Tropical Garden Cities:

Cultural Values & Sustainability in the Amazon's "Arc of Deforestation"

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ABSTRACT

In Garden Cities of Tomorrow (1902), Ebenezer Howard proposed a model of sustainable urban development, "garden cities." as an alternative to industrial urbanism. A forerunner of the urban green movement, he envisioned a type of galactic urbanism as an alternative to industrial urbanism. The model proposed tightly integrated networks of towns, each gravitating around a central public park, orbiting around a core town. Towns were linked by well-developed transportation and communication networks and the multi-centric form produced a more subtle gradient between urban and rural areas and coupled with well-developed transportation networks. Recent archaeology and indigenous history conducted in the Upper Xingu area has revealed small garden city-like clusters of settlements, composed of a central plaza settlement and four cardinally oriented satellite plaza settlements, tightly integrated by major roads and surrounded by mosaic countryside of fields, orchards, gardens, and forest. Far from stereotypical models of small tropical forest tribes, these patterns were carefully engineered to work with the forest and wetland ecologies in complex urbanized networks. Such multi-centric, networked forms were quite common, if not typical, in many parts of the pre-Industrial world, particularly major forest regions. This paper explores land-use and dynamic change in coupled human-natural systems, or bio-historical diversity, during the past millennium in the Upper Xingu. In particular, it examines how archaeology and historical memory not only provide means to consider what the Amazon was like 500 years ago but also have vital implications to urgent questions of sustainability and cultural heritage and rights in the face of rapid landscape change related to economic development in the southern Amazon, the "arc of deforestation." It promotes grounded or context-specific participatory approaches to sustainable development, which require robust collaboration between diverse stakeholders, each with very different social and cultural values and interests.

INTRODUCTION

The tropical forests of lowland South America, Amazonia, have long held a special place in the Western imagination as a region inhabited by small, mobile societies that had little impact on the natural environment. Today the region's tropical forests are well known for their remarkable biodiversity, home to over a third of the world's terrestrial species. It is by far the world's largest river basin, which at nearly seven million km² is twice the size of the next largest, the Congo River basin. In one month the Amazon River discharges more fresh water than the Mississippi River – the world's third largest basin – in a year, accounting form over 30% of the world's fresh water. It is also widely known as the "lungs of the world," since plant biomass is responsible for over a third of the oxygen produced worldwide. The Amazon is an icon for global ecological well-being, as the world region of greatest biodiversity and a critical regulator, or "tipping zone," in global climate. It is one of the most culturally and linguistically diverse regions of the world and the plight of its traditional indigenous peoples in the face of rapid development is also widely recognized as an urgent concern.

Long seen as pristine tropical forest little impacted by human groups, recent studies of the Amazon's archaeology and history have revealed an equally rich and varied cultural heritage, including diverse pre-Columbian complex societies, domesticated landscapes, and the historical legacies of colonialism and capitalist expansion. As elsewhere across the globe, the record of human civilizations in the Amazon region – a critical chapter in our global heritage - is vanishing at an alarming rate. New perspectives on Amazonia highlight the great cultural diversity and dynamic histories of the region, especially noting long-term and large-scale transformations of the natural environment

Today, regional specialists agree that humans and environments in Amazonia act recursively, rather than directionally (i.e., one simply causing change in the other). As Cleary (2001:65) notes: "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." The late Holocene, from ca. 3500 to 500 years ago, witnessed the emergence of small polities in various areas, of similar age and complexity to other parts of the Americas, such as early examples in the SE USA, Mesoamerica, and coastal Peru. In the

Late Holocene, particularly after ca. 1500 BP, plural regional societies emerged, including small- to medium-sized integrated polities in several areas, many of which developed complex or semi-intensive systems of forest and wetland management systems. In these areas, environments are more socially heterogeneous and ecologically patchy, which often increase overall biodiversity in an area, in terms of species diversity and ecological heterogeneity (Balée 2006; Balée and Erickson 2006; Posey 1985).

Long-term occupations of many areas, in some cases since Mid-Holocene times, resulted in the creation of complex anthropogenic landscapes, followed by wholesale forest fallowing as a result of European colonialism and depopulation. Recent findings are part of a growing realization that prehistoric peoples in many parts of the world were capable of having a major impact on plant and animal communities, hydrology, and even climate (Mason 2004; Ruddman 2003; Willis et al. 2004). Models of socio-ecological change in Amazonia must acknowledge this great variation in Amerindian systems, ranging from small-scale, low impact systems to fairly large-scale systems that heavily influenced local landscapes in the past, creating unique "islands" of bio-historical diversity (Heckenberger and Neves 2009). However, these complex societies are very poorly understood in terms of scale, land-use, and impact on Amazonian forest ecologies and comparison or linkage across temporal and spatial scales is hampered by a lack of time depth, including large-scale prehistoric systems.

The recognition of societies larger and more complex than small-scale 20th century groups, begs the questions: how do Amazonian semi-intensive systems compare with those from other world areas and what are the implications for the contemporary composition of the area? Cultural landscapes in Amazonia built up over many millennia, in some cases initiated by subtle changes of foraging societies in early to mid-Holocene times, but the last millennium of the Holocene – the Anthropocene – in Amazonia is characterized by increasing transformations of the natural environment. They differ in important ways from classic settings of the origins and development of settled, agricultural societies, such as the focus on root-crop agriculture and arboriculture in palm and fruit trees, including an immense inventory of plants in some stage of domestication, and the focus on wetland resources and management and fish farming (Balée & Erickson 2006; Clement 1999; Clement et al. 2010).

Recent research in the southern and southwestern headwaters, the southern Amazonian periphery, reveal important new details regarding the internal dynamics and variability of these genuinely Amazonian complex societies, as well as how they compare with other world regions.

Suddenly, one of the best answers provided to the vexing question of how to "Save the Amazon," in terms of conservation and development, is provided by its indigenous peoples, who constructed forest and wetland technologies that worked with the natural environment not against it. The term "cultural landscape," as used by UNESCO to describe such world heritage sites, defined as the "combined works" of nature and humankind, aptly characterizes areas like the Xingu basin:

> Cultural landscapes often reflect specific techniques of sustainable land-use, considering the characteristics and limits of the natural environment they are established in, and a specific spiritual relation to nature. Protection of cultural landscapes can contribute to modern techniques of sustainable land-use and can maintain or enhance natural values in the landscape. The continued existence of traditional forms of land-use supports biological diversity in many regions of the world. The protection of traditional cultural landscapes is therefore helpful in maintaining biological diversity (http://whc.unesco.org/en/culturallandscape).

The cultural landscapes of the headwater basin of the Xingu River, one the Amazon's largest southern tributaries, preserve an unparalleled example of the scale and sophistication of landscape domestication associated with the distinctive polities of the pre-Columbian past in Amazonia and where the living descendants of these complex societies continue to practice their intact, traditional life ways. The anthropogenic landscapes of the southern Amazon are critical sites of cultural, historical, and biodiversity heritage. Our project helps situate humans as active agents of change through problem-oriented research that address both cultural and non-cultural factors. Indigenous resource management strategies, in particular, may hold important clues to alternative and sustainable approaches to regional development over the

long term, as well as approaches aimed at the inclusion of indigenous and other rural populations in discussion of the future of the Amazon.

THE PRE-COLUMBIAN SOUTHERN AMAZON

The forested peripheries of the southern Amazon basin, which extend from the Tocantins River headwaters in the east to the upper Purus and northern portions of the Madeira River headwaters is dominated by semi-deciduous forests transitional between the high forests of lowland Amazonia and the low and scrub forests of the highland central Brazilian plateau. The overall topography can be characterized by pockets of flat, low-lying and forested areas, corresponding to the headwater basins of the major rivers that eroded out along the northern and western flanks of the Brazilian highlands (300-500 meters above sea level), historically dominated by settled agriculturalists, commonly speaking languages of the Arawak family.[1] These basins, which represent highly domesticated (anthropogenic) landscapes of densely, settled complex societies constructed over the past two millennia, are interspersed by rolling topography and more open forests in highland interfluves between the headwater basins and more mobile social formations.

Increasing supra-regional interaction between large, settled regional polities in late pre-Columbian times including far-flung prestige goods systems, which provides not only the substance but the language of interaction between hierarchical polities and other societies in regional systems, as well as relations between entire regions. Ethnogenesis of regional social systems involved complex phylogenetic and reticulate processes culminating in a great diversity of plural societies in these ethnically and linguistically complex regions (Heckenberger 2002, 2005; Hornborg 2005). The post-Columbian period witnessed the decline of these native systems and the ethnogenesis of new indigenous identities in the milieu of colonial expansion and the dynamics of the emerging World System, notably the post-Industrial globalization, the time when anthropological (ethnographic) and ecological understandings of Amazonia took on a scientific outlook.

