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JOHN CHARLES RYAN

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John Charles Ryan

Editorial

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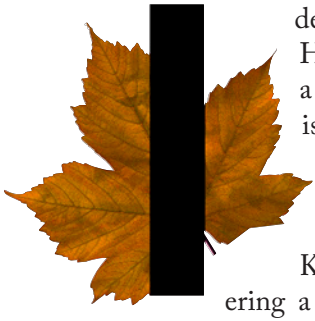

dentified recently in an isolated canyon on the Hawaiian island of Kaua'i, *Schiedea waiahuluensis* is a member of the carnation family. The cliff-dweller is the 36th recorded species of *Schiedea*, all of which are endemic to Hawai'i. The 345 known individuals of *S. waiahuluensis* inhabit small patches of soil in tiny fractures on the sheer rock faces of Kaua'i's Waimea Canyon (Figure 1). While uncovering a new species is historically momentous in itself, the event at the same time marked the first usage of drone technology to locate and collect an undescribed plant. In addition to taking aerial footage of the endemic, the team based at Hawai'i's National Tropical Botanical Garden (NTBG) developed and deployed a remotely controlled robotic sampling arm called a Mamba, suspended beneath the drone, to procure a herbarium specimen (Letman 2024). In 2019, additionally, drone imaging allowed NTBG to 'rediscover' Wood's hau kuahiwi (*Hibiscadelphus woodii*), a hibiscus previously considered extinct (NTBG 2019). According to the researchers, 'hidden floristic diversity is likely to emerge as we embark on *this new era of exploration and documentation* of cliff ecosystems' (Wagner et al. 2024: 120, emphasis added).

About 20,000 kilometres away, in the oNgoye Forest Reserve of South Africa's easternmost province, KwaZulu-Natal, botanists are harnessing the potential of drones, remote sensing and AI to find a female partner for the Wood's cycad (*Encephalartos woodii*), labelled 'the world's loneliest tree' (Pallardy 2024). As indicated by fossil evidence from 280 million years ago, cycads are among the world's most ancient flora (Jones 2002). Palm-like in appearance, the trees are dioecious, so either female or male. Extinct in the wild since the early 1900s, moreover, *E. woodii* ranks as one of the planet's rarest plants. All 500 specimens held in botanical gardens and collections across the globe are clones of the same male collected from oNgoye in the late-nineteenth century (Figure 2). Incapable of reproducing by natural means and unable to diversify its genetic pool, the species remains acutely susceptible to diseases and other stressors. Consequently, botanists are combining

FIGURE 1.

Waimea Canyon is located on the western side of the island of Kaua'i.

Source: Wikimedia Commons (Frank Schulenburg): https://commons.wikimedia.org/wiki/File:Waimea_Canyon,_Kaua%CA%BBi.jpg

drone technology and AI to detect possible female cycads in aerial images of the forest.

The above examples of *Schiedea waiahuluensis, Hibiscadelphus woodii* and *Encephalartos woodii* underline the long, intersecting and, oftentimes, contentious histories of botanical life and technology. As David Miles (2016) and other archaeologists have vividly illustrated, many of the social, political and religious structures of Neolithic societies formed around polished stone axes used to clear forests for farming and process timber for fuel, among other purposes. From weathered mould-board ploughs drawn by oxen to glistening combine harvesters controlled by GPS, technology has been integral to the transformation of agricultural paradigms and practices. Etymologically, that the term *plant* (vegetation) eventually came to denote *plant* (factory) signifies this peculiar historical interpenetration. In the late-eighteenth century, *plant* began to refer to an industrial complex and, later, in a pejorative sense, a spy (Harper 2025). By the late 1800s, cinematic and botanical advances also

FIGURE 2.

All Wood's cycads (*Encephalartos woodii*) are in cultivation, including this specimen at the Royal Botanic Gardens, Kew.

Source: Wikimedia Commons (Dryas): https://commons.wikimedia.org/wiki/File:Encephalartos_woodi_RBGK.JPG

started to intertwine. As film enabled new understandings of vegetal life, flowering plants, in turn, inspired keen public interest in the moving image (Gaycken 2015). Through time-lapse in particular, events in the lives of plants became more perceptible and thus appreciable. Presently, in the Anthropocene context, commuters in Dhaka, Istanbul, Kinshasa, Mexico City, Mumbai, New York, Tokyo and other megacities interact, often unwittingly, with plants on an everyday basis through the energy unleashed from petroleum produced from their ancient remains.

The 'new era of exploration and documentation' announced by botanist Warren Wagner and coauthors (2024) echoes the perils of technological utopianism and botanical imperialism. Nonetheless, what is irrefutable is that technology will continue to shape human-plant relations including issues of conservation. Ecologists have become more and more reliant on drones and AI to locate 'plant diversity darkspots', improve species loss predictions, monitor endangered flora trafficking and respond to human-forest conflicts especially through enhanced data interpretation (Ondo et al. 2024). Machine learning and modeling techniques are facilitating more precise determinations of the extinction risk of unassessed flora (Bachman et al. 2024). All the while, AI is contributing to the translation of human observations of plants and other organisms into scientific knowledge. For ecologist Sam Reynolds and colleagues, AI has the potential to expand 'the scope of human imagination or creativity' by pinpointing gaps or 'surprises' in data, models, methods and prior studies (Reynolds 2025: 2).

Yet, the same technologies applied to conservation can be exploited by rare plant poachers, illegal timber harvesters, transnational land grabbers and government regimes bent on suppressing environmental activism particularly among Indigenous peoples. There is also the lurking danger of AI colonialism in which data originating in the Global South is processed by centres in the Global North to inform AI systems (Muldoon and Wu 2023). This data power differential can result in the imposition of AI-based mandates on the South along with the erasure of local knowledge and traditions. Cognisant of the need to minimise such risks, ecologists emphasise the crucial importance of 'interdisciplinary collaboration' between AI specialists, conservationists, social scientists, local communities and Indigenous knowledge-holders to creating accurate and ethical AI models (Reynolds 2025: 203).

This, indeed, is an area where interdisciplinary plant studies offers a generative intervention. In response to the global biodiversity crisis, the steadily growing field presents a unique framework for interrogating plant-technology conjunctions. The field critiques the dominant cultural narrative of flora as the passive objects of technological manipulation and promotes awareness of the significance of vegetal diversity in an increasingly technologised world by drawing from the interrelated domains of human-plant studies (grounded in cultural studies), critical plant studies (philosophy), ethnobotany (anthropology), economic botany (anthropology), phytocriticism (literary analysis), plant geography and neurobotany (plant science).

Contributors of research articles to Volume 2, Issue 1 of *Plant Perspectives* address plant-technology intersections by theorising, contesting and applying ideas of ruderal futurism (Alex Young), alien flora (Harri Uusitalo et al.), archaeological storytelling (Zuzana Chovanec), plants as designers (Julian Rutten et al.) and photographic phytography (Epha J. Roe). In doing so, the authors underscore the capacity of interdisciplinary plant studies to remould and reimagine the prevailing cultural narratives of species such as the linden, mountain ash, oak, poppy, rose and spruce. The common thread connecting these heterogeneous approaches, timeframes and species is the narrative agency of botanical nature. In literary terms, plants often act as agents providing context, expressing meaning and conveying knowledge. The oral and written stories of various cultural traditions position plants as central characters. In some cases, plants serve as narrators who vocalise from their own standpoints, interact with other characters and form distinctive identities. Yet, as the five articles in this issue show us, plants are *intrinsically narrative* – their sensuous, corporeal presences in our lives communicate wordless stories of history, society, ecology and futurity.

In the issue's opening article, 'An Archaeology of Ruderal Futurism', Alex Young interrogates the multifaceted relationship between ruderal plants and industrial capitalism. The conjunction of technology and narrative underpins the article's approach to the lives of the ruderal species populating the margins of sidewalks, highways, railways, landing strips, mine sites and other disturbed landscapes, reflecting the origin of the term *ruderal* in the Latin noun *rudus* for 'rubble' or 'ruins'. The British ecologist John Philip Grime and colleagues (1988) characterised ruderals as plant species capable of self-pollination, rapid seed release and

other attributes that 'confer resilience [in response to] frequently and severely disturbed habitats' (35). Young develops a critique of ruderality through an insightful integrative reading of the work of Swiss botanist Albert Thellung (1881–1928), French garden designer Gilles Clément (b. 1943) and American media artist Andrea Callard (b. 1950). This fresh interpretation of the ruderal comprises three elements: 'disturbed areas; a heterogeneous cohort of life (particularly vegetation) whose life-history traits and adaptive strategies correlate with living in disturbed areas; and the systems that produce disturbed areas alongside which life there spreads'. Considering this expansive conception of ruderality, especially the third element of 'systems', ruderal futurisms are necessarily post-capitalist and decolonial.

Young's attention to ruderalism accords, in many ways, with the issue's second article, 'Alien Plants Between Practices and Representations: The Cases of European Spruce and Beach Rose in Finland', by Harri Uusitalo, Heta Lähdesmäki, Kirsi Sonck-Rautio, Otto Latva, Hannu Salmi and Teija Alenius. Applying the concept of plantiness first formulated by geographers Lesley Head, Jennifer Atchison and Alison Gates (2012), the authors rethink the political ecology of the native-alien dichotomy in the Finnish context. The article's approach to two introduced species, the European spruce (*Picea abies*) and the beach rose (*Rosa rugosa*), synthesises palaeoecology, ethnology, cultural history and linguistics. The varied array of data collated from pollen records, comparative etymology, historical texts and online content demonstrates the versatility of plant studies as an interdisciplinary framework. Uusitalo and colleagues reframe the dominant narrative of invasive species victimising local plants as a political construct derived from culturally inherited ideas of belonging and non-belonging. While the spruce became associated with pre-Christian traditions of sacred trees, the beach rose was first welcomed in Finland in the early-nineteenth century as a desirable addition to gardens but is now widely regarded as invasive. As the authors elaborate, 'Finns were once encouraged to plant beach roses in their gardens, but nowadays the law demands that they be eradicated'. Of note, as well, is the article's leveraging of digital methods to comprehend the transformation of societal attitudes towards introduced plants over time.

The narrativity of plants is the overarching concern of the issue's third article, 'Poppies and Women Under the Linden Tree in a Slovak

Village: Exploring Culturally Significant Plants Through Informed Archaeological Storytelling', by Zuzana Chovanec. The essay opens with a galvanising image of technological and historical import: *the awl*. Indeed, copper awls discovered in the Middle East are among the most ancient metal objects in the world. Chovanec makes a compelling argument for the revitalisation of storytelling in archaeology specifically in relation to plant cultures and archaeobotany. For the author, storying entails making and remaking meaning intergenerationally through narratives that engage intensely with flora and other non-human agents. The history of technology and the possibility of narrative merge in Chovanec's restorying of the opium poppy (*Papaver somniferum*) and the linden tree (*Tilia* spp.) among ancient Central European societies. A crucial part of the process of restorying the opium poppy is decentring the historical focus its narcotic affordances (Booth 1996). Instead, the author's own enactment of informed storytelling recasts the poppy in Slavic contexts of symbolism and subsistence. Copper pins, for instance, 'fashioned to appear as the tall, proud poppies [and] nearly as long as the poppy stalks', exemplify the modeling of early technologies on botanical forms. The potential of restorying extends to other prominent plant subjects such as the linden tree, or lipa, known for its distinctive heart-shaped foliage and cherished widely by Slovak people as a potent cultural symbol.

The fourth article, 'Plants as Designers of Better Futures: Can Humans Let Them Lead?' by Julian Rutten, Alexander Holland and Stanislav Roudavski, deepens the issue's technological bearing from the perspective of design. Rutten and colleagues consider the ecological, aesthetic and ethical dimensions of 'vegetal design' in which plants are creative, discerning and intentioned agents contributing to design processes. A multispecies concept of design unsettles engrained anthropocentric tenets and reimagines the field as 'any activity that results in collaborative innovation'. For the authors, lidar scanning, numerical modelling, data visualisation and related technological interventions enliven plant agencies and foster human-vegetal dialogue in design contexts. An acronym for 'laser imaging, detection, and ranging', lidar is an especially interesting inclusion in vegetal design and, more broadly, in plant studies. Conceived in 1930 by Irish physicist Edward Hutchinson Synge, lidar technologies emit pulses of ultraviolet, visible and near-infrared light to generate high-resolution, 3-D renderings of

objects, landscapes and organisms. At the same time, plants such as the mountain ash (*Eucalyptus regnans*) perceive these bands of light through their photoreceptor cells. A case study of large, long-lived *E. regnans* of Lutruwita (Tasmania, Australia) illuminates the synergistic possibilities emerging between plants and technology within vegetal design practices. Regarded as the world's tallest flowering plant, mountain ash is endemic to the states of Tasmania and Victoria in Eastern Australia. A granular visual analysis of *E. regnans* in terms of care, complexity and adaptation enables the authors to reframe the species as a designer expressing particular capabilities and innovations.

The issue's final article, 'Photographic Phytography: Towards a Photographic Re-Centring of the Oak Tree within Theory, Material and Practice', by Epha J. Roe, details the author's experimentation with tannin-toned cyanotypes to create portraits of six heritage oaks in England. More than producing representations *of* trees, Roe's practice endeavoured to create images *with* oaks 'conceived as participants and collaborators [who became] agents in the process of their visual representation'. For the artist, phytography can be understood as 'the act of making photographs, as well as its history, together with notions of vegetal thinking and study, resulting in photographic images that are made intentionally *with* the subject matter of their focus'. The article presents a fascinating account of photography's emergence vis-à-vis plant life, characterising botanical nature as 'an enduring component of the history and development of photographic practice'. In 1816, pharmacist Henri August Vogel noted the photosensitivity of an alcoholic tincture of flowers (Lautenschlaeger 2021: 41). Chemicals in trees were integral to the calotype, a photographic process devised in the 1830s and 1840s through the application of light-sensitive silver iodide. Calotypic image development required a solution of silver nitrate, acetic acid and gallic acid, one source of which is oak bark. Moreover, in the 1830s, the English chemist Sir John Herschel devised the phytotype – originally termed the anthotype – to generate images from flowers and other photosensitive plant materials. Evoking the knitted histories of plants and photography, Roe's own creative interventions provide a visual narration of the storied heritage of oaks.

The issue's narrative non-fiction, artist commentary, poetry and reviews offer readers generative spaces to perceive human-plant interconnections differently through rigorous thinking and imagining. The

narrative non-fiction contributions are evocative personal accounts of post-Soviet human-botanical intersections from ethnographic perspectives (Susanne Fehlings); birch tree memory networks in the life of a Ukrainian botanist (Mykyta Peregrym); and the transformation from tree-lover to tree-listener in the creative investigations of an arboreal pilgrim (Isabella Clarke). A commentary by artist Minjie Wen foregrounds the conjunction of technology, art and plant life through data visualization, while poetry by Megan Kaminski and Evgenia Emets confronts themes of temporality, communication and transcorporeality in the vegetal world. The issue concludes with three reviews of new additions to the plant studies corpus. Daniela Kato's review of Jon L. Pitt's translation of Hiromi Ito's *Tree Spirits Grass Spirits* highlights concerns of immigration, boundary-making and transnational passage through the poet's evocation of cosmopolitan species such as kudzu. Maura Flannery offers a lively reading of Joela Jacobs and Agnes Malinowska's edited collection *Microbium: The Neglected Lives of Micro-Matter*, while Tamara Caulkins draws our attention to Laura Drouet and Olivier Lacrouts' important anthology of essays, art and interviews, *Greenhouse Stories: A Critical Re-Examination of Transparent Microcosms*.

As further testimony to the burgeoning of interdisciplinary plant studies, Volume 2, Issue 1 of *Plant Perspectives* casts light on the complex technological formations that both silence and enliven botanical agencies. At the same time, the issue delineates a myriad of possibilities for bringing plant studies into dialogue with complementary fields such as science and technology studies (STS) to probe the social ramifications of human-plant-technology entanglements.

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Alex Young

An Archaeology of Ruderal Futurism

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ABSTRACT

Language used to describe plant life and their environments is shaped by how plants are perceived. In turn this language reproduces how plants continue to be perceived and contributes to the further shaping of attitudes toward them. This essay presents the ruderal as a framework for understanding and envisioning being-with more-than-human others in a world altered by colonial and capitalist exploitation, extraction and expansion. Enacting an archaeological tracing of language and cultural thought towards ruderal plant species, consideration is given to: vernacular language applied to vegetal beings; identities of belonging applied to the movement of vegetation at a planetary scale; and decolonial modes of thinking-with and being-with vegetal others in the aftermath of colonialism and capitalism. Particular consideration here is given to the classification systems of botanist Albert Thellung, the thought of gardener and landscape architect Gilles Clément and the work of artist Andrea Callard. This paper extends an ongoing area of research I have previously examined in the curatorial research project *Ruderal Futures* (2022) for SixtyEight Art Institute and the essay 'A brief constellation towards a ruderal futurism' (2020).

KEYWORDS

decolonisation, post-capitalism, futurism, agriculture, ruderal, weeds

> As the cellar window looked into an area in the street, down which boys might throw stones, it was protected by an outside shelter, and was oddly festooned with all manner of hedge-row, ditch, and field plants, which we are accustomed to call valueless, but which have a powerful effect either for good or for evil, and are consequently much used among the poor. (Gaskell 1906 [1848]: 12)

EED THINKING

On a small patch of earth, immediately adjacent to the front door of my Pittsburgh apartment, I am joined by no fewer than five plants whose English common names give direct indication of the weedy status that has been conferred upon them. They are: common ragweed (*Ambrosia artemisiifolia*), Japanese knotweed (*Fallopia japonica*), low smartweed (*Persicaria longiseta*), pinkweed (*Persicaria pensylvanica*) and pokeweed (*Phytolacca americana*). At the time of writing, the pokeweed has reached full

maturation, with its clusters of purple berries, dark to the point of being nearly black, plump on their stems. Meanwhile, the red deadnettles (*Lamium purpureum*) that had encircled its shoots earlier in the year have long since decomposed to humus.

This lot, an edge effect area where asphalt road and concrete sidewalk margins terminate at the precipice of a steep hillside, is also host to additional co-occupants: amur honeysuckle (*Lonicera maackii*), black-eyed susan (*Rudbeckia hirta*), broadleaf plantain (*Plantago major*), common buckthorn (*Rhamnus cathartica*), common hackberry (*Celtis occidentalis*), creeping thistle (*Cirsium arvense*), field mint (*Mentha arvensis*), green bristle grass (*Setaria viridis*), multiflora rose (*Rosa multiflora*), red clover (*Trifolium pratense*), spotted spurge (*Euphorbia maculata*), tree of heaven (*Ailanthus altissima*), wild parsnip (*Pastinaca sativa*) and a host of other wild vegetal life. Of these, common buckthorn, Japanese knotweed, multiflora rose and wild parsnip are listed by the Pennsylvania Department of Agriculture (2022) as Class B Noxious Weeds, which are defined as plants that 'cannot feasibly be eradicated' – although efforts are frequently made by landholders. Others on this lot are subject to being perceived – and colloquially referred to – as weeds and may be more or less likely to be isolated for extermination on public or private lands. Having been deemed weeds, these plants are suggested to be, as Beal (1910: 103) and later Gissen (2009: 150) claim, 'out of place.'

Weeds are frequently defined in a Western context as plants that disturb some quality of anthropic order, be it agricultural, urban or otherwise – with Salisbury (1961: 15) even pathologising them as criminals who 'rob cultivated plants'. Others, such as Baker (1965), have attempted to situate weeds in more ecological terms as spontaneously growing denizens adapted to – and primarily located in – areas disturbed or otherwise modified by human action. Holzner (1982: 5) succinctly combines these definitions with the summary: 'weeds are plants adapted to manmade habitats and interfering there with humans'. Mabey (2010:1) further refines this sentiment, stating: 'plants become weeds when they obstruct our plans'. While perceiving the characterisations contained in such accounts serves to elucidate the fraught epistemic constructs imposed upon these plants, further reproduction of the term would constitute the continued propagation of error and harm. Perhaps more circumspectly, Frenkel (1977 [1970]: 4) advises: 'despite the widespread employment of this term the denotation of weed is sufficiently imprecise, variable

and relative to give cause for caution in its use'. He continues, stating 'the word [weed] has strong connotations and though it has economic meaning, there is controversy regarding its ecologic denotation' (Ibid.). We might more assertively state: while the word 'weed' may be of use as an indicator of human prejudice towards certain vegetal beings and their perceived relation to various economic schema, it is of little to no use as an ecological category.

Returning to the plants outside my door – several of whom are presently entangled in this linguistic mess by their English common names alone, as though the categorisation of weediness was somehow intrinsic to their being – we might think-with these plant companions beyond the delimitations and antagonism embedded within the English word 'weed'. This is not to say that the negative connotations contained in the designation of weed are limited to the English language. The implicit anthropocentric prejudices and negative connotations of this word are present in many analogues found in modern European languages – some with even greater transparency such as French, Spanish and Italian: all of which contain equivalent words for 'weed' that directly translate to 'bad herb' (Holzner 1982: 3). However, in considering the vegetal others with whom I am presently thinking, it is my hope that I might address both the plants themselves – and their interrelationship with others – with language that is inclusive of their simultaneous agency and conditionality. To think-with these plants is to acknowledge the relationality of thought. Or, as Bataille (1985: 181) writes: 'what I have thought or represented, I have not thought or represented alone'. Similarly, to think-with these plants is to think alongside what Uexküll (1957) calls their '*umwelt*' – their experience as plants as they operate within their world according to how they themselves perceive it. To this end, I look to the word 'ruderal' as a means to meet the turn towards thinking and being-with other life, like the vegetal beings at my door, with terms of interdependency: to not think them purely conditional to any form of human action, even as colonising humans affect change to the earth – both geologically and climatically – on a planetary scale.

RUDERAL RELATIONS

The word 'ruderal', adapted from the Latin *rudera*, which broadly refers to rubble or ruins, is here proposed as the most resonant with the conditions experienced by the plants just outside my door. Ruderal plants are those whose 'life-history' traits and adaptive strategies allow them to establish themselves in varying intensities of stressed and disturbed grounds (Grime 1979: 47).[1] The category ruderal encompasses those plants whose propagation methods and habitats are facilitated by human activity, both intentionally and unintentionally, as well as those indeterminately existing adjacent to the realm of human causation. The appearance of writings on plants wherein they are clearly positioned as possessing characteristics of, and moreover are classified as, ruderal can be traced to botanists in nineteenth-century Europe studying the adventive flora of industrial cities.[2] In the nineteenth century, and continuing into the twentieth, numerous categorical systems were introduced in the West by practitioners of botanical sciences in an attempt to understand plants and their dispersal as they relate to – and are affected by – human activity. While definitions of ruderal may differ from scholar to scholar – with some sharing varying degrees of affinity with classifications that focus on plant origins and imperatives of being determined by the geographies to which they are considered to belong – this terminology is preferred for its ability to be descriptive of both the environmental and biotic characteristics of the plant life it describes. Additionally, unlike the word 'weed', it is generally employed without the import of whether humans consider a lifeform to be desirable or not.

Ruderal vegetation has been characterised by both its relation to human activity and land use and its relation to the systems that impact and organise human activity and land use. As an example of the former, Numata (1982: 21) classifies ruderals as a distinct category from

1 Grime (1979) divides plant adaptation strategies into three categories based on the ability to inhabit different intensities of environmental stress and disturbance: competitors (low stress, low disturbance), stress-tolerators (high stress, low disturbance) and ruderals (low stress, high disturbance). These categories are extremes and not mutually exclusive. For example, a species may have both ruderal and stress tolerant traits.

2 As a plant growing in ruins, the word 'ruderal' has been used since the 1835 version of J.C. Loudon's *An Encyclopædia of Gardening* (1835: 458) (OED).

both cultivated crops and agrestals – the latter of which he refers to as 'weeds' that grow in 'tilled, arable land' for crops. Numata defines ruderal plants as explicitly residing in 'the area not being used for the production of economic crops, where the original community is destroyed and a destructive agent is repeatedly applied' (Ibid.). Such categorisation, centring the division of plant groups into how they factor into different land use practices, presents only a limited scope of the ruderal as it will be employed here. Yet, Numata's definition is instructive in its emphasis on the repetition of destruction and economic extraction to connote whether something is or is not ruderal. Regarding systems that impact and organise human activity and land use, writings by Naegeli and Thellung (1905) and Anderson and Woodson (1935) are noteworthy for their consideration given to the interrelationship between environmental disturbance, economic extraction and ruderal vegetation within systems of capitalism and colonialism, respectively. In *The Flora of the Canton of Zürich* (*Die flora des kantons Zürich*) (1905: 226), Otto Naegeli and Albert Thellung characterise the distribution of ruderal flora as running parallel to the size and intensity of trade and industry while further suggesting that they serve as a direct measure of technical culture. According to Naegeli and Thellung (Ibid.), industrial activity not only provides ruderal plants with suitable soil, but also takes care of the influx and sowing of seeds. They locate the spread of ruderal plants in Zurich within the context of industrial capitalism, specifically noting the unimaginable extent that the opening of the Swiss Northern Railway in 1847 would have on their migration (229). Writing from the North American continent, in *The Species of Tradescantia Indigenous to the United States* (1935: 67), Edgar Anderson and Robert E. Woodson situate the ruderal within colonial exploit when they state:

> The flora of today surely differs from that of five hundred or more years ago, due largely to the influence of an increasingly complicated civilization; may it not be of interest to record the ruderals and escapes of to-day as a prophesy of the flora of the not-too-distant future?

The dispersion of ruderal environs can be understood as a simultaneous result and indicator of the reorganisation of matter arising from both colonialism – regardless of whether conducted as feudal plunder or capitalism – and industrial capitalism. Similarly, ruderal vegetation can be understood as a result and indicator of the relationship that it

have with these systems that organise the production of anthropogenic space. While ruderal vegetation is adapted to sites of naturally occurring disturbance (forest fires, floods, landslides, etc.) – and is spread across vast geographies through colonialism – the continued proliferation of ruderal environs at a planetary scale exists as the result of capitalism and its 'need to impose its imperatives as universally as possible' (Wood 2002: 155). In other words: not all ruderality is the result of colonialism and capitalism, but the planetary ruderal certainly is.[3] Descriptive of the unfolding interrelationships between spaces, species and anthropogenic systems that structure the reorganisation of matter, the ruderal functions as a broadly applicable category. This may consist of any of the following: disturbed areas; a heterogeneous cohort of life (particularly vegetation) whose life-history traits and adaptive strategies correlate with living in disturbed areas; and the systems that produce disturbed areas alongside which life there spreads.

While the history of the use of the word ruderal may reveal some differences in the target of its application, rather than creating contradiction, these distinctions can be seen to provide a more holistic understanding of the conditions that contribute to ruderality. Further, adding to this understanding, different nomenclature and systems of categorisation from commonplace to rarified have intersected – and shared varying degrees of consonance – with definitions of the ruderal. Of such categorisations, perhaps among the most pertinent to the development of the ruderal as it is presented here is the concept of the 'anthropophyte' as outlined in several papers and the publication *The Adventive Flora of Montpellier* (*La flore adventice de Montpellier*) (1912) in the early twentieth century by botanist Albert Thellung. Thellung's categorisation of anthropophytes is of particular interest as it provides an earnest attempt to dislodge the nomenclature of plant typologies from the limitations of the 'colloquial metaphors' and prejudices contained in both vernacular language and prior botanical systems through the use of descriptive Greek root words (Chew 2011: 145). Nominally, the term anthropophyte centres the human in the relation of human (*anthropo-*) and plant (*-phyte*) as well as the conditions that the plants it describes inhabit. However, Thellung's articulation of anthropophyte

3 This line deliberately echoes Max Liboiron's (2021: 18) framing of pollution: 'not all pollution is colonial, but the idea of modern environmental pollution certainly is'.

contains within it a measure of mutability between the myriad subcategories of 'anthropochores' (plants introduced to an area by humans both intentionally and unintentionally) and 'apophytes' (indigenous plants), thus at least partially subduing the primacy of the human within interrelationships between plant species and soils.

