

The Root of the Problem

WHAT'S DRIVING TROPICAL DEFORESTATION TODAY?

Cattle and Pasture



Union of Concerned Scientists

Citizens and Scientists for Environmental Solutions



CHAPTER 5

Cattle and Pasture

Doug Boucher

COMPARED WITH OTHER FORMS of agriculture, cattle production is a fundamentally different way of producing our food. Unlike fruits and vegetables, which people eat directly, beef (and other meat) is produced in a two-step process: plants feed cattle and then their meat and milk feed humans. Beef production also differs from the other two principal kinds of livestock—pigs and chickens—because it mostly uses pasture or harvested forage crops like alfalfa instead of grain crops to feed the cattle. These features explain how cattle pasture has become the main driver of deforestation in Latin America in recent years.

Rumens and Pastures

Cattle are able to eat pasture grasses, which are inedible to humans and most other animals, because of their unique digestive system. As *ruminants*, cattle have a stomach called a *rumen* that contains a collection of beneficial bacteria and other microbes that can break down cellulose. This abundant molecule in plants has a complex chemical structure that makes it difficult for most animals to digest.

With the aid of their ruminant bacteria, however, cattle (and other ruminants such as sheep, goats, deer, and llamas) can break down most cellulose and extract its energy. This allows them to grow on a grass diet, although they grow even faster with protein sources (e.g., soy meal) and grain (e.g., maize). The ability to digest cellulose means that cattle can graze on many kinds of “rangelands,” including some that could not produce appreciable amounts of crops because the climate is too dry, the soil is infertile, etc. So, cattle can turn large amounts of inedible plant matter into edible meat and milk (Herrero et al. 2009).

There is a cost, however, and it can be a very large one. This conversion of grass to beef is quite inefficient, and only about 2 percent of what cattle eat ends up as

meat that people can consume. Thus, even in the European Union, where productivity is relatively high, it takes about nine hectares of permanent pasture plus about three hectares of cropland to produce one ton of meat. This compares with less than one hectare of cropland to produce one ton of poultry or pork (Wirsenius, Hedenus, and Mohlin 2010).

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Using cattle to produce food for humans is inherently *extensive*, meaning it requires large amounts of land to generate relatively small amounts of food. Supplementing pasture with feed grains and legumes can reduce the amount of land needed, even taking into account the land where feed is grown. However, the process still requires much more land than the alternatives—not only plant-based foods but also other animal products such as chicken, eggs, and pork (Wirsenius, Hedenus, and Mohlin 2010).

The result is that about 70 percent of the land used for agriculture globally is pasture (3.4 billion out of 4.9 billion hectares) (Steinfeld et al. 2010) (see Chapter 3). However, only about 33 percent of the protein and 17 percent of the calories consumed by humans come from animals (Herrero et al. 2009). Of that amount over two-thirds comes from pigs and poultry, not from pasture-fed ruminants (Chapters 6 and 12 in Steinfeld et al.

2010). Thus just 6 to 11 percent of humanity's food comes from those pastures that make up 70 percent of the agricultural lands we use.

Cattle Colonize the Americas

While cattle are not native to the New World, they were introduced by the Spanish within a few years of 1492 and have been an important part of the humanized landscape of the Americas for centuries (Crosby 1986/2004). Much of the Pacific coast of Mexico, Central America, and South America, as well as the temperate grasslands of Argentina, was converted to cattle pasture early on, but large-scale expansion into the tropical forest lowlands is a more recent phenomenon.

In Central America this expansion occurred as part of the push into the wet eastern coast of the isthmus from the long-settled and drier western coast, and did not begin until the latter half of the twentieth century. In South America it involved movement into the Amazon lowlands from all sides—south from Venezuela and Colombia, east from Ecuador and Peru, and north from Bolivia—but most intensively and rapidly in Brazil, where cattle production moved from the long-settled southern part of the country northward and westward

into Amazonia. As with soybeans (see Chapter 4), the most dramatic changes in Brazil have occurred in just the past few decades.

