Creativitas: Critical Explorations in Literary Studies
An International Journal of English and Cultural Studies

ISSN: 3048-8575 (Online)

Volume 3, Issue 1 (2026)

Manuscript Title: Why the Tree of Life? From Cosmological World Trees to Darwin's Branching Evolution

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ORCiD: 0009-0007-9892-9932

DOI: https://www.doi.org/10.5281/zenodo.24272528

Abstract

Across widely separated civilisations and religious traditions, one striking cosmological motif repeatedly appears: the presence of a central tree organising the structure of the universe. Examples include Yggdrasil in Norse cosmology, Ashvattha in Hindu mythology, the Bodhi Tree in Buddhist tradition, the Tree of Life in Biblical literature, the Maya World Tree in Mesoamerican traditions, and many more. Despite differences in geography and theology, the image of a central tree consistently emerges as a structure through which cosmic order is imagined.

Existing scholarship generally interprets these trees as mythological symbols representing the interconnectedness of life or cyclical processes of existence, treating them primarily as cultural metaphors or sacred cosmological images. Yet an important question

remains: is this recurrence merely a symbolic coincidence, or does the persistent appearance of the tree reflect a deeper structural intuition about reality itself, and why the tree rather than any other natural form?

This paper argues that the cross-cultural recurrence of the tree represents an instance of epistemic convergent evolution, reflecting embodied engagements with botanical life as active participants in human thought. The branching architecture of trees mirrors divergence and connectivity across ecosystems, genealogies, and evolutionary lineages, offering a non-anthropocentric lens on continuity and differentiation.

Methodologically, the study integrates mythological, cognitive, and scientific perspectives, grounded in theories of embodied cognition and cognitive affordance. It revisits Charles Darwin's branching diagram in *Notebook B* as an early scientific articulation of this structural logic and traces parallels in classical philosophical taxonomies (the Porphyrian Tree), linguistic evolution, and ecological thinking. In doing so, trees emerge as more-than-human agents shaping knowledge and cultural representation.

This paper contributes to critical plant studies, showing that cosmological and literary forms encode human engagement with living botanical life. The Tree of Life functions not merely as a symbol but as a living epistemic partner, guiding humans toward awareness of the relationality and interdependence of life itself.

Keywords: *World Tree; Tree of Life; Critical Plant Studies; Phytocriticism; Ontology; Comparative Mythology; Darwin's Notebook*.

Conflict of Interest: The author/s declared no conflicts of interest.

Article History: Received: 17 March 2026. Accepted: 04 October 2026. Published: 30 November 2026.

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Publisher: https://thesapientiainitiative.org/

Introduction

"Trees are poems that the earth writes upon the sky." — Kahlil Gibran, *Sand and Foam*.

When Kahlil Gibran famously described trees as "poems that the earth writes upon the sky," he articulated an intuition that extends far beyond poetic metaphor. Across distant cultures, the image of the central tree stands as a recurring archetype. In the freezing winds of the North, the Old Norse cosmology centred on Yggdrasil, a massive "cosmic ash tree" that functioned as the universe's nucleus, binding the realms of "earth, hell, and heaven together" (Lima 18, 22). Thousands of miles away, in the tropical lowlands of Mesoamerica, the Maya revered the Wacah Chan, a sacred Ceiba tree that served as a "world axis" connecting the three worlds of the underworld, the earth, and the heavens (Lima 18; McDonald 333). Simultaneously, the Vedic and later Hindu traditions contemplated the Ashvattha, an eternal fig tree whose mystical morphology, often depicted with "roots above and branches below", served as a macrocosm of existence (Aloi and Marder 50–51; Bhagat 779).

The persistence of this motif suggests a phenomenon far deeper than simple cultural diffusion. As Mircea Eliade argued in his foundational work on comparative religion, the Cosmic Tree functions as an *axis mundi*, a fixed, sacred point that "ontologically founds the world" by linking the profane and the sacred (69, 84). Eliade emphasised that while "history" may modify the specific "theophanies" or appearances of these trees, the underlying structure, the "celestial symbolism", remains non-temporal and primordial (341–43). Earlier anthropological scholarship, exemplified by James George Frazer's *The Golden Bough*, focused on dendrolatry (tree worship), interpreting it as "primitive" attempts to manipulate nature and regulate vegetational death and rebirth. Frazer notes:

> The representation of the tree-spirit both by the King of the Wood and by the Golden Bough (for it will hardly be disputed that the Golden Bough was looked upon as a very special manifestation of the divine life of the grove) need not surprise us, since we have found that the tree-spirit is not unfrequently thus represented in double, first by a tree or a bough, and second by a living person. (107)

The tree, therefore, is a symbol of "fertility, immortality, and rebirth," with the "King of the Wood" acting as a human incarnation of the tree-spirit responsible for making "the rain to fall, the sun to shine, [and] flocks and herds to multiply" (66–67, 106). However, both traditional folkloric approaches and classical history of religions remain bound to an anthropocentric paradigm. They assume that human minds independently generate symbolic meanings and project them onto passive botanical objects (Rival 2, 9). Furthermore,

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a significant research gap remains: why did civilisations repeatedly select the tree specifically, rather than other vertical or interconnected natural structures like mountains, rivers, or serpents? While mountains provide height and rivers represent linear flow, neither form simultaneously captures unity, divergence, and hierarchical differentiation (Ingold 2–3, 43; Lima 123, 231).

To solve this problem of selection, this article establishes its theoretical framework at the intersection of Critical Plant Studies and embodied cognition. Rather than relegating vegetal philosophy to the margins of analysis, this study adopts a phytocritical lens at the outset, proposing that trees are active epistemic partners in the formation of human conceptual systems. As philosopher Michael Marder argues in *Plant-Thinking: A Philosophy of Vegetal Life*, plants possess a "non-conscious intentionality" and a "vegetal democracy" of dispersed, non-hierarchical growth (10, 25, 35). Marder suggests that human cogitation is altered, "de-humanized, and rendered plant-like" through its fundamental encounter with the forest (10). The recurring Tree of Life motif is not a passive human projection, but the "transfigured" manifestation of this vegetal logic in human thought (Marder 10).