Prone to the continuous reworking and expanding of his system, in *Plant Migrations under the Influence of Man* (*Pflanzenwanderungen unter dem Einfluß des Menschen*, 1915) and *On the Terminology of Adventive and Ruderal Floristics* (*Zur terminologie der adventiv- und ruderalfloristik*, 1918–19), Thellung would return to the concept of the ruderal as a distinct element within his categories of anthropophytes, which itself appears to have been phased out in favour of 'hemerophyte' to denote the entirety of plants living with humans regardless of how they came to do so.[4] Thellung describes ruderal plants as inhabitants of the secondary cultural formations of human-made wastelands. Subsequently, Thellung's (1918–19) subcategories of 'ruderal apophytes', 'true ruderals', and 'apophytoids' proceed to reproduce all subclassifications of plants contained in his original overarching anthropophyte category.[5] Notably, the inclusion of the 'apophytoid,' which encompasses all plants living with humans that have migrated to wastelands, provides an intimation of a wholesale alienation of plant life, which is at once a wholesale naturalisation of all plants existing amid ruderal conditions regardless

4 Preferring Greek root words for his taxonomy of anthropophytes, Thellung's use of the Latinate word ruderal is conspicuously absent in his major work introducing this concept, *La flore adventice de Montpellier* (1912).

5 Thellung's concept of hemerophytes (the entirety of plants living with humans, native or introduced, with or without human intervention), with consideration to the ruderal appears to potentially fold nearly all plants into relationship with ruderality. The classificatory system of hemerophytes consists of: A - ruderal plants (inhabitants of secondary cultural formations, wastelands), A(i) - ruderal apophytes (native plants transitioning to wastelands), A(ii) - true ruderals (most abundant wasteland plants), A(iii) - apophytoids (species normally inhabiting cultivated land, both crop and weed, which migrate to wastelands including: ergasiophiles, ergasiophytes, and ergasiosyntrophophytes), B - ergasiophiles and ergasiophilophytes (inhabitants of full cultural formations, plants in human cultivated/worked soil), B(i) - ergasiophytes (cultivated/worked plants), B(ii) - ergasiosyntrophophytes (plants interacting with cultivated/worked land), B(ii)a - cultivated land apophytes, B(ii) b - cultivated alien land weeds, B(ii)b1 - archaeophytes (present since prehistoric times, recurring), B(ii)b2 - epokophytes (present in recent times, recurring), B(ii) b3 - ephemerophytes (present recently, transiently) (Thellung 1918–19)

of place of origin. Written during World War One, Thellung's concept of the ruderal here extends beyond the remnant waste piles of early human settlement niche construction, as well as his and Naegeli's earlier observations, to something much vaster in the scale of the World War itself. As Thellung (1915) would assert, during this time, 'among those factors which are now, before our very eyes, transforming the surface of our planet, man's activity must undoubtedly be foremost'. With the increased scale of geography affected by war, which would become the *de facto* geography of broad swaths of Europe, Thellung's thoughts appear to have shifted towards an ever-expansive view of the role of ruderal species and spaces within the anthropogenic landscape. Thellung directly attempted to postulate the effects of war in relation to vegetation in his essay 'Stratiobotany' (*Stratiobotanik*) (1917). Therein, Thellung provides observations of the new secondary cultural formations of plants (ruderal plants) arising in the aftermath of the war, the effects of elements of modern warfare – such as shrapnel and poisonous gases from artillery – on vegetation, initiatives to gather and cultivate wild culinary and medicinal plants that may have previously been disdained, forgotten, or otherwise underutilised as a response to interrupted trade and food shortages, and imperatives to expand cropland into wasteland. By imagining post-war ruderal environments as a posthuman grounds for the restructuring of biota, we might also think of the ongoing anthropogenic transformation of the Earth at a geologic and climatic scale via the framework of the ruderal.

RUDERAL, BIOTA WITHOUT A FLAG

Whereas Thellung positioned the ruderal within an archaeological system of plant and human interrelations with consideration to biotic and social factors, Gilles Clément orients the ruderal as the condition of an ongoing future-oriented process of planetary transformation. In *In Praise of Vagabonds* (*Éloge des vagabondes*) (2011 [2002]: 282), Clément positions the ruderal condition as a force that contributes to the 'mixing' of 'all living things'. In the first sentence of the text's introduction, Clément succinctly states: 'Plants travel.' Deeming movement as central to the ontological condition of vegetal beings, Clément pronounces plants not to be bound by belonging to any geographical confines. In

so doing, he disavows the systematic antagonism towards alien species widely espoused – under the auspices of origins, rootedness and place-based biotic belonging – in the West through the proliferation of conservation biology and invasion biology rhetoric. Chew (2011) locates this tendency to regard introduced species as unwelcome elements within a larger ideational framework of nineteenth- and twentieth-century 'anekeitaxonomies', or categorical systems for classifying biota as belonging to specific places.[6] These place-based taxonomies intersect with the practice of states and nations either domesticating and declaring natural through colonisation and assimilation or excluding any and all moving living things deemed undesirable, human or otherwise. Countering such practices of exclusion, Clément (2011 [2002]: 277) positions the ruderal as part of a planetary condition whereby Earth becomes a 'country without a flag'. Proposing a theoretical single world continent, Clément's vegetal planetary citizens travel freely across geologic continents and are bound solely by the biomes and soils that their adaptive strategies allow them to become established within. The 'general ruderalization of territory' articulated by Clément (2011 [2002]: 293), while in some manners not entirely dissimilar to Thellung's concept of the ruderal, becomes the central organising principle for perceiving plants and other life forms as capable of universal belonging in the wake of the near-totalising disturbances wrought by colonialism and capitalism on Earth.

Via Clément, the ruderal may be understood as a planetary process of making dynamic futurities against the enforcement of borders and the preservation of environments as static and past-oriented. In thinking towards a practice of planetary ruderalisation, we might again refer to Clément (2005: 127), who – identifying as a gardener – states:

> I decided not to do what one usually did, which was to work systematically *against*, but to do as much as possible *with*. In all gardens, we are constantly working against something that's in the process of happening: we cut, we prune, we spray, we poison, we water when it's dry, we drain when it's too wet: we don't accept the situation. We therefore expend an incredible amount of contrary energy, we labor, we pain. I didn't want to work in a way that might make something so pleasant and harmonious become detestable.

6 Anekeitaxonomy is a neologism from Chew (2011), derived from 'anekei' a Greek word for belonging, and is used to describe systems that are used to determine where certain species belong.

To engage the ruderal is to articulate a form of being-with that is open to that which is possible. The ruderal is thus situated outside of work, which is a mode of being-against the other to which it is applied. Clément (2005: 134) urges for a 'garden politics', that may perhaps be better understood as a ruderal politics, where 'nothing is planned' as a site of 'non-work' and 'non-doing'. Non-doing, as a transformation of values away from doing, is bound with undoing. When an action ceases, the unworking that contests the *against-ness* of work begins. This non-work or worklessness entrusts the world to the other. Clément's gesturing towards passivity is evocative of that of Maurice Blanchot. In *The Writing of the Disaster*, Blanchot (1986 [1980]: 18) locates in such passivity a self that is wrested from the self, unsubjected and patient in 'sheer alterity'. Sara Ahmed (2000: 137) writes of Blanchot's writing of the disaster: 'a writing of and for the other, begins with the refusal to identify the other as enemy'. Akin to Blanchot's refusal to identify in the other an enemy, ruderal futurisms look to such models of passivity that consign the world to the other as a means of 'unsettling colonial and capitalist realities' (Young 2020: 132).

In this sense, the conception of a ruderal futurism aligns with the concept of alterlife as articulated by Michelle Murphy in *Against Population, Towards Alterlife* (2018: 112). Murphy writes:

> Making futurities in the aftermaths of ongoing violence requires alternative decolonial ways of retheorizing life with and against, alongside and athwart, technoscientific framings of life and the environment. It is to learn from and propagate politics and concepts in the tensions between violences that have already happened and the need to undo them nonetheless, the condition of being already altered and the struggle to become otherwise in the aftermath.

In the state of having been 'already altered', Murphy (2018: 113) locates a ground for 'the struggle to exist again but differently'. In the sense of the already altered, the ruderal is here suggested as grounds upon which more-than-human alterlife may be asserted towards alterworlds of becoming otherwise in ruderal futures. Arising from the remnants of colonial and capital extractive relations to land and life, ruderal ecologies as sites of future-oriented thinking must be positioned counter to the conditions of their creation. As with Murphy's alterlife, the decolonial distinction is central to existing again differently in the context of a planetary ruderal.

How such a distinction is made is relative to who is making it. As a settler, the decolonial might be understood, at least in part, as a practice of openness to alterity that receives rather than appropriates or erases the other. Non-work and non-doing provide a position from which to remain open. From this position of openness, ruderal futures may be arrived at through actions – or perhaps, more fittingly, forms of inaction – that entrust the planetary ruderal to plural decolonial, as opposed to universal colonial and capitalist, modes of thinking and being-with more-than-human others.

While, thus far, the pernicious and rather pervasive concept of invasive species has for the most part not factored into this writing, it bears brief introduction here for the purposes of contrast with beliefs outside those that are replicated by colonial and capitalist worldviews. Biota labelled 'invasive' are typically seen as human-introduced alien species that unwantedly establish themselves in territories where they were not previously present. Once perceived as such, they are often prohibited and eradicated by states for reasons that intersect with conservationist notions of belonging and economic interests. As with 'weed', the life forms described by the term 'invasive species' are often the very same as those here described as ruderal. However, unlike the word 'weed,' the violent prejudice contained in the term 'invasive species' is nothing if not opaque. This invasive paradigm is challenged by many individuals whose cosmologies differ from that of settlers and Europeans. In *Anishnaabe Aki: An Indigenous Perspective on the Global Threat of Invasive Species*, Nicholas Reo and Laura Ogden (2018: 1448) summarise a sampling of perspectives toward 'invasives' from Anishnaabe elders in Michigan, with whom they conducted fieldwork, noting that their interviews showed 'a repeated caution to not judge plants for attributes beyond their control' and feelings that people 'should not intervene using … drastic management techniques'. Among Reo and Ogden's interviewees, Rita Bulley laments: 'I feel bad for those things that are getting introduced, because … they don't know they're invasive. They're just growing, doing the only thing they know how to do.' Working from or with the ruderal is to begin with such challenges – of harm, trauma, eradication, erasure and any complicity we may have therein – facing more-than-human others and further, in processing these challenges, discerning what should in turn be challenged by doing so.

A FIELD OF CLOVER WITH OR WITHOUT A POSTGLACIAL HISTORY

'Technically, there is no postglacial history of vegetation on this site, since the highway was built on landfill that extended the original Manhattan shoreline 150 meters', Lance F. Howard (1985: 92) writes of a portion of the West Side Highway in Lower Manhattan, New York City. When his *Plant Colonization on an Abandoned, Elevated Highway in New York City* (1985) was published, the West Side Highway had been closed for many years following a partial collapse in 1973. The Battery Park City landfill, on which the West Side Highway stretches, was formed by successive waves of landfilling that extended the lower western area of Lenapehoking Manahatta (Manhattan) into the New York Harbor.

While, technically, one might say that there is no postglacial history of Battery Park City (in that it was formed by human activity), geologic, biotic and human cultural history remain as intertwined elements within the moved matter that constitutes the site. An extension of Battery Park City completed at roughly its present-day footprint, largely through the movement of earth and rubble excavated during the creation of the original World Trade Center, opened to the public in 1976. From the opening of Battery Park City through the 1980s, numerous art and cultural practitioners engaged this site with the creation of sculptural and performance-based works. The breadth of works realised on this site provide an opportunity to discern a range of approaches to working with and against ruderal conditions through the representation or omission, acceptance or negation and mutualism or alienation of the multispecies life residing there.

Images from the years immediately following the opening of Battery Park City depict a lively world of artists and idlers amid the ruderal plant-covered manufactured beach on top of the land fill that preceded it. Today, the area has been thoroughly developed as originally intended by the Battery Park City Authority, but for a decade it served as a site of indeterminate use and adventive exuberance. However, in stark contrast to this image of Battery Park City, the most iconic visuals of it during this time are perhaps those of Agnes Denes' 1982 work *Wheatfield: A Confrontation – Battery Park Landfill, Downtown Manhattan*. In *Wheatfield*, Denes saw to the alteration of the grounds of Battery Park

City to accommodate a two-acre plot of wheat, from the importing of large quantities of soil to sowing seed, weeding, irrigating, spraying fungicide and ultimately harvesting the crop. Widely reproduced images of the project, cropped to show solely Dene's field of wheat against the towering monoliths of the Lower Manhattan skyline, visually erase the great social and ecological diversity of Battery Park City. What remains is a condensation of settler colonial dichotomies of 'stone city against soft rural lands' – towers of accumulated wealth and the colonial crop with which hierarchical cereal/human/state/capital environmental relations were composed (Denes 1987: 86).

In 1976, the year of Battery Park City land fill's completion and six years prior to Denes' wheatfield, Andrea Callard created two Super 8mm films on the site: *Lost Shoe Blues* (1976) (Figure 1) and *Flora Funera (for Battery Park City)* (1976). In both works, Callard reveals fragmentary views of the ruderal zone that was the land fill and its vegetation that would be judiciously rendered absent in Denes' representation of Battery Park City. In *Flora Funera*, a stationary camera focuses on a concrete retaining wall with protruding rebar that forms the edge of the park land fill and the Hudson River. At the foot of the retaining wall, ruderal vegetation slowly sways in the wind. Gently, stones and rubble lobbed overhead by Callard – and friends Bernice Ruben and Richard Friedman – sonorously impact the metal bars above, as though mallets upon a marimba. The film both heightens the presence of the vegetation through its colour contrast while, at the same time, reducing the plant life to an indistinct mass of green-stuff. My eye wants to see clover or sow thistle, but the soft edges of the film grain allow them to remain elusive. As Callard lifts the camera from its tripod position at the end of the film, the context of this tableau is established as further terrain of the urban prairie is revealed. A still indistinct mass of green slowly reveals hazy outlines of white and red clover as well as mullein.

In *Lost Shoe Blues*, Callard moves through the terrain of Battery Park City, only partially glimpsed in *Flora Funera*, revealing the dense vegetation surrounding her as well as the Hudson River, the retaining walls and the skyscrapers, cranes and other city infrastructure that enclose the park. Much of the vegetation remains an ambiguous green mass to my eye, as with *Flora Funera*, again with a few exceptions such as white and red clover, mugwort and mullein. Callard's camera points to the ground shaking up and down with her gait as she ambles and spins

FIGURE 1.
Still from Andrea Callard, *Lost Shoe Blues,* Super 8mm sound film (preserved on 16mm film and digitally), 4 min, 1976. Courtesy of the artist.

about, crisscrossing through the field focusing at times on one group of plants or another. All the while, she sings:

> I lost my shoes
> in a field of clover.
> I stayed so long
> that the clover growed over.
> I lost my shoes.
> I got the blues.

Through this process of time spent being-with the plants of Battery Park City, Callard performs an act of non-doing that is also an act of unworking, making space for herself as well as the vegetal life at her feet. The shoes with which one might step to the pace of working against our environs or trample plant life underfoot are instead lost within the growth of this vegetal other. The growth of the vegetal is, as Marder

(2011: 95) writes, 'enacted in a seemingly limitless extension in every conceivable direction' that is, in turn, by becoming possible in every direction: 'a becoming-literal of intentionality'. The clover that swallows up and conceals the lost shoe in Callard's song enacts its will: combining there with Callard's will as it is directed towards non-doing. In this mutualistic way, both Callard and the vegetal beings of Battery Park City resist legibility and the logic of the colonial capitalist city looming overhead, gesturing towards less defined, more entangled forms of cohabitation.

THOSE THAT WILL WORK, THOSE THAT CANNOT WORK AND THOSE THAT WILL NOT WORK

> I sell chickweed and grunsell, and turfs for larks. That's all I sell, unless it's a few nettles that's ordered. I believe they're for tea, sir. I gets chickweed at Chalk Farm. I pay nothing for it. I gets it out of the public fields. Every morning about seven I goes for it. The grunsell a gentleman gives me leave to get out of his garden: that's down Battlebridge way, in the Chalk-road, leading to Holloway. I gets there every morning about nine. I goes there straight. After I have got my chickweed, I generally gathers up enough of each to make up a dozen halfpenny bunches. (Mayhew 1968 [1851]: 153)

Between 1849 and 1851, the English journalist Henry Mayhew endeavoured to conduct interviews reporting on the conditions of the urban poor in London for *The Morning Chronicle*, which would later be published as the voluminous *London Labour and the London Poor*, originally subtitled *A Cyclopedia of the Conditions and Earnings of Those that Will Work, Those that Cannot Work, and Those that Will Not Work*. In this reporting, Mayhew provides exhaustive accounts of mid-nineteenth century London street-folk, excluded from the spoils of the nation's colonial and capital exploits, encompassing sellers, buyers, finders, performers, artisans and labourers. A significant portion of this writing focuses on costermongers – or individual merchants selling goods in the street – among whom are the 'street-sellers of green stuff' within which Mayhew (1968 [1851]: 145) includes 'street-purveyors of water-cresses, and of the chickweed, groundsel, plantain, and turf required for caged birds'.

This account by Mayhew is introduced here as a curious example that stresses the awkwardness, if not total incompatibility, between ruderal futurisms predicated on that which is possible in all directions, and capitalism's articulation of itself as the one and only universal possibility. The ruderal, like those plants growing amid the urban margins of mid-nineteenth-century Manchester that, Elizabeth Gaskell muses in *Mary Barton* (1906 [1848]: 12),'we are accustomed to call valueless' and are 'much used by the poor', is for the most part of little use to capital. The ruderal plants plucked freely from public and private grounds by these nineteenth-century London street-sellers of green stuff represent the vestigial resources of an impoverished and disregarded all-but-eliminated commons. Mayhew (1968 [1851]: 145) remarks that the purveyors of green-stuff 'seem to be on the outskirts, as it were, of the costermonger class'. He further claims that 'regular costers look down upon them as an inferior caste' comprising 'very poor persons, and generally … children or old people' (Ibid.). By attempting to insert that which is freely abundant, not worked, and not already held in private into the private commerce of capitalism, the green-stuff sellers – while not to be criticised for subsisting – may be regarded as diverting the radical potential of the ruderal as a force beyond capitalist land use.

Written less than a decade after Friedrich Engels published *The Conditions of the Working Class in England* (1845), Mayhew's recording of the lives of London street-folk is also situated in relation to an epistemic of work, even when in the absence of work. The London poor documented by Mayhew, however, have little to do with the working class that Engels and would term the proletariat. Rather, those described within would best be likened to the *lumpenproletariat* whom Engels (1926 [1850]: 16) and Marx (1906 [1852]: 41; 1850/1952: 44) describe variously as 'scum of the decaying elements of all classes', 'that whole undefined, dissolute kicked-about mass' and 'people without a definite trade, vagabonds, *gens sans feu et sans aveu* [people without hearth or home]'. Neither Marx nor Engels would allow the lumpenproletariat to be included in their vision of a communist future. To this end, Engels (1926 [1850]: 16) would declare: 'every leader of the workers who utilizes these gutter-proletarians as guards or supports, proves himself by this action alone a traitor to the movement'. The poor, of whom Mayhew writes, subsisting in the aftermath of capital, are alienated from all but their complex relationships among the ruins. As Marx's and Engels'

lumpenproletariat, they themselves are ruderal: decaying, undefined, vagabonds on an Earth in a persistent state of alteration.

The London poor of the mid-nineteenth century, whose lives were entangled with the social and environmental ruins of an emergent industrial capitalism, offer an alternate starting point to the worker of Marx and Engels to become otherwise amid our world as already altered. As Ian Shaw and Marv Waterstone write in *Wageless Life* (2019: 117):

> The struggle Marx articulated rested on workers in industrializing Europe. Today, it falls on capitalism's billions of surplus lives. The future will not be dictated by those with waged work. For better or worse, it is in the hands of the outcast.

From the ruderal, the outcast acts in a form of solidarity with more-than-human others in the unworking of exploitative land relations towards care and mutualism. Ruderal futures – read as decolonial ruderal futures – entail being-with and doing-with or doing not-at-all with more-than-human others. Confronting the already altered, the ruderal represents the struggle to exist again but different from that of the joyless cities of Europeans and settlers, which as Davi Kopenawa and Bruce Albert describe in *The Falling Sky* (2013: 355), are populated by those persons for whom: 'once their hair is white, they disappear, and the work—which never dies—survives them without end'. Ruderal futures are those that flourish in the aftermath of work as working-against as alienation from belonging to a possible more-than-human whole, without reducing what those possibilities – of the whole, in all directions – might be.

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Alien Plants between Practices and Representations: The Cases of European Spruce and Beach Rose in Finland

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ABSTRACT

In Finland, the European spruce (*Picea abies*) and the beach rose (*Rosa rugosa*) have very different cultural resonances and ramifications, but they also have many similarities. In this study, we examine these species through the concept of 'plantiness' to reveal the political ecology behind the categories of native and alien, demonstrating the national and biological belonging of said species. We ask why people want to protect certain species and not others – which ultimately amounts to deciding which plants are permitted to exist and which are not. Acknowledging that natural changes occur constantly, we also ask how people come to decide what counts as the 'status quo' that should be protected. We create a synthesis from our disciplines: palaeoecology, which focuses on the ecology of the past; cultural history and ethnology, which explore historical and contemporary times; and linguistics, which focuses on a long time period from prehistoric to contemporary times.

KEYWORDS

European spruce, beach rose, plantiness, belonging, non-belonging

INTRODUCTION

In this paper, we explore the political ecology of belonging by analysing the notions of alienness and nativeness through the concept of 'plantiness'. We selected two plants for our study: the European spruce or spruce (*Picea abies*) and the beach rose (*Rosa rugosa*), also known as the Japanese rose.

The beach rose is deemed non-native to Finland. In contrast, the European spruce is widely considered a native, though it arrived in Finland relatively late, if a longer-term perspective is applied. Their different itineraries offer a fruitful perspective on the question of alien species: the spruce has inhabited Finland longer, resulting in the fact that the Finnish word for it has existed in the language for a long time. The domestication of the beach rose has been much more rapid: compared to the spruce, it is a newcomer both geographically and linguistically. In addition, the beach rose has aroused strong emotions as an alien species that has to be eradicated and it is

on the list of 'worst' (sic) alien species in Europe, according to Nentwig et al.[1]

The European spruce and the beach rose therefore have very different cultural resonances and ramifications, but they also have many similarities. For instance, their presence in Finland and the ability to cause changes in their environment has been contested. In this study, we examine these species through the concept of plantiness in order to reveal the political ecology behind the categories of native and alien, demonstrating the national and biological belonging of said species. We understand belonging and non-belonging as culturally defined umbrella terms for more natural science-based categories such as alien/native/invasive. In this paper, we ask why people want to protect certain species and not others – which ultimately amounts to deciding which plants are permitted to exist and which are not. Acknowledging that natural changes occur constantly, we also ask how people come to decide what counts as the 'status quo' that should be protected.

The use of the native–alien dichotomy and its connotations has traditionally been relevant in the natural sciences, but has also, to some extent, been scrutinised within the fields of social sciences, cultural geography, history and ecolinguistics.[2] However, more research is needed.

This paper proposes a transdisciplinary approach, as it combines ethnology, cultural history, palaeoecology and linguistics. We argue that the study of 'alien' plants requires transdisciplinary work: a parallel analysis of both cultural and ecological processes (that are in continuous flux). We proceed in thematic sections integrating all disciplines as we aim at instigating and nurturing a richer dialogue among our fields.[3] This is necessary to understand the full complexity of the matter. Our goal is to show that parallel analysis reveals new insights about the tensions between alien and native, belonging and non-belonging, and about human–plant relations in general.

Since our disciplines have different time scopes – palaeoecology focuses on the ecology of the past, linguistics looks at the lengthy period from prehistoric to contemporary times, and cultural history and

1 Nentwig et al. (2018).

2 See e.g., Jones and Cloke 2002; Coates 2007; Rotherdam and Lambert 2011; Uusitalo and Suomalainen 2023; and Stibbe 2015 on ecolinguistics.

3 For a similar approach see e.g., Rautio et al. 2022.

ethnology explore historical and contemporary times – we are able first to focus on the profound environmental changes since prehistoric times (i.e., plant lives as a realm of practices), and second to emphasise the perceptions, attitudes and affections for plants that have been formulated and have changed over time (i.e., plant lives as a realm of representations). Our research is based on methodological and theoretical reflection, but we also draw on examples from a wide range of different materials: pollen data, etymological data, historical texts and Internet discussions.

In this paper, we first introduce the reader to our multidisciplinary research material and analysis frameworks, following with sections discussing, first, the European spruce and, second, the beach rose. We end our paper with a concluding discussion. Even though our focus in this paper is on Finland, we encourage scholars to consider similar cooperation, no matter where they or their interests are situated geographically.

METHODOLOGICAL AND THEORETICAL FRAMEWORK

Data

Being transdisciplinary, our research involves several methodological points of departure, from contemporary literature, media content and linguistic analysis to the palaeoecological analysis of pollen data.

The spruce has a long history that exceeds the reach of written texts. Such history, as well as the migratory dynamics of other tree species, can be studied from lake sediments and bogs, as trees produce abundant pollen grains that are well preserved in anaerobic conditions. Dating such sediments using the radiocarbon method provides a chronology, which makes it possible to reconstruct the timing and character of the spread of a species.

Digitised newspaper collections offer a plethora of material on both the spruce and the beach rose. The National Library of Finland digitised all published works in Finland up to the late 1930s.[4] The post-war period is by no means completely digitised, but the amount of material is sufficient for content analysis. Besides newspaper articles, we also

4 https://digi.kansalliskirjasto.fi/etusivu?set_language=en (accessed 21 February 2024).

used some contemporary literature (such as non-fiction books on alien plants written by biologists) and material provided by international and national officials on this topic. Our exploration was based on thematic reading of both newspaper and contemporary literature references to both the spruce and the beach rose, especially on how their supposed nativeness or non-nativeness was expressed. We interpreted these references in their historical contexts.

The Finnish word for spruce, *kuusi*, also has another meaning: the number six. The digital extraction of newspaper references was therefore difficult, and care was needed to avoid including a wrong word in the data. The case of beach rose was completely different: there were far fewer references, and they were easy to identify. The first mention of the Finnish word *kurtturuusu* appeared in 1954. Its scientific name, *Rosa rugosa*, could be found as early as 1885.

In language, lexical and grammatical choices may reveal impressions and perceptions toward plants.[5] In addition to the thematic reading of references to the spruce and beach rose, we drew on linguistic analysis. While this was partly based on the aforementioned data from the National Library, we also used an online discussion corpus, which is presented later in this paper. Etymology, too, is an advantageous perspective in transdisciplinary studies of the past. Words can tell us much about cultural or natural changes. Sometimes a new word appearing in a language is an indicator showing what happened in the speaker's culture or environment.[6]

Analysis framework

As a multidisciplinary theoretical framework, political ecology offers us tools to analyse our data. Political ecology can be seen as being derived from the traditions of human geography and anthropology and ethnology. In 1970s and 1980s, political ecology mainly focused on Third World countries and issues like poverty and the capitalistic economy. It was argued that social theories should be more engaged with human–environmental relations and vice versa.[7] Most political ecology research conducted was concerned with environmental degradation,

5 Berlin 1992: 103–108; Uusitalo & Suomalainen 2023.

6 Piha 2018: 135–141; de Smit 2019.

7 Neumann 2005: 22.

which includes a wide range of environmental problems, such as soil erosion and the loss of biodiversity.[8] Although political ecology is often connected to research advocating against social injustices in relation to environmental issues, there is a significant amount of research dedicated to power relations between knowledge and science.[9] As have so many other frameworks, political ecology has gone through the plant turn, and a subfield often referred to as vegetal political ecology has emerged. A fair amount of attention has been given to the characteristics or abilities of different plants: the 'plantiness' of plants and how the plantiness of different plant species is entangled with society and culture, or the human sphere. Plantiness is a concept that was advanced by the political ecologists Lesley Head, Jennifer Atchison and Alison Gates (2012) in what they framed as an 'assemblage of material properties and expressive capacities that prefigure plant relations with people'.[10] Plantiness is said to describe the way people now see plants in their own terms, and it is through plantiness that plants actively co-produce the world.[11]

The question of alienness – being an alien or categorised as an alien – is at the heart of our exploration. The terms native and alien have been used in botany since the 1840s.[12] Like other more ecology-derived terms, they are connected to movement: species that have travelled between countries or continents with human help are called invasive species, archaeophytes or neophytes; plants that do so without human help are alien species; and plants that spread from gardens are garden escapees. Native species, on the other hand, are plant species that are perceived to occupy their natural spatial range. Such plants may form part of the national landscape.[13] These terms carry meanings of values and belonging: the word 'alien' suggests that a plant is non-native, a foreigner, something that does not belong where it is, as it infers displacement from a supposedly natural environment. The term 'invasive' emphasises both human perception and the harmfulness of the (alien) species. Among the humanities and social sciences, several accounts

8 e.g., Robbins 2012 [2004].

