



Figure 1. The Main River Systems of "the Amazon"

TOWARDS AN ENVIRONMENTAL
HISTORY OF THE AMAZON:
From Prehistory to the Nineteenth Century*

David Cleary
The Nature Conservancy

Abstract: This article reviews the environmental history of the Amazon basin from early prehistory to the 1850s, concluding at the start of the rubber boom. It argues that the Amazon's past can be understood in terms of a transition from wilderness to landscape, in a broadly similar way to the environmental history of Europe and North America. A detailed overview of the archaeological record suggests that both floodplain and upland environments were heavily influenced by human intervention during prehistory. The colonial and early republican periods also saw dramatic environmental changes. Interpretations of the Amazon that stress environmental constraints on human agency or portray it as largely virginal or unsettled prior to the modern period are at best an oversimplification.

On both sides of this river we
passed the most beautifull cuntrye
that ever mine eies beheld;
and whereas all that we had seen before
was nothing but woods, prickles,
bushes and thornes, heere we beheld
plaines of twenty miles in length,
the grass short and greene,
and in divers parts groves of trees
by themselves, as if they had been
by all the art and labour
in the world so made of purpose;
and stil as we rowed the Deere
came downe feeding by the waters side,
as if they had been used to a keepers call

Sir Walter Raleigh, 1596
*The Discoverie of the Large, Rich
and Bewtiful Empyre of Guiana*

*The author would like to thank Bill Woods for the map and help with the archaeology, three anonymous LARR reviewers for their help in refining the text, and John Womack and the Department of History at Harvard for providing the new institutional context that gave birth to it. Views expressed are personal and unrelated to The Nature Conservancy.

To begin at the beginning: where is the Amazon, and what is meant by it? This is not as strange a question as it might seem. The river the English language calls the Amazon has three names in Portuguese and Spanish. The Amazonas applies only from the estuary to the junction with the Rio Negro. Thereafter the river becomes the Solimões until it enters Peru, where it is called the Marañón. Scholars typically take refuge in the illusory certainties of physical geography and use the term *Amazon* as a synonym for the Amazon basin, the area drained by the main channel of the Amazon and its tributaries. But this approach is also problematic, since in this part of the world the boundary between land and water fluctuates. The seasonal rhythms of climate and rainfall flood large plains on the edges of the Amazon basin: the grasslands and forest islands of Llanos de Mojos in north-eastern Bolivia, the Rupununi savanna in the Guyanese interior, and the Pantanal marshlands in Mato Grosso. These annual floods extend the capillary network of Amazonian rivers to communicate with adjoining river systems that are not part of the Amazon basin: the Rupununi to the Essequibo and the Mojos to the Guaporé and thence via the Pantanal to the headwaters of the Paraguai. In addition, a permanent waterway, the Casiquiare Canal, links the southern headwaters of the Orinoco with the northern headwaters of the Rio Negro. In theory, with good timing and patience, a small canoe could travel from the Orinoco estuary to the mouth of the Río de la Plata, one of the few journeys apparently never made by some crazed adventurer. These connections are not mere geographical curiosities. They formed the basis of an extensive system of trade routes prior to the sixteenth century that linked the Amazon to the Orinoco, the Caribbean, and the Andes.¹

As if these fuzzy boundaries were not enough, definitions of the Amazon based on physical geography are vulnerable to *reductio ad absurdum*. A number of river systems in the Guiana Shield, most notably the Essequibo but also including the Corantijn, the Maroni, and the Oiapoque, drain into the Atlantic rather than into the Amazon. The most extreme example is the Brazilian state of Amapá, on the northern shore of the Amazon estuary, riddled by river systems draining into either the Amazon or the Atlantic and therefore simultaneously part and not part of the Amazon basin. It would be a brave academic or politician who argued that Guyana, Surinam, and French Guiana are not Amazonian countries, even though regional hydrography clearly shows that among them they cannot muster a single river that drains into the Amazon.² Anthropological convention likewise dictates that

1. The most detailed work on ancient trade networks concerns links among the Caribbean, the Andes, the Orinoco, and northern Amazonia. See A. Boomert, "Gifts of the Amazons: Greenstone Pendants and Beads as Items of Ceremonial Exchange," *Antropologica* 67 (1987): 33-54; and Neil Whitehead, "The Mazaruni Pectoral: A Golden Artefact Discovered in Guyana and the Historical Sources Concerning Native Metallurgy in the Caribbean, Orinoco, and Northern Amazonia," *Archaeology and Anthropology* 7 (1990):19-36.

2. One could quibble that French Guiana is not a country but an overseas department of

the many indigenous peoples of the Guianas are unambiguously Amazonian, while maps of the distribution of "Amazonian language families" take in the southern Caribbean and much of the Orinoco.³ Virtually no one actually means the Amazon when saying it, and this article is no exception. The area is vaguely defined, taking in most of the northern and central tropical lowlands of South America, and is not restricted to the Amazon basin. Sometimes it stretches as far as the southern Caribbean coast or the Orinoco or Paraguay, sometimes it does not.

But however scholars choose not to define it, the Amazon is, true to stereotype, the most biodiverse place in the world. The lists of numbers of species become steadily more meaningless with repetition—how can scientists know how many species are unknown? What is clear is that no taxonomy, indigenous or scientific, adequately captures the full variety of habitats and ecosystems that the region contains. Beyond the general distinction between *várzea* floodplain and upland *terra firme*, no standard taxonomy exists of regional environments, although several attempts have been made.⁴ Classification becomes an exercise in fractal geometry: the closer one comes, the more underlying patterns of complexity reveal themselves. It is an enormous irony that this complexity, taken for granted and enthusiastically catalogued for over three centuries in specialist circles, coexists with a tradition of erudite and popular representation of tropical nature in the Amazon that stresses its uniformity and monotony. Not the least of the complications of writing about the Amazon is the persistence of these stubborn representational conventions, which have conditioned perceptions of the region from the colonial period to the present. Forests, however classified, are portrayed as virginal and primeval. The region itself is seen as impenetrable, when a simple glance at a map shows that no place on earth offers more avenues of penetration. The mere notion of an environmental history of the Amazon therefore immediately leads to a paradox: either it will be the history of a natural domain that can have no history except for the tale of its destruction,

France, but the inclusion of Surinam and Guyana in the Amazon Pact clearly shows that the Guianas are regarded internationally as Amazonian. One of the many interesting things about them is the interstice they occupy between the Amazon and the Caribbean. For example, they were regarded as part of the Caribbean world by their colonial masters, and cricket is the national sport of Guyana. They exemplify the fuzziness of regional boundaries discussed here.

3. See, for example, Peter Rivière's setting of Guiana Amerindians in a broader Amazonian context in *Individual and Society in Guiana: A Comparative Study of Amerindian Social Organization* (Cambridge: Cambridge University Press, 1984); and the foundational map of Amazonian language distribution by Curt Nimuendajú, *Mapa etno-histórico do Brasil e regiões adjacentes* (Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística, 1980, first published in 1944). "The Guianas" are here understood to comprise Guyana, Surinam, and French Guiana.

4. For a valiant recent attempt, see Emilio Moran, *Through Amazonian Eyes* (Iowa City: University of Iowa Press, 1993).

or it will be the history of a natural domain far too complex for a chronological account of its development to be imagined.

This article will summarize the environmental history of the Amazon from prehistory to the start of the rubber boom. The modern period requires a separate essay, given the speed and scale of environmental transformation. The argument rejects the idea that anything like a comprehensive environmental history of the Amazon is impossible, given the biological complexity of the region. In some respects, one could argue that the Amazon is actually an easier subject for environmental historians than some other parts of the world. The size of the region is not an insurmountable problem. Environmental historians have tended to take large geographical areas as their unit of analysis: the Mediterranean, the Caribbean and Mexico, North America, the Brazilian Atlantic forest, even Europe and the Americas combined.⁵ No individual could hope to master all the sources bearing on environmental change in such well-studied regions, as is reflected in the canonical texts. Fernand Braudel, Carl Sauer, and Alfred Crosby wrote synthesizing overviews based on radically selective reading and archive work, but they are no less valuable for that. The fact that the Amazon has inspired a less voluminous literature than Mexico or the Caribbean, for example, is in some respects unfortunate but at least allows researchers to master a larger proportion of the sources.

Far from being impossible to write, the broad outline of environmental change in the Amazon is actually fairly straightforward. It has five phases: early human occupation based on a combination of fishing and foraging; a subsequent intensification of land management over at least 10,000 years; depopulation precipitated by the arrival of Europeans and the recolonization of much of the basin by forest and secondary growth; an expansion of extractivism in the late nineteenth century and the reoccupation of riverine ecosystems, during which the Amazon's population returned to pre-Columbian levels; and a phase of unprecedentedly rapid environmental change in the postwar period, most of it unnecessarily destructive and concentrated more in upland ecosystems than the floodplain. The devil is in the detail, and the rest of this article will be devoted to exorcising it to the

5. Fernand Braudel, *The Mediterranean and the Mediterranean World in the Age of Philip II* (New York: Harper and Row, 1973); Alfred Crosby, *The Columbian Exchange: Biological and Cultural Consequences of 1492* (Westport, Conn.: Greenwood, 1972); Elinor Melville, *A Plague of Sheep: Environmental Consequences of the Conquest of Mexico* (Cambridge: Cambridge University Press, 1997); Carl Sauer, *The Early Spanish Main* (Berkeley and Los Angeles: University of California Press, 1992; first published in 1966); and David Watts, *The West Indies: Patterns of Development, Culture, and Environmental Change since 1492* (Cambridge: Cambridge University Press, 1987). For Brazilian environmental history, scholars owe an enormous debt to the pioneering work of Warren Dean, tragically abbreviated by his premature death. See especially *Brazil and the Struggle for Rubber: A Study in Environmental History* (Cambridge: Cambridge University Press, 1987); and *With Broadax and Firebrand: The Destruction of the Brazilian Atlantic Forest* (Berkeley and Los Angeles: University of California Press, 1995).

extent possible in a single essay. This is a largely empirical exercise, but it is important to bear in mind the theoretical issues that the endeavor addresses.

