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DOMESTICATION, DOMESTICATED LANDSCAPES, AND TROPICAL NATURES

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Domestication politics and the human footprint

This chapter explores how competing models of domestication and human impact are currently playing out in debates over indigenous “footprints” in the Amazon basin in pre-Colombian times. These questions might be viewed as arcana in a scientific debate, except that these controversies illuminate divergent ideologies about nature, domestication, and social impacts on landscapes. From the perspective of science and technology studies, this debate involves differing epistemic communities, their sociologies, and their explanatory framings. These analytics also pertain to broader questions such as the implications of historic land use for climate change, dating the Anthropocene, civilizational discourses about native peoples, current development, and indigenous land politics in Amazonia.

The Brazilian constitution of 1988—which has been widely copied throughout the Amazon countries—recognizes land claims based on historical markers and explanations of use, which include forest activities. Thus, traditional and indigenous peoples need forms of evidence including ethnohistorical and archival documents, landmarks like historical villages, and historical ecological information as part of the legal dossier to claim lands. While showing land use legacies is important for such territorial claims, showing the absence or minimal presence of humans has become increasingly necessary for land assertions associated with “strong” conservation for biodiversity, for carbon offsets and watershed control, and ultimately for Reduced Emissions from Deforestation and Degradation (REDD) payments (De Barros et al.) as these are inscribed in the Paris Climate accords. Since conservation is a regional land use “development” option, it is also often contested.

Further, the sustainability arguments that infuse regional development debates privilege local knowledge systems and their derived practices, arguing that these hold the keys to long-term ecological viability of Amazonian land uses under a range of climate and economic regimes, especially compared with many of the monocultural land uses on offer (Brondizio, “Agricultural Intensification”). These sustainability arguments had their roots in the search for alternatives to the highly destructive Amazon development models

of the authoritarian period (1964–1985) and focused on traditional technologies and social formations (Hecht and Cockburn; Posey and Balée; Redford and Padoch). This has produced a cohort of researchers concerned with theoretical dimensions of knowledge systems, settlement, land use, and history as well as socially situated discussions about Amazonian research.

Underpinning these debates are assumptions about the civilizational capacities of Amazonians that have been in play for centuries. Were Amazonians even able to influence their environments at large scale or on the terra firma? Many nineteenth-century development thinkers, such as Henry Buckle, argued that the exuberant Brazilian nature swamped the civilizational capacity of locals and condemned them to underdevelopment, a position echoed by many nineteenth-century naturalists, ethnographers, casual observers, and politicians who used this idea, along with concepts of racial debility and the “miscegenation degeneration problem,” to promote European immigration (Hecht, *Scramble*; Skidmore; Weinstein). Indigenous and traditional populations have been subject to structural and overt racism for hundreds of years, with natives as wards of the state during the much of the nineteenth and twentieth centuries and with highly contested claims to territory (Hemming; Garfield).

Mid-century functionalist cultural ecological anthropology, as for example Napoleon Chagnon’s description of the Yanomami, fed into negative views of natives. Because of Chagnon’s sociobiology of the “fierce people,” Brazil’s authoritarian regimes interpreted the Yanomami as violent brutes lacking the skills to even act as citizens, let alone partake in their own autonomy, as Davi Kopenawa, a long time Yanomami activist, describes in his moving autobiography. The functionalism of Betty Meggers’s “soil limitation” model, which I discuss further on, also rendered many Amazonian populations “invisible.” She insisted that there were environmental limitations on native culture, and the resultant trope of “demographic void” became one of the pretexts for Amazonian occupation as a central political, geopolitical, and cultural modernization project under Brazil’s authoritarian regimes (1964–1985) (Hecht and Cockburn; Silva; Becker). Ironically, Meggers thought ecological limits would preclude Amazonian interventions, and did not expect that her arguments—sparse population and cultural insufficiency—would stimulate rather than restrain the developmentalist Generals. Later in this essay, I will return to Meggers’s civilizational arguments and the “modernization” of her pedological arguments, as she serves as the muse for a recent set of debates that rehearse her premises and blind spots, but first, the questions of domestication, why now, and why environmental humanities?

