

The Scourge of Cows

by James J. Parsons

Copied with permission from Whole Earth Review (Spring 1988), pp. 40-47.

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NOTE: As you read, you will see **highlighted passages**. **(Q1)** At the end of each passage you will see a marker like the one here, in red. Each marker corresponds to a question in Assignment 12.

Don't worry about "wrong" answers... they do not count against you! What I want you to take away from this exercise is understanding how an Environmental Systems Analysis works. If your answer is "wrong"... look at the answer given, and see if you understand why it was entered into the flowchart where it was.

Each question will ask you to identify what heading (Human Driving Force, Human Activities, Environmental Change, Adverse Consequences, Solutions) each passage best describes, and which subcategory that passage best fits into under each heading.

I recommend that you print out the flowchart so that you can use it as you are reading.

The flowchart will show you what the relationships are between each heading and subcategory. See also the flowchart for the Aral Sea in the Additional Readings for Chapter 12.

If you have any questions about why a particular passage is placed under a particular heading and then in a particular subcategory, please email me! ... ramey@bridgew.edu

This exercise will take some time to do with the reading, thinking about how things fit into the flowchart, and then completing the assignment in Blackboard.

MY INTEREST IN livestock in Third World development was initially spurred less by any concern for Third World economic development as such (and I here direct my attention primarily towards the tropical parts of Latin America) than by an interest in landscapes and landscape change -- especially vegetation change resulting from human activity. The advance of pasture (grassland) at the expense of lowland rain forest and dry tropical forest in the Americas first attracted my attention some 35 years ago on the Caribbean coast of Colombia inland from Cartagena in the Magdalena and Sinu river valleys. **(Q1)** Not long after, during a visit to Costa Rica, my attention focused on the Pan-American Highway, which was pushing southward toward the Panama border, opening up the richly forested Valle General and the Pacific lowlands of that country to pioneer settlement. The process was just beginning to be dominated by cattlemen. The destruction of Amazonia was to come later.

As a geographer I was interested in the fact that most of these newly forming potreros (pastures) were composed not of native American species but of grasses of African origin. They were palatable to cattle and they were aggressive colonizers. They were here to stay. Several of them, like pangola and kikuyu,

had only recently been introduced to the New World tropics. A couple of them dated back to the 18th century, having moved gradually from points of introduction in Brazil or the West Indies to other parts of tropical America. These Old World grasses or their cultivars are still arriving, now more often through experimental introductions than by chance. The "Atlantic Exchange," as Alfred Crosby terms it -- the transfer of economically valuable plants that began in 1492 -- is still going strong.

Grass, of course, was of singularly little interest or utility to native American populations. They had no cattle, really no domesticated grazing animals with the exception of the high-Andean pastoralists with their llamas and alpacas. There were, of course, natural grasslands or "savannahs" (the Arawak term) in the American tropics -- the most extensive being the llanos or plains of the Orinoco in the interior of Venezuela and Colombia -- but even these lacked the big game, the grazers, of the African plateau. It is in association with such creatures that the more palatable native grasses of that continent seem to have evolved over millions of years. We know little of how or why.

In America, grass only came to be seen as useful or desirable after Columbus' second voyage, on which the first cattle were introduced to the New World. When the Spaniards saw the savannas of Santo Domingo and Cuba and, later on, the mainland, all they could think of was cattle. The savannahs were successional stages of abandoned Indian gardens. As Indian populations were decimated their abandoned fields grew up with second-growth scrub and weedy native grasses. Spanish livestock, in effect, replaced native peoples. Alexander Skutch, the ornithologist, who holds the tropical forest and its ecological diversity in reverence, speaks of "the scourge" of the cow and the grass its introduction has generated, and how it had been the great good fortune of the Indian cultures that domestic livestock had been unknown to them, thus providing no incentive to convert forest to grass.