9 e.g., Berkes, Colding and Folke 2000; Fischer 2000; Sonck-Rautio 2019; Sodikoff 2012.

10 Head, Atchinson and Gates 2012: 27.

11 Duran and Sundberg 2022: 190–191.

12 Davis et al. 2011.

13 See e.g., Jones and Cloke 2002.

have contested the alien/native dichotomy and highlighted that these categories are coined from a cultural bias that promotes national identity and encourages discrimination against anything 'foreign'.[14]

According to Argüelles and March (2022), conservation organisations and governments very commonly apply the narrative of local plants being the victims of invasive species, which are labelled as biodiversity-threatening. From the point of view of political ecology, it is more crucial to note that 'it is not species, but sociobiological networks that are invasive'.[15] In fact, as our case here demonstrates, invasiveness is more of a socio-cultural (and political) notion than one objectively ecological, derived from the culturally defined categories of belonging and non-belonging. It has been argued that the invasiveness of a plant is related to three key points: the origin, behaviour and impact of the plant.[16] The behaviour of plants is seen as part of their plantiness, whereas the impact of the plant is at the core of the political ecology of alien species. The central questions then remain: who is impacted in what way, and who determines whether the impact is 'good' or 'bad'? Judging from these three key points, a plant species will be ruled to either belong or not to belong in a certain environment.

The framing of certain plant species as belonging or invasive is a cultural practice. It leaves little space for plantiness, the wide possibilities of the plant itself, or the agency of the plant. Nevertheless, these practices should not be seen as cultural or political practices only imposed by humans, but as the entanglements of plants, people, other species and the landscape, all both constraining and enhancing one another.[17] In ecology, humans are often assumed to be disturbing or damaging natural biodiversity rather than potentially enhancing it;[18] and sometimes humans are left out in ecosystems analysis altogether – although palaeoecological evidence shows that the human impact on ecosystems has a long history, and not necessarily always a damaging one.

14 Argüelles and March 2022; Warren 2007.
15 Robbins 2004: 140.
16 Kull and Rangan 2015.
17 See Head, Atchison and Gates 2012.
18 See e.g., Ellis and Ramankutty 2008: 445; Rival 2006.

BELONGING: THE EUROPEAN SPRUCE

The European spruce is commonly considered a native plant in Finland. During its existence in Finland it has gained numerous meanings that have bound it tightly to Finnish culture.

A pre-Christian tradition of sacred trees (*uhripuu*) indicates the importance of the European spruce to the Finnish people. Across the country, it was a tradition to worship spruces or other trees that grew in people's yards or further away from human settlements in hills or islands, and to sacrifice food and drinks to them. Sacred trees that grew in gardens were believed to protect people's homes. In eastern Finland, spruces were also used as *karsikkopuu* (marked tree) or *kalmakuusi* (death spruce), marked and pruned in order to keep a deceased person from returning home after they died, to celebrate a turning point in a person's life, or as landmarks (Figure 1).[19] The Christmas tree (*joulukuusi*, *joulupuu*) tradition has also highlighted the cultural importance of the European spruce, since it has traditionally been the 'the only right' tree to be used as a Christmas tree.[20] Nowadays, more and more Finns buy cultivated Serbian spruce or fir trees, but many still favour the 'native' spruce as their Christmas tree.[21]

The nativeness of European spruce can also be examined through plant etymology. Plant names may have different ages, and thus they may represent different eras. The Finnish word for spruce, *kuusi*, is part of the oldest lexical stratum in Finnish. It has counterparts in the most distant related languages of Finnish, namely, the Samoyedic languages in Siberia.[22] The word's reconstructed predecessor **kusa* existed in the Proto-Uralic language, which dates back 4,000–5,000 years. It is important to note that, at the time, the Proto-Uralic speakers did not yet inhabit the area of today's Finland, and Finnish speakers' ancestors migrated to the area later.[23] If only the age of the word were noted, it would seem that spruce trees have 'always' been in Finland.

19 Luttinen 2012: 270–78.
20 Päivänen 1993: 2–4.
21 Ibid.: 11–14.
22 Häkkinen 2004.
23 Saarikivi 2022: 55–58.

FIGURE 1.
Kalmakuusi in Oravivaara, Finland, photographed in 1915 by Samuli Paulaharju.
Source: Finnish Heritage Agency. Shared under CC BY 4.0.

When examined through palaeoecology and with a geological timeline, the European spruce is a relatively new addition to Finland's ecosystems, especially in the west. At the end of the last glaciation, the

areal extent of most plant species in Finland differed greatly from today's. The rapid increase in temperatures and retreat of the continental ice sheets opened up vast new areas for plants to colonise. The tree species that came to Finland after the Ice Age, about 10,000 years ago, were mostly birches and pine.[24] The highest abundance of temperate deciduous tree species was reached during the Holocene Thermal Maximum, c. 6000–3000 BCE.[25] The dominance of these trees, however, ended about 4500 BCE, when spruce spread westward to eastern Finland in high population densities, causing the decrease in the distribution of the former mixed conifer-deciduous forests.[26] Spruce gradually spread further westward. About 3500 BCE, the eastern half of southern Finland had already developed into the boreal ecosystem, while the western half was still dominated by mixed conifer-deciduous forest. By about 1000 BCE the whole of southern Finland was occupied by boreal forest. In the Åland Islands, the spruce became common around 350 CE.[27]

When examining a long period comprising thousands of years, many 'native' species can be considered aliens, like the European spruce in Finland, or anthropochores (plant species deliberately or accidentally distributed by humans). As Jones and Cloke point out, in order to be considered 'native', a plant species has to have existed somewhere for a certain amount of time.[28] We add another condition: to be granted belonging (or to be granted it more quickly), a non-native species must also have physical and biological characteristics – a certain plantiness – that are useful to humans economically and culturally. The plantiness determines whether the plant will succeed, flourish, spread, crossbreed or disappear in a certain area. Research regarding the agency of plants from the point of view of human experience has shown that humans experience plantiness in positive ways as long as it offers them some aesthetic value or mental health benefit, but these perceptions become negative if the plantiness is beyond human control or the plant cannot be utilised somehow.[29]

24 e.g., Donner 1971; Hyvärinen 1975.
25 Heikkilä and Seppä 2010.
26 Giesecke and Bennett 2004.
27 Sarmaja-Korjonen et al. 1991.
28 Jones and Cloke 2002: 31.
29 See e.g., Jones and Cloke 2002.

The political ecology really lies within the questions of how the plants' plantiness is perceived, for whom they create benefits, for whom they are a nuisance and the type of ecosystem considered worth protecting. Not all aspects of the spruce's plantiness have been appreciated by humans in the long run. On some rare occasions, the European spruce has been described as an alien species. In his non-fiction book on alien and invasive species, biologist Seppo Turunen describes spruce as 'an annoying occupier' that is edging closer to the habitat of oaks and lime trees and possibly suppressing them with light deficiency.[30] From an ecological perspective, spruce is an ecologically competitive, shade-tolerant species becoming dominant especially on mesic and nutrient-rich sites. Palaeoecological evidence shows that its invasion changed the forest structure, suppressing the shade-intolerant temperate deciduous tree species such as oaks, lime trees and hazel.[31]

We cannot say for sure how contemporary people felt about these changes, but can suggest something about how different tree species were valued and used by people since the Neolithic era. Palaeoecological findings from eastern Finland have shown that foragers during the Neolithic in Finland were not just passive users of the environment, but actively manipulated it.[32] Conscious and unconscious human–plant interactions affected the vegetation dynamics, and the deliberate manipulation of plant resources in particular had an impact on the abundance and distribution of certain species. Archaeobotanical data from Stone Age sites in mainland Finland have provided evidence that various nuts, fruits, roots and seeds originating from wild plants were gathered.[33] Edible plant species present in Finnish macrofossil materials include species such as raspberry (*Rubus idaeus*), juniper (*Juniperus communis*), hazel (*Corylus avellana*), wild strawberry (*Fragaria vesca*) and sorrel (*Rumex*) species. Hazel and lime were an important source of materials. Lime bast was widely in use as a raw material for different textiles and cordage during the Stone Age.[34] Most of these species had a competitive advantage and were growing more abundantly among the

30 Turunen 2015: 45.
31 Giesecke 2005; Seppä et al. 2009.
32 Alenius et al. 2021.
33 Vanhanen and Pesonen 2015.
34 Alenius et al. 2017; Mannering, Gleba and Hansen 2012.

early successional communities. In this context, due to its invasion into the region, the spruce could well have been considered an annoying occupier already by Stone Age people, as it suppressed the hazel and lime communities and other useful species that they favoured for food and other resources.

In southern Finland the period of highest biomass of spruce roughly dates to 2000 BCE–500 CE.[35] After this, the declining trend coincides with the dawn of forest clearance and farming. Spruce, preferring relatively nutrient-rich and moist soils,[36] was growing densely at the sites that were also best suited for cultivation. The first forest types cleared for slash-and-burn cultivation – the traditional Nordic means of clearing the land for cultivation – were therefore the spruce forests.[37] Instead of annoying occupiers, the people likely saw the spruce forests as a pristine source of various provisioning services such as food, firewood and material for buildings and utensils.[38] Daily life in the Middle Ages and pre-urban period (1000–1600 CE) in Finland was to a considerable extent based on utilisation of wood and wooden products, and there were no restrictions on forest utilisation. In the long run, wasteful forest resource use resulted in large-scale deforestation in the vicinity of villages and towns.[39] In the eighteenth century, the demand for timber began to increase in Europe, and spruce became an important raw material for the sawmill industry. Its plantiness was now appreciated.

At the end of the nineteenth century, nature conservation took shape as a conceptual entity and an idea with certain goals and a programme. Interestingly, from the perspective of nature conservation, the European spruce can be seen as a threat. Turunen, the biologist calling spruce 'an annoying occupier', describes how in some nature conservation areas spruces are logged to clear space for broad-leaved trees such as oaks.[40] Turunen also tries to control spruce in his own yard with the help of a bow saw. He writes that during the last hundred years the European spruce and the pest insects favouring this tree such as European spruce

35 Seppä et al. 2009.

36 Diekmann 1996.

37 Soininen 1974; Pitkänen et al. 2002.

38 Vuorela 1975.

39 Roiko-Jokela 2016.

40 Turunen 2015: 46, 176.

bark beetle have become more abundant partly due to changes in Finnish forestry. Turunen further argues that the spruce's presence has caused major ecological changes. This can result in cutting down spruces in the name of ecological restoration or habitat management. As historian Peter Coates states, the national citizenship of problem species can be easily contested.[41] If the European spruce is seen as a problematic occupier, its national identity or right to become abundant in Finland or in certain regions can be challenged.

NON-BELONGING: THE BEACH ROSE

The case of the beach rose underscores the question asked by political ecologists engaged in multispecies studies: who decides which species or varieties are and are not allowed to exist, and how is it in fact decided which species are worthy of love and care? [42] Furthermore, as advocated by Paul Robbins, an examination of sociobiological networks should be undertaken, rather than focusing on the beach rose as a species.[43] The terminology that describes and grants spatial belonging to plant species often assigns values to them, which further emphasises the political ecology of belonging. Many archaeophytes are viewed positively (such as cultivated plants that are useful to humans). Species that are classified as invasive species or garden escapees, on the other hand, are viewed as intruders that do not belong in Finnish ecosystems. This rests on the idea that invasive species and escapees may threaten species that are deemed native and thus decrease biodiversity.[44]

The beach rose is an example of a plant species whose cultural place and meaning has shifted. It was first welcomed in Finland as a new delight in Finnish gardens and flower beds, but nowadays it is, alongside its white-flowered form, *Rosa rugosa* 'Alba' categorised as an invasive alien species that does not belong in Finland. This species of rose was brought to Europe from northeast Asia in the late eighteenth century and arrived in Finland around the turn of the nineteenth and twentieth

41 Coates 2007: 188.

42 See e.g., Sodikoff 2012; Lorimer 2015; Rose, van Dooren and Chrulew 2017.

43 Robbins 2004: 140.

44 Coates 2007; Davis et al. 2011; Jones and Cloke 2002.

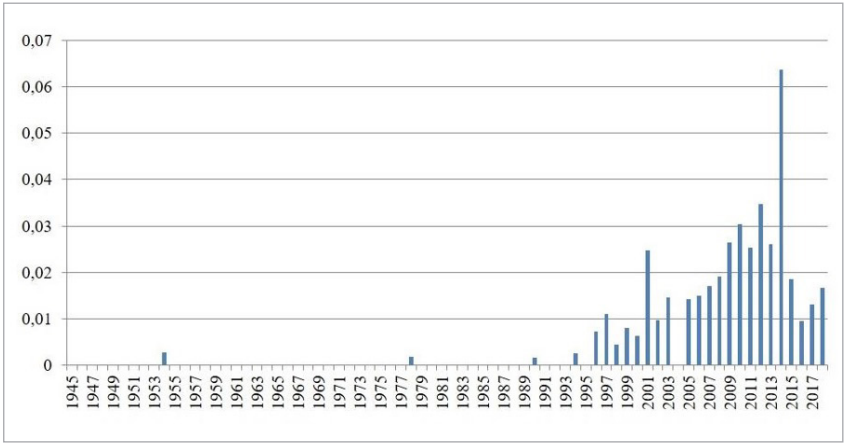

FIGURE 2.

References to *kurtturuusu* (*Rosa rugosa*) in the Finnish-language press from 1945 up to 2018.

centuries.[45] The Latin name *Rosa rugosa* was first mentioned in an advertisement in 1885. The Finnish compound word *kurtturuusu*, 'beach rose' (literally, wrinkly rose), is a much newer word in the Finnish language than *kuusi* (spruce). It appears in written sources in the mid-twentieth century and verifiably in 1954. Even before that, the plant had Finnish names, such as *kurttulehtiruusu* (wrinkled leaf rose), *jaapaninruusu* (Japanese rose) and *äkäruusu* (peevish rose).

Figure 2 shows the references to *kurtturuusu* (beach rose) in Finnish-language newspapers and journals. The annual figures were normalised by dividing the number of hits with the number of digitised pages per year. This revealed how frequently the beach rose's character as an alien plant received attention toward the end of the twentieth century.

Roses in general have many strong meanings in Western culture and Christian symbolism.[46] Even though the beach rose has not gained the same remarkable cultural importance as the European spruce in Finland, its plantiness has been considered beneficial by humans. The beach rose

45 Jauni and Seppälä 2017.

46 e.g., Liitiä 2006.

has edible rosehips, leaves that can be brewed as tea and petals that can be preserved as jam, which is similar to how other species of roses have been used for centuries. In his book about useful plants, which was published during the Continuation War 1941–44 and the subsequent austerity era in Finland, Toivo Rautavaara described the beach rose as the most important and recommended rose species because its rose hips contain high amounts of vitamin C.[47] Rautavaara encouraged people to plant them along roadsides and in parks, yards and even woodlands. The beach rose is still highly valued among collectors and consumers of wild plants.[48] Besides the species' edibility, its strength and resistance were appreciated and valued throughout the twentieth century. As it tolerates salt, it was planted in gardens near the coast and central reservations of motorways, which are continuously salted during the cold season as salt prevents roads from icing over. In 1997, the beach rose was chosen as the 'shrub of the year' in Finland due to its ability to flourish in nutrient-poor and dry soils and because it tolerates wind, salt and air pollution.[49] It is also valued for its longer flowering time than other wild roses, with blooms from June to late autumn.[50]

A major shift in the plant's cultural meaning from a useful and resistant plant to a harmful invasive species took place in the 2000s. In 2011, the *EU Biodiversity Strategy to 2020* was issued to halt biodiversity loss and combat invasive alien species.[51] By 2020, invasive alien species were supposed to be identified, priority species controlled or eradicated, and pathways managed to prevent new invasive species from disrupting European biodiversity. In the *Finnish National Strategy on Invasive Alien Species* published in 2012, 157 invasive alien species were identified, and one of them was the beach rose.[52] Since June 2022, it has been illegal to breed, cultivate, sell or release beach rose or its white-flowered form into the wild. Interestingly, cultivated beach rose hybrid varieties are not

47 Rautavaara 1943: 273–275.

48 Laitio-Ramone 2016.

49 STT [Finnish News Agency] 1997.

50 Rautio 2013: 4.

51 https://environment.ec.europa.eu/strategy/biodiversity-strategy-2030_en (accessed 21 February 2024).

52 https://mmm.fi/documents/1410837/1894125/Finlands_national_strategy_on_invasive_alien_species.pdf/ (accessed 21 February 2024).

regulated. There is ongoing discussion about which species should be categorised as harmful.[53]

One reason that the beach rose was included in these international and national strategies and listed as an unwanted invasive alien is the fact that it is originally a garden escapee. It spread from roadsides and people's gardens to wastelands and sandy, rocky seashores in the beginning of the twentieth century. Many biologists have highlighted that on the few sandy Finnish beaches, the beach rose has spread, formed wide growths and replaced native vegetation due to its rhizomes.[54] The need and urge to eradicate beach rose is therefore linked to the idea of protection of seashores and native plants.

The beach rose and other invasive species and garden escapees are sometimes referred to as enemies, and this language can resemble that used in relation to unwanted human foreigners.[55] The extermination of the beach rose has even been referred to as warfare. For instance, the *Länsi-Savo* newspaper wrote on 31 March 2011 that a war had been declared against alien species such as the beach rose.[56]

Nevertheless, not all Finns see the beach rose as a non-belonging invader. Some biologists and ecologists have debated the harmfulness of beach rose and argued that even though the species should be eradicated from sandy beaches, it has a right to exist in gardens.[57] It seems that the beach rose is almost violently out of place when it spreads to the seashore, yet its right to exist in gardens is open to debate. Besides biologists, many other people view the beach rose as a cherished and traditional garden plant, and some have criticised the decision to place it on the list of invasive aliens.[58]

In modern language, people's perceptions and attitudes toward the beach rose can be linguistically studied, using online discussions, for example. A popular research source for this is the Suomi24 (Finland24) discussion forum.[59] All its discussions are stored by the Language Bank

53 Turunen 2015: 186.

54 Cajander 2018: 42; Louna-Korteniemi 2019; Turunen 2015: 186, 188.

55 See also Coates 2007.

56 Nikkilä-Kiipula 2011.

57 See e.g., Turunen 2015; Cajander 2018; Kasvi 2019.

58 Konttinen 2017.

59 https://www.kielipankki.fi/corpora/suomi24/ (accessed 21 February 2024). See e.g., Lehti et al. 2020; Uusitalo and Suomalainen 2023.

of Finland and can be searched with the *Korp* concordance tool, a web-based tool that can be used for corpus queries based on morphosyntactic analysis and other features.[60] The data is accumulating, and at the time of composing this paper it includes writings from the period 2001–2020.

A search for *kurtturuusu* ('beach rose') provided 789 results, including singular and plural forms in all cases. The contexts in which the word is used varies from racist human immigration references to neutral nature discussions. In this case, when focusing on the nature-related comments, a language-focused content analysis was performed.[61] The analysis revealed mixed emotions toward beach rose, which were evident, for example, through the affectiveness of the adjectives used. While some commentators had a positive attitude toward beach rose as part of Finnish natural heritage, many others did not. The following examples are English translations and the original Finnish comments are provided in footnotes.

Some commentators expressed mixed feelings, as can be seen from one of the comments (equivalent adjective translations underlined or bolded):

> It is a pity about the beach rose, it is so **pretty**, but I guess it is <u>harmful</u> in its own way and needs to be removed.[62]

Sometimes people found the public discussion around the beach rose amusing. The following example shows a writer who imitated political jargon ironically:

> Beach rose must be eradicated from the country, and [Finland must be] the first one in the EU [to monitor it] strictly with a conditional fine. Finland, as the first one in the world, will move to an era without beach rose and will lead the way for others toward developing a society without beach rose. Beach rose and combustion engines do not belong to Finland, and they will be removed despite the objections of reactionary forces.[63]

60 Korp Concordance Tool, The Language Bank of Finland. https://korp.csc.fi/korp/#?corpus=&cqp=%5B%5D&lang=en (Accessed 28 February 2023).

61 See e.g., Herring 2004: 4–5.

62 *Sääli vain sitä kurtturuusua, se olisi niin **nätti**, mutta kai sekin on omalla tavallaan <u>haitallinen</u> ja siis poistoon sekin.*

63 *Kurtturuusu on hävitettävä maasta ensimmäisenä EU:ssa ja tiukimmin uhkasakoin. Suomi ensimmäisenä maailmassa siirtyy kurtturuusuttomaan aikaan ja on samalla tiennäyttäjä muille kurtturuusuttoman yhteiskunnan kehittämisessä. Kurtturuusut*

The out-of-placeness and non-belonging of the beach rose is created and strengthened not only through language, but also through practices of control and prevention. Biologists and officials have encouraged Finnish citizens to use different methods to remove the species. People need to identify the species first, and then control it by pulling and digging it out manually or mechanically with the help of machinery (such as pruning shears, brush saws, tractors), to make sure that all the roots are removed. It can also be controlled with the help of grazing animals.[64] Natural scientists Jauni and Seppälä noted that the beach rose can further be controlled by collecting its rosehips or 'starving it' for several years, which in effect means cutting all the young branches and shoots annually until the plant dies.[65] In Finland, people have voluntarily eradicated local beach rose populations in events organised by municipalities and nature conservation organisations. The characteristics of the thorny, densely growing and well-rooted beach rose make it a difficult plant to get remove. Nevertheless, Finns have devised many ways to destroy beach rose populations.

CONCLUSIONS

In this paper, we have reflected on the political ecology of belonging and the notions of alienness and nativeness through the concept of plantiness. We selected two species, the European spruce and beach rose, which are different biologically, culturally and economically, as the focus of our attention. We have argued that transdisciplinary approaches – here, the combination of palaeoecological, historical, cultural and linguistic studies – can help clarify why people perceive, feel and behave in certain ways toward plants. We have applied political ecology to better understand the political rather than only the ecological, cultural and social attitudes behind the emotions and actions taken. Categorising plants as belonging and non-belonging, as native or alien and invasive, is also always about power, especially if these categories are then used as arguments for or against the plants in conservation or provisional

ja polttomoottorit eivät kuulu Suomeen ja ne lähtee taantumusvoimien vastustuksesta huolimatta.

64 Ikonen, Kekki and Räikkönen 2009; Cajander 2018.

65 Jauni and Seppälä 2017: 281.

strategies, for example. The political ecology framework here also demonstrated that we should focus on sociobiological networks, instead of singling out specific species and one-sidedly categorising them.

Attitudes to invasive species have also varied and changed, as the example of the beach rose reveals: Finns were once encouraged to plant beach roses in their gardens, but nowadays the law demands that they be eradicated. People seem to have mixed feelings about the species. While some people support the eradication, others think that it is unnecessary. Meanwhile, the European spruce has had important economic and cultural relevance over a very long time horizon, even though it can be considered originally to have been an alien species. It is difficult to draw a line between native and non-native, especially if a long time has passed since the arrival of the plant. Considering the long history of human land use and exploitation of forests, there are almost no truly natural areas remaining in Fennoscandian forests. Scholars therefore need to view forests and the many plant species there as existing in different stages of naturalness.[66]

Linguistic and palaeoecological perspectives may be helpful when drawing conclusions about the times before written sources, while cultural historical and ethnological perspectives, as well as linguistics, are crucial for analysing historical and modern times. Combining disciplines with different time scopes can help scholars see and understand that their environment and the perceptions, attitudes and affections to plants have been formulated and have changed through time. We encourage scholars to develop more transdisciplinary perspectives when studying human–plant relations.

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66 Peterken 1996; Brumelis et al. 2011.

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Poppies and Women Under the Linden Tree in a Slovak Village: Exploring Culturally Significant Plants Through Informed Archaeological Storytelling

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ABSTRACT

In her 1993 book, *What This Awl Means*, Jane Spector examined the relationship between gender, objects, environment and archaeology through a female personal narrative. While such historical storytelling has been viewed as unconventional, it is effective as it paints a vibrant picture communicating context, significance and insight into what might otherwise be viewed in traditional archaeological description as a simple, utilitarian tool. However, to do this effectively, sufficient cultural competence and symbolic understanding must be woven with archaeological research, anthropological interpretation and understanding of the cultural and historical context through the lens of storytelling. This paper explores this approach by presenting the complex symbolic and agroeconomic relationships maintained with the opium poppy (*Papaver somniferum* L.) and the linden tree (*Tilia* spp.) by ancient peoples in Central Europe. The story draws on a body of archaeological, botanical and chemical research, Slovak cultural and linguistic background, as well as ancestral oral history.

KEYWORDS

storytelling, plants, poppies, linden tree, archaeology, Slovak.

INTRODUCTION

A story is connected to many elements, including the relationship of the storyteller to the story that is woven. As the teller of this story, I draw from my research as an archaeologist working on various aspects of the environmental history of the opium poppy, with data collected as a Fulbright scholar in the Slovak Republic (2018–19), but also many years of accumulated cultural knowledge from my own experiences, having been born in the Slovak city of Trnava, and ancestral oral traditions covering multiple generations. My work is also informed by research on Indigenous storytelling and environmental relationships, to which I was introduced through my experiences in North American archaeology over the last decade and related engagement with Tribal Nations in historic preservation contexts.

THE LOST ART OF STORYTELLING IN ARCHAEOLOGY

Stories are, in principle, at the centre of what archaeologists do – namely, unraveling the lifeways of past peoples through the ordered examination and analysis of the material remains left behind.[1] The nature of those stories depends largely on the hands weaving these remaining threads. Maggio notes that there is some focus on storytelling as a domain within anthropology, but this tends to be more about individuals telling stories of experience and the relationship of the storyteller to listeners, story characters and events. The resulting narrative is predominantly analytical, rather than utilising storytelling as a research method or mode of communicating results.[2] Such analytical writing often takes the form of what Pluciennik terms *diktat*, where archaeologists view themselves as experts weaving authoritative and objective narratives that they are uniquely qualified to write.[3] This is unfortunate because, in almost every domain, storytelling informs the human aspect of our lives.

The stories told in archaeology have changed over time. In the foundational years, stories meant fanciful tales of princes and princesses and presumptions about the past that said more about the predominantly Western European men writing them than the lives represented in patterns of material culture remnants. Over the years, archaeology firmly articulated its methods of investigation and diversified modes of interpretation by engaging with various anthropological models. Regarding gendered perspectives, the entry of women into the field initiated changes in archaeological narratives – inserting women, children, people of colour, those crossing gender categories, and numerous other voices into an archaeological record previously only inhabited by men as primary actors.[4]

Thus, the character of the academic narrative also changed, towards Pluciennik's[5] *demotic* voice, which presents archaeologists as 'mediators

1 London, 'Ethnographic and ethnoarchaeological insights', pp. 99–100.

2 Maggio, 'The anthropology of storytelling and the storytelling of anthropology', pp. 90, 92.

3 Pluciennik, 'Authoritative and ethical voices', pp. 55, 61–62.

4 Aggarwal, 'Traversing lines of control: Feminist anthropology today', p. 17; London, 'Ethnographic and ethnoarchaeological insights', p. 120.