Domestication and the environmental humanities

Domestication has been a durable research arena and analytic trigger for most of the last two millennia. The practice of agriculture was taken as a central proof of the Earth as an “Abode for Man” in classical and medieval thought (Glacken), and specifically, agricultural surplus was considered a necessity for more complex divisions of labor, political complexity, and urbanization. Domestication fundamentally conflates with sedentary lifeways and civilization and has often, incorrectly, been portrayed as part of a linear progression from nomadism to sedentarism, associated either with domesticated organisms or exceptionally rich “natural” concentrations of wild resources. The globalization of food and industrial crops has been a regular feature of imperial movements, an icon of improvement, and, in

modern political ecology analytics, the axis for analyzing an array of environmental problems. In this sense, agricultural differences became markers of the exotic and fulcrums of resistance that emblemize cultural aptitudes, differences, virtues, vices, and land transformations and continuities.

Environmental historians and cultural geographers have been especially interested in landscapes and social changes associated with agricultural and agrarian systems, and the institutions, such as botanical gardens, royal charters, ecclesiastic missions, markets, and slavery, that mediated these transformations. These institutions made some agricultural systems prominent while others sank from view, thus contributing to the invisibility of indigenous cultivars and techniques even if they did not fade from practice (Mann; Schiebinger and Swan; Endersby; Driver and Martins; Brockway; Carney; Carney and Rosomoff; Carney and Voeks). One of the central foci of much of current ethnoagronomy and ethnoecology has been to recover and analyze these practices.

Many landscapes “read” as wild have much stronger human signatures than generally assumed. Many land uses, cultigens, and activities have fallen outside what observers have understood or could even see as agriculture, as the recent attention to nontimber forest products, successional management, forest tending, and an array of arboreal management has shown (Brookfield; Brookfield and Padoch; Ellen et al.; Chomitz and Kumari; Aguilar-Støen et al.; Freitas et al.; De Jong; Lewis; Mathews; Kennedy). Problems of classifying subsistence strategies revolve around such invisibilities and hamper understanding of different paradigms of agriculture, especially when fundamentally dichotomous classifications hold sway, including those of wild versus domesticated, forest versus garden, and tended versus planted. These dichotomies obscure the complex management regimes spread over time and space that constitute the relations of people with landscapes at many scales and that construct agrodiversity in tropical livelihoods (Kennedy; Brookfield; Padoch and De Jong). These epistemic blinders problematically shape the ways in which these landscapes are represented.

The resurgence of interest in paleo-agriculture and early domestication, with several recent themed issues in journals like *Holocene* (2015), *Diversity* (2010), and *Proceedings of the National Academy* (2014), suggests that there are other issues in play. Partly this may reflect anxiety about the vast scale of simplifications of agriculture landscapes in the US, Latin America, China, and Southeast Asia, the simultaneous concerns over heritage food production, loss of agrodiversity, biodiversity, and *in situ* conservation, the privatization of germplasm and the rise of GMOs, the rapid and drastic changes in agrarian communities, and perhaps most centrally, the larger issue of the viability of production systems in relation to climate change, with agriculture as both driver and victim of climatic events. But why should there be an explosion of domestication debates, and why should this be of interest for the environmental humanities? While climate change is in the foreground, I think there are several other reasons as follows.

First, domestication and crop lands, as a highly humanized landscape or “second nature” and, in highly manipulated GMO landscapes, even a third nature or “neo-nature,” have implications for thinking about cultures, representations and constructions of nature, science ideologies, indigenous knowledge, technology, and political ecologies.

Second, domestication and landscape models are sites for new methods of environmental history that deploy quantitative biophysical data from the “natural archive”—agronomic, botanical, pedological, and palynological evidence—in historical debates. While the “natural archive” is widely used in archeology, its application in environmental history is relatively

recent. Scientific data, ideologies of science, and critique thus become part of the arsenal of analysis for constructing environmental histories. These debates are becoming more salient because, as in the climate sciences, “rerunning the models” through environmental change is a means of analyzing current framings and exploring biophysically mediated cultural transformations (Wood; Davis).

