Nature as Kin: Reconsidering evidence of ‘incipient agriculture’ in southwest Amazonia in the early and mid-Holocene

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Rosa Mason
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NATURE AS KIN: Reconsidering evidence of 'incipient agriculture' in southwest Amazonia in the early and mid-Holocene

BA Thesis

Rosa Mason

Supervisor: Dr. A. Geurds

Leiden University, Faculty of Archaeology

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CHAPTER 1: *Introduction*

The evolution of foraging to farming is a persistent concern in archaeology. Dominion over natural resources has long been held as the apex of our species' progress, purportedly facilitating larger populations, more advanced technology, and complex socio-political and economic organisation (e.g., Price, 2000, p. 1). Yet many questions remain unanswered in the study of this agricultural development, and its visibility in the archaeological record. Such questions often arise from re-examining the definition of 'agriculture,' and the epistemic foundations on which it is based.

1.1 Agriculture in southwest Amazonia: prior research

Early archaeologies of agriculture were strongly based in studies of the Near East (e.g., Childe, 1936) and particularly on domestication processes. As the study of agriculture expanded beyond this region, archaeologists increasingly began to recognise the complicated nature of such ecological manipulation. In the tropical forests of Amazonia, for example, identifying 'agricultural origins' has been complicated and elusive. Research historically focussed on downstream lowland and delta areas, which were seen as more ecologically-'suitable' for large-scale agricultural undertakings and thus more complex societies (e.g., Meggers, 1954, 1991; Lathrap, 1968). However, research since the late-20th century has shown that upland, *terra firme* areas also harbour long, rich histories of occupation and landscape modification. This thesis compiles evidence from *terra firme* areas in southwest Amazonia, particularly in the interfluvial zones around the Madeira and Purus rivers [Fig. 1].

In this region, archaeobotanical studies provide the primary evidence for ecological modification. Phytoliths for cultivated crops dating to *c.* 8,000 BP are found widely (Clement et al., 2010, p. 77, 92; Watling et al., 2018, p. 23), and in some areas date to as early as 10,250 BP (Lombardo et al., 2020 for sites in the Llanos de Moxos). Arboreal distribution patterns and pedological signatures also indicate that humans have been shaping the *terra firme* landscape since its earliest occupation (Levis et al., 2017; Kern et al., 2015). This evidence refutes studies claiming the region was largely 'untouched' by anthropogenic activity (*sensu* McMichael et al., 2012; Bush & McMichael, 2015; Barlow et al., 2012), and marks southwest

Amazonia as one of the earliest centres for plant experimentation and domestication globally (Watling et al., 2018; Lombardo et al., 2020).

Fig. 1: Map of study area, with key rivers highlighted orange. Significant sites/regions discussed in Chapter 3 are marked (Map from Macharia, 2021; modified by author)

1.2 What research is still lacking?

Recent palaeoecological studies have transformed our understanding of the early-mid Holocene in southwest Amazonia. However, there is a pressing need to integrate these data within broader transdisciplinary dialogues. Many current archaeological analyses continue to seek refuge in scientific methodologies and evolutionary models of agriculture, without properly interrogating the ontological basis of these approaches. Situating geochemical and archaeobotanical evidence within frameworks borrowed from anthropology and ethnography enables a more comprehensive assessment of the extent and characteristics of human-plant interactions in this region's past. Theoretical paradigms such as multinatural perspectivism (Viveiros de Castro, 1998) and familiarisation (Fausto & Rodgers, 1999) can enrich archaeological interpretation of these complex and multidirectional interactions.

1.3 Research aims and orientation

This thesis is part of a current wave of research seeking to re-shape our understanding of southwest Amazonian landscapes. It links recent archaeobotanical and palaeoecological findings with broader theories on human-landscape relationships, to explore the complexity and antiquity of human ecological management in this biome. As part of this goal, this thesis addresses the inadequacy of (neo-)evolutionary frameworks of agriculture, centred on domestication and intensification. It discusses how the very definition of these terms – and the models used to explicate them – propagate Eurocentric epistemic constructs like the nature-culture binary (Vrydaghs & Denham, 2010, p. 7-8). Challenging these traditional perspectives on agriculture is vital to the larger task of broadening and decolonising academic knowledge. Transdisciplinarity is a pivotal part of this process of knowledge (re)formation, providing the "multi-epistemic literacy" (Kuokkanen 2007, p. 155) necessary to rethinking dominant archaeological discourses.

1.4 Research questions

A two-pronged research question is adopted to pursue these aims. Firstly: what has palaeoecological data revealed about botanic management techniques in the *terra firme* zones of southwest Amazonia during the early and mid-Holocene? Secondly: how can we interpret this data with the help of anthropological concepts such as 'mutual care' and 'familiarisation'?

The following sub-questions support this core research agenda:

1. In what ways did early and mid-Holocene populations of southwest Amazonia actively manipulate their botanic environment?
    - *1.2.* How is this evidenced in the palaeoecological record?
2. When do we see the earliest evidence of plant 'domestication' processes in this region, and how do these processes unfold over time?
3. What are the implications of this on our understanding of early "agriculture" in southwest Amazonia, and how it can be studied archaeologically?
    - *3.2.* How has the conceptual framing of agriculture evolved in recent decades?
    - *3.3.* How have findings from the southwest Amazon contributed to this discussion?
4. How can archaeological and palaeoecological data be integrated with anthropological understandings of human-nonhuman entanglements?

4.2. What can these understandings contribute to the interpretation of human-plant relations in ancient Amazonia?

1.5 Dataset, theoretical paradigms, and methodology

This thesis reviews and analyses the ongoing debates surrounding human-plant interactions in southwest Amazonia during the early and middle Holocene. It summarises recent palaeoenvironmental studies into the extent of human influence on this region's ecology, considering evidence from pedogenic analyses, tree-species distribution mapping, and phytolith evidence of cultivars (Chapter 3). These three categories offer a good combination of depth and diversity in the information they provide about past landscapes. They also intersect (i.e*.,* soil fertility affecting vegetative composition) to create a comprehensive overview of the most salient ecological traces left by past communities.

These palaeoecological data are then analysed using concepts from anthropology and ethnography (Chapters 4 and 5). These disciplines are chosen because they help to problematise current archaeological models; an interdisciplinary approach enables us to probe the underlying epistemology of 'agricultural development,' and challenge the ways that human-landscape relationships in the past are (mis)represented in academic research. Modern ethnographic data is used in these chapters to achieve this aim. The application of ethnographic data in archaeology is controversial: many archaeologists are wary of using ethnographic analogies for fear of applying inappropriate and/or circular theories to the archaeological record (*sensu* Isaac, 1968, p. 260; Wobst, 1978, p. 303; Hayter, 1994, p. 44-46; Bednarik, 2010). Yet, the synthesis of these two disciplines has also received a lot of support, and is undeniably a prominent discussion point in modern archaeology. Many scholarly perspectives have developed to explain why and how we should work to reconcile these two datasets (see Castañeda, 2008). Such discussions recognise the compatibility and fertility of these disciplines – in appropriate situations and with proper disclaimers. The ethnographic data in this thesis is <u>not</u> meant to be transplanted directly onto the behaviours or beliefs of the Holocene communities discussed. Rather, the integration of ethnography serves the crucial purpose of elucidating the *potential for alterity.* It demonstrates that Euro-American[1] academic definitions of nature, agriculture, landscape, and personhood are not universal.

[1] The term 'Euro-American' is used in this thesis (instead of 'Western'), to describe the epistemological trends of Europe and North America that have come to dominate the knowledge structures of modern academia.

If anything, refusing to consider ethnography when studying Amazonian archaeology entails a far worse miscarriage of research than the risks of using it. Amazonian ethnographies and anthropologies evidence the region's rich and varied traditions of knowledge, forcing us to recognise the relativity of ontology to socio-cultural background. As defined by Hamilakis & Anagnostopoulos (2009), archaeological ethnography therefore provides a "transcultural, politically loaded *space*…for multiple conversations, engagements, interventions, and critiques, centred on materiality and temporality" (p. 67). This conceptual space enables archaeologists to broaden their analytic and methodological frameworks beyond Eurocentric theoretic principles such as Cartesian rationalism. This is the paradigmatic justification for this thesis' integration of archaeological, ecological, anthropological, and ethnographic datasets. Its aim is to broaden the scope of research into human-nature relationships, by striving for a posthumanist, decolonial, and thoroughly transdisciplinary methodology in studying southwest Amazonia's archaeo-ecological record.

1.6 Thesis outline

The next chapter summarises the formative research in this subject area, and analyses its paradigmatic background. Chapter 3 studies recent palaeoecological studies in southwest Amazonia, and their implications for our understanding of human influence on the landscape. Chapter 4 then reviews some of the anthropological and ethnographic perspectives that are crucial to a more holistic interpretation of human-nature interactions in the region. Subsequently, Chapter 5 considers these perspectives in relation to the data examined in Chapter 3. This discussion chapter presents my suggestions for how archaeology can become more responsive to southwest Amazonia's complex history of human-nature entanglements. The thesis concludes with Chapter 6, which revisits the research questions above, summarises my findings, and considers their implications for future archaeological practice.

CHAPTER 2: *Discourses on 'early agriculture' and their application to southwest Amazonian archaeology*

2.1 The conventional definition and broad disciplinary tradition of "agriculture" and "domestication"

Archaeological research has long been preoccupied with agriculture and its origins. Many of archaeology's most publicised outputs are devoted to the questions of where, when, and how our distant ancestors stopped living 'on' the land and began actively shaping it. The topic is amongst the most widely investigated within popular and academic archaeological literature[2]. These works rely upon the assumption of a discrete boundary between wildness vs. subjugation, foraging vs. farming, "pristine landscapes" (Denevan, 1992) vs. anthropogenic landscapes (i.e., landscapes transformed by the infrastructure of agriculture). This assumption is rooted in 18th-century European philosophies of knowledge, which consigned culture and nature as distinctly separate. This binarization, born from Enlightenment preoccupations with scientific empiricism and Linnaean classification, was then exported around the world through processes of colonisation (Johnson & Murton, 2006). It has pervaded mainstream geographical, biological, and archaeological discourses since, particularly in discussions of human-environment interactions and the rise of "agriculture" (Terrell et al., 2003; Vrydaghs & Denham, 2010).

Domestication is a cornerstone of archaeological discourses of agriculture – not simply as a biologically-assessable trait[3], but also as a conceptual paradigm for differentiating farmers from foragers. Domestication is perceived as the foremost indicator of agriculture (*sensu* Rindos, 1984; Ford, 1985; Zvelebil, 1986; Smith, 2001), and archaeobotanical evidence of domestication is used to determine when past societies 'crossed the major threshold' into farming (Smith, 2001, p. 14). In bioarchaeology, claims of domestication are based on observable morphogenetic signals in recovered plant remains (seeds, phytoliths, etc.). This process is often rendered as empirical, yet it is fraught with problems. It is **methodologically** challenging to locate firm spatiotemporal origins for morphogenetic change: they take time to develop, and usually only become visible once a species is moved outside of its natural

[2] e.g., Childe's (1936) 'Neolithic Revolution' theory, Flannery's (1973) 'The Origins of Agriculture,' Diamond's (1987) 'The Worst Mistake in the History of the Human Race,' and Scott's (2017) 'Against the Grain'.