5 Pluciennik. 'Authoritative and ethical voices', p. 62.

and facilitators' in a conversation about the past that includes many voices. This approach accepts the 'responsibility of archaeologists as authors'[6] and that archaeological data represents a subset of a lived reality. Those working in ethnoarchaeological perspectives and in consultation with descent communities may more readily appreciate the potential misinterpretations of their datasets.

Day acknowledged that the 'linear, written, expository' archaeology narrative does not reflect how human beings experience life and as such 'experimental narratives' transform 'the two-dimensional world of data… into the multidimensional world of sensory life'.[7] But are these necessarily stories?

Ranco and Haverkamp state in regard to Indigenous storytelling that '[w]ithout stories, we have no way of connecting what it means to be human with the pathway of our existence' and that stories are 'central to knowing, learning, and teaching about the world and reality'.[8] In this sense, stories serve as the lens through which we comprehend our surroundings, as well as other living creatures inhabiting it.

The terms *narratives*, *stories* and *storytelling* require some distinction. Grötsch and Palmberger note that 'narratives give meaning to events and experiences',[9] while Bruner differentiates between 'landscape[s] of action' and 'landscape[s] of consciousness', wherein one addresses events and the other how they are experienced and perceived.[10] These landscapes are ultimately 'intertwined' through the story.[11] However, the distinctions soon blur into synonyms and analytical treatment as mere indications of cultural thinking and values. Boas and Malinowski acknowledged as much a century ago in recognising oral traditions as a touchstone for understanding other cultural elements.[12]

Nothing stated here should be taken to suggest that such archaeological storytelling lacks rigour, principles or methods. Successful archaeological storytelling requires parameters, such as those espoused

6 Ibid, p. 55.
7 In Van Dyke and Bernbeck, 'Introduction', pp. 3–6.
8 Ranco and Haverkamp, 'Storying indigenous (life)worlds', p. 2.
9 Grötsch and Palmberger, 'Introduction', p. 4.
10 Ibid., p. 4.
11 Ibid., p. 5.
12 Ibid. pp. 5–6.

by ethnoarchaeological approaches, the goal of which is to better understand 'how ancient societies functioned day-to-day' from archaeological remains.[13] In London's work on pottery production in Cyprus and the eastern Mediterranean, it quickly becomes clear how arbitrary interpretative categories that well-meaning archaeologists unknowingly superimpose on their subjects may be. In reality, people had far 'more fluid lifestyles and workplaces'.[14]

STORYTELLING AND COMMUNICATING RESEARCH

Who tells the story makes a difference. Van Dyke and Bernbeck[15] rightly suggest limitations for outsider archaeologists (i.e., Western European, American, or others where colonial or imperial legacies have privileged their positions) in writing fictionalised accounts of ancient individuals that purport to give the said individual(s) a voice. This need not apply to all, as a greater number of anthropologists and archaeologists are working in their own communities, protecting their own heritage and writing histories from their own perspectives. It is acknowledged that archaeology as a scientific discipline must be explicit about its methods, data and interpretative schemes, and, thus, storying cannot replace other modes of research dissemination. Pollack, who makes an important point in a field where popularised misinformation can reign, emphasises that such creative presentations must explicitly connect to archaeological data.[16] However, as recent critiques of the discipline's history have shown, new perspectives are needed.

The story presented by Phillip Tuwaleststiwa (Hopi) and Judy Tuwaleststiwa is instructive. Their work, which uses imagery from diverse points in history, represents an accumulation of cultural understanding, with the resulting story carrying 'much truth as fiction' 'to the Native eye and ear'.[17] Such a perspective is invaluable; but outsider archaeologists can also take steps to account for such differences (e.g., Van

13 London, 'Ethnographic and ethnoarchaeological insights', p. 97.
14 Ibid.
15 Van Dyke and Bernbeck, 'Introduction'.
16 Ibid., p. 19.
17 Tuwaleststiwa and Tuwaletstiwa. 'Landscape', p. 102.

Dyke making sources explicit and Jane Spector's extensive collaboration with descent community members).[18]

Returning to the needed distinction between story and narrative, Phillips and Bunda aptly characterise storying 'as an act of making and remaking meaning through stories', which are 'alive and in constant fluidity as we story with them'.[19] They rightly view 'humans as storying beings' wherein 'telling stories is a natural human habit'.[20] Why should the presentation of ancient human lives through archaeological data be any different? More recent focus on oral traditions demonstrates they act as great repositories of cultural information, capable of communicating complex, interrelated themes in the form that our human brains are best equipped to process. Thus, '[s]torytelling reveals meaning without the error of defining it'.[21] There is much to be learned from listening to these voices in their own right,[22] but also in how the relationships between ecological knowledge, cultural understanding and intergenerational communication are approached and understood. The significant role that storytelling holds for multigenerational women is further acknowledged, as well as how it functions to encapsulate and transmit cultural and technical knowledge.[23]

WOMEN AS TRANSMITTERS OF KNOWLEDGE

The domains traditionally inhabited by women as holders and transferers of knowledge interface with the ecological, religious and economic. Montanari and Bergh illustrate how women's traditional knowledge

18 Van Dyke, 'The Chacoan past', p. 93.

19 Phillips and Bunda, *Research Through, With, and As Storying*, p. 7.

20 Ibid., p. 8.

21 Ibid., p. 10.

22 The social, historical, and environmental implications of Indigenous storytelling – and the traditional knowledges that underpin them – are inseparable from the acknowledgment that there are other ways of knowing. But they are also inseparable from modern historical realities (see Whyte 'On the role of traditional ecological knowledge' for an introduction to these concepts and the USGS *Incorporating Indigenous Knowledges* webinar series for case studies). These contemporary conversations have specific aims for the Indigenous communities that strive to ensure their sovereignty and prosperity.

23 Dever, 'Women in archaeology and antiquity', pp. 183–84.

transforms product development.[24] Kelly and Ardren[25] further relay archaeological case studies wherein women's traditional knowledge covers various domains (culinary, ethno-medicinal, agricultural, etc.) and forms 'an integral part of the women's contribution to the daily sustenance and maintenance of the household'.[26] This should not, however, be taken as a simple statement about domestic work, but as fundamental and critical work in which women are actors, directing not only the perpetuation of crucial knowledge systems in complex social pathways, but also decision-making that ensures the health and prosperity of the social system at multiple levels.

As 'knowledge and use of … plants are concentrated among women because of their role as managers of household health', Reyes-Garcia[27] shows that such knowledge is distributed based on a series of variables (e.g., kinship, age, degree of specialisation) and transmitted through social network relationships. For example, information may be transmitted vertically (e.g., from parent to child), horizontally (between 'two individuals of the same generation'), or through oblique, but nonvertical transmission (from parental to filial generation, but not a parent to child).[28]

Storytelling is often the mechanism through which such information is transmitted and within the domain of women. According to Phillips and Bunda, '[w]omen were always the story-givers, the memory-keepers, the dreamers', with the transgenerational transfer of 'grandmothering stories' serving to 'connect womenhood across time, culture, and place'.[29]

PLANTS AS ACTORS

There may also be other nonhuman actors in such storytelling, including plants. In such scenarios, not only are the stories different, but the characters taking the central role may also be so. Middlehoff and

24 Montanari and Bergh, 'Why women's traditional knowledge matters'.
25 Kelly and Ardren, *Gendered Labor in Specialized Economies*.
26 Montanari and Bergh, 'Why women's traditional knowledge matters', p. 4.
27 Reyes-Garcia, 'The relevance of traditional knowledge systems', p. 5.
28 Ibid., p. 6.
29 Phillips and Bunda, *Research Through, With, and As Storying*, pp. 12, 27.

Peselmann[30] highlight not only the myriad ways in which plants interweave themselves in human lives, but also how they enter the narratives that humans weave about themselves. Those that observe and understand the individual, communal and temporal relationships plants have with both vegetal and non-vegetal co-inhabitants within an ecosystem perspective come to realise the value of other explanatory models (i.e., traditional ecological knowledge systems). Myers stated that 'more than the sciences [was needed] to engage in meaningful encounters with plants'.[31] These sentiments highlight the degree of separation and alienation from nature (as conceived by Tyburski)[32] and the great desire to reinsert an 'ecological consciousness' into Western science.

> Sensing plant stories requires so much unlearning … [of] approaches that alienate us from our more-than-human kin and render them as objects and resources… unlearning what we think sensing is, what we think communication is, what we think counts as a story…[33]

However, those coming from a cultural paradigm based on extraction and exploitation must take care not to focus this desire into an appropriation from 'eco-cultures' that have maintained their connections to nature.[34] Such examples can readily be seen in the popularised search for secret Indigenous knowledge from psychoactive plants and the assumption of Indigenous practices, like smudging.[35] Tsymbalyuk likewise highlights not only a similar 'resourcification' of the Russian war on Ukraine, but also the significant role that stories about plants have on the emotional connections of places – destroyed or forcibly abandoned – to the extent that 'the connections to plants in those landscapes are synonymous with conceptions of home, self, and being'.[36]

In the context of storying practices, plants may serve as actors and tell us about themselves at three levels: a plant's lifecycle, that of a plant community (i.e., forest, field, garden) and individual plant lives.[37] Such levels

30 Middelhoff and Peselman, 'The stories plants tell', pp. 171–88.
31 Myers, Middelhoff and Peselmann, 'Stories are seeds', p. 276.
32 Tyburski, 'Hendryk Skolimowski on ecological culture'.
33 Myers, Middelhoff and Peselmann, 'Stories are seeds', p. 269.
34 Tyburski, 'Hendryk Skolimowski on ecological culture', pp. 81, 85.
35 Spichak, 'Psychedelics are surging'; Pember, 'Native Americans troubled'.
36 Tsymbalyuk, 'I dream of seeing the steppe again', pp. 248–49.
37 Marder, 'A philosophy of stories plants tell', pp. 189, 196.

are represented in the story below with different types of plants whose lifecycle extends on vastly different time scales, individual plants (i.e., individual trees), and communities of plants (i.e., poppy fields and treestands). As discussed later, the story serves as a repository of knowledge – drawing from fifteen years of archaeological research from various viewpoints (botanical, chemical, archaeological, culinary, etc.), accumulated cultural knowledge, and ancestral oral traditions – presented in a format that is equally accessible to readers (or listeners) across diverse domains. Complex interrelated themes, histories and information are communicated in a simplified form that humans – as storying beings – understand best.

STORY: POPPIES, PINS AND WOMEN UNDER A SLOVAK TREE GROVE

Our village is one of several within a broad valley that is nestled in the forested foothills of two low mountain ranges and made fertile by the streams that descend from them. At the end of spring, the gardens of our village were set ablaze with the vibrant colour of our poppy crop, standing tall and proud, swaying in the wind as it rolled through the valley.

One of the happiest times when I was a girl would happen a few months later, when the poppies were dried, piled up and carried to the courtyard of our family's compound. It was here that the women of my family – my mother, grandmother and sisters – would sit in a circle talking – telling stories of our village, family and how our people came here and established our village generations ago, stories of brave heroes that once fought against invaders, of young girls seeking shelter under the linden tree in the sacred woods of the surrounding hills that still remained at the edge of the valley, and children's stories where mountains, flowers, trees and mushrooms came alive.

The memories of these simpler times of my life in my family's house bring me joy, though they now seem a lifetime away, as I walk in silence alongside the other high-status women of my husband's family. The men trot their horses before us to the neighbouring village for the summer festival.

My clothes are now made of the finest flax. Grown and harvested by men like my father and grandfather, who later stacked it to dry in little piles across the hills. Later it was spun by women not unlike my sisters – all of whom live on the lower road of our village – where I rarely get the occasion to travel freely

FIGURE 1.

Poppies in bloom, Podbanské, Slovakia, 2021 (left); dried poppies in field, Zuberec, Museum of the Orava Village, Slovakia, 2023 (right).
Source: courtesy of Alena Chovanec.

these days. My sleeves are layered and adorned with the age-old designs of my village foremothers; my hair is parted, wrapped and braided with summer flowers, and my neck and arms laden with metal spiraling bands. My ceremonial dress is affixed with metal pins extending from the breast of my dress up beyond my shoulders. They are long, like that of a poppy stalk and their carefully fashioned heads are globular like that of a dried poppy capsule top.

These metal ornaments reflect my husband's stature. They are fine, but heavy, making the miles we are to walk to the celebration in the neighbouring village far more arduous than it once was. We walk the lower road, where I spent my childhood and past my father's compound. I longed to walk through the wooden doorway and take one more look through the courtyard where I spent my younger, carefree days.

The swaying poppy flowers that coloured so many mornings of my youth had already passed. The petals had long blown away, and all that remained were the large, bloated capsules filled with blue seeds to make pastries filled with ground poppy seeds sweetened with my grandfather's honey. The stalks were tall, rigid and dry, being collected into wooden wagons, which would soon be delivered into the compound courtyard, where the women of the household would sit for many hours. With their heavy skirts gathered, holding a

FIGURE 2.

Copper pin, *Malá Vieska* type*, measuring 44 cm in length, head of pin, 1.3 cm diameter. A1983.
Source: photograph by author with permission of the Balneologické Múzeum V Piešťanoch, Piešťany, Slovakia, 2019.

Note: * The *Malá Vieska* type of copper pin is longer than many other types of pins, which may measure between 40 cm to well over metre in length. The example discussed here represents a shorter version. See Novotná *Die Nadeln in der Slowakei* for detailed catalogue.

weathered but still sharp knife, they would skillfully slice off the wheel on top of the capsule, and the lovely gray and blue seeds would be poured into the buckets between their feet. Typically, we would sit close to the animal pen or the outdoor hearth, where we would discard the stalks and empty pods that would be later burned or composted with other trash.

They were difficult but happy times, narrated by the songs that women in our village had sung for generations before ours, filling the hills with music, as they toiled in the fields. My favourite when I was a girl was the song about the little finch and how the poppy is sown, grows, flowers and is eaten. These flowers and seeds always seemed to follow me through the happy and difficult times of my life. They sweetened my meals and nourished me when meat was scarce.

By this time, the dried poppies would fall apart almost as soon as the seeds left their casing. But occasionally there was an especially large, or lovely capsule, that would be kept in its entirety, to remind us of the blessings of the

FIGURE 3.
Gabriela Čechovičova harvesting and selling poppy seed in Cifer, Slovakia.
Source: Alena Chovanec, 2021.

summer and keep away the unruly spirits that roamed the changes of seasons. These my aunts would save and place in vases or weave into wreaths at the end of the summer, which would later be placed to guard our windows or doors.

In the years when the great sickness swept through the villages, I learned how the smaller, more shriveled capsules could be soaked in a tea made from the mountain herbs to be given to the little ones when their fevers raged through sleepless nights. It brought my little cousin some brief comfort as I sang to and cradled him close just before the morning light – before he like many others in the village succumbed to the great god. It still weighs on my heart to think of when we laid his frail little body to rest with all the other faces I had once known. Now it is only those few of us who remain that know what lies beneath the unmarked, barren ground in the empty space at the entry way of the cemetery. In following summers, I used to make a little man

FIGURE 4.
Dried, halved poppy capsules in wreaths and dried poppy stalks on display.
Source: Author, 2018, Trnava, Slovakia.

or wagon out of the dried chaff and leave it on the stone wall to let him know I still think of him.[38]

My fingers slowly touched the long metal ornament binding the layers of embroidered cloth, running down from each of my shoulders. They were long and fashioned to appear as the tall, proud poppies, and were in fact nearly as long as the poppy stalks. The poppies no longer dotted the margins of the fields, but I always carried their significance with me in this way.

Years later when the people from the east came, I would carefully shed my fine clothes and metal adornments, along with those that my daughters and their cousins had worn. We bound them together and wrapped them in our layered garments, before burying them. This was not the only time my people buried metal objects; the men would likewise bury objects made of our

38 It should be noted that various mortuary practices are documented during Central European prehistory, with cremation predominating in certain periods. See Furmánek and Mitáš, 'Poherbiská a pohrebný rítus', pp. 268–71; Bátora, 'Poherbiská a pohrebný rítus', pp. 117–24; Furmánek, 'Kov', pp. 223–45; Furmánek, 'Hromadné nálezy kovových predmetov', pp. 288–89; Ožďani, 'Poherbiská a pohrebný rítus', p. 161.

valuable metal axes and spearheads at strategic paths along their journeys. The burial of our pins differed from their more practical means.

We women removed our pins, carefully bent the bottoms to close their spiritual paths, bound them with items of each of our clothes and buried them on the south side of the hill overlooking our valley.[39] *We laid them in the shade of the linden trees in the primordial forests, where stories resounded of my ancestors who revered these ancient trees. As a child I only knew them as the source of the flowers that we used for tea in the winter. When I became a woman, I learned that they held much greater power and significance for us – like the poppy that had followed me through the ups and downs of my life, that we looked to for wishes of protection and prosperity and new beginnings. We only went to the linden in greater times of need. As we have for generations before, we return to these sacred woods; so now it seems fitting to take the symbol that led and nourished me through my life thus far and entrust it to these trees so that the women our village may be protected from dangers that come from across the eastern mountains. And so, we bury these great symbols, born of our fields, products of the mountains, and moulded by fire, we lay them here, bind them with the fruits of our labour, that they may protect us as we move further west.*

POPPIES IN THE FIELD

As much of the above centres around the imagery and symbolism of the opium poppy, a brief introduction to the plant's characteristics and significance follows. The opium poppy, *Papaver somniferum* L., is a plant with which human beings have maintained a long and complex relationship. The plant has four-petaled flowers that vary in color, a capsule-like fruit that produces many seeds and a white juice (latex) that produces numerous pharmacologically active chemical compounds, found in the exterior of the capsule[40] (see Figure 1). It serves both as

39 See Novotná and Kvietok 'Nové Hromadne Nálezy z Doby Bronzovej z Moštenice' for details about a series of long metal pins with ends bent that were bound together and buried in four Bronze Age metal hoards on a hill overlooking Moštenica.

40 Chovanec and Flourentzos, 'A review of opium poppy studies', p. 146; Merlin, *On the Trail of the Ancient Opium Poppy,* p. 92.

a highly nutritious food and one of the most widely used psychoactive and medicinal substances.[41] These features make it a multipurpose plant in a genus (*Papaver)* with various members.

The white juice in the outer skin of the capsule serves as a defensive mechanism against predators that would injure the capsule to get to the seeds inside. It contains over forty alkaloids, in five different classes, including morphine, the most abundant. The concentrations of alkaloids may differ based on plant development and environmental factors. Together, the product opium is highly addictive but also has a wide range of medicinal applications. Excessive doses result in nausea, convulsions or death.[42] As such, the opium poppy and its alkaloids are at the centre of the global opioid crisis. Public concerns about opium addiction are not a modern phenomenon, with large scale addiction documented in the nineteenth century, as evidenced by a range of tonics with opium as an ingredient, public criticism of opium addiction in nineteenth century news articles, and the well-known account of an English self-professed opium-eater.[43]

Despite this history, the opium poppy in Central Europe was traditionally utilised as an edible plant, which corroborates much of the archaeobotanical data.[44] It may be noted that Sovičová classifies the opium poppy in a list of poisonous plants.[45] Those from East and Central Europe are keenly aware of the number of food items produced from poppy seeds and that the poppy seeds and the alkaloid-rich opium are synthesised and harvested from different parts of the plant in different ways.[46] The seeds are obtained from inside the poppy capsule and may be harvested when the seeds inside the capsule sound like a child's rattle.

41 Bernáth 'Utilization of poppy seed', p. 338. Merlin, *On the Trail of the Ancient Opium Poppy*, p. 91.

42 Chovanec and Flourenztos, 'A review of opium poppy studies', p. 146; Kapoor, *Opium Poppy*, p. 162; Merlin, *On the Trail of the Ancient Opium Poppy,* p. 91.

43 De Quincey, *Confessions of an Opium Eater*; Kapoor, *Opium Poppy*, p. xv; 'The opium habit', p. 6.

44 Chovanec and Flourtentzos, 'A review of opium poppy studies'; Chovanec, 'Examining the history of the opium poppy'; Hajnalová, *Archeobotanika v dobej bronzovej na Slovensku.*

45 Sovičová, *Jedovaté Rastliny V NPR Regetovské Rašelinisko*, p. 39.

46 Marec, *Požehnaj tieto dary*; Beranová, *Jídlo a Pití. V Pravéku a ve Stredovéku*', pp. 72–73, 255.

Depending on the point of harvest, different varieties (blue, gray, white, etc.) have different flavour profiles[47] (see Figure 3). Opium derives from within the exterior coat of the poppy capsule and functions botanically as a defensive mechanism, to protect the seeds inside the capsule.[48]

Direct and indirect archaeological and historical evidence for the knowledge of the opium poppy occurs throughout the Mediterranean Basin, Europe and beyond. The nature of evidence includes preserved macrobotanical remains (seeds and capsules), microbotanical remains (pollen and phytoliths), chemical residues, literary references and a broader body of suggestive evidence for the knowledge of and a symbolic association with the opium poppy's psychoactive and soporific (sleep inducing properties). In Central Europe, remains of poppy were first encountered in the nineteenth century in the context of Neolithic pile-dweller villages around the banks of Swiss lakes, which had extraordinary preservation of organic remains. There is some evidence for poppy species in modern-day Slovakia in these earlier periods, but it is not until the Bronze Age that it appears in notable amounts, reaching high levels of cultivation in the Medieval period. The remains most often are found within food storage contexts, and almost exclusively in the form of seeds.[49]

The nutritional value of poppy seeds is significant, largely due to their high oil content. This oil, which has a long shelf-life, contains various vitamins and minerals. It is especially high in Vitamin E and the essential fatty acid linoleic acid, which is key to growth and development. Safflower (*Carthamus tinctorius*) is the only other plant oil that is higher in linoleic acid.[50] Olive oil, one of the key edible and industrial oils of ancient times, is high in oleic acid, but relatively low in linoleic.[51] The benefits of poppy seed oil have received greater attention in recent years.[52]

47 Abrahámova and Čechovičová, *Maková knižka*, p. 17; personal communication Dr Steggman-Rajtar (2019).

48 Fejér and Salamon, 'Poppy (*Papaver somniferum L.*) as a special crop'; Hajnalová, *Archeobotanika v dobej bronzovej na Slovensku*, p. 85.

49 Chovanec and Flourtentzos, 'A review of opium poppy studies'; Chovanec, 'Oil, seeds, and cultural symbols'; Merlin, 'On the trail of the opium poppy'.

50 Lančaričová, Havrlentova, Muchová and Bednárová, 'Oil content and fatty acids composition of poppy seeds'.

51 Chovanec. 'Cracking the history of the olive', p. 46; Kapoor, *Opium Poppy*, p. 97.

52 Jurgová and Kaššová, *Mak na našom stole*, pp. 8–11.

Delineating the early history of the opium poppy and its use by humans is complicated in that it's a weedy species that readily invades disturbed soils. Differentiating the small seeds to the species level can be difficult. This is necessary to determine if and how the remains were used by ancient humans.[53]

There are significant cultural and symbolic associations with the plant, particularly in the Slavic world where its use as a culinary product is widespread and it is a frequent element in folklore.[54] Far too often the narcotic and medicinal uses of the opium poppy are overemphasised whereas its importance in subsistence and symbolic culture overlooked, as is its embeddedness within the broader environmental, social, economic and cultural framework. Interwoven in this framework are relationships with other actors, such as the people who grow, process and use the poppies and their products, other plants with which the poppy shares an ecological landscape (i.e., hemp and flax) and the stories, songs and rituals – both large and small – that communicate their meaning intergenerationally.

THE OPIUM POPPY, ROLE OF WOMEN AND STORYTELLING IN SLOVAK CULTURAL CONTEXT

Several important themes pertaining to the poppy are illustrated in the story. The first is that, for Central European Slavic people and Slovak people especially, the opium poppy is an agricultural product, used for its seeds and oil, having a special role in culinary culture, signifying wealth and prosperity, health and goodness,[55] but also having broader symbolic associations with the plant's soporific properties.[56]

As noted above, there is a greater research focus on the psychoactive characteristics of the plant and its use by humans than on its agricultural history (and prehistory). The archaeological, botanical and

53 Chovanec and Flourentzos, 'A review of opium poppy studies', pp. 145–47; personal communication, M. Hajnalová (2018).

54 Chovanec, 'Examining the history of the opium poppy'.

55 Abrahámova and Čechovičová, *Maková knižka*, p. 17; Jurgová and Kaššová, *Mak na našom stole,* pp. 8–11; 'Striga', *Centrum pre tradičnú ľudovú kultúru*.

56 See Chovanec, 'Examining the history of the opium poppy' for a discussion of these.

historical evidence for much of the opium poppy's history has largely been agricultural in nature, though the plant's role as medicine, narcotic and poison cannot be overlooked either.

In that regard, this story examines the spatial, ecological and social relationships involved in the cultivation of poppy, including conditions under which it is sown, harvested and used, who does this work and how, and other key plants with which the poppy has a relationship, particularly flax (*Linum usitatissimum*). The story likewise highlights a knowledge of the 'poppy tea' traditionally used to help children sleep,[57] while making it clear that the extraction of opium from the plant was not how it was used in this cultural context.

A number of details derive from personal and family experiences, locations and oral histories, including the relationship among multi-generational women within the same extended family, and their role in society and household production. In this regard, the story should not be viewed as one that occurred at a particular historical time or place, which is a key characteristic of novelistic tales in the Slovak tradition[58] (as well as the Hopi story above). In such tales, time and place remain undefined, and they tend to be situated in Slovak towns, and focus on 'everyday life of a common person'.[59] More specifically, 'novelistic tales reflect social reality', depicting rituals, with 'material culture also work[ing] its way in'.[60]

Today's corpus of Slovak folktales was collected in the nineteenth century by Pavol Dobšinský, Ján Botto and other Slovaks in the generation of Ľudovit Štúr, who codified a formal literary Slovak language.[61] One belief, in collecting these tales, was that, inasmuch as the *wondertales* may reflect 'events of the ancient past, only symbolically',[62] in examining their content and the themes held therein '"we would see the entire science of our forebearers about the gods, the creation and the order of the

57 Personal communication, Mária Izakovičová, Alena Chovanec, Aug. 2019; personal communication, S. Ďuranová. Slovak Agricultural Museum, Nitra, Oct. 2018.

58 Cooper, *Traditional Slovak Folktales,* pp. xxiv–xxvii.

59 Ibid., p. xxv.

60 Ibid., p. xxvii.

61 Ibid., p. 281.

62 Ibid., p. xxvii.

earth'".[63] This is not vastly dissimilar from the role of storying as taken up by Phillips and Bunda.[64] Zipes emphasises that 'fairytales are rooted in oral traditions', 'were never given titles, nor did they exist in' their modern forms.[65] Thus, there is a malleability or dialogic character between the tales and the cultural themes to which they relate. Further, not only do the tales 'contribute to our storying selves but [they] also weave the threads of social relationships and make life social'.[66]

In that regard, themes of space, in the organisation of village life, but likewise in the distance of social space experienced by married women, are important elements to the story and in a sense ensure the reader is aware of that traditional societal norms and hierarchical divisions are at play, while acknowledging the significant role that female kinship played in the maintenance of various types of cultural knowledge. Other cultural elements, that again reconnect with archaeological and historical elements, relate to the production of fine cloth from the finer flax thread and the use of fine metal adornments that simultaneously highlight elements of the historical *kroj* – traditional, ethnic clothes the designs of which were highly localised. This is also reference to the long metal pins that would have served as adornments similar to those used in the Bronze Age.[67] Novotná and Kvietok suggested that this pin type, taken together in its shape, dimensions and decoration, signified the opium poppy[68] (see Figures 1 and 2 for comparison). The symbol of the poppy, representing wealth, prosperity, goodness and health, would fit this context well.