In recent years, the central question in debates about the Amazon in a number of disciplines has been the nature of environmental constraints on economy and culture. Ironically, part of this argument is grounded in a much more detailed awareness of biological complexity and regional variation within the Amazon. This body of knowledge emerged in turn from research driven by concern for what was routinely constructed by policy makers, scientists, and others as pristine wilderness. In this barrage of new data and novel interpretations, one fact stands out: the scale of human intervention in Amazonian ecosystems over time. Researchers now know that the South American lowlands were occupied by humans for many thousands of years longer than was previously thought.⁶ Intensive agriculture was practiced by indigenous Amazonians in both floodplain and upland environments for millennia before the arrival of Europeans. Significant landscape transformation occurred, in several locations on a scale that can only be appreciated from the air. Historians can suspect that the population decline subsequent to the arrival of Europeans in the Amazon was even more precipitous than has been supposed, although it operated over a longer timescale than previously thought. It is known that the consequent reversion of much of the basin, especially the floodplain, to uncultivated secondary growth by the nineteenth century meant that much of the supposedly primeval forest was actually between one and two centuries old, at least along the main channel of the Amazon and its tributaries, by the time a series of great natural scientists introduced the region to the international reading public in quintessentially Victorian books saturated with liberal Romanticism and an omnivorous, interdisciplinary scientific zeal.⁷

In the debates over environmental constraints, a defining feature has

6. The dates are highly controversial. One site at Pedra Furada in northeastern Brazil has been convincingly dated at circa 50,000 B.P. See Paul Bahn, "50,000-Year-Old Americans of Pedra Furada," *Nature* 362 (11 Mar. 1993): 114–15. Although this point is controversial in North American archaeology, it is less so in Europe, where it is widely accepted in France and Britain. Another site, Monte Verde in Chile, excavated by Thomas Dillehay, has been securely dated at around 12,500 B.P. Both findings imply initial human occupation of the Amazon many millennia prior to the earliest carbon dates recorded up to the present (circa 11,000 B.P.), but this is conceivable. The spotty nature of the archaeological record in the lowlands at present together with the collapse of the Clovis paradigm suggest that as further research is done in the lowlands, the date for initial human occupation of the Amazon will move back in time. The latest evidence to emerge, skeletal remains from southern Brazil dated tentatively at 11,500 B.P., reinforces this supposition. See "An Ancient Skull Challenges Long-Held Theories," *New York Times*, 26 Oct. 1999, p. D1.

7. Their classic texts are a basic source for the environmental or any other history of the lowlands. See Henry Bates, *The Naturalist on the River Amazons* (London: John Murray, 1863); Alexander von Humboldt and Aimé Bonpland, *Personal Narrative of Travels to the Equinoctial Regions of the New Continent* (London: Longman, Hurst, Rees, Orme and Brown, 1821–1825); Johann Spix and Carl von Martius, *Viagem pelo Brasil, 1817–1820* (São Paulo: Itatiaia, 1981; first published

been an unproblematic distinction between the natural and the cultural, and arguments over the extent to which, crudely speaking, nature constrains culture.⁸ To outsiders, these arguments must often appear provincial. Some anthropologists and archaeologists adopted a position of hard environmental determinism, arguing that the nature of Nature in the Amazon precluded forms of social organization more complex than the small village and shifting cultivation, unless the Amazonians happened to be intruders from more socially advanced parts of the continent (like the Andes) in the process of decline.⁹ Others rejected the terms of the debate and criticized the distinction between the natural and the cultural on both philosophical and ethnographic grounds. The most extended critique was provided by Philippe Descola, who has argued that the multiplicity and synergistic nature of relationships between an Amazonian society and its environment in practice makes determining causation dangerously speculative.¹⁰ A neat example of this abstract point is Laura Rival's analysis of the relationship between the Huaorani and peach palms. Peach palm groves grow in the forest but are managed by the Huaorani in complex ways. Like many forms of indigenous land management in Amazonia, Huaorani peach palms fall into a gray area between gathering and farming that makes a distinction between the wild and the domesticated impossible to maintain: forests can be tame and gardens wild.¹¹ The construction of the nature-culture dualism is our problem, not theirs.¹²

in 1831); Richard Spruce, *Notes of a Botanist on the Amazon and Andes* (London: Macmillan, 1908); and Alfred Wallace, *A Narrative of Travels on the Amazon and Rio Negro* (London: Reeve, 1863).

8. The number of potential citations here is enormous. A representative sample of the anthropological school of environmental determinism is *Adaptive Responses of Native Amazonians*, edited by Robert Hames and William Vickers (New York: Academic Press, 1983). This work is a product of a predominantly North American approach often called human ecology, whose best-known exponent is perhaps Napoleon Chagnon. A fundamental critique is Philippe Descola, *In the Society of Nature: A Native Ecology in Amazonia* (Cambridge: Cambridge University Press, 1994). A similar opposition exists in archaeology between the work of Betty Meggers and Anna Roosevelt, cited in subsequent notes.

9. The best-known expression of this view is Betty Meggers, *Amazonia: Man and Culture in a Counterfeit Paradise* (Washington, D.C.: Smithsonian Institution Press, 1996; first published in 1971).

10. Descola, *In the Society of Nature*, 5–6. He is talking of the Achuar, but the point holds for indigenous societies in the Amazon in general.

11. Laura Rival, "Domestication as a Historical and Symbolic Process: Wild Gardens and Cultivated Forest in the Ecuadorian Amazon," in *Advances in Historical Ecology*, edited by William Balée (New York: Columbia University Press, 1998), 232–50.

12. Ethnoecologists have made this argument for a long time. See *Resource Management in Amazonia: Indigenous and Folk Strategies*, edited by Darrell Posey and William Balée (New York: New York Botanical Garden, 1989), vol. 7 of *Advances in Economic Botany*. See especially the contributions by Balée, "The Culture of Amazonian Forests," 1–21, and Dominique Irvine, "Succession Management and Resource Distribution in an Amazonian Rainforest," 223–37.

It follows that a truly historicized account of the Amazon's past, an indispensable preliminary to policy making in the present, should regard the nature-culture divide that has underlain so much research on Amazonia with deep suspicion. I suggest that the notion of landscape and landscape history, derived from environmental history, is one way out of the various intellectual and representational problems that have bedeviled writing on the Amazon. "Landscape" is not the most precise of concepts, but it does convey the transition from wilderness to artificially modified and manipulated environment, in which nature coexists with culture and imbues it with a sense of scale that transcends the purely local. It is now clear that since the late Pleistocene (before 12,000 B.P.), indigenous Amazonians have been manipulating ecosystems, dealing or failing to deal with ecosystem responses to human intervention, and unleashing a chain of intended and unintended environmental consequences. In Europe and North America, the study of the transition from wilderness to landscape has been a central concern of environmental historians and historical geographers for decades.¹³ It may seem something of a leap from the manicured landscapes of Tuscany and the Cotswolds to the Napo or the Solimões, but understanding of the Amazon would be helped by thinking of it as landscape and understanding its past in terms of landscape formation, as in dealing with Europe or North America: something produced by complex interactions between humans and ecosystems from the Pleistocene to the present.

There are many important differences among landscape formation in Europe, North America, and the Amazon: huge variations in density of settlement, agricultural intensity, and continuity of occupation. From the seventeenth century to the present, the history of the Amazon is about displacement, depopulation, and recolonization, not the intensive, continuous, and wholesale transformations that have marked landscape history in Europe and North America. But I would suggest that the evidence as to the antiquity and scale of the human presence in Amazonia makes comparisons with Europe and North America far from fanciful. For example, the mound complexes of Marajó and Llanos de Mojos immediately make one think of the parallels that might exist with the mound complexes of Cahokia and the Mississippi Valley, another American várzea supporting a complex civilization that collapsed centuries before the arrival of Europeans. The number and size of anthropogenic soil deposits in the Amazon remind one of the mulching and composting practices of intensive European farming, or the central valley of Mexico prior to conquest. The difference is that indigenous Amazonians, through the deployment of a specifically American crop arse-

13. See, for example, William Hoskins, *The Making of the English Landscape* (London: Hodder and Stoughton, 1955); Elias Sereni, *History of the Italian Agricultural Landscape* (Princeton, N.J.: Princeton University Press, 1997); and John Stilgoe, *Common Landscape of America, 1580 to 1845* (New Haven, Conn.: Yale University Press, 1982).

nal of manioc and maize, appear to have been more successful than their European peasant counterparts in generating agricultural surpluses on supposedly marginal lands, at least until the Industrial Revolution.

Domesticated forests, wild gardens . . . In short, if we think of the Amazon as landscape, an arena of agency rather than a constraining wilderness, we might get somewhere.

PREHISTORY

One instinctively dislikes the term. If the archaeology of the Amazon teaches anything, it is the historical nature of its prehistory, the half-understood dynamics of its progressions from initial occupation to agricultural intensification and the rise and fall of complex societies. But there seems to be no more convenient one-word shorthand for the immense stretch of time between initial indigenous colonization and the first European incursions in the sixteenth century. *Precontact* is equally unsatisfactory, given the frequency of contact among its peoples, the extent of settlement and trade, and the largely unreconstructable complexity of prehistoric exchange. It seems misleading but unavoidable to use a single term for such a long period of time, agglomerating the minimal environmental impacts of the first settlers with the intensive exploitation of floodplain and upland ecosystems in the late prehistoric period. That said, what is known about the prehistory of the Amazon?¹⁴

More than is often thought. Archaeological writing on the Amazon often begins with a litany of the gaps in knowledge: the peculiar problems posed by tropical environments for preserving organic material and artifacts, the high costs and discomfort involved in field research, and the paucity of properly documented and excavated sites, no more than the odd colored pin on a very large map.¹⁵ Without minimizing the importance of gaps in the research literature, I find this conventional pessimism to be misplaced. Archaeologists working in the Amazon have been able to interrogate a variety of historical sources: colonial and national-period documents, mission records, accounts by scientists and travelers, and amateur and semiprofessional excavations in the nineteenth and early twentieth centuries. From all these sources, scholars have been able to extract useful information, even

14. Recent reviews with detailed bibliographies include Neil Whitehead, "Amazonian Archaeology: Searching for Paradise? A Review of Recent Literature and Fieldwork," *Journal of Archaeological Research* 4, no. 3 (1996):241-64; Cláudio Barreto, "Brazilian Archaeology from a Brazilian Perspective," *Antiquity* 72, no. 277 (Sept. 1998):573-80; and Eduardo Neves, "Twenty Years of Amazonian Archaeology in Brazil (1977-1997)," in the same issue, 625-32. The last two are rare and fascinating reviews in English by Latin American archaeologists.

15. A good example of the genre is one of the standard textbooks, S. Fiedel, *Prehistory of the Americas* (Cambridge: Cambridge University Press, 1987), 192-93.

identify promising field sites.¹⁶ When the modern archaeological literature of the lowlands is viewed as a whole, most primary research from the 1960s on actually tells a rather consistent story, with differences among individual researchers turning more around points of detail than the broad chronologies and lifeways of prehistoric Amazonians, which command widespread consensus.¹⁷ It is now increasingly clear that the Amazonian data fit into a wider continental picture, supporting the findings of other research in Mexico, Chile, and non-Amazonian Brazil that push the dates for the peopling of South America back to the late Pleistocene (before 12,000 B.P.), at least. The fact that this record of consistent archaeological findings stretching back over thirty years has not been more widely recognized until recently has nothing to do with the quality of the research per se but with the fact that the Latin American dates and interpretive hypotheses did not accord with the Clovis model for the peopling of the Americas, to which many U.S. archaeologists were committed.¹⁸ Findings from Latin America (including the Amazon) that undermined the Clovis model were ignored or subjected to unreasonable attack.¹⁹ Thus a mistaken view was perpetuated that the Amazon was marginal to American prehistory, a region where cul-

16. A discussion of the variety of sources available and an illustration of their potential can be found in Anna Roosevelt, *Moundbuilders of the Amazon: Geophysical Archaeology on Marajó Island, Brazil* (San Diego, Calif.: Academic Press, 1991), chap. 2, "Method and Theory for Amazonian Archaeology." A specific example is the way Herbert Smith's account of the middle Amazon in the 1870s has guided modern researchers to *terra preta* sites; see note 32.

