FURTHER REFLECTIONS ON AMAZONIAN ENVIRONMENTAL HISTORY:
Transformations of Rivers and Streams*

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Abstract: Despite the increasing sensitivity of researchers to historical and contemporary landscape manipulations in the Amazon basin, there is still a powerful consensus in both popular and scholarly literatures that, with the exception of predatory deforestation, the physical environment of the region is largely unmodified by human intervention. An emerging body of scholarship has challenged this view by describing ways that Amazonian populations have managed terrestrial ecosystems on a variety of spatial and temporal scales. In this research report, we present both new and previously published data showing that Amazonians also intervene in fluvial systems, manipulating rivers and streams to modify the landscape. We argue that these practices, occurring in many different forms, are widespread and commonplace throughout the region, and that, taken together with the emerging evidence for terrestrial manipulation, provide compelling reason for a fundamental reassessment of conventional views of Amazonian nature.

INTRODUCTION

In an important recent article in *LARR* (36:2), David Cleary (2001) surveyed a grand sweep of what he termed Amazonian "environmental history." The significance of Cleary situating his discussion within this subdisciplinary rubric should not be overlooked. In the context of a series of high-profile popular accounts that have called attention to the sophistication and transformative impacts of the resource management

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practices of regional populations (see Associação Brasil 500 Anos Artes Visuais 2000; McEwan, Barreto, and Neves 2001; Mann 2002), Cleary's contribution marks a growing willingness on the part of Amazonianist scholars to historicize a landscape long regarded as inimical to human intervention, and to do so by emphasizing the agency of the region's inhabitants.

This is a decisive shift. For almost a half century, the influential work of the North American anthropologist Julian Steward and his followers—in particular that of Smithsonian archaeologist Betty Meggers—established Amazonia as the principal ethnographic proving-ground for cultural ecological theories of adaptation that stressed the limits placed on social and cultural "development" by ecological constraint (Meggers 1954, [1971] 1996; Steward 1946–50; Steward and Faron 1959; Hames and Vickers 1983; cf. Balée 1989; Nugent 1981; Roosevelt 1980, 1991). As we describe below, although important data that contradicted this position were long present in the ethnographic and archaeological literatures, it is only in the past two decades that researchers have explicitly begun to theorize alternative histories for the region, and only today that this revisionist scholarship is gaining popular currency.

In this research report, we present both new and previously published material on the manipulation of Amazonian landscapes by local populations. We understand these data as contributing to an emergent body of work in Amazonianist social scientific scholarship that rejects the notion of a pristine rain forest and the associated ineffectuality of local populations, and instead proposes a more hybrid conception of a "natural-cultural" regional landscape (e.g., Balée 1989, 1998; Denevan 1992, 2001, n.d.; Hecht and Posey 1989; Raffles 1999, 2002; Roosevelt 1980, 1991; Smith 1995; cf. Demerritt 1994; Haraway 1997; Latour 1993). Part of this argument is the claim that nature is socially constructed as a discursive practice and that the contemporary opposition between nature and culture is historically and culturally specific to post-Enlightenment European thought (Latour 1993; Strathern 1981; Williams 1980). More specifically, however, this body of research insists on the biophysical materiality of Amazonian nature, arguing for the recognition of these landscapes as cultural in an older sense of embodying social labor, of being worked and transformed by humans (cf. Sauer [1925] 1963; Williams 1973; Doolittle 1984). It is this realist aspect of the argument that we build on and expand in this paper.

Recent empirical research suggests that the forests of the Amazon basin have undergone substantial manipulation and management since long before modern development of the region and, indeed, prior to the arrival of Europeans in the New World. Researchers have documented in detail the long-term manipulation of forest composition and species density (e.g., Balée 1994; Moran 1996; Roosevelt 1999, 2000), with Balée,

for example, estimating that 12 percent of Amazonian forest is currently of "biocultural" origin (Balée 1989, 14). In building a convincing account of region-wide, landscape-scale manipulation and transformation, scholars point to anthropogenic forests managed for the extraction of particular tree crops (Balée 1994), to trails planted with useful foods by traveling or semi-nomadic people (Hecht and Posey 1989; Posey 1985), to managed forest islands amidst a dominant savannah landscape (Posey 1985, 1992), and to the long-term use of what were once thought to be abandoned swiddens (Denevan and Padoch 1987; Irvine 1989). In addition, studies of the anthropogenic origins of the extensive areas of black or dark earth soils known as *terra preta do índio* have revealed a significant human contribution to pedogenesis (Smith 1980; Woods and McCann 1999; McCann, Woods, and Meyer 2001; Glaser et al. 2001; Petersen, Neves, and Heckenberger 2001) and researchers have also identified other types of soil management, including concentric ring agriculture and in-field burning (Hecht and Posey 1989), sediment trapping in the floodplain (Padoch and Pinedo-Vásquez 1999), and organic matter harvesting (WinklerPrins 1994).

So far, this literature has focused almost exclusively on the terrestrial landscape. Apart from the substantial body of research carried out on the raised and ridged fields of the Venezuelan and Bolivian savannas (Denevan 1966, 1970; Denevan and Zucchi 1978; Erickson 1980, 2000; Erickson, Winkler, and Chandler 1997) that we discuss below, reports of the manipulation of rivers and streams in the Amazonianist literature have been scattered, limited, and in general expressed without attention to their potential significance. In what follows, we provide evidence that Amazonians routinely intervene in fluvial systems and that these changes modify landscapes at a wide variety of scales. Indeed, we argue that such practices have contributed to dramatic changes to regional landscapes, ecologies, and social organization in a manner consistent with what we know of terrestrial interventions.

