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## Sensory ecologies, plant-persons and multinatural landscapes in Amazonia

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**Abstract:**

Seeking to generate a deeper methodological and theoretical dialogue between botanical science and anthropology, this paper summarizes interdisciplinary approaches to human-plant interactions we have described as “sensory ecology” and “phytoethnography,” applying these concepts to vital questions about human-plant relations in Amazonia.

Building on this work, we broaden the scope of our investigations by considering their relevance to the field of historical ecology. In particular, we discuss Eduardo Viveiros de Castro’s concept of “multinaturalism” and explore how it can be applied to understanding indigenous management and domestication of forest landscapes in Amazonia.

**Keywords:** *Amazonia, ethnobotany, ethnopharmacology, historical ecology, landscape domestication, perspectival multinaturalism*

**Introduction: What kind of plants are people?**

I already knew that the Matsigenka consider some plants as having human-like souls, but Romulo’s answer still surprised me. We sat in the shade of a palm-thatched hut overlooking the muddy expanse of the Manu River after finishing up an interview about

the health improvements brought by a new water and sanitation project in his community, Tayakome.<sup>1</sup> I continued chatting with Romulo Oyeyoyeyo, a respected elder, and on a whim, I asked him a question about a topic that had long intrigued me.

“Uncle Romulo, what kind of plants are people?”

The Matsigenka generally don't consider plants to belong to the grammatical category of 'animate' beings, defined by possessing a human-like essence, referred to as *suretsi*, translated as “soul.” While plants live, grow, multiply and contain a “life essence” (*ani*), they don't show willful locomotion, and hence are mostly considered 'inanimate' beings (Shepard, 2019). By contrast, animals as well as the sun, the moon, stars, planets and diverse anthropomorphized beings show willful motion and agency, and hence are considered 'animate' and possessing of a soul. A few exceptional plants are said to possess human-like souls or spirit owners, especially psychoactive plants like tobacco (*Nicotiana tabacum* L.), ayahuasca (*Banisteriopsis caapi* Spruce ex Griseb.) and *tohé* or *floripondio* (*Brugmansia suaveolens* [Humb. & Bonpl. ex Willd.] Bercht. & J.Presl.). Latex-containing plants like rubber (*Hevea brasiliensis* Mull.Arg.) and *chicle* (*Castilla ulei* Warb.) are also said to have souls because of their freely running sap and elastic resins. Finally, certain cultivated plants like yam (*Dioscorea* sp.) and sweet potato (*Ipomoea batatas* [L.] Lam.) were once human and able to speak, but lost this ability through a series of tragi-comical episodes related in Matsigenka myths.

Yet none of this prepared me for Romulo's answer. After considering my question for a

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<sup>1</sup> The interview was carried out in April of 2014 as part of the follow-up studies to the community water, health and sanitation initiative led by Rainforest Flow. See [rainforestflow.org](http://rainforestflow.org), <https://www.youtube.com/watch?v=WY-ZTNKzF4o>

few moments, he replied, “*Maempe*,” the Matsigenka word for *Hura crepitans* L., a species of Euphorbiaceae with highly caustic sap, known regionally in Peru as *catahua*.

“*Maempe* is very caustic. If the latex gets in your eye, it will blind you.”

He reflected a while longer and continued, “*Kapiro*,” the Matsigenka word for the spiny bamboo species *Guadua weberbaueri* Pilg. used for making arrow tips.

“*Kapiro* is very painful. We use it to make arrows. It really hurts. If we carve arrow points when our wife is pregnant, the soul of the plant will take revenge and cut the umbilical cord and she will bleed and lose the baby.”

Romulo’s answer reminded me of the complexity of indigenous concepts about substance, spirit and personhood, and how difficult it can be to translate a word like “person” or “soul” across languages and cultures. For Romulo, the spiritual essence and human-like agency of plants is closely linked to noxious properties and a capacity for inflicting harm. The caustic sap of *Hura crepitans* can be used medicinally to remove rotten teeth and treat snakebite. *Hura* sap is dripped on the body of a poisonous snake that has inflicted a bite to dissolve its flesh and reduce the spiritual potency of its venom in the victim. Sorcerers also apply *Hura* sap to the clothing or hair of their victims to cause illness.

Bamboo is the epitome of pain and lethal power in Matsigenka botany, whittled to razor sharp points for arrowheads used in daily hunting activities (Fig. 1). Matsigenka hunters claim that bamboo contains a poison that makes animals (and people) bleed profusely. A rarer form of bamboo, *shinkerokota* (*Guadua* sp.) has an even more powerful

hemorrhagic poison (Shepard et al., 2001). As recently as the mid-1980s, some of my Matsigenka friends have felt the painful sting of bamboo-tipped arrows fired at them by their traditional enemies, the Nahua people, or watched their loved ones die of arrow injuries during those conflicts. Bamboo is covered in sharp spines and tiny urticating hairs that can cause a severe itching reaction. For the Matsigenka, this collection of dangerous physical and chemical properties animates bamboo with human-like agency.

**[Fig. 1 about here]**

Despite a rich history of ethnobotanical research in the Amazon (Posey 1985; Schultes and Raffauf, 1990; Balée 1994), plants remained at the margins of mainstream anthropological theory until quite recently (Rival, 2012, p. 69). Anthropologists working in Amazonia and other tropical forest regions have examined the practical uses and symbolic associations of plants in ritual, agriculture and ethnomedicine (e.g., Turner, 1967; Hugh-Jones, 1979; Herdt, 1981; Rival, 2001). Medical anthropologists and ethnobotanists in particular have studied the complex interweaving of social, nutritional and pharmacological rationales in medicinal and dietary plant usage (Wilbert, 1983; Browner et al., 1988; Etkin, 1988; Johns, 1990; Moerman, 1991; Brett, 1998). Yet such biocultural insights into human-plant interactions have largely been overlooked in the emerging sub-field of multi-species ethnography and “anthropology beyond the human.” In Amazonia, anthropological understandings of non-human beings have focused on human-animal interactions (Kohn, 2013; see Daly, 2015). Only recently have cultural anthropologists begun to explore the botanical world in earnest (Daly, 2015; Oliveira, 2016; Myers, 2017; Daly and Shepard, 2019; Hartigan, 2019; Oliveira et al., 2020; Schulthies, 2020; Kawa, 2021).