The theoretical framework for this inquiry is grounded in the principles of embodied cognition and conceptual metaphor. As George Lakoff and Mark Johnson argue:

> Our concepts structure what we perceive, how we get around in the world, and how we relate to other people. Our conceptual system thus plays a central role in defining our everyday realities. If we are right in suggesting that our conceptual system is largely metaphorical, then the way we think, what we experience, and what we do every day is very much a matter of metaphor. (4)

In this view, abstract concepts are understood through spatial orientation metaphors, such as MORE IS UP or ORGANIZATION IS PHYSICAL STRUCTURE (14, 207). Manuel Lima expands on this by noting that the tree structure is uniquely successful because it "pragmatically expresses the materialisation of multiplicity (represented by its succession of boughs, branches, twigs, and leaves) out of unity (its central foundational trunk)" (25).

Furthermore, cognitive anthropologist Scott Atran suggests that humans possess an innate "folkbiological taxonomy" that utilises hierarchical categorisation as a "powerful logical device" (Atran 162). As Atran notes, humans have a "precocious emergence of

essentialist folkbiological principles" that naturally lead them to classify organisms in "groups under groups," a structure that Charles Darwin eventually literalised in his "tree of life" diagram in *On the Origin of Species* (Atran 691, 696; Darwin 325–27; Lima 47).

This research directly confronts the central question: why does the image of a central tree repeatedly emerge across geographically separated civilisations as a model of cosmic order and knowledge, and why the tree rather than any other natural form?

This article argues that the recurrence of the Tree of Life is an instance of epistemic convergent evolution (Lima 16, 25). The branching morphology of the tree provides a uniquely effective cognitive affordance and structural syntax for representing continuity through differentiation (Gibson 9, 13; Lima 7, 39). The tree persists because its physical growth mirrors how complex systems develop and how the human mind categorises reality. By tracing this structural logic through comparative cosmologies, classical philosophical taxonomies (the Porphyrian Tree) (Lima 31, 32), historical linguistics (Campbell and Poser 12), Darwinian evolution (*Notebook B*) (Darwin 325–27; Solinas 313–15), decision trees (Quinlan 84), and contemporary forest ecology (Simard 42), this paper demonstrates that the tree is not merely a cultural icon, but a living architecture of human thought.

Cosmological Trees Across Cultures: Structural Convergences Beyond Symbolism

The human drive to organise reality, to transform a "blooming, buzzing confusion" into a coherent system, has historically relied on robust architectural metaphors (Paden 69). As Mircea Eliade establishes, the religious person's need to inhabit a "cosmos" rather than a "chaos" necessitates a fixed, sacred point (69). This point, the *axis mundi*, often manifests as a cosmic tree that functions as an opening between different planes of existence, linking the celestial with the terrestrial and the subterranean (69).

Yggdrasil: The Relational Framework of Norse Cosmology

In Old Norse cosmology, the universe is structured around Yggdrasil, a massive cosmic ash tree whose body binds together the "nine worlds" of Norse myth (Andrén 27; Moser 104). While secondary summaries often reduce Yggdrasil to a static, metaphysical diagram of cosmic planes (Andrén 49; Moser 104), a close reading of the primary Old Norse poetry in the *Poetic Edda* reveals that Yggdrasil is depicted as a highly vulnerable and living biological system.

In *Grímnismál* (stanzas 35–36), the text explicitly emphasises the continuous biological distress and physical suffering endured by the world tree:

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> *Yggdrasils askr / drýgir erfiði / meira en menn viti; / hförtur bíta ovan, / en á hliðu fúnar, / gcina Níðhöggr neðan.* ("Yggdrasil's ash / suffers distress / more than men know; / the hart bites from above, / and on the side it rots, / Níðhöggr gnaws from below.") (*Poetic Edda*, *Grímnismál* 35)

The primary text details a complex, metabolic ecology of consumption and decay: four stags (Dáinn, Dvalinn, Duneyrr, and Duraþrór) continuously devour its upper shoots, its central trunk suffers rot (*fúnar*), and the subterranean dragon Níðhöggr constantly gnaws at its deepest roots. Rather than an inanimate structural scaffold, Yggdrasil is a suffering organism whose internal fluids actively circulate throughout the universe. In *Völuspá* (stanza 19), the tree is described as *"askr yppandir... ausinn hvítu auri"* ("an ash raised up, sprinkled with white mud/dew"), from which falls the honeydew (*dronnar í dali*) that feeds the earthly valleys (*Poetic Edda*, *Völuspá* 19; Lima 22).

The living status of Yggdrasil is also demonstrated in the apocalyptic narrative of Ragnarök. In *Völuspá* (stanza 45), the impending destruction of the universe is not signalled by a celestial collision, but by the physiological trauma of the tree itself: *"scelfr Yggdrasils / askr standandi, / ymbr hið aldna tré"* ("Yggdrasil's ash / trembles as it stands; / the ancient tree groans") (*Poetic Edda*, *Völuspá* 45). The verbs *scelfr* (trembles) and *ymbr* (groans/echoes) convey an organic agony. The world tree is thus not a passive backdrop for cosmic events; its physiological collapse is the collapse of the cosmic order. The Norse tradition chose the tree because its organic vulnerability mirrors the living world's precarious stability.

