraisal Report, Honduras. Third Agricultural Credit Project, April 25, 1983. Projects Department, Latin America and the Caribbean Regional Office, Report No. 4298-HO.

———. 1984. The World Bank Annual Report 1984. Washington, D.C.: The World Bank.

Yates, P. L. 1981. Mexico's Agricultural Dilemma. Tucson: University of Arizona Press.