The poppy was decorative in other contexts, being saved and used for wreaths which served a protective function at crucial times of year (see Figure 4). It appears in songs (e.g., *Čižiček, čižiček, vtáčik maličký*), modern stories (*Maková Panenka*, Poppy Fairy), and other versions of well-known fairy tales. An example of the latter comes from Cinderella (*Popoluška*). As many familiar with the tale know, our heroine is given menial tasks to fill her time so that she is unable to get ready for the

63 Francisci in Cooper, *Traditional Slovak Folktales*, p. 293.

64 Phillips and Bunda, *Research Through, With and As Storying*.

65 Zipes, 'Cultural evolution of storytelling and fairy tales', p. 2.

66 Franks in Ibid., p. 4.

67 See Urbanová, 'Prehistoric dressing for third millennium visitors' for reconstruction; and Novotná, *Die Nadeln in der Slowakei.* for full classification of pins.

68 Novotná and Kvietok, 'Nové Hromadné Nálezy z Dobe Bronzovej z Moštenice'.

ball, but, in the Slovak version, the task she is given is to separate poppy seeds from ashes.[69]

FUTURE STORY EVENTS AND THE SIGNIFICANCE OF THE LINDEN TREE (*LIPA*)

Future events are recalled in the story, namely the burial and 'killing' of the pins by bending them, which references metal hoards of bound Bronze Age metal pins within forested areas, well documented in the Bronze and Iron Ages, as well as in the Celtic world.[70] These events are accompanied by another important cultural plant – the linden tree (*Lipa* in Slovak). The relationship to the linden is a key aspect of the story, not only in terms of the relationships that plants have with other human and nonhuman entities, but also because it has very specific cultural connotations. Slavic cultures, including but particularly Slovaks, adopted the linden as a cultural symbol (see discussion below).

Trees as symbols in human culture may mean many things. For Rival, a key symbol is that of perseverance, due to their permanence in our surroundings and across human lives.[71] Wohlleben brings our attention to the temporal differences between the lives of creatures, including human beings, and the lives of trees – as individuals as well as communities.[72] It should be noted here that some of Wohlleben's viewpoints are controversial in that the biological and ecological 'actions' of trees have yet to be demonstrated.[73] However, Indigenous scholars, such as Robin Wall Kimmerer (Citizen Potawatomi Nation), may hold different perspectives about ascribing human characteristics to trees.[74]

Regardless, the actions and reactions of trees are minimally visible to us and, as a result, trees represent permanent beings in our lives, our landscapes and generally our understanding of the world around us. For

69 Ďuríčková and Pavlovičová-Baková (eds), 'Čižiček, čižiček, vtáčik maličký', p. 158. Personal communication, Alena Chovanec, 2019, 2023.

70 Brück, 'Hoards, fragmentation and exchange'; Marcus, 'Dressed to kill'; Repka, 'Intentionally broken vessels', p. 239.

71 Rival, 'Tree, from symbols of life and regeneration to political artefacts'.

72 Wohlleben, *The Hidden Life of Trees*.

73 Robinson et al., 'Mother trees, altruistic fungi, and the perils of plant personification'.

74 Nitzke, 'Narrative trees', pp. 208–09.

FIGURE 5.
The oldest linden tree in Slovakia at Bojnice Castle.
Source: Jan Chovanec, Bojnice, 2023.

example, the oldest linden tree (large-leafed variety, *Tilia platyphyllos*) known in Slovakia is over 700 years old and sits within the grounds of the Bojnice Castle located in the town of Bojnice, in Trenčin region (see Figure 5). According to legend, the tree was planted by Matús Čák in 1301 to mark the occasion of the death of the last Arpad king, a Magyar dynasty that established itself after the conquest of the Carpathian Basin and consolidation of its tribes at the turn of the tenth century. The story above likewise alludes to these historical events wherein invaders come from the east, but the focus is more on cultural themes, relationships with symbolic plants and the role of these plants as co-inhabitants of these landscapes. The Bojnice linden is today a national monument.[75] Another important tree is located near the Church of St Margita Antioch in Kopčany, overlooking the Great Moravian capital of Nitra. In 2019, the tree received sixth place in the European Tree of the Year contest.[76]

The linden continued to play a significant role in more recent Slovak national history. When then Czechoslovakia first became a republic in 1918, the occasion was celebrated with the planting of a linden tree in the main square of Skalica – the linden of freedom ('Lipa slobody'). Similarly, the planting of linden trees marked other important occasions in national history, clearly symbolising Slovak identity and perseverance,

75 Bellan, 'Stromy našich životov', p. 8; 'Najstaršia lipa na Slovensku má 715 rokov'.
76 'The guardian of Great Moravia's secrets'.

such as following the Velvet Revolution in 1989, and, indeed, a linden leaf is depicted on the Slovak Republic national seal.[77]

The story deliberately models the linden tree as a safe place, a place of refuge, associated with freedom, but also resistance, a symbol of Slovaks, safety and self. The tree, with its heart-shaped leaf, adorns many important entities in recent history, including the national seal and commemorative stamps, but it has had this connotation for hundreds of years, pre-dating Christianisation. In the first century BC, when Celtic tribes inhabited Slovakia, a coin depicts a king by the name Biatec riding a horse, holding tree branches with heart-shaped leaves, typical of the linden tree.[78]

Linden trees were incorporated into many parts of the Slovak cultural landscape; they were often planted by churches, at the entrances of villages, to mark important occasions.[79] This is not dissimilar from the Osage Indians (Osage Nation) in the central United States planting trees, sometimes culturally-modified, to mark important places, water sources or crossings, and facing specific directions.[80] The plants themselves are not inactive participants, with the actions of the tree hardly visible to rapid human lives, but moulding the intentions and actions of their co-habiting Slovak neighbours for centuries. This element of intra-species relationships explains the significance of stands of trees not only from an ecological perspective, but also as a locality where significant human events take place.

Sir James Frazer in his well-known compilation of cross-cultural religious practices shows a great interest in trees and their worship.[81] However, Ronald Hutton importantly highlighted the series of ethnic biases and political agendas underlying many observations in the *Golden Bough*.[82] For instance, in reference to the current topics, Frazer states, '[t]he heathen Slavs worshipped trees and groves'.[83] While such

77 Bellan, 'Stromy našich životov'; 'Symbols'. *Zuzana Čaputová, presidentka Slovenskej republiky*.

78 The British Museum, 'Biatec'; Palovic and Bereghazyova, *The Legend of the Linden*, p. 30.

79 Storl, *Magické Rostliny Keltů: Léčitelství Rostlinná Kouzla Stromový Kalendář* pp. 258–60; Personal communication, A. Chovanec.

80 Russel, 'Osage Nation dedicates tree'.

81 Frazer, *The Golden Bough*.

82 Hutton, 'Sir James Frazer'.

83 Frazer, *The Golden Bough*, p. 106a.

observations are quite problematic, the comparative methods he applied still provide important insights and demonstrate a clear reverence that human beings have for trees with many examples of human-tree (and plant) relationships.[84]

We see elements of kinship and their incorporation into the cycle of human reproduction; a connection to the supernatural, and a means to influence agricultural productivity. Some examples include rituals involving trees for women desiring a child – and signs of whether their desires will be granted.[85] Likewise, trees, including linden trees, were located in every yard, considered sacred, and 'pregnant women clasped [them] to ensure easy delivery'.[86] There are again references to flax, referenced in the story and in relationship to both the poppy and the linden. In an example from Germany, a ritual took place under seven lindens, in which a 'grass king' was stripped, crown removed, and branches were put in flax fields 'in order to make the flax grow tall'.[87] Elsewhere, linden bark was used for this purpose.[88]

There are clear, personal relationships with individual trees or communities of trees. In *The Giving Tree*, a modern story with which many readers may be familiar,[89] we see an individual relationship with a specific tree but situated within a more contemporary tendency to see trees as 'utilitarian sources for human life – providing wood, fruit, sap and shade'.[90] This kinship also extended to the trees themselves: 'The conception of trees and plants as animated beings naturally results in treating them as male and female, who can be married to each other in a real and not merely figurative or poetical sense of the world'.[91]

Such ideas are articulated in multiple storying traditions. Thus, these are the stories that plants tell if we listen to them.[92] And the opium poppy and the linden tree tell the story of the Slovak people.

84 Hutton, 'Sir James Frazer'.

85 Frazer, *The Golden Bough*, pp. 113–14b.

86 Ibid., pp. 114–a-b; Tenche-Constantinescu et al. 'The symbolism of the linden tree', p. 239.

87 Ibid., p. 123a.

88 Ibid., pp. 259–60a.

89 Silverstein, *The Giving Tree*.

90 Norkunas, 'Are trees spiritual', p. 170.

91 Frazer, *The Golden Bough*, p. 109a.

92 Middelhoff and Peselmann, 'The stories plants tell'.

AN INFORMED ARCHAEOLOGICAL STORYTELLING

In terms of the utility of informed storytelling in archaeological narrative, Maggio highlights elements of storytelling in ethnography, where storytelling is an act and thus an 'anthropology of storytelling should consider … everything that happens around it'.[93] As demonstrated above, many elements are woven into the story – cultural, material, botanical, structural – that intersect in complex ways. An informed story not only presents the complexity of our tasks as archaeologists, but likewise 'makes the reader [or hearer] empathise with the characters', thereby creating a relatable connection, and achieving the goal of understanding and re-animating the fullness of what remains of lives lived long ago.[94] Annabel argues that folktales simultaneously 'must always be understood in [their] social-historical context' but have 'universal appeal because of the way [they] function'[95] and, in that sense, there are always parameters required for an archaeological story of this sort.

In that sense, storytelling in archaeology can be an effective means for communicating the complex interplay of diverse sets of data that cross disciplines and vary in scope within the temporal scales unique to archaeological inquiry. Doing so within an informed story synthesises these data, presented in a format that connects data points to human experience and understanding, while also humanising the actions preserved in material remains – not only for readers of diverse backgrounds, but also as a much-needed reminder to the investigators themselves.

CONCLUSIONS

The goal of this paper was to use an informed storytelling framework that draws on historical and archaeological research, knowledge of significant cultural themes and related oral traditions to illustrate the dynamic and complex lives that ancient people, sometimes our ancestors, lived. From this perspective, a simple, but well-crafted, informed story, presents many themes interwoven in an approachable way to help

93 Maggio, 'The anthropology of storytelling and the storytelling of anthropology', p. 91.

94 Ibid., p. 97.

95 Patterson in Zipes, 'Cultural evolution of storytelling and fairy tales', p. 13.

us understand how different elements of the archaeological record work together. In the relating of this story, two culturally significant plants – the opium poppy and the linden tree – hold active and directing roles in the events, relationships and themes described. And thus, referencing Arthur Frank,[96] it may well be the plants within these stories that breathe and animate our lives.

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96 Frank, *Letting Stories Breathe.*

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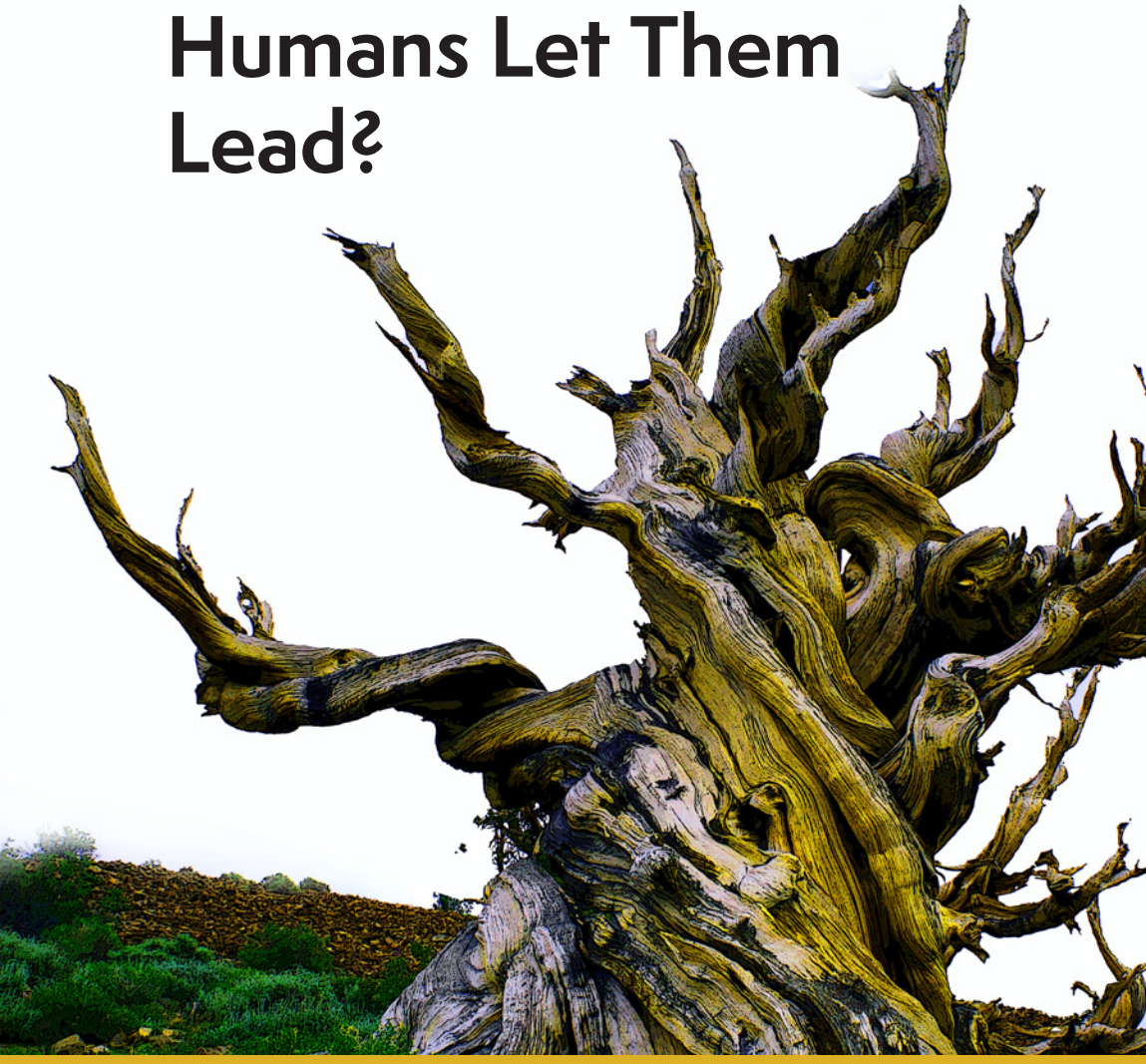
Julian Rutten, Alexander Holland and Stanislav Roudavski

Plants as Designers of Better Futures: Can Humans Let Them Lead?



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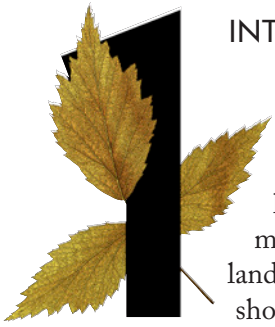
ABSTRACT

This research explores the idea of plants as designers and discusses approaches that humans can use to support plant's productive agencies. It argues that plants have unique and valuable capabilities for creating and caring for their environments. Human interventions often overlook or constrain such capabilities. In response, the article proposes to use numerical modelling to better understand plants better while challenging the anthropocentric assumptions that are common in design. It focuses on large old trees in Tasmania as examples of outstanding plant-designers that need more recognition and protection. The article also raises open questions for further research on the ethical, ecological, and aesthetic implications of vegetal design.

KEYWORDS

plant agency, large old trees, plants as designers, more-than-human care, more-than-human design



INTRODUCTION

Plants constitute an important part of earth's biodiversity, which is now facing large-scale, existential threats due to human activity.[1] In addition to major harms such as land use change and clearcutting, humans oppress tree lives in cities, gardens and on farmed land. They kill unwanted specimens, force trees to have shorter lives, lop off their branches, poison them, prevent their propagation, and press them into biologically uniform communities that are susceptible to parasites.[2] Many humans act to protect plants but do it in ways that exclude them from decision making because dominant worldviews do not consider nonhuman beings to be intelligent, goal-oriented, and innovating organisms that

1 IPBES, 'The global assessment report on biodiversity and ecosystem services' (Bonn: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) Secretariat, 2019).

2 For an example, see S. Roudavski and A. Davis, 'Respect for old age and dignity in death: The case of urban trees', in K. Hislop and H. Lewi (eds), *What If? What Next? Speculations on History's Futures*, *Proceedings of the Society of Architectural Historians Australia and New Zealand* **37**, (Perth: SAHANZ, 2020), pp. 638–652.

act as moral agents, knowledge holders and members of multispecies polities.[3] As a result, many humans resist acknowledging the roles of nonhuman beings by deploying ontological and epistemic violences when they characterise more-than-human ontologies as metaphorical or anthropomorphic. The consequence of these attitudes is a pervasive 'plant blindness'.[4] Multispecies societies become deprived of contributions that plants can make, and the resulting anthropocentric goals and approaches are corrupting the notions of justice in the society of all life and are empirically damaging at catastrophic levels.

This article aims to provide a robust account of plants as designers of better futures. We challenge three narrow assumptions about the failure of humans to protect plants, and point to distinct examples of design, creativity, and care provided by large old trees. The first assumption we challenge is that plants are not creative, decision-making agents. This assumption is based on anthropocentric presumptions that are short-sighted, exclusionary and poorly informed, as demonstrated by the repeatedly unexpected and negative consequences of human attempts at managing biotic systems.[5] In contrast, we argue that plants, like other nonhuman beings, are active agents whom humans should treat with respect and appreciation. The second assumption we challenge is that plants do not contribute to design. Biomimetic designs already challenge

3 On plant sentience, see M. Segundo-Ortin and P. Calvo, 'Plant sentience? Between romanticism and denial: Science', *Animal Sentience* **8** (33) (2023), https://doi.org/10/gtchdm; P. Calvo and M. Segundo-Ortin, 'Plant sentience revisited: Sifting through the thicket of perspectives', *Animal Sentience* **8** (33) (2023), https://doi.org/10/gtchdj.

4 A. Amprazis and P. Papadopoulou, 'Plant blindness: A faddish research interest or a substantive impediment to achieve sustainable development goals?', *Environmental Education Research* **26** (8) (2020): 1065–1087, https://doi.org/10/ghwgn3; M. Balding and K.J.H. Williams, 'Plant blindness and the implications for plant conservation', *Conservation Biology* **30** (6) (2016): 1192–1099, https://doi.org/10/f9bpvw; C. McDonough MacKenzie, S. Kuebbing, R.S. Barak, M. Bletz, J. Dudney, B.M. McGill, M.A. Nocco, et al., 'We do not want to "cure plant blindness" we want to grow plant love', *Plants, People, Planet* **1** (3) (2019): 139–141, https://doi.org/10/gpd86f.

5 For an overview of issues, see Z. St George, *The Journeys of Trees: A Story About Forests, People, and the Future* (New York: W. W. Norton, 2020). On hubris, see H. Washington J. Piccolo, E. Gomez-Baggethun, H. Kopnina and H. Alberro, 'The trouble with anthropocentric hubris, with examples from conservation', *Conservation* **1** (4) (2021): 285–298, https://doi.org/10/jdjj.

this assumption but tend to prioritise human needs; we depart from biomimetic approaches by asking how design actions taken by nonhuman beings can contribute to all stakeholders in multispecies communities.[6] The third assumption is that the inclusion of contributions by plants is impossible or impracticable.[7] This is an extension of an argument that nonhuman minds or ways of being are inaccessible, especially in the case of evolutionarily distant kin, including vegetal beings. In contrast, we examine whether humans can reorient existing practices and technologies to empower nonhuman agents. We use numerical modelling as an example that demonstrates one way to incorporate design contributions of nonhuman beings such as plants.

An exploration of what humans can do to help plants help themselves as well as many other living beings requires novel methods. We draw on our expertise as researchers within a school of design[8] who collaborate with scholars from fields including biology, engineering, computer science, philosophy, political science, animal studies, geography, law, anthropology and Indigenous studies. We see human traditional or scientific learning as generative of practical pathways for moral advances but are also conscious of its biases and limitations. For example, technical achievements in numerical modelling, artificial intelligence and sensing fail to benefit nonhuman beings if they progress solely in response to human interests and commercial funding.[9] In contrast, this article provides an example of lidar scanning and numerical modelling as one of many ways to empower plants as political and innovating agents. Our article is situated within a developing narrative that seeks to acknowledge, understand and empower capabilities, cultures and creative contributions by nonhuman living beings in the context of interspecies or more-than-human design.

6 Biomimetic designs can be as damaging as any other as is evident from the flagship example of Velcro that resulted in a huge commercial success but satisfies mostly trivial needs while generating plastic pollution and returning no benefits to plants.

7 Karl Petschke, 'Agency without voice? A political ecology of vegetal silence', in S. Dingli and T.N. Cooke (eds), *Political Silence: Meanings, Functions and Ambiguity* (New York: Routledge, 2019), pp. 129–145.

8 S. Roudavski (ed.), 'Design for all life', *Architect Victoria* **3** (2022): 32–75, https://doi.org/10/gr3wfb.

9 On the interrelationship between ways of living and states of knowledge, see S. Jasanoff (ed.), *States of Knowledge: The Co-Production of Science and Social Order* (London: Routledge, 2004).

The following Section 2 of this article outlines the limitations of current approaches in a concrete design challenge. We describe the need for bird habitats, such as tree hollows, and the limitations of common knowledge systems that fail to adequately include solutions already developed by trees. Next, in Section 3, the article offers a theory of plants as empowered designers, defining agency, design, care and empowerment in ways that are deliberately non-anthropocentric. The article expands on political, philosophical and scientific developments, drawing on examples regarding *Eucalyptus regnans* (mountain ash) and reframing design participation to include useful contributions by nonhuman beings. Next, in Section 4, we highlight the capabilities of large old trees as design contributors, providing visual evidence of habitat structures as well as other examples of interspecies care. In Section 5, we move to examples of imaging and sensing technologies, showcasing technical workflows that can advance collaborations with plants. In Section 6, we provide an example of design actions made feasible through the proposed approach. In our conclusion, we highlight benefits and limitations of this approach as well as directions for further research and show how design in more-than-human terms can lead to pragmatic benefits and just relationships within multispecies communities.

2. DESIGN CHALLENGE: FUTURE TREES IN ANTHROPOGENIC LANDSCAPES

Efforts to design artificial trees with their habitat features provides a telling example of limitations in practical design. What are the features of a good hollow for owls? Do birds prefer horizontal and dead branches? The need for evidence and meaning in observed patterns quickly reaches the boundaries of available human knowledge. Relevant knowledge sources in biology and ecology or traditional knowledge systems can provide important advice but are rarely sufficient, necessitating case-specific data collection and analysis.

One example is Barrer Hill near Canberra, Australia. This site lacks large trees and associated habitat structures. The park managers planted tens of thousands of new trees, but they will take hundreds of years to develop features that can support arboreal wildlife. In response, ecologists installed utility poles (Figure 1) that proved to be effective despite

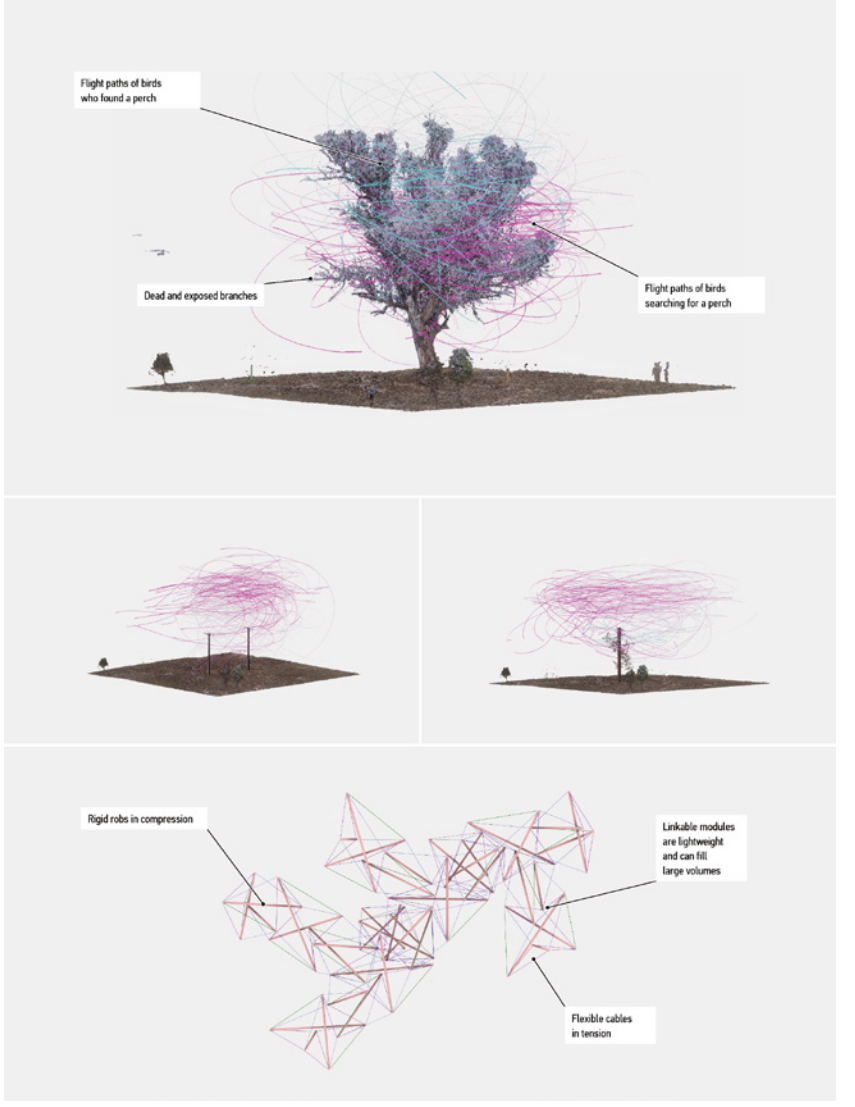


FIGURE 1.

Artificial habitat structures as a challenge for design. Top: a large old tree (*Eucalyptus camaldulensis*) provides many varied perch sites. Middle left: utility poles with a small number of artificial perch sites. Middle right: a utility pole with additional perch sites provided by a tensegrity (rod and cable) structure. Bottom: tensegrity modules. Magenta and cyan lines indicate simulated flight paths of birds searching for perches. All figures created by the authors.

their stark structural simplicity.[10] This situation is an opportunity for designs that can better replicate habitat features of biotic trees while also satisfying the need for low costs, convenient installation procedures, safety and aesthetic qualities acceptable to human communities.[11]

Figure 1 shows one possible design that uses an automatically generated rod-and-cable structure to simulate properties of trees.[12] The advantage of such structures is their rule-based nature; human designers can use digital models to generate them in response to numerically expressed objectives and constraints. To specify such numerical targets, human designers can turn to existing successful solutions, such as branches and hollows, already developed by trees.

3. DESIGN FRAMEWORK: TOWARDS PLANTS AS EMPOWERED DESIGNERS

To consider an approach that aims to engage plants as contributors, we: 1) demonstrate that plants have agency that enables them to act as designers; 2) define the notion of design in a way that does not *a priori* exclude plants; 3) frame innovative and beneficial aspects of such design as forms of care that plants bestow rather than services that humans extract; and 4) consider approaches that can empower plants' agencies in support of their lives and the lives of others.

To enable a discussion of plants as designers, we first introduce four key concepts in the list below. The subsequent sections provide evidential support for these definitions and apply them to case-study examples.

10 L. Hannan et al., 'Erecting dead trees and utility poles to offset the loss of mature trees', *Biological Conservation* **236** (2019): 340–46, https://doi.org/10/ggbjtk.

11 S. Roudavski and A. Holland, 'Tree designers and bird clients', *Landscape Architecture Australia* **177** (2023): 38–43, https://doi.org/10/gthkkz. For an example of a sculptural attempt at this site, see M. Whitelaw, J. Hwang and D. Le Roux, 'Design collaboration and exaptation in a habitat restoration project', *She Ji: The Journal of Design, Economics, and Innovation* **7** (2) (2021): 223–241, https://doi.org/10/gk8x.

12 A. Holland and S. Roudavski, 'Participatory design for multispecies cohabitation: *By* trees, *for* birds, *with* humans', in S. Heitlinger, M. Foth, and R. Clarke (eds), *Designing More-than-Human Smart Cities: Beyond Sustainability, Towards Cohabitation* (Oxford: Oxford University Press, 2024), pp. 93–128, https://doi.org/m7z3.

