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# The Green vs. the Brown Amazon

**By John Terborgh**

*The Last Forest: The Amazon in the Age of Globalization*
by Mark London and Brian Kelly
Random House, 312 pp., $25.95

One of the first things any Brazilian tells a foreigner is that Brazil is really two countries: the south and the north. With a highly educated population of predominantly European origin, the south, with its two great cities of Rio de Janeiro and São Paulo, is becoming an agricultural and industrial superpower, producing computers and advanced pharmaceuticals and exporting large numbers of jet aircraft to the US. Brazil has attained world-class status in forestry, ranching, and agriculture. Even more significant for the future is that largely through the use of biofuels, such as alcohol derived from sugar cane, it is one of the few countries in the world to have achieved self-sufficiency in energy. When oil reaches $100 a barrel, Brazil will be sitting pretty.

The north, in truth, is another country in all but political geography. A mostly non-European population languishes in poverty and illiteracy. With the exception of the largest cities, the north is saddled with the vestiges of a feudal past. Descendants of African slaves crowd the northeast whereas people of mixed African, European, and indigenous origin populate the huge region centered on the Amazon River and its tributaries—a region known simply as the Amazon. Since the days of the conquistadores, the Amazon has never had a stable economy. Cycles of boom and bust have encouraged a get-rich-quick mentality and lack of allegiance to place.

After five centuries of ignoring the north, powerful interests in the south have recently taken interest in the resources of the Amazon, precipitating a paroxysm of change in the north that will affect the entire world. Politics will guide the course of change but how, and for what reasons, remains uncertain, for internal and external forces are pulling in opposite directions. Internal forces, large corporations among them, overwhelmingly favor rapid development of the Amazon—expansion of the logging, mining, and agricultural frontiers. By contrast, those concerned with the world environment view the "loss" of the Amazon as an impending global tragedy. They want to find ways to sustain the vast forest, and with it, an unrivaled wealth of biological diversity, hundreds of indigenous tribes, and, of increasing importance, the vast store of carbon contained in the Amazon's trees.

How will these tensions play out? What happens to the Amazon over the next two or three decades may prove decisive in the world's efforts to curb greenhouse gas emissions. If the Brazilian government continues to take a cautious approach to energy policy, as it has for several decades, and makes an effort to plan and control

development in the Amazon, the area could serve as a model for the world's remaining regions of forest wilderness—among them the Congo basin, Siberia, northern Canada, and the outer islands of Indonesia. But if Brazil chooses to follow a business-as-usual policy—a laissez-faire, Wild West scramble for resources—it could push the South American continent, if not the world, over a climatic tipping point from which there would be no return, a prospect that should be of concern to everyone on the planet. Do Mark London and Brian Kelly in *The Last Forest* get to the heart of the problem? Not in my view. Their account is engaging, sometimes entertaining, but overall superficial, a one-eyed vision of a deep and complex set of issues.

Neither writer can claim to be an expert on the Amazon and it is not clear that either speaks Portuguese—an essential requirement for inquiring into the Brazilian mind. London is a lawyer in Washington, D.C., and Kelly is a journalist—the executive editor of *US News and World Report*. For them, the Amazon is a pastime—approached with passion and seriousness, to be sure—but inescapably they see it as outsiders looking in. Nearly twenty-five years ago, when they were earnest young adventurers, they wrote another book—*Amazon*. This is the sequel, building on the earlier experience to judge the pace and direction of change.

The text is a collage of anecdotes and interviews conducted over the course of several trips and thousands of miles traveled by air, water, and land. The authors sampled a broad spectrum of opinion from ministers and politicians to lowly slum dwellers, boat drivers, and *caboclos* (people who live on the riverbanks of the roadless interior of the Amazon). The scores of interviews and opinions may seem to the reader like a pointillist canvas viewed too closely, so that the emergent picture is blurred. London and Kelly succeed in conveying some of the distinct flavor of Brazil, but overall their work is frustrating for its blind spots and its failure to integrate the pieces into a coherent whole.