Cattle-keeping, of course, is a cultural thing. The original domestication of wild cattle in the Middle East, according to Eduard Hahn, was probably for ritual or ceremonial purposes. Their use for milk and meat came later and even today is hedged in on all sides by taboos and prejudices and, in the case of milk, by genetically based digestive barriers associated with lactase deficiency. (Q2) Most of the world's beef is consumed by the better-off members of Western cultures. The U.S. alone produces one-fourth of the world's red meat but is still an importer. Throughout the Far East hundreds of millions of people have never tasted beef and have not the slightest desire to try it. In Hindu India steak is as unthinkable as dog chops in America. Most Chinese find the idea of slaughtering cattle to make steaks appalling (Q2). It is pork, a much more efficient converter of energy, that they are addicted to and seek out when they can afford it.

There are, of course, other reasons for keeping cattle besides their value as food processors -- for draft or transport, for their hides, their horns, bones or dung (for fertilizer) and often as a form of wealth, a kind of mobile bank account (Q3) that can be driven on foot to market or, in case of drought, flood or war, to other areas. The very word "capital," which comes to us from the Latin, may be derived from "cattle." The Spanish ganado originally meant that which has been gained = property (ganaderia). Keeping cattle is still considered an especially prestigious activity in some cultures, including that of Latin America. As the proportion of animal products in the diet of Western nations has increased, modern governments have seen beef exports as an irresistible source of much-needed foreign exchange. This has been the root of the aggressive promotion of pasture expansion for stock raising as a part of Third World governments' development programs.

Beef is seen especially as a source of protein, symbol of the mass middle-class "good life" in America. But it is an expensive one. (Q4) Its preeminence in our diet is of recent origin. Before 1875 pork was our preferred daily meat; ham was the choice for honored guests. For the English in earlier times it had been mutton and even rabbit. As late as 1950 more pork than beef was consumed in the U.S. Today we consume nearly twice as much of the latter as of the former. But we still talk of "living high off the hog" and "bringing home the bacon" and we accuse politicians of "pork barrel" rather than "beef barrel" legislation. But a change is in the wind again. Per-capita beef consumption has begun to drop after a long uphill climb. medical warnings of cholesterol and the role of saturated fats in cardiovascular problems have contributed. So have cheaper pork and (especially) poultry. But worldwide the upward spiral of beef consumption continues as population soars and American middle-class values spread.

Before World War II most beef in America, as in other developed countries, was from grass-fed animals. Recently our cattle, which still grow up eating grass, have been spending the last month or two of their lives in feedlots being stuffed with grain and byproducts of agricultural processing (cottonseed or soybean cake, sugar-beet pulp, molasses). Such "finishing" produces a fat-marbled beef that draws a premium price but is inefficient in energy terms. It involves transforming edible protein in the form of grain or soybeans into fat simply to make the meat taste better. It takes six to eight pounds of grain or the byproducts of food and fiber processing to produce one pound of weight gain in cattle. For pigs and poultry the conversion ratio is at least three times more efficient. They also lend themselves far more readily to production by small-scale farmers and they thrive on waste products and garbage.

The World Bank says that some 600 million tons of cereals, half the world's production, are annually fed to animals, an amount that could feed the world's hungry three times over. Two-thirds of our U.S. tilled cropland produces animal feed, with corn, sorghum, and soybeans, along with alfalfa and other hay, leading the way. Significant amounts of these crops are exported to developing countries to feed livestock and poultry. Grain converted to meat loses 75 to 90 percent of its protein value so it is woefully inefficient in these terms. In the wake of a world food crisis (a crisis in distribution, not production) the use of grains to feed animals has come under close scrutiny (Q5). But here as elsewhere, the market rules. To shift consumption of grain from animals to people would require a massive transfer of purchasing power from rich countries to poor ones. Even if this unlikely prospect were realized the longer-term consequences would be problematic. Most of the world's hungry are farmers or live in farm areas where basic cereals are grown. It would be difficult if not impossible to inject large amounts of additional cereal into these areas without sharply reducing incomes and production in the very regions where increased income is most needed.