In trying to understand why landscape manipulations of both types have for so long remained marginal to the Amazonian literature, it helps to recognize the particular valence of such practices in a region burdened with overdetermining discursive histories of primal nature. Fundamental to discourse on northern South America since the arrival of Europeans in the sixteenth century and the circulation of accounts of exploration, has been a narrative of local subjection to tropical nature. Notwithstanding the ambivalence and instability of travelers' accounts of transoceanic voyaging, the writings of the sixteenth and seventeenth centuries show Europeans determined to locate native Amazonians in what we might call a society of nature (for commentary, see Greenblatt 1991; Hulme 1992; Pagden 1993; Slater 1996). Striking continuities across the centuries have prevailed: nineteenth-century theories that explain a

perceived agricultural backwardness by reference to the indolence-inducing effect on race of a too fertile nature correspond closely to the cultural ecological narratives of the late twentieth century that describe the apparently identical social effects of a rather different environment, one now seen as a harsh setting of nutrient-poor soils and inadequate protein. This is a long and stubborn genealogy in which influential scientific and popular narratives construct native Amazonians as both close to and subordinate to nature, and explicitly represent the region as a space of nature, rather than of society (Gondim 1994; Nugent 1981, 1993; Raffles 2002).

A governing trope of such constructions has been the representation of local Amazonians as profoundly passive. Nature-society relations have consistently been cast so as to deny the agency of the local populations of the region, both indigenous Amazonians and *caboclos*.[1] In this context, data on human-induced environmental change are of considerable significance and underscore the need for a re-evaluation of standard narratives of Amazonian social and natural histories.

In the remainder of this report, we present evidence of the human manipulation of fluvial processes on the floodplain of the Amazon River and its tributaries. Though covering only 2 percent of the basin, the Amazon floodplain is about twice the aerial extent of The Netherlands (Eden 1990; Sternberg 1975, 17). As an area of relatively rich plant and animal resources, it has been of pre-eminent significance to regional populations for centuries, and both the *várzea*, as the floodplain of the Amazon and its whitewater tributaries is known, and the *igapó*, floodplain formed from blackwater rivers with lower nutrient loads, continue to be characterized by settlement, agriculture, and diverse regimes of resource extraction (Chernela 1989; Coomes 1992; Padoch et al. 1999).

We begin with a description of Raffles' research in the Amazon estuary where residents of one community have substantially changed the course, dynamics, volume, and significance of local rivers and streams. In the section that follows, we describe new data collected by WinklerPrins near Santarém in the Lower Amazon, a site where local people take advantage of natural sedimentation processes to create land in the difficult conditions of the floodplain. We then present a general survey of the breadth and variation of Amazonian fluvial manipulation drawn from additional data of our own as well as from our review of a body of generally poorly known published sources. In the final section of the paper we reflect on the broader significance of our findings.

1. *Caboclos*, a local term that refers to Amazonians of rural origin—glossed as "peasants" in an earlier literature—is complex and contested. For discussions, see Harris 1998; Nugent 1997.

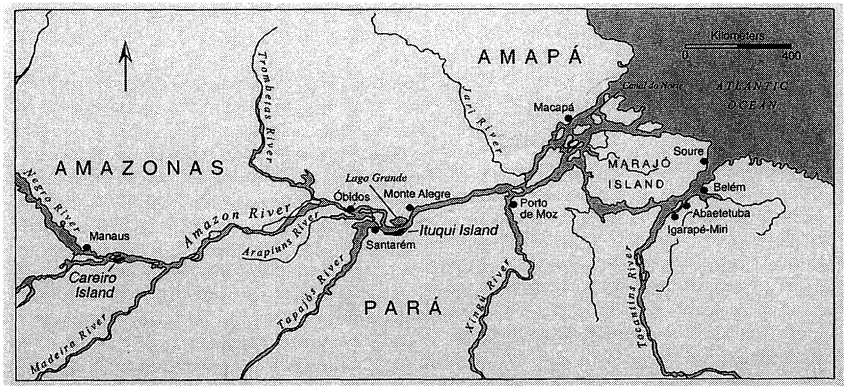

Figure 1 Map of Amazonia Indicating Locations Mentioned in the Text (Cartography by Ellen White, Michigan State University).

LARGE-SCALE ESTUARINE TRANSFORMATIONS: IGARAPÉ GUARIBA, AMAPÁ[2]

Research along the northern channel of the Amazon estuary has produced evidence of substantial recent human interventions in local fluvial landscapes. In the community of Igarapé Guariba, located four hours by motor-launch northeast from the city of Macapá, residents have significantly enlarged the main channel of the Rio Guariba—a river that flows directly into the northern channel of the Amazon estuary—and have dug a network of canals leading from it into floodplain forest.

Settlers have carried out fluvial interventions here since soon after they first arrived in the late 1950s.[3] Long-term residents describe the Rio Guariba of that time as a short and narrow river, about 15–25 m wide at its mouth where it met the Amazon; shallow and safe enough for children to wade or swim at low tide. About 2 km from its junction with the Amazon, the river cascaded over a low waterfall. Hunters would haul their canoes over or around the rocks of these falls to arrive in an open landscape of seasonally flooded grassland dominated by the papyrus-like *pirí* (*Cyperus giganteus*). Here, above the falls, the *pirí* formed a dense barrier, a *pirizal*, in association with *aninga* (*Montrichardia arborescens*), a woody aroid that commonly grows to a height of 2 m or more.