Interspecies relations involve the flow of signs across species boundaries (Kohn, 2013; Tsing, 2015; Swanson, 2017). As Hornborg (2001, 127) notes, “Even biochemical processes have a semiotic dimension..., not to mention the various visual, auditory, olfactory, and tactile communication systems of human and non-human organisms.” Our research on plant-human interactions in Amazonia has revealed how sensory experience permeates indigenous “logics of substance” and concepts about etiology, efficacy and agency (Shepard, 2004; 2018; Daly, 2015, 2019, in press; Daly and Shepard, 2019). Such sensory underpinnings of indigenous knowledge were alluded to in Claude Lévi-Strauss’s (1966) concept of the “science of concrete,” and especially in his essay, “The Fugue of the Five Senses” (Lévi-Strauss 1969). But as we have argued (Shepard, 2004; Shepard, 2018; Daly and Shepard, 2019), standard anthropological methods and theories are inadequate for apprehending the unique forms of self-organization (Gottlieb and Borin, 2005), communication (Witzany, 2008; Gagliano, 2018) and intelligence (Trewavas, 2003; 2016) found in plants. At the same time, mainstream botanists and ecologists have encountered methodological, theoretical and epistemological challenges in acknowledging the sociocultural processes that have shaped forest landscapes in some regions of Amazonia (Franco-Moraes et al., 2019).

Seeking to generate a deeper methodological and theoretical dialogue between botanical science and anthropology, we summarize these approaches and show how they have been applied to understanding human-plant relations in Amazonia. Building on this work, we broaden the scope of these investigations by considering their relevance to the field of historical ecology. We discuss Brazilian anthropologist Eduardo Viveiros de Castro’s (2002, 2004a) ontological concept of “multinaturalism” and explore how it can be

applied to understanding indigenous management, modification and domestication of forest landscapes in Amazonia.

### **From sensory ecology to phytoethnography: What kind of people are plants?**

Indigenous hunters, gatherers and horticulturists of Amazonia are deeply intertwined with the tremendous diversity of botanical varieties, species and landscapes that surround and sustain them. These entanglements and exchanges encompass empirical, social, historical ecological, sensorial and cosmological dimensions of human-plant relationships. As Gilbert Herdt (1981) observed among tropical forest peoples of New Guinea, plants offer more than just nutrients, medicines and raw materials for subsistence: the morphology, reproductive biology and sensory properties of keystone tree species provide essential metaphors to understand the ritual and sexual symbolism of the Sambia people. The living trees provide the physical context, intellectual framework and emotional disposition for Sambia ritual life. Rappaport (1967) examined the “ritual regulation of environmental relations” among the Tsembaga people of New Guinea. In Amazonia, Gerardo Reichel-Dolmatoff (1976; 1981) highlights synergies between indigenous concepts and ecological and neurophenomenological processes, while Århem (1996) describes a “cosmic food web” where ecology and cosmology become fused. In a dramatic illustration of the crucial role of biodiversity to indigenous worldview, Yanomami shaman Davi Kopenawa elucidates his own visionary experiences and philosophical concepts through an encyclopedic concatenation of plant and animal



species, individually named (Kopenawa and Albert, 2014).

Amazonian indigenous peoples have altered forest landscapes through itinerant agriculture and agroforestry management for centuries, if not millennia (Posey 1985; Balée 1989; Shepard and Ramirez 2011; Clement et al., 2015; Levis et al. 2017).

Amazonian ideologies about plant and animal life highlight the theme of diversity (Rival, 2001; Heckler and Zent, 2008; Carneiro da Cunha, 2017). For the Matsigenka of the Peruvian Amazon, the dizzying variety of plants and animals in the forest and the ongoing maintenance of agrobiodiversity in swidden gardens all depend on the transformative powers of primordial and current shamans (Shepard, 1999). The Makushi people of Guyana cultivate hundreds of folk-varieties of bitter manioc (*Manihot esculenta*), and celebrate diversity as a fundamental principle of their ecology and cosmology (Daly, 2015). Swidden fallows, agroforestry systems and secondary forests in various states of succession are dynamic spaces of inter-specific sociability, in which humans, plants and animals interact in intimate, symbiotic and multisensory ways (Daly and Shepard, 2019).

Addressing the subjectivity of non-human beings has been among the most important contributions of Amazonian ethnology to contemporary anthropology, especially via the intellectual currents of “animism” (Descola, 1994) and “perspectivism” (Viveiros de Castro, 1996). Anthropologists working among diverse Amazonian peoples have encountered relational and “highly transformational” cosmological systems (Rivière 1994) in which human and non-human persons of various kinds interact, exchange, compete, and sometimes metamorphose. In myths, ritual and shamanic contexts as well as in everyday life, personhood for Amazonian peoples is not restricted to human beings.

The personhood of wild animals is especially important in the theoretical construction of perspectivism. Indigenous people throughout Amazonia consider that each animal species sees itself as a person, with a human body and culture. The bodies of other species are perceived according to each one's "cosmological perspective" as determined by predatory relationships: the peccary sees itself as human, but regards the human hunter as a predatory jaguar; the jaguar sees itself as human, but regards humans as peccaries to be hunted and consumed (Viveiros de Castro, 2002). In this "cosmos-as-ecosystem," hunting is a fundamental metaphor structuring mutual exchanges, both ecological and cosmological, between humans, animals and the spirit world (Reichel-Dolmatoff, 1976; Århem 1996; Fausto, 2007).