Ashvattha: The Inverted Logic of Manifestation

Where Norse cosmology presents an ash tree anchored in the earth, the Vedic and Hindu traditions contemplate the Ashvattha (a sacred fig, *Ficus religiosa*), characterised by its striking *arbor inversa* morphology, an "inverted tree" with "roots above and branches below" (Aloi and Marder 60; Bhagat 779). This geometry is explicitly articulated in *The Bhagavad Gita*: "ऊर्ध्वमूलमधःशाखमश्वत्थं प्राहुरव्ययम् । छन्दांसि यस्य पर्णानि यस्तं वेद स वेदवित् ॥" which translates to, "They speak of an eternal Ashvattha tree with its roots above and branches below, whose leaves are the Vedic hymns; he who knows this tree is a knower of the Vedas" (*The Bhagavad Gita* 15.1).

The text continues in stanza 15.2 by describing its spatial expansion: *"adhaś cordhvaṁ prasṛtās tasya śākhā"* ("Below and above its branches spread"), nourished by the cosmic qualities (*guṇas*), with the objects of the senses as its sprouts, stretching roots downward to engender action in the human world (*The Bhagavad Gita* 15.2; Aloi and Marder 60). As described in *The Bhagavad Gita* and the *Katha Upanishad*, this inversion serves as a structural model of the relationship between the transcendent source and the manifested world (Bhagat 779; Aloi and Marder). The "roots above" signify a primordial, unmanifested unity, while the "branches below" represent the proliferation of multiplicity in the material world (Aloi and Marder).

To fully understand this inverted morphology, one must engage Michael Marder's concept of "plant-thinking" (Marder 10, 117). Occidental metaphysics has historically devalued vegetal life by viewing its root embeddedness in subterranean darkness as a figure of "unfreedom" and cognitive passivity (Marder 108, 117). The *arbor inversa* of the *Bhagavad Gita* radically uproots this anthropocentric framework. By placing the primary root (*mūlam*) in the transcendent, unmanifested realm (*ūrdhva*) and spreading its sensory foliage (*śākhām*) downward into the material world (*adhaḥ*), the text collapses the traditional Western opposition between the *uranic* (heavenly/soul) and the *chthonic* (earthly/body) (Aloi and Marder 60).

The Bodhi Tree: Epistemic Centre and Spatial Anchor

In Buddhist tradition, the *Ficus religiosa* transforms a cosmological axis into an explicit "epistemic centre", the Bodhi Tree under which Siddhartha Gautama attained *bodhi* (awakening/enlightenment) at Bodh Gaya (Lima 19; Harvey 75). The living tree served as the original spatial anchor for the culmination of spiritual growth. On this physical site, the conditionality and interdependent co-arising (*pratītyasamutpāda*) of existence were fully comprehended (Harvey 75, 82). The early Buddhist stūpa provides a physical literalisation of this tree's organising role. The stūpa's central axial pillar, or *yūpa*, was often a "substitute for the axial world tree" (Harvey 77). Harvey notes:

> It is more likely that the axis was an "Indra's stake" in a purely symbolic sense, symbolising the Dhamma, the stable centre of a Buddhist's life, which secures his safety in life's troubles and also acts as a "gateway" to a better life and, ultimately, to Deathlessness. (80)

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Interpreted phytocritically, this architectural shift addresses the vulnerability of botanical life. Unlike living trees, which remain bound to a "metabolic ecology" of rot, decay, and saṃsāric impermanence, the stone stūpa represents a deliberate cultural attempt to fossilise or petrify the tree's cognitive scaffolding (Marder 83, 111).

By erecting a rigid stone *yūpa* at the stūpa's centre, builders captured the tree's primary morphological affordance, its stabilising vertical centre, while stripping away its biological vulnerability (Gibson 127; Harvey 80). This material transition directly mirrors the soteriological goal of Buddhism: escaping the biological cycle of rebirth (*saṃsāra*) to attain *Nibbāna*, the "unshakeable state" (*Inda-khīla*) of the enlightened mind (Harvey 80). Even in stone, the stūpa preserves arboriform syntax through its tiered parasol discs (*chattrāvalī*), petrifying vegetal logic to insulate human enlightenment from natural decay (Harvey 75, 80).

The Biblical Tree of Life: Organisational Features of Edenic Space

In Genesis 2:9, the Tree of Life is established as the central organising feature of Edenic space:

> And out of the ground made the LORD God to grow every tree that is pleasant to the sight, and good for food; the tree of life also in the midst of the garden, and the tree of knowledge of good and evil. (Genesis 2:9; King James Version)

A close textual reading of the original Hebrew phrasing, specifically the spatial locator b'toch ha-gan ("in the midst/center of the garden"), reveals that the Tree of Life (*'etz ha-chayim*) functions as the absolute geometric and spiritual axis of the primordial world (Lima 16; Aloi and Marder 62). However, in contrast to the holistic synthesis of the Hindu *Ashvattha* (where life and knowledge are unified on one plant), the Biblical narrative introduces a fundamental spatial and ontological bifurcation (Aloi and Marder 62). It places two distinct trees at the centre: the Tree of Life (representing eternal temporal continuity) and the Tree of Knowledge of Good and Evil (*ve'etz ha-da'at tov va'ra'*, representing ethical differentiation) (Genesis 2:9; Aloi and Marder 62).

This structural separation defines the spatial dimensions of the "Edenic condition" (Aloi and Marder 62–63). Humanity's original sin, consuming the fruit of ethical differentiation, creates an immediate expulsion from the spatial vicinity of the Tree of Life: "lest he put forth his hand, and take also of the tree of life, and eat, and live for

ever" (Genesis 3:22; Lima 16). The Biblical narrative uses the spatial placement of trees to construct a foundational threshold between sacred immortality and mortal history, dividing human vegetality from ethical self-consciousness (Aloi and Marder 63).

The Wacah Chan: The Three-Dimensional Coordinate System of the Maya

For the ancient Maya, the world tree—manifested as the gigantic, spiny Ceiba tree (*Ceiba pentandra*), known epigraphically as the Wacah Chan or *Yaxche*—provided a sophisticated "three-dimensional coordinate system" for mapping creation (McDonald 333; Moser 111).