For the authors, the Amazon is synonymous with the Brazilian Amazon. They chose to ignore the fact that about 40 percent of the Amazon basin, including the headwaters of several of the largest tributaries, lies in neighboring countries. To present the Amazon as a solely Brazilian entity is to put on blinders, for many of the insights the authors draw from their travels and interviews do not apply to neighboring countries. The Amazon is really a much more complex, varied, and interesting place than these two intrepid travelers reveal.

Five Andean countries share the Amazon with Brazil. I have lived more than ten years in two of them: Vene-zuela and Peru. Both are radically different from Brazil with respect to many of the issues discussed in the book. Venezuela shortsightedly subsists on oil revenues and has become one of the most urbanized countries on earth; all but a small number of its inhabitants have lost all traces of the rural know-how that enables survival on a remote frontier. Government-sponsored efforts to promote settlement of the unpopulated interior have persistently failed to attract volunteers.

In contrast, Peru has an inward-looking indigenous population and a postcolonial history of feudalism that ended only in 1968 with the leftist military government of Juan Velasco Alvarado. Peru's population centers are along the Pacific coast and in

the Andes. Although the Amazon region makes up more than half the national territory, educated Peruvians have persistently shunned it as an insect- and snake-filled inferno. Government investment in the region has correspondingly been minimal. During the post–World War II period the main settlers in the Peruvian Amazon region have been Quechua-speaking people who have been impelled by demographic pressures to move down from the Andean mountains. Land-hungry peasants with no previous knowledge of lowland agriculture, they have made their way into sub-Andean valleys where growing coca leaf for the drug trade has proven to be the most lucrative economic choice. As strikingly different from each other as both are from Brazil, Venezuela and Peru have in common that upward of 90 percent of their shares of the Amazon basin remain in their natural state to the present day. The land fever that grips Brazil has not touched either of the two countries, at least not yet.

Land fever is the dominant theme in the Brazilian Amazon. Here is where London and Kelly are at their best. Through the eyes of their interviewees, they portray the competition between poor farmers and forest dwellers and representatives of powerful business interests in the rush to secure unoccupied land. We are introduced to the plight of the many losers and the braggadocio of a few big winners. A subtheme is the clash between the traditional lifestyles of *caboclos* and rubber tappers and the frenzied expansionism of cattlemen and soy farmers. The clash plays out in an atmosphere of fear and violence. The assassination by cattlemen of Chico Mendes, a leader of rubber tappers, briefly brought the festering conflict to the world's attention, but this was only one tragedy among untold hundreds of others.

Violent takeovers of land are a visible manifestation of the failure of the Brazilian government to reform a chaotic and archaic system of land titles dating back to the Portuguese colonial period. Many if not most land titles in the Amazon are bogus, having been obtained through bribery, forgery, or other illegal means. Multiple overlapping titles are the norm, in part because the land is so vast and inaccessible that it has never been surveyed. The result is an anarchic situation in which raw power tends to prevail.

Land fever is driven by multiple forces that so far have been peculiar to the Brazilian Amazon. The consolidation of agricultural land in the rich South dispossessed thousands of less fortunate farmers who sought to establish new lives in the north. These are the people who in recent decades have flooded into the central and western states of Goias, Mato Grosso, Rondônia, and Acre. The lure of quick profits in raising cattle and growing soy has been attracting much larger investors, such as Blario Maggi, governor of Mato Grosso, and the US grain giant Cargill, along with commensurately large investments. One has only to fly over Mato Grosso to see the future of agriculture in Brazil. The farms are enormous, dwarfing those in, say, Illinois or Iowa. The future for small farmers in Brazil, as elsewhere, looks bleak.

It stretches the mind to contemplate the size of the Amazon basin, an area equal to roughly 90 percent of the continental US. Perhaps the most memorable and inspiring flight I have ever taken was from Santa Cruz in Bolivia to Miami on a clear day. We traveled at 30,000 feet for hour after hour without seeing any sign that human beings had ever intervened in the seemingly limitless expanse of green

slowly passing beneath us. One has to wonder what sights will meet the eyes of fliers a decade or two hence, for the entire region is in transition. London and Kelly pose the question whether the region is being propelled toward another boom-and-bust cycle or toward a more sustainable future.