But despite the centrality of non-human personhood in contemporary anthropological theory of Amazonia, the plant world has played a marginal role. As Rival (2012, 69) wrote less than a decade ago, "There is a shortage of works on the symbolism of plants." The predominance of the perspectival paradigm, with its focus on symbolic elaborations of predation has proven less effective at elucidating plant perspectives. Even the influential work of Eduardo Kohn (2013) —and despite its suggestive title, *How Forests Think* — ends up getting carried away by what Daly (2015, 67) characterizes as a "faunal bias": "In purporting to explore 'how forests think', [Kohn] fails to adequately take into account perhaps the most 'iconic' living selves found in the rainforest: *plants*" (ibid.).

We have outlined the concept of *phytoethnography* as a remedy for this faunal bias in Amazonian anthropology (Daly and Shepard, 2019). Phytoethnography elevates plants to the status of ethnographic subjects in their own right at varying scales, from house yard gardens to swiddens, managed successional fallows, mature agroforests and the wider

forest realm. By directing anthropological attention to plants, this approach seeks to highlight the centrality of botanical beings, plant substances and forest landscapes in Amazonian lifeways.

The body for indigenous peoples of the Amazon is not given, but rather constructed (Seeger et al., 2019[1979]; Vilaça, 2002). Substances of plant origin play a major role in mediating vital transfers between different bodies and subjectivities (Shepard, 2004; Zent, 2005; Wright and Taylor, 2009; Santos-Granero, 2012; Daly 2015; Daly and Shepard, 2019). The idea of “substance sharing” is found in many Amazonian cosmologies: substances perpetually flow between bodies and beings of different kinds. Human-plant interactions often take the form of substance transfers, in which qualities, capacities and subjectivities of nonhuman beings are acquired by bodily incorporation (Santos-Granero, 2012). In these transfers, notions about substance, soul and body merge to the point of being nearly indistinguishable. As Luis Eduardo Luna (1984, 140) writes of Peruvian mestizo shamans, “It is with the help of the spirits of some of these plants, which I have called ‘plant teachers’, that the shaman is able to acquire his powers.”

In light of this evidence, we were driven to ask, how exactly do indigenous Amazonian peoples relate to plants, and what role do sensory experience, phytochemistry, ecology and plant intelligence play in mediating these relationships? We bring to this investigation our independent ethnographic and ethnobotanical field studies among the Matsigenka people of Peru (Shepard, 1998, 2004, 2018) and the Makushi of Guyana (Daly, 2015). Though geographically separated by thousands of kilometres and culturally and linguistically unrelated, the two groups showed remarkable similarities in their conceptions about plant agency, botanical substance exchanges and the healing power of

plants.

The Matsigenka live in the Amazon headwaters in southern Peru. They currently number thirteen thousand people throughout the Urubamba, upper Madre de Dios, and Manu River basins. Matsigenka is an Arawakan language, closely related to Ashaninka (Campa). The term *matsigenka* means, ‘person’, which also refers to the human essence of non-human beings. The Matsigenka plant sweet manioc, plantains and bananas, maize, sweet potatoes, cotton, annato, beans, peanuts, chili peppers and a variety of other crops in swidden gardens (Johnson, 1983). Fish, game, fruits and other wild foods are essential in their diet. While the Matsigenka exhibit little in the way of elaborate public rituals, a closer examination reveals frequent ritual and practical interventions in the private, family sphere, often involving plants. Since the 1980s, oil and gas prospecting activities have increasingly affected communities in the lower Urubamba region (Izquierdo and Shepard 2003).

Toxicity is fundamental to the Matsigenka’s understanding of illness and healing, as encapsulated in the concept of *kepigari*. The word is derived from the verb root *-piga-*, “to return, turn around, spin,” which by extension means “to feel dizzy, nauseous; to be intoxicated or poisoned; to go insane.” *Kepigari* refers to toxic, narcotic and psychoactive substances as well as lethal poisons. Plants that are *kepigari* are often “bitter” (*kepishiri*), “painful/pungent” (*katsi*), or have an “intoxicating odor” (*kepigarienka*). The Matsigenka seek out bitter, pungent and other noxious plants as medicines because their toxic properties are said to hurt, kill and expel intrusive pathogenic objects, agents or spirits (Shepard, 2004). Matsigenka shamans obtain their special healing and divining powers by consuming psychoactive and other toxic substances.

The Carib-speaking Makushi people live in the north Rupununi region of southwestern Guyana, a biologically diverse mosaic of savannahs, forests, and wetlands located on the northern fringes of Amazonia. Numbering 12,000 people in Guyana, with another 35,000 in Brazil, the Makushi have endured a long and tumultuous history of contact with European colonists. Despite significant socio-cultural and religious transformations, the conceptual system centered on shamanism and the proliferation of spirits (*imawari*) in the living environment remains vibrant, framing processes of cultural change (Daly, 2015).

The Makushi are expert horticulturalists, and place a high value on the botanical and phytochemical diversity of cultivated plants. The staple crop bitter manioc (*kîse*) is a keystone species that holds the dual status of life-giving foodstuff and cyanide-containing poison. As the chief of Yupukari village told Daly, with palpable passion, “We are scientists! Did you know that? We turn poison into food!” The concept of poison (*kawi*) is also central to Makushi cosmology and shamanism. Poisonous plants and venomous creatures such as ants, spiders, and snakes are important in origin myths (*panton*). Snakes (*kîi*) are closely tied to the mythical origins of poisonous plants. Shamanic ritual centers around the use of toxic, emetic and bitter plants, and shamans are intimately associated with the anaconda (*tînki*), considered the most dangerous snake of all.