In the southern Amazon, early ethno-historic accounts (1600-1750) describe the Bauré peoples of the middle Guaporé, the Pareci of the Tapajós River headwaters, and the

Terena/Guana peoples (upper Paraguay River) all as large, densely settled populations, complicated settlement and agricultural works, and regional socio-political organization. In the Llanos de Mojos, archaeological complexes associated with these groups, including sophisticated agricultural, settlement, and road earthworks, have long been known from the eastern lowlands of Bolivia (Denevan 2001). The availability of aerial photography in the mid-20th century immediately drew attention to the scale and configuration of agricultural earthworks, raised causeways, and other features. Recent archaeological work has revealed a complex system of earthworks, including causeways, fish weirs and ponds, and forest islands (ancient settlements), raised fields and diverse other archaeological landscape features (Erickson 2000, 2006, 2008; Walker 2004, 2008). Erickson notes that: "Rather than domesticate the species that they exploited, the people of Baure domesticated the landscape" (2000:193). Features of these domesticated landscapes in the Llanos de Mojos and adjacent forested areas to the east and north include a variety of constructions, including a complex of palisades, ring villages, major causeways, and wetland fish-farming complexes (Baures) and mounds and major raised field complexes in the central Mojo.

In the western edge of the southern Amazon transitional forest, along the Bolivian border of the Brazilian state of Rondônia, the Baures archaeological and ethnohistoric record shows one of the clearest example of the settlement pattern and regional landscape constructions, focused on the palisaded "ring villages, of Baures and the half-circle, peripheral ditches mapped along the Guaporé (Miller 1983). These are clearly settlements situated in tropical forested riverine settings, well described in more recent times in areas to the east, in the southern Brazilian Amazon, including managed wetlands and forest areas, such as described in Bolivia, but lacking the lowland savanna areas for raised field agriculture, terra firme forested areas appear to be the focus of Brazilian groups, along the major headwater tributaries of the Guaporé, Tapajós, and Xingu, as well as the upper Paraguai.

To the west, in southwestern Amazonia, recent discoveries and preliminary investigation of a complex of related monumental sites, "geoglyphs," in the upper Purus River (Schaan 2011; Schaan et al. 2007) and adjacent portions of Bolivia (Madre de Dios River) also documents highly constructed nature of local forested landscapes, and area also historically

dominated by Arawak-speaking peoples. The over-determined nature of some of these excavated features, up to 7 m deep, circles within squares, U-shaped features, and long linear processionals, up to 50 m wide and nearly 1 km in length, bespeak the ceremonial nature of these sites, and their monumentality. Some are clearly overlapping (sequential) features, but were no doubt obvious and possibly maintained elements of built environments of later groups. Regardless of function, the over 150 geoglyph sites registered in the Brazilian Amazon, suggest a broad distribution of integrated settlements, which investigators suggest may represent only 10% of the total number (Mann 2008). While investigations to date have not delineated the linkages between these sites, it is clear that relational features, including basic orientation, are similar and that sites were likely conceived as related elements of regional built environment.

In addition to the polities of eastern Bolivia, areas farher east in central Brazil also gave rise to other complex social formations, particularly in the Upper Paraguai, Tapajós, and Xingu rivers, all dominated by settled Arawak-speaking societies. In the upper Tapajós River headwaters, Antonio Pires de Campos, an early frontiersman, made reference to the settlement pattern of the Arawak-speaking Pareci nation: "These people exist in such vast quantity, that it is not possible to count their settlements or villages, [and] many times in one day's march one passes ten or twelve villages, and in each one there are from ten to thirty houses … even their roads they make very straight and wide, and they keep them so clean that one will find not even a fallen leaf" (Pires de Campos, 1862[1720]:443-444, authors' translation).

The Upper Xingu basin is the easternmost of the southern Arawak groups and recent archaeological work shows a settlement pattern very similar but even more developed and elaborated than that described for the historic Pareci nation. In many areas, continuity with ethnographic societies is difficult to document and the development of "mission" or other colonial "mixed blood" peoples, often involving significant geographic compression of indigenous territories related to colonialism, often obscures continuity in the practices of pre-Columbian and recent societies. The Upper Xingu region is somewhat unique in this regard, as

a region whose pre-Columbian heritage is well documented and clearly documents historical continuity with relatively unacculturated ethnographic Xinguano peoples.

THE XINGU CORRIDOR

The Xingu straddles three major transitional zones: the closed evergreen forests of the Amazon River and the lower reaches of its major tributaries, the more open evergreen forests and woodland transitions of southeastern Brazil and the southwestern transitional deciduous forests (Figure 1). Today, the Xingu corridor is home to diverse indigenous groups, whose cultural rights are widely recognized in international law, but are often imperfectly applied across the globe, the widely known plight of the Amazon. Contemporary indigenous peoples are not only the living legacy of this remarkable global heritage, but are the key to the stewardship of this key area of cultural heritage and biodiversity as an important region for cultural heritage recognition, including initiatives for documentation and preservation of tangible and intangible cultural heritage. Much of the basin lies within demarcated indigenous areas, but the upper headwaters generally lie within another zone of rapid agro-pastoral development and urbanization. At 27 million hectares, the Xingu corridor, which includes most of these indigenous groups and other rural populations, is about the size of the United Kingdom and represents the largest contiguous regions of indigenous lands and protected areas in the world (Schwartzman et al. 2012; Villas Boas). However, while protected areas are still verdant, an explosion of deforestation around cattle ranching, soy farming and other activities has devastated forests on the frontier.

The Upper Xingu, in particular, provides clear examples of complex socio-ecological systems among pre-Columbian and historic Amerindian social formations, preserving the most obvious anthropogenic footprint of ancient complex societies across the region (Heckenberger et al. 2006; Willis et al. 2004). Long-term environmental history, including from the lower, middle and upper Xingu River (Figure 4), suggests several major climatic shifts, ca. 3,000-4,000, ca. 1100-1200 BP, ca. 500 BP, which dramatically influenced forest extent and cultural adaptations (Behling and Costa 2001; Bush et al. 2007; 2011; Heckenberger et al. 2008; Sefiddine et al. 2001). It is the largest contiguous tract of tropical forest still under indigenous

resource management, little affected by 20th century mechanized development, except in highly threatened areas at the basin margins. It preserves some of the most intact system of traditional knowledge among descendants of these ancient complex polities. In late prehistory settlement patterns included much larger and more densely settled villages, revealed through participatory GPS and archaeological map-making, satellite image interpretation, and GIS.

These agricultural populations did not denude the landscape of trees, as commonly practiced in modern developmental practices, but instead created patchy (spatially and seasonally) mosaic patterns of land-use. Like today, these would have incorporated diverse forest and wetland management strategies, including sequential multi-cropping in long-term rotational cycles of agriculture and arboriculture, large-scale wetland management, and patchy land-use and forest "connectivity" through habitat corridors. The forested environments also preserve an unparalleled record of the post-contact (post-AD 1500) "fallowing" of much of the landscape associated with demographic collapse of Amerindian populations, between the 16th and 20th centuries.

In short, the Xingu is a "hotspot" of biodiversity *and* cultural and historical diversity, including the legacy of large settled Amerindian communities radically transformed local landscapes. There is a significant disconnect, however, between historical and ecological analyses, including incorporation of indigenous voices local participants, despite widespread use of the term "socio-ecological" in recent literature (e.g., Brondizio 2009). In this sense, what are needed are strategies of preservation by design of these remarkable cultural landscapes for the future, focused on partnership and training with descendent communities, who not only depend upon them but are most directly responsible for their preservation. It is aimed at developing local community-based strategies, informed by Western scientific and indigenous knowledge, which articulate with broader global initiatives, such as biodiversity conservation and recent initiatives to reduce tropical forest degradation (UN REDD+ program). The ultimate aim is to create the groundwork for local monitoring and management of cultural and biodiversity resources, which in historical terms and in the eyes of indigenous peoples are one and the same.

THE UPPER XINGU

The headwater basin of the Xingu River, the Upper Xingu region, is the best known example of settlement patterns, and the implications of built environment for socio-political organization. The pattern at local and regional levels is remarkable, not because of the scale of the monuments themselves, in terms of labor or height, but the massive area scope and organization of public structures, which are planed at local and regional scales, with orientations documenting sophisticated knowledge systems related to astronomical, mathematical, and engineering, which can be seen as extensions of corporeal, social, and ritual dispositions.

In the area, well defined wetlands take on four forms: major channeled meandering rivers, with associated levees and oxbow lakes, major braided rivers, with marshy wetlands, dominated by buriti palm (*Mauritia flexuosa*) and with deep "holes" that are likely anthropogenic to some degree, smaller seasonal streams and ponds, and large permanent lakes and ponds and seasonal lakes and small reservoirs, and large, deep lakes, which may have had large spits … Few fish or other wetland fauna escape exploitation in local resource management systems that incorporate all these areas and include, specialized fishing baskets, nets, pole-and-thatch weirs, and associated dams and bridges, bow and arrow, and leister fishing, although hook-and-line appears to be a recent addition.

The ecology is characterized by a wide diversity of forested areas and wetlands, but it lacks the fertile floodplain soils or agricultural ADE (*terra mulata*) soils of the Amazon River societies. Like other areas described above, many areas of wetlands and forests were modified over generations of near continuous occupation, and overtime well defined land-use "zones," consisting of areas of continual management (roads, settlements, bridges), and areas of active but occasional management (gardens, fish weirs, orchards, and grass fields for thatch), and areas that are utilized but not actively managed (forest "preserves"). Earthen causeways are present were roads pass over maintained wetlands, and are an important component of wetland management system.