Residents of Igarapé Guariba dismantled the waterfall and cut a channel through the grassland to reach economically valuable forest products, game, and agricultural land visible several kilometers to the northwest in dense *várzea* forest. Working in teams of men over several dry seasons, they used axes, machetes, and hoes to create an opening about 2 m wide and 1 m deep which they secured and maintained by

2. "Igarapé Guariba" is a pseudonym.
3. For complete accounts, see Raffles 2002.

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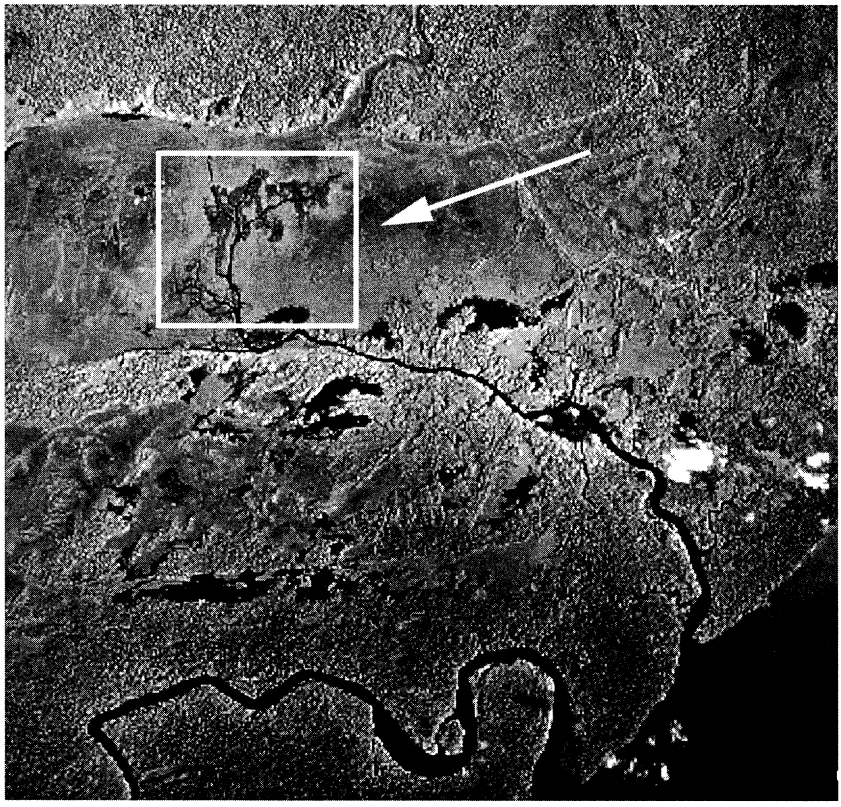

Figure 2 Rio Guariba (upper river), 1976. Infrared aerial photograph. Courtesy Daniel Zarin.

repeatedly driving water buffalo through the opening, encouraging the animals both to compact the soil by trampling and to graze the grass and sapling regrowth.

Once the headwaters had been breached and the channel opened, the huge volumes of water that enter the northern channel of the Amazon estuary with the twice-daily tides rapidly swept soil and vegetation out into the main river. Without a definable watershed and surrounded by land too flat for effective drainage, the Rio Guariba functioned as a long, narrow inlet, repeatedly washed by the erosive tidal action of the Amazon. With the barrier of the waterfall removed and a channel opened into the low-lying grasslands, the flood of the Amazon poured into the upstream basin, excavating and widening the main channel and enabling transport to the upstream forest by sail- and motor-boat as well as by canoe. From this moment on, residents could plant and harvest crops such as banana, corn, and watermelon, and collect a range of forest products in this upstream area.

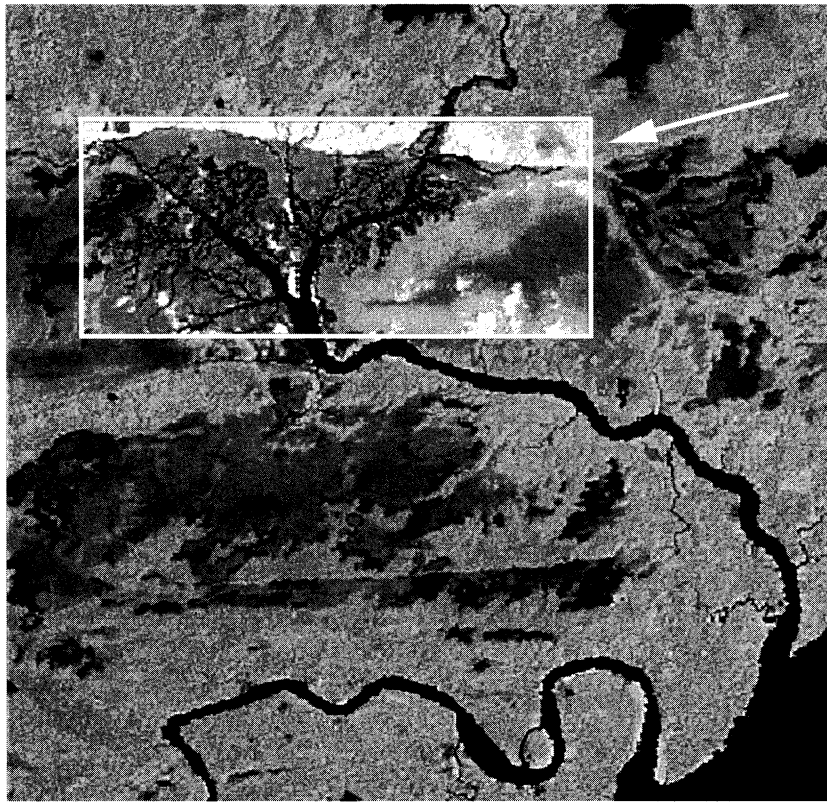

Figure 3 Rio Guariba (upper river), 1991. LandSat TM composite image. Courtesy Daniel Zarin.

