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Perspectives

Cognate Plants: A Renewed Concept for Species with Common Uses and Taxonomic Similarities

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Abstract The article introduces the cognate plant concept, presenting its novel application within an ethnobiological context. These are taxonomically or functionally analogous plant in-groups that remain overlooked and undervalued in public perception. In order to support the term definition, several examples of related plants are discussed, such as those used in the production of *piaçaba*, *cipó-titica*, and *tauari* wood, as well as the *açaí* case. In each example, the importance of correctly identifying the species is emphasized to warn against unsustainable extraction practices. Moreover, inaccurate consumer perception of the product offered can overshadow conservation problems with one or more of the cognate species that are the source of the raw material. In the *açaí case*, the introduction of *Euterpe oleracea* beyond its native range, alongside the native Acre *açaí* (*Euterpe precatoria*), raises concerns about socio-environmental impacts and the potential transition from extractive systems to monocultures. Although examples cited are from Brazil and the Amazon, the applicability of this concept extends universally. Therefore, incorporating the plant cognate concept into research, policy, and community practices offers a more realistic approach to biodiversity conservation while supporting cultural traditions and sustainable resource management.

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Introduction

This article introduces a novel application of ancient terminology aimed at enhancing environmental perception studies, particularly by addressing challenges in the popular understanding of plant species classified as cognates. Originally coined as *cognatum* by Pliny the Elder in his Natural History (Books 15–19) to denote botanical kinship, or *of the same bloodline* in old Latin (Lewis and Short 1879), the term's first and last recorded application for this purpose was in antiquity. It was only in the mid-nineteenth century that the term was adapted into linguistics to describe common words of etymological origin (Echeverría 2017; Sabino 2012). Most recently, it was formally applied to the biological sciences in 1942 by Harold H. Flor, with the development of the gene-for-gene theory of variety-specific resistance (Flor 1942).

Modern botany has employed the term cognates in the description of new species to designate specific epithets, likely applied to species that are very similar in appearance. In naming the epithet, the authors emphasize the morphological proximity of the described species to another within the same genus. This is achieved by highlighting shared characteristics such as length, width, venation patterns, and petiole dimensions, among other traits, to demonstrate the taxonomic overlap between the two taxa. Variations of the term, such as *Gaulettia cognata* (Steud.) Sothers & Prance, *Cheiloclinium cognatum* (Miers) A.C. Sm., and *Tynanthus cognatus* (Cham.) Miers have been employed in different botanical contexts, especially in naming species that show significant similarities to one another.

The recontextualized terminology proposed here—cognate plants—operates within popular

environmental perception studies, a field that examines the dissonance between how much we truly care about the environment and the extent to which the surrounding environmental reality is reflected in our feelings and tangible actions (Amorim et al. 2024; Ihemezie et al. 2021). By using the term *cognate* in the context of environmental perception and ethnobiological knowledge, I discuss how the process of public recognition, specifically how people perceive and identify plant species, can lead to incorrect identification and inaccurate labeling when it is flawed or mistaken. This culminates in consequences that undermine both conservation efforts and sustainable species use.

Cognate plants encompass species that, beyond taxonomic proximity and similar morphologies, share functional roles in traditional practices, often resulting in their collective association with a single final product in markets. This overlap is further compounded by vernacular naming practices: local names frequently fail to distinguish allied species due to intra-community variations or divergent uses of a "common language" across regions. Such linguistic ambiguity, combined with functional equivalence, drives indiscriminate species exploitation for the same purposes, often without the final consumers realizing it. Unintentional substitution therefore undermines distinctions in popular understanding, which can trigger ecological repercussions, including overexploitation or decline of populations of rare or vulnerable species.

The proposed term *cognate plants* underscores these dynamics by elucidating the ecological and cultural implications of such substitutions. This concept addresses a lacuna in existing nomenclature by emphasizing the need for accurate recognition and sustainable management practices. Furthermore, by delineating the risks of overexploitation and population decline among rare or vulnerable species, this concept not only seeks to bridge the gap in existing nomenclature but also stresses the need for more informed practices, promoting sustainable resource management and conservation efforts.

Cognate Species: Examples and Conservation Concerns

To operationalize this concept, this work establishes two key subcategories: (1) congenerics and (2) non-congenerics or paracognates (Table 1). The following delineates groups of species and traditional/ economical uses within this framework. Furthermore, classic cases will be discussed where species identification within cognate groups has led to problems. These cases underscore the challenges in distinguishing species that share common uses, frequently resulting in confusion in both scientific classification and local practices. Understanding these issues is crucial for improving botanical knowledge and the sustainable management of natural resources, as well as ensuring that local populations are better informed about the plants they use.