17. This assertion requires some justification. The overview offered here would be contested in most of its details by Betty Meggers, who has excavated widely in Brazil, Ecuador, and the former British Guiana since the 1940s and still participates actively in debates in lowland archaeology. Her last systematic field research in the Amazon, however, was in the late 1950s. A subsequent generation of archaeologists went to the field in the 1960s, notably Donald Lathrap, whose work heavily influenced historical geographers such as William Denevan. It is their work, together with that of Anna Roosevelt and others subsequently, on which I base this generalization.

18. The Clovis model argues that the Americas were settled via land bridges in the Bering Strait and that early Americans arrived on the North American plains between 11,000 and 12,000 years ago. For an exasperated European and Latin American perspective on the Clovis debates, see Niède Guidon and B. Arnaud, "The Chronology of the New World: Two Faces of One Reality," *World Archaeology* 23, no. 2 (1991):167-78. It is worth noting that even within U.S. archaeology, some researchers dissented from the Clovis timescales. The best-known textbook for North and South American archaeology suggested that human colonization of South America began as long ago as 17,000 B.P. See Gordon Willey, *An Introduction to American Archaeology* (Englewood Cliffs, N.J.: Prentice Hall, 1971), 2:29.

19. An interesting example was a letter from Vance Haynes, a prominent U.S. defender of the Clovis model, which suggested that seeds discovered in a cave site in the Brazilian Amazon that yielded inconvenient radiocarbon dates might have been deposited by natural processes. See *Science* 275 (28 Mar. 1997):1948. Given that Haynes has spent his professional career in the U.S. Southwest affiliated with the University of Arizona and his most significant fieldwork overseas was in the Sahara Desert, his grasp of tropical lowland ecology revealed an unexpected breadth of knowledge.

tural development was heavily constrained by the difficulties posed by a hostile natural environment.

The picture that emerges from the archaeological record gives the lie to this stereotype. The earliest undisputed radiocarbon dates from a site in the lowlands are from a cave, Pedra Pintada, near the town of Monte Alegre in the middle Amazon. They suggest initial occupation by nomadic foragers subsisting on a combination of fishing and fruit-gathering around 11,000 B.P.²⁰ Future research is likely to push the date of initial human occupation of the Amazon much further backward. The specific fruits found at Pedra Pintada suggest that the modern presence of tree species adapted to disturbance in the area can be traced back to Pleistocene occupations. The oldest ceramics found in the Amazon are decorated fragments from a midden in the same general area and date from around 7,500 B.P.²¹ This find predates the earliest Andean and Mesoamerican pottery by some 3,000 years, probably confirms northern South America as the earliest ceramic-producing region in the Americas, and provides hard evidence that the Amazon was occupied before the Andes.²²

Given that the ceramics found were decorated, earlier plain ceramics must remain to be discovered. Their presence would strongly suggest that at least on the floodplain, a transition to permanent settlements and a mixed economy, agriculture in combination with fishing and fruit-gathering and probably with manioc as the chief crop, had already taken place in some locations in the early Holocene (circa 10,000 B.P.). The earliest clear evidence of maize cultivation comes from the Ecuadorian Amazon and dates from around 6,000 B.P., suggesting that maize cultivation spread fairly rapidly into the Amazon from its origins in Central America.²³ Pollen evidence from the same site suggests a pattern of shifting cultivation over three millennia, with agriculture intensifying significantly around 2,500 B.P., together with considerable forest disturbance. This finding suggests that one of the causes of Amazonian biodiversity in upland ecosystems was adaptation to human disturbance over thousands of years. The level of disturbance was intense at some locations. Continuous occupation has been confirmed at one site in the western Brazilian Amazon from around 8,000 B.P. to the seventeenth century.²⁴ More recent research has shown that agricultural intensification,

20. Anna Roosevelt et al., "Paleoindian Cave Dwellers in the Amazon: The Peopling of the Americas," *Science* 272 (19 Apr. 1996):373-84. See also the subsequent exchanges between Roosevelt and her critics: "Paleoindians in the Brazilian Amazon," *Science* 274 (13 Dec. 1996): 1823-26; and "Dating a Paleoindian Site in the Amazon in Comparison with Clovis Culture," *Science* 275 (28 Mar. 1997):1948-52.

21. Anna Roosevelt et al., "Eighth Millennium Pottery from a Prehistoric Shell Midden in the Brazilian Amazon," *Science* 254 (13 Dec. 1991):1621-24.

22. Meggers has argued the opposite.

23. See M. Bush, D. Piperno, and P. Colinvaux, "A 6,000 Year History of Amazonian Maize Cultivation," *Nature* 340 (27 July 1989):303-5.

24. Neves, "Twenty Years of Amazonian Archaeology in Brazil," 628.

once thought to be confined to the floodplain, also occurred in terra firme uplands: late prehistoric deforestation, illustrated by aerial photography, has been dated to between A.D. 900 and 1400 in the Upper Xingú in central Brazil. There indigenous peoples lived in village sites much larger than postcontact villages, combining manioc farming on a substantial scale with fishing.²⁵

The most dramatic evidence of large-scale landscape creation comes from two other sources, both long known to specialists but whose true significance is only becoming apparent in conjunction with more recent discoveries. These sources are the existence of complex ridged field sites, spectacularly evident in aerial photographs, and the emerging scale of anthropogenic black-earth deposits, *terra preta do índio*, throughout the Amazon but documented best in Brazil, Venezuela, and Colombia.²⁶ The ridged fields typically occur on the fringes of the Amazon basin proper, in savanna zones liable to flooding and dotted with forest islands. One implication is that several savanna areas in the Amazon might be anthropogenic in origin.²⁷ In at least one area, the island of Marajó, prehistoric Amazonians possibly modified existing ridge topography to irrigate on a large scale, rather than constructing ridged fields from scratch.²⁸ The ridged field sites operated on an impressive scale, around 50,000 acres in Llanos de Mojos and 15.5 square kilometers in Caño Ventosidad in Venezuela. They would theoretically have been capable of supporting hundreds of thousands of inhabitants. Whether they actually did so is open to question, since an unknowable but considerable proportion of pro-

25 Michael Heckenberger, "Manioc Agriculture and Sedentism in Amazonia: The Upper Xingú Example," *Antiquity* 72, no. 277 (Sept. 1998):633–47. He notes, "Xinguano communities exist in intricate anthropogenic landscapes formed in the natural environment by the long-term occupation of specific ecological settings," p. 642.

26. For ridged field sites, see William Denevan, "The Aboriginal Cultural Geography of the Llanos de Mojos, Bolivia," *Ibero-Americana*, no. 48 (1966); James Parsons, "Ridged Field Sites in the Rio Guayas Valley, Ecuador," *American Antiquity* 34, no. 1 (1969):76–80; and C. Spencer, E. Redmond, and M. Rinaldi, "Drained Fields at La Tigra, Venezuelan Llanos: A Regional Perspective," *Latin American Antiquity* 5, no. 2 (1994):119–43. An early discussion of their significance can be found in Donald Lathrap, *The Upper Amazon* (New York: Praeger, 1970), 160–63. A very useful overview of the current state of knowledge is Clark Erickson, "Archaeological Methods for the Study of Ancient Landscapes of Llanos de Mojos in the Bolivian Amazon," in *Archaeology in the Lowland American Tropics: Current Analytical Methods and Recent Applications*, edited by Peter Stahl (Cambridge: Cambridge University Press, 1995). For black-earth sites, see Nigel Smith, "Anthrosols and Human Carrying Capacity in Amazonia," *Annals of the Association of American Geographers* 70, no. 4 (Dec. 1980):553–66; M. Eden, W. Bray, L. Herrera, and C. McEwan, "Terra preta Soils and Their Archaeological Context in the Caquetá Basin of Southeast Colombia," *American Antiquity* 49, no. 1 (1984):125–40; and William Woods, "Comments on the Black Earths of Amazonia," *Papers and Proceedings of Applied Geography Conferences* 18 (1995):159–65.

27. The term *anthropogenic* means caused by humans, wholly or in part.

28. T. Myers, "Agricultural Limitations of the Amazon in Theory and Practice," *World Archaeology* 24, no. 1 (1992):82–97, esp. 91–92.

duction must have been funneled into regional trade.²⁹ The ridged field sites may be evidence of increasing demographic pressure on resources or an increasingly sophisticated pre-Columbian economy geared toward producing agricultural surpluses for trade and exchange, a probability largely unexplored by archaeologists.

The main crop grown on these fields was manioc, possibly intercropped with maize and squashes.³⁰ Save for the fact that manioc was the main cultigen rather than maize, the fields bear a marked resemblance to other ridged field systems in Mesoamerica and North America in the late prehistoric period. They also suggest that some Amazonian populations may have achieved comparable levels of demographic density. For example, the population densities calculated for La Tigra in Venezuela match those of certain settlement types found in the Valley of Mexico.³¹ Given the collapse of Marajoara culture around the fourteenth century A.D. and the description of palisades and large defensive works in the first European accounts of Amazon towns and villages in the sixteenth century, an intriguing possibility is that some Amazonian societies may have entered the same cycle of agricultural intensification and eventual overexploitation of the environment that probably lay behind the decline of the Maya and the abandonment of the mound complexes of the Mississippi Valley.

Terra preta deposits echo ridged field systems in their implications. While their existence has been noted by travelers and scientists since the nineteenth century,³² their significance was not widely realized until the 1980s. Even now the most basic facts about the nature and distribution of the deposits are still being debated: there is consensus on their anthropogenic origin but on little else. While their systematic mapping is still in its infancy, it is clear that the number of deposits in the Amazon totals many thousands. The most detailed mapping of terra preta deposits in a single area, along the Arapiuns River in the middle Amazon, revealed "many hundreds" of

29. For example, Denevan calculates the ridged fields of the Mojos could have supported a population of 500,000, larger than the current population of the region.

30. Pollen analysis, the standard technique for reconstructing ancient cropping patterns, is impossible with manioc because it is propagated by cuttings and releases almost no pollen. Processing manioc requires complicated technology, however, and its presence can be inferred from these material remains.

31. Spencer, Redmond, and Rinaldi, "Drained Fields at La Tigra," 126. But see the caveats by Bill Woods on calculating population densities on terra preta sites.

32. A detailed description of deposits around Santarém and the way they were known and exploited by local farmers can be found in Herbert Smith, *Brazil: The Amazons and the Coast* (London: Sampson Low, Marston, Searle, and Rivington, 1879), chap. 4. One of the first modern archaeologists to work in the Amazon, Peter Hilbert, immediately noted their importance, but because he published in Portuguese and German, it took decades for his pioneering work to percolate into the English-language literature. See Hilbert, *A cerâmica arqueológica da região de Oriximiná* (Belem: Instituto de Antropologia e Etnologia do Pará, 1955).

separate sites.³³ Like ridged field sites, they date from the late prehistoric period and are often associated with ceramics and other traces of habitation. They can also be very large. Manacapurú, on the middle Amazon near the town of Alenquer, was measured at over 2 kilometers long and 400 meters wide.³⁴ Terra preta deposits were once thought to be limited to the floodplain but have now been reported in upland sites and interfluves as well, although upland deposits tend to be smaller.³⁵

Intriguingly, although they have been routinely described as “middens,” the majority of deposits appear not to have been village or household sites but the products of long-term mulching and composting of agricultural fields, even in locations of sandy soils and blackwater rivers long considered problematic for agriculture. Along the Arapiuns, one such agriculturally marginal ecosystem, hundreds of prehistoric terra preta deposits are still recognized and exploited by modern farmers. Furthermore, it appears that even after abandonment, soil dynamics result in terra preta deposits expanding over time. One researcher has suggested that they should be regarded as approximating “more closely a living organism than an inert fossil.”³⁶ At least one well-documented example of soil-enrichment techniques practiced by a modern Amazonian people, the Kayapó of southern Pará, fits with the observed pattern of terra preta deposits and is connected with the improvement of cleared fields rather than midden formation around villages.³⁷ Similarly, the sixteenth-century descriptions of the fields and settlements of the Tapajó people, lining the bluffs and shoreline around what is now the city of Santarém, are consistent with the ubiquity of terra preta deposits in the region. Again, one is confronted with the inadequacies of the nature-culture dualism in the field. Anthropogenic in origin but not in their growth, terra preta deposits, like the Huaorani peach palm, embody both the practical and the epistemological complexity of Amazonian landscape history.