The landscape within which these activities took place was radically transformed. The once narrow mouth of the river is today over 600 m wide and can capsize motor-boats on a windy day. The swampy *pirizal* has become a sweeping expanse of water, a "lake" nearly 2 km in diameter. The closed upstream forest is now threaded with a tracery of creeks, streams, and broad channels.

This transformation is visible in figures 2 and 3. Figure 2, taken in 1976, well over a decade after engineering work first began, is the earliest aerial image available of this area. Rio Guariba (the upper river) is still relatively narrow and the area upstream where the river fragments into smaller channels is poorly-defined. Compare this to figure 3, a composite Landsat TM image on the same scale from 1991.[4] Not only is the

4. These images are directly comparable. Seasonal variation has been eliminated by using images from the same months of different years (October/November). Diurnal tidal variation has been controlled for by the reading of exposed mud-flats as water

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expansion of the main river channel clearly apparent, but significant changes are also visible upstream where the river ramifies into the forest. In this area, channels initially 2 m wide now stretch up to 50 m at their widest points, and this width can persist for up to 2 km.

Some of the streams in this area are entirely new channels. Others are dried or overgrown streambeds reopened by work-teams. Still others were once narrow, seasonally impassable passages that have been engineered for year-round canoe or motor-launch access. Most, if not all, are the result of a combination of human labor and the erosive energy of the river.

As with the Rio Guariba itself, such channels were initially managed for the extraction of high-value timber and oil-seeds but are currently more important as access routes to agricultural fields, game and fishing grounds, and to stands of managed and unmanaged *açaí* (*Euterpe oleracea*) palms—a resource that has become increasingly valuable in recent years (Brondízio and Siqueira 1997).

MAKING LAND IN THE LOWER AMAZON: ITUQUI ISLAND, PARÁ

Research on the floodplain of the Amazon River in the Municipality of Santarém is demonstrating other types of interventions in the fluvial landscape. On Ituqui, a 21,000 hectare floodplain island 30 km downstream from the city of Santarém, residents have been manipulating sedimentation processes for decades, if not longer. In January, when the river is rising, people dig channels, called *cavados* (from the Portuguese verb *cavar*, to dig), to allow floodwaters to enter backswamp areas located behind the levees that surround the island. The purpose of these activities is to "make land" (*aterrar*) out of otherwise swampy (and unusable) backswamp areas.

People live along the narrow levee that surrounds the island. This is the highest part of the available land, and on an island in which the annual river flood regime covers most land for several months every 2–3 years, such high levee land is prized (WinklerPrins 1999). The details of the flood cycle, such as its height, duration, and the exact timing of its arrival and recession are variable and unpredictable but can limit the cropping season to 5–6 months. Manioc (*Manihot esculenta*), the staple crop, requires a six-month growing season, leaving it vulnerable to failure any year the flood recesses too late or arrives too early. Residents use the highest available land for this critical staple, and such land is therefore at a premium. The filling in of backswamp areas is consequently of considerable importance.

(Daniel Zarin, personal communication). For a comprehensive analysis of Landsat images from this region, see Pereira 1998.

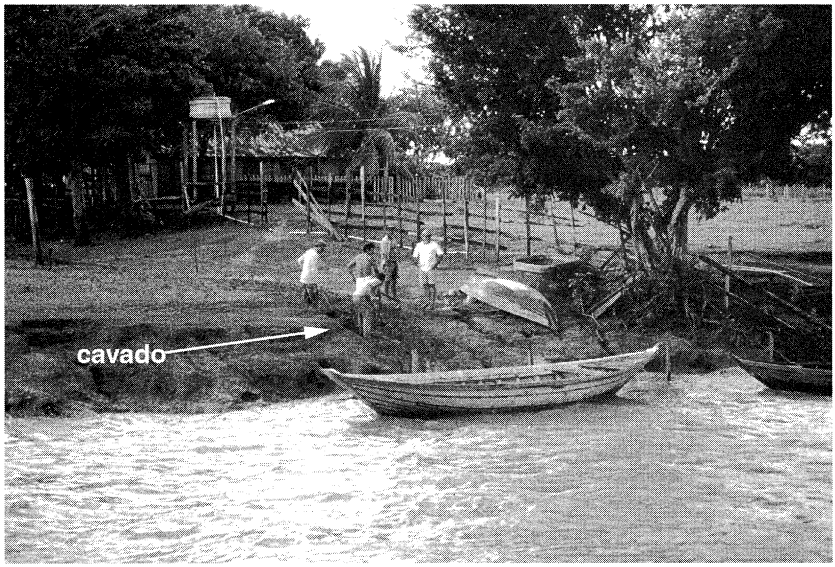

Figure 4 Men digging cavado *on Ituqui Island, January 1996 (photograph by A. WinklerPrins).*

People on Ituqui utilize the process of slackwater sedimentation. Flood-waters slow down considerably in the slackwater environment found in the backswamp areas. The whitewater Amazon River carries heavy loads of Andean sediment that fall out of suspension as the flood-waters slow, filling in the area behind the levee over time (Sioli 1951). Researchers estimate that annual sediment deposition could be about 3 cm/day along the Amazon River, producing a potentially significant sedimentation of up to 2 m in any flood season (Mertes 1994; 171). Most of these sediments are fine grain silts important for the maintenance of soil fertility (Irion 1984).