The category of non-congeneric cognates encompasses plants with very similar morphology and common uses, but which belong to different taxonomic genera. A classic example of confusion within this group is the *espinheira-santa* cognate species complex (*Zollernia ilicifolia* (Brongn.) Vogel, *Monteverdia ilicifolia* (Mart. ex Reissek) Biral, and *Sorocea bonplandii* (Baill.) W.C. Burger, Lanj. & Wess. Boer). Among the three species commonly confused or intentionally collected, only *Monteverdia ilicifolia* (Mart. ex Reissek) Biral contains authentic medicinal substances (Caldas and Matos 2019). The other species may either produce no medicinal effects or even be toxic. This situation emphasizes the challenges within the group of medicinal cognates. Due to their implications for human health these have garnered increased attention in recent years, contributing to the development of advanced regulations aimed at ensuring correct identification and sustainable use (Agência Nacional de Vigilância Sanitária 2014; Bennett and Balick 2014).

The Amazon's traditional use of non-congeneric cognate species is exemplified by fiber extraction for the *piassaba, piaçaba*, or *piaçava* broom production. However, unlike the previous example, this practice lacks species-specific regulation, operating under broad harvesting protocols (Guimarães-Junior et al. 2020). The fibers are sourced from the species *Attalea funifera* Mart. (found in the Atlantic Forest), *Leopoldinia piassaba* Wallace (northern Amazon), and *Aphandra natalia* (Balslev & A.J. Hend.) Barford (western Amazon, but in Brazil, exclusively in the state of Acre). These species possess sclerenchymatous fibers derived from leaf petioles, which are highly valued for broom production. However, improper management, such as cutting down entire plants or harvesting immature individuals, can severely affect their population distribution and endanger the species' continuity in the wild (Josa et al. 2011). These improper practices can disrupt the species' ability to regenerate naturally, potentially leading to population

Table 1 Plant cognates: Definition of term, subcategories and examples. Plant Cognates are different species that produce commercially equivalent products where gatherers and/or consumers fail to discriminate at the species level - intentionally or not.

Subcategory	Examples	Possible species
Congeneric Cognates	Tauri	*Couratari guianensis* Aubl., *C. macrocarpa* Mart. ex O. Berg, *C. prancei* W.A. Rodrigues, possible others
	Palheiras	*Attalea butyracea* (Mutis ex L. f.) Wess. Boer, *A. phalerata* Mart. ex Spreng., *A. maripa* (Aubl.) Mart.
	Cipó-titica	*Heteropsis flexuosa* (Kunth) G.S. Bunting, *H. reticulata* Croat & M.L. Soares, possible others
	Açaí	*Euterpe oleracea* Mart., *E. precatoria* Mart.
Non-congeneric cognates or *Paracognates*	Espinheira-santa group	Espinheira-santa group: *Zollernia ilicifolia* (Brongn.) Vogel, *Monteverdia ilicifolia* (Mart. ex Reissek) Biral, *Sorocea bonplandii* (Baill.) W.C. Burger, Lanj. & Wess. Boer
	Piaçaba group	*Attalea funifera* Mart., *Leopoldinia piassaba* Wallace, *Aphandra natalia* (Balslev & A.J. Hend.) Barfod

decline and local extinction. Such practices can pose significant risks to the sustainability of these resources, especially in areas where these plants are used traditionally without clear regulatory frameworks (Kronborg 2008).

Due to its limited distribution in the western part of the state of Acre (Daly 2008), the improper management and indiscriminate extraction of *Aphandra natalia* (Balslev & A.J. Hend.) Barford can affect the health of the plant populations, especially in heavily exploited areas. Community harvesters' reports indicate the growing scarcity of harvestable individuals, underscoring the need for studies on the distribution, ecology, and sustainable collection methods for this native species of Acre (Isaza et al. 2013). Critically, if *piaçaba* brooms—made from *Aphandra natalia* (Balslev & A.J. Hend.) Barford —disappear from Acre's urban markets, popular perception may not recognize their disappearance as an indicator of the species' probable local extinction. This is because brooms made from other species, not found in Acre, will continue to be sold in the market, and the population will continue to buy them without realizing their contribution to the eventual decline of the *Aphandra natalia* (Balslev & A.J. Hend.) Barford populations.