Third, discourses about forms of domestication and the extent of agricultural or “intervened” landscapes engage sharp political histories and narratives of rights over germplasm and territory. Lands and futures are contested on the basis of historical biotic landscapes, and whether they are “natural.” The debates have roiled over intellectual property of organisms and genomes, but also more generally over questions of common property, cultural recognition, and sociocultural development alternatives, especially in the developing world. Domestication also operates at scales from that of the seed to complex ecologies and thus engage definitional questions (Kennedy; Clement; Fraser et al.; Clement et al.; Pautasso et al.; Rival and McKey; McKey et al., “Ecological Approaches”; Pujol et al.).

Fourth, scientists have always had an important role in colonial and modernization policy (Schiebinger and Swan; Bowd and Clayton; Markham), but especially in tropical environmental and land politics since the mid-twentieth century (Foresta; Garfield). The tropical development literature is replete with interventions from scientists with stakes in development controversies, because they have an interest in the actions and scale of what constitutes agrarian landscapes. In short, scientists have been entangled in mythologies of development (the idea of progress) and conservation (lost Edens).

At another, deeper level, these debates reflect landscapes as texts that inform philosophies of nature. This is relevant in terms of the paradigms of normal science, whether positivist or inductive, the “co-production models,” the emergent analytics of Actor Network and object theory, and other models that recognize nonhuman elements as actors in human systems (Latour). Amazonian ethnographic research on what might be called “nature philosophy,” rooted in indigenous epistemes, is enjoying significant prestige and figures prominently in emergent “posthuman” or nonhuman paradigms in environmental thought as exemplified by the theoretical work of Philippe Descola, Eduardo Viveiros de Castro, and Eduardo Kohn. Researchers more rooted in archeological and ecological framings also engage alternative, integrative human/nature epistemes involving material approaches rather than the semiotic approaches mentioned above (Balée, “Culture”; Heckenberger and Neves; Heckenberger et al.; Balée and Erickson; Erickson, “Domesticated Landscapes”; Posey and Plenderleith). Thus, at issue in the “footprint debate” are practices usually categorized as “normal” and bench sciences where the sample and the transect become authoritative representatives of much larger systems, versus those approaches that contextualize and use an array of materials, including the natural sciences as well as local knowledge systems, archives, ethnography, ethnohistory, and ethnobiology, and include native Amazonians as authorities as well.

The great Amazon wilderness debate: Meggers, “Neo-Meggersians,” and the “Denevan School”

How do ideologies of nature, scientific practices, and the framing of domestication play out in current Amazonian pre-Columbian impact debates? Was Amazonia, as early observers like Walter Raleigh, gazing over savannas which actually had a significant human signature,

saw it, a pristine “nature never sacket”? Or was it instead, as Carvajal, the chronicler of the first careening voyage by Europeans down the Amazon, put it, a populous “place of teeming shores” (Carvajal et al.)? In the great “footprint” debate, I divide the controversy into two “camps.” The first camp I call the “Neo-Meggersians” because it takes on Meggers’s premises; the second is the “Denevan School,” which I discuss further on.

Betty Meggers’s functionalist ecological approach to Amazonian cultural development was initially seen as a vanguard analysis using equilibrium systems ecology informed by soil characteristics. She argued that ecological limitations, though Amazonian natives adapted to them in different ways, precluded civilizational development in terra firme environments because the agriculture could not generate sufficient surpluses (Meggers, “Environmental Limitations;” Meggers and Evans). Meggers’s work concretized cultural limitations within the easily intelligible dynamics of tropical soil fertility, which she generalized from large-scale assessments and whose documentation was just developing in the 1950s and 1960s. Tropical forest nutrient cycling was a highly funded and central research concern in this period (e.g., Jordan) and an early intellectual fetish of tropical systems ecology.