Export-led Expansion in Brazil

Under the military dictatorship in the 1960s and 1970s, Brazil's development of the Amazon was promoted and subsidized, and the cattle industry began to penetrate into the region. However, the cattle boom really took off in the 1990s, driven by growth in exports (Nepstad, Stickler, and Almeida 2006). This was favored by changes in currency exchange rates. Then in the 2000s the elimination of foot-and-mouth disease, which formerly prevented shipments of beef from Amazon states overseas, permitted a further increase in exports (Kaimowitz et al. 2004). While domestic beef consumption grew slightly, the big jump was in exports, which increased seven-fold in a decade. A fourth of Brazil's beef production now comes from the Amazon; the country is the largest beef exporter in the world (Cederberg et al. 2011).

As new land was converted to pasture in the Amazon, in the south pastures were converted to crops or abandoned so that Brazil's pasture area hardly increased



The Amazon rain forest is being cleared to make room for cattle



Deforested cattle pasture in Guatemala

above the level reached in the mid-1970s. The economic advantage of the move northward was not because the Amazon lands were better pastures. In fact, cattle productivity (carcass weight/hectare/year) in the Amazon was more than 40 percent less than the national average in 1996, and was still 30 percent less a decade later (Cederberg et al. 2011). But the cost of land was much lower in the north, so it still made economic sense to expand there (Kaimowitz et al. 2004).

Cattle Consume the Forest

While cattle pasture previously required little new clearing of forest as it expanded into savannas, temperate grasslands, or long-deforested areas in southern Brazil, in the Amazon the forest was in the way. Thus the expansion northward led to large-scale deforestation. Usually the forest was cleared and burned, with very little of the timber used (Kaimowitz et al. 2004). The point was to clear the land, and the trees were simply an obstacle to be removed. With the clearing of forest increasing the value of the land five- to ten-fold, cattle ranching in the Amazon could be profitable even though productivity was low (McAlpine et al. 2009).

The result was widespread deforestation as the industry moved into the rain forest. At both the state and municipal levels, deforestation correlated with the

growth of the cattle herd (Kaimowitz et al. 2004). While sometimes the transition to pasture would pass through an intermediate cropping stage for a few years, and pasture might later be abandoned and begin changing back to secondary forest, overall the trend was strongly from forest to pasture (Cederberg et al. 2011; Ramankutty et al. 2006; Fearnside 1997). Although soy became an important driver for a certain number of years (see Chapter 4), pasture was by far the pre-

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dominant new land use in the deforested region, occupying over 85 percent of the agricultural land in the “legal” Amazon (Kaimowitz et al. 2004).

The Role of Fire

Fire is a key component of deforestation for pasture. Land clearing is concentrated overwhelmingly in the

dry season in tropical forest regions, particularly in the wetter regions. Thus in the “arc of deforestation” along the southern edge of Amazonia, most forest clearing takes place during the dry season between June and November when the cut logs and branches can be burned after clearing. This initial clearing and burning leads to the loss of half or more of the forest’s carbon (Chapter 5 in Steinfeld et al. 2010).

However, burning continues in subsequent years, since fires are an effective way to stimulate continued pasture growth during the dry season. Normally the productivity of pasture grasses slows greatly as the rains diminish, but burning helps them re-sprout from the roots and thus produce a new supply of tender shoots at a critical time. It also helps maintain the pasture by killing weeds, as well as the saplings of trees and shrubs that would otherwise colonize and eventually shade out the grass.