So where's the beef? The world has some 1.2 billion cattle, together with a billion sheep and half that many hogs. There are close to five billion people; our numbers and theirs are growing equally rapidly. The U.S., with less than five percent of the world population, has ten percent of the cattle. The number of cattle equal or exceed the number of people in a few countries; especially the southern-hemisphere meat exporters such as Australia and Argentina, but also surprisingly in some of the fastest-growing Latin American countries -- Brazil, Colombia, Nicaragua, Costa Rica, Honduras. Even Cuba comes close to the one-to-one ratio.

Through the microbiological flora in their second stomach (rumen), cattle can convert to food otherwise unusable cellulose. That means grass, something that our gastric systems can't handle. So the world's vast open lands, its unused two-thirds that are too steep, too rocky, too dry, too wet, too salty,

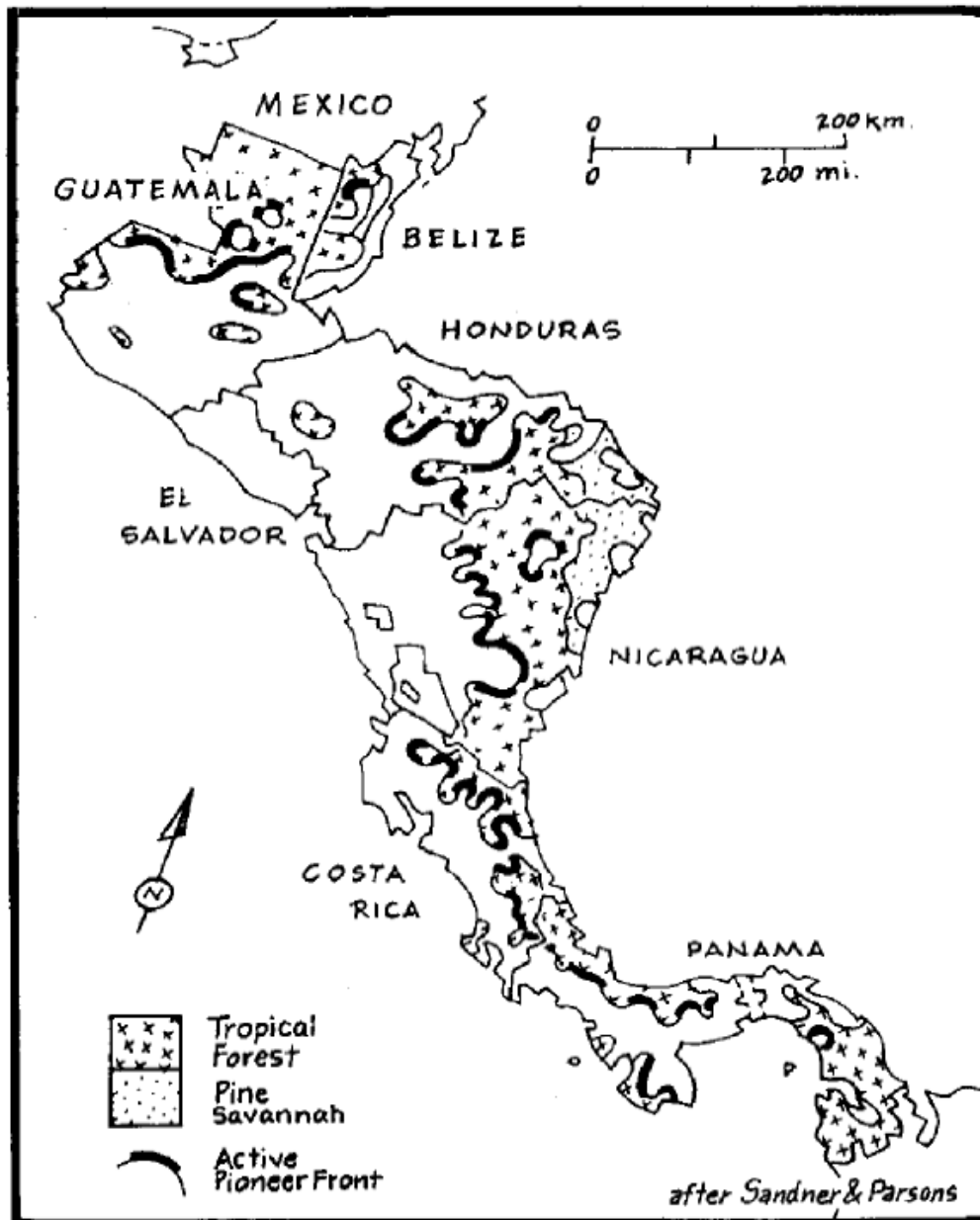
too infertile to permit cultivation for crops, can be and often are used to produce protein by grazing animals. Unfortunately, there has been a long history of overdoing it. Overstocking of cattle, especially on the drier margins, has led repeatedly to soil erosion, deterioration of the plant cover, and the process popularly if improperly termed "desertification."