Meggers’s powerful theory of nature and cultural limitation in the tropics held sway for decades because its intellectual coherence coincided with academic fashion and the emergent attention to equilibrium modeling and ecological explanations. Her work inspired an explosion in ecologically inflected field studies on tropical adaptation, especially in Amazonia (Hames and Vickers; Gross). While not exactly detaching her work from the more egregious colonial ideologies, Meggers scientized “stone age continuities” in Amazonia in a modern register (*Amazonia*; “Continuing Quest”). Even dramatic counter-evidence of anthropogenic soils could not shake her implacable rejection of autochthonous cultures of Amazonia (Meggers, “Mystery”), in spite of a plethora of soil studies on high-fertility Amazonian dark earths (ADEs) presented by a set of scholars from diverse intellectual lineages, institutions, and disciplinary backgrounds (Schmidt et al.; Lima et al.; Lehmann et al.; Woods et al.; Peterson et al.; Rebellato et al.).

The other camp, in contrast to the “constraint” theorists, is that of the “Amazon possibilists,” which I would place in a “Denevan School” of Latin American tropical analysis. The possibilists hold that Amazonian environments with their high primary productivities are largely able to develop complex human systems. William Denevan is significant because he pioneered diverse elements of this counter-paradigm, including, for example, his pathbreaking contributions in recasting pre-Columbian demography (*Native Population*); the documentation of enormous archeological sites of indigenous production systems in Bolivia’s Llanos de Mojos and beyond (*Aboriginal Cultural Geography*); his research on tropical forest swidden cultivation, particularly successional management and forest ecosystem management (Denevan et al.; Denevan, “Pre-European Forest”; Clement et al.); and his magisterial compendium on indigenous cultivation systems in the Andes and the Amazon and forest upland management (*Cultivated Landscapes*). Because of this attentiveness to the range of indigenous conditions of possibility, one did not have to be his student or colleague to feel his influence. It is almost impossible to find an article on traditional Amazonian historical and pre-Columbian settlement and land use that does not reference him. His work on pre-Columbian—not “pre-historic,” as the Neo-Meggersians would have it (Bush et al.; McMichael et al.)—production systems as well as their intellectual and landscape legacies are key lodestars in Amazonian analytics.

In the possibilist school, though it involves rigorous science, authority and insight are not uniquely available through the canons of Western science, but also through experiential

relations with native Amazonian experts and extensive field lives. Situating knowledge means understanding how social solidarities and values affect the generation of knowledge and using this understanding to create more diverse forms of explanation and insight (Jasanoff). Denevan “partisans” include scholars from all the major Amazon and Brazilian academic institutions, British, Dutch, French, and several US institutions, and embrace a much wider array of disciplines. The Neo-Meggersians concentrate in a handful of labs and share similar training and major professors.

The controversies between these two camps pivot on what Denevan has called the pristine myth (“Pristine Myth”) and also pertain to how domestications are conceptualized. Is domestication understood to include only specific forms of fire-based agriculture and specific annual crops, or is human impact assessed through a range of co-produced landscapes? Rather than the forest primeval of Amazonian conservation lore, the region’s landscapes are the outcome not only of shifting cultivation, but also of other fire-based systems, human water management, household planting experiments, gathering histories, and extensive movement through and within these landscapes. These human production systems incorporate, harness, and reflect wild and natural systems as well, but not within those categorical frameworks (Erickson, “Artificial” and “Domesticated Landscapes”; Raffles and WinklerPrins). Fire is not the only tool in the management repertoire that affected vegetation. Periodic treks for military, ritual, spiritual, surveillance, medical, trade, and collecting purposes have been shown to affect forests (Politis; Balée, “Indigenous Adaptation”). Further, light management fires often used in forest understories, or to clean forest campsites, might not leave much of a charcoal signature, which the Neo-Meggersians consider the only legitimate sign of human impact.

Indigenous peoples’ travels depended on resource islands that recent research suggests were largely anthropogenic and were certainly tended landscapes (Erickson, “Domesticated Landscapes”; Posey and Plenderleith; Rival). Management activities included camp clearing, planting (whether intentionally or otherwise), ritual activities, transfer of germplasm, extraction, and the casual pruning and weeding of resources islands. And even extensive, intensively managed agricultural systems may not always use fire (Iriarte et al.). Considering movement on secondary and minor tributaries, not just the massive rivers that form the central imaginary of human settlement among the Neo-Meggersians, can also help scholars understand settlement better. The rubber period reveals many things, among them how extensively permeable riverine travel was throughout the Amazon basin, and how significant the impact on hinterlands can be from urban systems and transregional trade (Hecht).