In Mayan mythic literature such as the *Popol Vuh* and monumental inscriptions (such as the 7th-century Tablet of the Foliated Cross at Palenque), the *Wacah Chan* is described as sprouting at the primordial moment of creation to raise the sky (*Ka'an*) above the primaeval waters of the underworld (*Xibalba*) (McDonald 333; Lima 18).

Its massive, tuberous root system penetrates deep into the watery subterranean abyss of *Xibalba*, depicted iconographically as emerging from the jaws of the terrestrial Water-Lily Monster (McDonald 333; Atran 159). Its columnar trunk forms the vertical conduit connecting the earth plane, while its broad, spreading canopy reaches into the thirteen layers of the celestial realm (*Ka'an*), topped by the Principal Bird Deity (McDonald 333; Lima 18).

On the Palenque panels, the lateral branches of the *Wacah Chan* do not merely bear leaves; they terminate in jewel-encrusted ears of maize and stylised human heads representing royal ancestors (McDonald 333; Lima 18). Mayan epigraphy thus explicitly writes the proliferation of royal dynasties and agricultural abundance as botanical offshoots sprouting from a single, central vegetal axis, demonstrating that human historical continuity was conceived as an extension of tree growth (McDonald 333; Moser 111).

Comparative Synthesis: Morphology as Metaphor

When we look across global traditions, the appearance of the tree is not merely a coincidence or an arbitrary choice of symbol. Civilisations did not pick the tree at random; they turned to it because its physical growth offers an intuitive, spatial grammar for organising complex ideas about existence.

A Central Axis: The Spatial Fixity of the Foundational Trunk

Across ancient cosmologies, the main trunk of a tree acts as a fixed axis that carves order out of chaos. To human perception, raw space can feel disorienting and vast without a

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baseline to mark a clear centre (Eliade 23; Paden 69, 154). By driving roots deep into subterranean ground while stretching its canopy into the sky, a tree's trunk creates a permanent vertical landmark (Paden 69). Whether we examine Norse *Yggdrasil*, the Maya *Wacah Chan*, or the Biblical tree planted "in the midst of the garden," the central trunk establishes an ontological core (Genesis 2:9; McDonald 333; Moser 111; Paden 154). It gives us a primary coordinate system from which cardinal directions, cosmic levels, and human territories take their meaning, converting an intimidating spatial void into an organised, inhabitable world (Eliade 23; Paden 69).

Branching Differentiation: The Visual Logic of Division

The splitting branches of a tree crown offer a clear, visual model for how variety grows out of a single source without breaking the underlying system apart (Campbell and Poser 12; Lima 25). In classical logic, most famously seen in the *Porphyrian Tree*, as well as in ancient myth, a primary bough dividing into secondary limbs and smaller twigs provides a natural template for step-by-step reasoning and conceptual classification (Lima 31, 114). By showing how new forms sprout at distinct node-points while staying tied to the central stem, the tree's architecture gives us the exact conceptual scaffolding needed to visualise historical lineages, moral categories (like medieval trees of virtues and vices), and the splitting of academic disciplines from a single origin (Campbell and Poser 12; Lima 25, 32).

Relational Connectivity: The Multidirectional Cosmic Bridge

Unlike flat geometric shapes or rigid ladders, a tree operates as a living, multidirectional web that enables both vertical movement and lateral growth (Ingold 43, 81). A simple linear path or ladder (*scala naturae*) forces a rigid, one-way progression that fails to capture the tangled relationships of ecosystems, genealogies, or spiritual realms (Ingold 2–3, 43; Jenner 572). A tree, by contrast, functions like a circulatory system where fluids and energy pass continuously between roots, trunk, and leaves, as seen in *Yggdrasil's* circulating dew or the *Ashvattha's* downward sensory shoots (*Poetic Edda*, *Völuspá* 19; Aloi and Marder 60). It weaves individual points into an interconnected network, intersecting vertical ascent and descent with horizontal spreading (Ingold 43, 81). In doing so, the tree serves as an integrated bridge, allowing human cultures to map environmental dependencies, ancestral histories, and cosmic tiers within a single, dynamic body (Ingold 81; Moser 109).

Continuity Across Levels: How "Nesting" Shapes Hierarchical Thought

The physical logic of nesting in a tree, where leaves are held within twigs, twigs within branches, branches within boughs, and boughs within the trunk, provides the direct physical blueprint for human classification systems (Gibson 9, 73; Atran 646, 688). In visual psychology, James J. Gibson demonstrates that our environment is naturally understood through "forms within forms," where smaller components are contained by larger structures (9, 73). A leaf cannot exist in perceptual isolation; it is physically attached to and fed by the twig from which it grows, which in turn belongs to a larger branch (Gibson 9). This physical containment gives us a tangible model for abstract categorisation: from Aristotle's logic and Linnaean biology to modern decision trees (Atran 691; Gibson 9, 73; Quinlan 84). The physical relationship of parts to the whole makes abstract hierarchies instantly legible to the human mind.

Integration of Multiplicity into Unity: The Gathering Centre

Finally, the tree offers a practical answer to the timeless philosophical problem of the "One and the Many" by demonstrating how vast complexity can be gathered back into a single, cohesive unit (Lima 25; Marder 10, 155). A mature tree supports thousands of distinct leaves, flowers, and fruits, yet it remains one bounded organism anchored to a single root system (Schwenk 14, 67). In human knowledge systems, this prevents expanding information from fragmenting into chaos. By linking a wild diversity of outer shoots back to a shared trunk, the tree gives us visual confidence that diversity does not destroy underlying unity. Whether bringing together sprawling royal bloodlines, complex theological ideas, or evolutionary species on a phylogenetic tree, the arboriform shape remains our most enduring framework for gathering multiplicity into a single, intelligible whole (Darwin 325–27; Lima 25; Marder 155–56).