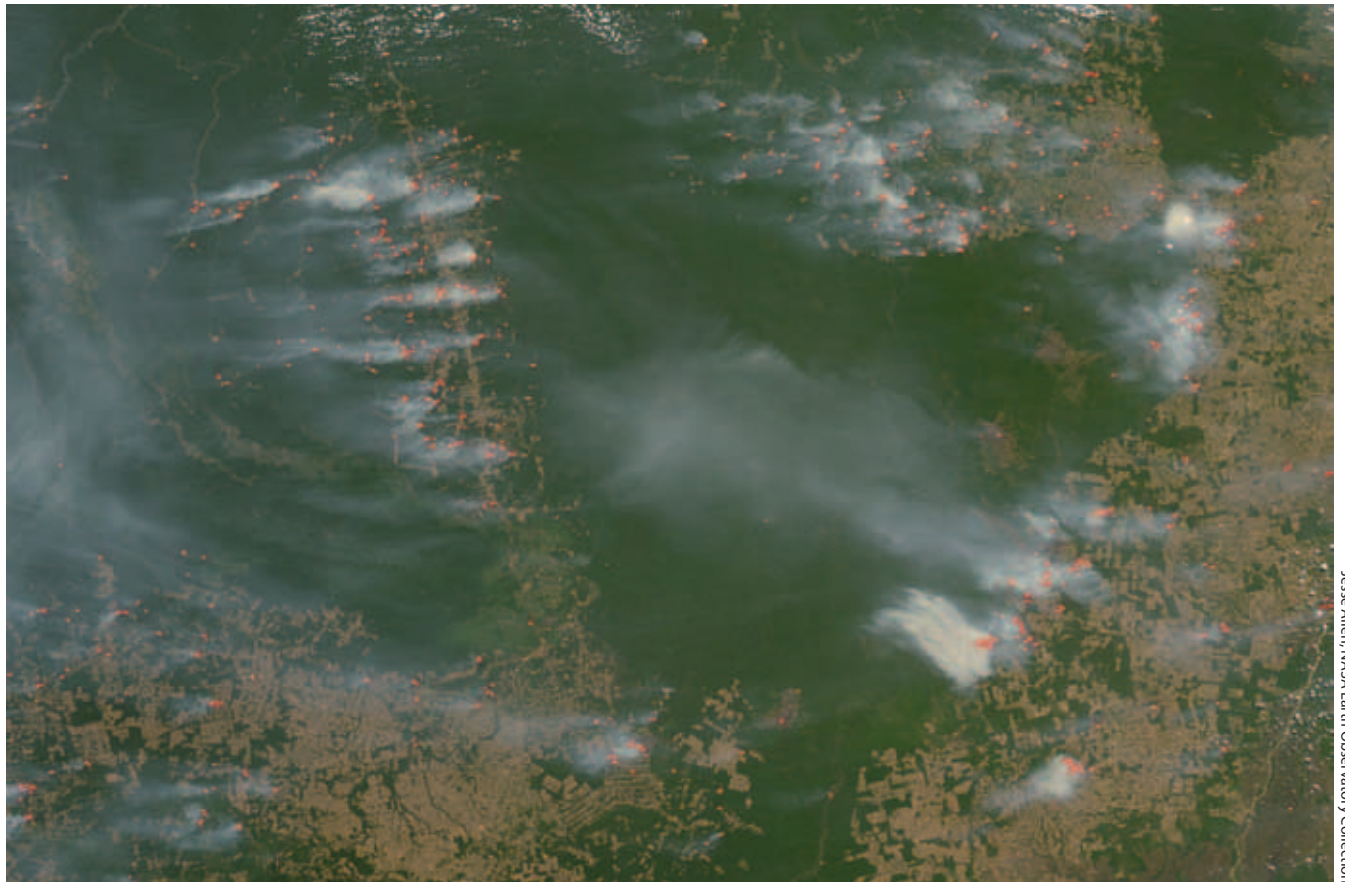
These repeated dry season fires tend to cause a net loss of additional carbon from the system, as well as other nutrients. This results in continued emissions of carbon dioxide, promoting global warming. It also causes losses of nitrogen and other nutrients from the

soil (Chapter 5 in Steinfeld et al. 2010). Over the long term, the productivity of pasture declines and it may eventually need to be abandoned.