In the first example of congeneric cognates (referring to taxonomically related species within the same genus), a classic case can be found in the emblematic history of *yerba mate* or *erva-mate* (*Ilex paraguariensis* A. St.–Hil.). Instances of mixed or substituted uses for *yerba mate* are considered adulterations since its cognates (such *Ilex theezans* Mart., *Ilex dumosa* Reissek and *Ilex brevicuspis* Reissek) contain biochemical compounds, such as saponins, that alter the flavor when used instead of *Ilex paraguariensis* A. St.–Hil. (Giberti 1989). Aimé Bonpland was possibly the first to warn about these adulterations in 1849 (Gerhardt 2013), and as consumption increased from the mid-twentieth century tea companies began mixing different species of *Ilex* L. By the late 1970s, there was a sharp reduction in cultivation areas, causing prices to rise. This prompted the 1977 Federal Law and the subsequent Brazilian regulations mandating the exclusive use of *Ilex paraguariensis* A. St.–Hil. for producing *yerba mate*, requiring companies to label their products with the species name (Brasil 1977).

A congeneric cognate example from the Amazonian timber species exploitation sector underscores the use of *tauari* (*Couratari* spp. Aubl.), an important resource for furniture production prized for the superior wood quality characteristic of this genus. In Acre, the three main native species commonly called *tauari* are *Couratari guianensis* Aubl., *Couratari macrocarpa* Mart. ex O. Berg, and *Couratari prancei* W.A. Rodrigues. While concerns in timber management often focus on silica content, which makes some species more difficult to process, the issue goes beyond this factor. Unsustainable exploitation, especially of the critically endangered *Couratari prance* W.A. Rodrigues (O'Brien 1998), can exacerbate

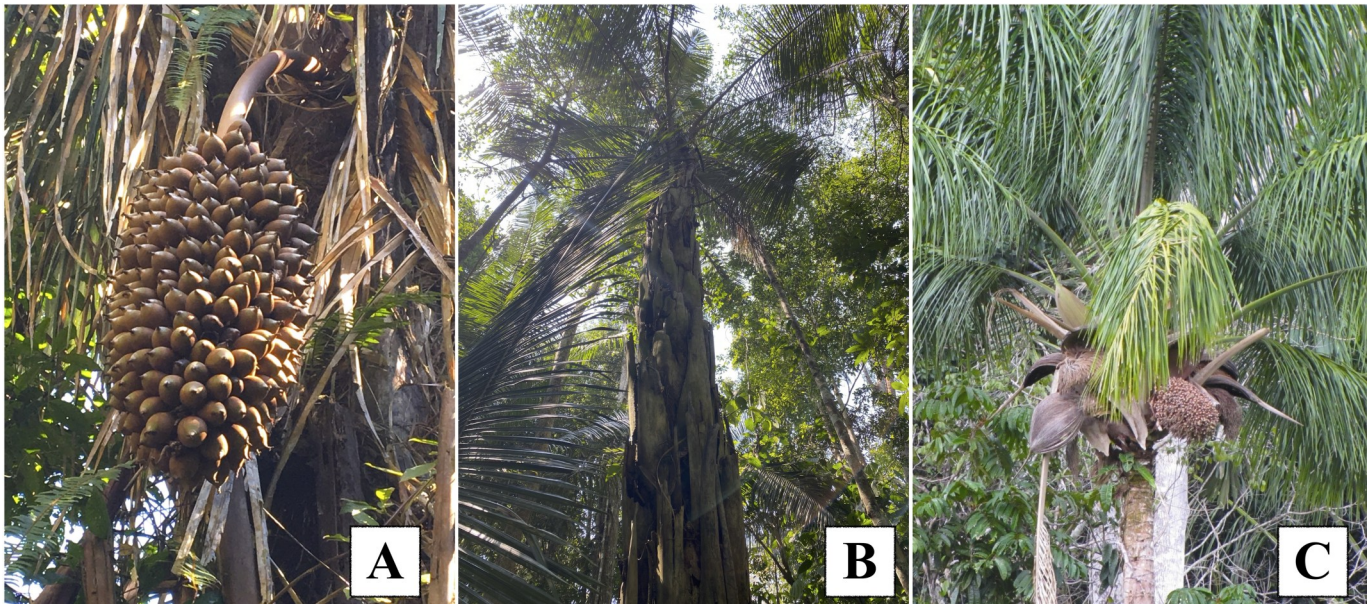

Figure 1 Three palm species belonging to the cognate group known as *palheiras* provide leaves for thatch production: **A** *Attalea butyracea*, **B** *Attalea phalerata*, and **C** *Attalea maripa*. All images by author.

population declines and increase extinction risks. These risks demand immediate attention to more stringent monitoring and improvements in species identification related to timber management. Many studies, reports, and technical notes emphasize the need for improved enforcement to better understand and apply the correct scientific names of species. This aims to ensure proper management and protect these species from over-exploitation (Procópio et al. 2010).