Much of the Makushi pharmacopoeia expresses a substance-based logic, whereby potent or otherwise powerful substances flow between plant and human bodies. Plant medicines are ingested as tea-like infusions, bathed on the body, rubbed into the skin or dripped into the eyes, and the curative power of plants depends on these substance transfers. Many medicinal plants are toxic, poisonous, irritating, astringent, or bitter (*mai*), and their efficacy or “strength” (*meruntî*) resides in these extreme chemosensory reactions.

Chemosensory properties, in turn, are entangled with the personhood of plants.

The Makushi consider plants to be “persons”, *pemon*, while shamanic plants are especially powerful persons. Certain food crops like manioc are considered to be “children” (*imun*) of their gardener “mothers”, and appear in myths as familial characters, an example of what Rarámuri ethnobotanist Enrique Salmón (2000) has termed ‘kincentric ecology’. Shamanic plant-charms are more ambiguous, considered either helper spirits or dangerous enemies depending on one’s point of view. Plant-charms constitute primary tools and allies of shamans (*pia’san*) as well as sorcerers (*kanaimà*). Certain particularly powerful plants are considered to be “plant-shamans” in their own right, botanical equivalents of their human counterparts.

Personhood is determined by possession of a vital essence (*ekaton*), literally “that which brings life to things” but typically translated as “soul,” integrating plants, animals and humans into a unified cosmic web. The soul “infuses” the substance or “body” (*esak*) of the plant with specific sensory properties that transmit curative or toxic powers. Makushi shamanic training involves the consumption of potent plant substances, notably tobacco (*kawai*), taken in copious quantities, either smoked or taken nasally as a viscous liquid known as “*piai*-juice” (‘shaman-juice’). The shaman becomes a “master” (*esak*, the same word for “body”) of plants, such that the person’s body becomes infused with plant substances and subjectivity (Daly, 2015; Daly and Shepard, 2019).

For the Matsigenka, some, but not all plants, are people. As noted in the introduction, Matsigenka grammar treats most plants as inanimate beings, with exceptions for latex-containing plants, plants that were mythological persons and toxic or psychoactive plants

imbued with spirit “masters” or “owners” (Shepard, 2018). The Matsigenka word for soul or spirit, *suretsi*, can also refer to the heartwood of a tree or the pith of an herbaceous plant without necessarily implying a human-like essence. Similar to the Makushi concept, *suretsi* also refers to the pharmacological principles of medicinal, toxic and psychoactive plants as manifest through specific sensory properties. When a plant is heated in water, its soul “contaminates” or “infuses” (*okitsitinkake*) the herbal brew with these properties, which in turn “infuse” the patient’s or healer’s body.

The Matsigenka, like the Makushi, consider tobacco as fundamental to shamanism. Indeed, tobacco and shamanism are synonymous in Matsigenka: the shaman is *seripigari*, “the one intoxicated by tobacco” (Baer, 1992). The spiritual power of tobacco is judged by how painful (*katsi*) it is: the more painful the tobacco, the more powerful the shaman who prepared it (Fig. 2). Apprentice shamans receive their special shaman’s soul (also *suretsi*) by ingesting a wad of extremely bitter tobacco quid (*opatsa seri*) that has been first swallowed and regurgitated by a master shaman. This shaman’s soul is conceived of as “Brother” (*Ige*), a spirit twin living in the parallel, invisible world of the spirits who switches places with his human counterpart during shamanic rituals involving psychoactive plants (Shepard, 1998).

**[Fig. 2 about here]**

For both the Makushi and Matsigenka, shamans might be described as part-plant, owing to their copious ingestion of powerful plant agents. Such human-plant consubstantiality permeates Amazonian shamanism. The Matsigenka and other indigenous peoples of western Amazonia consume the hallucinogenic plant brew ayahuasca, consisting of

*Banisteriopsis caapi* and *Psychotria* species among other plant admixtures. Ayahuasca is conceived as a “plant teacher” that imparts knowledge directly to the apprentice shaman (see Luna, 1984). Just as shamans can be part-plant, plants, too can be shamans themselves, capable of teaching, transforming and healing their human apprentices and allies.

The routine use of medicinal and charm plants by non-shamans also involves the exchange of substances and subjectivities with botanical beings. Fully one fourth of the Matsigenka pharmacopeia consist of plants used to improve men’s aim and hunting skill (Shepard, 2002). A man loses his “aim” (*kovintsari*) when he violates behavioral, dietary and sexual taboos: allowing wounded animals to die in the forest, eating spoiled or improperly cooked meat, eating the brain or head-meat of an animal he has killed, having sex the night before a hunt or any contact with menstrual blood. When a man violates these norms, his body begins to reek with carrion odor (*anigarienka*) associated with the spirit of the vulture, which offends the game animal masters, who proceed to hide the animals from the man so he won’t “waste their bounty.”

Hunting medicines include purgative, emetic and psychoactive plants that physically rid hunters’ bodies of the rotten odor associated with ritual impurities while opening channels of spiritual communication with game animal masters. Purgative preparations, including the toasted seeds of a highly caustic *Dieffenbachia* species (Araceae), rid the hunter of spiritual and bodily impurities through violent bouts of diarrhea. Matsigenka hunters also apply the painful (*katsi*) leaf juice of numerous plant species (mostly Rubiaceae) to their eyes in order to clarify vision and replace the carrion-smelling vulture soul with the sharp-eyed harpy eagle (Shepard, 2002). The eye-drops cause intense



stinging as the soul of the plant infuses the man's eyes, head, torso, arms, and hands, as well as his bow and arrow.