Even today, one of the Amazon region's largest cities, Iquitos in Peru, has no road to anywhere else. Incongruous as this may seem in our interconnected world, even stranger is the sight that greets a traveler landing at Iquitos, Manaus, or many smaller Amazonian cities. As the plane closes in on the runway, the view is one of unbroken forest extending to the distant horizon. A visitor from Europe or North America expects to see the usual signs of the city's rural support system: fields, roads, pastures, villages. But not in the Amazon. Suddenly there is an opening in the forest and the aircraft settles onto the runway. From the forest to concrete, there isn't any in-between. I don't know another place in the world like it, short of perhaps the Arctic.

There is of course a reason for the odd juxtaposition of forest and city. The soils of much of the Amazon are notoriously poor, having been leached of every atom of plant-nourishing minerals by millennia of drenching tropical rains. There are nutrients, yes, or there would be no forest, but up to 90 percent or more of them, such as nitrogen, potassium, and phosphorus, are locked up in the living and organic components of the ecosystem, primarily the trees themselves. Cut down the forest, and the nutrients are lost. Decades at a minimum are required for the leisurely processes of nature to restore them. Thus sustainable farming, at least up to now, has not been achieved. (Though it should be noted that native Americans achieved high population densities along the Amazon using now forgotten technologies.) Consequently, the food that sustains large cities like Iquitos and Manaus, apart from river fish, must be largely imported by ship from the outside world.

Scientific knowledge of nutrient cycling in the intact forest, reinforced by the demonstrable failure to overcome the environmental impediments to sustainable agriculture, has established the myth that agriculture is impossible in the Amazon. Flowing from this myth is the conclusion that no good can come from clearing the forest; doing so would convert the Amazon into a wasteland for only fleeting gain. Conservationists used this argument to urge governments to look elsewhere for development opportunities in the hope that the world's most diverse ecosystem could remain largely intact for posterity. The passage of time has now altered the assumptions of this argument and the Amazon faces threats from new quarters.

Modern settlement of the Amazon began in the 1970s with the launching of the Transamazon highway system under the military government of President Emìlio Médici. Vast territories were then unsettled, especially near the border of the Brazilian national territory. Military planners, whose influence in the government was then paramount, felt that unpopulated lands in remote frontier regions were at risk of being annexed by neighboring countries. Spanish-speaking people, they feared, could move undetected from across the border and create pockets of allegiance to the neighboring countries. Worse, indigenous tribes might learn Spanish before they learned Portuguese and become estranged from their homeland. Such concerns, however far-fetched they may have been, were much on the minds of the generals.

The military government built roads and encouraged settlement in the Amazon through two kinds of incentives: organized resettlement programs for the poor and the offer of attractive subsidized loans to those fortunate enough (or with the right political connections) to qualify for them. Organized settlements for poor, would-be farmers were carved out of the wilderness. Centrally located larger towns (*agrópolis*, *ruropólis*) lay at the hub of a wheel with satellite towns (*agrovillas*) located at the ends of spokes. Each settler received 100 hectares (about 250 acres) of which, by law, 50 percent was to be retained as forest. These early resettlement projects had mixed success. Lack of planning meant that soils were often of poor quality or did not have adequate drainage. But most often, what defeated the settlers was lack of transportation. The first-generation roads were unpaved. Torrential rains turned them into ribbons of quagmire for months at a time, leaving the settlements isolated without access to markets and no means of acquiring fertilizer or other essential goods. London and Kelly lurched from pothole to pothole for several days on one of these roads, encountering only one lone settler along the way. Many such projects failed, as disenchanted settlers left to seek better opportunities elsewhere.