A similar situation of indiscriminate exploitation occurs with the congeneric cognate group of palm species known as *palheiras* (Figure 1), traditionally used for thatching. In Acre, species like *Attalea butyracea* (Mutis ex L. f.) Wess. Boer, *Attalea phalerata* Mart. ex Spreng., and *Attalea maripa* (Aubl.) Mart. provide leaves for thatch production. These species are often improperly harvested by felling the individuals, which are monopodial and thus unable to regenerate their populations. This practice becomes especially concerning for species like *Attalea phalerata* Mart. ex Spreng., which is found in Acre at the limit of its geographic distribution (Soares 2020). Direct observations, especially from Indigenous environmental monitors, provide evidence of what many Indigenous people in Acre are referring to as *the crisis of the palheiras*. They have observed a decline in populations and increasing difficulty in obtaining the desired individuals, as they are having to venture further into the forest to find these species (Comissão Pró-Indígenas do Acre 2001).

Another example of a group of cognate species affected by Amazonian wild harvesting involves the *titica vine* or *cipó-titica* (*Heteropsis flexuosa* (Kunth) G.S. Bunting and probably other *Heteropsis* Kunth species), which is harvested throughout the Amazon for its adventitious roots, used in making brooms and other handcrafted products. However, in different regions, including Acre, this species has several other cognates being locally exploited in its place. This happens since the plant's useful parts, the hanging adventitious roots, cannot be reliably used to identify the source species. The difficulty arises because the mother plant is located high in the tree branches, making it difficult to properly discern and identify the species. This complicates the exclusion of threatened, rare, or small population species from exploitation. As with previous examples, the lack of efficient identification criteria and regulations aimed at sustainable use means that rare or endemic species like *Heteropsis reticulata* Croat & M.L. Soares could be overharvested beyond their capacity for regeneration, severely depleting populations.

Empirical reports collected over recent years from local gatherers indicate a reduction in *cipó-titica* populations. Additionally, few studies address the sustainable harvesting of *cipó-titica*, with most focused

Figure 2 Monoculture plantation of *Euterpe oleracea* (Arecaceae), a non-native palm species in this region, along BR-364 near Tarauacá, Acre, Brazil. Image by the author.

on the eastern Acre (Wallace and Ferreira 2016), creating an urgent need for more comprehensive investigations, particularly since species with different demographics and regenerative capacities might be exploited equally. This situation, compounded by the absence of regulations in Acre, raises concerns that the current management practices for these species may not be sustainable. Freitas (2024) tested the risk of improper management of *cipó-titica* experimentally extracted roots at different intensities and concluded that harvesting the roots to near total extraction (100%) compromises sustainability. With these levels of extraction, there are no roots regrowing, and the research results also reported the death of the mother plant. Consumers who buy *cipó-titica* brooms may notice price variations but are often unable to detect the possible substitution of the source species or reflect on their own role in participating in the potential ecological impacts on the species.

The last, but no less significant, example involves a well-known group of cognate species: the *açaí* palms (*Euterpe* spp. Mart.). The controversies surrounding the expansion of cultivated areas for one such species have been termed *the açaí case* (Freitas et al. 2025), reflecting its paradoxical social effects and conservation implications. The economically important *Euterpe* Mart. species in Brazil have distinct natural distributions: *Euterpe edulis* Mart. in the Atlantic Forest, *Euterpe oleracea* Mart. in the eastern Amazon, and *Euterpe precatoria* Mart. in the western Amazon. While there are regions of sympatry, in most areas where *Euterpe oleracea* Mart. does not naturally occur, it has been introduced—either sporadically in community yards or extensively in large monocultural plantations (Figure 2).