Such substance transfer can also work in reverse when human body substances are applied to plant tissue. When the Makushi fall ill from a curse (*taren*), they may place a few drops of their own blood into a hole made in the stem of an "omen plant" (*paani*) such as *Dieffenbachia*, causing the enemy shaman to be revealed in a dream. The clairvoyant capacity of the plant is related to its caustic properties. Among the Matsigenka, a similar procedure involves putting hair, clothing, dirt from a footprint or other personal possessions of a victim into contact with the caustic sap of *Dieffenbachia* or *Hura crepitans* in order to inflict an inflammatory sorcery illness.

Our collaborative investigation of Makushi "charm plants" (*bina*; Fig. 3) revealed unexpected synergies between their phytochemistry and the phenomena of shamanism (*piai*) and necromancy (*kanaima*). Makushi shamans and necromancers alike gain power by absorbing invisible, crystalline darts, known as *waawî*, from *bina* charm plants. Many *bina* plants belong (like the *Dieffenbachia* species noted above) to the Araceae, whose tissue, curiously, contains high concentrations of microscopic, needle-like crystals of calcium oxalate. Known as raphides, these sharp crystals puncture the skin, facilitating the passage of other toxins and causing severe inflammation of the soft tissues and mucus membranes, an important symptom of *kanaima* sorcery. While other anthropologists have studied the social, bodily and historical symbolism of Makushi shamanism, sorcery and necromancy (Colson, 2001; Whitehead, 2002), we were the first to point out the metaphorical and literal associations of raphide phytochemistry with these concepts (Daly and Shepard, 2019). This example highlights the defining role of phytochemistry,

chemosensation and native substance logics in some cosmological concepts, and illustrates the power of phytoethnography in addressing the agency of shamanic and medicinal plants in their full biocultural richness.

**[Fig. 3 about here]**

Plants are sophisticated communicators, transmitting information to each other and to the animal world via visual and taste signals, scents, hormones and biochemical impulses (Witzany, 2008). The most important chemical compounds in animal-plant interactions, alkaloids, polyphenols, and terpenoids, are “messenger molecules” whose primary function appears to be, not chemical defense, as was long thought, but rather transmitting information across cell membranes (Gottlieb and Borin, 2005). According to Trewavas (2003: 3), “the set of molecules used in the transduction of biochemical signals is totally similar between nerve cells [of animals] and plant cells.” In other words, bioactive compounds produced by plants (including shamanic and medicinal substances of plant origin) feed a kind of biospheric nervous system, transmitting information within and between plant cells, among different organisms and into the biospheric level (Shepard, 2018). Recent scientific research suggests that plants have *sui generis* forms of intelligence (Trewavas, 2016), echoing indigenous concepts about the notion of “plant teachers” in Amazonian shamanism (Luna, 1984).

Plants live in intimate symbiotic associations with fungi, forming vast underground communication networks that shape the character of entire forest landscapes (Tsing,

2015). Large-scale deforestation disrupts this complex ecosystem of communication between plants, animals, fungi and the biosphere, leading to climatic disturbances on a continental and even global scale (Lovejoy and Nobre, 2018). Indigenous people have their own theories about the substance transfers and spiritual pathologies connecting environmental devastation, climatic instability, cosmological imbalances and epidemic illnesses (Kopenawa and Albert 2014; Lagrou 2020). Indigenous peoples are increasingly seen as key allies in the defense of tropical forests (Chapin, 2004; Stevens et al., 2014), and their lands serve as effective barriers against deforestation (Nepstad, et al. 2006).

### **Multinatural landscapes of Amazonia**

How do wider forest landscapes in Amazonia intersect with indigenous conceptions about non-human personhood? Virtanen and Saunaluoma (2017) have argued that extensive geoglyphs (ancient earthworks recently made visible by deforestation) in the Brazilian state of Acre might represent an extension of indigenous Amazonian practices of body ornamentation: these forest landscapes may have been marked as social bodies amplified to the macro scale. Like human and plant bodies, forest landscapes are permeated by substance flows and transformations among biological and spiritual beings. As in our discussion of plant teachers and messenger molecules, above, the multi-scalar quality of these interactions may give them a fractal character, with patterns repeating at varying scales from individual human and plant bodies to the biospheric and cosmological level.

Drawing on a perspectival understanding of Amazonian metaphysics, Viveiros de Castro (2004a) has described the “multinatural” character of indigenous Amazonian ontologies. In the Western philosophical tradition, the biological body is seen as a universal structure on which human cultural variations alternate superficially, like costume changes: a “multicultural” ontology. According to Amerindian concepts, by contrast, many living beings are fundamentally human, sharing a universal human culture. It is the “natural” biological form—the body, defined according to predatory relations and cosmological perspective—that varies: to wit, a “multinatural” ontology. In contrast to the Western scientific viewpoint, which postulates a single, all-encompassing universal “natural world,” multinaturalism implies multiple, variable, perspectival *natures* that are determined by the unique lifeways of different animal and plant species and human cultural groups. In this sense, Viveiros de Castro and other authors involved in the so-called “ontological turn” (Kohn, 2015) apply insights from ethnographic investigations of non-Western cultures towards a deep-reaching ontological critique of Western metaphysics.

The nature/culture dichotomy is a fundamental axiom of Western science and philosophy, dating back to the Enlightenment era and beyond (Descola, 2013). Mind/body dualism, asserted in the notorious Cartesian *Cogito ergo sum*, is the foundation for what Latour (1993, 12) refers to as “the Great Divide” between the human (Culture) and nonhuman (Nature) realms which characterizes modern Western thought. In contrast, indigenous conceptual systems and attendant lifeworlds are predicated upon a more fluid ontology which incorporates ‘natures’ and ‘cultures’ into an integrated, relational whole. And yet

by inverting the nature/culture dichotomy and swapping “multiculturalism” with “multinaturalism,” Viveiros de Castro appears to have recreated the problematic Cartesian divide from the other side of the looking glass, as it were (Shepard, 2008, 78). The entanglements of biochemistry with cosmology implicit in Matsigenka hunting medicines and Makushi necromancy defy Cartesian dualism and the disciplinary boundaries between anthropology and botanical science.