The pressure to provide more food for cattle recently has posed an increasingly ominous threat to the world's tropical forests, or at least the 57 percent of them in the Americas. Suddenly, and largely because of the acceleration of clearing for pasture (and wood products), we have become sensitized to a looming global crisis -- the threat that the world's most complex and massive ecosystem may be on its way to extinction.

Four-fifths of the soils of the humid tropics of the New World are acid and infertile. The lushness of the forests that they support is misleading. Where there is forest cover, nutrients are almost entirely locked up in the biomass of the trees and their roots and are continuously recycled through leaf fall and root uptake. When the forest is cleared to make way for short-rooted crops or grasses, bases and essential plant nutrients are rapidly leached from the soil due to continuously high temperatures and high rainfall (Q6).

The forest creates its own environment. Once removed it is not readily reestablished; there is some question whether it may ever be, in anything less than very large tracts. For a year or two after clearing, the ashes and decaying leaves and branches support reasonable crop yields but the rapidly weathering exposed soil may soon be impoverished. Eventually it is abandoned to secondary weedy growth unless major inputs are made of fertilizers, pesticides and herbicides, the means for which are seldom at hand. Interior South America has been described by George Borgstrom as "a great fertility desert." Except for the narrow river floodplains and restricted outcrops of basalt (terra rosa) or other volcanic parent materials, the soils are unfit for permanent cropping. And markets are almost always far away.

The traditional American Indian land-use system was a kind of forest-fallow or shifting cultivation (slash-burn or swidden) where, after two or three years, the land is abandoned to secondary growth for 15 to 20 years before another cycle of clearing and cultivation is initiated.



Forest retreat in Central America

The modern colonists who are making clearings (rozas) in the high forests, attracted by new penetration roads and sometimes by government credits, tend to be as interested in cash returns as in subsistence. After a crop or two the roza, increasingly infested with noxious insects and weeds, is likely to be directly planted to jaragua or Guinea grass (aggressive non-native grasses) (Q7) and sold to the small capitalists who follow behind. The caboclo or campesino may go on to clear another patch of monte somewhere ahead, but where a road or a nascent commercial center is close at hand, his hard-earned money is often quickly squandered. He frequently ends up as a wage earner on the same property that was once his own.

An alternative scenario, depending on the land tenure situation, is when large landowners who have obtained title to tracts of forest pay colonos to clear a few hectares or contract them to do so in return

for the privilege of taking two or three crops of maize or manioc from the cleared land, at the end of which time they must leave it in pasture (Q8).

Then they move on to repeat the process. In such a fashion, men with capital or influence become the permanent benefactors of the sweat of those who have gone before them with axe or machete. Agriculture becomes merely an intermediate step in the conversion of forest to pasture. It's all reminiscent of how the Argentine pampas years ago was converted to alfalfa and clover by Italian immigrants contracted by large landowners anxious to improve the carrying capacity of their stock-raising haciendas.