Although within its native range, there is ample evidence that large monocultural plantations of *Euterpe oleracea* Mart. have negatively affected native biodiversity (Barros et al. 2023; Freitas et al. 2021; Silva et al. 2023). In the Atlantic Forest, studies have documented risks of hybridization and competition for essential ecological services, such as pollination and seed dispersal, directly impacting the native species *Euterpe edulis* Mart. (Tiberio et al. 2016). In Acre, where açaí juice (*vinho*) is widely sold by street vendors representing small to medium-scale collectors, fruit juice or pulp derived exclusively from *Euterpe oleracea* Mart. is increasingly common. However, these products often lack proper labeling, leaving consumers unaware of the species being used.

This scenario exemplifies a complex interaction of ecological and socio-economic dynamics, indicating the need for more research to anticipate the long-term impacts of the transition from forest harvesting systems (*E. precatoria* Mart.) to monocultural plantations of *E. oleracea* Mart. (Fonseca and Lima 2024). The example also aligns with the cognate species concept, where different species with closely related uses or traits are treated interchangeably in trade or local practices. Without proper management, these practices can undermine the ecological and conservation risks associated with species substitution.

Final Considerations

The concept of cognate plants serves as a tool for understanding groups of species that share functional uses and present taxonomic or morphological similarities. This model is particularly relevant when addressing challenges in traditional practices and resource management. The incorrect identification or unregulated exploitation of species within a group of cognates can mean the risk of overexploitation and the loss of biodiversity.

This aligns with the idea of utilitarian redundancy (Medeiros et al. 2020), but with a critical distinction: substitutability here is tied to cognate groups rather than any species serving the same function. From a Social-Ecological Theory of Maximization perspective (Albuquerque et al. 2019), this reflects how people preferentially use cognate species due to three factors: ecological accessibility, use effectiveness, and cultural familiarity. However, this very substitutability, the interchangeable use of various species as raw materials for identical end products, undermines conservation efforts when gatherers drive unsustainable harvesting of equivalent resources.

To mitigate this, consumer education on species origins must be strengthened to support ethical sourcing practices, considering the unequal distribution of knowledge and valuing multicultural and critical content. Beyond consumer awareness, the erosion of traditional ecological knowledge further compounds risks of unsustainable harvesting. Furthermore, commercial market demands can drive shifts toward monocultural production or exotic species cultivation, displacing traditional native cognate management systems. Evidence of this is seen in Borneo, where the native cognates of introduced *Mangifera indica* L., *Mangifera casturi* Kosterm., and *M. rubropetala* Kosterm., are now extinct in the wild, with only sporadic cultivation by local traditional communities persisting (Gunawan et al. 2024).

This latter case demonstrates that although many examples cited in the text are from Brazil and the Amazon, the applicability of this concept extends universally, wherever different but morphologically related plant species offer similar products for human needs. A fundamental requirement for addressing a group of cognates is the exact identification of the species, not only to improve knowledge about biodiversity but also to help support good traditional management and to promote a truly sustainable bioeconomy. By using a cognate plant perspective, species conservation and natural resource management efforts can be better aligned with local socioeconomic dynamics.

As noted above, reports from Indigenous communities and gatherer communities highlight the difficulty in obtaining individuals of important species such as *Heteropsis* spp. Kunth and roofing palms. Understanding how local perceptions of cognate species work is fundamental to developing management and sustainable use strategies that respect both ecological and cultural dimensions. Failure to adequately differentiate species risks accelerating the decline of rare or endemic plants, such as *Heteropsis reticulata* Croat & M.L. Soares, due to indiscriminate exploitation and the lack of popular perception of the consequences of such exploitation.

Monocultural plantations, such as those established for *Euterpe oleracea* Mart., exemplify the complexity of the paradoxical relationship between economic efficiency and ecological sustainability. Although monocultural systems increase production, they often negatively impact local biodiversity while diminishing the ecological knowledge incorporated into traditional practices. Conservation, propagation, and management efforts should prioritize the cognate native species of the *Euterpe* Mart. group in Acre, and management regulations should guarantee the use of these native species in forest restoration actions.

Therefore, the integration of this concept into research, policy, and community practices provides an important insight into a more realistic approach to biodiversity defense actions, while supporting cultural traditions and sustainable resource management. The use of the cognate plant concept allows collaboration between researchers, communities, policy-makers, and other stakeholders to organize the understanding of

the similarity of species with shared use in a better way, shedding light on the complexities of conservation and seeking the resilience and sustainability of both natural ecosystems and human societies.

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