In our comparative examination of indigenous Amazonian plant medicines and shamanism, we were both struck by the crucial role of phytochemical substances and their associated chemosensory properties in mediating deeply entangled ontological conceptions about body, soul and personhood. Viveiros de Castro (2004b, 8) warns about the dangers of “silencing the Other by presuming a univocality—the essential similarity—between what the Other and We are saying.” Especially within the discipline of ethnobiology, with its comparative methods and intercultural dialogue between indigenous and biological ways of knowing (see Berlin, 1992; Hunn, 2006), it is important not to reduce or misconstrue indigenous concepts to match those of the dominant scientific epistemology (Furlan et al., 2020). And yet treating indigenous cosmologies as abstract, metaphysical systems severed from the living, murmuring, pungent, rank, cacophonous multitude of species involved in all that relating and predated and transformation is to engage in a different form of “silencing.” We reiterate the point we made in the introduction: the challenges of a truly multi-species “anthropology beyond the human” are methodological as well as theoretical; biochemical as well as metaphysical.

When moving from the scale of individual plant medicines to the anthropogenic forest landscapes that surround many indigenous communities, we also argue that the quantitative methods of floristic community analysis and historical ecology, as much as ethnography and cosmology, are essential to understanding human-plant interactions. Just as indigenous conceptions about botanical substance sharing and plant personhood subvert the Cartesian dichotomies of mind/body and matter/spirit, so do indigenous agroforestry practices—resulting in measurable alterations of entire forest landscapes without disrupting otherwise “natural” ecological functions and biodiversity—challenge traditional scientific as well as anthropological understandings of the Nature/Culture divide. As a case in point, studies of Matsigenka ecological knowledge have revealed a richly detailed system of habitat classification based on geomorphological features, flooding regimes, soil types, human disturbance histories and indicator species that are, in turn, inextricably linked with mythical places, cosmological beings, oral histories, seasonal cycles of resource use and a collective sense of territorial identity (Shepard et al., 2001).

The engagement of indigenous peoples with the Amazonian botanical universe is part of a long cultural history, until recently underappreciated, of management, modification and domestication (Shepard and Ramirez, 2011; Clement et al., 2015; Levis et al., 2017; Franco-Moraes et al., 2019). As Hornborg (2001, 127) notes, “Amazonia provides us with remarkable evidence for the extent to which human, cultural behaviour can be constitutive of ecosystems.” Due to the presence of vast expanses of intact and apparently untouched forests in the Amazon when European settlers and explorers first arrived, a

persistent, but largely misguided presumption emerged that much of pre-colonial Amazonia uninhabited or little impacted by indigenous people: what Denevan (1992) dubbed the “pristine myth.” According to the predominant twentieth century archeological theories about Amazonian cultural history, ancient indigenous societies would have been mostly semi-nomadic hunters or itinerant farmers surviving within a challenging and nutrient-poor ecosystem, leaving few lasting traces in the landscape (Meggers, 1971).

It is now clear that vast tracts of “pristine” Amazonia are in fact anthropogenic. More recent archeological research has revealed densely settled societies in some regions that altered the landscape through earthworks, soil enrichment and agroforestry management (Erickson, 2006; Heckenberger et al., 2008), resulting in lasting changes in floristic composition (Levis et al., 2017). These processes increased the productivity of forests for human needs and, therefore, represent a form of landscape domestication (Clement et al. 2015). Likewise, ethnographic research by historical ecologists has demonstrated that landscape transformations by contemporary indigenous peoples are widespread across the Amazon basin (Posey, 1985; Balée, 1994; Rival, 2006; Kawa, 2015). These new insights and discoveries from archeology and historical ecology have revolutionized our understandings of human history in South America, overturning orthodox models of cultural evolution and environmental history focused on the centrality of agriculture (Shepard et al., 2020). Amazonian food production and environmental management reveals cultivation without domestication and domestication without agriculture, a syndrome that has been referred to as “counter-domestication” (Aparício, 2019, p. 108) or “anti-domestication” (Carneiro da Cunha, 2019). It was high mortality from exotic

diseases brought by Europeans, more than any inherent ecological factor, that led to the perception of the Amazon as a largely uninhabited and “pristine” environment (Clement, 1999).

Recent studies have pointed to persistent floristic legacies left by the management practices of pre-colonial and historical indigenous peoples (Shepard and Ramirez, 2011; Lins et al., 2015; Franco-Moraes et al., 2019; Levis et al., 2017). Amazonian indigenous peoples invested their domestication efforts both in domesticated species in gardens as well as wild populations of plants in actively managed agroforests (Clement et al. 2015). The result was the transformation of many Amazonian landscapes into human-influenced spaces that appeared “natural” to the eyes of the colonizer, but that in fact are cultural in origin. These cultural or “ancestral” forests (Franco-Moraes et al, 2019) represent social spaces domesticated (in the sense of Clement et al, 2015) for human purposes without excluding the multitude of other species, thus maintaining their ecological functions largely intact.

Juliano Franco-Moraes, one of Shepard’s graduate students, analyzed soil features and floristic composition of interfluvial forests located in the Içana River basin, northwestern Amazonia, traditional territory of the Baniwa people (Franco-Moraes et al. 2019). Prior remote sensing and climate studies predicted that this region was unlikely to bear lasting imprints of ancient human habitation (Bush et al., 2015). However, working with the Baniwa people to locate ancient village sites, abandoned centuries ago, Franco-Moraes was able to identify “ancestral forests” with as much as 57% of the tree biomass composed of fruit trees managed by the Baniwa, compared to only 10% of such species



in old-growth forests with no memory of management or habitation in Baniwa oral tradition. Baniwa management also appears to have improved soil fertility in this acidic, sandy region through the addition of charcoal. Yet structural analysis of ancestral forests reveals them to be nearly indistinguishable from old-growth forests with no memory of Baniwa habitation: to an ecologist or botanist, they would appear to be “natural” and pristine. If anything, these cultural forests have slightly *greater* forest biomass and more evenly distributed biodiversity than comparable old-growth forests, owing to increased soil fertility resulting from past Baniwa management. Participatory mapping and direct observations revealed ancestral forests to be widely distributed throughout the region, whereas old-growth forests are rare.