Concern for the future of the world's tropical forests and the possible consequences of their destruction has led to a recent outpouring of popular and scientific writing. For a world-view one can scarcely do better than Catherine Caulfield's *In the Rain-Forest*, which gives appropriate attention to the unique role of cattle-raising and the "pasture revolution" in the case of the Americas. Widely contrasting figures are offered as to the rate and extent of tropical forest destruction. Two-thirds of the Central American forests are believed to have gone, mostly converted to pasture (Q9). The Caribbean coastal plains of Colombia have been converted into a largely man-made grassland in one generation; the boundaries of the grasslands of the Llanos are being expanded at a quickening pace. The great Amazon rain forest (selva) appears more and more like a green, moth-eaten carpet frayed at its edges and increasingly pocked with holes as access roads have been pushed down from the crowded Andes and the Brazilian highway system has been extended to crisscross virtually the entire Brazilian portion of the river's drainage basin. Along with improved technologies for roadbuilding and forest clearing (enter the chainsaw) has come the revolution in public health and most importantly, at least for the moment, the successful suppression of the dreaded malaria, which for so long put the brakes on the settlement of these lands (Q10).

In the Amazon basin, the march against the selva has been fueled by the rising tide of nationalism, which demands the incorporation of sparsely settled areas into the political and economic life of each country (Q11). It is a popularly held belief that "to govern is to people." Any aboriginal tribes that may stand in the way of such colonization activities are generally either eliminated or driven deeper into the forest (Q12). In conflicts between Indian and colono, the latter always wins. Grandiose schemes for la conquista de la selva, however ecologically disruptive they may be, are likely to be seen as providing a unifying cause, a common purpose or rallying point to which all factions may subscribe. At the same time, they provide a distraction from the more intractable social and political issues of the day.

The promotion of cattle ranching as a development strategy seems to be almost entirely a Latin American phenomenon. In Africa tsetse fly and trypanosomiasis, as well as several other diseases (rinderpest, hoof-and-mouth), severely limit cattle numbers and their distribution. In any case they are chiefly found on the dry margins, kept by semi-nomadic herdsmen in small, noncommercial herds and prized as much as a symbol of status as a source of food. Desertification is an over-riding concern, and mobility a principal mechanism for countering it. In most of Asia cultural considerations and high human population densities make development via livestock all but unthinkable. Australia, especially tropical Queensland where major advances in tropical grass selection and range management have occurred, offers the closest parallel to the Americas, but here cattle ranching is a high-tech business, well capitalized and increasingly oriented toward the export market (Q13). The U.S.S.R., facing high and

growing demands for meat, has given priority in recent years to importing feeds, especially from the huge U.S. surpluses.

In Brazil, with more than half of the great Amazon rain forest, it was the military coup of 1964 and the subsequent "revolution from above" that made the development of the Amazon a cornerstone of that country's program. It was called "the moral equivalent of war," and it put huge blocks of state forest lands in the north into the hands of Big Business, corporations both from Sao Paulo and from overseas. The Belem-Brazilia highway had been completed by 1960 and others soon thereafter, including the much-publicized "Trans-Amazon" (now all but abandoned). The most recent and most destructive such development seems to be the new road system that has opened up Rondonia state along the once-remote Bolivian border.

As new roads were built, colonists flooded in and so did corporate interests, attracted by generous fiscal incentives. In Brazil, Amazonia was seen as a new farming and stock-raising frontier that was to serve as a safety valve for the drought-ravaged northeast, blunting demands for land reform. It was an idea that fit neatly with military ideology, including the securing of national sovereignty by establishing a substantial civilian presence in the vast northern forest. At the same time the economy was to be stimulated and jobs provided by an **unprecedented road-construction program (Q14)**. Cattle were to provide a new source of cheap meat, first for growing Brazilian markets and later for export.