A Low-Productivity Industry

While the Brazilian cattle industry showed the same pattern of rapid export-driven expansion northward into the Amazon as the soybean industry (see Chapter 4), it was quite different in some important ways (Morton et al. 2006). Unlike soy, cattle production was extensive rather than intensive, with low levels of investment per hectare, frequent abandonment of the cleared land, and a low level of productivity. As soybean production entered an area, it would often displace cattle ranching farther into the forest, since the potential profits were considerably greater from soy for those who could make the necessary investments (Barona et al. 2010).

Amazon cattle ranchers used the land wastefully, even compared with their compatriots farther south. Stocking rates (animals per hectare) were low, and slow growth rates of the animals led to low rates of meat production per year as well as per hectare (McAlpine



Satellite photo showing fires set to clear forest in the Amazon

et al. 2009). Supplemental feeding with energy-rich grains and protein meal was rare, despite the boom in soybean production in the same region. Pastures were seldom improved with legumes and hardly ever fertilized; abandoning them and clearing new areas from forest was more profitable. With the prevailing abandonment rates in the 1990s, barely half of the cleared land would remain in production over the long term (Cederberg et al. 2011). Employment levels in ranching were low, and ownership was highly concentrated

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in a small number of owners. All in all, the cattle industry was based on using small amounts of capital and labor combined with the large extensions of cheap land that could be obtained by clearing the forest. That, plus the rapid growth of export demand, was enough to make it profitable.

Pressure Builds on the Industry

With the growth of the environmental and social movements in Brazil in the 2000s and the commitment of the new government of Luis Inacio Lula da Silva to reduce deforestation, a more skeptical view of the industry as the principal agent of deforestation was inevitable. However, for the first several years of Lula's administration (beginning in 2003), actions to reduce deforestation emphasized the creation of protected areas and recognition of indigenous lands, as well as enforcement actions against illegal logging. These steps did in fact bring down the deforestation rate substantially (Ricketts et al. 2010). Additionally, the rising Brazilian environmental movement pushed not only for strong government action, but also for direct steps by the cattle industry at all points along the supply chain.

With the publication of two widely publicized reports by Brazilian non-governmental organizations (NGOs) in April and June 2009, the pressure became irresistible. Amigos da Terra Amazonia Brasileira's *Time to Pay the Bill* and Greenpeace's *Slaughtering the Amazon* (Amigos da Terra 2009; Greenpeace 2009) showed how cattle pasture creation played an overwhelming role in destroying the Amazon forest. The



Soybean production often displaces cattle ranching further into the forest

reports placed the responsibility not only on the ranchers, but on the banks that financed deforestation, the slaughterhouses that bought the meat, the exporters that shipped it abroad, and the government policies that directly and indirectly subsidized the whole process. As with the soybean industry three years before (Rudorff et al. 2011), these two organizations demanded a moratorium on deforestation, calling for players throughout the supply chain to take action.

The Beef Moratorium

While ranchers objected loudly, the other parts of the export supply chain, recognizing their vulnerability to bad publicity, quickly realized that they needed to deal with the controversy. The action of the World Bank, which quickly canceled its loan for Amazon expansion by Bertin, S.A.—Brazil's largest beef exporter and the second largest in the world—showed the financial

risk. Within days, major supermarket chains in Brazil announced they were suspending purchases of beef from Bertin.

Because slaughtering, packing, distributing, and exporting were concentrated within a small number of large businesses, it was clear that deforestation could be stopped through purchasing power. So in July 2009, the major slaughterhouses and distributors announced they would refuse to buy cattle from any ranch that expanded its pasture at the expense of the forest.