[3] Commonly defined as the morphological and/or genetic changes in plant and animal species that make these species reliant on humans for reproduction (Rindos, 1984, p. 140; Ford, 1985, p. 6; Smith, 2001, p. 14).

'wild' range (enabling genetic isolation) (Pearsall, 1995, p. 159). Thus, if plants were being harvested regularly and systematically but in proximity to wild/unharvested populations, genetic intermixing would obscure the signals of any anthropogenic activity. Moreover, the reliability of palaeobotanical techniques for assessing morphogenetic changes are themselves highly debated (e.g., Staller's (2003) methodological critique of Pearsall's (2002) maize phytolith analyses).

More importantly, there are serious **theoretic** flaws with linking evidence of morphogenetic change to evidence of early agricultural practice (Vrydaghs & Denham, 2010, p. 3-4). Challenges in tracking domestication signals through time and space are compounded by the increasing recognition that the 'transition' to agriculture was "a very gradual process" (Price & Gebauer, 1995, p. 7). Archaeobotanical studies of cereals and pulses in the Near East indicate a 4000 year-long gap between the first instance of wild cultivation and the appearance of 'domesticated' cereals (i.e., species with morphogenetic characteristics that make them reliant on human intervention for reproduction, like non-shattering ears) (Fuller, 2007). Concurrently, experimental archaeology has convincingly estimated that it should only take 20-100 years for cereals to reach 'full domestication' morphogenetic stages – even when accounting for various possible delays and inconsistent rates of change (Hillman & Davies, 1990). Yet, archaeobotanical data across different species and geographic regions suggests that prehistoric processes of domestication took far longer than this (Allaby et al., 2017). This protracted period of plant-exploitation prior to 'full' domestication further evidences the inadequacy of classificatory divisions between agricultural/preagricultural, domestic/wild, and farmer/forager.

The inadequacy of such binaries has also been thoroughly demonstrated through ethnoarchaeology. Numerous works attest to more complex, 'ecologically fluid' lifestyles combining foraging and farming in flexible ways (see e.g., contributions to Denham et al., 2010). These indicate that, contrary to conventional wisdom, agriculture is not necessarily (or even frequently) an alternative or replacement to foraging lifestyles: agriculture is "a porous category" often adopted as an 'optional or seasonal subsistence choice' (Vrydaghs & Denham, 2010, p. 6). It is one tactic amongst an arsenal of other strategies that communities employ to 'put food on the table' (Terrell et al., 2003, p. 359).

Evidently, conventional definitions of domestication and agriculture are both too vague and too restrictive. They obfuscate the prolonged, multidirectional processes of ecological interaction occurring in the past. This has profound implications for the way plant exploitation is studied within archaeology. Scholarship on human-landscape relationships in the southwest Amazonian interfluves provides a telling example of these implications.

2.2 Expressions of this discourse in research on the southwest Amazonian *terra firme*

In the mid-20th century, prehistoric occupation of the region was seen as smaller, less impactful, and generally 'simpler' than in other areas of Amazonia such as the eastern floodplains (the *varzea*) (i.e., Steward, 1948; Meggers, 1954, 1991; Lathrap, 1968). The *terra firme* were considered unsuitable for environmental exploitation due to poor soil quality, preventing the possibility of "continuously profitable, intensive food production" (Meggers, 1954, p. 803). This landscape was thus considered incapable of supporting 'advanced' socio-political communities (Meggers, 1954, p. 807). This has left a persistent legacy of interpreting the area's ecology as largely untouched by human impact (McMichael et al., 2012; Barlow et al., 2012; Bush & McMichael, 2015).

The advent of historical ecology approaches in the 1980s led to a re-evaluation of this 'pristine myth' (Denevan, 1992). Archaeologists borrowed methods and theoretical paradigms from ecology, socio-biology, and anthropology to produce novel conceptualisations of human-environmental interactions (Oliver, 2008, p. 186-194). Increasingly, researchers probed the possibility that ancient Amazonians living in the southwest *terra firme* had been actively manipulating their environments since deep time through more subtle practices of ecological management. Seminal papers proposed that Amazonian populations since the late Pleistocene did not merely *adapt to* but consciously *constructed* the environment around them, using creative technological and social strategies (Oliver, 2008, p. 193). Notably, these comprised the selective growing, transplanting, and culling of certain species in organized patches or 'corridors' of managed forest (e.g., Denevan, 1992; Balée, 2002; Heckenberger et al., 2003; Erickson, 2006).

This blossoming field of research compromised the *terra firme–varzea* dichotomy (Pärssinen et al., 2009, p. 1087). Moreover, it disrupted the persistent archaeological narrative that agriculture was 'invented' at a discrete moment, followed rapidly by domestication and

sedentism (Harris, 1972). The emerging evidence from southwest Amazonia suggested that "agriculture *followed* domestication and settled life" (Oliver, 2008, p. 193, original emphasis), and moreover that domestication was neither rapid nor unilinear. There was a conscious shift away from analysing subsistence based on frameworks of Optimal Efficiency (e.g., Flannery, 1969; Stiner, 2001), towards a more holistic approach emphasising human agency in intentionally constructing the landscape. As part of this, archaeologists began to redefine domestication as a long-term, mutual interaction between humans, animals, and plants (Rindos, 1984; Lathrap, 1984; Pearsall, 1995).

Many new terms were suggested to rationalize this new definition of domestication: Smith's (2001, p. 33) "low-level food production systems," Killion's (2013) 'low-impact hunter-fisher-gardener' societies, and Clement et al.'s, (2015) "incipient domestication", for example. Piperno's (2011, p. 463) "non-domestication cultivation (NDC)" is a paragon of this trend of jargonistic hair-splitting. As with the former examples, Piperno's NDC model continues to propagate a narrative of a linear evolution towards 'full' domestication and agriculture. This also reflects a pervasive preoccupation with production and subsistence, where cultigens are solely economic actors in Amazonian lifeways. These terminologies thus continue to reproduce Euro-centric conceptions of agriculture and underestimate the potential for other practices and outcomes of human-nature relationships.

Ethnography has indicated that reciprocity and mutual care are defining features of many modern Amazonian communities' conceptualisations of nature (Fausto & Rodgers, 1999; Vilaça, 2002). This informs their practices of ecological manipulation today (see Chapter 4). Though it is dangerous to project modern ethnographic data into the past, this indicates the possibility that 'alternative' ontologies of nature also existed in prehistoric times. Thus, labelling the early to mid-Holocene as a 'formative' or 'incipient' period of protracted domestication "risks subsuming sophisticated forms of knowledge...within a long 'transitional' stage" (Fausto & Neves, 2018, p. 1606).

2.3 Conclusion

Recent years have nurtured a growing movement to radically reconfigure landscape archaeology frameworks, to recognise that "agriculture, cultivation and domestication are distinct processes" used in myriad creative permutations and at different levels of reliance (Fausto & Neves, 2018, p. 1607). Increasing interdisciplinarity amongst archaeology and

environmental sciences has enabled a more comprehensive analysis of vegetation and pedogenic patterns (discussed in Chapter 3). However, it is necessary to reinterpret this palaeoecological and archaeobotanical evidence with the aid of ethnographic evidence, anthropological theory, and indigenous ontology. As discussed in Chapter 5, this has great potential to enrich and nuance archaeologies of early human-plant interactions, both in southwest Amazonia and beyond.

CHAPTER 3: *The age and extent of anthropogenic influence in* terra firme *landscapes: recent contributions from archaeology and (palaeo)ecology*

Determining the age and extent of human ecological impact is a heated debate in Amazonian landscape archaeology. In the last decade, archaeological studies have increasingly approached this question using techniques from the environmental sciences. This multidisciplinary collaboration has wrought important new insights, and enabled a firm re-evaluation of the longevity of anthropogenic landscape management. I have divided these insights into three broad categories of findings: pedogenic research (soil), arboreal distribution patterns (trees), and evidence of cultigens. This diversity of evidence enables a better grasp on the variability and complexity of early and mid-Holocene subsistence strategies.

3.1 Soils

Amazonian Dark Earths (ADEs) and *terra mulata* (TM) are the two primary types of soil evidence for anthropogenic landscape modification. ADEs are patches of darker soil resulting from waste disposal, food-preparation, construction, and agricultural practices such as burning, mulching, irrigation, and composting (Lombardo et al., 2013, p. 7; Kern et al., 2015; Clement et al., 2015, p. 3). These activities improve soil quality by raising the levels of certain chemical elements like carbon, nitrogen, phosphorus, and calcium (Kern et al., 2015). In turn, this encourages greater vegetation richness and abundance. In particular, ADEs exhibit a high density and diversity of domesticated and/or edible plants (Maezumi et al., 2018, p. 540). For these reasons, ADEs are generally interpreted as proxies for archaeological settlements and early 'farming' (Clement et al., 2015). TMs, meanwhile, are lighter versions of ADEs representing human activity at a less intensive scale. They comprise more organic material than unmodified soils, but less nutrients than ADEs; they are associated with agricultural practice such as vegetation-clearing (Kern et al., 2015, p. 430-31).

In many studies of the southwest *terra firme* forests, edaphic conditions are considered the main determinants of soils (e.g., Meggers, 1954, 1996; McMichael et al., 2014; Bush & McMichael, 2015). The assumption that the land was too nutrient-poor to sustain extensive habitation and ecological exploitation (*sensu* Meggers, 1996) resulted in archaeological models asserting a lack of anthropogenic soils in these areas (McMichael et al., 2012; Barlow

et al., 2012). However, recent geochemical analyses have contradicted these models and demonstrated a long history of anthropogenic soil modification (Clement et al., 2015; Kern et al., 2015; Franco-Moraes et al., 2019; Pärssinen et al., 2020). ADEs are attested dating to the 6th millennium BP, and TMs from *c.* 10,000 BP (Clement *et al.,* 2015: 3; Pärssinen et al., 2020, p. 1551). This latter date comes from a geoglyph site in Acre; sampling beneath the geoglyph (constructed in *c.* 2500 BC) found evidence of anthropogenic soils predating the geoglyph by 7000 years, thereby indicating soil modification since the early Holocene. Anthro-pedogenic signatures in this region are not only old, but spatially extensive. They spread "well beyond" the observed boundaries of ADEs, creating an expansive mosaic of differentially-affected soils stretching between occupation zones (Kern et al., 2015, p. 445). These soils are closer to TMs in terms of chemical composition, charcoal content, and archaeological materials but nevertheless show geochemical signs of human impact, "amplifying significantly the boundaries of archaeological sites" (Kern et al., 2015, p. 446).