Archaeological studies (1992-2005) were conducted in the traditional territory of the Kuikuro Amerindian community, whose three villages form part of the larger Xinguano society (composed of nine sub-groups, living in 14 villages, and almost 2500 people, confined today to the PIX). The Kuikuro territory expands over an area of some 1200-1500 km² (the regional society was minimally spread over an area ten times this size or more in late prehistory based on known archaeological distributions). Over 30 residential sites have been identified in the Kuikuro territory. Most or all of these were occupied and inter-connected in late prehistoric times (1250-1650) and were organized into two or three integrated and ranked clusters of between 8-12 villages.

The cultural sequence can be broken into four distinctive periods: (1) early occupations by Arawak and, perhaps, Carib-speaking peoples, ca. 500 CE or before, until 1250 CE; a galactic period, from ca. 1250 to 1650 CE, or soon thereafter, marked by the integrated clusters of small to large villages; a historical period, dominated by adaptation to the indirect and direct effects of Western expansion, from ca. 1650 to 1950 CE; and the modern period, from 1950 to now. The first known occupations were agriculturalists (proto-Xinguano tradition), were historically related to other Arawak-speaking groups to the west. After AD 1250 there was a major reconstitution of the overall regional settlement system, whereby settlements are reconstructed and formally linked into galactic patterns of nodes and roads across the area through the construction and/or elaboration of linear village earthworks.

The colonization of the Xingu and early Xinguano tradition were established by 500 to 800 CE, or before, but occupations related to this period are poorly understood, due to reworking of residential sites in occupations associated with middle Xinguano or “galactic” period, 1250 to 1650 CE, is characterized by the integration of regional social clusters into tightly integrated small polities, organized and planned within small, well defined territories, and within a regional peer-polity that encompasses the majority of the forested upper Xingu basin (Figure 2). Early late Xinguano or “historic” period (1550-1750) occupations are only vaguely remembered in oral traditions, which describe walled communities, but do not situate galactic clusters or the major walled towns in local histories, except as very ancient

settlements viewed as components of “dawn time” villages, before or at about the same time as human groups, including Xinguano peoples, were born.

The galactic clusters of the late pre-Columbian period are particularly noteworthy in regional ethnology. Like the densely clustered plaza villages noted by Pires de Campo (1862[1720]) among the Pareci in the adjacent upper Tapajós River, the middle Xinguano (1250-1650) settlements were densely distributed across nuclear areas of the Upper Xingu basin (Figure 3). In the Upper Xingu, these settlements were organized into small territorial polities composed of a core residential areas, defined by five primary sites, included a walled or unwalled central settlement and four walled residential nodes, all of large size (25-50 ha), situated according to cardinal directions in relation to the center. The core area, roughly 50 km² in size, was largely agricultural countryside and areas dominated by settlement and other artificial constructions, although this area was no doubt characterized by patches of secondary forest. Major residential settlements were structurally elaborated with plaza and road mounds, forming a radial pattern emanating fro the circular central plaza, as well as peripheral ditches and bridges associated with them. In non-core areas, smaller plaza (<10 ha) satellite communities were distributed in a peripheral zone, which was a mosaic landscape of forest and agricultural areas. Areas between the galactic clusters formed a “green belt” of dense forest located between independent clusters (polities).

The domesticated landscapes of the Upper Xingu basin in late prehistoric times reveal critical dimensions and perspectives on the built environment, as a form of cultural memory that reflects unique principles of symbolic and social self-organization in cultural systems through time. In particular, the orientation of human bodies and their movements through structured space in domestic and public settings and across the broader landscapes, and how these practices become inscribed or “sedimented” in built environments. One aspect of the landscape that is only partially understood in many areas is the actual social-political partitioning of the land, including internal settlement divisions, regional distributions and integration, and the more fixed patterns of near settlement agriculture, distant countryside, and more remote wilderness. In pre-Columbian times, landscapes were more densely packed and land-use was more intensive. Settlements and countryside features (fields, orchards,

wetlands) were laid out and administrated according to more rigidly defined divisions and schedules. Where today there are three villages of about 500 people (one of 350 in 1993), there were over 20 settlements, in at least two clusters, with the larger first-order settlements ranging well over ten times the residential area of the Kuikuro. These settlement hierarchies were both centric and multi-centric, but unquestionably integrated territories of about 250-400 km².

In the context of multiple contemporary villages, such as typical in the past, a lattice-like pattern was created by roads and plaza villages and adjacent communities would have overlapping orbits of cultivated and managed lands. This raises the question of whether European depopulation actually curbed deforestation, which may have degraded local lands by the 16th century but more likely not given the remarkably sophisticated system of land management that was sensitive and well-adjusted to ecological variation. Certainly in the past there was a greater proportion of non-forested to forested areas, but evidence suggests that sustainable levels of land-use were being maintained. In fact, it seems that economic productivity and landscape configuration had co-evolved over many centuries, and intensification was carried out by fine-tuning the diverse and patchy orchard, field, and garden agricultural areas, as well as amplification of wetland fisheries.

It is often hard to say what the exact scale of communities or regional populations was, but the configuration of villages is quite clear. Plaza villages, like today, were critical social nodes and tied into elaborate socio-political networks. Primary roads and bridges are oriented to plazas, or more accurately, are ordered by the same spatial principles, which also orders domestic and public space, creating a cartography and landscape that was highly partitioned and rigidly organized according to the layouts of settlements and roads. These plaza villages and, by extension, galactic clusters are easily detectable across the region, but detailed regional survey has only been conducted in one area, the Kuikuro territory.

The actual planning that went into these regional constructions is well known from the Xingu. Large walled towns, 15-50 ha, small non-walled villages (<15 ha), as well as short-term hamlets and ADE farming plots, and large agricultural countryside of mosaic production areas, marked in fallow as *pequi* orchards, and vast open woody savannas, and the ever present high

story secondary forest (*tehugu*), as well as high forest *itsuni*, that grades into large wilderness areas, which are home to forest trees, animals, and spirit beings (other types of forest and animal beings). In galactic clusters, both internal and external relations were hierarchical. Internally, the plaza ritual complex is a nested hierarchy of plazas and, by extension, the living descendents of elite ancestors (Figure 4). This is a variation of the complex of political ritual characteristics that led to the definition of a theocratic chiefdom, the definitional "temple-idol-priest" complex (Steward & Faron 1959). In other word, the ancestors buried at small (non-walled) communities were encompassed by medium and large communities, and all were subordinate to the ritual political centers of each cluster, the "theater capitals" of these small polities.

In prehistoric times, polity rather than society may be the appropriate term, since it was not a confederation of peer-villages, but instead a confederation of peer-clusters, with communities that extended over an area some 200 x 100 km, or more (or about 20,000 km², just smaller than Vermont or Belgium). In this area, there may have been up to 50 clusters, given 400 km² as a territory in the past, but this, like precise population estimates, is premature. My educated guess is that clusters ranged from under 1,000 to over 2,500, and perhaps as much as 5,000; that there were at least 10 to 12 of them over the territory of the Xinguano nation in 1492; and, that the overall populations must have therefore ranged into the 10,000s, perhaps many.

Xinguano agricultural patterns can also be reconstructed over the long run, as well through analysis of functionally specific utilitarian ceramics through time, which also show continuity in forms used to cook manioc and fish. Indeed, Xinguanos still eat better than 99% traditional foods, fish and manioc, primarily, supplemented by turtle, monkey, and some bird meat, some insects, *pequi* fruit, several palm fruits (see Basso 1973; Carneiro 1983; Dole 1978; Heckenberger 2005). Agricultural landscapes are composed of clusters of manioc plots, some of which are turned into successional *pequi* (*Caryocar* sp.) fruit tree orchards, and large areas of *sapé* grass (*Imperata* sp.), "hay-fields," and woody savanna. Diverse palms and other useful trees and plants are concentrated in abandoned settlement areas, and particularly dense in ancient sites.

Anthropogenic dark earths (ADE) form an integral part of the landscape. Today, ADE comes in two primary forms, house trash middens (*tsulo*) and the soil and vegetation characteristics of forested archaeological sites, called *egepe*. *Egepe* sites are characterized by a mosaic soil patterns, including soils, also called *egepe*, which is also the name of corn plots (Carneiro 1983), resulting from the distributed in overlapping and sometimes mixed refuse disposal middens (composts), domestic contexts and work areas, and public areas, such as the plaza and it's ritual house, or the roads leading away from it (Heckenberger 1996; MJ Schmidt 2010). In contemporary villages a pattern of ringing *tsulo*, enclosed by an area of non-*egepe* soils, modified by burning farther from villages, which is likely similar to practice in agricultural countryside associated with pre-Columbian settlements. In these sites, ADE soils that are concentrated in settlement core areas and form macro-strata that cover areas of about 6 to 8 hectares (within larger residential sites, 20-50 ha). In other areas, trash middens and domestic areas show restricted soil darkening and alterations, like in contemporary villages. This distribution of ADE deposits, like vegetation and wetland habitats, is the historical outcome of Xinguano settled agricultural lifeways, including village permanence, as well as sustained demographic decline during the past five centuries. Many technologies, such as subterranean manioc storage, and water-storage features in seasonal ponds (wells, or forming of existing channel, in place since late Pleistocene), turtle pens have largely been abandoned, although fish weirs are still widely in use.