Most anthropogenic channels start out as no more than a trench several meters across and about 1 m deep. In January, at the onset of the flood season and before the river overtops the levees, work parties typically composed of male family members will open or reopen the entrance to a *cavado* by digging a small trench about 1 m deep and 2 to 3 m across (figure 4). The work is done using only hand tools such as shovels and spades. Over a period of decades these channels are enlarged through the combined erosive actions of the river and the annual reopening of the channel entrance by teams of workers. Channels started 40 to 50 years ago are now as much as 20 m across in places and 2 to 5 m deep.

One channel in the community of São Benedito on Ituqui Island serves as an example. It was initially dug about fifty years ago at a width of 2 m

and a depth of 1 m. It was subsequently extended far enough to reach a backswamp area about 100 m behind the levee and now reaches back about 150 to 250 m. The area that started out as a backswamp is now a relatively flat open space used for agricultural purposes, especially cropping and pasture land, but also as a soccer field. Such channels are common on Ituqui.

Another type of channel is also found in the Ituqui area. These channels are shortcuts or navigation channels that provide easy canoe access between the island and the nearby upland bluff area. As the river rises, work parties cut through the maze of lakes and levees in the area to create direct and therefore easier access to nearby upland bluff areas. This shortens travel time as well as making the journey safer for canoes, the usual mode of transport.

Access to bluffs is becoming ever more important in the Ituqui area as greater numbers of inhabitants migrate to these sites as a result of changes in the regional economy. Jute, a fiber crop used to make sacking, was the economic mainstay from about the mid 1930s until the mid 1980s. However, with changes in the packaging and transportation of coffee and other commodities as well as the elimination of tariffs, the industry collapsed (Gentil 1988; Homma 1998). Jute grew during the flood season, complementing dry season agriculture and fishing, and it permitted residents to live and work on the floodplain year-round (Gentil 1988; McGrath et al. 1993; Poetzscher 1940). The collapse of the jute industry has left smallholders of Ituqui searching for a new winter activity and one of the main choices is seasonal migration to nearby upland bluff areas (WinklerPrins 1999, 2002). Interestingly, this activity may be the return to a pattern of resource use and occupancy that dates from pre-Columbian times (Denevan 1996).

THE ENVIRONMENTAL HISTORY OF AMAZONIAN WATERWAYS

The two cases discussed above are illustrative of a set of heterogeneous but commonplace and widespread practices. In our view, Amazonian rivers and streams have long been and continue to be important sites of interventions at a wide range of scales. As yet, however, there is no systematic survey of anthropogenic landscapes—fluvial or terrestrial—in Amazonia. Nor do we foresee one being undertaken, given the impracticalities of carrying out an ethno-ecological project of this type over such a vast area.

References in the scholarly literature to fluvial manipulation remain dispersed and rarely substantive, and hence have attracted little attention.[5] In this section, we offer a partial and preliminary corrective to this

5. For the most comprehensive extant account, see Denevan 2001. Balée 1989 provides the broadest synopsis of data on anthropogenic forests.

situation by drawing on bibliographic research, on personal communication with colleagues, and on additional fieldwork of our own to present a range of examples that indicates the scope and variety of these interventions. In so doing, we hope to sensitize other scholars to such activities and encourage more attention to the transformative practices of Amazonian populations.

Fluvial manipulations occur throughout Amazonia. At the far eastern edge of the region, on the Rio Preguiça in Maranhão, fishermen have described the cutting of a *furo* (stream) in the 1950s to reduce the distance from the coast to the market town of Barreirinhas (Michael Reynolds, personal communication, May 2000). Not far from here, on Marajó Island in the Amazon estuary, cattle and buffalo ranchers dig drainage trenches and canals, and for centuries have used *barragens* (barrages) and other forms of damming to control the hydrology of this low-lying tidal area (Palmatary 1949, 265–266; Roosevelt 1991: 24, photograph C; Jaime Rabelo, personal communication, September 1996).

At the other end of the basin, along the Rio Môa, a tributary of the Rio Juruá close to the Peruvian border with the Brazilian state of Acre, *caboclos* have cut a series of passages called *valas* that slice through meander loops and shorten travel time on a tightly winding river (David Cleary, personal communication, April 2000).

Similar shortcuts through the necks of river meanders are a feature of the Arapiuns basin near Santarém. There, residents cut passages along upland streams and rivers by dragging their canoes overland and by clearing earth and vegetation with hoes, scythes, and machetes. These are often high-water routes only and may not exist in summer when canoeists have to follow the river's meander.

In addition, residents of the Arapiuns basin cut through above-ground *igapó* vegetation to reduce travel distance for water craft of various types. These routes allow people to enter an area to fish or to reach a house or settlement, and are maintained by people with machetes as they pass through. In the summer months, these same routes may function as dry trails (*estradas*) used for transport by foot and bicycle between villages, and between villages and upland agricultural settlements. The dry season compaction caused by human and animal traffic—particularly that of cattle—helps maintain the trails (McCann 2001; William Woods, personal communication, March 2000).