The implications are important. Terra preta sites may be a dangerous basis on which to project prehistoric population estimates, but they are consistent with a general picture of agricultural intensification in the late prehistoric period, in upland ecosystems as well as on the floodplain.³⁸ In com-

33. J. McCann and William Woods, “The Anthropogenic Origin and Persistence of Amazonian Dark Earths,” in *Conference of Latin Americanist Geographers Yearbook 25*, edited by César Caviedes (Austin: University of Texas Press, in press). Terra preta deposits in the Arapiuns river basin is the subject of McCann’s doctoral thesis in progress.

34. Gordon Willey, *An Introduction to American Archaeology* 2:412.

35. *Interfluves* refer to upland areas between rivers. As a map of the Amazon basin makes clear, the interfluve is a very convenient unit of description of subregions of Amazonia.

36. Woods, “Comments on the Black Earths of Amazonia,” 162.

37. Susanna Hecht and Darrell Posey, “Preliminary Results on Soil Management Techniques of the Kayapó Indians,” in Posey and Balée, *Resource Management in Amazonia*, 174–88.

38. McCann and Woods, “The Anthropogenic Origin and Persistence of Amazonian Dark Earths,” in press

bination with what is known of the antiquity of human settlement in the Amazon, the number and wide distribution of terra preta deposits strongly suggest that few if any parts of the Amazon were unoccupied during prehistory. The bulk of the archaeological record comes from riverine sites, and the literature contains a strong assumption that the intensive exploitation of the floodplain recorded in the first European accounts in the sixteenth century reflects the greater desirability and ecological potential of the floodplain, as compared with the uplands and interfluves. This inference is clearly true up to a point, but the emerging, albeit more fragmentary, archaeological evidence from the uplands suggests that the opposition between terra firme and floodplain has been overemphasized. Far from being marginal, the uplands were also colonized and underwent the same processes of agricultural intensification and demographic concentration that can be documented more extensively in the floodplain. Upland population densities must have been lower, but this may have been a reflection of the exceptional environmental potential of the floodplain rather than an indication of environmental poverty in the uplands.

To take one geographical example, consider the large interfluve in the southern Amazon basin bounded by the headwaters of the Xingú to the east and the Tapajós to the west. Although some archaeological studies have been done in this area, not a great deal is known about regional archaeology. Most of the published research on the region is in Portuguese, little-known outside Brazil. Another important category of relevant information exists in the form of unpublished reports and documents, which are difficult even for specialists to find and evaluate. In both the Upper Tapajós and the Upper Xingú, modern archaeological research began in the 1950s. Other documentary sources provide a basic outline of the region back to the seventeenth century.³⁹ In this respect, it is a typical example of how a large area of the Amazon (in this case, about the size of Colorado) appears, or not, in the literature. Nevertheless, once again the broad outline of events is clear. Although the earliest radiocarbon dates from sites on the Upper Xingú go back to around A.D. 900, this situation reflects the lack of detailed research

39. The mission system did not penetrate as far as the Upper Xingú and Tapajós until the late nineteenth century, thus depriving researchers of one of the most useful sources until relatively late. But slave raiders arrived, as did traders, forming a new mosaic of political alliances and conflicts between neo-Europeans and indigenous peoples in the region. This occurrence allows ethnohistorians to reconstruct the region's history from the seventeenth century on in some detail. See the contributions in the section "Amazônia Meridional" in *História dos Índios do Brasil*, edited by Manuela Carneira da Cunha (São Paulo: Companhia das Letras, 1992), 281-380. Additional accounts were written by nineteenth-century scientists (Henri Coudreau for the Upper Tapajós and Carl von den Steinen for the Upper Xingú), and the first modern anthropological accounts of both the Upper Xingú and the Tapajós date from the 1920s, by Curt Nimuendajú. Specialists will note that this sequence of sources is typical of upland Amazonia.

rather than particularly late occupation. The southern Amazonian plateau was colonized at least 10,000 years ago and probably earlier.⁴⁰ Much older dates than those from the Xingú have been obtained from the Upper Tapajós, although they have not yet been published. Wooden artifacts from a large terra preta deposit on the Rato Creek, a tributary of the Tapajós, were dated to around 3,000 B.P.⁴¹ The significance of this date is that the site is located about 30 kilometers up a small creek, suggesting widespread occupation of the area, including terra firme uplands, even at such an early period.

Since the 1960s, the Upper Tapajós has become the largest informal-sector goldfield in the Amazon, and miners regularly report finding ceramics, wooden artifacts, and skeletal remains in the course of excavations, which generally result in the destruction of the site.⁴² Although no systematic mapping of archaeological or terra preta sites in the Upper Tapajós has yet been made, the region is riddled with both. There is no reason to think that had gold miners combed the Upper Xingú with the same thoroughness, a similar number of sites would not have been found there. Even given the unsystematic nature of archaeology in the region, it is evident that reasonably complex settlement existed by the end of the prehistoric period. The most recent significant piece of research from the Upper Xingú describes very large village sites (between 30 and 50 hectares) dated around A.D. 1500. These sites were heavily fortified through large-scale earthworks and palisades and linked to each other by a complex road system, an interesting example of nonriverine transport networks in the prehistoric Amazon.⁴³ It seems reasonable to suppose that the defensive earthworks are evidence of large-scale conflict with geographically distant adversaries and therefore also of at least occasional trade linkages with distant peoples.⁴⁴

It also seems reasonable to suppose that there is a strong anthropogenic element in the regional landscape. Prehistoric agricultural fields in

40. Michael Heckenberger, "War and Peace in the Shadow of Empire: Sociopolitical Change in the Upper Xingú of Southeastern Amazonia, A.D. 1400–2000," Ph.D. diss., University of Pittsburgh, 1996.

41. Anna Roosevelt, letter dated 23 Sept. 1993. The collections were made by Dr. Alicia Durán Coirolo, of the Museu Paraense Emílio Goeldi in Belém, with the assistance of the European Commission and Imperial College Consultants.

42. My fieldwork with miners in the Tapajós began in 1989 and included four years of continuous residence in the region between 1994 and 1998. I saw this happen many times. Together with Dr. Coirolo, I witnessed the destruction of a prehistoric cemetery near the center of the town of Itaituba in 1994 by a municipal construction crew. Many mine owners keep a collection of ceramics, wooden artifacts, and bones that their miners have come across.

43. Heckenberger, "War and Peace in the Shadow of Empire." For prehistoric road networks in the Amazon, see W. Denevan, "Prehistoric Roads and Causeways of Lowland Tropical America," in *Ancient Road Networks and Settlement Hierarchies in the New World*, edited by C. Trombold (Cambridge: Cambridge University Press, 1991), 230–42.

44. The Kayapó, one people of the Upper Xingú, engaged in raiding expeditions exceeding 400 kilometers until fairly recently. See G. Verswijver, *Club-Fighters of the Amazon: Warfare among the Kaiapó Indians of Central Brazil* (Ghent, Belgium: Rijksuniversiteit, 1992).

the Upper Xingú were large enough to be identified through aerial photography and dwarf modern fields. One of the contemporary peoples of the Upper Xingú, the Kayapó, are renowned for the sophistication of their land-management techniques.⁴⁵ The well-documented Kayapó practice of intensive management of forest islands in savanna raises a series of interesting questions about the cultural origins of central Brazilian savanna landscapes. Although projecting contemporary land-management practices into the past is an elementary mistake, it is inconceivable that cultures capable of land management on the scale revealed by Michael Heckenberger's satellite images were not at least as sophisticated in their environmental manipulations as the contemporary Kayapó. Modern practices can therefore be used as a baseline for evaluating the past. These supposedly marginal upland environments, then, were unquestionably settled for millennia before the arrival of Europeans and supported a much larger population than has traditionally been assumed for the region.⁴⁶ Their ecosystems, far from being "natural," formed in adaptation to human interventions in the landscape.

Scholars already know that this was the case in the floodplain, thanks to the early European accounts of Amazonian peoples and environments in the sixteenth century. The European presence in the sixteenth century was sporadic rather than permanent but was well documented. Two Spanish expeditions traveled down the Amazon, Francisco Orellana in 1542 and then Pedro de Ursúa and Lope de Aguirre in 1561. Their accounts are available, together with the surviving accounts of the ultimately unsuccessful attempts of northern Europeans (English, Dutch, and Irish) to establish settlements in the lower Amazon from the 1550s on.⁴⁷ For a long time, the Spanish sources especially were regarded as unreliable, full of the exaggerations typical of early conquistador accounts. They certainly cannot be read as straight-

45. Heckenberger reproduces two extraordinary satellite images of large-scale prehistoric deforestation near village sites in "War and Peace in the Shadow of Empire," 100–101. On the Kayapó, see Hecht and Posey, "Preliminary Results on Soil Management Techniques."

46. William Denevan, in the most widely quoted estimate of prehistoric population in the Amazon, calculates 0.2 inhabitants per square kilometer of "interior lowland forest" and 0.5 for "Brazilian central savannas," the two most important environments in the Upper Xingú-Tapajós interfluvium. See Denevan, "The Aboriginal Population of Amazonia," in *The Native Population of the Americas in 1492*, edited by Denevan (Madison: University of Wisconsin Press, 1992), 205–34, 230. Heckenberger's work suggests this figure must be a serious underestimate in that it compares with an estimate for the floodplain of 14.6.

47. The chronicle of the Orellana expedition, written in 1542 by Gaspar Carvajal, was the first European account of the Amazon. A critical edition with notes and supporting documents is *The Discovery of the Amazon*, edited by J. Medina (New York: Dover, 1988). A chronicle of the Ursúa expedition was written a year after the event by a participant. See F. Vázquez, *El Dorado: Crónica de la expedición de Pedro de Ursúa y Lope de Aguirre* (Madrid: Alianza, 1992). See also the collection of accounts by other participants in T. Ortiguera, "Jornada del Marañón," *Biblioteca de Autores Españoles* 206 (1968):217–358. For English and Irish sixteenth-century accounts, see *English and Irish Settlement on the River Amazon, 1550–1646*, edited by J. Lorimer (London: Hakluyt Society, 1989).

forward ethnographic description. Yet in many respects, they do chime with the emerging archaeological record of the floodplain. On points such as size and appearance of settlements, trade products, food stocks, agriculture, and natural resource management, there is a high degree of internal consistency between the two Spanish accounts and other European sources.