Regional ethnohistory shows diverse migrations and episodes of ethnogenesis, in response to Western frontier expansion over five centuries, which as helped filled the gap of declining population, but by 1950 the regional population was a mere 500, perhaps less than 5% of its pre-Columbian size (Agostinho, 1972; Fausto, et al. 2008; Franchetto, 1992; Franchetto & Heckenberger 2001; Heckenberger 2005). Proto-historic occupations are poorly known, but can be considered transitional between the well-established galactic clusters and the reconstituted Xinguano society known from 1884 onward, which had lost the tightly integrated and highly planned aspects of earlier regional clusters and entered a period of major depopulation, geographic compression, and ethnogenesis. Population compression continued through the mid-20th century, but more recent subgroups, which moved into the

area after 1800, later moved out of the area (Bakairi, Trumai, Suya, among others). Population collapse resulted in a process of landscape "fallowing," as settlement after settlement was merged and areas whole areas abandoned. It is an exemplary case example of what a large, settled pre-Columbian polity looks like after five centuries of decline, but remarkably many basic cultural patterns have been resilient through the time, such as circular plaza village form and general landscape orientations.

In the Upper Xingu, particularly, the regional built environment has a uniquely cultural signature, associated with networked communities of late pre-Columbian regional polities. These polities, extending over an area larger than Wales, established a grid-like pattern of settlements across the region. Core areas of integrated (galactic) polities, estimated at roughly 50 km² were largely deforested agricultural countryside, surrounded by more mosaic forest and converted land-use areas across the roughly 250-400 km² territorial area of each polity. The over a dozen known polities extend over an area of minimally 20,000 km², and given that much of the area is unsurveyed and likely had numerous additional polities may have covered an area of 50,000 km². The extent of anthropogenic landscapes in the Upper Xingu headwater basin is likewise characteristic of other headwater basins in the southern Amazon transitional forests. The implications for biodiversity are clear: rather than pristine tropical forest, biodiversity across the area, both in terms of broad regional distributions and the specific composition of local settings, must be understood as the result of complex socio-cultural and historical factors, as well as local and regional ecologies. A further implication is that the semi-intensive resource management and land-use strategies of the pre-Columbian past have important clues not only to the composition of tropical nature in these areas, but also appropriate strategies for conservation and sustainable development, including the recognition of indigenous rights and the importance of indigenous knowledge systems in contemporary environmental discourse and policy.

Recognition of late prehistoric and historic period complex societies in the Brazilian Amazon refutes traditional views that portrayed the region's environment as inimical to the development of such societies. Early portrayals of the deep history of the region in the mid-20th century, typically focused less on what lowland people were, but instead what they were

not or, more precisely what they lack – the harbingers of classical civilization, such as stone architecture, cities, domesticated animals, writing, surplus, among other things. New approaches to Amazonian deep history attempt to rewrite the rules and trait-lists of human civilizations to include the obviously large, densely settled, and socio-politically complex societies in several areas, and thus avoid evolutionary caricatures from other areas that truncate contemporary Amazonian peoples from their deep history.

In Garden Cities of Tomorrow (1902), Ebenezer Howard proposed a model of sustainable urban development, "garden cities." as an alternative to industrial urbanism. A forerunner of the urban green movement, he envisioned a type of galactic urbanism as an alternative to industrial urbanism. The model proposed tightly integrated networks of towns, each gravitating around a central public park, orbiting around a core town. Towns were linked by well-developed transportation and communication networks and the multi-centric form produced a more subtle gradient between urban and rural areas and coupled with well-developed transportation networks. Recent archaeology and indigenous history conducted in the Upper Xingu area has revealed small garden city-like clusters of settlements, composed of a central plaza settlement and four cardinally oriented satellite plaza settlements, tightly integrated by major roads and surrounded by mosaic countryside of fields, orchards, gardens, and forest (Figure 5). Far from stereotypical models of small tropical forest tribes, these patterns were carefully engineered to work with the forest and wetland ecologies in complex urbanized networks. Such multi-centric, networked forms were quite common, if not typical, in many parts of the pre-Industrial world, particularly major forest regions.

THE ANTHROPOCENE

The last millennium of the Holocene in Amazonia, in particular, is characterized by increasing transformation of the natural environment, as seen across the globe. Particularly important, the conversion of natural forest to anthropogenic woodlands is the initial impetus of human-induced changes that has led some researchers to suggest a new epoch of geological times, the “Anthropocene.” Changes that resulted in this distinction, in addition to forest conversion, include changes to sea level, global temperature, CO^2, particularly

associated with the rise of urbanism worldwide after 1750. The actual "golden spike" is typically situated in the 20th century, but initial changes, particularly in the denudation of forests across the globe extends earlier to 500 to 1000 years ago (Zalasirwicz, 2008).

In Amazonia, the Anthropocene can be broke into five primary periods: (1) large-scale conversion of forest to mosaic anthropogenic landscapes associated with late pre-Columbian complex societies in a variety of settings (ca. 1000-1600 CE); (2) cultural and population decline (ca. 1600-1750), including large-scale forest "fallowing," related to European colonialism; (3) increased European colonization and exploitation of the Amazon, after ca. 1750, related to geo-politics and initial resource extraction and, particularly, nation-building and worldwide industrialism, such as the "Rubber Boom" into the mid-1800s to early 1900s; (4) 20th century globalization, particularly the "March to the West" and "economic miracle" in the Brazilian Amazon in the mid-1900s; and (5) contemporary (late 1900s-present) articulations between conservation (environmentalism), agricultural expansion (soy-bean frontier), and socio-political actions of indigenous and rural populations.

What patterns and processes can be reconstructed from the emerging cultural history of the Amazon? First, there is substantial evidence now available to suggest that many areas were dominated by settled regional polities by 1492. These are pluri-ethnic and sometimes multi-lingual social formations that represent the complex blending of deep Amazonian cultural phylogenies, ecological variation, and local and regional histories of cultural development and interaction. It also suggests that the view of Amazonia dominated by small-scale societies, semi-sedentary, and autonomous villages, which are dispersed across the region, requires a significant deconstruction. To the contrary, however, recent archaeology documents both uniquely Amazonian complex societies and great diversity within the region, culturally, ecologically, and historically, including small, medium, and even some fairly large pre-modern social formations, and the remarkable evidence of these societies in diverse forms of cultural memory, including the artifacts, structures, and landscapes of the past, but also in the lifeways, languages, bodies, and oral traditions of living societies.

Obviously, the archaeology of the deep past across periods that can be situated in larger schema of historical and ecological change, at the scale of centuries and millennia, has

critical implications for contemporary discussions of what the Amazon is, and how it should be used or not today, including biodiversity and ecological resilience and, hence, conservation and sustainable development, as well as the cultural heritage and human rights of indigenous peoples. Globally, the conversion of natural forest to anthropogenic woodlands is the initial impetus of human-induced changes that has led some researchers to suggest a new epoch of geological times, the "Anthropocene" Amazonia was a critical major region in this transformation, as it is today, only in most of this region and general "fallowing" of the forested landscapes from the region separated the transition from native world systems to the early European World System and, subsequent, post-Industrial globalization.

What is particularly crucial is the recognition that long-term and dynamic change in coupled natural-human systems was no less relevant in Amazonia than other major forested regions of the world, particularly the tropics. The process of landscape domestication began early in many parts of the Amazon, but was particularly propelled by the expansion of early agriculturalists associated with several large linguistic diaspora (Arawak, Tupi-Guarani, and Carib). Riverine and coastal adapted Arawak-sepaking peoples, in particular, initiated and developed semi-intensive resource management strategies that resulted in complex anthropogenic landscapes, culminating in the complex anthropogenic landscapes of the Amazon floodplains, southern borderlands, and other regions. Indeed, in the southern Amazon transitional forests, research from the Upper Xingu and other areas, suggests that a large part, perhaps 50% or more, of this macro-ecological province is anthropogenic, the result of complex socio-cultural, historical and ecological factors.

What this all suggests is that forested regions along the southern Amazon periphery, the "arc of deforestation," human modifications of the landscape have very deep roots and that throughout the Anthropocene human factors, including social, political and economic systems were critical factors in regional ecology. Considering the scale of pre-Columbian social formations, including large settlements, which just in terms of timber use for major palisade walls (2 km long) and other structures in major villages and thatch for houses, harvested from vast areas of anthropogenic *sape* (Imperata sp.) grass fields, was a large scale industrial economy in pre-modern terms. This was supported by large agricultural countryside, focused

on manioc and tree crop agriculture, within broad patchy mosaics of gardens, orchards, grass fields and low- and medium-height secondary forest in complex long-term rotational cycles. Likewise, wetlands were extensively managed and anthropogenically altered, which like the forest areas included a complex network of greater and lesser human paces. But, critically, these past systems refined a management system that, unlike current development strategies, worked with rather than against nature.

CONCLUSIONS: EXPANDING THE DIALOGUE ON SUSTAINABILITY IN THE "ARC OF DEFORESTATION"

There are few places on earth where "nature" looms as large in the Western imagination as the Amazon. Early European explorers were awed by its vast natural resources, today coveted by developers and environmentalists alike. The Amazon is often viewed as a vast wilderness, only lightly occupied and unused – "owned" – by native peoples, the setting, par excellence, of pristine nature and primitive tribes – the alter-egos of Western civilization and built environment. Portrayed as small-scale or "simple" societies, indigenous peoples possess scant means to transform or "domesticate" nature. And, as wilderness, *terra nullius*, "empty" or "undeveloped" land, the region is open to development or conservation as outsiders see fit. The discourse of backwardness further implies that indigenous peoples are unlikely to provide forward thinking solutions to contemporary problems, incapable of knowledgeably "developing" or "conserving" the land, and even an impediment to social advancement more generally: "why so much land for so few people." As Alcida Ramos (1998:157) notes, under successive government agencies: "Indians were turned into hopeless children, lost in ignorance, living under the wing of the state, which … kept them in a sort of civil suspended animation …." This willful ignorance of indigenous histories and voices pervades many broader discussions on sustainable development and the environment.