Such findings illustrate the need to re-evaluate "not only…the breadth of adaptive variation of early South American populations but also the manner in which sites are identified and interpreted" (Lombardo et al., 2013, p. 12). This claim is based on evidence collected in the Llanos de Moxos (Bolivian southwest Amazonia), where soil profiles indicate human activity from the early Holocene (see Fig 2). These traces suggest high mobility of interfluvial communities at that time (Lombardo et al., 2013, p. 12; Kern et al., 2015, p. 431). This likely hindered the identification of soil modification in this region until recently; however, it is now clear that peoples were modifying their (pedological) environments since the early Holocene, and continued doing so for thousands of years prior to becoming sedentary. Further interdisciplinarity between archaeology, geochemistry, and pedology would help refine the documentation and interpretation of these anthropogenic soils.

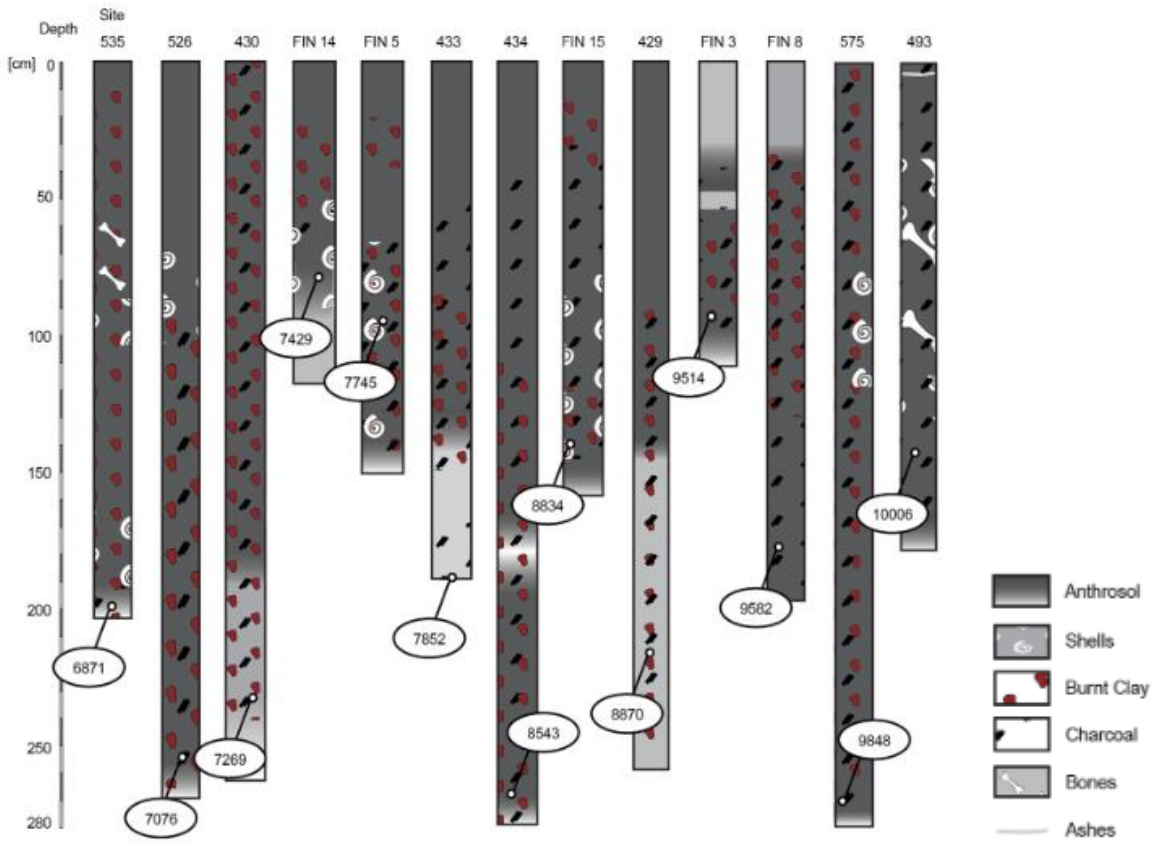

Figure 2: *Sample of stratigraphic descriptions & radiocarbon dates generated from coring data in Llanos de Moxos, attesting the antiquity of anthropogenic soils in this region. (Adapted from Lombardo et al., 2020, p. 202).*

3.2 Trees (Arboriculture)

Arboreal studies are another, increasingly important strand of evidence in studying anthropogenic landscapes in this region. They indicate that humans have been intentionally managing tree species' distributions since deep time, shaping the forest composition observed today (Clement, 1999; Oliver, 2008; Clement et al., 2010; Shepard & Ramirez, 2011; Levis et al., 2012; Levis et al., 2017; Fausto & Neves, 2018; Franco-Moraes et al., 2019). Intentional management of tree groves is "a major human subsistence focus in [its] own right," yet has been persistently under-researched in human-landscape archaeology (Terrell et al., 2003, p. 335). Amazonia is a crucial study region in this field, as trees and vines comprised 68% of all cultivated plant species pre-colonisation (Clement et al., 2010, p. 73).

The process of arboriculture probably began with the selection and management of individual trees *in situ*. These were then propagated intentionally (to i.e., 'home gardens' near settlements) and unintentionally (via seed disposal in middens and along walking trails) (Clement, 1999; Clement et al., 2010, p. 80; Levis et al., 2017). This gradual process resulted

in species with “subtle” morphogenetic changes, easy to overlook in the palaeoecological record (Levis et al., 2017, p. 925). This visibility issue is compounded by the diversity of arboriculture activities that were likely practiced, including seed dispersal, low-intensity harvesting, weeding, localised small-scale burning, and the creation of ‘forest trails’ between and within managed groves to facilitate sapling growth (Clement, 1999, p. 189-92; Ribeiro et al., 2014; Stahl, 2015, p. 1600; Clement et al., 2015).

These practices, and the diversity of species they affected, resulted in a range of anthropogenic forests. Some patches became dominated by selected ‘useful’ species, such as Brazil nut, peach palm, bamboo, and liana (Levis et al., 2012, p. 1; Stahl, 2015, p. 1600). A seminal publication by Levis et al. (2017) studied the abundance and richness of these ‘incidentally domesticated’ tree species, which are “five times more likely than non-domesticated species to be hyperdominant” (p. 925). Their distributions correlate strongly with the location of archaeological sites and ADE patches. Further, statistical analyses imply that ‘human’ factors greatly outweigh environmental variables in influencing these distributions; especially compared to other regions in Amazonia (see Fig. 3).

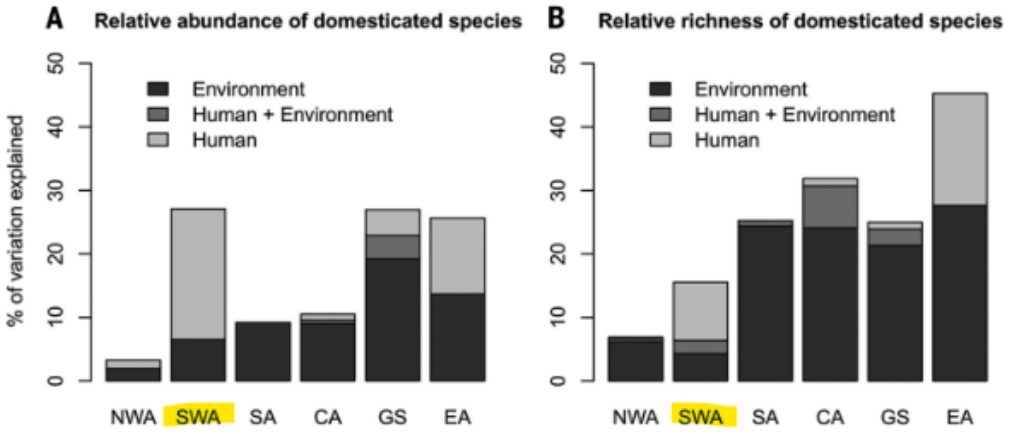

Fig 3: *Contributing factors to domesticated species’ abundance and richness, based on distance to archaeological sites and navigable rivers (‘human factors’) and soil chemistry, average rainfall, and elevation (‘environmental factors’). Data for Southwest Amazonia (‘SWA’) is highlighted yellow*. (*Adapted from Levis et al., 2017, p. 929-930*).

Brazil nut is one such 'hyperdominant domesticate' whose regional distribution has been comprehensively analysed (Shepard & Ramirez, 2011; Thomas et al., 2015). Brazil nut stands (*castanhais*) are distributed widely and densely across Amazonia, and particularly in the southwest (see Fig. 3). Individual trees' long lifespans mean that these *castanhais* are a window into past landscapes (Shepard & Ramirez, 2011). Statistical analyses of their locations today indicate that "ecological conditions alone can't explain [their] dominance…in the interfluve" (Levis et al., 2012, p. 7). Further, *castanhais* appear in higher frequencies and densities around ADE sites, implying a high probability of human inducement (Levis et al., 2012; Thomas et al., 2015).

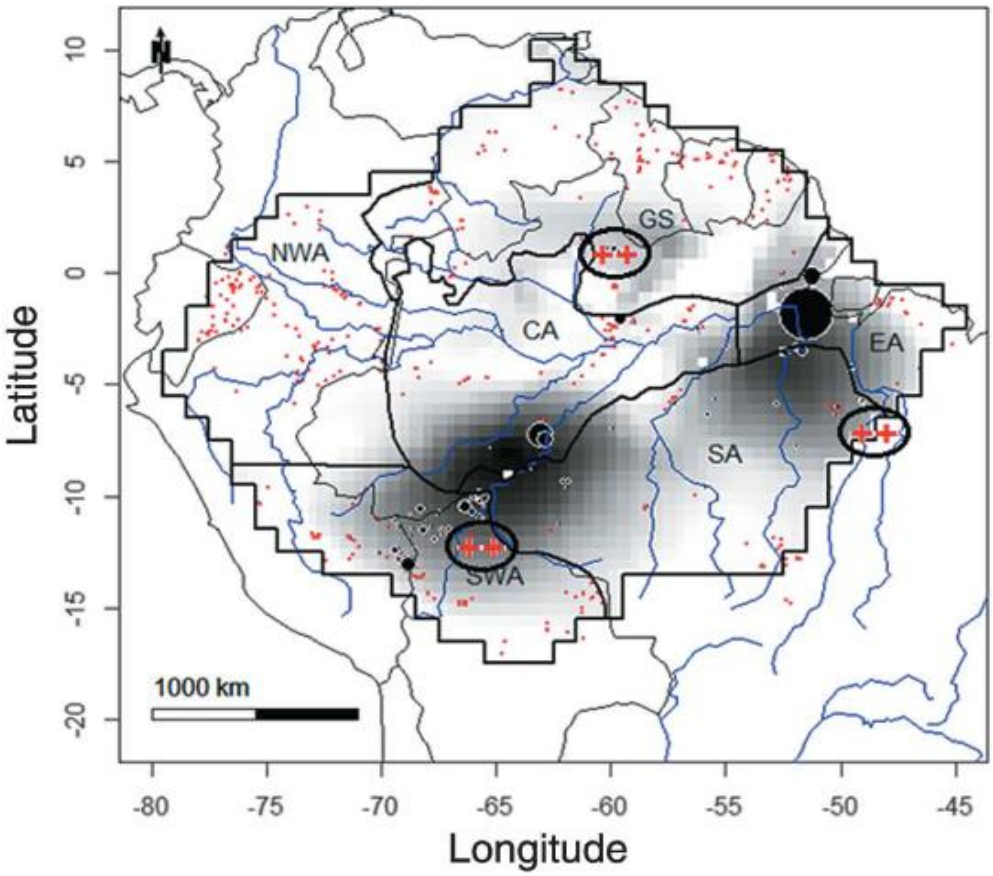

Figure 4: *Distribution map of the 'hyperdominant domesticate'* Bertholletia excelsa *(Brazil nut). Symbol '++' indicates hypothesised origin of domestication; red and black dots represent plots where this species is recorded, and the size of black dots represents the relative abundance of trees in these plot; shading represents interpolated distribution of the species. (Adapted from Levis et al., 2017, p. 926).*