Cattle raising was to be given special priority, taking advantage of new Australian pasture technologies and the **availability of improved breeds of Brahma-type animals and their crosses, which are resistant to tropical conditions (Q15)**. From the beginning, entrepreneurial interests were given special consideration in the form of cheap credit, tax exemptions and generous land concessions. **A 1966 tax law permitted 50 percent of corporate tax liabilities to be canceled by an equivalent investment in what came to be defined as "Amazonia Legal." (Q16)** A land market developed where none had existed before, and enormous speculative gains were there for the asking. Attracted by government largesse and promises of favorable tax treatment, numerous transnational corporations jumped in -- some, like the King Ranch and a Swift-Armour consortium experienced with cattle; others, like several European firms, not. A favorable FAO report on prospects for livestock in Latin America and another a few years later by the World Bank encouraged international development agencies to become involved, citing their mandates to promote "the downward redistribution of wealth and income for the betterment of the poor and landless." Between 1960 and 1980 the World Bank funded 123 livestock development projects, two-thirds of them in Latin American but more especially in Brazil. The IDB and AID were also active in the area. One Brazilian government report estimated that between 1960 and 1975, 38 percent of all the rainforest destroyed in that country could be attributed to large-scale cattle developments. Today there may be some eight million cattle in the Brazilian Amazon, about the same number as in Nebraska, "The Beef State."

In the last few years the golden flow has slowed, in part because of the foreign debt crisis facing Brazil and other Latin American countries. More importantly, experience has shown that stock-raising in the tropical forest, at least in Amazonia, is not the panacea it was once thought to be, that the soils under grass lack staying power, and that soil compaction from trampling and brush invasion are intractable problems, not to mention diseases, biting insects and poisonous weedy plants. The paucity of information and experience remains an overwhelming obstacle to successful ranching in the tropics. Geographer Susanna Hecht reports that nine out of ten of the new ranches along the Belem-Brazilia

went out of business within eight years of their establishment. Today this well-traveled highway passes through hundreds of miles of abandoned secondary scrub. Only with costly fertilizer and pesticide use, coupled with lower stocking rates and aggressive hand weeding, does there seem to be much hope for a sustainable ranching industry (Q17) on these upland (terra firme) soils.

The invading brush, usually seen as a major problem, may yet be converted into a valued resource. At least there may be potential for palatable browse in the few nitrogen-fixing legumes (Q18) among the many invading species here (one introduced browse plant, a *Stylothansus* from Australia, has given outstanding results), but as yet little advantage has been taken of them. In part it is a cultural problem, linked to the deeply rooted perception of an ideal stock-raising environment as composed of lovely, smooth European-type pastures. In fact animals that live in invaded, deteriorated pastures are sometimes fatter and glossier than those on clear pasture. Deeper root penetration gives brush species an advantage in nutrient cycling. So the search for those that nodulate continues. Fertilization of these acid soils is not only costly but of uncertain effectiveness. It often backfires, destroying mycorrhiza in the soil, locking up phosphorus and promoting the leaching of other essential nutrients such as calcium and potash.

As ranching the Amazon loses some of its gloss Brazil has been turning to a family of industrial mega-projects that promise even greater environmental impact, such as the damming of some of the region's major rivers, beginning with the Tucuri hydroelectric project on the Tocantins and the Gran Carajas mining development in which bauxite, iron ore, copper and the precious metals are all involved. The infrastructure of cities, railroads and highways promise to be on a Chicago-like scale. Most startling in the view of environmental groups would be the recently proposed construction of at least 20 iron smelters that would use wood in the form of charcoal as the main source of energy with the inevitable destruction of primary forest. Blast furnaces at last in the Amazon!

The conversion to pasture continues. It not only increases land values; it is the best way to secure land title (Q19), because here as elsewhere land unused (i.e. in forest) is always a potential target for squatter invasions or for expropriation under government land reform programs. So the visitor to Rondonia (recently opened a new land rush as a result of the asphaltting of a new 800-mile highway from Cuiaba north to Porto Velho) sees large areas in pasture but few cattle. Such is the logic of Amazonian development. Subsidies, fiscal incentives, new roads and speculation in an inflationary economy produce enormous untaxed capital gains for the few. Land has been a vehicle for the capture of subsidies just as it has on the irrigation projects on the arid west of the United States.