For the politically connected businessman there were subsidized loans designed to promote cattle ranching in the rainforest. Brazil was then experiencing rapid inflation. The loans carried low rates of interest—far below the rate of inflation—so that they could be repaid in devalued currency. The loan program was widely abused. Borrowers would use a small portion of their loans to hire a crew of poor peasants to clear land and then invest the remainder in land or other speculative investments that were appreciating at the rate of inflation or higher. This was immensely profitable but the ranching economy the loans were intended to encourage proved largely a sham. The productivity of Amazonian cattle pastures declined inexorably because of leaching of nutrients, invasion of weeds, and soil compaction from the hooves of the animals. The typical useful life of a pasture was five years. Additional forest had to be felled to create new pastures or the ranch went into decline. Owners frequently lived in the South and neglected their ranches because their real interests were in the business ventures they surreptitiously financed with their loans.

Ironically, schemes to promote rural development in this period often failed whereas urban development flourished. Manaus was declared a duty-free port and soon had a thriving industrial sector. The lure of jobs drew thousands of *caboclos* in from the isolation of the forest, swelling Manaus to a city of nearly two million. The population of the Brazilian Amazon region is now 80 percent urban. No one in 1970 imagined that would be the case. Unforeseen developments can overturn seemingly unassailable assumptions.

The story of the Amazon continues to unfold as a saga of unforeseen developments. Consider the *cerrado*, a vast belt of grassland that swept from southwest to northeast through the heart of Brazil. The *cerrado* is a big prairie, comparable to our great plains. Numerous attempts to farm it failed and it was widely believed that the soils were too poor to support agriculture. It remained essentially intact until the 1970s when it was discovered that a generous application of crushed phosphate rock could convert the *cerrado* into a breadbasket. Farming in the *cerrado* proved highly profitable and set off an explosive land rush. By the end of the century only 7 percent of it remained in a

natural state, presenting a conservation emergency. No one had foreseen the boom. Few protected areas had been established in the *cerrado* before it came under assault. In 2005, I traveled ten hours by bus from Brasìlia in the northern cerrado to Uberlandia in the south and saw no more of the natural savanna than one would see of our native tall grass prairie in traveling between Minneapolis and Kansas City.

The lesson of the *cerrado* is one I think will continue to apply to future development in Brazil, and is especially relevant to the Amazon region. All that was required to stimulate development of the *cerrado* was a little bit of science: the knowledge that the agricultural potential of the soil was constrained by a deficiency of phosphorus. That constraint was easily overcome. Other constraints continue to impede agricultural expansion into the Amazon basin. The soils there are even less fertile than those of the *cerrado*. Heavy rains leach the soil and engender erosion. The more humid climate sustains a greater diversity of weeds, pests, and pathogens. But these are merely technical challenges that could be overcome if the incentives were there. The myth that rainforest soils can't be farmed is just that—a myth, as was convincingly demonstrated by North Carolina State University soil scientist Pedro Sanchez and others in the 1980s. All that is lacking is infrastructure such as roads, ports, and power plants, as well as sufficient market incentives. The Brazilian government knows this, even if the rest of the world doesn't. That is why the government is so eager to push ahead with the project called *Avança Brasil*.

*Avança Brasil*, like many other things Brazilian, is grandiose in scale and conception. It is a multifaceted, multibillion-dollar program for infrastructure development. And, of course, it is highly controversial. Conservationists see it as anathema; the pro-development visionaries in Brasìlia see it as key to the fulfillment of Brazil's manifest destiny as an agricultural powerhouse that can achieve a global economic importance commensurate with its rank as the world's fifth-largest country.

If *Avança Brasil* goes forward as planned, it will transform the Ama-zon region. Unpaved sections of the Transamazon highway system will be paved, rivers will be dredged and equipped with locks to allow barge traffic, new ports will be built, and dams will be constructed to provide hydropower for anticipated new cities and industries. Better access provided by all-weather roads will precipitate a frenzy of land clearing and speculation. The logging industry, now concentrated along the eastern and southern fringes of the Amazon, will move into the central and western portions of the basin. Unlike the export-driven logging of forests in Southeast Asia, logging in the Brazilian Amazon serves primarily to supply a ravenous domestic market. Its scale is astonishing. A recent study documented 1,300 active sawmills around Belém, a major port near the mouth of the Amazon. Hundreds of additional mills are operating to the south and west of Belém in areas not served by ports. Most of the output of these mills goes into the domestic market to supply Rio de Janeiro, São Paulo, and the other burgeoning cities of the south.