In the mid-1990s, Conklin and Graham (1996) described a "shifting middle ground" between indigenous peoples and environmentalism, but "the rainforest card is stronger than the indigenous card." By the turn of the millennium, this had crystallized in a more explicit antagonism, "parks versus people," which … trenchant critique: as Chapin (2005) notes: "As

corporate and government money flow into the three big international organizations that dominate the world's conservation agenda, their programs have been marked by growing conflicts of interest—and by a disturbing neglect of the indigenous peoples whose land they are in business to protect." Indigenous peoples were not seen as "suitable allies because they, like most other people, are not even good conservationists, sometimes choosing their economic well-being over preservation of natural resources." The general tone echoes that of Garret Hardin's influential 1968 essay "The Tragedy of the Commons" (1968): the rational decisions of self-interested individuals are likely to undermine the common good, and must be monitored or "governed."

Resilience and sustainability are keystone concepts in biodiversity conservation and interdisciplinary research on coupled natural-human systems and critical to contemporary questions of global climate change, biodiversity loss, ecosystem restoration, and economic development. They are particularly relevant in the world's major tropical forests, such as the Amazon (~40%), which are undergoing rapid development and deforestation. Sustainability science provides a conceptual framework for addressing the pluralistic nature of contemporary research, notably by focusing on: (a) scalar properties of natural-human systems and interactions within and between scales; (b) multi-disciplinary research strategies, including change in coupled bio-physical and socio-historical systems; and, (c) multiple domains (e.g., ecological, economic, and socio-cultural factors), which are multi-vocal and open to diverse interpretations, including those of local indigenous and other rural peoples (Martens 2006). The viewpoint of sustainability science promotes the co-production of knowledge and a process of "learning through doing and doing through learning," making not only interdisciplinary but intercultural interactions an active part of research design (Martens 2006:5, 36; see also Gezon and Paulson 2005).

In the final analysis, sustainability and resilience are historical concepts, since they imply process over time. It is a critical concept in studies of change in natural-human systems, such as global climate change, biodiversity loss, ecosystem restoration, and sustainable development. Resilience theory benefits from the long-term perspective on natural-human systems and cycles provided by archaeology, since time and socio-historical variation is critical.

Fisher and Feinman (2005:62), paraphrasing a recent editorial in *Science* (Kennedy 2004:1565), note that: "time depth for both human and environmental records is a prerequisite if we are to assess and explain correlations between human-environmental links and ultimately determine whether apparent trends are meaningful, directional, or neither (e.g., Crowley 2000)." Redman and Kinzig (2003:14) even more emphatically argue that "resilience theory would benefit from an increasing collaboration with archaeologists, who would provide a long-term perspective on adaptive cycles." As Stahl (2006:127; see also 1993) notes, regarding questions of Holocene environmental and climate change that studies "must rely on the techniques and methodologies of [archaeology] for generating inferences about a deep time that existed beyond human memory and before the advent of written documents." Nonetheless, as Redman (2005:71) notes, "only a few integrative ecological studies of human land use cover time scales longer than a century," and, importantly he cites the Upper Xingu study (Heckenberger et al. 2003) as one of only a handful of studies worldwide.

The historical change and "plasticity" of tropical forest ecosystems, but rarely attends to anthropogenic landscapes that differ from widely described non-altered forest areas, such as their ability to withstand or recover from shock, in this case from climate fluctuation and land cover change. Understanding this will not only help understand how to manage significant change, but will also help devise alternative strategies for development (Schwartzman et al. 2001; Redford and Sanderson 2001). However, in many places, such as Amazonia, integration between ecological and socio-cultural patterns, between long-term and short-term processes, and local and regional patterning is inhibited by lack of time-depth in most areas.

Primary landscape transformation in Amazonia rarely (if ever) attains the degree that ecologists would characterize as primary succession, but large-scale transformations can be suggested in various parts of the Amazon floodplains (Neves and Petersen 2006; Roosevelt 1999) and southern Amazon (Erickson 2006; Heckenberger 2005). Questions of ecological resilience and sustainability in this area need to be framed in the context of secondary or altered – anthropogenic – forest landscapes, rather than primary forest settings (forests that are not directly influenced by humans in the past). Given that the areas likely constitute >10%

of the region and have greater potential for human use, as reflected in past land-use practices, it is important to begin incorporation of the areas of complex socio-ecological systems. Such intensive indigenous systems are not only critical to understanding the composition of the Amazon region, could provide the critical middle ground between harmful extensive (slash-and-burn) and entirely destructive clear-cutting development (Laurence et al. 2004).

Several pressing questions must be addressed in future research. First, what were the parameters of these systems in the past, in terms of economic production, ecological transformations, and social and cultural change across the region, including large, settled populations? Second, what are the productive limits of such alternative systems in the face of the rapid demographic and economic growth throughout much of the region? This is particularly crucial to the indigenous areas not yet engaged in mechanized development, which make up the vast majority of remaining forest areas in the Xingu. Third, can indigenous systems be used as models for contemporary development in the southern Amazon or elsewhere, including strategies for ecological restoration, notably among other small rural land-holders?

Much of the discussion on sustainability in Amazonia is focused on pan-regional patterns and models, created from remotely sensed data, or highly localized studies on individual communities or micro-regions. Questions of collaboration and sustainability science address questions about contemporary biodiversity conservation, climate change, economic development, and human rights and, by extension, what research strategies are best suited to diverse interests? Participation has also become a buzzword of resource management and research in tropical forest areas, but, as noted recently by Chapin (2004), this claim often falls far short of developing meaningful partnerships. Alcorn and Zarzicky (2005:12) suggest: “if we are really concerned about the loss of biodiversity, new paradigms of collaboration are needed to address this crisis, not more catchwords. Non-indigenous society needs to acknowledge the challenge of representation and communication across cultures.” Participation in Amazonia involves significant synergistic activities with Brazilian scientific community, at diverse levels, and local education and cultural heritage development projects. The articulation of science with broader forces and interests within society at large also extends to participation and

training of underrepresented groups and indigenous cultural rights. The project develops and strengthens collaborations between Brazilian and US researchers and between scientists and indigenous peoples. The project also develops methods for broad-regional assessment, though use of coupled field-collected data and satellite imagery analysis.

Despite a remarkable rise in research in all disciplines, there is remarkably little articulation between historical and ecological research approaches. Furthermore, the dialogue between scientists and indigenous peoples is poorly developed and often divisive, although less typical of historical ecology and archaeology that are rooted in the indigenous practices and places themselves. The question is: how to move beyond critique, focused on recognition that indigenous peoples have often been disenfranchised in scientific research and associated conservation strategies, to develop fully engaged collaborations, working with these groups as full collaborative partners rather than "human subjects" (Heckenberger 2007, 2009; Schwartzman and Zimmerman 2005)? How do we create dialogic communities of knowledge production, which actively engage indigenous peoples and NGOs and other entities, which interact most closely with them, notably economic and political interest groups and representatives.

Three areas, in particular, merit scrutiny: 1) What are the implications of a new view of the Amazon basin's tropical forests as anthropogenic landscapes have for understanding biodiversity, in terms of genetic, species, and ecological variation?; 2) As cultural authors and historical stewards of the Amazonian biome, what is the place of indigenous peoples and history in contemporary debates regarding biodiversity conservation, sustainable development, and global initiatives (REDD+) to curb tropical deforestation and degradation? Of particular importance, what contributions do indigenous knowledge systems and historical strategies of land use have to say to contemporary concerns to "save the Amazon," and what are the implications of the recognition of anthropogenic landscapes have for questions of indigenous cultural and land rights?; and 3) How have scientific discourses constructed an image of Amazonia that is a distortion of the historical and socio-political realities of indigenous peoples, including the recognition of alternative pathways to socio-political complexity and semi-intensive land-use and the historical reality of colonialism and

globalization over the past few centuries? Are we justified in saying that, although unique, i.e., genuinely Amazonian, past social formations, historical trajectories, and cultural diversity and the dynamics of coupled natural-human systems in the Amazon, like other tropical forest regions, was not less "complex" or diverse than any other major world region?

In Amazonia, as elsewhere in the global south, "new models of governing common [property], public property, and unappropriated land and resources have gained their greatest momentum from international environmental activists' collaboration with the sponsors of global development (Blackmar 2006:72)." This neoliberal political agenda is wedded to a pervasive view that natural scientific models of ecology should be central in governing land-use management and long-term planning. But, as Latour reminds us in *The Politics of Nature*, "the ecology movements have sought to position themselves on the political chessboard without redrawing its squares, without redefining the rules of the game, without redesigning the pawns" (2004:5).