The Neo-Meggersians argue, based on a very small sample set over half of the Amazon basin, that human impact on Amazonia was sparse (Bush et al.; McMichael et al.). Based on fifty-five clustered sites and 245 soil cores in the western Amazon—a quantity of samples that would not be adequate for understanding local shifting cultivation sequences—the Neo-Meggersians argue that upland forests in western Amazonia were occupied by small, shifting human populations. They claim that these small populations had minor effects on forests and cleared very little land, and thus one cannot assume that Western Amazon forests were resilient after pre-Columbian disturbance. They also argue that oligotrophic forests—forests dominated by one species, usually one that is very useful to humans—reflect mainly natural dispersal. This argument is surprising in light of the well-documented fact that the palm Buriti (*Maritius*), Brazil nuts (*Bertholetia*), açai (*Euterpe*), Piqui (*Caryocar*), and Babassu (*Orbignia*), for example, are often intensively used by local people and have figured in regional and international markets. Some, like Brazil nuts and cacao, are often reported in pure stands on the banks of the Purus and Madeira and have been in international

export markets for centuries (Roller). There is extensive ethnobotanical evidence of these trees' use, management, and planting (Rival; González-Pérez et al.; Shepard and Ramirez; Souza et al.; Paiva et al.; Clement).

In the Amazon, there is evidence of widespread raised-field agriculture, mounds, development of forests islands, and extensive distribution of terra preta associated with historical urbanism; intensive agroforestry; more than four hundred sites of ring-ditched formations, which are a striking signature throughout the uplands of extensive geo-engineering; a "tropical Stonehenge"; and artistic masterpieces of many kinds. Given all this, how is it that the Neo-Meggersians' model rejects human impacts on forest systems? While referencing the entire Amazon Basin in their titles, the Neo-Meggersians' model has stayed intact by hiving off sites that do not fit their analysis, and only accepting as evidence of human intervention shifting cultivation as exemplified by charcoal signatures in soils, phytoliths, and palynological data. Many of Amazonia's most significant domesticates, such as manioc, Brazil nuts, and cacao, do not have these signatures to a significant degree. Neo-Meggersians conclude that if their (sparse) samples do not show charcoal on the uplands, human impact was negligible.

The Denevan School, as I have explained, suggests that human intervention was much more widespread (Clement et al.). While pristine versus anthropogenic understandings of Amazonian nature as well as declensionist versus possibilist interpretations of human intervention are in play here, another bifurcation pertains to models of domestication. Is domestication wholly defined by the "domestication syndrome," or does it reflect the hybridity and expansiveness of the "landscape model?"

Models of domestication

Annual crops in the temperate zone epitomize "the domestication syndrome," a term initially used by Harlan to describe a suite of characteristics outlined in Table 2.1. Ideas about domestication have largely unfolded in the context of some "model crop" systems: most of these model crops are annuals, including many genera of the Poaceae (grasses) and a few annual legumes, and very few of them are trees (Meyer et al.). This model of domestication, which has a venerable history, reflects the durability of these kinds of plant materials, especially in more arid environments, and their dominance in temperate zone diets and now in world commerce. Of the fifty-four "key plants" in an important review of domestication studies, only five were tree crops, and such shrubs as coffee, cacao, and rubber, among other crops with long histories and immense current markets, were not included (Larson et al.). Analysts of the ecological dynamics of domestication of root and tropical crops, especially manioc, make rather different arguments (McKey et al., "Ecological Approaches"; McKey et al., "Pre-Columbian"; Pujol et al.). Many useful trees and their array of products do not necessarily reflect domestication criteria that are based on short-cycle annual grass cropping systems (McKey et al., "Ecological Approaches"; Rival and McKey; Clement). The lack of easily traceable ethnoarcheological features has obscured how extensive manioc cultivation was and how its cultivation and phenotypic plasticity in mixed systems was widespread. This limited the understanding of manioc as a foundational carbohydrate for complex societies (Isendahl; Heckenberger). But manioc was far from the only kind of production system. The ensemble of varying production regimes mediated by a range of non- or semi-domesticated organisms is predicated on a different kind of interaction with nature and positioning of one's place in it. Table 2.1 suggests some of these differences.