So, what is the prospect? Will *Avança Brasil* go forward and catalyze logging operations in the rest of the Amazon forest? London and Kelly have frustratingly little to say about this. The words "*Avança Brasil*" do not appear in their book.

They assert vaguely that development is inevitable but what form it will take and what the economic incentives will be are mostly left to the reader's imagination.

Is deforestation of the Amazon unavoidable? I agree with London and Kelly that the romantic notion that the Amazon can be "saved" is a fantasy. Brazil will continue to pursue its long- cherished goal of integrating the Amazon into the national economy. Much of the forest will go. But I would be surprised to see it vanish entirely because an increasing portion of the Amazon in Brazil, and in neighboring countries, is under formal, legal protection (a crucial detail omitted by London and Kelly): 11 percent in national parks and other categories of federal land; 8 percent in state-sponsored protected areas; 21 percent in lands of indigenous people.

New areas are coming under protection every year through ARPA (Amazon Region Protected Areas program) supported jointly by the national government, the World Wildlife Fund, and other conservation organizations. It is not unrealistic to imagine that 50 percent will eventually come under some form of protection or another. More than 70 percent of the state of Amapá, for example, is already protected. Large new areas were recently created in the state of Pará; the state of Amazonas is actively planning additional reserves. Short of a complete breakdown of civil authority, the Amazon won't be entirely "lost."

But this formulaic way of thinking—protected + unprotected = the whole—is bound to be naive. Unforeseen developments are likely to determine the future of the Amazon, just as they did in the case of the *cerrado*. One such unforeseen development is fire, which holds the potential to be the undoing of the Amazon, a fact not mentioned by London and Kelly. Humid tropical forests simply don't burn, or at least that was the conventional wisdom. After all, millions of fires are set in tropical forest regions every year in conjunction with the slash-and-burn methods used to clear land for agriculture; yet the fires almost never escape into the surrounding forest. But in 1983, the large-scale fluctuation in climate called El Niño brought about a different reality. Southeast Asia became a tinderbox after unprecedented drought. Fires broke out and burned for months in the equatorial rainforests of Borneo, creating a pall of acrid smoke that shut down airports hundreds of miles away and caused respiratory distress in thousands.

Scientists investigating the causes and consequences of the Borneo fires discovered an important corollary. Forests that had been logged were the ones that burned; unlogged forests resisted fire. Logging synergizes fire in two ways. First, cutting down trees opens the forest canopy, admitting sunlight and drying out the leaf litter on the forest floor. Second, the debris of branches, chips, and stumps left behind by logging operations serves as fuel for any subsequent fire. For these two reasons, fire can propagate through logged forest under drought conditions but usually peters out in unlogged forests.

Ground fires burned huge tracts of Amazonian forest in conjunction with the El Niño of 1997 and 1998. The toll promises to be far more severe in the future. The first time a tropical forest burns, the damage can hardly be detected from above because the destruction is largely confined to saplings and small trees whose crowns lie below the canopy. But the subsequent presence of large numbers of dead trees greatly increases the fuel available to stoke the next fire. Consequently,

second fires burn hotter and more destructively, killing large trees as well as practically all smaller ones. And, of course, second fires generate even more fuel for the third fire. Colleagues of mine who study this subject, notably, Carlos Peres and Jos Barlow of the University of East Anglia (UK) and William Laurance of the Smithsonian Tropical Research Institute in Panama, assert that the third fire spells doom for the forest, since it kills all remaining trees. After that, the land once occupied by forest fills with coarse shrubs and grasses that become flammable every dry season. Fires then become a permanent feature of a transformed ecology and defeat the prospects for recovering the forest. Millions of acres of forest are now primed to burn a second time and millions more are primed for the first burn, thanks to the wave of rampant logging that has spread through the region.