Ethnographic evidence from several culturally-unrelated groups in interfluvial areas has also demonstrated a range of anthropogenic influences on *castanhais* distribution patterns

(Shepard & Ramirez, 2011; Ribeiros et al., 2014). Modern Kayapó harvesting strategies encourage productive regrowth by purposefully spreading seedlings along specific trails, and their hunting patterns within *castanhais* promote species regeneration by reducing seedling predators (Ribeiro et al., 2014, p. 5-6). Kayapó communities (and many others in modern Amazonia) also cut away undergrowth in and around *castanhais* to improve growing (Posey, 1985; Shepard & Ramirez, 2011, p. 48). Funerary practices amongst the Wari', meanwhile, include burning small patches in familial Brazil nut groves when a family member dies. Fruit capsules from previous collecting seasons are deposited at the same time; combined with the fertilising properties of ash, this accelerates sapling recruitment for subsequent growing years (Shepard & Ramirez, 2011, p. 48) (see Figure 5). Ethnographic study has evidenced a range of other ways that indigenous Amazonian communities actively co-create their landscapes through low-impact, localized disturbances (p. 49). These practices illustrate the potential for "beneficial coexistence between people and…natural resource[s]" (Ribeiro et al., 2014, p. 6). Further, they are often described by modern communities as 'ancient traditions' (Posey & Plenderleith, 2002, p. 28).

Figure 5: *Brazil nut seed cases burnt and scattered in a castanhais as part of a modern Wari' funeral (Shepard & Ramirez, 2011, p. 49).*

In the last decade especially, new techniques for studying anthropogenic forests have enabled greater understanding of their age and composition. The subfield of phylogeography examines plant molecular-DNA to track the genetic history of certain populations (Clement et

al., 2010, p. 75). Using phylogeography, researchers have produced geo-temporal distribution patterns for prominent Amazonian tree crops like Brazil nut and peach palm. They suggest that intentional human management of these species began in the early Holocene or before (Clement et al., 2010). Further, it is evident that "manipulation was not limited to…settlements along major rivers, but *extended over interfluvial areas*" (Levis et al., 2012, p. 1, my emphasis). This directly contrasts work by McMichael et al. (2012) and Bush & McMichael (2015), which posit that agroforestry in the southwestern interfluves was "small, infrequent, and highly localized" (McMichael et al*.,* 2012, p. 1429). Markedly, these studies are predicated on searching for signs of 'human disturbance signatures' like intensive forest-burning, as would arise from practices like modern slash-and-burn cultivation (McMichael et al*.,* 2012; McMichael et al., 2014). Yet such practices were probably "alien" to early and mid-Holocene agroforestry, which centred on the propagation and protection of useful species in "mosaics of intermediate disturbance" (Stahl, 2015, p. 1599-1601). Indeed, even within 'oligarchic forests' of Brazil nut or palm, *biodiversity* was a key element of forest management (see Chapter 5). Evidently, early and mid-Holocene agriculture looked very different to farming practices in Amazonia today.

Thus, the subject and parameters of analysis has huge implications for how Amazonian cultivation is reported. As Levis et al. (2017) note, "humans were probably managing hyperdominant species in forests instead of investing their efforts to fully domesticate populations" (p. 927). This trend results in much subtler ecological modifications than 'traditional' agricultural practices like field-marking, terracing, or irrigation. Holocene Amazonia comprised heavily-modified 'cultural forests' *integrated* within the broader landscape (Heckenberger et al., 2003). This complex form of landscape management highlights the inadequacy of domestication-centred analyses of agriculture.

3.3 Cultigens

Managed forests were also the loci for "casual horticulture" of other cultigens (Clement et al., 2015). Within managed tree groves, edible plant species like manioc, arrowroot, and gourd were transplanted, weeded, and raised in polyculture 'garden' contexts (Oliver, 2008, p. 202-203; Stahl, 2015, p. 1600; Maezumi et al., 2018). Yet these activities were undertaken in tandem with extensive foraging, in a mixed economy that included exploitation of plants across the 'wild to semi-domesticated spectrum' (*sensu* Watling et al., 2018, p. 23).

Oliver (2008) proposes an “itinerant gardeners” model for ancient Amazonians in interfluvial forests: moving between different areas in yearly cycles to harvest a range of managed and non-managed resources (p. 198-205). In this scenario, communities planted root crops in small forest gardens, departed during the 9-month growing phase (during which time they could travel between tree groves in their respective fruiting seasons, collecting fruit and hunting game), and then return to their forest gardens once the crops were matured. Long absences during the growth phase would mean no active management of the plots, which could explain the protracted length of these species’ domestication processes. Further, communities may have maintained a network of gardens along the annual trails between their campsites, creating “an underground stock/storage of root crops awaiting weeding, harvesting and replanting” (Oliver, 2008, p. 203). This version of agriculture would not have required intensive labour input, yet created a flexible subsistence mode capable of supporting “stable and long-lasting productive economies” (Fausto & Neves, 2018, p. 1608).

In the inland savannah of Llanos de Moxos, Lombardo et al. (2020) identified ‘islands’ of anthropogenically-fertilised soils that could have hosted such forest-gardens. These middens were created by accumulative deposition of organic waste, increasing soil fertility and creating raised patches above the wet-season water level (see Figure 5). These raised areas contain phytoliths for squash, manioc, jack bean, chilli pepper, and peach palm dating to *c.* 10,350 BP (p. 190). Many of the phytoliths are larger than wild varieties’, indicating low-intensity cultivation and at least “partial” domestication from the early Holocene. These “home gardens” also bear the Amazon’s earliest recorded evidence of maize (p. 191-2).

Meanwhile, ADE sequences beginning in *c.* 9,900-9,500 BP have been discovered at Teotonio (upper Madeira River; see Fig. 1), making them some of the earliest in the Amazon basin (Watling et al., 2018, p. 2). Phytoliths of cultivated arrowroot and macrobotanical traces of tuber and root fragments were found in association with the earliest phases of these sequences, attesting exploitation of these crops in the early Holocene (p. 18). These finds were accompanied by archaeobotanical remains of morpho-genetically wild Brazil nut, guava,

and *pequia* fruits, reinforcing the association of agroforestry and root-crop cultivation within a multi-resource economy (p. 19).

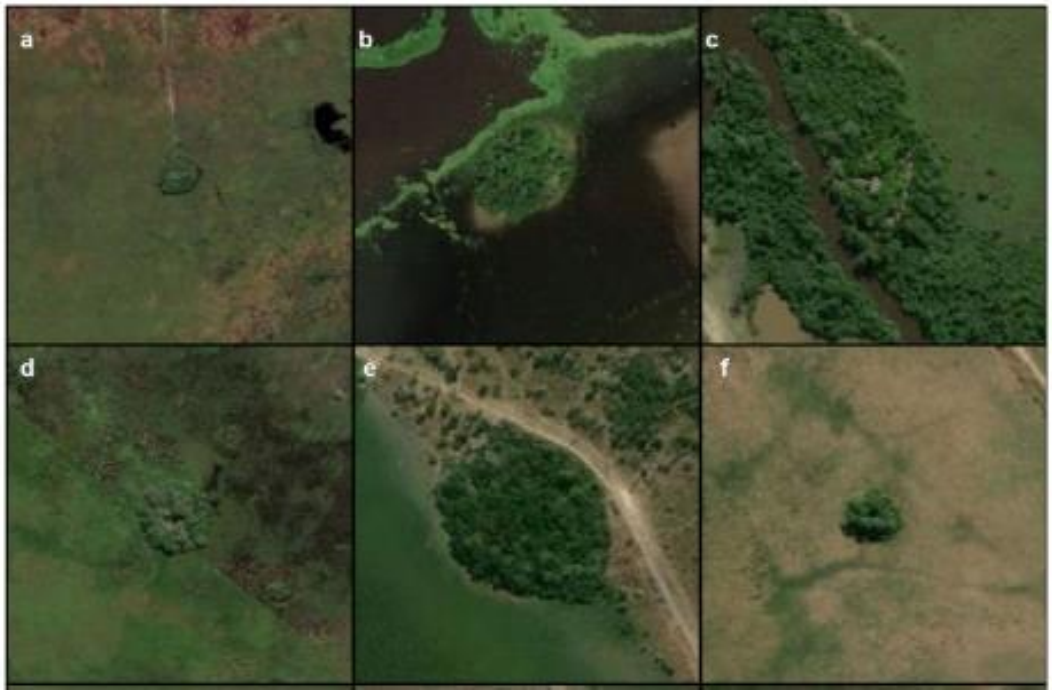

Figure 6: *Examples of anthropogenic 'forest islands' from the early Holocene, surveyed by Lombardo et al. (2020) in the Llanos de Moxos region. These artificially-enriched soils contain phytoliths for cultivated crops, and were likely the sites of prehistoric forest-gardens (p. 191-2). (Adapted from Lombardo et al., 2020, p. 200).*

Findings like these are becoming more frequent as more studies are conducted in this region, lending further credit to models like Oliver's. Studies outside the southwest *terra firme* are also finding similar evidence: in eastern Amazonia, for example, weeding and controlled burning were practiced in systems of long-fallow polyculture agroforestry, creating "a complex landscape that transition[ed] from forest to field and back to forest again" (Maezumi et al., 2018, p. 543) (see Figure 7). Evidently, humans have been intervening in the ecology of Amazonian forests since their earliest inhabitation, employing small-scale, diverse activities across varied ecosystems that have culminated in substantial landscape modification.