They describe a floodplain environment under intensive exploitation: large stocks of manioc stored in towns and broad roads leading to planted fields, settlements lining bluffs continuously for several miles, large-scale farming of turtles in pens, fisheries, swarms of canoes, and some settlements defended by palisades and earthworks—for all the world like the Upper Xingú, against whose inhabitants the defenses could conceivably have been constructed. Perhaps the most suggestive fact is that the Ursúa-Aguirre expedition was some nine hundred strong yet traveled with few supplies and found little difficulty in replenishing its stocks, by trade or force, from the peoples encountered along the way. It seems likely that the floodplain did not support similar numbers again until the rubber boom of the late nineteenth century. To this day, in many areas of the várzea, the modern inhabitants farm terra preta patches and build their houses around ancient middens. But they are fewer in number than the population seen by Gaspar Carvajal in 1542, part of a landscape as thoroughly formed as that of Castile, and probably more densely populated.

COLONIALISM AND AFTER

Contrary to common assumption, a hostile natural environment had little to do with the late arrival of European settlers in the Amazon and the patchy European colonization of the region during the colonial period. Spain and Portugal to an even greater extent had limited resources with which to run their imperial enterprises. They concentrated their efforts on the regions that offered the most immediate economic returns, as close as possible to their original landfalls and penetration routes: the Caribbean islands, the central valley of Mexico, the Andean mines, and the plantations of northeastern Brazil. The Amazon thus became a periphery by accident rather than predestination.

Things could have turned out very differently. By the time the Portuguese turned their attention north in the early seventeenth century and finally moved decisively against the English and the Dutch, sugar plantations had already been established in northeastern Brazil. The district of Alcântara on the coast of Maranhão, on the fringes of the Amazon basin and much more a part of the Amazon than the northeast in environmental terms, became for a short time an important part of the northeastern plantation complex—yet another demonstration of fuzzy regional boundaries. Prevailing winds and currents made communications between Belém and Lisbon easier and quicker than between Belém and the rest of Brazil, reflected

in the fact that northern Brazil was ruled for most of the colonial period directly from Portugal rather than as part of the viceroyalty of Brazil.⁴⁸ In other circumstances, one can imagine the rich alluvial soils of Marajó Island or the Igarapé-Mirim region near Belém or the estuaries of the Guianas as important plantation zones within the Atlantic system. All have produced high yields of sugarcane for over three centuries, serving regional markets into the twentieth century. And all are closer to Europe, North America, and the Atlantic trade routes than northeastern Brazil. They were more malarial and more subject to flooding than the Northeast, but their marginalization within the Atlantic plantation complex resulted more from the fact that the colonial metropoli had limited resources and other priorities than from any environmental barrier to colonization. When internal and external prerequisites meshed, as they did in Maranhão in the late eighteenth and early nineteenth centuries, Amazonian estuaries and várzeas were rapidly converted to plantation agriculture with little problem. The fact that the cotton and sugar they produced were subsequently driven out of world markets was again due to external factors, such as competition from North America and preferential European tariffs for Caribbean colonies, rather than environmental constraints.⁴⁹

But marginalization has its advantages. In the Amazon, it certainly improved the quality of colonial documentation. In broad terms, in both the Portuguese and the Spanish Amazon, the Crown constructed an alliance of convenience with the missionary orders, particularly the Jesuits, Franciscans, Carmelites, and Mercedarians. These groups became one of the two principal agents of European expansion into the lowlands over the seventeenth and eighteenth centuries and left a rich literature behind them.⁵⁰ The other agents were the small numbers of European settlers and entrepreneurs attracted or deported to the lowlands, who competed with the missions for access to indigenous labor in an extractive economy based on Indian slavery.⁵¹ Their efforts, in both the long and the short term, transformed the regional landscape.

Changes had already taken place even before the establishment of permanent European settlement in the early seventeenth century. Although

48. For a discussion of communications between Brazil and Portugal, see A. J. R. Russell-Wood, "Ports of Colonial Brazil," in *Atlantic Port Cities: Economy, Culture, and Society in the Atlantic World, 1690-1850*, edited by F. Knight and P. Liss (Knoxville: University of Tennessee Press, 1991), 196-239.

49. For an analysis of the late-colonial boom in Maranhão and its aftermath, see A. de Almeida, *A ideologia da decadência* (São Luís de Maranhão: Instituto de Pesquisas Sociais, 1983).

50. A comprehensive listing of the mission sources for the Portuguese and Spanish Amazon can be found in the annotated bibliography of D. Sweet, "A Rich Realm of Nature Destroyed: The Middle Amazon Valley, 1640-1750," Ph.D. diss., University of Wisconsin, 1974.

51. Sweet provides the most comprehensive account of the mission system and the Ama-

only a small minority of indigenous Amazonians could actually have laid eyes on a European by the time the city of Belém was founded in 1616, the economy and society of the Amerindian Amazon was already being transformed. While the Spanish expeditions made only fleeting visits, by 1616 the English and Dutch had already established a number of trading posts and "factories"—grand names for crude stockades and huts under constant danger of attack from European rivals or indigenous enemies—in the estuary and middle reaches of the Amazon. The Spanish had occupied the Orinoco estuary since the early sixteenth century, and the Dutch made a vigorous attempt to dominate the interior trade of northern Amazonia from Surinam after being pushed out of the Amazon estuary in the seventeenth century. From these initial centers of dispersal, metal axes, knives, guns, and fishhooks began to circulate along long-established trade routes and new networks of ethnic alliance and antagonism crystallized by the slave trade and the availability of a new order of trade goods. These new indigenous networks were soon overlaid by the developing networks of the mission system over the next 150 years.⁵² Metal goods were acquired in exchange for foodstuffs, slaves, and the *drogas do sertão*. This extraordinarily long list of products (usually mistranslated as coming from the forest) testifies to the comprehensiveness of indigenous resource management and the avidity of European markets: sasparilla, sassafras, vanilla (which the Europeans encountered in the Amazon for the first time), wild cinnamon, cacao, nutmeg and cloves, manatee meat and oil, turtle shells, meat, eggs and oil, feathers of all kinds, annatto, tonka beans, fava beans, timber species by the score, chinchona bark, tobacco, isinglass, rubber, waxes, cotton, twines, vines, hides, skins, cashew and Brazil nuts, gums, resins, caulks; and the myriad regional prod-

zonian economy during the colonial period. For the mission system in the Spanish Amazon, see A. Golob, "The Upper Amazon in Historical Perspective (Peru, Ecuador)," Ph.D. diss., City University of New York, 1982. For Bolivia and the Llanos de Mojos, see David Block, *Mission Culture on the Upper Amazon: Native Tradition, Jesuit Enterprise, and Secular Policy in Moxos, 1660-1880* (Lincoln: University of Nebraska Press, 1994). Scholars writing in English have concentrated on the Jesuits. The lack of studies of other missionary orders is a significant gap in the literature. For a less Jesuitical account, unfortunately restricted to the Portuguese Amazon, see *A história da Igreja na Amazônia*, edited by E. Hoornaert (Petrópolis: Vozes, 1992).

52. There are many ethnohistorical studies tracing these processes over the colonial period in different parts of the Amazon. A concise summary of the practical and theoretical issues involved is Neil Whitehead, "Ethnic Transformation and Historical Discontinuity in Native Amazonia and Guayana, 1500-1900," *L'Homme* 126-28, nos. 13-14 (1993):285-305. A landmark study in the ethnohistory of the lowlands is Whitehead's *Lords of the Tiger Spirit: A History of the Caribs in Colonial Venezuela and Guayana, 1498-1820* (Providence, R.I.: Foris, 1988). Two intriguing detailed reconstructions of the material transformation of indigenous societies, even with minimal physical contact with Europeans, are N. Farage, *As muralhas dos sertões: Os povos indígenas no Rio Branco e a colonização* (Rio de Janeiro: Paz e Terra, 1991); and B. Ferguson, *Yanomami Warfare: A Political History* (Santa Fe, N.M.: School of American Research, 1995).

ucts with no translation to this day, such as guaraná, urucum, andiroba oil, massaranduba, jutaicica, copaíba oil, ucuúba oil, piassava, breu, estopa, tapioca, puxurí, bombonassa, tucum fibers, carnaúba wax, ipecac, jatobá, jarina, and curare.⁵³ This first colonial extractivist boom has long been overshadowed by the more famous boom of the nineteenth and early twentieth centuries, but its environmental consequences were just as dramatic.

First came a leap in the productivity of indigenous agriculture caused by the influx of metal tools, although it is uncertain whether this development greatly increased the actual amount of forest clearance. Extra production was certainly needed to meet the European demand for foodstuffs, but the Europeans were not present in large numbers and rapidly adopted manioc as the staple of their diet. Evidence abounds of large-scale precolonial production of manioc, as noted. Given that the indigenous population was decreasing from the sixteenth century onward and that the acquisition of metal goods was a powerful motive for the diversion of indigenous labor out of agriculture into extractivism, it is even possible that the transition from stone to metal involved no increase in forest clearance. New European crops, livestock, and domesticated animals were introduced. Chickens, pigs, cattle, and guinea fowl became a part of every Amazonian village scene within a couple of centuries. Most important was a revolution in the orientation of trade and transport networks in the lowlands. Previously, the labyrinthine river system had operated to connect the floodplains with the uplands, and it was upon that internal relationship that the whole structure of prehistoric society and economy depended. With the arrival of Europeans and the implantation of an extractivist economy, the regional economy was turned inside out and reoriented toward the coast. The trade links that had integrated the lowlands with the Andean highlands for millennia were ruptured, and the Amazon became more isolated within the continent while a new network of external relationships—administrative, economic, and religious—tenuously began to bind it to Europe.