It is in this sense that we propose to reinterpret Viveiros de Castro’s (2004a) essentially metaphysical conception of “multinaturalism” as a tangible, concrete property of anthropogenic forest landscapes in Amazonia. Domesticated forests in the Amazon are not the pristine, “natural” environments perceived by early naturalists, and some ecologists and conservationists to this day; rather, they are cultural spaces, built by centuries-long management and domestication processes of indigenous peoples (Levis et al., 2017). Such processes of landscape domestication also highlight the unique features of lowland South American farming and agroforestry, which have overturned orthodox archeological theories about agriculture and human cultural evolution (Shepard et al., 2020).

Juliana Lins, also a student of Shepard's, brings an additional nuance to the multinatural approach to indigenous landscape domestication. Her floristic studies of anthropogenic dark earth sites on culturally distinctive archaeological horizons in the central Amazon reveal measurably different floristic compositions of spontaneous plant species native to Amazonia (Lins et al. 2015). Even when controlling for soil characteristics, distance and other ecological features, the factor that correlated most strongly with site-to-site variation in floristic composition was the ancient cultural context, even though these archeological sites were abandoned as much as a millennium ago. In other words, cultural diversity in the distant past, acting through variable social habits, management practices and food preferences, was capable of leaving behind distinctive botanical signatures in the landscape that have persisted for centuries. The multinatural paradigm is manifest, not only in cosmological terms, but also in the lived physical world: different cultures have created measurably different "natures." When introduced species are included in the floristic analysis, however, the statistically significant differences in species composition vanish: a floristic analog of the homogenization and outright annihilation of the diverse, multinatural processes and lifeways of indigenous peoples that were overwhelmed by European colonization.

Despite being social and humanized spaces, which vary according to the preferences and cultural habits of the different peoples who domesticated them, such cultural forests preserve the ecosystem services necessary for maintaining Amazonian biodiversity. Within these "multinatural landscapes," each human group, and each biological species, contributes to the construction of its niche or *domus* according to its position—its

multinatural perspective—in a complex social, ecological and cosmological web composed of multiple species, forces and beings. The multinatural perspective also helps de-center the anthropocentric viewpoint by incorporating indigenous understandings of forest landscapes that are “owned” or “planted” by different non-human beings (Oliveira, 2016), thus contributing a diversity of multinatural interventions and relations.

While the concept of multinaturalism comes from anthropological theory, its application to landscape-scale phenomena, in their full, multi-species, relational character, requires the use of ethnobotanical, ecological and historical as well as ethnographic methods, in an intense collaboration between the human and natural sciences and local knowledge systems. In this way, multinaturalism brings indigenous ontologies, predicated on other-than-human personhood and trans-specific relationality, into dialogue with parallel scientific understandings. This synthesis can be applied to phenomena ranging across multiple scales from the micro (e.g., particular human-plant engagements in specific ethnographic contexts) to the macro (e.g., the dynamics of the rainforest biosphere at large).

### **Conclusion:**

Schultes grappled with the unsettling clash between the cosmology of his Amazonian informants and that of his own modern science, a world view that prevented him from understanding the plants on the Amazonians’ own terms (Sheldrake, 2020, p. 365).

Relatively late in his long and productive career, ethnobotanist Richard Evans Schultes (1986) became intrigued by what he described as the “enigma” of how indigenous Amazonian people could identify and distinguish closely related botanical varieties of certain wild plants, consistently and at a distance, that he himself was unable to differentiate using all the tools of taxonomic science. In his recent discussion of “Schultes’ dilemma,” Merlin Sheldrake draws on Viveiros de Castro’s (2002, 2004a) work to reflect on the epistemological and ontological chasm between indigenous and scientific ways of knowing: “In proposing that what is ‘natural’ for us may be ‘cultural’ to Amazonians, [Viveiros de Castro’s] perspectival multinaturalism suggests that people differ in their nature as well as their culture. The very basis of reality is at stake” (Sheldrake, 2020, p. 364).

In a similar vein, Furlan et al. (2020) draw on Viveiros de Castro’s (2004b) conception of “controlled equivocation”—a playful parody on the ‘method of controlled comparison’ in twentieth century ethnography—as a tool for enriching the field of ethnobiology. Both Sheldrake (2020) and Furlan et al. (2020) call for a more symmetrical dialogue between indigenous and scientific viewpoints, while highlighting the possibility of epistemic and ontological incommensurability. Given the political, economic and power relations inherent in encounters between the knowledge systems of indigenous peoples and European colonist-settlers, it is only right that this dialogue should reverse historical asymmetries. Yet by insisting that the dialogue begin with botanists and ethnobiologists becoming more familiar with anthropological theories about indigenous Amazonian

peoples, neither author considers the reverse possibility: that anthropology in Amazonia could be enriched by botanical and ethnobiological methods and theories.

In considering Schultes's perplexity at how Amazonian indigenous people could identify certain "wild" plant varieties from a distance, Sheldrake (2020, p. 351) notes, "If particular plant individuals were cultivated and already known to the local inhabitants, this would not be extraordinary." And yet, as pointed out above, the process of domestication in the Amazon can be entirely independent from cultivation and the Old World agricultural paradigm. As the methods of historical ecology have revealed for important plant species like Brazil nut (Shepard and Ramirez, 2011) and many others (Levis et al., 2017; Franco-Moraes et al., 2019), the distinction between wild and cultivated plants in Amazonia is not always clear cut, and the very concept of domestication has to be rethought at the level of entire landscapes, rather than just cultivated fields (Clement et al., 2015).