In keeping with current scientific evidence and Indigenous ontologies, these definitions are deliberately non-anthropocentric; they are an attempt to include all forms of life, together with their ecosystems and communities. Nor are they anthropomorphic; on the contrary, our goal is to 'naturalise' human concepts and systems by demonstrating their continuity with the work of nonhuman agencies. We propose the following definitions:

Agency is a capability to act found in systems that can maintain their stability in changing conditions. Agency depends on subjective interpretations of limited information about the world provided by sensing. The notion of agency does not neatly correspond to that of an individual. Multiple agencies are always co-present and interacting.

Design is any activity that results in collaborative innovation. It is an interplay of agencies that produces novelty to cope with change. The change can be ongoing or potential, likely to occur in the future. The capability for design is significant in some circumstances but can be irrelevant or detrimental in others.

Care is a pattern of actions with shared benefits. It is a product of multiple interacting and innovating agencies. In other words, care is a possible outcome of design. Care is positive by definition; the net total of its outcomes supports life. Thus, care can serve as a criterion that captures beneficial characteristics of design.

Empowerment refers to activities that increase the ability of agents to influence political processes affecting their lives and wellbeing. In this context, empowerment leads to an ability to affect design. Often, empowerment depends on emancipation from existing systems that oppress contributions by participating agents.

3.1 Agency

To establish whether plants can design, we first need to recognise them as decision-making agents. This section relies on available evidence and theoretical frameworks that recognise directed action and meaningful interpretation as features that are necessary for and characteristic of all life.[13] Here, *agency is a capability to act found in systems that can maintain*

13 For two overlapping approaches, see: D.M. Walsh and G. Rupik, 'The agential perspective: Countermapping the modern synthesis', *Evolution & Development* (2023): 1–18, https://doi.org/10/gsmzs3; K. Kull, 'Biosemiotics: To know, what life knows',

their stability in changing conditions. All forms of life have agency in the sense of resisting entropy.[14] They process energy and matter to grow, repair and reproduce. Beyond that, an increasing body of evidence shows that all organisms, including plants, are goal-directed, intelligent, sentient, communicating and autonomous.[15]

For example, plants can evolve to modify their genetic composition across generations through mutation, recombination or gene flow. Genetic adaptability allows plants to cope with persistent changes in their environment, by creating new variations that may confer an advantage. Some plants have evolved resistance to herbicides, pests or diseases through gene mutation or hybridisation. Others can do this within one organism via the application of enzymes or through horizontal gene transfer.[16]

Plants change their behaviour, morphology and physiology in response to environmental cues, such as light, temperature, water or nutrients.[17] Called phenotypic plasticity, this ability allows plants to cope with short-term or unpredictable changes in their surroundings, without altering their genetic makeup.[18] For example, some plants can grow

Cybernetics and Human Knowing **16** (3–4) (2009): 81–88; M. Barbieri, 'What is information?', *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* **374** (2063) (2016): 20150060, https://doi.org/10/gd6fcg.

14 See the discourse emanating from E. Schrödinger, *What Is Life? The Physical Aspect of the Living Cell; with, Mind and Matter and Autobiographical Sketches* (Cambridge: Cambridge University Press, 1992).

15 For some of the references on plant intelligence, see A. Trewavas, 'Aspects of plant intelligence', *Annals of Botany* **92** (1) (2003): 1–20, https://doi.org/10/bm3gx5; S. Mancuso and A. Viola, *Brilliant Green: The Surprising History and Science of Plant Intelligence* (Washington: Island Press, 2015); S. Mancuso, *The Revolutionary Genius of Plants: A New Understanding of Plant Intelligence and Behavior*, trans. V. Di Stefano (2017; repr., New York: Atria Books, 2018); Q. Hiernaux, *Du comportement végétal à l'intelligence des plantes?* (Versailles Cedex: Éditions Quæ, 2020).

16 P. Raimondeau et al., 'Lateral gene transfer generates accessory genes that accumulate at different rates within a grass lineage', *New Phytologist* (2023), https://doi.org/10/gsthz8.

17 T. Piersma and J.A. van Gils, *The Flexible Phenotype: A Body-Centred Integration of Ecology, Physiology, and Behaviour* (Oxford: Oxford University Press, 2011).

18 A. Raza et al., 'Plant adaptation and tolerance to environmental stresses: Mechanisms and perspectives', in M. Hasanuzzaman (ed.), *Plant Ecophysiology and Adaptation under Climate Change: Mechanisms and Perspectives I: General Consequences and Plant Responses* (Singapore: Springer, 2020), pp. 117–145.

taller or produce more leaves in the shade to capture more sunlight. Other plants can change the colour or shape of their flowers to attract different pollinators.

Besides phenotypic plasticity and genetic adaptability, plants design and innovate using epigenetics, symbiosis or learning. Awareness of these abilities can be important in design because the effects of such processes might be significant but not apparent. Epigenetics refers to the changes in gene expression caused by chemical modifications or interactions with other molecules.[19] For example, some plants can alter their chemical defences based on the type of herbivore that attacks them and then pass these traits to their offspring. Symbiosis refers to the close and long-term associations between different organisms. The notion of symbiosis includes mutualism, commensalism and parasitism but excludes less prolonged interactions such as predation. It is interesting here as an example of the pervasive co-evolution that results in the emergence of diverse and robust systems.[20] Thus, many plants can also form mutualistic relationships with fungi, bacteria, or animals that help them obtain nutrients and water, receive protection or reproduce (Figure 3). Learning refers to the ability of a plant to modify its behaviour based on previous experience or observation. Some plants can learn from their mistakes or from other plants' actions.[21] The fuzziness and multiplicity of biological individuals make the situation even more complex.[22] So does the emergence of agential actions in collectives that range from bacterial superorganisms to colonies of social insects that protect and depend on plants, as well as evolutionarily linked forest communities.

Using examples derived from the life patterns of *Eucalyptus regnans* (trees that we discuss in more detail later in the article and that are otherwise called mountain ash, swamp gum or stringy gum), characteristic

19 D. Ramos-Cruz, A. N. Troyee and C. Becker, 'Epigenetics in plant organismic interactions', *Current Opinion in Plant Biology*, Epigenetics **61** (2021): 102060, https://doi.org/10/gkbncg.

20 J.N. Thompson, *Interaction and Coevolution* (Chicago: The University of Chicago Press, 1982); P.A. Corning, 'A systems theory of biological evolution', *Biosystems* **214** (2022): 104630, https://doi.org/10/gsf5zb.

21 For a review of perspectives and examples, see F. Baluska, M. Gagliano and G. Witzany (eds), *Memory and Learning in Plants* (Cham: Springer, 2018).

22 R.A. Wilson and M.J. Barker, 'Biological individuals', in *The Stanford Encyclopedia of Philosophy*, ed. Edward N. Zalta (2007; repr., Stanford: Stanford University, 2019).

agential interactions that often remain unknown, unnoticed and unvalued in human decision-making include:[23]

Self-awareness: *Eucalyptus regnans* do not self-fertilise promoting outcrossing, avoiding inbreeding and maintaining genetic diversity.[24]

Awareness of the environment: *Eucalyptus regnans* can sense and respond to fire by shedding large volumes of seeds into resulting ash beds in anticipation of better recruitment.[25]

Learning and memory: *Eucalyptus regnans* moderate leaf growth and accumulate nitrogen in summer to help during cooler seasons.[26]

Decision making: *Eucalyptus regnans* sprout new growth to recover after bushfires.[27]

Communication: *Eucalyptus regnans* dominate their surroundings with extensive roots that communicate and exchange nutrients with other plants and fungi.[28]

Niche construction: *Eucalyptus regnans* grow deep roots that increase water availability, reducing severe bushfires and providing habitat for other rainforest plants.[29]

We can conclude that plants are self-motivated, competent and innovating beings able to cope with complex communal and environmental challenges. Using multiple mechanisms that involve changes at different levels of organisation, from molecules to populations, plants

23 Refer to Supplementary Material: Plant Agencies table for a more detailed listing. For the additional background of cognition beyond humans, see P. Lyon et al., 'Reframing cognition: Getting down to biological basics', *Philosophical Transactions of the Royal Society B: Biological Sciences* **376** (1820) (2021): 20190750, https://doi.org/10/ghvqh4; Segundo-Ortin and Calvo, 'Plant sentience?'; Calvo and Segundo-Ortin, 'Plant sentience revisited'.

24 A.R. Griffin et al., 'Life cycle expression of inbreeding depression in *Eucalyptus regnans* and inter-generational stability of its mixed mating system', *Annals of Botany* **124** (1) (2019): 179–187, https://doi.org/10/ghwdh3.

25 Griffin et al., 'Life cycle expression of inbreeding depression in *Eucalyptus regnans*'.

26 J. Kruse et al., 'Plasticity of leaf respiratory and photosynthetic traits in *Eucalyptus grandis* and *E. regnans* grown under variable light and nitrogen availability', *Frontiers in Forests and Global Change* **3** (2020): 5, https://doi.org/10/gtg8pr.

27 S.C. Sillett et al., 'Biomass and growth potential of *Eucalyptus regnans* up to 100m tall', *Forest Ecology and Management* **348** (2015): 78–91, https://doi.org/10/f7fcqc.

28 A. Novoplansky, 'What plant roots know?', *Mesenteric Organogenesis* **92** (2019): 126–133, https://doi.org/10/gf4xbd.

29 D.Y.P. Tng et al., 'Giant eucalypts – globally unique fire-adapted rain-forest trees?', *New Phytologist* **196** (4) (2012): 1001–1014, https://doi.org/10/f4c2zk.

are constantly evolving and experimenting with new solutions to survive and thrive in their habitats.

3.2 Design

With an outline of the agential capabilities of plants to hand, we can now provide an inclusive definition of design that does not confine design activities to professional humans. Here, our proposal is to recognise that *design is any activity that results in collaborative innovation*. This 'naturalistic' definition does not *a priori* confine the ability to design to one group (trained professionals, all humans or their close evolutionary relatives). Nor does it depend on the mechanisms of innovation or the attributes of the designing agent (such as the ability to plan, the possession of the theory of mind, the reliance on written texts or the use of mathematics).[30]

This usage of the term 'design' is unusual among professional designers but aligns with established interpretations in several evidence-driven domains. Relevant examples include:

– The discourse on innovation in living systems that focuses on the exploration and exploitation of ecological opportunities, phenotypic plasticity and other sources of novelty across multiple scales. Here, the term innovation encompasses the emergence of novel characteristics or processes that go beyond typical patterns of variation and selection.[31]
– The interpretation of processes termed niche construction within theories of Extended Evolutionary Synthesis. Niche construction is one of the common activities of all living beings.[32] Processes of niche

30 For a discussion of evolved innovations, see A. Wagner, *The Origins of Evolutionary Innovations: A Theory of Transformative Change in Living Systems* (Oxford: Oxford University Press, 2011).

31 For outlines of innovations in living systems, see, for example: M.E. Hochberg et al., 'Innovation: An emerging focus from cells to societies', *Philosophical Transactions of Royal Society B* **372** (1735) (2017): 20160414, https://doi.org/10/gfsp29; D.H. Erwin, 'A conceptual framework of evolutionary novelty and innovation', *Biological Reviews* (2021), https://doi.org/10/ghrk9r.

32 K. Laland, B. Matthews and M.W. Feldman, 'An introduction to niche construction theory', *Evolutionary Ecology* **30** (2) (2016): 191–202, https://doi.org/10/f8fvc9; F.J. Odling-Smee, K.N. Laland and M.W. Feldman, *Niche Construction: The Neglected Process in Evolution* (Princeton: Princeton University Press, 2003).

construction do not exclude human animals, their culture or their architecture.[33]

– The types of actions that result in habitat structures within ecosystem engineering and animal architecture.[34]
– The growing number of practices that self-characterise as interspecies, more-than-human, or animal-driven design, which demonstrates an increasing awareness that designing includes and depends on non-human beings.[35]

Humans often find it easier to accept that animals can act as designers under the influence of the anthropocentric bias that portrays human-like cognitive capabilities as superior. However, other forms of life also construct their niches.[36] Plants specifically are remarkable designers and engineers, from planetary to microscopic scales, as shown for *Eucalyptus regnans* in Figure 3. In line with this reasoning, we resolve to characterise plants as designers. However, designing understood as

33 J.R. Kendal, J.J. Tehrani and J. Olding-Smee (eds), 'Human niche construction', special issue, *Philosophical Transactions of the Royal Society B: Biological Sciences* **366** (1566) (2011): 783–934, https://doi.org/10/bkvww3; K.N. Laland and M.J. O'Brien, 'Cultural niche construction: An introduction', *Biological Theory* **6** (3) (2011): 191–202, https://doi.org/10/gc3j7b; J. Odling-Smee and J.S. Turner, 'Niche construction theory and human architecture', *Biological Theory* **6** (3) (2011): 283–289, https://doi.org/10/gfspw4.

34 A. Hastings et al., 'Ecosystem engineering in space and time', *Ecology Letters* **10** (2) (2007): 153–164, https://doi.org/10/bxqmvd; N.J. Boogert, D.M. Paterson and K.N. Laland, 'The implications of niche construction and ecosystem engineering for conservation biology', *BioScience* **56** (7) (2006): 570–578, https://doi.org/10/c7r3gw; N.V. Coggan, M.W. Hayward and H. Gibb, 'A global database and "state of the field" review of research into ecosystem engineering by land animals', *Journal of Animal Ecology* **87** (4) (2018): 974–994, https://doi.org/10/gh48gf. On animal architecture, see M.H. Hansell, *Built by Animals: The Natural History of Animal Architecture* (Oxford: Oxford University Press, 2009).

35 S. Roudavski, 'Interspecies design', in J. Parham (ed.), *Cambridge Companion to Literature and the Anthropocene* (Cambridge: Cambridge University Press, 2021), pp. 147–162; W. Weisser and T. Hauck, 'Animal-aided design: Using a species life-cycle to improve open space planning and conservation in cities and elsewhere', *BioRxiv* (2017), 150359, https://doi.org/10/gfsqhg; R. Clarke et al., 'More-than-human participation: Design for sustainable smart city futures', *Interactions* **26** (3) (2019): 60–63, https://doi.org/10/gf35h5.

36 For the many examples of the inseparable intermeshing of the organism and the environment, see S.E. Sultan, *Organism and Environment: Ecological Development, Niche Construction, and Adaption* (New York: Oxford University Press, 2015).

collaborative innovation is not necessarily beneficial to whole communities and can be harmful to many stakeholders. To distinguish the beneficial characteristics of design, the next section turns to its effect that we propose to recognise as care.[37]

3.3 Care

Humans most frequently encounter care as a cultural, ethical or legal norm. In turn, thinking about relationships in human communities, researchers tend to define care based on their observations of human behaviours. As a result, their conceptualisations emphasise that care is a combination of human action with human emotion and, often, with human intent.[38]

However, many common understandings of care do not depend on human intentionality or other human attributes. For example, a broadly used definition adopted by the European Union's European Foundation for the Improvement of Living and Working Conditions reads that care is 'the provision of what is necessary for the health, welfare, maintenance, and protection of someone or something'.[39]

In keeping with this understanding, our definition suggests that *care is a pattern of actions with shared benefits*. Understood in this way, we avoid confining the ability to provide care to carers with privileged identities or capabilities. Instead, this definition emphasises that care is a net effect of multiple enacted relationships, rather than an outcome of intentional actions by individuals. From any local perspective, all care comes at a cost: it takes time, consumes resources, generates risks and takes away alternatives. It can involve locally negative effects including dependency, competition, parasitism and others. However, this article aims to emphasise and illustrate that over time, community-level outcomes often evolve to become positive and take the form of opportunities for diverse and persistent life.[40]

37 See Supplementary Materials: Social Roles of Plants for a mapping of human and nonhuman designers and clients.

38 J.C. Tronto, *Moral Boundaries: A Political Argument for an Ethic of Care* (New York: Routledge, 1993).

39 *Eurofund*, https://www.eurofound.europa.eu/en/topic/care#:~:text=Care-may-be-globally-defined,those-with-disabilities-and-healthcare.

40 For the evolutionary dynamics of whole ecosystems, see e.g. G. Upreti, 'Understanding ecosystem evolution and behavior', in G. Upreti (ed.),

The benefit of this conceptualisation is in dethroning the often selfish and harmful human efforts in parallel with the acknowledgement of the supportive efforts of nonhuman others. This conceptualisation has strong empirical precedents in multiple domains. For example, traditional/Indigenous knowledge systems provide concepts such as 'care as country' that emphasise mutualistic support of all for all.[41] Here, Country (and all that makes it up) cares for humans and other lifeforms (or sometimes it does not). If an animal, plant or human agent is attentive, they can live. If not, they will struggle. To give one interesting consequence, we agree with traditional/Indigenous views that agents do not have to be biologically alive to care. Our work shows that fallen trees provide care by linking communities or providing shelter and nutrients.[42]

Contemporary studies of biology and ecology increasingly concur on notions of care. For example, researchers studying constructive networks observe that all life, including trees, comes into mutualistic relationships, modifies places and assembles communities.[43] This shift of emphasis from competition to facilitation and mutualism is key to seeing plants as members of care-giving communities.[44] Here, we see care as the net benefit of actions in an ecological network.[45]

Ecosociocentrism: The Earth First Paradigm for Sustainable Living (Cham: Springer, 2023), pp. 65–89.

41 S. Suchet-Pearson, S. Wright, K. Lloyd, L. Burarrwanga, on behalf of the Bawaka Country, 'Caring as country: Towards an ontology of co-becoming in natural resource management', *Asia Pacific Viewpoint* **54** (2) (2013): 185–197, https://doi.org/10/gfst9p; D. Ngurra et al., 'Yanama budyari gumada: Reframing the urban to care as Darug Country in western Sydney'. *Australian Geographer* **50** (3) (2019): 279–293, https://doi.org/10/gjdcns.

42 J. Rutten et al., *Vegetal Voices: Learning Through Making with Trees and Humans*, digital video, laser scanning, digital modelling and simulation, photography, mapping, 4K video, 15min, 2023, Conference of the Society for Social Studies of Science (4S), Sea, Sky, And Land: Engaging in Solidarity in Endangered Ecologies, Honolulu and online, https://vimeo.com/883218960.

43 G. Losapio, 'Contextualizing the ecology of plant–plant interactions and constructive networks', *AoB PLANTS* **15** (4) (2023): plad035, https://doi.org/10/gtcggw.

44 For a discussion of facilitation, see T. Koffel, T. Daufresne and C.A. Klausmeier, 'From competition to facilitation and mutualism: A general theory of the niche', *Ecological Monographs* **91** (3) (2021): e01458, https://doi.org/gjwg4k.

45 On ecological networks, see G. Losapio, A. Montesinos-Navarro and H. Saiz, 'Perspectives for ecological networks in plant ecology', *Plant Ecology & Diversity* **12** (2) (2019): 87–102, https://doi.org/10/gf32k2.

Such networks of relationships provide care when their participants can find ways to behave in patterns that support communal survival, reproduction and flourishing (Figure 4). For example, stochastic events damage limbs, which house microorganisms and over time rot into hollows to house birds or marsupials that in turn transport nutrients and seeds as they defecate. Such patterns are not guaranteed. They depend on attitudes, attributes, circumstances and luck. But the empirically observable tendency, as is the case with large old trees, is to provide and receive care.[46] Such care does not need to be self-conscious, even among human beings. Attributes such as intentionality and an ability to make conscious choices are just some of many evolved tactics that can aid survival and flourishing. Brain-driven, rationalising cognitive capabilities are at the forefront of human discourse but are not necessary, universally useful or automatically beneficial.

The point of using the proposed conception of more-than-human care is to reframe the ontological position for design away from unitary entities towards networks, from objects toward processes and from humans towards heterogeneous communities of living and nonliving agents. As active and goal-directed agents, plants come into multiple interactions with other living beings. The emphasis on 'selfish' actions of genes or organisms tends to undervalue the supporting fabric of relationships within living communities or innovation through collaboration. In parallel with competition, activities of plants acting as ecosystem engineers enable the emergence of diverse and resistant communities.[47] However, the capabilities for care vary significantly in anthropogenic environments such as managed forests, agricultural landscapes or cities.[48] This is important for an understanding of the constraints on current human management and its failures to benefit from or protect contributions by plants. Recognition of care can lead to the enhancement of plants' capacities to provide it, as we discuss in the next section.

46 S. Simard, *Finding the Mother Tree: Discovering the Wisdom of the Forest* (New York: Knopf, 2021). For roles of large old trees, see D.B. Lindenmayer, 'Conserving large old trees as small natural features', *Biological Conservation* **211** (B) (2017): 51–59, https://doi.org/10/gbn34v.

47 J.-F. Ponge, 'Communities, ecosystem engineers, and functional domains', *Ecological Research* **36** (5) (2021): 766–777, https://doi.org/10/gn5v25.

48 See Supplementary Materials: Forms of Care for forms of care by large old trees and the constraints in human-dominated environments.

3.4 Empowerment

Plants find themselves in the world where rapid anthropogenic changes undermine their community roles. We recognise this situation as a form of oppression that prevents better design. In the conditions of oppression, cultural appreciation, biological sciences, traditional knowledge or preservation of plants' autonomy in wild reserves will not suffice. To contribute beneficially, it will be necessary to express and support plants' capabilities as forms of political power that can influence decisions and redefine the future.

Plants live as striving and prospecting agents that operate subjectively in concrete situations with local information. Their interactions with other agents, including human beings, occur in constrained spaces with limited resources. These interactions are necessarily political but political representation of plants in systems such as ecodemocracy is difficult because plants cannot give consent to those who seek to represent them.[49]

In response, we aim to support both political representation that substitutes voices of participants and mediatic representation that reproduces and transmits their expressions. Such empowerment is necessary given the plants' subaltern status that restricts their constitution as subjects in a polity and submits them to multiple forms of violence including structural (where plants are resources and not subjects), epistemic (where those in power presume to know better) and economic (where capital accumulation and use depend on the dispossession of plant communities). To defend their privilege, the powerful (human) agents simultaneously exclude plants and appropriate them as objects for use and exploitation.[50]

49 On ecodemocrary, see J. Gray and P. Curry, 'Ecodemocracy and political representation for non-human nature', in H. Kopnina and H. Washington (eds), *Conservation: Integrating Social and Ecological Justice* (Cham: Springer, 2020), pp. 155–166. On representation, see M. Marder, *Plant-Thinking: A Philosophy of Vegetal Life* (New York: Columbia University Press, 2013), p. 185.

50 G. Chakravorty Spivak, 'Can the subaltern speak?', in G. Nelson and L. Grossberg (eds), *Marxism and the Interpretation of Culture* (Urbana: University of Illinois Press, 1988), pp. 271–313; M. Marder, 'Resist like a plant! On the vegetable life of political movements', *Peace Studies Journal* **5** (1) (2012): 24–32; Petschke, 'Agency without voice?'.

Political voice is an ability to engage in political representation. A qualification for such representation depends on the ability to suffer damage or endure risks emanating from policies and decisions. All those affected by such risks should have opportunities to participate in decision making.[51] Existing discourse on relevant issues discusses challenges of listening to plants, ecological justice, legal standing for plants and political organisations that could include plants.[52]

There is a further need to move beyond acknowledgement and listening towards supporting the agential capabilities of plants to affect, innovate and benefit, but also falter and make apparently selfish decisions even when they can disadvantage or harm humans. Any meaningful redress of the current situation will require an equivalent of positive discrimination such as the compensatory principles discussed in net-positive design.[53]

Methods of research and design tend to privilege human agency over agencies of nonhuman beings such as plants because humans can only have partial understanding of plant actions and capabilities.[54] This unavoidable limitation on human knowledge confines the scope of human leadership. As in other domains where the powerful govern the oppressed, the exclusion of stakeholder voices leads to neglect and harm. As a remedy, previous research demonstrated that co-production

51 R. Eckersley, 'Representing nature', in S. Alonso, J. Keane and W. Merkel (eds), *The Future of Representative Democracy* (Cambridge: Cambridge University Press, 2011), pp. 236–257; J. Gray and P. Curry, 'Ecodemocracy: Helping wildlife's right to survive', *ECOS* **37** (1) (2016): 18–27.

52 A.M. Lawrence, 'Listening to plants: Conversations between critical plant studies and vegetal geography', *Progress in Human Geography* **46** (2) (2021): 629–651, https://doi.org/10/gnzjdq; A. Wienhues, *Ecological Justice and the Extinction Crisis: Giving Living Beings Their Due* (Bristol: Bristol University Press, 2020); C.D. Stone, 'Should trees have standing? Toward legal rights for natural objects', *Southern California Law Review* **45** (1972): 450–501; S. Mancuso and G. Conti, *The Nation of Plants* (2019; repr., New York: Other Press, 2021).

53 J. Birkeland, *Net-Positive Design and Sustainable Urban Development* (New York: Routledge, 2020).

54 V. Plumwood, 'Nature in the active voice', *Ecological Humanities* **46** (2009): 111–128; J. Atchison and L. Head, 'Rethinking ethnobotany? A methodological reflection on human–plant research', in M. Bastian, O. Jones, N. Moore and E. Roe (eds), *Participatory Research in More-than-Human Worlds* (Abingdon: Routledge, 2017), pp. 179–191.

of knowledge can provide additional explanatory powers.[55] Researchers working in the context of traditional knowledge acknowledge that a commitment to a relational ontology requires attention to co-production.[56] However, others observe that being situated and attentive will not be sufficient for understanding of nonhuman lives.[57]

In response to these concerns, our approach is to support political and creative actions. To this end, more-than-human design can extend capabilities for beneficial innovation.[58] Multiple approaches are possible, but we hypothesise that technical amplifications of human sensing, communication, analysis and action will likely play a role. To continue discussion in a concrete context, we consider lidar scanning and numerical modelling as one of many ways to empower plants as political and innovating agents.

4. OUTSTANDING DESIGNERS: THE CASE OF *EUCALYPTUS REGNANS*

Under the impact of human practices, plant species and distinct stages of plant lives are going extinct.[59] For example, plants lose the ability to reproduce independently if they grow among sealed surfaces in cities or in over-fertilised, over-grazed and over-compacted agricultural landscapes. They cannot replenish the soil to provision themselves in old age or to

55 Jasanoff, *States of Knowledge*.

56 S. Wright et al., 'Telling stories in, through and with country: Engaging with Indigenous and more-than-human methodologies at Bawaka, NE Australia', *Journal of Cultural Geography* **29** (1) (2012): 39–60, https://doi.org/10/gg4c8v.

57 Atchison and Head, 'Rethinking ethnobotany?'.

58 S. Roudavski, 'Multispecies cohabitation and future design', in S. Boess, M. Cheung and R. Cain (eds), *Proceedings of Design Research Society (DRS) 2020 International Conference: Synergy* (London: Design Research Society, 2020), pp. 731–750, https://doi.org/10/ghj48x.