Why the Tree? Cognition, Morphology, and the Architecture of Thought

Why did human societies repeatedly choose the tree over other prominent natural structures? To answer this question, scholarship must move beyond treating the tree as an arbitrary cultural symbol and investigate the convergence between botanical morphology and human cognitive architecture (Atran 644; Gibson 127; Goethe xvii–xx).

Goethe's Urpflanze and the Morphological Logic of Growth

To understand why the tree functions as an enduring model for human thought, we must first examine the generative principles of plant morphology articulated by Johann

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Wolfgang von Goethe in *The Metamorphosis of Plants* (1790). Rejecting the static, rigid taxonomies of Carl Linnaeus, Goethe sought a dynamic principle that could explain the unity underlying all botanical diversity—an original, archetypal plant (*Urpflanze*) (Goethe xvii, xxiii). Walking through the Botanical Garden at Padua and the public gardens of Palermo, Goethe experienced a famous epiphany: "From first to last, the plant is nothing but leaf, which is so inseparable from the future germ that one cannot think of one without the other" (Goethe xvii). For Goethe, the "leaf" was not merely a single green organ, but a protean, dynamic archetype (*Proteus*) that successively transforms itself into cotyledons, stem leaves, sepals, petals, stamens, pistils, and fruit (Goethe xvii–xix).

Goethe posited two great driving forces behind this metamorphic process: "intensification" (*Steigerung*), an "ever-striving ascent" toward qualitative complexity and spiritual refinement, and "polarity" (*Polarität*), an alternating rhythmic pulse of expansion and contraction (Goethe xix–xx). In Goethe's model, the plant expands from the seed into vegetative stem leaves, contracts into the sepals of the calyx, expands into the colourful blossom of petals, contracts into the essential reproductive organs (pistil and stamen), expands into the swelling fruit, and ultimately contracts back into the concentrated seed (Goethe xx; Marder 142).

This morphological logic allows a living plant to generate vast complexity without fracturing its central systemic identity. As Theodor Schwenk demonstrates in *Sensitive Chaos*, organic creation is governed by flowing, generative processes where "an organic form, despite continuous chemical change, remains intact" (Schwenk 14, 67). The tree's branching system is thus an orderly expansion of a single foundational unity (Goethe xix; Schwenk 67).

Phenomenology, Affordance, and Embodied Realism

This botanical morphology intersects directly with human perceptual and cognitive mechanisms. In *The Poetics of Space*, phenomenologist Gaston Bachelard notes that natural forms provide immediate spaces of psychological intimacy and daydreaming, pointing to the tree's "heroic uprightness" and its capacity to anchor a house or human psyche with "cosmic roots" (Bachelard 22, 52, 140). Bachelard observes that human imagination instinctively seeks refuge in arboriform geometries, such as the nested protection of a bird's nest in a tree's fork, because the tree offers a localised, stable centre for an expanding universe of thought (Bachelard 52, 94, 104).

This phenomenological intuition receives empirical grounding in James J. Gibson's *The Ecological Approach to Visual Perception*. Gibson coined the concept of "affordance" to define what an environmental layout "offers the animal, what it provides or furnishes, either for good or ill" (Gibson 127). Gibson demonstrates that visual perception does not process abstract, disembodied geometrical points; rather, animals directly perceive environmental affordances based on the physical complementarity between their bodies and the layout of surfaces (Gibson 127–29).

This structural perception is further reinforced by the principles of embodied cognition. As George Lakoff and Mark Johnson argue in *Philosophy in the Flesh*, "reason is not disembodied" (4). Human conceptual systems are grounded in sensorimotor experiences and spatial orientation metaphors derived from bodily existence, such as ORGANIZATION IS PHYSICAL STRUCTURE and MORE IS UP (Lakoff and Johnson, *Philosophy in the Flesh* 4, 14, 207; Lakoff and Johnson, *Metaphors We Live By* 14). Because humans interact daily with stationary, rooted objects, the tree provides a concrete physical metaphor for stability and structural hierarchy (Gibson 13; Lakoff and Johnson, *Philosophy in the Flesh* 27).

Structural Suitability Rather than Cultural Borrowing

Pascal Boyer argues in *Religion Explained* that cultural transmission is "relevance-driven" (164). Concepts that "excite more inference systems, fit more easily into their expectations, and trigger richer inferences" are more likely to be "acquired and transmitted" (164). The tree structure is cognitively efficient because it aligns with our brain's internal inference systems for categorisation and memory (Boyer 47).

Manuel Lima demonstrates that tree diagrams have emerged independently across cultures because they solve similar "cognitive problems" related to the "visual organisation" of branching knowledge systems (15–16). The convergence suggests that different civilisations independently arrived at the tree form because it represents a "natural basin of possibilities" to which human cognitive lives "spontaneously converge" (Atran 470, 477).

Transition Toward Darwin: The Scientific Rediscovery of a Structural Intuition

This deep compatibility between tree morphology and human cognition reaches its ultimate expression in modern evolutionary thought. When Charles Darwin first sketched his branching diagram in *Notebook B*, he was literalising a structural intuition that was millennia old.

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Darwin recognised that the "odd looking affair" of a branching diagram was "indispensable to show the nature of the very complex affinities of past & present animals" (Lima 38, 255). His theory of "descent with modification" required a branching structure because evolution unfolds through "branching continuity" rather than linear progression (Ingold 3). Thus, "evolutionary theory was Goethean morphology running on geological time" (Richards, qtd. in Goethe xv). Darwin did not arbitrarily adopt the tree form; rather, the "isomorphism" between the tree's physical morphology and the "relational growth" of biological species made the tree the only "morphologically suitable" model for evolutionary descent. This transition from the mythological "world axis" to the scientific "phylogenetic tree" reveals the tree's enduring status as the definitive architecture for mapping the development of life itself (Lima 16).