In recent years, climate change has eclipsed biodiversity conservation in global concern over the Amazon, notably attempts to preserve carbon stocks, since 20-25% of anthropogenic carbon emissions result from deforestation and degradation of forests and Brazil accounts for 40% of the world's deforestation. In the Amazon, widely seen as a major global regulator or "tipping zone," debate is centered on payments for ecosystem services, notably international "carbon markets." This is commonly framed in the UN program REDD: "Reduced Emissions from Deforestation and Forest Degradation in Developing Countries," which often amounts to parks versus people, part II.

The Xingu headwaters figure prominently in these discussions, as one of the hardest hit areas of Amazonian development. Stickler et al. (2008) note that deforestation in the Xingu basin represents between 5 and 13% of total Brazilian Amazon deforestation, or about 1% of total global annual emissions of carbon from land-use/land-cover change. Once again, if the optimistic scenarios of forest restoration and protection in the developed lands around the Xingu Park come to pass, curbing the rampant "business as usual" development, this can't be a bad thing. In fact, it has the potential to be critically important to ecological integrity within

the TIX, which is under urgent threats from sedimentation, agrochemical run-off, and associated fish die-off.

Also at issue, however, are standing reserves of forest in the TIX and other indigenous areas, veritable gold mines of carbon stocks? But, what is the role of indigenous partners, what are their stakes and how are these to be represented in local solutions and global markets? Until now the answer is very little. It is once again a question of power brokering and economic trade-offs by external players.

The idea that REDD is the new green, as we might imagine, is also not without it ardent critics, notably indigenous peoples. Early in the process, "Indigenous Peoples Condemned Carbon Sinks in the Kyoto Protocol as a New Form of Colonialism and Genocide," noting in 2001 that "These negotiations have churned out more than 5 million words of text but do not even mention Indigenous Peoples' rights." More attention has been paid in recent years to indigenous claims, but questions of who will broker carbon deals and relations between the local concerns of traditional peoples and global concerns of conservation and development are still points of extreme contestation. In late 2008, the report "Cutting Corners: World Bank's forest and carbon fund fails forests and peoples," Dooley et al. note that the Bank "has rushed its review process and is failing to follow its own rules set to protect indigenous people and forest communities."

In a New York Times (05/18/2008) article entitled "Whose Rainforest is this, Anyway?," questions of biodiversity, ecosystem integrity, and climate change are tied to the idea that the Amazon biome is global patrimony. Al Gore, for instance, commented that: "Contrary to what Brazilians think, the Amazon is not their property, it belongs to all of us." Little wonder that as elsewhere across the global south the neoliberal agenda is met with skepticism, viewed as Ong (2006:3) notes as a "radicalized capitalist imperialism." Supporters argue that neoliberalism limits the scope of government and state power, but, as she goes on to note: "it can also be conceptualized as a new relationship between government and knowledge through which governing activities are recast as non-political and non-ideological problems that need technical solutions … " In the Amazon, science, we are led to believe, will save the day.

Questions of biodiversity conservation and ecological integrity in Amazonia are obviously complex and multi-vocal: there are no easy answers. Clearly "saving the Amazon," sustainable development and conservation, must be a good thing, but as Amity Doolittle (2003) notes: "Without deep reflection on the images and rhetoric that surround the rain forest, how can we really know what it is we are trying to 'save'?" Still many commentators appeal to shopworn stereotypes of Amazonian uniformity, such as Betty Megger's *Amazonia: Man and Culture in a Counterfeit Paradise*, the bible for many ecologists' portrayals of the region's past. Rather than *terra nullius*, "no-man's land," sophisticated indigenous strategies of land management offer potential solutions to questions of sustainable development, particularly in indigenous areas.

Indigenous lands, as government controlled and locally administrated common property, constitute over a fifth of Brazilian Amazon and are "currently the most important barrier to deforestation" (Nepstad et al. 2006:65). This is particularly true in the southern Amazon's transitional forests, the "arc of deforestation." At the current pace, the transitional forests will be reduced to 20% by 2015, the majority of which is restricted to indigenous areas, which are also precisely those areas that archaeology and indigenous history suggest that forests are extremely anthropogenic.

More importantly, the role of indigenous peoples in conservation and development continues to suffer from an entrenched crisis of listening, considering not only whether the subaltern indigenous peoples can speak, but who and how will non-indigenous stake-holders listen (Spivak and Gunow 1993). In the world of Amazonian eco-politics, or governance – that nexus of power-knowledge wedded to a-historical and mono-vocal natural scientific models, the voices of indigenous and other traditional communities are as often as not unheard. They are partners only at lower, practical levels of local implementation, as the technology and language of scientific knowledge production, which is both foreign and often alienating to local communities, marches on.

The recent summit Rio 20+ focused again on questions of sustainability, including issues of ecological integrity, urban and frontier economic development and social justice, but as major demonstrations by indigenous, land-less rural peoples and urban poor and their

advocates demonstrate, there is much that still needs to be done to level the playing field. Recent discussions of the Amazon still include views of pristine nature (McMichael et al. 2012; Bush et al. 2007, 2011), based on small, decontextualized samples that are supposed to reveal that the forest has always been forest, due to the low incidence of soil charcoal indicative of burning and actual domesticates preserved as phytoliths. These recent studies completely ignore the epistemological and political implications of a terra nullius conclusion, which disempowers indigenous groups and other small-scale rural communities, precisely the groups most responsible for the stewardship of the region. To transform engagement with indigenous peoples in a way that becomes more meaningful to them and creates a dialogic environment more conducive to their voices being heard requires basic modifications in how knowledge is produced and consumed by outsiders, researchers, policy-makers, and those aiming to "save the Amazon." This involves a change not only in how science "speaks to" diverse publics, but, in turn, how these can "speak back to" scientific research.

Studies conducted in collaboration with descendant communities highlight the dialogic nature of scientific knowledge production, particularly the intersection of indigenous histories and cultural rights and the contemporary politics of nature, including global and regional issues of conservation and development. In this new world of scientific knowledge production, heterogeneous research teams resolve questions of immediate importance to specific contexts of application, rather than global solutions or the detached scientific strategies of outsiders. Recognizing this does not diminish the quality of research, but does suggest greater balance between so-called "intellectual merits" – bound by cultural, historical, and disciplinary perspectives – and "broader impacts," framed in both local and more global terms. In this world of research, archaeology and indigenous history plays a vital role, particularly in understanding centennial- and millennial-scale change in coupled human-natural systems, which are vital to debates regarding conservation, climate change, and, critically, the cultural heritage and rights of indigenous peoples in an era of unprecedented change across the region.

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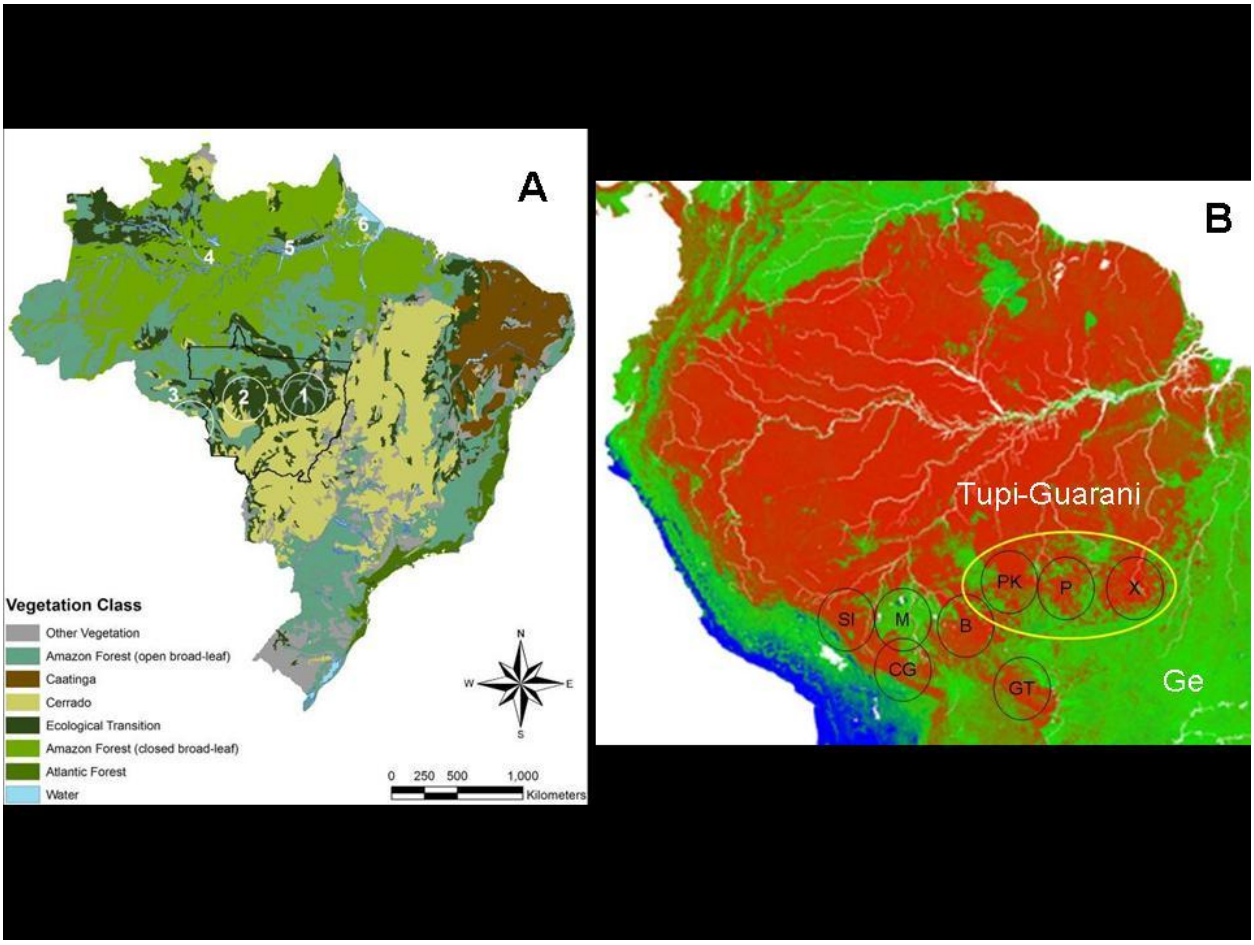