59 On large old trees, see: D.B. Lindenmayer and W.F. Laurance, 'The ecology, distribution, conservation and management of large old trees', *Biological Reviews* **92** (132) (2016): 1434–1458, https://doi.org/10/gdvpqh; M. Gilhen-Baker et al., 'Old growth forests and large old trees as critical organisms connecting ecosystems and human health. A Review', *Environmental Chemistry Letters* **20** (2022): 1529–1538, https://doi.org/10/gpv9cg. On functional extinctions in plants, see Q. Cronk, 'Plant extinctions take time', *Science* **353** (6298) (2016): 446–47, https://doi.org/10/gg879s.

feed others if humans remove their branches and leaf litter, as is common in managed landscapes. They cannot provide habitats to arboreal and ground-dwelling animals if they are unable to senesce and develop complex canopies that come with old age. Their abilities to reinforce the ground, create microclimates, interact with other plants and fungi or resist attacks also suffer. Some of these constrained or disappearing capabilities fall under the rubrics of ecological, functional, societal and phenotypic extinctions that are hard to recognise and address.[60]

To explore such challenges, we focus on large, old and rare *Eucalyptus regnans* trees that survive in Lutruwita (Tasmania, Australia) (Figure 2). Common in the southeast of Australia, these trees can grow to more than 100 metres and live as long as 600 years.[61] *Eucalyptus regnans* competes for height with *Sequoiadendron giganteum* (giant sequoia) and is the tallest flowering plant in the world. Today, it is impossible to determine whether *Eucalyptus regnans* is the tallest tree on Earth because European colonists felled the biggest specimens in the 1800s without collecting the measurements. These newcomers saw *Eucalyptus regnans* as a source of wood for buildings, furniture and railway sleepers. Damaging human activities persist to this day. By 2019 less than one per cent of forest areas in Victoria were more than one kilometre away from disturbances such as logging and fire.[62] The state of Victoria decided to end logging of native forest by 2024. In Tasmania, the logging continues. Negative impacts of climate change on forest fires further increase the already heightened vulnerability of disturbed forest communities. An important consequence is the increasing rarity of elder trees and the loss of their unique contributions. *Eucalyptus regnans* grow fast and may appear

60 Cronk, 'Plant extinctions take time'.

61 A. Hay, *Gum: The Story of Eucalypts and Their Champions* (Sydney: NewSouth Publishing, 2021). For the background on *Eucalyptus regnans*, see D. Lindenmayer et al., *Mountain Ash: Fire, Logging and the Future of Victoria's Giant Forests* (Clayton South: CSIRO, 2015). For the history of the struggles to preserve Tasmanian forests, including Styx, see G. Buckman, *Tasmania's Wilderness Battles: A History* (Crows Nest: Allen and Unwin, 2008).

62 D. Lindenmayer et al., 'The case for listing mountain ash forests in the central highlands of Victoria as a threatened ecological community', *Pacific Conservation Biology* (2023): PC23010, https://doi.org/10/gssg7v; C. Taylor and D.B. Lindenmayer, 'Temporal fragmentation of a critically endangered forest ecosystem', *Austral Ecology* **45** (3) (2020): 340–354, https://doi.org/10/gjpxtk.

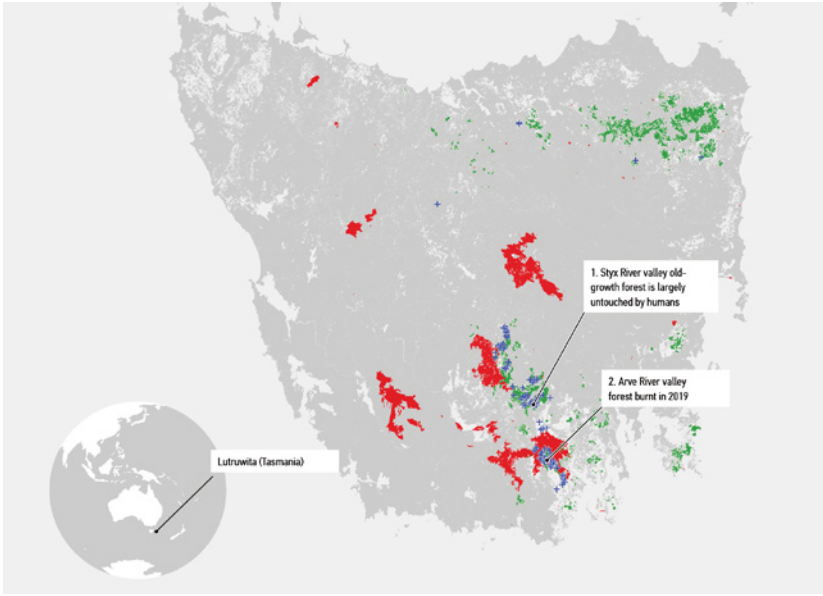


FIGURE 2.

Study sites. Site 1, old growth forest in the Styx Valley, and site 2, a recently burnt forest near the Arve River. Red designates the last major bushfire in 2018, while green shows *Eucalyptus regnans* wet sclerophyll forest. Blue crosses show trees over 70 metres or similarly old trees that have lost their tops.

very tall, but most are relatively young.[63] At the same time, many older trees lose height from dieback and need time without disturbances to re-grow.[64] We focus on large old trees because they have beneficial features that humans will do well to understand, value, support and integrate as contributions into more-than-human design (Figure 3).

63 D. Lindenmayer and E. Bowd, 'Critical ecological roles, structural attributes and conservation of old growth forest: Lessons from a case study of Australian mountain ash forests', *Frontiers in Forests and Global Change* **5** (2022): 878570, https://doi.org/10/gr3ht8.

64 DPIPWE, 'Giant trees and very tall forest values in the Tasmanian Wilderness World Heritage Area', Report for the Tasmanian Wilderness World Heritage Area Natural Values Identification and Assessment Program (Hobart: Tasmanian Government, Department of Primary Industries, Parks, Water and Environment, 2018); J.L. Williams, D. Lindenmayer and B. Mifsud, 'The largest trees in Australia', *Austral Ecology* **48** (4) (2023): 653–671, https://doi.org/10/gtcq93.

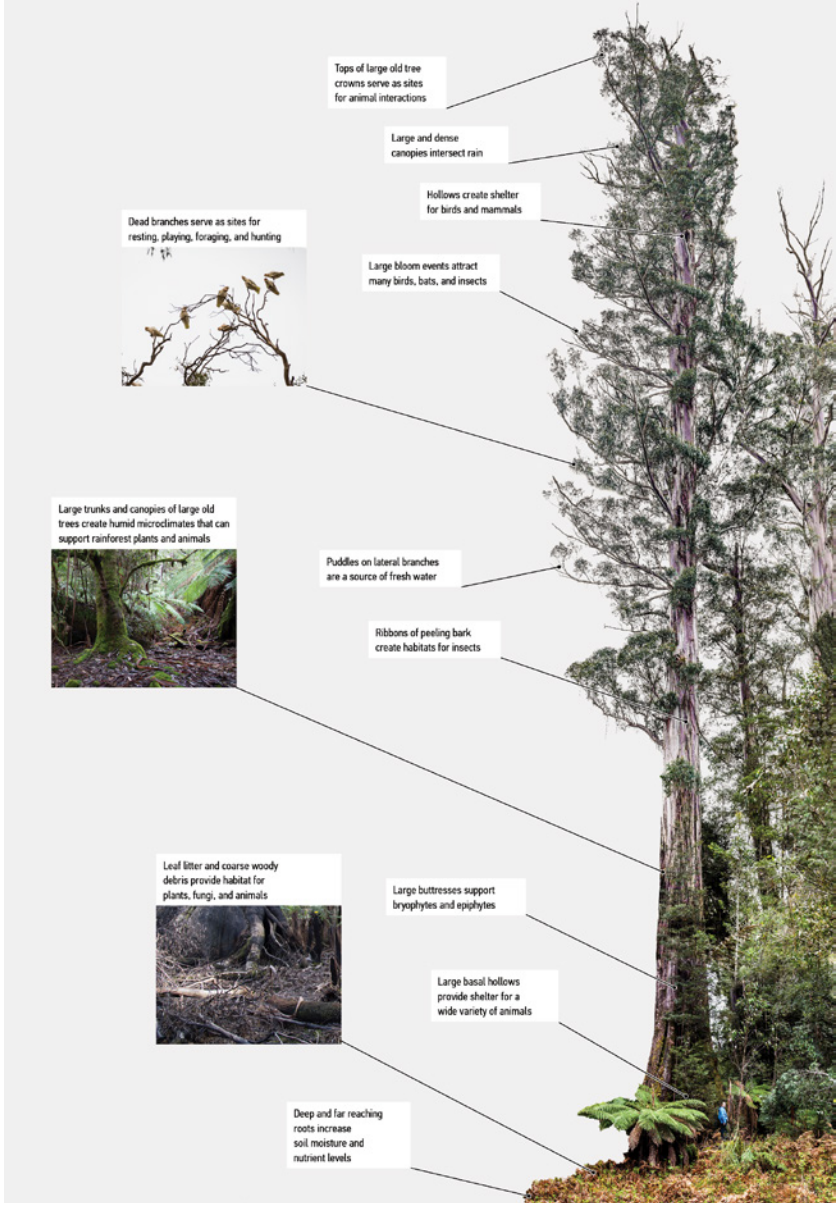


FIGURE 3.
Design actions by a giant tree in the Styx Valley at site 1 and examples of habitat structures it provides.

FIGURE 4.

Examples of care from site one. Top left: bryophytes and epiphytes growing on the bark. Top right: stringy bark. Bottom left: a basal hollow. Bottom right: ground debris.

5. PROMISING METHODS: OPPORTUNITIES AND LIMITATIONS OF NUMERICAL MODELLING IN INTERSPECIES DESIGN

Utilisation of creative contributions by plants in interspecies collectives will depend on broadly accepted and well-evidenced appreciation of their capabilities. Yet, plant capabilities are hard to quantify, understand and appreciate. They vary substantially and are often too complex for human analysis. Many relevant vegetal processes take hundreds or thousands of years, thus extending beyond lifespans of human projects, whole human cultures, and even the total history of human science. Plants can be small or tall or otherwise cumbersome to access and study. As a result, human knowledge about plant capabilities is lacking in detail, precision and interpretation. This lack of knowledge constrains the

scope for remedial action and design innovation, limiting plants' opportunities to contribute to design.

To illustrate one way to overcome these difficulties, we present examples of how imaging and sensing technologies, the numerical data they produce and the modelling based on these data provide ways to support design communication with nonhuman beings. The examples focus on three scales: stands of trees, individual organisms and limbs.[65]

We create these visualisations to obtain information about and engage with properties, capabilities and preferences of trees. To be representative such visualisations have to be products of collaborative processes that involve trees, their neighbours and meanings they exchange, which are captured as information, traced in data and recognised by algorithms.[66]

5.1 Data Acquisition and Preparation

A lidar device emits millions of rays of light in a spherical pattern. Each ray measures the distance by timing its return after striking a surface. Leaves block laser light, requiring multiple scans from different locations to capture all sides of a tree. Initially, these scans are independent from each other. Algorithms can align scans by looking for similar features. However, the way plants grow complicates the process. They have many self-similar features that can lead to mismatches. Branches sway in the wind and appear in different locations, creating a ghosting effect. Leaves flutter appearing as a blurry cloud rather than as distinct shapes. The height of trees also affects the data because the density of rays reduces as the light travels further away. The fine twigs, stems and leaves at height remain poorly represented. Consequently, the challenge of collecting data about trees is a difficult process that requires experience, persistence, awareness of local opportunities and constraints; in one word – craft. This craft is a dialogic endeavour that depends on previous knowledge but improves with trial and error, growing through embodied and *in silico* experiences with plants.

65 See, Supplementary Materials: Technical Workflow.

66 On the construction of images in science, see P. Galison and C.A. Jones (eds), *Picturing Science, Producing Art* (Abingdon: Routledge, 1998).

5.2 Data Analysis and Meaning Recognition

The next challenge is finding traces of meaning in the obtained information. For this to be possible, the raw data requires curation. A typical sample of 500 million points is too large for practical use with current computers. We can reduce samples by selecting points that appear sufficient for spatial analysis. Next, algorithms recognise groups of points that belong to individual trees based on the distance from their neighbours.[67] This approach is quick but can miscategorise dense foliage or overlapping branches (see Figure 6). The subsequent step recognises trunk, branch and leaves by clustering points based on the similarity of their neighbours. In this case, we used a dataset of Red Tingle trees in the Southwestern part of Australia to develop a Gaussian Mixture Model measuring neighbourhood linearity, planarity, sphericality, and variation for each point. We then label clusters as tree organs.[68] With a shift of perspective, we can interpret this operation as one group of trees helping humans understand another. The difference between the Red Tingle trees and Styx trees leads to some misrecognition but other measures can improve the results.

5.3 Data Visualisation and Modelling

To produce the views, the rendering system uses the sky-dome light and outlines groups of points to accentuate the depth.[69] This approach can work with billions of points and supply them to the renderer on demand to avoid overwhelming the machine. It reduces the complexity of living forests to match limitations of human perception and computational capabilities of human-built machines while attempting to preserve discovered meanings. Technical capabilities and curatorial decisions by human scientists, engineers and designers can acknowledge or miss and

67 J. Hackenberg et al., 'SimpleTree: An efficient open source tool to build tree models from TLS clouds', *Forests* **6** (11) (2015): 4245–4294, https://doi.org/10/ggb35g.

68 D. Belton, S. Moncrieff and J. Chapman, 'Processing tree point clouds using gaussian mixture models', *ISPRS Annals of Photogrammetry, Remote Sensing and Spatial Information Sciences* II-5/W2 (2013): 43–48, https://doi.org/10/gcdbx8.

69 M. Schütz, Potree: Rendering large point clouds in web browsers (Diploma Thesis, Vienna University of Technology, 2016). M. Schütz, S. Ohrhallinger and M. Wimmer, 'Fast out-of-core octree generation for massive point clouds', *Computer Graphics Forum* **39** (7) (2020): 155–167, https://doi.org/10/gn3gvh.

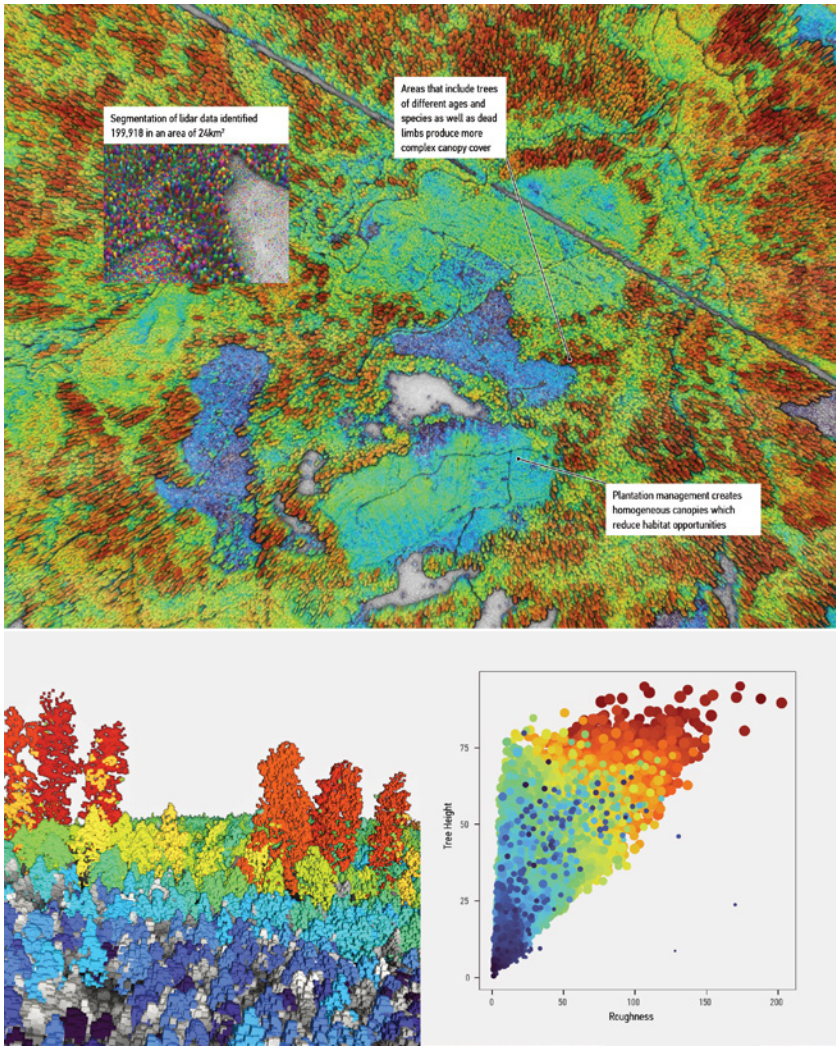


FIGURE 5.

Complexity of old-growth forests at site one. Red shows a high vertical complexity index, yellow a medium and blue a low. Grey designates areas with no detected trees. Bottom left: the contrast between giant eucalyptus trees and the surrounding forest at site one. Bottom right: a graph that relates height, roughness and vertical complexity. Each circle represents a tree. Colours indicate vertical complexity; sizes show canopy radii. The vertical axis shows tree heights in metres and the horizontal axis plots roughness in relative units.

block meanings created by the agencies of plants, opening a tricky but promising path towards mutual understanding and better collaboration.

5.3.1 Stands

This example (Figure 5) visualises the measure of forest structural complexity represented by the vertical complexity index" should read "structural complexity of the forest as represented by the vertical complexity index. Structural complexity of forest stands in multiple regions relates to faunal diversity that we identify as a form of care.[70] Such complexity develops in *Eucalyptus regnans* forests with trees older than 120 years.[71] Figure 5 shows a visualisation produced by algorithms that isolate individual trees and then use aerial lidar data to estimate their complexity. For each tree, we calculate two values that relate to faunal diversity. In addition to the vertical complexity index mentioned above, we show the roughness of canopies as represented by the rumple index.[72] Previous research demonstrated the value of combining multiple indices to estimate structural complexity of trees and the diagram in Figure 5 indicates the relationships between the two measures. Spatial analysis of lidar data has potential to inform the understanding of complex habitats co-designed and co-created by trees by expressing niche-constructing actions of plants in three dimensions.[73] This example highlights the importance of old growth forests and helps to outline its hard-to-perceive capabilities. The resulting understanding can inform protection and management decisions, helping to resist spatial, temporal and organisational constraints of human understanding.

5.3.2 Organism

The second example (Figure 6) shows a large old tree surrounded by an old-growth forest. Trees grow in response to their genetic makeup, their

70 As implemented in the LidR package for the R programming language, also see K.Y. Van Ewijk, P.M. Treitz and N.A. Scott, 'Characterizing forest succession in central Ontario using lidar-derived indices', *Photogrammetric Engineering and Remote Sensing* **77** (3) (2011): 261–269, https://doi.org/10/gssw8q.

71 Lindenmayer and Bowd, 'Critical ecological roles, structural attributes and conservation of old growth forest'.

72 As implemented in the LidR package for the R programming language, see also J.S. Jenness, 'Calculating landscape surface area from digital elevation models', *Wildlife Society Bulletin* **32** (3) (2004): 829–839, https://doi.org/10/fvc7bv.

73 S. Gámez and N.C. Harris, 'Conceptualizing the 3D niche and vertical space use', *Trends in Ecology & Evolution* **37** (11) (2022): 953–962, https://doi.org/10/gqkx4t.

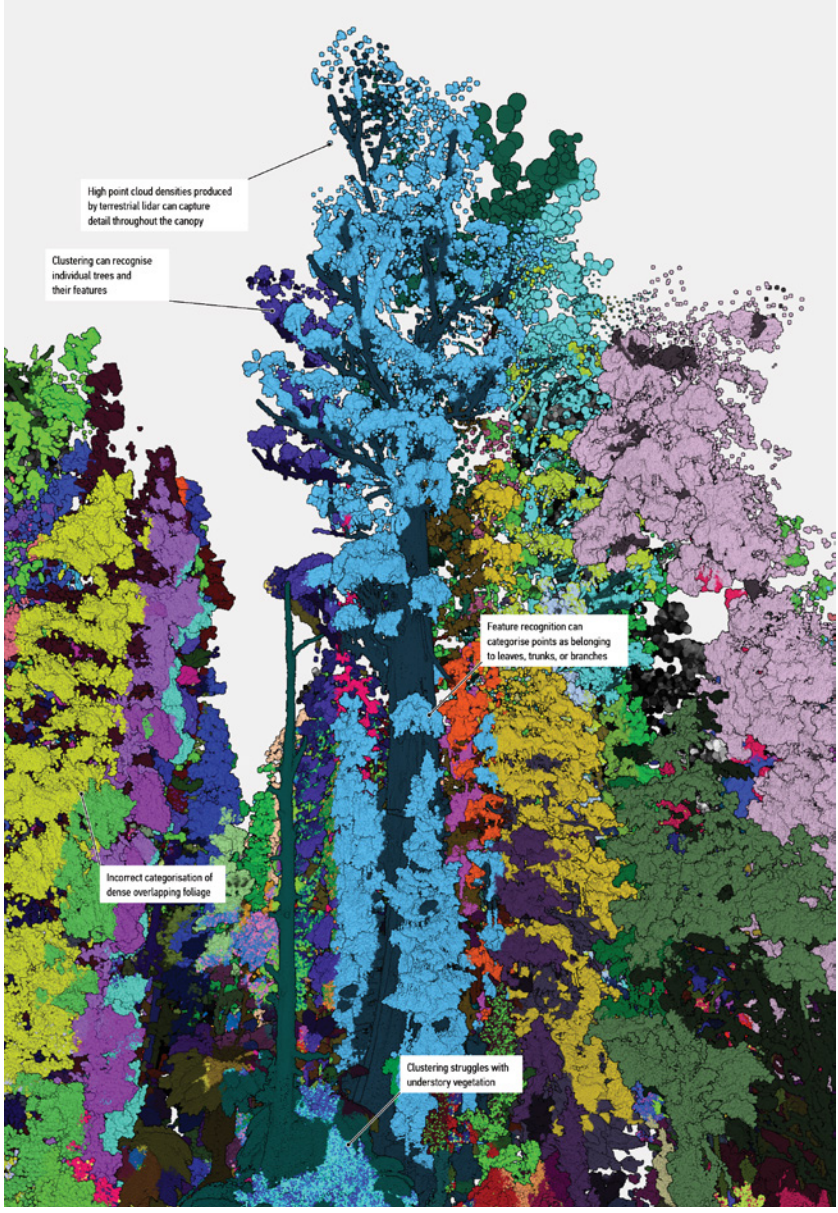


FIGURE 6.

A large old *Eucalyptus regnans* tree with its neighbourhood, trimmed to an area 50 metres wide and 50 metres deep. Colours indicate trees. Darker shades indicate leaves, lighter shades indicate wood.

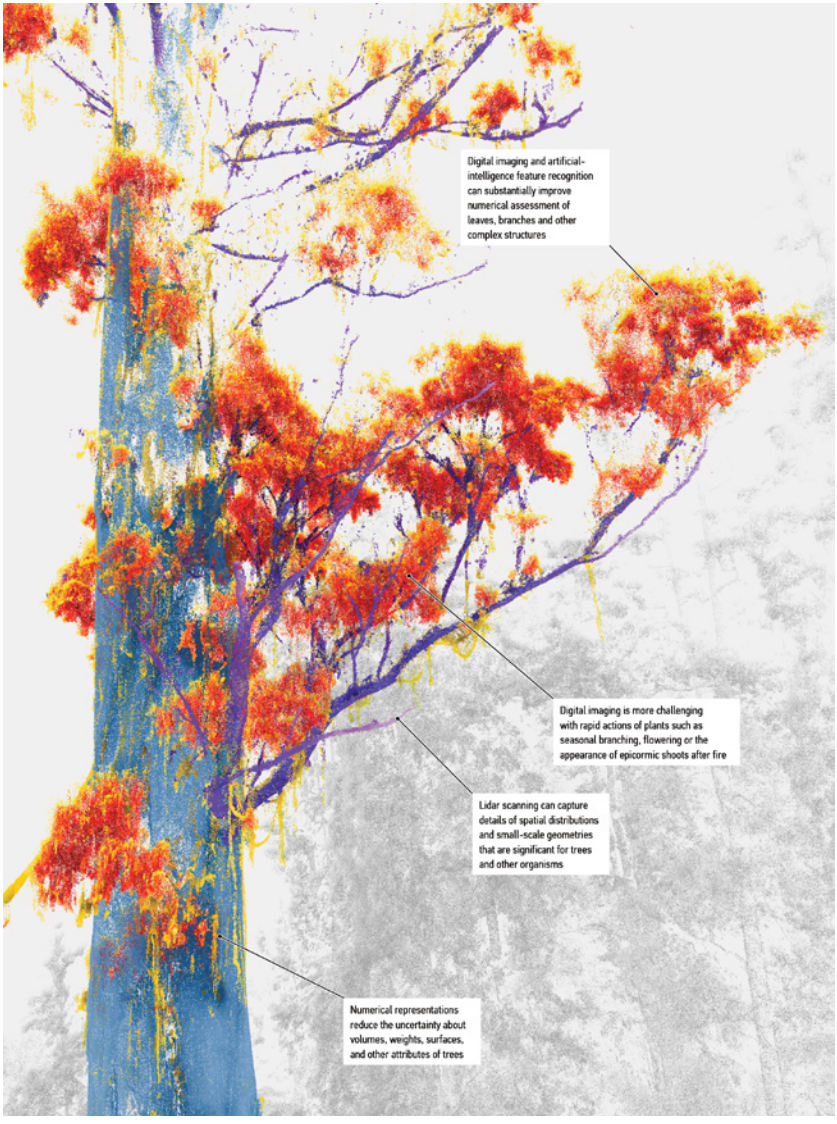


FIGURE 7.

Object recognition at a branch scale from site one (Figure 2). Blue, trunk; purple, branches; red, leaves; yellow, peeling bark; grey, surrounding vegetation.

environment and disturbance events such as lightning, strong winds, fire or fungal attacks. As a result, each tree is unique, and shapes of large old trees can be very different.[74] Numerical descriptions of tree structures in ecology and human understandings of their meaning in living communities are far from complete because such descriptions are difficult and time-consuming to produce.[75] This example uses machine learning to automatically group and colour points that belong to one plant. Such categorisation can help to measure and model significant relationships in interspecies communities. Analyses of this type can help to reframe plants as designers because they focus on capabilities and innovations of trees as individuals who express the potential of their phenotypic plasticity and demonstrate the broad scope of their resilience in the face of adversity. Better understanding of these capabilities can influence assessments of health, utility, aesthetic quality, viability and other criteria that human society applies to control and often oppress the lives of trees.

5.3.3 Organs

This last example focuses on the structures of the canopy. Canopies support many lifeforms within buffered microclimates and complex microhabitats. To date, human sciences know them poorly but field experiments in combination with imaging can provide significant advances.[76] Here, the agential perspective can emphasise capabilities that 'canopy science' acknowledges as forms of vegetal care. For example, bark streamers (shown as yellow in Figure 7) develop on the largest trees and are an understudied microhabitat for invertebrate taxa such as flightless tree crickets.[77] In our interpretation, such structures are examples of design that can inform maintenance regimes that should preserve organic litter and provide blueprints for artificial replacements

74 F. Sterck, 'Woody tree architecture', in C.G.N. Turnbull (ed.), *Plant Architecture and Its Manipulation* (Oxford: Blackwell, 2005).

75 Y. Malhi et al., 'New perspectives on the ecology of tree structure and tree communities through terrestrial laser scanning', *Interface Focus* **8** (2) (2018): 20170052, https://doi.org/10/gf3k43.

76 C.M.P. Ozanne et al., 'Biodiversity meets the atmosphere: A global view of forest canopies', *Science* **301** (5630) (2003): 183–186, https://doi.org/10/cpftbc; A. Nakamura et al., 'Forests and their canopies: Achievements and horizons in canopy science', *Trends in Ecology & Evolution* **32** (6) (2017): 438–451, https://doi.org/10/f987zv.

77 Lindenmayer and Laurance, 'The ecology, distribution, conservation and management of large old trees'.

in the areas, such as many locations in inner cities, where relevant features cannot develop or persist.

***

So far, we have argued that plants are agents that design, and we illustrated some approaches that can empower such agencies. This agential framing is useful because it can provide benefits that escape other conceptualisations. Examples in the existing discourse include proposals to rely on plant mobility to resist constraints of human property, support the intellectual right of plants to promote and compensate for their contributions, frame plants as health-supporting agents in the context of 'one health' and limit exploitation of plants by recognising their actions as forms of labour.[78]

Progress in this direction will depend on persistent mutual learning. Humans can learn about chemistry, ecological engineering, climate modification, forms of mutual support and other topics. In many places, plants must find ways to live with humans and in modified landscapes. This mutual learning is a difficult challenge. Researchers studying *Eucalyptus regnans* forests argue for the importance of long-term projects.[79] Such projects have multiple benefits but the oldest in Australia is only some 40 years in duration. By contrast, one tree can live 600 years, and three generations amount to almost 2,000.