As Sheldrake (2020, p. 365) himself observes, "It is precisely the lack of clear knowledge about the nature of the actors, *both plant and human*, that form the subject matter of the enigma" (emphasis added). If anthropology can contribute to understanding the nature of plant actors, why couldn't botany also contribute to understanding the human actors? Indigenous peoples have incorporated ecological realities like predation into the heart of their cosmological conceptions (Reichel-Dolmatoff, 1976; Århem, 1996). Emerging scientific understandings of phytochemical communication, biosemiotics and plant intelligence also seem to have synergies in certain indigenous concepts (Daly and

Shepard, 2019). While it is important not to conflate indigenous and Western philosophical notions, especially in ways that erase, misconstrue or “equivocate” the former (Viveiros de Castro, 2004b), perhaps the two are not so utterly incommensurable as they might seem at first glance. Indeed, Schultes and many other ethnobotanists throughout the history of the discipline have been consistently impressed with the detail and sophistication of indigenous knowledge about plants and other elements of the landscape, often surpassing the knowledge of scientific botanists, not to mention anthropologists (see Shepard et al., 2001). If Schultes’s enigma is a “postcard from the limits” of ethnobotany (ibid., 365), it is also a postcard from the limits of cultural anthropology.

The challenges faced by so-called “multispecific ethnography” (Kirksey and Helmreich, 2010), or what we have described here as *multinatural landscape ecology*, are theoretical as well as methodological. How can ethnographic research be carried out with botanical partners? Ethnographic and ethnobiological theory can enrich one another in a truly interdisciplinary *dialogue*. Although they are a step in the right direction, recent contributions such as those by Sheldrake (2020) and Furlan et al. (2020) feel more like a one-sided harangue. People-plant relationships are intrinsically sensory, and often mediated by chemosensory experiences related to specific phytochemical compounds (Shepard, 2004; Daly and Shepard, 2019). Biosemiotics and emerging scientific understandings of “plant intelligence” reveal unexpected synergies with shamanic concepts (Shepard, 2018; Daly and Shepard, 2019). Moving from the level of individual human-plant interactions to the landscape scale, a number of recent studies have

documented how the lifeways of Amazonian peoples give rise to mature forest environments that are as much the product of cultural as of natural forces. The socio-environmental processes that create “cultural forests” in Amazonia run in both directions, creating a kind of “forested” human culture (Franco-Moraes et al., 2019), as revealed in the fundamental role of biodiversity and ecological concepts in Amazonian cosmology (Fig. 4). These multi-species and multinatural forest landscapes have been managed and used by humans for centuries without excluding the multitude of other species and ecological processes that make the region crucial to conservation and global climate stability.

**[Fig. 4 about here]**

Here, we have synthesized the results from these diverse research enterprises to suggest a methodological outline for further research in phytoethnography and multinatural landscape ecology. Methods from the human sciences, including linguistics and archeology as well as cultural anthropology, are of course fundamental to this endeavor. However, scientific results of botanical, phytochemical, ecological and even atmospheric studies can sometimes yield unexpected insights into the deep and complex engagements of indigenous peoples with tropical plants and forests (Daly and Shepard, 2019). This multidirectional and intercultural dialogue is especially important in the collaborative research arrangements between indigenous peoples, scientists and anthropologists that have been implemented in different parts of Amazonia (Shepard et al., 2001; Carneiro da Cunha and Almeida 2002; Hutukara Association, 2015). Such transdisciplinary dialogue

is essential to documenting, and ultimately maintaining the increasingly threatened cultural forests and multinatural landscapes that safeguard global biodiversity and climate stability.

### **Epilogue:**

As I chatted with Romulo about plant-persons and non-human intentions on that hot afternoon in 2014, I was reminded of my first encounter with what might be called a “multinatural equivocation” many years before during my first fieldwork expedition to Tayakome in 1987. Romulo’s son-in-law had pursued a herd of white-lipped peccaries and killed several with his arrows, and sent back word for help carrying them to Romulo’s hamlet. I went with Romulo and a few other relatives to haul the heavy carcasses from the distant kill site. Being slower than the rest, I was the last to pass through the recently felled swidden by Romulo’s house. High in the wall of forest along the swidden’s edge, I caught sight of a troupe of six or seven spider monkeys vocalizing and swinging among the tree branches. I dropped the gutted peccary and ran to Romulo’s house.

“Uncle Romulo, grab your arrows, there are spider monkeys by your garden!”

Romulo laughed, “No, those are pets! No one hunts them! My son-in-law killed their mothers long ago and my daughter raised them like babies. When they grew up, they



went back to the forest, but they return sometimes to visit. They call out to us from the garden just the way visitors call from a distance to let us now they are arriving.

“They’re just like people! Their hands, just like humans. The way they grab tree branches, the way they hold their hands out to ask for food. So we don’t bother them. They call their friends from the distant forest for us to hunt, and they plant *Pouteria* seeds for us to eat, just like we plant our gardens.”

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**Figure captions:**

Figure 1. “Bamboo is the epitome of pain and lethal power in Matsigenka botany, whittled to razor sharp points for arrowheads.”

Figure 2. “The more painful the tobacco, the more powerful the shaman.”

Figure 3. “The Makushi category of ‘charm plants’ (bina) revealed unexpected synergies between their phytochemistry and the phenomena of shamanism (piai) and necromancy (kanaima).”

Figure 4. “The socio-environmental processes that create ‘cultural forests’ in Amazonia run in both directions, creating a kind of ‘forested’ human culture.”

Draft



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Figure 2. "The more painful the tobacco, the more powerful the shaman."

965x527mm (72 x 72 DPI)



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