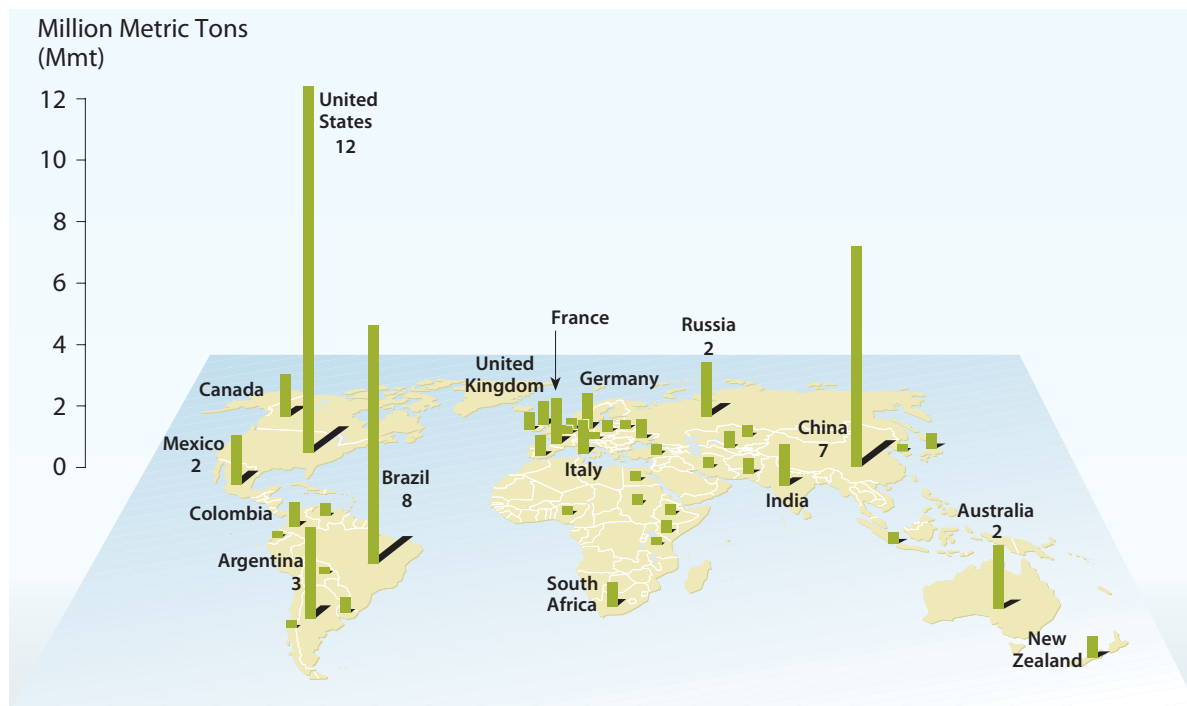
Enforcement was based on overlaying the boundaries of each ranch (its “polygon”) with the satellite photos showing deforestation, which are made public on the Web by the Brazilian National Space Research Institute, INPE. Either a ranch would have to provide the polygon information to the slaughterhouse or (since boundaries of some ranches are poorly delimited, and ranchers are often reluctant to share this information even when they have it for fear of government action against them) demonstrate that it was located at least 10 km away from any deforestation area.

It is too early to assess the success of the Brazilian beef moratorium, which only went into effect two years ago. However, the success of the soy moratorium, operating in the same region and enforced using similar satellite technology, is an indication that the same approach can work with beef.

Other related industries have now been brought into the beef moratorium. For example, leather from the hides of Amazon cattle is also exported, and can end up in products like shoes, handbags, and cars. This is not as important as beef as an economic driver of pasture expansion—the hides are relatively low in quality and only worth selling as a by-product of beef—but it



Aerial view of cattle in the Brazilian Amazon

Figure 5.1. Map of Beef Production by Country, 2006

Among tropical forest countries, only Brazil has a substantial share of global production.

Source: United Nations Environment Programme 2009, ©Philippe Rekacewicz, Paris.

does provide some additional income to ranches. Thus, NGOs such as the National Wildlife Federation have been working with leather companies to ensure that none of their products come from pastures created by deforesting the Amazon rain forest.