When the land itself has been of minimal importance, cautious management of it has seemed irrelevant and environmental degradation inevitable. It is ironic, as my colleague Hilgard Sternberg pointed out years ago, that even accepting the dubious hypothesis that the best way to meet the protein needs of the country is to increase beef production, this goal could be much more easily reached by using existing pasture in southern and central Brazil in a more rational, intensive way (Q20). The trade-off of the tropical rain forest, with its unique genetic diversity and potential, habitat of half the world's known species of living things, for the short-lived returns of the "pasture revolution," seems a singularly bad deal. And this takes no account of possible eventual impacts of forest removal on regional and global climates (Q21) or the annihilation of surviving Indian peoples who are so thoroughly integrated into this great tropical ecosystem.

Colombia and Venezuela present a rather different picture. In the north the dry season may last for five months. Deforestation has been most conspicuous in more humid interior locations against the mountains. Irrigated crops have competed successfully with the traditional cattle culture for the best land. As long ago as 1915, a packing house was built at Covenas near the mouth of the Sinu river in anticipation of the development of a major meat-export trade. Until the recent sharp devaluation of its currency, Venezuela had been a traditional importer of Colombian beef cattle, up to 200,000 a year moving across the border on the hoof. The doubling of cattle numbers and improved pasture area since 1950 in Colombia have been largely to supply the market demands of a population growing at more than three percent annually. Because of hoof-and-mouth disease, fresh and frozen beef from Colombia, as from the rest of South America, continues to be excluded from the United States.

In Colombia, where the "bull cult" is strong and where cattle numbers exceed humans, beef cattle utilize more than half the developed land, even in the mountains. In neither of the major commercial ranching areas, the Llanos (with 15 percent of the national herd) and the North Coast (with three times that number), have international assistance programs been of much significance in the continued expansion of the industry and the pastures supporting it. A semi-official Cattle Bank has been the principal source of credit. The old cattle culture of the North Coast (Costeno) has a traditional latifundia structure with large haciendas worked by a landless campesino class in a clientele relationship with the landholders. In the rainy Colombian Amazon (Caqueta, Putumayo) where forest removal following the completion of roads from the upper Magdalena Valley created a quarter-million hectares of improved fenced pasture, political violence and the turmoil associated with the clandestine coca-growing has put the brakes on development. For the rest of the country the carrying of herds through the long dry season (verano) is a major problem. Seasonal drives, a kind of transhumance, are the rule between the higher sabanas and the seasonally inundated floodplain of the Magdalena, where even at the height of dry season there is water and green grass. It is an area that in pre-Columbian times was intensively cultivated around the calendar under a unique system of chinampa-like raised garden beds.

In Ecuador and Peru, with much smaller populations, the cattle industry and thus the extension of man-made grasslands are less well developed, though petroleum discoveries on the Andean piedmont east of the Andes have led to the construction of several access roads that are attracting growing numbers of colonists with aspirations to become stockmen.

It is Central America that has of late been the focal point of much of the forest-to-pasture controversy. Here, where the political units are much smaller and the volcanic-derived soils often much better, deforestation has tended to be less destructive of the productive capability of the land. The explosion of cattle ranching has been promoted by superior transportation (the Pan-American Highway) and proximity to the open U.S. market. Although coffee remains the top export, two-thirds of Central America's farmland is devoted to cattle raising. Most of this is on the drier Pacific side of the isthmus. Stanley Heckadon suggests that the land-hungry peasants of Panama's Azuero district actively "hate" the forest. It stands in their way as an unfriendly barrier. But their neighbors, the Guaymi Indians on the other side of the isthmus, consider it a friendly home.

In Central America, too, the best way to establish land title has been to cut down the trees. Unless institutional brakes are placed on the potreroismo that has been sweeping these countries, it is projected that Central America may be completely denuded, except for national parks and reserves, within a decade. Yet per-capita consumption of beef may be lower today than when the rapid growth of

the industry began 25 years ago. A new cattle-ranching elite, politically powerful, has tended to replace the coffee elite as the ruling class. The Somozas of Nicaragua were a conspicuous example. The absence of hoof-and-mouth disease and the new demand for lean, grass-fed beef in the U.S. have especially favored the development of the export trade.