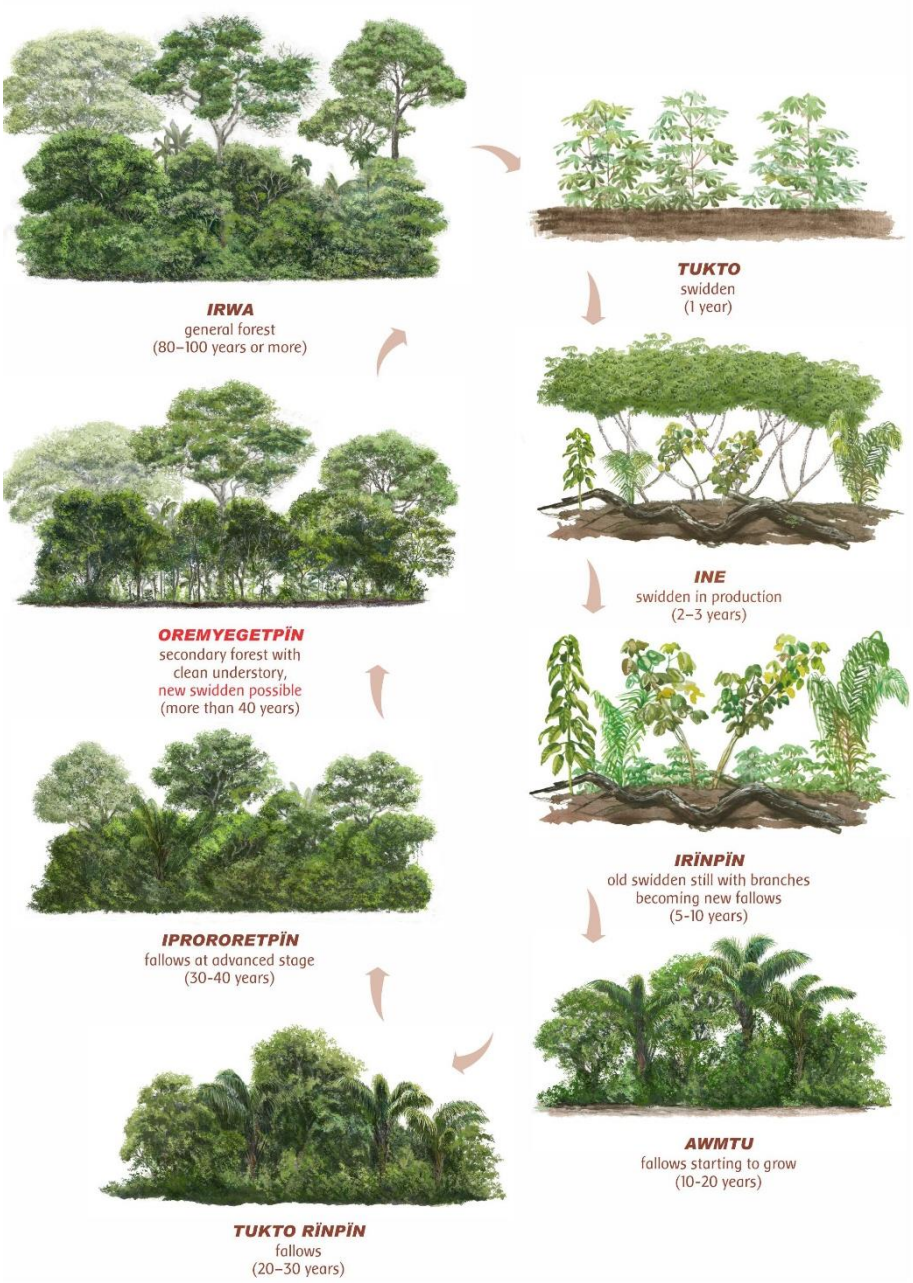

Fig 7: *Example of long-fallow polyculture agroforestry for manioc, as practiced by modern Ikpeng communities in the Central Amazon. Such systems encourage biodiversity and holistic forest regeneration* (*Schmidt et al., 2021, p. 9*).

3.4 *Conclusion*: the 'domesticated landscapes' concept

These subtle but enduring modification processes can be termed 'landscape domestication' (Terrell et al., 2003, p. 334; Clement et al., 2015, p. 2; Watling et al., 2018, p. 1; Franco-Moraes et al., 2019, p. 326). Clement et al. (2015) explicitly separates this concept from that of plant domestication at the species-level, describing domesticated landscapes as "the demography

of a variety of useful and domesticated plants, and their interactions with settlement features, soils, earthworks and fluvial works" (p. 2). This necessitates an expanded definition of 'domestication,' to encompass the variety of intersecting subsistence *practices* employed in past environments. It also requires a recognition that species or ecosystems can be integral to the human diet (and thus part of the domesticated landscape) without 'looking domesticated' (Terrell et al., 2003, p. 334).

Indeed, plants without morphogenetic changes characteristic of full domestication were clearly vital resources. Clement et al. (2015) estimates that 3000-5000 such 'non-domesticated' species were regularly exploited across early-mid Holocene Amazonia (p. 2). For example, of the many subspecies of palm in Amazonia, only the peach palm was (morphogenetically) domesticated. Yet phytolith evidence shows that numerous of the other subspecies were widely and extensively exploited at the same time. These wild varieties offer significant benefits: seeds from seje palms produce a versatile oil with similar protein content to olive oil, and moriche palm can be used to make starchy flour, fermented beverages, hammock and basketry fibres, and construction materials (Oliver, 2008, p. 199). Further, as discussed above, the extraction of these arboreal resources was likely pro-active and with greater spatial extent than even modern farming practices (Clement et al., 2015, p. 2).

Foraging strategies were not only used alongside early cultivation strategies, but the two are intrinsically intertwined. Attempting to establish divisions between foraging and cultivating, or between 'incipient' and 'full' agriculture, is evidently problematic: complex and protracted ecological manipulations were at play in Amazonia's southwest in the early-mid Holocene (Watling et al., 2018, p. 23). The concept of 'domesticated landscapes' takes the first steps towards recognising this problem. It also responds to the call by Vrydaghs & Denham (2010) that archaeobotany must "seek to understand past plant exploitation practices...within their environmental and socioeconomic contexts" (p. 6). Bearing this in mind, the next chapter will consider how cosmology likely informed early human-plant interactions in the southwestern Amazon.

CHAPTER 4: *Human-nonhuman engagements and philosophies of 'mutual care': considering anthropological perspectives*

Locating archaeological data within social contexts is vital to better understanding human-landscape interactions of the past. This chapter borrows analytical frameworks from anthropology and ethnography to help contextualise the evidence discussed in Chapter 3. These frameworks explicate a worldview in which personhood is flexible and dynamic, ascribed across multitudes of human and nonhuman beings including animals, plants, objects, spirits, and natural features. Such worldviews are a key ontological component of modern Amazonian lifeways (Viveiros de Castro, 1993, 1998; Fausto & Rodgers, 1999; Vilaça, 2002). Ethnographic evidence suggests that it extends deep into the realm of human-plant interactions (Miller, 2011; Fausto & Neves, 2018; Daly & Shepard, 2019), and indicates that "cultivation practices among indigenous groups in the Amazon are embedded in…dimensions of meaning that go beyond subsistence" (Neves & Heckenberger, 2019, p. 371). Considering anthropological perspectives thus has critical implications for how we understand human-landscape activity in this region, both past and present.

4.1 Multinatural perspectivism

Viveiros de Castro's (1993, 1998, 2012) writings on Amerindian cosmologies were some of the first to describe Amazonian worldviews in detail. His texts explicating the twin concepts of multinaturalism and perspectivism marked a "watershed moment" in Amazonian anthropology and archaeology (da Col, 2018, p. 347). They articulated the foundation for an entire discourse investigating the complexities of Amazonian ontologies.

The core principle of multinatural perspectivism is the acknowledgement that all entities on Earth share a common spirit (or 'culture') that manifests in different corporeal forms ('natures'). Every entity thus inhabits reality from a distinct perspective, whilst sharing in a holistic "spiritual unity" (Viveiros de Castro, 1998, p. 469). In this sense, all beings perceive themselves as 'persons,' with habits, conscious thought, communication systems, morality, and social institutions equivalent to those humans perceive for ourselves (Viveiros de Castro, 1998, p. 470; Virtanen et al., 2012, p. 229). This principle governs all human-nonhuman relationships, and the way that otherness is conceived, perceived, and enacted. Transformation is a crucial theme: there is a constant tension between 'being' and

'becoming,' with constant potential for movement between different natures. This fluid boundary between human and nonhuman has both positive and negative repercussions for the humans involved (Miller, 2011). This understanding of reality is a fundamental component of activities from hunting (Shepard et al., 2012) and plant-rearing (Miller, 2011; Fausto & Neves, 2018) to warfare (Fausto & Rodgers, 1999), shamanic ceremony (Posey & Plenderleith, 2002), and rituals of birth and marriage (Hugh-Jones, 1980, p. 123-33; Vilaça, 2002; Allard, 2003).

De Castro's framework of perspectivism certainly has flaws: it focusses largely on human-animal relationships, and makes generalisations across Amazonia's diverse cultures (Ramos 2012). It has also been criticised for *reinforcing* the nature-culture binary, simply proposing its inversion (Shepard & Daly, 2022). Nevertheless, it has been a pivotal contribution in establishing the possibility of fundamental divergences from Euro-American conceptions of nature, personhood, and kinship (Kohn, 2015, p. 318-321).

4.2 Consubstantiality and human-nonhuman kinship

Vilaça (2002) uses the concept of 'consubstantiality' to explain this conception of the world as an "undifferentiated universe of subjectivities" (p. 361). Human-ness is an "essentially transitory" position, which also means that all beings also have equal potential to be 'incorporated' as kin (p. 349). This is an essential aspect to understand: it has been interpreted as an assertion that there is no divide between 'internal' and 'external' ('us' vs. 'them'), as typically discussed in anthropologies of kinship (Viveiros de Castro, 1993, p. 371; Vilaça, 2002, p. 394). Evidently, exactly how kinship is perceived and practiced differs among Amazonian communities. Yet, this core idea of "affinity itself…encompassed by the outside" (Viveiros de Castro, 1993, p. 371) is reiterated in reports from across the biome (e.g., Fausto & Rodgers, 1999; Vilaça, 2002; Allard, 2003; Santos-Granero, 2007; Walker, 2013). Essentially, it means that "the production of persons as well as the reproduction of society is dependent on the exterior" (Allard, 2003, p. 29). It translates to a perceived 'universal affinity' in which all beings have the potential to be(come) consanguine.

Different conceptual schemas have been applied to this dynamic. 'Predation' is the most common: a generalised term referring to the "mastery" of other beings through hunting, war, physical consumption, marriage, and other activities (McCallum, 1989; Viveiros de Castro, 1993; Fausto & Rodgers, 1999). In Amazonian anthropology, predation is entangled with ideas

of filiation, reciprocity, and balance (Viveiros de Castro, 1993; Fausto & Rodgers, 1999; Vilaça, 2002; Fausto, 2008; Whitaker, 2018). It is a process characterised by some form of exchange between master and mastered, where the latter is metaphysically incorporated into the former (Viveiros de Castro, 1993, p. 380; Fausto, 2008). Within the context of multinaturalism, this relationship is fluid, reversible, and ambivalent: "a master (predator) can be protective or oppressive to his prey" (Miller, 2011, p. 71). This is what marks predation as a reciprocal, consubstantial arrangement – built on a foundational assumption of inter-subject equivalence and an understanding that all beings are 'mutually constitutive' (Viveiros de Castro, 1993, p. 380-382).