A second, though related, unforeseen development is radical climate change. Land clearing and the transformation of the landscape by fire act synergistically to alter the local microclimate and hydrological cycle. Much of the solar energy that falls on a natural forest is dissipated high in the tree canopy through "transpiration," the evaporation of water transmitted from the soil through the roots, stems, and foliage of plants, a process that consumes solar energy and cools the environment. When the forest is largely cut down, less solar energy is intercepted by foliage and more reaches the ground where it is absorbed and heats the surface to stifling temperatures. Reducing the vegetation that covers the ground alters the hydrologic cycle as less moisture is returned to the atmosphere through transpiration and more flows directly into streams and rivers, accelerating erosion.

As the agricultural frontier extends northward into the Amazon region, climate scientists fear that a "tipping point" will be reached at some as yet unknown level of deforestation. The argument runs like this. Nearly all the water that falls as rain in the Amazon derives from the Atlantic Ocean, where it evaporates and is carried onto land by easterly trade winds. The isotopic content of evaporated seawater possesses a distinctive character or "signature" that is altered when rainwater is transpired through the leaves of trees and plants. (The ratios of isotopes of hydrogen and oxygen change with evaporation and transpiration because the heavier isotopes do not evaporate as readily as their lighter counterparts.) The Brazilian atmospheric scientist Eneas Salati showed many years ago that the signature of rainwater varies systematically from east to west across the Amazon basin in a way consistent with the idea that much of the water originally derived from the ocean off the eastern coast is recycled through plants in passing over the Amazon basin. Salati estimated that three quarters of the rainwater falling in western Amazonia is recycled water. When deforestation reduces the amount of rain that is recycled to the atmosphere via transpiration, there will be less water available to fall as rain in the downwind direction, that is, to the west.

Concern that the crucial recycling mechanism will be disrupted by deforestation in the eastern Amazon is widespread in the scientific community. Most climate models agree in indicating a tipping point beyond which parts of the Amazon will become significantly drier. Less rain implies longer, more severe droughts and increased incidence of fire. Carlos Nobre, Brazil's most distinguished climate scientist, talks of the "savanaization" of the Amazon region, i.e., its reduction to grasslands. A major alteration of the Amazon's hydrological cycle could have

global consequences, but current climate models disagree about what the consequences would be.[*]

What is the attitude of the Brazilian government toward a possible climatic calamity in the Amazon? On being shown the predictions of some climate models, President Luiz Inácio Lula da Silva reputedly posed two alternatives. If the rest of the world is so concerned about the future of the Amazon, then let the rich countries pay us not to cut it down. Otherwise, if the forest is going to succumb to drought and fire, then we ought to cut it down first so that we can benefit from the resources before they are lost to the ravages of nature.

Not everyone will be happy with these alternatives, but Lula's pronouncements may not be that far off the mark. The Amazon is being logged at a prodigious rate and with further improvements in transportation envisioned under the *Avança Brasil* program, logging, and with it the risk of fire, is bound to spread over much of the basin. Slowing or stopping the logging would require a political will that simply doesn't exist in a country obsessed with maximizing development.

Which of Lula's alternatives will the future bring, a green Amazon supported by an international community united against the specter of radical climate change, or a brown Amazon, parched by deforestation and scorched by fire? In my view, the prospects of the green alternative will be determined by the treaty that will succeed Kyoto. At Kyoto, it was decided not to include forests in a system by which carbon emissions are controlled through "cap-and-trade"—i.e., by allowing countries that cut back on emissions to receive tradable credits for doing so. Many now feel that the omission was a mistake because forests store such huge stocks of carbon. Yet how forests will be brought into a second-generation treaty is anyone's guess. Short of significant international intervention through financial incentives or other mechanisms, the business-as-usual scenario will certainly prevail. So if you desire to see the great Garden of Eden that is the green Amazon today, you should not delay your trip.

**Notes**

[*] For interested readers, an authoritative exposition of the scientific issues raised here can be found in the September 2007 special issue of *The American Prospect*.

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**Letters**

December 20, 2007: Mark London, **'The Green vs. the Brown Amazon': An Exchange**