The first indigenous cultures pulverized by slavers, disease, and the mission system were therefore the peoples of the várzea, whose success in colonizing the rich floodplain environment of the main channel of the river system put them squarely on the main exit route for the slaves and drogas do sertão heading for the coast. Within a couple of centuries, the stretches of the Solimões and Amazonas floodplain that had boasted the highest population densities in the Amazon basin in the sixteenth century were reduced

53. This list was compiled from export items appearing in colonial documents reproduced in the following sources: A. Carreira, *A Companhia Geral do Grão-Pará e Maranhão* (São Paulo: Editora Nacional, 1988); and *A Amazônia na era pombalina*, edited by M. de Mendonça (São Paulo: Gráfica Carioca, 1963); *Dicionário histórico, geográfico e ethnographico do Brasil* (Rio de Janeiro: Imprensa Nacional, 1922). Also consulted were mid-nineteenth-century export records in the president's reports to the legislatures of Pará and Amazonas; see note 56.

to a largely empty landscape, enormous distances separating isolated villages and occasional homesteads.⁵⁴

But it was not only the floodplain that was transformed by the colonial economy. *Drogas do sertão* came from upland as well as floodplain environments, and in the rush to find marketable quantities, sustainability was rarely a consideration. As time went on, slavers, extractivists, and missionaries were all forced to range further and further afield to locate their respective products, as more convenient sites were rapidly exhausted through overexploitation. In the modern period, the extraction of *drogas do sertão* (tropical forest products or TFPs in the unlovely specialist jargon) has become synonymous with sustainable resource management. But for most of the Amazon's history, extractivism has resembled nothing so much as strip-mining. Many of the details of this extractivist assault are lacking, but clearly some items were already seriously depleted by the nineteenth century.⁵⁵

Reasonably systematic export records exist for the Brazilian Amazon for the 1840s on because the provincial administration depended on taxes on the movement of goods rather than on incomes.⁵⁶ According to these records, exports of turtle and manatee products were minimal by the mid-nineteenth century; when they occurred at all, the amounts were very small. Yet one finds frequent descriptions during the colonial period of large-scale exploitation of turtles and manatees for both domestic and export markets. These animals were notable for the range of products they provided. Turtles yielded fresh and salted meat, shells for jewelry and combs, eggs, and turtle oil. The oil represented a major industry of the floodplain during the colonial period, when entire villages would decamp to sandbars for weeks at a time to collect eggs and produce oil at certain times of year. Manatees also produced meat and oil. *Mexira*, manatee meat cooked and preserved in its own fat, was also an important export. It took around two centuries of intensive exploitation to decimate turtle and manatee stocks. Probably only the diversion of all available labor into rubber extraction after 1850 saved them from extinction along the main channel of the Amazon.⁵⁷ Other resources survived the colonial assault with little apparent problem. The sources never

54. See, for example, the descriptions of the Solimões in the 1820s in Spix and Martius, *Viagem pelo Brasil*, vol. 3; and H. Maw, *Journal of a Passage from the Pacific to the Atlantic* (London: John Murray, 1829), chaps. 9–11.

55. The most useful overview of colonial extractivism, based on a painstaking compilation of primary sources, is R. Anderson, "Following Curupira: Colonization and Migration in Pará, 1758 to 1930, as a Study in Settlement of the Human Tropics," Ph.D. diss., University of California, Davis, 1976, esp. chap. 1. See also Sweet, "A Rich Realm of Nature Destroyed."

56. For the Brazilian Amazon, these export statistics are found in annexes and fiscal data set out in the reports of the provincial governors from Pará (series beginning in 1833) and Amazonas (1852 on). They will be cited hereafter as *Relatórios*, followed by province and date.

57. See Nigel Smith, "Destructive Exploitation of the South American River Turtle," *Yearbook of the Pacific Coast Geographers* 36 (1974):85–102.

mention shortages of fish. Dried and salted *pirarucú* was an Amazonian codfish substitute that served both the region and export markets. Yet the nineteenth-century sources, despite constant complaints about food shortages and high prices in urban areas, always mention the availability of dried fish. The issue appears to have been a cultural preference for meat on the part of the upper classes. Problems with the overexploitation of fish stocks apparently did not occur until the twentieth century.

If the colonial economy greatly influenced change in the landscape, the other major influence was colonial demography. The topic is controversial. Once again the Amazon has suffered from stereotyping, in this case an assumption that the Amazonian experience broadly reflects that of indigenous populations elsewhere in the Americas: in other words, they were devastated by epidemics in short order. As a number of scholars have pointed out, overenthusiastic microbe-centered readings of Latin American history oversimplify what actually happened in the lowlands.⁵⁸ In contrast to the dense and clustered indigenous populations in the Andean highlands and Mesoamerica, who were thrown into early and intensive contact with relatively large numbers of Europeans in circumstances that guaranteed frequent and deadly epidemics, Amazonians were fewer in number, more dispersed, and lived in a larger geographical area. Because of the sporadic nature of early European penetration of the Amazon, Amazonians came into contact with European diseases later than other native Americans. It is the only part of the hemisphere where this process continues to the present day, through cycles of infection traveling along trade routes, with or without direct physical contact between Indian and non-Indian.

Smallpox exemplifies the specificities of Amazonian history. The sixteenth-century Northern European sources make no mention of smallpox in the Amazon. Nor do the sixteenth-century sources from the Orinoco, although the Spanish had lived there since the early part of the century. Yet it was precisely during this period that smallpox was decimating the Incas, Aztecs, and natives of the Caribbean islands. The apparent delay in the arrival of smallpox in the lowlands may be artificial. It could have been simply that the relatively few Europeans present happened not to come across any cases. But the balance of probability is that smallpox took a century longer to arrive in the Amazon. A number of factors explain the difference: the smallpox virus's intolerance of heat or bright sunlight, the reorientation of Amazonian trade and communications away from the Andes toward the coast, and the irregularity of direct contact with Europe during the sixteenth century. The first recorded cases of smallpox in the Amazon date from 1621, a direct consequence of the Portuguese decision to move against other Europeans in the Amazon estuary. The disease was imported by a

58. A concise summary of the issues here is provided by Whitehead in "Ethnic Transformation and Historical Discontinuity," 288-91.

ship arriving from northeastern Brazil, where smallpox had been established since the mid-sixteenth century.⁵⁹ From then on, smallpox was part of the social fabric of the Amazon into the twentieth century. Popular resistance to variolation and vaccination contributed to its longevity and mortality, despite the fact that the first recorded vaccination attempts against smallpox in Latin America were made in the Amazon in 1729 by a Carmelite missionary.⁶⁰ But its spread, although rapid, was uneven. By the end of the seventeenth century, smallpox had moved along the main channel of the Amazon to reach the Jesuit province of Maynas in the extreme west of the Amazon basin. It had also reached the mission villages of Llanos de Mojos in present-day Bolivia, although it is sometimes difficult to distinguish between Andean and lowland origins of smallpox epidemics in the western Amazon. Its lethality during this period is undoubtable. Mission sources and administrative correspondence routinely provided harrowing descriptions of suffering. But after about a century, mortality rates declined sharply as survivors developed resistance and epidemics became less frequent. All the documentation refers to the floodplain, but one can infer that it took longer to arrive in the uplands, and longest of all in the southern basin, where trade routes and missionary efforts were less concentrated than in the west and the north.

The general point here is that great variation occurred in the cycles of disease outbreak, mortality, and resistance over time and space, with some groups climbing back up the population curve at the same time as others endured the high mortality of first contact with Old World diseases. The exact sequence of events was determined by several factors, not just physical contact with Europeans: local ecology, participation in trade networks and the colonial economy, relationship to the mission system, and so on. Amidst this complexity, a few general points stand out. First, the floodplain rapidly became the unhealthiest place to be for an indigenous Amazonian, and not just for the access it offered to slavers and missionaries. It was a perfect setting for the spread of malaria and other diseases with insect vectors.⁶¹ Although indigenous American strains of malaria may have predated the arrival of Europeans, the floodplain environment ensured that new European and African strains rapidly became endemic. Second, disease was closely linked to the geography of the mission system, which was highly riverine. The missions were only dubiously effective at producing converts but were very efficient machines for propagating disease. They concentrated

59. Sweet, "A Rich Realm of Nature Destroyed," 79.

60. *Ibid.*, 88.

61. Leishmaniasis, endemic in the Amazon to this day, is another example. An African disease with an insect vector, it was first recorded in the Amazon in the early nineteenth century. It cannot be a coincidence that a reasonably large-scale African slave trade to the Amazon began in the late eighteenth century.

peoples of different ethnic and geographic origin in a single floodplain location, ensured regular physical contact with Europeans, and disrupted indigenous farming and resource management with ill-considered, often comically disastrous attempts to produce a pseudo-European monocultivating peasantry.⁶²

Finally, the salient fact of the impact of disease on indigenous Amazonians is that it helped to produce a dramatic population decrease throughout the Amazon by the nineteenth century. Disease had help, of course: a brutal slave economy, made more brutal still by the violence and dislocation it brought to indigenous societies throughout the interior, even those never within the ambit of missionary orders or colonial states. Nor did the declining populations of mission villages necessarily reflect the death of all the absentees: the missions were also factories for detribalization and assimilation. By the time the mission system collapsed when the Jesuits were expelled by jealous secular authorities in the 1750s and 1760s, detribalized Indians had become the largest element in the region's population. They formed the basis for the modern riverine mixed-race peasants called *caboclos* in the Portuguese-speaking Amazon and *riberleños* in the Spanish areas. *Gentio* became *gente*, but there were markedly fewer of them. Comparing sixteenth-century accounts of the same stretches of the Amazon with nineteenth-century sources shows that well enough. Numbers games are diverting but embody too many dubious assumptions to be sound. Let me merely say that when the archaeological record and the early European accounts are run past the first semireliable estimates of the nonindigenous population of the Brazilian Amazon in the mid-nineteenth century, a conclusion of literal decimation seems defensible.

The impact on the landscape was paradoxical. While the extractivist explosion was causing serious damage to ecosystems in the floodplain and uplands, depopulation was allowing forest to recolonize areas where it had been cut back in the late prehistoric period, especially the upland savannas and the floodplain. These were precisely the areas that would be visited and used as collection sites by nineteenth-century natural scientists and misconstrued as virgin and primeval. Meanwhile, Europeans were introducing new forms of land use with increasing impacts: new forms of plantation agriculture, notably cacao, sugar, and coffee, as well as cattle ranching. The location of these new land uses was determined by a combination of environ-

62. For an overview of the implications of missionization for the missionized, see D. Sweet, "The Ibero-American Frontier Mission in Native American History," in *The New Latin American Mission History*, edited by Erick Langer and R. Jackson (Lincoln: University of Nebraska Press, 1995), 1-48. For a perspective from the horse's mouth, see J. Daniel, *Tesouro Descoberto no Rio Amazonas: Anais da Biblioteca Nacional* vol. 95 (Rio de Janeiro: Biblioteca Nacional, 1975). See especially Book 5 on agriculture. Daniel, a Jesuit priest, spent decades in the Amazon trying unsuccessfully to get mission Indians to adopt Portuguese farming methods and crops.

mental factors and economic geography. Europeans realized at an early stage that many parts of the lowlands contained grasslands and savannas well-suited to cattle and horses. By the mid-eighteenth century, most of the large-scale enterprises in the region were cattle ranches: the Mercedarian and Carmelite ranches on Marajó island in the Amazon estuary, the Jesuit herds of Llanos de Mojos, the settler and mission *estancias* of the Venezuelan llanos, and the royal *fazendas* of the Rio Branco in the savannas that ran from Roraima in the Portuguese Amazon to the Guianese interior.

Plantation agriculture during the colonial period, with the important exception of cacau, tended to be on or near the coast and was restricted to the alluvial soils of the floodplain or low-lying terra firme. Sugar and cotton in western Maranhão and the coast of the Guianas were export crops, but in other cases agriculture was an adjunct to the domestic economy, used to produce not so much sugar as rum. This trade item and cultural weapon was so important that the Crown never dared or cared to tax it, and its significance is matched only by its invisibility in the historical record.⁶³ Until the arrival of permanent steam navigation in the Amazon in the 1850s, the only industrial machines in the region were occasional steam-powered *engenhos* in sugar plantations.