Darwin's Notebook B and the Scientific Rediscovery of the Tree

In the nineteenth century, Charles Darwin's transition from static taxonomies to a dynamic, branching model of life represented an independent scientific convergence. In Darwin's hands, the tree ceased to be an atemporal symbol of cosmic harmony and became a structural necessity for mapping the historical contingency of descent with modification.

Textual and Visual Analysis of Notebook B (1837): "I Think" and the "Coral of Life"

In July 1837, shortly after returning from his voyage on HMS *Beagle*, Darwin opened his *Notebook B* to explore systematically the "transmutation of species" (Darwin, *Notebook B* 1, 21; Kohn 168). On page 21, he recorded his first explicit formulation of arboriform growth*:* "organised beings represent a tree, irregularly branched some branches far more branched. —Hence Genera. — as many terminal buds dying, as new ones generated" (Darwin, *Notebook B* 21). Here, Darwin identifies the terminal bud as the fundamental unit of generational continuity and death, recognising that the formation of taxonomic genera requires a continuous balance between proliferation and loss (Darwin, *Notebook B* 21; Solinas 316).

Four pages later, on pages 25–26, Darwin pauses to refine this botanical metaphor, introducing a striking textual alternative:

"The tree of life should perhaps be called the coral of life, base of branches dead; so that passages cannot be seen — this again offers contradiction to constant succession of germs in progress —" (*Darwin*, Notebook B *25–26)*

In this "coral" passage, Darwin performs a rigorous critical assessment of the tree metaphor. A living tree possesses living bark across its entire trunk, which might falsely suggest an unbroken, observable connection between ancient ancestors and present forms (Darwin, *Notebook B* 25; Kohn 169; Solinas 316). A coral reef, by contrast, consists of a thin layer of living polyps growing upon a massive, calcified structure of dead ancestors (Darwin, *Notebook B* 25; Archibald 80; Solinas 316). By writing "base of branches dead; so that passages cannot be seen,*"* Darwin literalises the structural role of extinction and deep time (Darwin, *Notebook B* 25; Solinas 316). Extinction obliterates intermediate forms, creating the immense structural gaps observed between living genera and explaining why the "community of descent" remains a hidden genealogical bond (Darwin, *Notebook B* 25–26; Kohn 169; Solinas 316).

This structural logic culminates on page 36 of *Notebook B* beneath the famous heading *"I think"* (Darwin, *Notebook B* 36; Solinas 316). Above his sketch of an irregularly branching diagram, Darwin writes: "Case must be that one generation then should be as many living as now. To do this & to have many species in same genus (as is) REQUIRES extinction" (Darwin, *Notebook B* 36). The accompanying diagram visualises this mathematical rule: thirteen lines terminate in perpendicular cross-bars (representing surviving species that leave offspring), while twelve other lines terminate prematurely without cross-bars (representing extinct lineages) (Darwin, *Notebook B* 36; Solinas 316). Darwin's sketch then is a diachronic map of lineage splitting (*cladogenesis*), where current diversity (*B, C, D*) is shown to diverge from a single ancestral origin (*1*) through the structural necessity of extinction (Darwin, *Notebook B* 36; Jenner 550; Kohn 169).

Close Textual Analysis of On the Origin of Species (1859): The "Great Tree" Passage

Twenty-two years after his initial notebook sketches, Darwin published *On the Origin of Species* (1859). The only illustration featured in the entire book is a folding copper-plate diagram of a branching phylogenetic tree, to which Darwin dedicated eight pages of detailed textual exposition in Chapter IV ("Natural Selection") (Darwin, *Origin* 116–26; Lima 130). Darwin concludes this crucial chapter with an extended prose passage that elevates the tree from a private diagram to a grand, literary synthesis:

> The affinities of all the beings of the same class have sometimes been represented by a great tree. I believe this simile largely speaks the truth. The green and budding twigs may represent

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> existing species; and those produced during each former year may represent the long succession of extinct species. At each period of growth all the growing twigs have tried to branch out on all sides, and to overtop and kill the surrounding twigs and branches, in the same manner as species and groups of species have at all times overmastered other species in the great battle for life... As buds give rise by growth to fresh buds, and these, if vigorous, branch out and overtop on all sides many a feebler branch, so by generation I believe it has been with the great Tree of Life, which fills with its dead and broken branches the crust of the earth, and covers the surface with its ever branching and beautiful ramifications. (Darwin, Origin 130)

A close textual analysis of this famous passage reveals how Darwin weaves botanical mechanics directly into his theory of natural selection:

- Competitive Verbs and the Battle for Life: Darwin employs aggressive, active verbs like "tried to branch out," "overtop," "kill," and "*overmastered"* to describe arboriform growth (Darwin, *Origin* 130). The physical crowding of living twigs on a bough becomes a direct, literal embodiment of the *"great battle for life"* in natural ecosystems (Darwin, *Origin* 130; Lima 133).

- The Organ of the Bud as Lineage Continuity: Darwin explicitly focuses on the bud as the generative vehicle of heredity: "As buds give rise by growth to fresh buds, and these, if vigorous, branch out..." (Darwin, *Origin* 130). By selecting the bud, an organ capable of both vegetative propagation and branching differentiation, Darwin anchors the abstract concept of "descent with modification" in concrete plant physiology (Darwin, *Notebook B* 21; Darwin, *Origin* 130; Lima 133). Vigorous buds survive and ramify; feebler buds are shaded out and perish, mirroring differential reproductive success across generations (Darwin, *Origin* 130).