Figure 1. (A) map of Brazil showing major vegetation characteristics and several areas of pre-Columbian complex societies, including (1) Upper Xingu; (2) Pareci; and (3) Baures/Guaporé River areas of southern Amazon periphery and (4) central Amazon, Manaus; (2) Santarém; and (3) Marajó along the Amazon floodplains. (B) MODIS image of tropical forest (red) and more open wooded savannas (green) of Amazonia and distribution of Arawak societies, including Xingu (X), Pareci (P), Pareci/Kobishi, Enawene nawe, and Saluma (PK), Baure (B), Mojos (M), San Ignacio, Apurina, Piro (SI), Chane/Chiriguano (CG), and Guana/Terena (GT), mainly in forested basins (note: southern Amazon periphery marked by yellow oval). Figure 1A reproduced from Heckenberger et al. 2008.

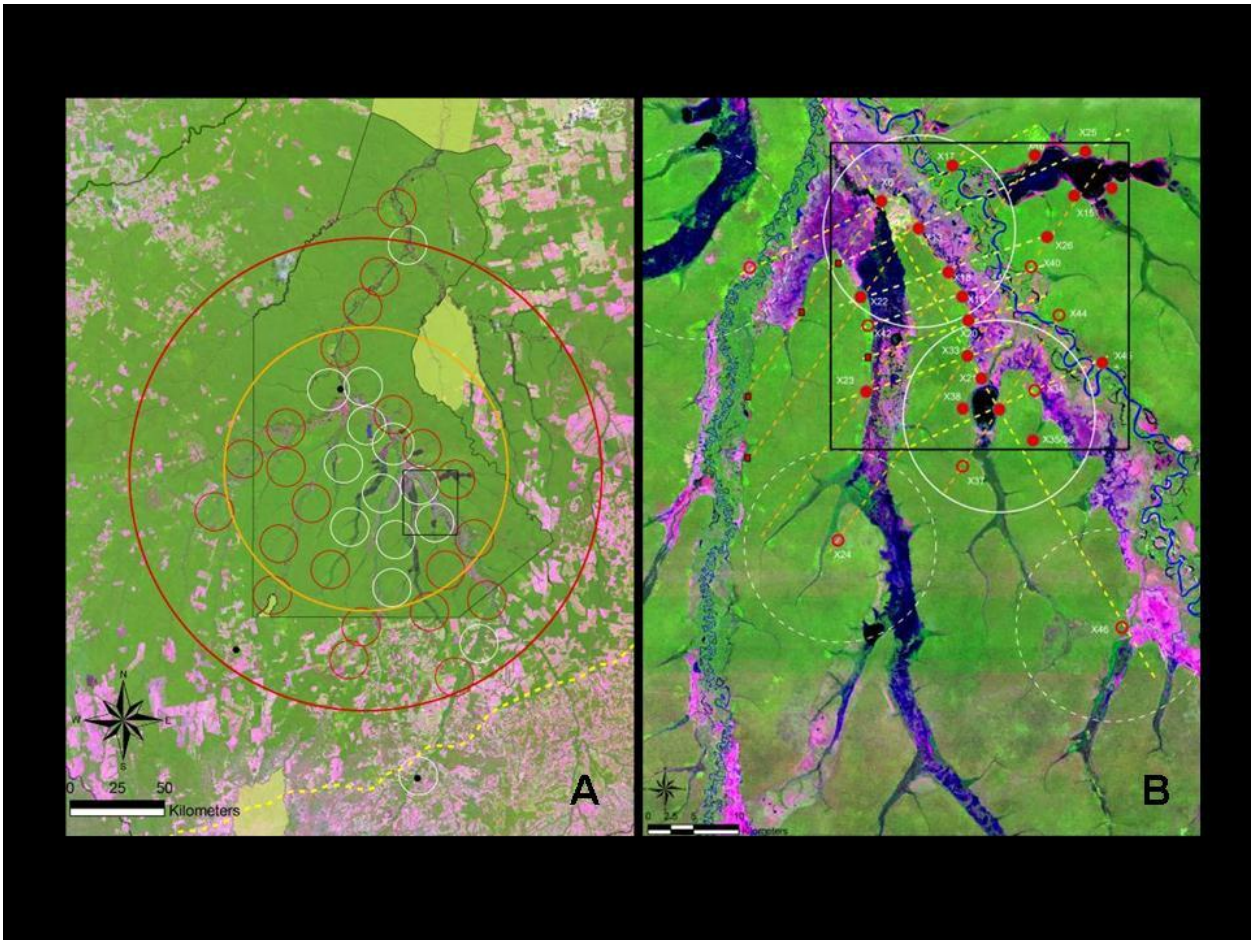

Figure 2. (A) distribution of galactic clusters in nuclear portions of the Upper Xingu, including those suggested from the known presence of large (30-50 ha) walled villages (white circles) and possible other clusters in areas that are currently unstudied archaeologically (red circles); yellow circle represents minimal area of saturated anthropogenic landscapes and red circle possible maximal extent. (B) distribution of site s in the Kuikuro study area and hypothetical linkages based on road angles from primary sites; note: white circles represent hypothetical territory ofg individual galactic clusters. Reproduced from Heckenberger et al. 2008.

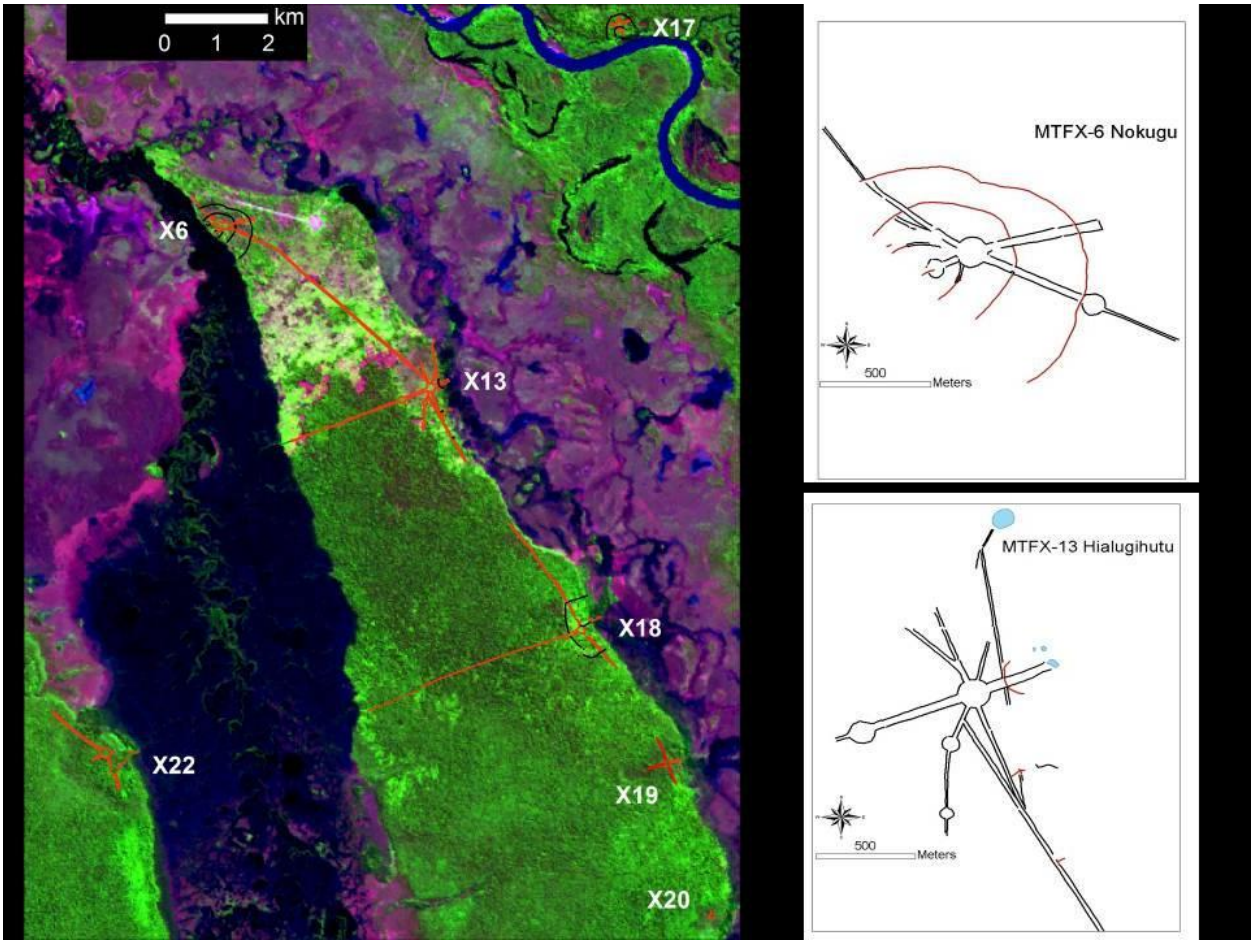

Figure 3. Major core settlements of the Ipatse (northern) cluster in the Kuikuro study area, including ceremonial hub (X13), major walled, first-order residential centers (X6, X18), walled secondary residential centers (X17, X22), and smaller un-walled satellite plaza settlements (X19, X20). Note: red lines denote roads and black lines peripheral ditches (walls).