Upstream of the Arapiuns, on Careiro Island near Manaus, farmers manage rivers in ways similar to those described above for Ituqui Island. In his detailed human and physical geography of Careiro, Sternberg describes "*campos que foram formados graças à colaboração da água e do homen*" ("fields formed through the collaboration of water and people")(Sternberg 1998, 98). Sediment-rich water from the main river channel is guided through artificial conduits into backswamp areas in

order to fill these with sediments. According to Sternberg, these conduits (*brechas*) are about 2 m wide and cut across the levee "imitating nature" (Sternberg 1998, 98, 103).[6]

Raffles (2002) reports anecdotal evidence of widespread small-scale canal-making along the lower Rio Negro, also near Manaus. Artificial access streams in this area are apparently named in acknowledgment of the people who created them.

Considerable research on fluvial engineering has been carried out in the Llanos de Mojos of Bolivia, an area of tropical lowland savanna commonly included in hydrographic and biogeographical mappings of the Amazon Basin. Recently, for example, the work of archaeologist Clark Erickson and colleagues has provided dramatic evidence of large-scale pre-Columbian water management, specifically raised fields and fish weirs (Erickson 1980, 2000; Erickson, Winkler, and Chandler 1997).

Erickson's findings follow the now-classic geographical account of William Denevan (1966), who draws on both archaeological and ethnohistorical sources to document fluvial interventions in this area. Denevan identifies cuts (locally termed *cortes*) through river meander loops as well as canals that run adjacent to raised causeways. Alfred Métraux, writing in Julian Steward's *Handbook of South American Indians* (1948, 414–16), also drew attention to these features:

> Some of the wide causeways connecting the Mojo villages remained above water level during the annual floods. In the dry season, the ditches from which the soil had been taken to make the embankments formed canals that the natives navigated in canoes, especially at harvest time when they brought home their crops. One of these canals, 2 km. long and 6 to 7 m. wide, connects the Mamoré River with the Urupuru River. Another canal 5 km. long and 2 m. wide, unites the Chumano and San Juan River, from which another canal leads to the Itonama River.

Denevan points out that the channels seen by modern researchers may have been created by native Amazonians on their own account or, during the seventeenth or eighteenth centuries, under the authority of the Jesuit missions (1966, 74–6). Erland Nordenskiöld, a Swedish anthropologist who first drew attention to the canals in eastern Bolivia in the early years of the last century, argues that the practice of canal-making was passed from indigenous Amazonians to their Jesuit administrators (1916, 144–7).

6. Using similar techniques, farmers on the Orinoco floodplain in Venezuela plant a double-layer tree and grass barrier around agricultural plots on levees to create slackwater environments that force the deposition of river sediments in the same way as residents of Ituqui and Careiro Islands. During the annual flooding of the Orinoco, fine-textured sediments are deposited in the slackwater environment behind the barriers after the coarse textured material falls out of suspension (Barrios et al. 1994; Barrios 1996). The tree/grass barrier acts as a filter, preventing the coarsest particles from being deposited on these plots.

Like Métraux, Denevan identifies "river-connecting canals" that "facilitate water travel by joining different river systems or lakes or by connecting areas of settlement with navigable streams" (1966, 74, Plates 9a and 10; n.d.). These canals vary in length from just a few meters to one of 120 km (Pinto Parada 1987, 233, 269). Canals of this type have been documented at various locations in Amazonia. Nordenskiöld (1916, 153–55), for example, cites correspondence from his colleague Teodor Koch-Grünberg suggesting that the lower reaches of the famous Casiquiare Canal linking the Amazon (via the Rio Negro) and Orinoco river-systems may have been opened by Arawak labor. "In regard to the Casiquiare," wrote Koch-Grünberg:

> It is possible that the beginning of this canal is man-made from the Orinoco for a short stretch, perhaps to Caripó or a little further down stream. The entry to the Casiquiare was earlier very narrow. Several years ago one could still see the steep *barranca* [high bank] where the right bank is broken through.[7]

A further river-connecting canal is perhaps the best documented of all. From 1821–23 a local landowner in the small town of Igarapé-Miri, south of the city of Belém, organized a team of slaves to dig a channel linking the Rio Igarapé-Miri and the Rio Moju. The canal was actively used as a sheltered route for trade between Belém and the rubber and Brazil nut groves on the Rio Tocantins, and a number of nineteenth-century travelers—including the British naturalists Alfred Russel Wallace and Henry Walter Bates—recorded their passage (Bates [1863] 1892, 58; Wallace [1853] 1911, 37). Despite enduring periods of neglect, the canal is today a relatively busy waterway. A recent history of the municipality of Igarapé-Miri reveals that during the digging of the canal, the barrier between the two rivers collapsed prematurely and the flood swept eighteen slaves to their deaths (Lobato 1985, 132–33).