Understanding the broader context of kinship formation is helpful here. Across most Amerindian cosmologies, kinship is not seen as biologically-determined (Allard, 2003, p. 15, 56). Instead, kinship is chosen*;* and it arises only from consistent and ongoing care towards your (intended) kinsperson (McCallum, 1989; Vilaça, 2002, p. 352). This practice of active care involves sharing, cohabiting, eating together, and so on. Specifically, becoming kin is often inextricably bound with the act of feeding (Allard, 2003, p. 48-51). In some languages, 'to domesticate' also means 'to feed', just as wild animals are considered wild because they are not fed (Hugh-Jones pers.com. in Allard, 2003, p. 50).

Amazonian pet-keeping provides a well-documented example of how nature becomes kin, through predation. This tradition, common to many different cultural groups, entails the adoption of young wild animals (parrots, peccaries, monkeys, jaguars) into a human community (Costa, 2017). The animal is physically and ontologically accepted as a member of the community, with equal status to its human members. At the same time, it becomes reliant on its human captors to feed and care for it. This process of single-event domestication involves a duality of ownership and genuine familial care (Costa, 2017). Linguistic analysis supports this enmeshment: in all Amazonian languages, the term for these 'wild pets' has a reciprocal term meaning 'owner' or 'master'. Yet this terminological pair is also used to describe the relationship between chiefs and followers, shamans and the spirits who guide them, and adoptive parents and children (Fausto, 2008, p. 330-34). Clearly, then, it is a relationship comprised of more complex dynamics than mastery-servitude. Fausto proposes the term "familiarising predation" to reconcile the oppositional forces that regulate these relationships: appropriation (predation) and incorporation (familiarisation) (Fausto &

Rodgers, 1999; Fausto & Neves, 2018). 'Familiarising predation' is thus the requisition of alterity to produce kinship (Fausto & Neves, 2018, p. 1607).

4.3 Relevance to human-landscape relationships

From this essentialised anthropological position, we can begin to consider the implications for studying human-plant relations. In keeping with dominant discourses on agriculture, archaeological work in the Amazon has routinely failed to consider the role of plants outside of their functional, nutritional capacities (e.g., Roosevelt, 1980). Yet plants have far greater significance in Amazonian lifeworlds: they are active agents possessed of "practical, symbolic, aesthetic and perspectival importance" (Miller, 2011, p. 74).

Their meaning is often tied to broader ideas of family, fertility, and regeneration. The reciprocal terms used to describe human/pet and adoptive parent/child relationships are also often used to describe plants and their cultivators (Fausto & Neves, 2018, p. 1606-7). Ethnographic reports across Amazonia frequently describe a perception of plants not only as 'persons', but as *children* of their human cultivators (e.g., Nimuendajú, 1939; Seeger, 1981; Rival, 2001; Taylor, 2001; Heckler, 2004). This "embodied parental bond" (Miller, 2011, p. 76) is found across culturally-, linguistically-, and geographically-diverse communities and for many different cultivars, including manioc (Hugh-Jones, 1980, p. 123-33), maize (Miller, 2011, p. 76), peanuts (Silva, 2009), and sweet potato (Fausto & Neves, 2018, p. 1612). It is often accompanied by practices like giving plants human names, singing songs to them, and other forms of ceremonial respect (Nimuendajú, 1939, p. 90; Lagrou, 2007 in Miller, 2011, p. 82). It is also common to abstain from certain foods or activities (usually sex) after planting. In many local lores, those who abstain from sex in this time do so because they are co-producing the growing plants (Fausto & Neves, 2018, p. 1612). In this way, forest-gardens are considered family, and cultivars are persons who talk, think, and possess the potential to both care for and harm their (human) tenders.

Indeed, establishing a garden is considered "dangerous" because it entails the appropriation of a domain with non-human owners (Fausto & Neves, 2018, p. 1611). Similarly, the act of reproducing a plant for human consumption necessarily entails appropriating an 'original' plant individual from the forest. Everything grown in forest-gardens therefore remains co-owned by various human and nonhuman agents, usually including a dominant spirit-owner of the entire plant species (Fausto & Neves, 2018, p. 1611). These spirit-owners are ambivalent

and ambiguous. Hence why Wayãpi mothers do not enter manioc gardens with newborn babies, and why Achuar women sing to their manioc plants to 'control' them: in attempts to stop manioc spirit-owners from harming their (human) children (Descola, 1997, p. 93, 98; de Oliveira, 2006 in Fausto & Neves, 2018, p. 1611).

Yet the act of "co-parenthood" of the new plant 'offspring' also *unites* human and nonhuman entities (Fausto & Neves, 2018, p. 1611). Miller (2011) argues that, though consumption is "undoubtedly an act of mastery" over the cultivar, it also materialises an 'intimacy' between human and plant (p. 82). This intimacy is heavily predicated on consubstantiality, since human growers ingest the crops they have (co-)parented. Indeed, harvesting and consuming cultigens has diverse ritualistic associations (e.g., Nimuendajú, 1939, p. 89-90, 134; da Matta, 1973, p. 284-7; Posey and Plenderleith, 2002, p, 4, 38, 78-80, 170-5). For the Cashinahua, for example, maize becomes male semen after it is consumed, and thus plays a role in conceiving future human children (Lagrou, 2007 in Miller, 2011, p. 82). Among the Araweté, where maize is largely consumed as beer, the fermentation process is led by women and discussed as a form of incubation or pregnancy (Viveiros de Castro, 1992, p. 129). In Barasana worldviews, manioc plots are "the site of human conception and birth" (Hugh-Jones, 1980, p. 115). Beliefs and practices related to this regenerative power of plants and gardens are recorded across Amazonian ethnographies (see Miller, 2011). Just as humans parent plants, plants parent humans.

4.4 Conclusion

Kinship in Amazonian cosmologies is not automatic or biological, but actively sought. The way to become kin is to 'incorporate' your intended kinsperson (i.e., to take part in some form of reciprocal exchange in which both parties are treated as equal and co-constitutive). Often, this process is embodied in the real world through feeding, as an essential act of (mutual) care. So how does this relate to the world of plants, and specifically to anthropogenic management of plants?

Human-plant relationships constitute the same type of relationship as human/pet, shaman/spirit, and parent/child. As such, a model for 'agriculture' founded in anthropocentric ideas of unidirectional ownership of and domination over nature – that is, a domestication model – cannot satisfactorily comprehend the complexities of Amazonian ecological management techniques. By widening our search parameters and incorporating more

transdisciplinary analyses, we can begin to rectify this skewed understanding of human-plant engagements in Amazonian prehistory. This process leads to improved understanding of ecological manipulations in the past, highlighting the value of cross-disciplinary synthesis in facilitating new, more accurate narratives of history.

CHAPTER 5: *Transdisciplinary synthesis and proposing an 'archaeology of symbiosis'*

How can we reconcile the theoretical background of multinatural perspectivism (and its application to plant-human relationships) with the hard data of eco-archaeological studies? This chapter begins the challenging task of synthesising these materials, to make pragmatic suggestions for how archaeologies of human-environment interactions can become more receptive and comprehensive.

5.1 Applying anthropological models to the eco-archaeological record of southwest Amazonia

i. 'Familiarisation' rather than 'domestication'

Early Holocene communities in the southwest interfluves engaged in multifaceted ecological practices that shaped their surrounding environment. These practices defy conventional definitions of domestication and thus problematise traditional archaeological models for agriculture. To address this problem, I suggest the adoption of 'familiarisation' as an alternative paradigm to 'domestication' when studying the eco-archaeological record (see Table 1).

A domestication model of human-plant relations prioritises the rate of change imposed upon plants towards greater productivity. Yet, plants evidently occupy a more complex position in human livelihoods than simply nutrition. Familiarisation here refers to the act of bringing something into the sphere of human interaction on levels beyond the pursuit of immediate (functional) return. It is a term laden with connotations of reciprocal care and multi-directional flows of influence (see Fausto & Rodgers, 1999). It acknowledges that domestication is not always (if ever) the primary goal of plant-resource exploitation. Terrell et al. (2003) alluded to this 20 years ago when they suggested a radical overhaul to the theoretic schema of domestication: "domestication can be measured more effectively by its *performance* – by the skills characterizing it – than by its *consequences*" (p. 326, original emphasis). Studying only the physical changes wrought to species by human manipulation gives a heavily blinkered view of the much larger, complex entanglement between humans and their environment. Instead, archaeologists should strive to understand how human-plant

interactions played out pragmatically: what tactics or behaviours were being implemented, and what knowledge did these require about local ecologies?

Table 1: *A summary of two alternative theoretical approaches to studying agriculture in archaeology: Domestication (traditional paradigm) and Familiarisation (proposed paradigm)*

	DOMESTICATION	**FAMILIARISATION**
Scope	Focuses on single species or species families. Prioritises the study of these species' physical and genetic changes.	Shifts the focus to landscape-wide analysis. Prioritises the study of human ecological practices and collaborative interactions with nature.
Conceptualisation of human-nature relationship	Sees humans as dominating nature, and therefore as the (sole) creators of 'civilization'. Neglects the agency of nonhuman beings.	Recognises the multidirectional complexity of human-plant interactions. Decentres humans within the landscape, recognising the important roles of nonhuman beings in co-creating environments.
Philosophy of history	Teleological: agriculture is portrayed as a unilinear development towards increasing human domination over nature. Focuses on agricultural origins and human 'progress' in evolutionary schemas designed to distance modern (Euro-American) civilizations from the 'savagery' of prehistoric and non-European societies.	Acknowledges the variable rate of change and patterns of flux characterising the historical development of human societies. Actively combats the legacy of evolutionary schemas of development, as part of the broader mission of decolonising academia and empowering non-Eurocentric epistemologies.
Perception of human agency	Prioritises the functional, economic motivations behind past peoples' practices and habits.	Recognises the multilayered and entangled patterns of knowledge, belief, and behaviour that constitute past lifeways.
Underlying epistemology	Reflects Euro-American perspectives on nature and on human behaviours.	Integrates 'alternative' understandings of nature and the drivers of human action/thought.

Hunter-foraging lifestyles require systems of expertise as sophisticated as any agricultural knowledge (Terrell et al., 2003, p. 330-34). Ethnography since the 1950s and a growing corpus of texts by indigenous authors has attested these rich knowledge systems underlying Amazonian subsistence patterns. These systems comprise observation of and familiarity with geomorphological, pedological, arboreal, and biological factors, tied together with mythology, social history, and communal identity (e.g., Balée, 2002; Abraão et al., 2008; Silva, 2009; Shepard & Ramirez, 2011; Schmidt et al., 2021). Even the most prejudiced mid-20th century European evolutionists acknowledged the complexity of this knowledge:

> "*No tribe of the modern world, however primitive, is without a vast amount of realistic knowledge and understanding of the nature and behavior of plants in their locality, and we may therefore infer that primitive man, long before the origin of agriculture, possessed like knowledge of his flora. The origin of agriculture was not, therefore, the result of an idea or discovery; the cultivation of plants required no new facts or knowledge*." (White, 1959, p. 283-84).