In 1984 the U.S. imported 44,000 tons of frozen boneless beef from the five Central American countries, down from a peak of more than twice that five years earlier. This represented between 10 and 15 percent of all U.S. frozen beef imports (New Zealand and Australia are the principal suppliers), between one and two percent of all U.S. consumption.

The conversion of forest to pasture in Central America, as in Amazona, may have peaked. Political unrest has contributed its share, encouraging herd liquidation and on-the-hoof exports to non-U.S. markets such as Mexico and Venezuela. But there has also been a growing recognition of the negative consequences of continued forest destruction -- flooding, soil erosion, reservoir siltation, losses of gene pool, wildlife, tourist attractions, (Q22) etc. Resulting social ills are no less obvious, including an increased migrant flow from countryside to city and declining production of traditional food crops. Small farmers tend to be driven off the land whenever cattle raising becomes dominant because cattle require little manpower. Ironically, rural unrest may work in favor of wildlife and discourage land clearing. It seems to be doing so on the east coast of Nicaragua, where there has been continuing conflict between the Miskito Indians and the government. In Panama the threat of continued clearing on the upper drainage of the Canal's Gatun Lake is a matter of widening public concern. Quick action may have thwarted an AID plan to bulldoze a military access road through a pristine rain forest in eastern Honduras. In Costa Rica, too, conservation groups and scientists associated with the Organization for Tropical Studies have been exceptionally active, supported by enlightened local political leadership and a substantial grant for land purchase for a tropical forest reserve by at least one major foreign foundation. There are signs that a new land ethic may be forming in which, as the late Archie Carr suggested, a quetzal or a condor may one day be prized above a cow. (Q23) But change comes slowly. Joseph Tosi's charge that "the innocent-looking beef cow is at the center of a destructive ecologic cycle that is strangling Central America" has yet to be refuted.

There has been much talk of late about "the hamburger connection," suggesting that the U.S. appetite for Big Macs or Whoppers might be responsible for the almost exponential rate of deforestation in Central America. But with this area's population growing at close to three percent a year, only 12 years will be needed to add another eight million people. (Q24) Tom Vale, University of Wisconsin geographer, has calculated that a decade of growth at these rates is all that is needed to absorb the productive potential of all the land currently devoted to export beef production. Even if Central America were to end exports, feeding the population growth would soon require all the land now used for maintaining livestock. Forest clearance would then resume. And if diets are to improve, still more land would be required. Cessation of beef exports would buy a little time but would hardly solve the problem. In the long run population growth will make equivalent demands on the forest.

Development is inevitably a destructive process. Production means pollution, breaking down, spreading out, using up. The best we can do is to minimize its harmful effects. The principal harmful effect of livestock development in the Third World is long-term environmental degradation, especially the destruction of tropical forests whose recovery even under the best of circumstances may require some hundreds of years. (Q25) Things have gone as they have in good part because the land has been

cheap or free and labor abundant, so that there has been little incentive for intensification or efficiency. The potential of existing pastures is far from being reached. "Even the sad yields that pastures do produce," writes James Nations, "carries no benefits for the local population, either Indians or immigrant colonists.... Food production systems practiced by traditional rain-forest people are, without exception, more productive than the pasturelands that are replacing these systems." He cites his own work among the forest Lacandons of Chiapas, who are being displaced by immigrants from the highlands inexperienced in rain-forest ways. They are laying waste to a previously productive selva for short-term gains.

Livestock production in developing countries is currently among the world's most inefficient industries. One report suggests that the present beef-cattle population of existing grassland areas of tropical America could probably be increased four or five times through application of available knowledge to existing pasture and animal resources. The cow, itself a product of the tropics, is a magnificent converter of cellulose, the best there is. With perseverance, a scaled-down but sustainable grassland economy based on sound ecological principles and the new findings of animal industry research centers in places like Australia, Puerto Rico and the International Center for Tropical Agriculture in Colombia may be within reach. But only if future population growth can be held within check. (Q26) More than enough of the forest has already been cleared to make room for the cow. It is time to pause in this mindless assault upon nature, time to think more in terms of saving what is left. We are rapidly running out of time and forest.