Although the Canal de Igarapé-Miri was the most important artificial waterway in eastern Pará, it was only one of several such officially sponsored projects. Eladio Lobato shows that local and provincial government officials were preoccupied with maintaining free access through a significant number of canals and streams in this area during the second half of the nineteenth century. Relatively large-scale works were financed throughout this period. In 1849, along with funds for the canal at Igarapé-Miri, money to maintain canals was provided to the town of Salinas; in 1899 funds were set aside to clear not only the Canal de Igarapé-Miri, but streams at Suruú and at Soure on Marajó Island, and to drain a swamp close to the town of Porto de Moz near the mouth of the Rio Xingu. Lobato details ten such projects in the municipality of Igarapé-Miri alone between 1841 and 1899 (Lobato 1985, 126–33).[8]

7. Our thanks to William Denevan for this translation.

8. For a more recent state-sponsored canal project, see the description of the impor-

While these formal engineering projects undertaken in Pará may seem distinct from the "non-state" (Scott 1998) practices that we have described elsewhere in Amazonia, they point to the familiarity of fluvial intervention, that is, its status as normal, rather than exceptional practice in the region.[9] As Nordenskiöld claimed was the case with the canals built by Jesuits in Bolivia, these relatively highly capitalized undertakings drew on the long-standing example of indigenous management. Indeed, in certain circumstances state agencies have explicitly sought to mimic indigenous and *caboclo* fluvial management while attempting to increase its scale.

For example, in 1950, the Instituto Agronômico do Norte (Agronomic Institute of the North) initiated a project that sought to utilize natural sedimentation processes such as those used today on Ituqui (Sioli 1951). The goal was to "force the Amazon to deposit part of its load of eroded soils and fertilizing elements midway on its path to the sea to create 'made' land of high fertility" (Camargo 1958, 15). Through the enlargement and creation of several channels cut through the river levee, the state agency aimed to increase the area of cultivable land by filling in Lago Grande, a large floodplain lake on the left bank of the Amazon River across from Ituqui Island. By 1953 several of the channels between the Amazon River and Lago Grande had been dug out and straightened. The largest measured about 30 m across, 6 m deep, and 4 km in length (Sternberg 1995a, 117, 143). As Sternberg observed, the Institute was attempting to achieve "what *várzea* farmers . . . accomplish on their property: the diversion of silt-laden floodwaters into low-lying tracts" (Sternberg 1995a, 143). Unlike on Ituqui and Careiro, however, the operation was unsuccessful. Due to the much larger scale of the project, instead of sedimentation occurring, the powerful inflow of water from the Amazon caused accelerated erosion and the unforeseen expansion of the lake. Despite this unintended outcome, the channels today serve for transportation between the Amazon River and the communities on the bluff side of Lago Grande, significantly shortening the voyage to the town of Monte Alegre from upstream locations (see figure 5).

In the lower reaches of the Amazon, it has been extractive logging rather than agriculture that has driven such larger-scale fluvial management. During the 1970s and 1980s, the Dutch company BRUMASA (Bruynzeel Madeiras S/A) exercised a powerful hold over the estuarine

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tant route opened by government mechanical diggers at Anajás on Marajó in Luxardo (1977), 65–67.

9. We intend the term "non-state" to be understood as suggestive rather than rigorously analytic. We do not wish to imply that the localities in which these activities took place are outside the domain of national or local states; only that the projects themselves have been undertaken without direct state sponsorship or direction.

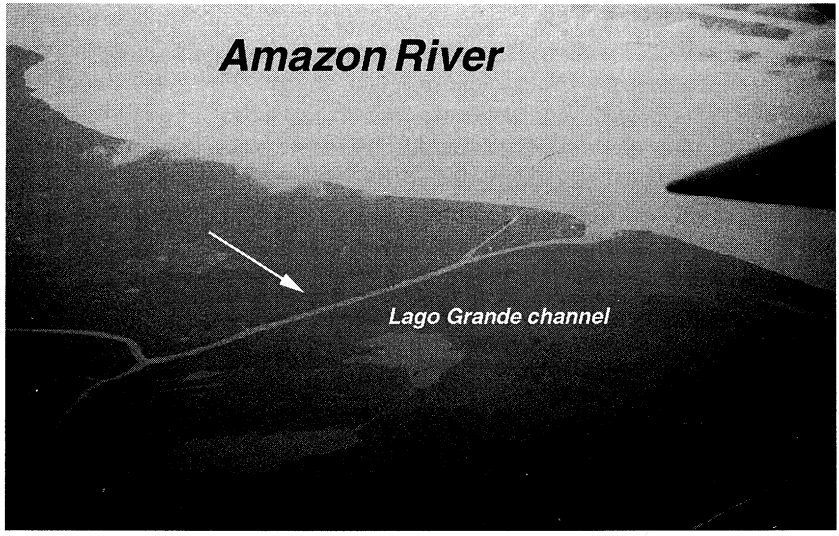

Figure 5 Lago Grande channel from the air, January 2000 (photograph by A. Winkler-Prins).

timber industry. BRUMASA operated through concession, contract purchase, and also by carrying out logging operations of their own. Using mechanical diggers and dredgers, they cut many kilometers of access channels in the municipality of Breves on Marajó, and they also encouraged similar activities on the parts of suppliers (Raffles 2002). One independent supplier on the Ilha de Gurupá, for example, opened a 3 km long, 2.5 m wide logging canal by hand in the mid 1980s.[10]

The most spectacular interventions have—perhaps thankfully—not as yet progressed beyond the planning stage.[11] We know of two examples of Amazon fluvial engineering projects that appear to have sprung fully formed from the technocrat's drawing-board, geopolitical schemes with little reference to Amazonian knowledges or rural ways of life. The first was proposed by Franklin Roosevelt's Industrial Mission to Brazil

10. As we have already seen in Igarapé Guariba, access to timber on the estuary has also been a motive for canal-making by *caboclo* and landowner extractivists acting as suppliers to local and regional markets (Raffles 1999; also see Anderson et al. 1999; Macedo and Anderson 1993).