The one exception to the crablike clustering of plantations around the coast was the Amazon's most important export crop prior to rubber, cacau.⁶⁴ Cacau plantations were established on the coast around Cayenne and the estuaries of Surinam during the eighteenth century, using wild cacau plants brought back by extractivist expeditions. Sugar proved more profitable. By the mid-eighteenth century, the main focus of cacau production had shifted to the Portuguese Amazon, where increasing shortages of wild cacau as extractivism-depleted stocks encouraged settlers to experiment with cultivation, after some diligent prodding by the Crown. The need to turn to plantations was yet another indication of the impact of colonial extractivism in that "wild cacau"—probably the descendants of cacau planted and managed by indigenous Amazonians a few centuries ago—was very common

63. No overview of Amazonian-Guianan plantation systems has been written for the colonial period. Much useful material can be gleaned from R. Price's trilogy on the Saramaka maroons of Surinam: *First Time* (Baltimore, Md.: Johns Hopkins University Press, 1983); *To Slay the Hydra* (Ann Arbor, Mich.: Karoma, 1983); and *Alabi's World* (Baltimore, Md.: Johns Hopkins University Press, 1990). A useful comparison of the plantation systems of Pará and French Guiana can be found in C. de Cardoso, *Economia e sociedade em áreas coloniais periféricas: Guiana Francesa e Pará, 1750-1817* (Rio de Janeiro: Graal, 1984). On the rum industry and the interior trade, see S. Anderson, "Engenhos na várzea: Uma análise do declínio de um sistema de produção tradicional na Amazônia," in *A fronteira agrícola vinte anos depois*, edited by P. Lena and A. de Oliveira (Belém: CEJUP, 1990).

64. Dauril Alden, "The Significance of Cacau Production in the Amazon Region in the Late-Colonial Period: An Essay in Comparative Economic History," *Proceedings of the American Philosophical Society* 120, no. 2 (Apr 1976):103-35.

in the lower reaches of the Amazon River and its main tributaries in the early colonial period.⁶⁵

By the late eighteenth century, the only significant interior plantation complex anywhere in the Amazon until the modern period had taken shape in the floodplain and terra firme between the towns of Santarém and Obidos, on the middle Amazon. Cacao continues to be grown in the middle and lower Amazon to the present day, although its primacy in the export market was ended by the growth of cacao production in southern Bahia in the late 1800s. The nineteenth-century scientific accounts of the middle Amazon reveal that cacao estates were the only reasonably large-scale economic enterprises on the floodplain prior to the rubber boom. The ranching industry, largely unvisited by foreigners because it tended to be concentrated in the more remote llanos and savannas off the main channel of the Amazon, was at least as important an industry in terms of value of output and number of people involved—and certainly more important in terms of environmental impact. Ranching first stopped and then reversed the encroachment of forest on savannas in many parts of the Amazon by the mid-nineteenth century, as the herds grew and urbanization, with its carnivorous bourgeoisie, began to affect the region.

The growth of the cacao plantation complex through the eighteenth century was significant not just in its own terms. It proved to be a vital development for the extractivist sector as well. Prior to the growth of cacao exports, the international linkages of the Amazonian economy had been tenuous at best. The difficulties of communication with the Andes after the disruption of indigenous trade routes in the early colonial period meant that the western Amazon could send only low-bulk and high-value products to Quito and Lima. Spanish rivalries with the Portuguese limited the extent to which the main channel of the Amazon could be used as an export corridor. This situation presented almost insuperable problems for the non-subsistence colonial economy, in striking contrast to the scale of agricultural production in the prehistoric economy. Even the largest economic enterprises in the western Amazon, such as the ranches and plantations of the Jesuit missions in Llanos de Mojos, were not profitable and depended on external subsidies.⁶⁶ In the eastern Amazon, although extractive products abounded, they often rotted on the quayside due to the lack of ships linking Belém to export markets. In 1748 not one ship bound for a non-Brazilian port called at the city, and just one in 1754 and in 1758.⁶⁷ Ships did not call predictably until cacao production became regular and large-scale with the growth of plantations. And because it was a relatively low-bulk commodity, cargo space remained to be filled by other products, notably the drogas

65. *Ibid.*, 116.

66. Block, *Mission Culture on the Upper Amazon*, 72–77.

67. Alden, "Significance of Cacao Production," 133.

do sertão.⁶⁸ Without cacao plantations, the impact of extractivism prior to the rubber boom would have been considerably attenuated.

A good illustration of the transformations involved in the regional landscape is the history of Amazonian boatbuilding. From Gaspar Carvajal to *National Geographic*, observers have noted how the peculiarly Amazonian combination of rivers with innumerable species of timber has made boatbuilding a central (albeit largely unstudied) feature of regional culture and economy. Colonial illustrations show that the meeting of European and indigenous traditions of marine design had led to the growth of a shipbuilding industry of remarkable sophistication before the end of the eighteenth century. The thousands of river craft, large and small, upon which the economy and regional transport depended were all locally made.⁶⁹ The Portuguese Crown, attracted by the abundance of ship timber, located one of its three Brazilian naval shipyards in Belém, which rapidly became the largest-scale industrial enterprise in the Amazon, with a workforce of 370 as early as 1771. This yard was one of the most important centers of naval construction in the Portuguese Empire, building twelve oceangoing ships between 1801 and 1822, including the forty-gun frigate *Imperatriz*.⁷⁰ This ship, recently completed, happened to be in the shipyard when it was captured by British mercenary Admiral Thomas Cochrane in the fighting that attended the independence of Brazil in 1822. His expert assessment of its quality and the excellent local materials the shipwrights had to work with made its way into his memoirs many years later. Cochrane had reason to know the ship well because he sailed it as a prize back to England.⁷¹ This and the other ships were all made from local timber, but as the nineteenth century progressed, shortages of timber restricted the shipyard to producing barges and lighters for river traffic. From the 1850s on, reports of the provincial presidents of Pará and the imperial ministry of the navy noted the need to send woodcutting teams as far afield as the headwaters of the Capim and Acará Rivers, over 100 kilometers from Belém, to find particular timber species.⁷² The next major ship to be built at the shipyard, the gunboat *Manaos* in 1881, had a deck and masts made of imported North American pine, a striking demonstration of the denuding of the Amazon estuary of the hardwoods that indigenous and European boatbuilders had counted on for centuries.⁷³

68. *Ibid.*, 132.

69. For reproductions of colonial illustrations of river boats and their manufacture, see *Alexandre Rodrigues Ferreira: A Amazônia redescoberta no século XVIII* (Rio de Janeiro: Biblioteca Nacional, 1992), plate 21; and *História dos Índios no Brasil*, edited by M. Carneiro da Cunha (São Paulo: Companhia das Letras, 1992), 110–11.

70. Summary of the shipyard's history and figures are based on the *Relatório do Ministro da Marinha, 1873* (Rio de Janeiro: Typographia Americana, 1873), 27.

71. Thomas, Earl of Dundonald, *Narrative of Services in the Liberation of Chili, Peru, and Brazil from Spanish and Portuguese Domination* (London: James Ridgeway, 1859), 2:64–65.

72. See, for example, *Relatório, Pará, 1855* (n.d.), p. 21; and *Relatório, Pará, 1 Oct. 1859*, p. 55.

73. *Relatório, Pará, 15 Feb. 1881*, p. 36.

CONCLUSION

When does modern history begin? At different times in different places, but for the Amazon the decade of the 1850s seems the logical choice, ushered in by Charles Goodyear's accidental discovery of vulcanization and the initiation of regular steamboat services on the Amazon in 1853. This reduced journey times from weeks to days and more than any other single factor made the Amazon into an integrated, relatively efficient export economy, complete with banks, telegraphs, and opera houses. With the opening of the main channel of the Amazon to ships of all nationalities by the Brazilian government in 1866, all the major preconditions for the rubber boom were in place, although it would not peak for another thirty years. Once it did, the boom set off a process of landscape transformation that accelerated, stopped, reversed, and then accelerated again, repeating in the course of a single century the nonlinear sequence of the Amazon's environmental history over the previous fifteen or twenty thousand years. This is another story, to be written separately. But it allows me to hope that the century ending as I write turns out to be a palimpsest, an image from which we read the past, not the future.

REFERENCES

- ALDEN, DAURIL
1976 "The Significance of Cacao Production in the Amazon Region in the Late-Colonial Period: An Essay in Comparative Economic History." *Proceedings of the American Philosophical Society* 120, no. 2 (Apr.):103-35.
- ALMEIDA, A. DE
1983 *A ideologia da decadência*. São Luís do Maranhão: Instituto de Pesquisas Sociais (IPES).
- ANDERSON, R.
1976 "Following Curupira: Colonization and Migration in Pará, 1758 to 1930, as a Study in Settlement of the Human Tropics." Ph.D diss., University of California, Davis.
- ANDERSON, S.
1990 "Engenhos na várzea: Uma análise do declínio de um sistema de produção tradicional na Amazônia." In *A fronteira agrícola vinte anos depois*, edited by P. Lena and A. de Oliveira, 217-29. Belém: CEJUP.
- BALEE, WILLIAM
1989 "The Culture of Amazonian Forests." In POSEY AND BALEE 1989, 1-21.
1998 *Advances in Historical Ecology*. New York: Columbia University Press.
- BARRETO, CLAUDIO
1998 "Brazilian Archaeology from a Brazilian Perspective." *Antiquity* 72, no. 277 (Sept.): 573-80.
- BATES, H.
1863 *The Naturalist on the River Amazons*. London: John Murray.
- BIBLIOTECA NACIONAL
1873 *Relatório do Ministro da Marinha, 1873*. Rio de Janeiro: Typographia Americana.
1992 *Alexandre Rodrigues Ferreira: A Amazônia redescoberta no século XVIII*. Rio de Janeiro: Biblioteca Nacional.
- BLOCK, DAVID
1994 *Mission Culture on the Upper Amazon: Native Tradition, Jesuit Enterprise, and Secular Policy in Moxos, 1660-1880*. Lincoln: University of Nebraska Press.