Shifting the focus onto the skills and behaviours required to bring about observed environmental changes recognises several important principles:

a) Human impact on the environment "has not been limited to changing the genetic composition of the species that we harvest," but also encompasses translocation, extirpation, weeding out, "and in yet other ways altering the species composition of [landscapes]" (Terrell et al., 2003, p. 349-50)
b) There is no guaranteed correlation between the extent of a plant's morphogenetic alteration (by human activity) and the significance of its role in local livelihoods
c) There is a high likelihood of disparities between how a particular species is valued by contemporary archaeologists/ecologists, compared to its valuation by the local peoples exploiting it in the past (Oliver, 2008, p. 193)
d) Pursuing monoculture or species homogeneity was not a universal desire across communities who cultivated plant resources

Within our case study, these points are well-encapsulated by the intentional pursuit and management of heterogeneity in forest-garden spaces.

ii. Intentional biodiversity

Amazonian ecological knowledge emphasises biodiversity as part of a broader ethos of reciprocal and sustainable human-nature interaction (Abraão et al., 2008; Virtanen et al., 2012, p. 230-1; Carneiro da Cunha & Morim de Lima, 2017; Fausto & Neves, 2018). The palaeoecological data discussed in Chapter 3 indicates an array of resources were exploited concurrently by the early-mid Holocene 'itinerant gardeners' of the southwest *terra firme* (Oliver, 2008). Trees, root crops, and other cultigens formed the basis of these "mixed and diversified cultivation systems" (Neves & Heckenberger, 2019, p. 383). These systems were the product of both intentional and uncontrolled factors, creating forest-garden spaces shaped by multiple species and environmental processes (Franco-Moraes et al., 2019, p. 327).

From an anthropological standpoint, this matches the common inclination towards accepting and encouraging alterity in Amazonian ontologies. The 'openness to otherness' encouraged in multinatural perspectivism and conceptualisations of kinship "promotes a recurrent outside-inside movement, in which life is created through the *incorporation and preservation of small differences*" (Fausto & Neves, 2018, p. 1614, my emphasis). This philosophy was enacted in forest-garden settings, where 'small (genetic) differences' were enabled by (a) frequent fallows, which allowed intermixing with ecological actors outside the garden system, and (b) lack of strict control over cultigens' sexual reproduction (Fausto & Neves, 2018, p. 1614). The latter facilitates cross-species pollination and germplasm diversity, translating into a rich assortment of cultivated species and varieties (Fausto & Neves, 2018, p. 1614; Carneiro da Cunha & Morim de Lima, 2017, p. 62). This would account for the high interspecies diversity observed in the archaeobotanical record (see Archila Montañéz, 1999; Clement et al., 2010; Watling et al., 2018; Lombardo et al., 2020).

Biodiversity is also central to many modern indigenous agricultural practices. Kuikuro communities in the Upper Xingu intentionally mix different seeds when planting and managing *pequi* forest-orchards. This creates groves with many *pequi* varieties, each with its own valuable traits: the fruit of one variety is best suited to eating raw, whilst others can be used to make fruit jelly or oils (Smith & Fausto, 2016, p. 101). The same is true of peanut diversity amongst the Kaiabi (Silva, 2009), and manioc varieties in Amuesha and Makushi communities (Terrell et al., 2003, p. 341-2; Elias et al., 2000). For the Amuesha, morphogenetic diversity is valued not simply because of the benefits of different varieties, but also because manioc plants are considered people with their own histories, names, songs, and rituals. The Amuesha have a responsibility to keep the many species varieties alive because of this ascribed personhood (Terrell et al., 2003, p. 342). A similar cosmological influence is found in fava bean cultivation practices among the Ramkokamerkra-Canela. The patterning of some varieties resemble designs used in bodypainting and on ritual masks, whilst other patternings resemble human faces; as such, "the distinct colours, shapes, and designs of certain varieties are appreciated for…their likeness to specific categories of people" (Miller, 2011, p. 73).

It is thus evident how agrobiodiversity in Amazonian ecosystems is both a pragmatic exercise and an expression of cosmology. This agrobiodiversity creates a "chromatic succession"

between ‘cultivated land’ and ‘natural forest’: something also observed in the archaeobotanical and pedological record (Fausto & Neves, 2018, p. 1614). This fluid spectrum of land-use results from extensive and creative anthropogenic intervention in the environment.

5.2 Rethinking landscapes

These ideas have significant ramifications for the (sub)discipline of landscape archaeology, and how it interprets human-landscape interaction in the past. The intentional pursuit of biodiversity observed above indicates that we must consider “the [whole] species pool” in which specific (semi-)domesticated species were manipulated (Terrell et al., 2003, p. 329). We must broaden our frame of analysis from species-scale domestication to the moulding of entire landscapes.

Yet to label this process the study of “landscape domestication” (see Chapter 3.4) is still limiting. A landscape is process in action: it is the site of constant and dynamic “transfiguration” (Descola, 2016) comprising numerous cosmological agents engaged in intentional and unintentional relations (Virtanen & Saunaluoma, 2017, p. 622). It is thus necessary to question the epistemic underpinnings even of terms like “anthropogenic landscapes,” which continue to imply a unidirectional relationship between humanity and nature. Indeed, the influence of *landscapes* on *humans* is clearly visible; Amazonian cosmology is noted for its “striking salience of biodiversity and ecological concepts” (Franco-Moraes et al., 2019, p. 327). Descola’s (2016) ethnography among the Achuar, for example, notes that Achuar gardens are considered as imitations of the surrounding forest (p. 7). This hints at the complex reciprocal relationship between humans and landscape: not only did humans co-create the forest, but the forest co-created human culture.

5.3 Towards an ‘archaeology of symbiosis’

So how can archaeological practice be opened to understanding this symbiotic human-landscape interaction? To appreciate the intricate ways that human-nature kinship can manifest in eco-archaeological records, it is necessary to employ a range of transdisciplinary ideologies, schemas, and techniques. This entails not just a marriage between archaeology and ‘natural sciences’ (ecology, biology, geomorphology, botany, etc.), but also with the humanities. Anthropology and ethnography have valuable contributions – not to imply continuity between ancient and modern communities, but to elucidate the potential for

diverse material manifestations of human-nonhuman engagements. Other social sciences can also enrich archaeology: sociology, linguistics, geography, (eco)politics, history, and art and literature studies all contain divergent systems of knowledge that can enable a better grasp of human-environment engagements (Rubenstein, 2004; Nilsson Stutz, 2018; Shepard & Daly, 2022).

Indigenous and local knowledges (ILK) must be embedded within this transdisciplinary approach to the past. In Amazonia, ILK forces an acknowledgement of nonhuman agents as political actors involved in processes of world-construction. It reinforces the importance of *place* as a linchpin for ecology, community, identity, and knowledge production (Sundberg, 2014, p. 35-36). Collaborative, integrative archaeology has incredible potential for enhancing our understanding of the past (Nilsson Stutz, 2018, p. 53), and for combatting new challenges as we move into the future (see e.g., Athayde et al., 2017; Balée et al., 2020; Schmidt et al., 2021 for how Amazonian ILK is being implemented in current sustainability discourses). By equipping archaeologists with an understanding of relational ontologies and their 'alternative' possibilities of world-construction (compared to Euro-American philosophies), we can begin to pursue 'archaeologies of symbiosis'. These recognise the close intertwining of ecology and society, structured by notions of balance and reciprocity; they thus illustrate the potential of a familiarisation paradigm when studying eco-archaeological remains.

i. Archaeologies of symbiosis in practice

Archaeologies of symbiosis are already burgeoning in niche transdisciplinary subfields. In the study of human-plant interactions, there is multispecies archaeology (Pilaar Birch, 2018), phytoethnography (Shepard, 2018), and the Edibility Approach (Attala, 2017), among others.

'Multispecies archaeology' approaches the past by centring interspecies interactions, including humans, plants, animals, fungi, microbes, and molecular biology (DNA) (Pilaar Birch, 2018). Steeped in posthumanist thinking and modelled off the related subfield of 'multispecies ethnography' (Kirksey & Helmreich, 2010), multispecies archaeology recognises landscapes and their varied inhabitants as "integral, not subsidiary" to human existence (Pilaar Birch, 2018, p. 2). It combats anthropocentricism in the theoretic sphere by encouraging methodological shifts: for example, advocating the replacement of optimal foraging theories with theories of niche construction as a collaborative interspecies undertaking (e.g., Fuentes et al., 2010; Candea, 2011). It also rejects the historic

archaeological preoccupation with 'origin points' or 'revolutions' in studies of agriculture, instead urging a holistic perspective on the variation and adaptation of inter-organism relationships across time and space (Pilaar Birch, 2018, p. 6). Multispecies archaeology therefore reframes archaeology as 'archaeo-ecology': "an archaeology of life which understands the past through networks and interactions rather than stochastic events and places" (p. 4).

Phytoethnography is an example of multispecies ethnography at work, and provides a skeletal outline of how multispecies archaeology could pursue a human-plant 'archaeology of symbiosis'. The term phytoethnography was coined by Daly & Shepard (2019) as a conceptual paradigm that "elevates plants to the status of ethnographic subjects in their own right" (Shepard & Daly, 2022, p. 86). It seeks to redress anthropology's tendency to neglect the significance of plants in human lifeways (*sensu* Miller, 2011, p. 74), stressing the "centrality of botanical beings, plant substances, and…landscapes" for past and present communities (Shepard & Daly, 2022, p. 86). It makes close reference to phytochemical and biosemiotics research on complex plant intelligence and communication (e.g., Witzany, 2008; Trewavas, 2016; Daly & Shepard, 2019). Moreover, it compares these emergent scientific studies with indigenous concepts and knowledges – for example, the common notion of "plant teachers" in Amazonian shamanism (Shepard & Daly, 2022, p. 92; Shepard, 2018). Indeed, phytoethnography was developed specifically to address the multidimensional 'interspecies sociability' and 'multinatural landscape ecology' observed in Amazonia (Shepard, 2018, p. 85, 91). It makes explicit references to Amazonian landscape archaeology, advocating for multi-directional, -cultural, and -disciplinary dialogues to better envisage Amazonian forests as "cultural spaces" co-created by humans for millennia (Shepard & Daly, 2022, p. 89-91).

Phytoethnography also emphasises plant substances as a crucial element of human bodily perceptions and constructions. Shepard & Daly (2022) argue that "substances of plant origin play a major role in mediating vital transfers between different bodies and subjectivities" (p. 86). Consumption of plants (i.e., their bodily incorporation) occurs in various forms, and can provoke intense physical and metaphysical consequences: "phytochemical substances and their associated chemosensory properties [mediate] deeply entangled ontological conceptions about body, soul, and personhood" (Shepard & Daly, 2022, p. 89). This idea is echoed in other anthropological paradigms for plants, notably Attala's (2017) Edibility

Approach (EA). She describes EA as a "botanical ontology and conceptual tool" that studies human-plant 'eco-entanglements' with a particular focus on ingestion (p. 125). Using a relational, material, multispecies approach, Attala reimagines plants as 'alert, responsive actors' capable of profound influence on humans and other animals through the mechanisms of eating (p. 139). In this framework, cooking, tasting, and digesting are relational events through which plants demonstrate their ability to affect human bodies both externally and internally (e.g., Mol, 2008). 'Edibility' is thus emphasised as a key characteristic of plant-beings, enabling an embodied relationship between humans and plants that "ruptures species' boundaries" and elucidates existence as "a co-productive exercise" (Attala, 2017, p. 139, 126). Given the evidence discussed in Chapter 4, southwest Amazonian archaeology clearly has great potential for the application of EA to explore the complex relationships between plants, eating, and kinship.