Table 2.1 Contrasting models of domestication and the characteristics of species and ecosystems associated with them.

<i>Domestication Syndrome</i>	<i>Landscape Domestication</i>
“Wild” vs. “domesticated”	Extensive range of use between “wild” and “domesticated”
Annual seed plants as central model; temperate zone grains	Tropical tubers and trees
Tendency to monocrop	Some monocropping, some multispecies cropping
Plants have reduced ability to disperse seeds without human intervention	Most plants not dependent on human dispersal
Reduction in plants’ toxic chemical compounds for palatability	Toxins removed in processing; toxins act to reduce predation
Reduction in seed dormancy	Seed dormancy variable
Predictable and synchronous germination	Much less synchronous germination
Larger inflorescences	Depends on degree
Reduction in size of plant	Variable, but plant size mostly not reduced
Single use (food for humans)	Multiple use (food, sap, artisanal, and industrial uses)
Narrow ecological function (food for humans)	Diverse ecological functions including wildlife support
Ecosystem simplifications	Multiple ecosystem manipulations at different scales; beta diversity

The “landscape domestication” model addresses historical ecology and human impacts in the context of complex ecosystems. It turns our attention away from specific plants and frames a set of domestication processes more around “group selection” and human effects at large scales. Analysts generally assert that domestication of landscapes occurs before, during, and after the emergence of full-scale agriculture (Balée and Erickson). This approach reassesses paradigms of human intervention in tropical landscapes as well as more general processes of civilizational development in six major ways:

1. The landscape domestication model diverts attention away from the Neolithic revolution and grain-based agriculture as the most transformative events in shaping environments, especially in the tropics where a long history of landscape interventions may be more critical.
2. It emphasizes cultural activities that influence the presence, availability, and productivity of a wide range of species, rather than focusing on a clear cultivation agriculture.
3. It shifts attention from individual species to landscapes and their contingencies as historical outcomes of a “co-produced” landscape with human and nonhuman signatures.
4. The landscape domestication model rejects the idea of a linear evolution from foraging to agriculture, and looks at organisms with longer temporal scales, as well as short cycle agronomies and complex civilizations, as constitutive of places.
5. In landscape domestication, the production of the system is not uniquely a function of human agency. Nonhumans also perform “work” of various kinds. While this is true of many kinds of systems, in tropical areas these effects are so profound as to make these landscapes seem wild. But nonhumans can be beneficiaries as well, so the idea of “utility” has a more relational resonance.

6. Such a paradigm moves us away from pristine tropics with noble savages into a more complex framing of interactivity and conditions of possibility at the level of landscapes. It not only helps us understand the past and current plant distributions as part of landscape legacies (Hecht et al.), but also can inform study of forest transitions now.

The Neo-Meggersian position is basically that culture can be understood without reference to culture, but only to soil chemistry, pollen, starch grains, and phytoliths as the central explanatory elements whose goal in the service of tropical ecology.

By contrast, long-time field researchers armed with soils samples and phytoliths as well as with historical accounts, ethnographic data, historical ecology, and a wide range of ethnobotanical sources, tell a story about landscapes as artifacts and habitats, one that includes Amazonians as important sources of knowledge who go beyond what the laboratory can say.

This brief overview of a fairly acerbic debate between the optics of constraint, declension, and wildness, and those of possibilist innovation in the tropics—innovation that rivaled that of any place in the world in pre-Columbian (not “pre-historical”) times—is an exercise in examining scientific practices, explanations of land patterns, loci of intellectual authority, and the kinds of proof that are invoked in these arguments. This ongoing debate leaves us with important questions: What constitutes domestication? Do different epistemes of nature, as many Amazonian ethnographers argue, conceive of ways of being in the natural world that diverge from the reductionisms of normal science? How did the nonhuman world figure in the shaping of Amazonia in the past, and how will the nonhuman world shape its future? By discounting the human in Amazonian landscapes, we run the risk of blinding ourselves to history, knowledge systems, management possibilities, and ultimately to the natures of Amazonia itself.

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