There are also other products from Brazilian cattle, but they are of minor importance in relation to deforestation. The country's milk and dairy products come almost exclusively from the cooler areas in the south, not from the Amazon. Beef tallow and waste products from slaughterhouses can be used to create biodiesel fuels, but this is only done in tiny amounts, and nearly all of Brazil's biofuel is in the form of ethanol derived from sugar cane.

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Other Countries

This chapter has concentrated on the Brazilian Amazon because it is the best-studied example of pasture

expansion as a driver of deforestation, and because it is the cause of much more forest loss than in any other country (Figure 5.1). Wassenaar et al. (2007) estimated that 17 million hectares of forest would be lost to pasture in Brazil over the first decade of the 2000s; the estimate for the next largest country was Colombia at only 3.4 million hectares, followed by Bolivia and Peru at 1.5 million hectares each.

In Colombia, as in Brazil, cattle pasture expansion has played the leading role in tropical deforestation, with crops occupying only a small proportion of cleared land (Etter et al. 2006). Production has been extensive and productivity low, and until recently export to the United States and Central America was prohibited because of foot-and-mouth disease (McAlpine et al. 2009). Cattle were introduced into savanna areas such as the *llanos* many decades ago but only recently have moved farther southeast and entered the forested lowlands of the Orinoco and Amazon in large numbers. Once deforestation begins in an area it tends to proceed rapidly, with forest cover declining from 85 percent to below 20 percent in the space of 15 years (Etter et al. 2006). While showing some of the same patterns as Brazil, pasture-driven deforestation in

Colombia has differed in that the influence of the export market has been small and there has been no beef moratorium yet. Furthermore, deforestation seems to follow the rivers rather than expansion of the road network (Armenteras et al. 2006).

The cattle industry has also been a principal driver of deforestation in other Latin American countries, with exports being important in some (as in Brazil) but minor in others (as in Colombia). In the Amazon, where almost all of the remaining forest is found, there is some indication that its importance increased from

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the 1980s to the 1990s, while in Central America the reverse trend may have occurred (Rudel et al. 2009).

In contrast to its overwhelming role in the Americas, cattle ranching is not an important driver of deforestation in Africa and Asia (Rudel et al. 2009) despite the fact that some Old World regions have high densities of cattle, such as East Africa and South Asia (Figure 9-1 in Steinfeld et al. 2010). This is partly due to their extensive grasslands. In India, the trend has actually been one of major reforestation rather than deforestation. It is worth mentioning that, despite the well-known fact that Hinduism prohibits eating “sacred cows,” the subcontinent’s cattle herd is a vital source of both dairy products and power for plowing and transport (Harris 1966).

Cattle Pasture and Future Deforestation

The extensive nature and low productivity of tropical pasture-based beef production is an underlying reason

why it can be an important driver of deforestation, but it also suggests an alternative future: increasing production by increasing productivity per hectare. There is certainly a great deal of room for improvements such as higher stocking rates, more productive pastures, rotational grazing, and breeds better adapted to tropical conditions (Steinfeld et al. 2010; Herrero et al. 2009). Some of this kind of improvement has already taken place in Brazil, with ranchers planting legumes and higher-quality grasses to improve pasture and finding ways to increase stockings (maintaining more head of cattle per hectare).

Such changes are generally referred to as “intensification,” meaning using less land. On the other hand, “intensification” is often taken to mean the use of more inputs such as feed grains and protein supplements, or concentration of animals in CAFOs (confined animal feeding operations). When used this way it raises many questions concerning its environmental and social impacts (Gurian-Sherman 2011; Steinfeld et al. 2010; Herrero et al. 2009; Gurian-Sherman 2008). Furthermore, there is a fundamental issue regarding whether feeding grain and soy to cattle is the best way to produce protein for people. Even without considering vegetarian alternatives or comparing health effects, the big difference in the efficiency of pigs and chickens versus beef cattle as producers of meat suggests that encouraging less consumption of beef and more pork and poultry would be a better approach (see Chapter 2) (Wirsenius, Hedenus, and Mohlin 2010; Steinfeld et al. 2010).