5.4 Conclusion

Approaches such as these illustrate both the need and potential solutions for archaeology to become more attuned to symbiotic relationships between humans and landscapes. "Fluid ecological arrangement[s]" are not exclusive to Amazonian prehistory (Graeber & Wengrow 2021, p. 260). However, this region has the double advantage of an extensive palaeoecological footprint and rich traditions of knowledge that view nature very differently to European ontologies. Amazonian landscapes like the southwestern *terra firme* are thus well-suited for exploring 'archaeologies of symbiosis' and the new insights they could yield. The approaches described above would be a fitting starting-place for pursuing such an aim.

CHAPTER 6: *Conclusion*

This thesis has presented a range of evidence elucidating human-plant interactions in the southwest Amazon *terra firme*. It illustrates that, contrary to much of 20th century archaeological literature, humans have been shaping this landscape since the early Holocene. This complex and ancient landscape modification has been persistently under-researched and under-recognised because it defies archaeology's traditional understandings of 'agricultural practice'. This thesis thus illustrates the need to change how archaeologists approach the study of human-environment interactions in the past, moving away from a definition of agriculture reliant on domestication. This thesis also suggests the important roles of anthropology and ethnography in aiding this theoretical shift. Using concepts from these disciplines, familiarisation is proposed as an alternative paradigm to domestication, and as a way to pursue 'archaeologies of symbiosis'. This paradigm enables us to interpret the eco-archaeological record in tandem with local ontology, to recognise the complex patterns of human activity that have shaped the region's ecology.

6.1 Summary of findings

Below, I revisit the research questions outlined in Chapter 1 and summarise my findings:

> *What has palaeoecological data revealed about botanic management techniques in the* terra firme *zones of southwest Amazonia during the early and mid-Holocene?*

Palaeoecological data shows that botanic management techniques in these areas is older and more spatially extensive than previously thought. Though these data do not reflect the patterns of domestication traditionally studied in archaeologies of plant-manipulation, there is nevertheless a strong, clear record of human influence on landscape in this region. This influence includes the creation of fertile ADEs, an increase in the abundance and distribution of certain 'useful' tree species such as Brazil nut, and the managed cultivation of root crops.

> *How can we interpret this data with the help of anthropological concepts such as 'mutual care' and 'familiarisation'?*

These are salient principles in modern Amazonian communities, and demonstrate the potential for worldviews to be grounded in very different ideas of human-nature relationships than that propounded in Euro-American discourses. 'Familiarisation' is a concept used to understand the quality of certain relationships in Amazonian communities, including

parent/child, master/(animal) pet, and cultivator/cultivar. Such relationships are structured by multinatural perspectivist ontology, and characterised by reciprocity, consubstantiality, and mutual care. This thesis borrows the anthropological concept of 'familiarisation' to use as a paradigm for re-interpreting the eco-archaeological record of southwest Amazonia. This illustrates the usefulness of such concepts in facilitating broader understandings of human-nonhuman interactions in the past, and their material manifestations.

Sub-questions

1. *In what ways did early and mid-Holocene populations of southwest Amazonia actively manipulate their botanic environment* (Chapter 3)

1.2 *How is this evidenced in the palaeoecological record?* (Chapter 3)

The evidence collated in Chapter 3 indicates the range and profundity of botanic manipulations in this region. Pedogenic evidence shows that past communities have been enriching the soils both within and around habitation centres, which in turn has affected the structure of the plant communities in these patches. Certain tree species also appear to have been selected for their useful products (e.g., Brazil nut), and encouraged to grow in the observed patterns of greater density and distribution than would be expected without human interference. It is likely that past inhabitants of the southwest *terra firme* used a range of practices to encourage these growth patterns, including weeding, seed dispersal, hunting, and low-intensity burning. Communities also appear to have cultivated root and tree crops in small but biodiverse 'forest gardens.' Phytolith remains from these spaces indicate early signs of morphogenetic change resulting from human management. This suite of practices can be characterised as localised, intermediate disturbances to the environment. Signatures of these disturbances are visible in the palaeoecological record, and echoed in the practices of many modern Amazonian communities.

2. *When do we see the earliest evidence of plant 'domestication' processes in this region, and how do these processes unfold over time?*

Palaeoecological evidence indicates the enactment of defined ecological management techniques as early as 10 000 years ago, including phytoliths indicating an early form of domestication. However, this domestication (sometimes labelled 'incipient' or 'semi-' domestication) does not develop in a linear trajectory towards greater human control over species' morphology or genetics. Rather, the preservation of genetic variability and biodiversity appear to have been important features in how human-plant interactions

unfolded over time. Indeed, the palaeoecological and anthropological evidence presented is thesis illustrates the need to de-centre 'domestication' when studying human influence on landscapes over time.

3. *What are the implications of this on our understanding of early "agriculture" in southwest Amazonia, and how it can be studied archaeologically?*

3.2. *How has the conceptual framing of agriculture evolved in recent decades?*

3.3. *How have findings from the southwest Amazon contributed to this discussion?*

We must rethink the definition of agriculture in archaeology, to make it more applicable to the diverse environments and communities in world history. Southwest Amazonia – with its tropical rainforest ecology, predominance of root and tree crops, and tradition of perspectivist ontologies – presents a wholly different archaeological context for studying agriculture than, for example, the legume- and cereal-domesticating societies of the Neolithic Near East. The evidence of ecological practices from southwest Amazonia indicates that 'agriculture' here was predicated on very different ideas and goals, including a proclivity for polyculture and mixed-economy exploitation.

Recent decades have seen a growing recognition in archaeology that traditional models of agriculture are inadequate. Terms like 'domestication' have come under scrutiny for methodological shortcomings and a Eurocentric epistemic basis, and the evolutionary schema of agriculture has been gradually abandoned. Increasingly, and with the aid of interdisciplinarity, archaeologists are recognising the multidimensional forces that shape human-landscape interactions. Studies of the southwest Amazonian interfluves have helped in encouraging this theoretical shift.

4. *How can archaeological and palaeoecological data be integrated with anthropological understandings of human-nonhuman entanglements?*

4.2. *What can these understandings contribute to the interpretation of human-plant relations in ancient Amazonia?*

Past communities around the world engaged with their botanic environment in myriad and nuanced ways. Studying only the extent of these changes (the 'product' of ecological management practices) misses half the story; these practices form part of a larger cosmology and 'way of being'. Understanding this is essential to any interpretation of past cultural behaviours and activity. Anthropology and ethnography therefore have crucial roles to play

in informing and facilitating a broadening of archaeological theory, to better account for culturally- and geographically-diverse societies. Data from these disciplines (discussed in Chapter 4) demonstrate the diverse ways that human-plant relations can be conceived, and how this shapes human-plant interactions in practice. By integrating these disciplines into archaeological method and theory, we can thus become more receptive to identifying and analysing these practices within archaeo-ecological contexts.

This regional case study has illustrated the importance of transdisciplinary integration in this field. Southwest Amazonia has a long but under-researched history of human manipulation of plants, encompassing many complex, long-term patterns of ecosystem exploitation and regeneration. By applying anthropological concepts such as 'familiarisation' to these patterns, we can begin to recognise not only their antiquity but also their significance to local lifeways. We can also begin to investigate the sophisticated traditions of knowledge and practice behind these ecological modifications, and hypothesise about their intersections with aspects of life from subsistence and craft-production to kinship and cosmology. The combination of archaeology, palaeoecology, and anthropology presented in this thesis elucidates the central role of plants in Amazonian communities both past and present, and helps us to interpret when, where, how, and *why* human-plant interactions took place.

6.2 Broader implications for future archaeological practice

Entanglements of humans, nonhumans, space, and place defy discrete classification; similarly, the division of research into disciplinary categories inhibits the potential of its outputs. The alternative paradigms for studying eco-archaeological records discussed here would not be possible without transdisciplinary synthesis. Archaeology is not merely anthropology (as the Binfordian aphorism goes), but is also ecology, geography, theology, sociology, and so on. Further, this transdisciplinarity necessitates the broadening of academic methods to include marginalised knowledge systems such as ILK. In this way, archaeology is also *activism*.

Recognising and embedding these ideas in discourses on Amazonian landscape archaeology is part of a larger project of decolonising academia. It forces us to acknowledge the contingency of knowledge-production and the need for further exploration and integration of the multiple, diverse ontologies that make up this world. Doing so furthers the essential, holistic mission of archaeology: to re-instil the lives and livelihoods of peoples in the past with

a richness and entangled complexity. Humans in the past were multisensorially-engaged participants with many overlapping systems of being, thinking, acting, and relating to others (human and nonhuman) and to place, time, and knowledge.

In this vein, the alternative paradigms suggested here can also be a blueprint for reconceptualising human-environment interactions (and their material record) in other regions. Domestication-centric discourses evidently do not fit well with evidence from the Amazonian biome, and it is possible they will also be inadequate to explain anthropogenic activity in other environments. To overlay the Cartesian assumption of a culture-nature divide onto past societies' interactions with nature is to propagate such an ontology as the universal *a priori*. As such, paradigms such as 'familiarisation' can be a valuable addition to the landscape archaeologists' theoretic toolkit.

ABSTRACT

Humans have been modifying landscapes in the southwestern Amazon for 10 000 years. Yet this modification did not comprise the intensive horticultural activities generally defined as 'agriculture' within archaeological discourses. Instead of pursuing plant species' domestication, local communities prioritised mixed-resource economies, *in situ* cultivation, and intentional biodiversity. These subtle but complex practices left a marked footprint on Amazonian soils, tree distributions, and biodiversity patterns. This thesis brings together palaeoenvironmental evidence of this footprint, to paint a picture of how humans managed landscapes in southwest Amazonia in the early and middle Holocene. It then approaches this ecological and archaeological data using anthropological theory and ethnographic evidence; these disciplines can (a) clarify the visibility of human-plant interactions in the eco-archaeological record, and (b) aid in interpreting what this record signifies about past lifeways. This transdisciplinary approach acknowledges the importance of considering cosmology when studying human-plant interactions, and how they can manifest materially. Human-nonhuman reciprocity is a prominent principle in many contemporary Amazonian ontologies, and is used in this thesis as a central paradigm for studying human ecological manipulations through time. Where conventional archaeological models of agriculture emphasise the central role of landscape *domestication*, the evidence from southwest Amazonia indicates that human horticultural activities comprised a process of active landscape *co-creation.* This thesis thus emphasises the need to rethink how we study human-plant interactions in archaeology, with critical implications for how we understand 'agriculture' as a whole – in Amazonia and elsewhere.

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