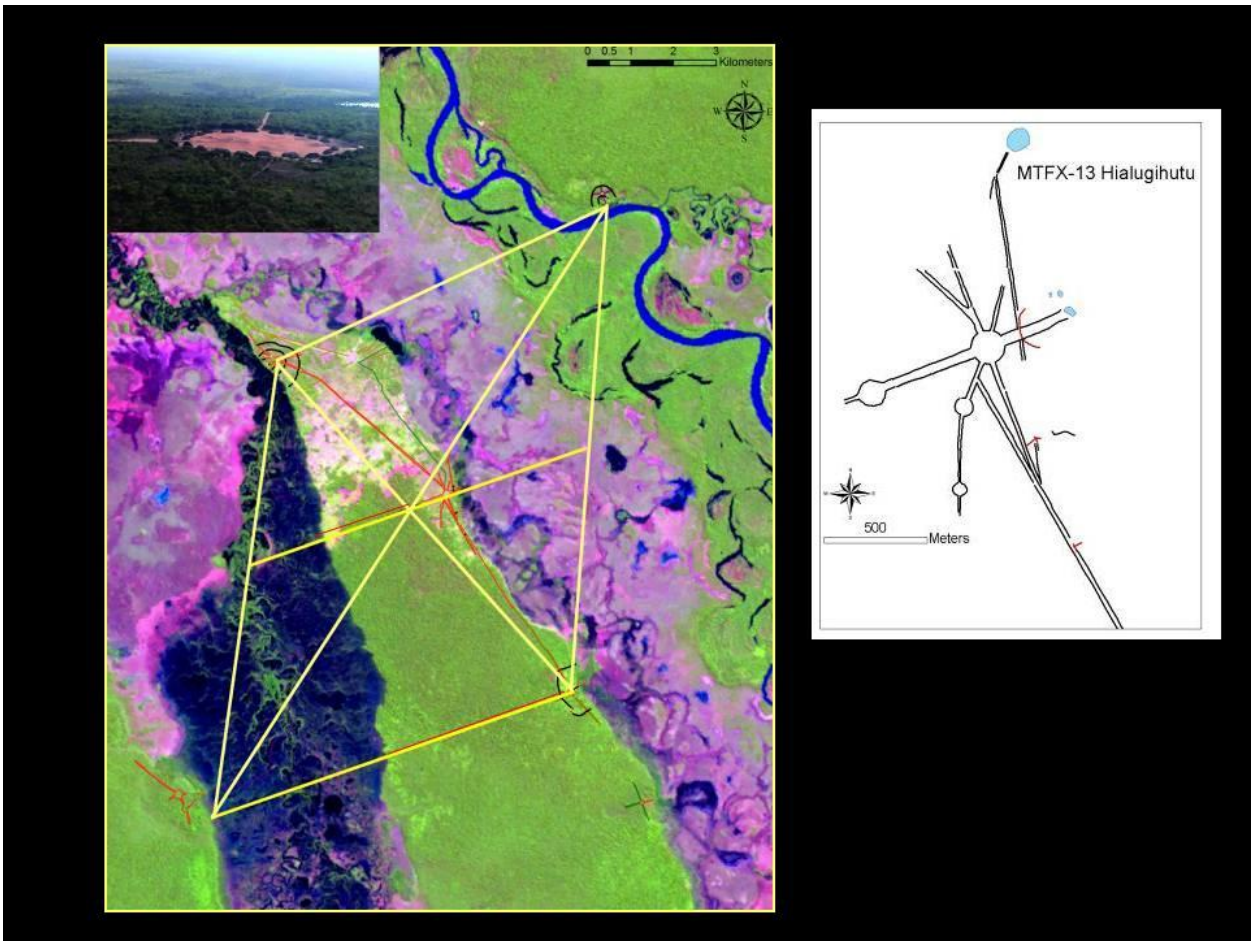

Figure 4. Orientations of settlements in Ipatse cluster showing the symmetry of settlements in relation to ceremonial hub settlement of X13. The area in an around the quadrangle represents core areas of the cluster, interpreted as mosaic agricultural countryside, surrounded by more forested areas; areas between clusters interpreted as closed forest "green belts."

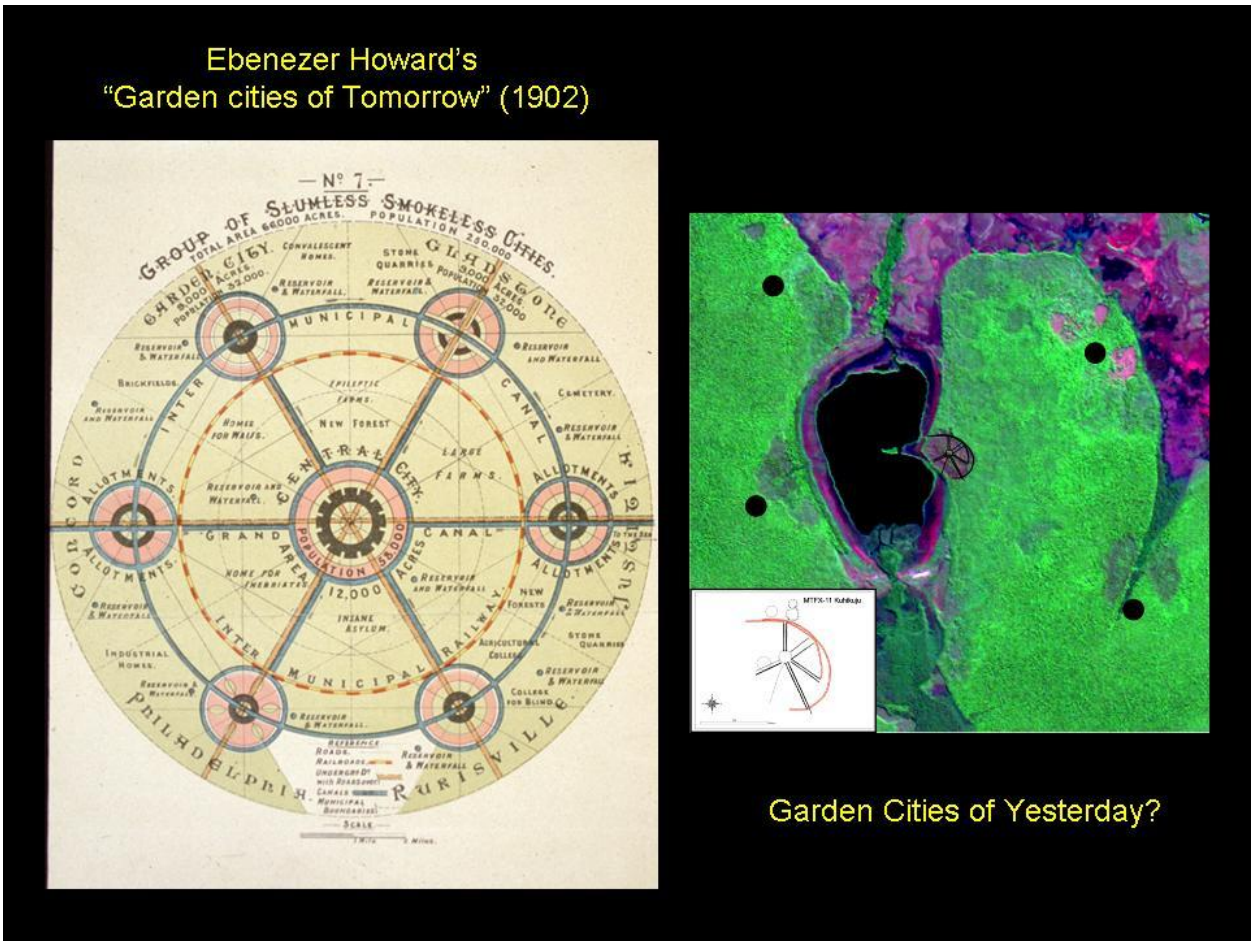

Figure 5. Howard's (1902) model of a garden city and distribution of settlements in the Kuhikugu (southern) cluster in Kuikuro study area, oriented around the major residential hub settlement of X11 (see inset). Note: anthropogenic "scars" on forest associated with settlements in satellite image.

[1] Steward and Faron in *Native Peoples of South America* (1959) called these complex societies "theocratic chiefdoms," which dominated the densely forested areas of the basins. They borrowed the term chiefdoms from Oberg (1955), who was also describing South America, although the term gained widest currency in other regions, particularly Polynesia (Sahlins 1958; Service 1962). See Kehoe (1998) and Pauketat (2007) for incisive critiques of the term as a general cultural category or type, particularly as applied to the "New World."