- Spatial Stratification: Subterranean Crust vs. Earth's Surface: Darwin constructs a profound spatial contrast between the subterranean geological record and the living surface (Darwin, *Origin* 130). The earth's geological crust is described as being "filled with its dead and broken branches," transforming fossil strata into the literal, fossilised wood of the Great Tree (Darwin, *Origin* 130). Meanwhile, present

biodiversity "covers the surface with its ever branching and beautiful ramifications" (Darwin, *Origin* 130). The dead branches in the crust are not useless refuse; they constitute the essential, structural foundation that physically supports the living canopy above (Darwin, *Notebook B* 25; Darwin, *Origin* 130; Solinas 316).

Impact: Lineage Thinking and Dismantling the Scala Naturae

Darwin's textual and graphic revolution fundamentally dismantled the traditional Great Chain of Being (*scala naturae*) and the symmetrical "quinary" classification systems (such as those of William Sharp MacLeay and William Swainson) that dominated early nineteenth-century natural history (Darwin, *Notebook B* 114, 263; Jenner 551; Solinas 314–15). Symmetrical systems relied on atemporal symmetry, assuming that nature was a fixed, static grid with no inherent capacity for historical transformation (Jenner 566; Solinas 314).

Darwin replaced atemporal symmetry with temporal asymmetry and historical contingency (Jenner 551, 566; Solinas 315). While a ladder implies a unidirectional, teleological march toward human perfection, the tree emphasises that species diverge unpredictably based on local adaptation and ancestral inheritance (Darwin, *Notebook B* 225; Solinas 315, 317). In this genealogical framework, humans cease to be the "pinnacle" of a vertical ladder; they are recognised as merely one among millions of terminal buds on a sprawling, irregularly branched structure (Darwin, *Notebook B* 21; Jenner 572; Solinas 317).

As evolutionary biologist Ronald A. Jenner demonstrates in "The Emergence of Lineage Thinking," Darwin's branching model successfully unifies two distinct evolutionary realms:

1. The Realm of Taxa (Tree Thinking): The synchronic, empirically accessible pattern of collateral relatives produced by lineage splitting (*cladogenesis*) (Jenner 550–51).
2. The Realm of Lineages (Lineage Thinking): The diachronic, continuous process of evolutionary modification running along single streams of ancestors and descendants (*anagenesis*) (Jenner 550–51).

By combining close textual prose with his branching diagram, Darwin demonstrated that tree morphology is the only model capable of holding these two realms together (Darwin, *Origin* 130; Jenner 551; Lima 130). The Tree of Life thus achieved its modern apotheosis: a scientific rediscovery that converted an ancient cosmological archetype into the

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definitive, empirical architecture of biological history (Darwin, *Origin* 130; Lima 7, 134; Solinas 314).

Beyond Biology: Trees as Architectures of Knowledge

The Tree of Life also persists across philosophy, linguistics, and computation, suggesting a utility that transcends biological imagery. By providing a spatial logic for hierarchy, the tree diagram facilitates "cognition and insight" in ways other natural forms cannot.

The Classical Model: The Porphyrian Tree

In the history of Western philosophy, there exists a profound theoretical irony at the root of classical logic. Beginning with Aristotle's *De Anima* and *Categories*, classical metaphysics constructed a rigid *scala naturae* that placed plants at the very bottom of the natural hierarchy, deeming them passive, insensate, and lacking a rational soul (Aristotle 410b; Hall 17–20; Marder 165–67). As Matthew Hall demonstrates in *Plants as Persons*, this zoocentric orientation established a "logic of domination" that excluded plants from moral consideration and reduced them to passive objects for human use (17, 37–39).

Yet, when the Neoplatonist logician Porphyry wrote his *Isagoge*, the definitive third-century introduction to Aristotle's *Categories*, classical logic encountered an insurmountable problem: to visualise and categorise its highest rational abstractions (moving from supreme genus down to *infima species*), it could not function through abstract symbols alone (Hall 21, 44; Porphyry 10.9). To render its taxonomy legible, Aristotelian logic was forced to adopt the biological morphology of the plant, producing the Porphyrian Tree (*scala praedicamentalis*) (Hall 21; Lima 28, 44).

The Porphyrian Tree is not a mere "metaphor" or an external "didactic tool" devised for students (Hall 21; Marder 10, 108). Rather, it reveals that the very architecture of classical human logic is fundamentally vegetal (Hall 21; Marder 108). To classify substance, quality, and relation, human reason inherently depends on the branching syntax of the plant (Hall 21; Marder 10). The very system that historically devalued plant life was entirely reliant on botanical morphology to map its own capacity for rational thought (Hall 17, 21; Marder 165–67).

Cultural Lineages: Linguistic Ecology and the Stammbaum

When historical linguistics sought to track the evolution of human speech in the nineteenth century, it similarly turned to arboriform growth. August

Schleicher's Stammbaum (family tree) model explicitly treated linguistics as a "natural science," conceptualising ancestral "mother languages" branching into "daughter languages" and regional dialects (Campbell and Poser 12, 66).

Engaging this linguistic shift through Michael Marder's concept of "plant-thinking" reveals why the tree model proved so remarkably durable (Marder 10, 25). Language development is inherently non-mechanistic and decentralised; it does not progress along a single, linear track, but grows through lateral divergence, local adaptation, and organic proliferation (Campbell and Poser 66; Marder 10, 189). Schleicher's model succeeded because language itself operates ecologically: words, inflexions, and dialects branch, cross-pollinate, mutate, and die off exactly like botanical shoots and foliage (Campbell and Poser 12; Marder 189). The "hidden bond" (*nexus*) that unites disparate language families across deep time is at root vegetal, a shared heritage of organic, branching divergence (Campbell and Poser 12; Marder 25, 189).

Computational Logic and Decision Trees: Artificial Intelligence in the Forest

In contemporary computer science and machine learning, the tree has transitioned into a foundational mathematical structure for automated reasoning (Quinlan 81, 84). Algorithmic models, such as J. Ross Quinlan's ID3 algorithm for the top-down induction of decision trees, solve complex classification tasks by recursively breaking down decisions into branching paths of test nodes and terminal "leaves" (Quinlan 81, 83–84).