11. We have chosen not to include large-scale dam projects in our review. Though these are undoubtedly a particularly dramatic form of fluvial transformation—and one that has been imposed with baleful results in the region—we have restricted our account to the less familiar activities of canal-digging and channel manipulation. For an effective introduction to the history of state dam projects in the Brazilian Amazon, see Cummings 1990.

during World War II. This Inland Waterways Project was to be a series of locks and canals linking the Amazon with the Oficina oilfields of the Venezuelan Orinoco by a route sheltered from the German Atlantic submarine fleet. The project won the support of Nelson Rockefeller's Office of the Coordinator of Inter-American Affairs but was shelved once the Brazilian navy established control of the coastal shipping routes (Colby and Dennett 1995, 138, 154). Even grander, and still apparently on the table in the context of the MERCOSUL economic zone and the current soybean boom, is the persistent scheme to build a continuous waterway linking the Caribbean to the Rio de la Plata via the Orinoco and Amazon—a project fantastic enough to have led engineers to dream of using nuclear explosions to blast trenches through the forest (Sternberg 1995b, 107–8).

CONCLUSIONS

We would not want to gloss the important distinctions between the *valas* of Acre and these grand schemes for a transregional internal waterway. The differences are not simply of scale, but of institutional context, social relations, and ecological impact. In conception, however, these and the other fluvial interventions described in this paper share a straightforward and familiar instrumentalism—a quality well described by Nordenskiöld (1916, 147–48):

> It is very easy to understand how people came upon the idea of digging these canals. The rivers themselves cut new courses, the so-called "cortes." In 1908 I traveled on the Río Chimoré (a tributary of the Río Chaparé in Bolivia). In one place only a few meters were lacking for the river to take an entirely new course, thereby shortening a canoe trip by a full day.
>
> For those who live by the river and must often travel on it, and who constantly experience, as exerting as it is, paddling up a rapidly flowing stream, the river in such a place may be helped to break through. If one travels on a river here, for example the Río Guaporé, great discussions always occur "under the helm" on whether one could break a shorter passage, whether there is enough water present on this or that place to go through. Sometimes this is attempted on *cortes* where there is not enough water, and then one must pull the canoe across. Such an activity is the start of a canal trench.

In this and similar passages, Nordenskiöld effectively captures a *várzea habitus* that resonates with findings from our own research. The intimate everyday relationship with rivers that Nordenskiöld points to is associated with both a complex symbolic universe (see, for example, Descola 1994; Motta-Maués 1993; Slater 1994) and a notably instrumental attitude to landscape management. It is the latter in which we are interested here. We have been strongly impressed during our fieldwork with the quotidian character of fluvial interventions. In our experience, Amazonians consider the logic of these interventions—the practice of altering the course of a river or stream or of building a canal—to be a

question of technical pragmatics. As we have seen repeatedly, and as others have argued in relation to terrestrial landscapes, the putatively constraining environmental conditions of Steward and Meggers' "tropical forest culture area" are not only uneven and heterogeneous but are routinely subject to human intervention and transformation (Balée 1989; Roosevelt 1980; Viveiros de Castro 1996).

Yet even Nordenskiöld, convinced as he was of this pervasive anthropogenic pragmatism, was willing to state categorically that "excavated canals occur in no other place except Mojos" (1916, 153). And a half century later, Denevan could still write that "no one has verified the existence of artificial canals or cortes anywhere in the Orinoco and Amazon basins other than in Mojos" (1966, 77).

Fortunately, this is no longer the case. The corollary, of course, is that it should also no longer be viable to conceive of Amazonia as primarily a space of nature. Nevertheless, the debates around biodiversity that dominate international discussion of the region's future conventionally imagine nature as a domain ontologically independent of the human, erasing Amazonians' role in making the rain forest nature that is now such a potent transnational object of desire. In a contemporary context in which regional politics is conducted under the sign of a global environmental emergency, the invisibility of the anthropogenic landscapes of Amazonia has important material effects. In policy circles and in much associated scientific research, Amazonian people are seen as a peripheral and largely negative component of a natural landscape, a landscape valued precisely for its non-human nature (Nugent 1993). In these contexts and in a great deal of popular analysis, Amazonia is often imagined as a wilderness—a culturally empty natural space—an identity that necessarily casts people as invasive and contaminant (Cronon 1996; Slater 1996). As a result, it has been difficult for local activists and sympathetic scholars to draw attention to critical social questions—such as chronic inequalities of land distribution and endemic political violence—that have often driven environmental degradation. While a small number of indigenous groups have been able to successfully, if ambivalently, position themselves as environmentalists at one with the wilderness (Conklin and Graham 1995), this framing of Amazonian politics has simultaneously marginalized other regional populations, most notably *caboclos* and colonists. In this light, Candace Slater, tracing ways in which particular naturalizing tropes have been tied to the region across the centuries, argues that "the tendency to see the Amazon—or Amazonian nature—as a kind of Eden fosters a skewed and largely static approach toward a multi-layered and decidedly fluid reality" (1996, 114).

More precisely, we would argue that the evidence for human manipulation of landscapes in the past and today requires a reconsideration of key aspects of the politics of Amazonian conservation, beginning

with a recognition of the accumulated labor through which this valued landscape has been and continues to be produced. As Steven Pyne (1982) has demonstrated in relation to fire in the North American West, the paradoxical irony of environmental conservation frequently lies in its attempt to protect nature from the very people who created it in its currently desired form. That project, misunderstanding the character of a nature that is fundamentally co-constituted with people, simultaneously marginalizes and disempowers those same populations whose involvement is necessary to its success.

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