- BOOMERT, A.
1987 "Gifts of the Amazons: Greenstone Pendants and Beads as Items of Ceremonial Exchange." *Antropologica* 67:33-54.
- BRAUDEL, FERNAND
1973 *The Mediterranean and the Mediterranean World in the Age of Philip II*. New York: Harper and Row.
- BUSH, M., D. PIPERNO, AND P. COLINVAUX
1989 "A 6,000 Year History of Amazonian Maize Cultivation." *Nature* 340 (27 July): 303-5.
- CARDOSO, C. DE
1984 *Economia e sociedade em áreas coloniais periféricas: Guiana Francesa e Pará, 1750-1817*. Rio de Janeiro: Graal.
- CARREIRA, A.
1988 *A Companhia Geral do Grão-Pará e Maranhão*. São Paulo: Editora Nacional.
- CROSBY, ALFRED
1972 *The Columbian Exchange: Biological and Cultural Consequences of 1492*. Westport, Conn.: Greenwood.
- CUNHA, MANUELA CARNEIRA DA, ED.
1992 *História dos Índios no Brasil*. São Paulo: Companhia das Letras.
- DANIEL, J.
1975 *Tesouro descoberto no Rio Amazonas: Anais da Biblioteca Nacional*, v. 95. Rio de Janeiro: Biblioteca Nacional.
- DEAN, WARREN
1987 *Brazil and the Struggle for Rubber: A Study in Environmental History*. Cambridge: Cambridge University Press.
1995 *With Broadax and Firebrand: The Destruction of the Brazilian Atlantic Forest*. Berkeley and Los Angeles: University of California Press.
- DENEVAN, WILLIAM
1966 "The Aboriginal Cultural Geography of the Llanos de Mojos, Bolivia." *Ibero-Americana*, no. 48.
1991 "Prehistoric Roads and Causeways of Lowland Tropical America." In *Ancient Road Networks and Settlement Hierarchies in the New World*, edited by C. Trombold. Cambridge: Cambridge University Press.
1992 "The Aboriginal Population of Amazonia." In *The Native Population of the Americas in 1492*, edited by W. Denevan, 205-34. Madison: University of Wisconsin Press.
- DESCOLA, PHILIPPE
1994 *In the Society of Nature: A Native Ecology in Amazonia*. Cambridge: Cambridge University Press.
- EDEN, M., W. BRAY, L. HERRERA, AND C. MCEWAN
1984 "Terra preta Soils and Their Archaeological Context in the Caquetá Basin of Southeast Colombia." *American Antiquity* 49, no. 1:125-40.
- ERICKSON, CLARK
1995 "Archaeological Methods for the Study of Ancient Landscapes of Llanos de Mojos in the Bolivian Amazon." In *Archaeology in the Lowland American Tropics: Current Analytical Methods and Recent Applications*, edited by Peter Stahl. Cambridge: Cambridge University Press.
- FARAGE, N.
1991 *As muralhas dos sertões: Os povos indígenas no Rio Branco e a colonização*. Rio de Janeiro: Paz e Terra.
- FERGUSON, B.
1995 *Yanomami Warfare: A Political History*. Santa Fe, N.M.: School of American Research.
- FIEDEL, S.
1987 *Prehistory of the Americas*. Cambridge: Cambridge University Press.
- GOLOB, A.
1982 "The Upper Amazon in Historical Perspective (Peru, Ecuador)." Ph.D. diss., City University of New York.

Latin American Research Review

- GUIDON, NIEDE, AND B. ARNAUD
 1991 "The Chronology of the New World: Two Faces of One Reality." *World Archaeology* 23, no. 2:167-78.
- HAMES, ROBERT, AND WILLIAM VICKERS, EDs.
 1983 *Adaptive Responses of Native Amazonians*. New York: Academic Press.
- HECHT, SUSANNA, AND DARRELL POSEY
 1989 "Preliminary Results on Soil Management Techniques of the Kayapó Indians." In POSEY AND BALEE 1989, 174-88.
- HECKENBERGER, MICHAEL
 1996 "War and Peace in the Shadow of Empire: Sociopolitical Change in the Upper Xingú of Southeastern Amazonia, A.D. 1400-2000." Ph.D. diss., University of Pittsburgh.
 1998 "Manioc Agriculture and Sedentism in Amazonia: The Upper Xingú Example." *Antiquity* 72, no. 277 (Sept.):633-47.
- HILBERT, PETER
 1955 *A cerâmica arqueológica da região de Oriximiná*. Belem: Instituto de Antropologia e Etnologia do Pará.
- HOORNAERT, E., ED.
 1992 *A história da Igreja na Amazônia*. Petrópolis: Vozes.
- HOSKINS, WILLIAM
 1955 *The Making of the English Landscape*. London: Hodder and Stoughton.
- HUMBOLDT, ALEXANDER VON, AND AIME BONPLAND
 1821- *Personal Narrative of Travels to the Equinoctial Regions of the New Continent*. London:
 1825 Longman, Hurst, Rees, Orme, and Brown.
- IRVINE, DOMINIQUE
 1989 "Succession Management and Resource Distribution in an Amazonian Rainforest." In POSEY AND BALEE 1989, 223-37.
- LATHRAP, DONALD
 1970 *The Upper Amazon*. New York: Praeger.
- LORIMER, J., ED.
 1989 *English and Irish Settlement on the River Amazon, 1550-1646*. London: Hakluyt Society.
- MCCANN, J., AND WILLIAM WOODS
 n.d. "The Anthropogenic Origin and Persistence of Amazonian Dark Earths." In *Conference of Latin Americanist Geographers Yearbook 25*, edited by César Caviedes. Austin: University of Texas Press, in press.
- MAW, H.
 1829 *Journal of a Passage from the Pacific to the Atlantic*. London: John Murray.
- MEDINA, J., ED.
 1988 *The Discovery of the Amazon*. New York: Dover.
- MEGGERS, BETTY
 1996 *Amazonia: Man and Culture in a Counterfeit Paradise*. Washington, D.C.: Smithsonian Institution Press (originally published in 1971).
- MELVILLE, ELINOR
 1977 *A Plague of Sheep: Environmental Consequences of the Conquest of Mexico*. Cambridge: Cambridge University Press.
- MENDONÇA, M. DE, ED.
 1963 *A Amazônia na era pombalina*. São Paulo: Gráfica Carioca.
- MORAN, EMILIO
 1993 *Through Amazonian Eyes*. Iowa City: University of Iowa Press.
- MYERS, T.
 1992 "Agricultural Limitations of the Amazon in Theory and Practice." *World Archaeology* 24, no. 1:82-97.
- NEVES, EDUARDO
 1998 "Twenty Years of Amazonian Archaeology in Brazil (1977-1997)." *Antiquity* 72, no. 277 (Sept.):625-32.
- NIMUENDAJU, CURT
 1980 *Mapa etno-histórico do Brasil e regiões adjacentes*. Rio de Janeiro: IBGE (first published in 1944).

ENVIRONMENTAL HISTORY OF THE AMAZON

- ORTIGUERA, T.
1968 "Jornada del Mara n." *Biblioteca de Autores Espa oles* 206 (1968):217-358.
- PARSONS, JAMES
1969 "Ridged Field Sites in the Rio Guayas Valley, Ecuador." *American Antiquity* 34, no. 1:76-80.
- POSEY, DARRELL, AND WILLIAM BALEE, EDS.
1989 *Resource Management in Amazonia: Indigenous and Folk Strategies*. New York: New York Botanical Garden.
- PRICE, R.
1983 *First Time*. Baltimore, Md.: Johns Hopkins University Press.
1983 *To Slay the Hydra*. Ann Arbor, Mich.: Karoma.
1990 *Alabi's World*. Baltimore, Md.: Johns Hopkins University Press.
- RIVAL, LAURA
1998 "Domestication as a Historical and Symbolic Process: Wild Gardens and Cultivated Forest in the Ecuadorian Amazon." In *Advances in Historical Ecology*, edited by William Bal e, 232-50. New York: Columbia University Press.
- RIVIERE, PETER
1984 *Individual and Society in Guiana: A Comparative Study of Amerindian Social Organization*. Cambridge: Cambridge University Press.
- ROOSEVELT, ANNA
1991 *Moundbuilders of the Amazon: Geophysical Archaeology on Maraj  Island, Brazil*. San Diego, Calif.: Academic Press.
- ROOSEVELT, ANNA, ET AL.
1991 "Eighth Millennium Pottery from a Prehistoric Shell Midden in the Brazilian Amazon." *Science* 254 (13 Dec.):1621-24.
1996 "Paleoindian Cave Dwellers in the Amazon: The Peopling of the Americas." *Science* 272 (19 Apr.):373-84.
1996 "Paleoindians in the Brazilian Amazon." *Science* 274 (13 Dec. 1996):1823-26.
1997 "Dating a Paleoindian Site in the Amazon in Comparison with Clovis Culture." *Science* 275 (28 Mar.):1948-52.
- RUSSELL-WOOD, A. J. R.
1991 "Ports of Colonial Brazil." In *Atlantic Port Cities: Economy, Culture, and Society in the Atlantic World, 1690-1850*, edited by F. Knight and P. Liss, 196-239. Knoxville: University of Tennessee Press.
- SAUER, CARL
1992 *The Early Spanish Main*. Berkeley and Los Angeles: University of California Press (first published in 1966).
- SERENI, ELIAS
1997 *History of the Italian Agricultural Landscape*. Princeton, N.J.: Princeton University Press.
- SMITH, HERBERT
1879 *Brazil: The Amazons and the Coast*. London: Sampson Low, Marston, Searle, and Rivington.
- SMITH, NIGEL
1974 "Destructive Exploitation of the South American River Turtle." *Yearbook of the Pacific Coast Geographers* 36:85-102.
1980 "Anthrosols and Human Carrying Capacity in Amazonia." *Annals of the Association of American Geographers* 70, no. 4 (Dec.):553-66.
- SPENCER, C., E. REDMOND, AND M. RINALDI
1994 "Drained Fields at La Tigra, Venezuelan Llanos: A Regional Perspective." *Latin American Antiquity* 5, no. 2:119-43.
- SPIX, JOHANN, AND CARL VON MARTIUS
1881 *Viagem pelo Brasil, 1817-1820*. S o Paulo: Itatiaia (originally published in 1831).
- SPRUCE, RICHARD
1908 *Notes of a Botanist on the Amazon and Andes*. London: Macmillan.
- STILGOE, JOHN
1982 *Common Landscape of America, 1580 to 1845*. New Haven, Conn.: Yale University Press.

Latin American Research Review

SWEET, D.

1974 "A Rich Realm of Nature Destroyed: The Middle Amazon Valley, 1640-1750." Ph.D. diss., University of Wisconsin.

1995 "The Ibero-American Frontier Mission in Native American History." In *The New Latin American Mission History*, edited by Erick Langer and Richard Jackson, 1-48. Lincoln: University of Nebraska Press.

THOMAS, EARL OF DUNDONALD

1859 *Narrative of Services in the Liberation of Chili, Peru, and Brazil from Spanish and Portuguese Domination*. London: James Ridgeway.

VAZQUEZ, F.

1992 *El Dorado: Crónica de la expedición de Pedro de Ursúa y Lope de Aguirre*. Madrid: Alianza.

VERSWIJVER, G.

1992 *Club-Fighters of the Amazon: Warfare among the Kaiapó Indians of Central Brazil*. Ghent, Belgium: Rijksuniversiteit.

WALLACE, ALFRED

1863 *A Narrative of Travels on the Amazon and Rio Negro*. London: Reeve and Co.

WATTS, DAVID

1987 *The West Indies: Patterns of Development, Culture, and Environmental Change since 1492*. Cambridge: Cambridge University Press.

WHITEHEAD, NEIL

1988 *Lords of the Tiger Spirit: A History of the Caribs in Colonial Venezuela and Guayana, 1498-1820*. Providence, R.I.: Foris.

1990 "The Mazaruni Pectoral: A Golden Artefact Discovered in Guyana and the Historical Sources Concerning Native Metallurgy in the Caribbean, Orinoco, and Northern Amazonia." *Archaeology and Anthropology* 7:19-36.

1993 "Ethnic Transformation and Historical Discontinuity in Native Amazonia and Guayana, 1500-1900." *L'Homme* 126-28, nos. 13-14:285-305.

1996 "Amazonian Archaeology: Searching for Paradise? A Review of Recent Literature and Fieldwork." *Journal of Archaeological Research* 4, no. 3 (1996):241-64.

WILLEY, GORDON

1971 *An Introduction to American Archaeology*. Englewood Cliffs, N.J.: Prentice Hall.

WOODS, WILLIAM

1995 "Comments on the Black Earths of Amazonia." *Papers and Proceedings of Applied Geography Conferences* 18:159-65.