To characterise computational decision trees as mere "pragmatic tools of graph theory" is to fall into an anthropocentric trap (Quinlan 84; Lima 150). Applying Andy Clark's "extended mind" thesis demonstrates that even within synthetic, digital, and artificial intelligence environments, human reasoning remains coupled to environmental and biological scaffolding (Clark xxv, xxvii, 6). When computer scientists designed algorithms to navigate massive, multi-dimensional decision spaces, they did not invent a novel organisational logic from scratch; they rediscovered the branching architecture of the plant (Clark xxv; Marder 10; Quinlan 83–84).

The computational decision tree represents the ultimate instance of epistemic convergent evolution (Clark xxvii; Marder 10; Quinlan 83–84). It demonstrates that when human cognition attempts to build artificial intelligence capable of managing complex probability, the only architectural logic capable of supporting that algorithmic hierarchy is the biological structure of a tree (Clark xxv; Quinlan 83–84).

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Beyond Symbolism: Trees, Thought, and More-Than-Human Knowledge

In his groundbreaking work *How Forests Think*, Eduardo Kohn demonstrates that forests possess their own semiotic agency, representing the world to themselves and generating meaning through a vast, living "ecology of selves" (105, 108–09). Meaning-making is not a human monopoly projected onto a blank botanical canvas; rather, human conceptualisation is a co-production (Kohn 108–09).

Modern ecology supplies the scientific substrate for this mythological-ecological bridge. Suzanne Simard's research into "Mother Trees" reveals that forests operate through complex underground mycorrhizal networks—cryptic fungal channels where elder trees perceive, communicate, and distribute carbon and nutrients to surrounding saplings in a web of mutual interdependence (Simard 4–5, 18–19). Far from being mere "intuitive guesses" or poetic myths, ancient world-tree cosmologies were early forms of empirical ecology. The Old Norse description of *Yggdrasil's* circulating, honeydew-laden fluids (*Poetic Edda*, *Völuspá* 19) and the Maya *Wacah Chan's* tuberous roots penetrating the subterranean realm of *Xibalba* (McDonald 333) were precise cultural encodings of the very mycorrhizal webs Simard maps today. The myth was the science of its time, a narrative mechanism for storing empirical observations of forest connectivity (Simard 18–19; McDonald 333).

Conjoining Robin Wall Kimmerer's ethics of reciprocity with Scott Atran's cognitive anthropology demonstrates that non-human organisms actively serve as "negotiating partners" in human cultural diversity (Atran 250; Kimmerer 48). Replacing the passive concept of a "natural symbol" with the active reality of an epistemic collaborator completes the thesis of epistemic convergent evolution (Atran 250; Mandal). If the tree is an active, negotiating partner in human thought, then human epistemology—how we know what we know—has never been strictly human (Atran 250; Kohn 108; Marder 10). From ancient cosmological world axes to Darwin's phylogenetic diagrams and modern computational algorithms, humanity's greatest conceptual breakthroughs were achieved in active collaboration with vegetal life (Clark xxv; Darwin, *Origin* 130; Marder 10, 155). The recurrent Tree of Life reminds us that we do not merely draw trees to represent knowledge; we think *with* and *through* them.

Conclusion: The Architecture of Multiplicity

The inquiry central to this study began with a deceptively simple observation: the image of the central tree appears with uncanny regularity across the vast, disconnected reaches of

human history. From the ash-hewn cosmology of the Norse Yggdrasil to the inverted manifestation of the Hindu Ashvattha, and from the rigorous dichotomies of the Porphyrian Tree to the revolutionary branching of Darwin's *Notebook B*, the tree has served as the preeminent model for mapping the universe and the mind alike. As the evidence presented throughout this article suggests, the recurrence of this motif is far too pervasive to be dismissed as a mere historical accident or a byproduct of cultural diffusion. Rather, it represents an instance of epistemic convergent evolution, wherein widely separated traditions—cosmological, philosophical, and scientific—independently selected the tree as the most effective structural solution to a shared organisational problem.

Ultimately, the tree persists because its branching morphology provides an unusually powerful model for representing continuity through differentiation**.** This study offers a decisive contribution to scholarship by moving beyond three dominant paradigms: the treatment of mythology as mere symbolism, the interpretation of trees as static religious metaphors, and the analysis of trees as isolated cultural motifs. Instead, by synthesising insights from Intellectual History**,** Comparative Mythology, and the History of Science, this article proposes that the tree functions as an enduring cognitive and epistemic framework through which humans organise relational complexity. Furthermore, by engaging with Critical Plant Studies and the Environmental Humanities, this research suggests that trees are not merely objects of human thought but active participants in the formation of conceptual systems.

Future research should look toward the next bifurcations of this model. The investigation of branching structures in artificial intelligence and network theory offers fertile ground for understanding how we continue to manage uncertainty through hierarchical "nesting". Simultaneously, deeper engagement with Indigenous botanical epistemologies and the "relational ecology" revealed by mycorrhizal networks suggests that we are moving toward a more-than-human theory of cognition.

The recurrence of the Tree of Life leaves us with an inescapable conclusion: the boundary between human intellect and the botanical world is an arrogant illusion. For centuries, we have treated the tree as a passive mirror for our own brilliance. But we do not merely draw trees to represent knowledge; we think *with* them, borrowing their structural logic to make our own existence legible. The "trace of the soul" found in every leaf and root is perfectly replicated in the branched architecture of our own minds. Ultimately, the cosmologies, linguistic models, and evolutionary histories we claim as our highest

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intellectual achievements are not strictly ours. They are the undeniable proof that human epistemology is, and always has been, a language spoken by the trees.

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