But even in the short term the encouraging initial results of the beef moratorium in Brazil suggest that deforestation due to pasture expansion can be stopped without waiting for major changes in diets or production systems. Deforestation has dropped to record low levels in Brazil despite major spikes in world food prices and continued steady growth of both the country’s cattle herd and its beef exports (Boucher 2011). Combined with the example of nations in the Old World in which large cattle herds are not driving deforestation, this suggests that although pasture expansion has been a major driver of deforestation in the past, it does not have to be in the future.

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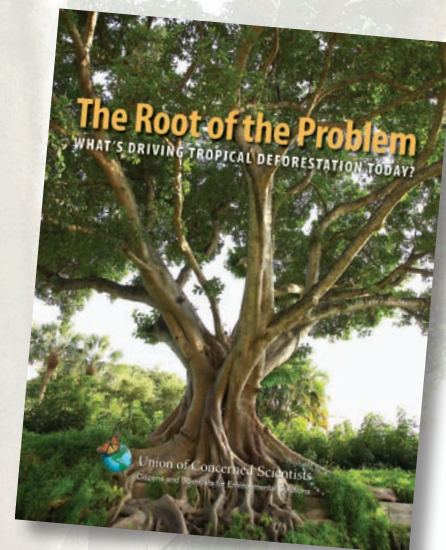
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The Root of the Problem

WHAT'S DRIVING TROPICAL DEFORESTATION TODAY?

Deforestation and forest degradation have been occurring for thousands of years. Both are important sources of global warming pollution, as well as threats to biodiversity and the livelihoods of forest peoples. Thus it is important to understand the causes of these changes—the “drivers” of deforestation.

In this report we focus on the economic agents that currently play a critical role in deforestation, as well as agents that have played a historical role in deforestation (to determine their role today).



Background and Context

- Chapter 1: Introduction
- Chapter 2: Population and Diet
- Chapter 3: Tropical Forest Regions

Agents of Deforestation

- Chapter 4: Soybeans
- Chapter 5: Cattle and Pasture
- Chapter 6: Palm Oil
- Chapter 7: Timber and Pulp
- Chapter 8: Wood for Fuel
- Chapter 9: Small-Scale Farming and Shifting Cultivation

Solutions and Successes

- Chapter 10: Successes
- Chapter 11: Development without Deforestation

The full report, executive summary, and chapters are available online (in PDF format) at www.ucsusa.org/whatsdrivingdeforestation.

Doug Boucher, Calen May-Tobin, Katherine Lininger, and Sarah Roquemore work in the Tropical Forest & Climate Initiative at the Union of Concerned Scientists. Patricia (Pipa) Elias and Earl Saxon are consultants to the Tropical Forest & Climate Initiative.

About the Union of Concerned Scientists

The Union of Concerned Scientists (UCS) is the leading science-based nonprofit working for a healthy environment and a safer world. UCS combines independent scientific research and citizen action to develop innovative, practical solutions and to secure responsible changes in government policy, corporate practices, and consumer choices. More information is available about UCS at www.ucsusa.org.

About the Tropical Forest & Climate Initiative

The Tropical Forest & Climate Initiative (TFCI) is a project of the UCS Climate and Energy Program. TFCI analyzes and promotes ways to cut global warming pollution by reducing tropical deforestation. To learn more about this work, visit www.ucsusa.org/forests.

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National Headquarters

Two Brattle Square
Cambridge, MA 02138-3780
Phone: (617) 547-5552
Fax: (617) 864-9405

Washington, DC, Office

1825 K St. NW, Suite 800
Washington, DC 20006-1232
Phone: (202) 223-6133
Fax: (202) 223-6162

West Coast Office

2397 Shattuck Ave., Suite 203
Berkeley, CA 94704-1567
Phone: (510) 843-1872
Fax: (510) 843-3785

Midwest Office

One N. LaSalle St., Suite 1904
Chicago, IL 60602-4064
Phone: (312) 578-1750
Fax: (312) 578-1751