A key benefit of lidar imaging is its ability to capture the complexity of traces produced by plant lives. For instance, lidar can identify individual plants, branches, leaves, and other parts, producing a more detailed and nuanced view of plant structures. Lidar imaging can also

78 B. Cooke and R. Lane, 'Plant–human commoning: Navigating enclosure, neoliberal conservation, and plant Mobility in exurban landscapes', *Annals of the American Association of Geographers* **108** (6) (2018): 1715–1731, https://doi.org/10/gdg5fj; D.J. Jefferson, *Towards an Ecological Intellectual Property: Reconfiguring Relationships Between People and Plants in Ecuador* (Abingdon: Routledge, 2020); S. Elton, 'Relational health: Theorizing plants as health-supporting actors', *Social Science & Medicine* **281** (2021): 114083, https://doi.org/10/gkbvfj; J. Palmer, 'Putting forests to work? Enrolling vegetal labor in the socioecological fix of bioenergy resource making', *Annals of the American Association of Geographers* **111** (1) (2021): 141–156, https://doi.org/10/gjhbmd.

79 Lindenmayer et al., 'The case for listing mountain ash forests in the central highlands of Victoria as a threatened ecological community'.

facilitate the interpretation of meanings expressed by plant communities. By combining lidar data from multiple perspectives and collected at different times, humans can gain a more holistic view of plants and their roles in their environment.

6. DESIGN RESPONSE: USE OF NUMERICAL MODELLING TO EMPOWER PLANT AGENCIES

Let us now return to the design challenge introduced above. The sites and trees in it are very different from those that survive in the Styx valley, but the lessons translate. For example, our ongoing work demonstrates that it is possible to combine detailed descriptions of tree features with field observations of bird behaviours to understand the meaning of branches and other structures as they are perceived by birds.[80] Numerical properties of such structures can serve as constraints or goals for generative design procedures that work with different species, structures and computational simulations including, for example, genetic algorithms, multi-agent simulations and form-finding (Figure 8).

7. CONCLUSION

In this article, we asked: why do human actions fail plants and other living beings? What can humans do to help plants help themselves and many others? Our response to these questions is twofold. Firstly, we argued that even best-intentioned human practices will fall short without the inclusion of all stakeholders that can stand or benefit from their impact. This logic is similar to the convincing arguments already advanced by other emancipatory movements with their slogan of 'nothing about us without us'.[81] Secondly, we suggested that the scepticism regarding communication with and the involvement of nonhuman beings, including plants, exaggerates the barriers between forms of life on Earth. To illustrate a possible path for collaborative designing that included trees, we referred to numerical analyses of scanned data and their potential

80 Holland and Roudavski, 'Participatory design for multispecies cohabitation'.

81 J.I. Charlton, *Nothing About Us Without Us: Disability Oppression and Empowerment* (Berkeley: University of California Press, 1998).

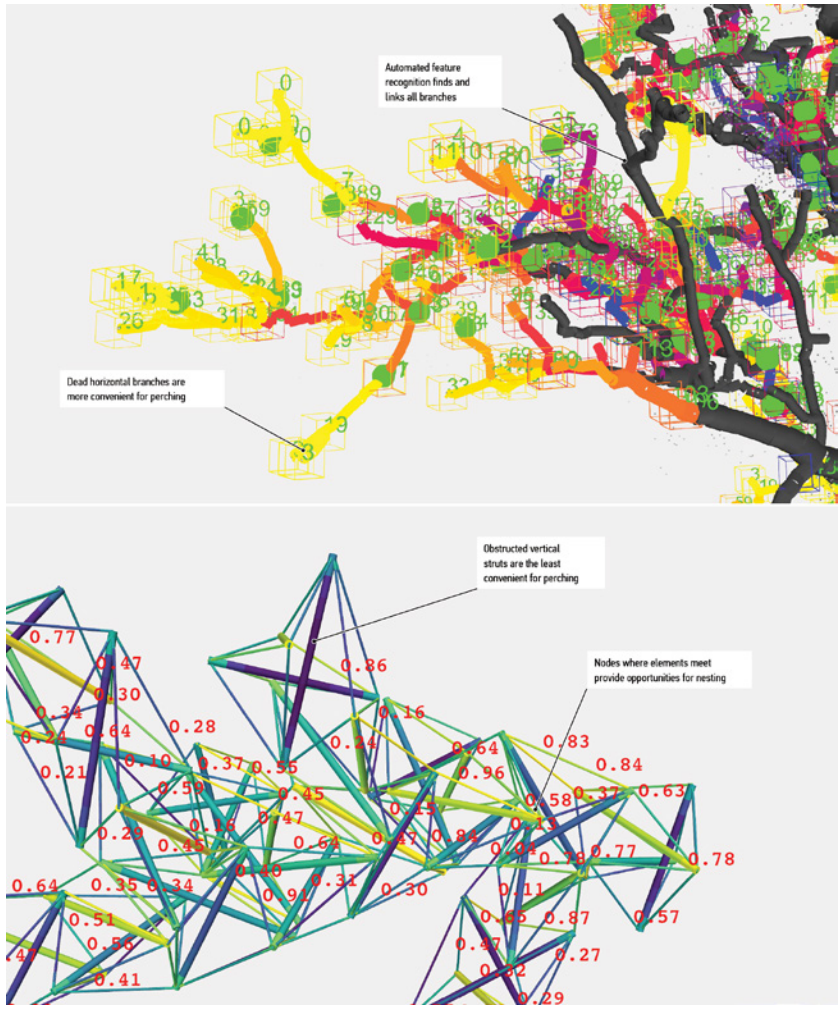


FIGURE 8.

Numerical analysis of living and artificial habitat structures as a basis for generative design. Numbers and colours indicate numerical estimates of suitability for perching. Top: branch segments recognised in scanned tree data. Bottom: a possible replacement design assessed against the same constraints. Yellow indicates high suitability and blue low suitability.

use in design. Many forms of existing learning in sciences and management already contribute to this objective but more is possible if trees, plants and other nonhuman stakeholders are supported in taking leadership roles to define new studies and experimental projects.

To support this narrative, we first described plants as decision-making agents with behaviours and actions. Secondly, we discussed plants as participants in design collectives that involve other nonhuman beings as well as humans. Thirdly, we categorised beneficial outcomes of design and as essentially supportive practices of care and indicated constraints that anthropogenic management imposes on plant capabilities. Fourthly, we demonstrated numerical imaging and modelling techniques that can strengthen plants' capabilities but also simplify and misrepresent plant lives.

The audience for this article includes all humans who triage their attention, finances, and efforts by selecting what to study, manage, modify or support. Relevant parties include researchers in ecology and conservation science, environmental managers, designers and planners working in business or city councils, as well as experts in politics and law who oversee frameworks for the protection of biological life. Recent science and practice in combination with Indigenous and traditional worldviews challenge habitual Western opinions about agency, innovation and care in application to plants and many other beings. We hope that this article helps to advance the ongoing conversation by providing convincing justification and practical detail. It aligns with other interdisciplinary and collaborative work that includes artificial habitat-structures, manufactured replacements for disappearing old trees, smart systems to minimise environmental light pollution, urban surfaces for mosses and coastal habitats co-designed with mangroves.[82]

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Further work in this direction is important to demonstrate that bottom-up approaches that follow living agents can interrogate and resist top-down methods of governance that entitle humans to decide what ecosystems need, which species should survive, where and how. The history of oppression across domains demonstrates that top-down paternalisms do not result in beneficial, just or sustainable outcomes and highlights the need for alternative approaches amid the increasingly acute environmental crises.

Our work shows that humans can 'listen' to vegetal political voices and use found meanings to recognise significant contributions that would otherwise remain unnoticed, unstudied, unappreciated and will soon disappear. This approach recognises trees not as objects, resources, or helpless patients dependent on human support, but as competent active agents, knowledge holders, innovators, and designers. This stance is different both from metaphorical appreciation of trees in human cultures as well as from biomimetic engineering that sets out to copy without compensation or acknowledgement for human use, often with harm. We hope that future research will experiment with the implications of this narrative, adjust its framing to suit the emerging evidence and formulate novel design experiments that will test and expand creative capabilities of more-than-human collectives to act – and to act with care.

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Author Contributions

J.R.: conceptualisation, methodology, software, validation, analysis, investigation, data curation, writing (original draft preparation, writing), review, editing, visualisation and project administration; A.H.: methodology, investigation, software, data curation, writing (review and editing, supervision); S.R.: conceptualization, methodology, validation,

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writing—original draft preparation, writing—review and editing, supervision, project administration, funding acquisition. All authors have read and agreed to the published version of the manuscript.

Deep Design Lab is a multidisciplinary and interspecies group dedicated to creating better worlds for all beings. Operating at the intersection of design, ecology, technology and ethics, it employs evidence-based, data-driven design experiments to develop novel theories and practices. These experiments include physical installations, computational modelling, interactive visualisation and scenario-based forecasting. The lab's projects range from immersive storytelling about endangered plants to computational studies of tree geometries and prototypes of bioreceptive building elements. Deep Design Lab aims to develop groundbreaking solutions that foster thriving, interconnected, more-than-human communities, paving the way for more sustainable and equitable futures.

Julian Rutten is a Deep Design Lab member with qualifications in landscape architecture and mechanical engineering who conducts research at the intersection of culture, nature, and technology. His work addresses ecological challenges of urbanisation by proposing that theories of place must expand to include plants as marginalised nonhuman subjects. This research leverages the latest advances in ecology and three-dimensional imaging technologies – such as lidar, photogrammetry and computer tomography – to develop design practices that can incorporate multiple ways of knowing in support of more sustainable and just futures. Julian publishes and exhibits his work internationally and contributes to various practical environmental-conservation projects.

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APPENDIX: SUPPLEMENTARY MATERIALS

These Supplementary Materials provide additional evidence for the narrative in the main text. The materials include listings of: plant agencies (1), forms of design and the roles of plants (2), care (3) and an outline of the technical workflow used in the examples (4).

Plant Agencies

TABLE 1. Agential capabilities of nonhuman beings, including plants.

Agential Capability	**Example**
Self-awareness Recognise self.	Plant roots distinguish between themselves, other roots of the same species, roots of different species, other organisms and minerals.[A1] Empirical studies show that the ability to recognise kin and neighbours is very common.[A2] In *Eucalyptus regnans*, an example is self-incompatibility which prevents self-fertilisation and promotes outcrossing to avoid inbreeding and maintain genetic diversity. [A3]
Awareness of the environment Recognise meaningful features and events in the environment.	Plants can sense light, temperature, water, nutrients, hormones, and pathogens. They use different mechanisms to perceive these signals and translate them into biological responses.[A4] For example, like many trees, *Eucalyptus regnans* can sense and respond to fire by shedding large volumes of seeds into resulting ash beds in anticipation of better recruitment.[A5]
Learning and memory Use past experiences to guide behaviour.	For sessile organisms such as plants, cognitive processes such as learning, memory and decision-making are critical to survival and reproduction.[A6] As an example, *Mimosa pudica* can learn not to fold its leaves in response to repeated shocks when previous exposures did not result in harm.[A7]
Decision making Make adaptive, discerning, flexible, anticipatory, and goal-directed decisions.	Plants, like all organisms, act in complex environments and among conflicting signals. They routinely select one of many options and account for trade-offs.[A8] For example, their roots grow away from typical gravity directed pathways to avoid toxic soils and predict dynamic nutrient patterns to maximise absorption. Plants' epigenetic variation can function as memory, for example clonal plants interpret nutrient and light levels to forage in unknown environments.[A9]

Communication Exchange meaningful signals within and between biological systems.	Plants engage in multiple forms of information processing and communication to achieve higher-level goals such as responding to pathogen attacks. [A10] For example, they release and detect a wide range of volatile organic compounds to communicate with themselves, other plants, insects, fungi, microorganisms, pollinators, herbivores and their predators.[A11]
Niche construction Construct conditions that support life.	Land plants alter all environments through surface remodelling and their effect on the atmosphere.[A12] Plant growth, metabolism and death produce ecological niches for whole communities.[A13] For example, quick growth following fires establishes eucalyptus trees whose deep roots then increase water availability, reducing severe bush fires and providing habitat for other rainforest plants.[A14]

Social Roles of Plants

To understand the roles of plants in design and outline the potential for their future engagement, we compare their current roles in design, management, and governance practices formulated by humans. Examples in this table are a simplification and many concrete projects could span multiple rows. The first row focuses on human benefits from nonhuman life and the second row explains how human management can benefit nonhuman living beings. The third row emphasises respect and protection of nonhuman lifeforms. We propose here that these existing frameworks can further benefit from a better understanding of plants' creative agencies.

TABLE 2. Plants in current frameworks that govern relationships between clients and designers.

Designers and Clients	**Frameworks and Roles**
By humans for humans Design by humans to achieve human goals while minimising damage.	Sustainable development emphasises human needs, for example through approaches that exploit forests to store carbon.[A15] Planting of trees for such purposes reduces their ecological and cultural roles potentially leading to impoverished forests.[A16] Similarly, nature-based solutions can aim to solve the anthropogenic heat island effect in cities by planting trees.[A17] Economists frame trees' abilities to mitigate pollution, noise and support human recreation as ecosystem services. These approaches often accept harming plants through the exposure to high temperatures and pollution but can also aim to include nonhuman interests.[A18]
By humans for other lifeforms Design by humans to support or restore nonhuman life.	Some examples in this section include design for nature. This approach aims to make buildings that enhance biodiversity and create habitat niches for endangered organisms.[A19] Similarly, nature positive design seeks to retrofit old designs to offset past damage and create new habitat opportunities.[A20] Stepping closer to nonhuman autonomy, rewilding converts abandoned land into nature reserves with pre-human plant communities.[A21] Many such approaches rely on human knowledge and judgement to improve the conditions for nonhuman lifeforms. The results can be problematic. Preference for some species can lead to the suffering of others or to the neglect of individual organisms leading to the calls for compassionate conservation and conservation welfare.[A22] Respect for autonomy in bounded exclusion zones can also lead to the loss of health and death as happened in Oostvaardersplassen.[A23]
By all life for all life All living beings contribute to design.	Emerging conceptions that prioritise the 'rights of nature' and often seek to integrate indigenous knowledge attempt to overcome human paternalism by ascribing legal and political protections to nonhuman beings. Examples include *buen vivir*, earth jurisprudence, animal property rights or Indigenous approaches to the care of country.[A24] These important approaches frame human attitudes towards nonhuman beings and can benefit from further evidential support. Additional work to include and empower beings or relationships that operate beyond current human knowledge can further extend these approaches.

Forms of Care

Table 3 outlines forms of care by large old trees and contrasts them with the losses that result from the curtailment of vegetal agencies.

TABLE 3. Forms of care and anthropogenic constraints.

Form of care This column includes examples of ecosystem contributions resulting from agential actions by large old trees.	**Protection of plant agency** This column includes directions for future research and design that could support beneficial agencies of large old trees in the conditions of human-induced environmental change.
Sustain themselves Tree roots can provide favourable environments for the growth of beneficial microorganisms, inhibit harmful nematodes and limit the growth of neighbouring plant species.[A25]	Many human activities prevent the formation and constrain the beneficial functioning of the rhizosphere. Supportive measures could include elimination of anthropogenic alterations such as hard surfaces, removal of the physical separation from conspecifics, alleviation of the stressful living conditions and restoration of important resources. These measures support trees' ability to reproduce and maintain their young without human interventions.[A26]
Maintain the community Large old trees provide resources crucial to other species when alive and after their biological deaths, sometimes for hundreds or even thousands of years. This persistence supports the character of the neighbourhood and its communities.[A27]	A single old tree in an urban area can also create persistence and encourage habitation by ecologically relevant species. This ability to support the character of place also applies in other situations such as agricultural landscapes. Protective measures could include retention of trees in managed environments and a reassessment of their value.[A28]

Clean the environment Large old trees absorb ozone, sulphur dioxide, nitrogen dioxide and carbon dioxide while releasing oxygen through photosynthesis thus providing breathable and healthier air. They can also filter pollutants in air and water.[A29]	Trees' ability to engage in cleaning has limits and the exposure to harmful substances can lead to stress and death. Protection of plants as agents should support trees' right to safe environments including air, water, and soils. Protections of soils is a characteristic example where volume, compaction, contamination, structural alterations can inhibit plants' capabilities.
Regulate climate Large old trees reduce the global greenhouse effect by trapping carbon dioxide and can construct local micro- and meso- climates by providing shade and evaporating water from their leaves.[A30] They further extend this effect by dropping large volumes of leaves that trap moisture and extracting underground water with their deep roots. Their impact influences rain, wind, fire, lightning, and landslides.	Humans select plants to for protection against extreme conditions. For example, trees that act as windbreaks persist in constant stress, without an opportunity to utilise the full spectrum of their capabilities. The same is true for those deployed for their decorative value or to provide shade.[A31] An extended consideration of trees' agencies would consider these capabilities in the context of whole plant lives instead of instrumentalising them at the expense of health, wellbeing, and longevity.
Supply nutrients Plants, including trees, are the primary producers in most ecosystems, converting light energy into chemical energy that is useable by other organisms. They are the main source of food for fungi, and bacteria, herbivore animals and indirectly for carnivores.[A32]	Human practices often do not allow trees to distribute nutrients though interactions with animals and fungi because anthropogenic landscapes impose accidental or deliberate isolation. Fertilisation and watering practices further reduce these abilities. Artificial light also plays a negative role by disrupting activity rhythms, increasing stress, and affecting the production of leaves, fruit and pollination networks.[A33] Appropriate responses would support plants rights to live in rich communities that support a fuller spectrum of their capabilities. Here, large old trees can act as foci for communal organisations that interlink needs and entitlements of multiple lifeforms under emerging political schemas including citizenship, rights and custodianship.

Support dwelling Large old trees offer protection and refuge for many animals and other organisms. They provide habitats for nesting, breeding, hiding, resting, and hunting. Some animals also use plant materials to build their own shelters, such as nests, burrows, webs and hives. For example, the hollows of large old trees can house hundreds of species of birds, mammals, reptiles, amphibians, and insects. For example, *Eucalyptus regnans* act as pioneer trees that can germinate after fire, establish quickly in 20-30 years, and create a microclimate that supports shade-dependent rainforest plants.[A34] The canopies of large old trees contain large numbers of species many of which remain to be discovered.[A35] Bark streamers are another example poorly known micro-habitats. The roles of large old trees extend beyond the immediate neighbourhood and influence ecosystem processes at multiple spatial scales, including whole landscapes.	Human practices often prevent evolved patterns of growth and senescence in way that reduce trees' ability to contribute habitat opportunities. This happens when humans fill hollows, cut of tops to limit height, or prevent pollen, lop off branches that might fall or clean ground litter. Relevant measures can include protection of remaining old-growth forest as well as preservation, cultivation or replication of habitat features in managed landscapes.[A36]
Aid communication Large old trees can communicate with each other and other organisms through chemical signals, electrical impulses, sound vibrations, and physical contact. They can warn each other of pests or diseases, attract beneficial insects for pollination or protection, share resources or information with other plants or fungi and influence the behaviour or emotions of animals.[A37]	Current management practices do not take communicative capabilities of plants into account, but their consideration would substantially reframe the best case in many modified environments. For example, recent research suggests a relationship between plant volatiles and insect behaviour in the urban environment with implications for management.[A38] Support for the communicative capabilities of plants can involve protection for their signalling and sensing abilities as a right to communal association.

Technical Workflow for Empowerment

The following steps capture a typical workflow using lidar data.

1. Acquire data.

    1.1. Scan trees and the surrounding environments with a terrestrial lidar at multiple locations.

1.2. Align multiple scans into one scene. Use trunks and other static features to manually align point clouds.

1.3. Overlay scanned data with publicly available lidar datasets.

1.4. Repeat 1.1 to 1.3 for other trees and related sites.

2. Analyse data.

2.1. Reduce point clouds for data analysis using uniform spacing of 10 to 50 centimetres.

2.2. Segment point clouds by clustering neighbouring points below a threshold distance.

2.3. Classify points into foliage, main trunk, branches, and other categories.[A39]

2.4. Create a quantitative structure model (QSM) using trunk and branch points. This algorithm produces a graph network of branch segments with each part having length, radius, and orientation information.[A40]

2.5. Correlate points with QSM information to categorise dead branches.

2.6. Calculate geometric metrics such as structural complexity, roughness, and curvature to categorise bark as well as other features.

3. Visualise the outcome of analysis.

3.1. Upscale categories and geometric analysis from the reduced data to higher density point clouds with 1-10 centimetre spacing.

3.2. Visualise and explore high detail point clouds by mapping categorising using colour spectra.[A41]

3.3. Identify relationships between features with graphical plots.[A42]

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Photographic Phytography: Towards a Photographic Re-Centring of the Oak Tree within Theory, Material and Practice

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ABSTRACT

This paper explores my practice-based research project *Arboreal Encounters*, a collection of tannin toned cyanotypes made with six heritage oak trees that form an element of my part-time, practice-based Ph.D. at the University of Brighton, UK. It comprises a brief history and background of the project before exploring how photographic practice might interact with and integrate notions of vegetal intelligence within artistic practice. By thinking of the production of *Arboreal Encounters* as if an invitation to the trees to become part of the process of their own representation, I consider how such interactions might act symbolically as human-plant collaborations and how methods of thinking, as well as doing, may resist notions of the plant as commodity within artistic practice.

KEYWORDS

trees, photography, vegetal intelligence, human-plant relations, art

INTRODUCTION

At the time of writing, *Arboreal Encounters* comprises six photographic portraits of ancient oak trees within England (four of which feature in and illustrate this paper) that in 2002 were all named heritage trees by the environmental and tree charity, The Tree Council, to commemorate Queen Elizabeth II's Golden Jubilee.

As my research on and visits to the trees started, my interest in the notion of heritage trees and the stories that surrounded them began to unfold. When travelling to my first tree, the Queen Elizabeth I Oak, the closest to me while living in Brighton and Hove, there seemed an initial disconnect between a) the language around the trees that signified their cultural importance and encouraged people to visit, and b) the lack of signage and general ambiguity around the tree's whereabouts, making it difficult to find. This gave the Queen Elizabeth I Oak a mystic quality, emphasising my visitation as a kind of pilgrimage as well as a method for research. Following this route, I became fascinated with the roles of conservation management, cultural infrastructure, natural heritage and their wide variance among the 'Great British Trees', largely because of their location and association

FIGURE 1.

Son of Royal Oak, Boscobel House, Boscobel, Shropshire from the series 'Arboreal Encounters', Author, 2021. 21 x 29.7cm print on 29.7 x 42cm paper. Oak bark tannin-toned cyanotype on Langton watercolour paper.

with the crown, as well as the more general idea of preserving living organisms for the purpose of their cultural (humanly related) heritage.

Around this time (2019–2022), several exhibitions and books concerning plant intelligence emerged and I became interested in the dual properties of heritage trees both as 'social constructions and as real dynamic material entities'.[1] Scientific research that discusses the underground interactions formed by the combination of tree and mycorrhizal roots that develop symbiotic networks in the sharing and movement of nutrients became of significant interest to me, as this signified a tree's

1 P. Cloke and O. Jones, *Tree Cultures: The Place of Trees and Trees in Their Place* (London: Routledge, 2002), pp. 3–4.

ability to co-exist and cooperate with a species other than itself.[2] As the human stories and cultural associations that surround the trees of my study have, in most cases, acted as a form of defence against the trees' destruction and enabled them to be preserved while other trees around them were felled, I began to wonder if one could think of cultural networks and the wider interaction between humans and these ancient trees as a form of collaboration that directly impacted the trees' survival.

In addition to this, the cultural contexts of the trees in my study are widely defined by human associations with historical figures, especially the monarchy, and with aristocratic families, private estates and formally designated conservation landscapes. As this context acts as a lens through which the trees are engaged with, something that I too experienced by formulating my own relationships with them through research visits, photographs and collecting material about them, I began to feel that further attention should be paid to their organic nature; in essence to balance out their identity between the human and the vegetal.

Due to my fascination with the management of these trees as cultural heritage products, together with the rise of exhibitions and publications surrounding plant intelligence, my original focus developed from its initial emphasis on national identity and folklore towards the interrelation of nature and culture. However, because of these trees' inevitable linkages to my previous interests (some of the stories that surround them being folktales or legends, for example; and with the oak, at least pre-industrial revolution, having played a significant part in English national identity) they remain a component of my research and operate as historical context for each of the trees I visit.[3] In this sense, the trees of my study are constructed by a convergence of natural and cultural worlds. Trees on heritage registers are preserved to lengthen their life which is of some benefit to the tree and its survival, but only insofar as

2 Such research has been conducted and popularised by forest scientists and biologists through publications such as *The Hidden Life of Trees* by Peter Wollheben; *Finding the Mother Tree* by Suzanne Simard; and *Entangled Life* by Merlin Sheldrake, to name just a few. As these references relate to accounts of scientific research that incorporate the personal experiences and encounters of the authors, they are not used here as a form of evidence to back up claims of vegetal intelligence, but rather to demonstrate the ways in which such concepts have worked their way into the public domain.

3 A. Miles, *The British Oak* (London: Constable, 2016); A. Farjon, *Ancient Oaks in the English Landscape* (London: Kew Publishing, 2017).

the human stories related to them survive.[4] As histories and myths are projected upon them and are thus upheld and maintained by the living trees, they operate as visible, tangible markers of those myths within the landscape. This makes the trees significant due to the cultural value bestowed upon them, as well as the myriad forms of biological, cultural, social and political systems that function to maintain and reinforce their national significance.

TREES AND THE CLIMATE

Trees, as an easily recognisable and familiar form, have also arguably become an emblem of the climate crisis within mainstream media over the last few decades, often being paired with anthropomorphic language and emotive phrases such as 'the lungs of our earth' (a corrupted quote attributed to the 32nd President of the United States, Franklin D. Roosevelt in 1937), to exemplify their significant role in climate change, principally as absorbers and storers of carbon.[5] Recent popular works such as *The Hidden Life of Trees* by Peter Wohlleben (2015) and *Finding the Mother Tree* by Suzanne Simard (2021) use a combination of scientific research, personal experience and anthropomorphic metaphor to imply that trees' organic functions act as mirrors to the ways in which humans form communities and relationships with other human beings. Even the popularity of art exhibitions such as *Rooted Beings*, Wellcome Collection (2022); *Among the Trees*, Hayward Gallery (2020); *The Botanical Mind*, Camden Art Centre (2020); and *Trees*, Fondation Cartier pour l'art contemporain (2019), to name just a few, is focused on the importance of relationships between the vegetal and human worlds. This includes, but is not limited to, the perceived loss, or distancing, of relations between humans and plants, particularly in relation to (and in some ways as suggested evidence of) the climate emergency.

4 Forestry Commission England (2013) *Operations Instruction No. 31: Trees of Special Interest and Forest Operations*: https://ianswalkonthewildside.files.wordpress.com/2014/07/forestry-commission-guidance-note-on-veteran-trees.pdf (accessed 13 June 2020).

5 F.D. Roosevelt, *Statement on Being Awarded the Schlich Forestry Medal* (Letter to the Society of American Foresters, 29 Jan. 1935): https://www.presidency.ucsb.edu/documents/statement-being-awarded-the-schlich-forestry-medal (accessed 28 Sept. 2023).

The tree in photography, however, is also a longstanding trope, not least due to its stillness compared with fidgety human beings during the days of minute-long exposures.[6] Their relationship is connected historically through the work of scientists, photographers, and artists alike, such as John Hershel (1772–1871) and Anna Atkins (1799–1871), Gustave le Gray (1820–1888) and Benjamin Stone (1838–1914), and has long continued into contemporary life through the work of Ansel Adams (1902–1984), Robert Mapplethorpe (1946–1989), Rodney Graham (b. 1949) and Barbara Bosworth (b. 1953), to name just a few. Even certain chemical compounds within a tree's organic makeup have an enduring legacy in photographic history, such as the use of gallic acid in Henry Fox Talbot's early calotypes – an aspect I will expand on later in this paper.[7] Indeed, trees, or more accurately the vegetal kingdom at large, carry with them an enduring fascination and complex, interwoven history of human vision, both creatively and conceptually. As the communication of climate crisis concern can often involve and be influenced by visual culture, of which the photographic representation of forests, woods and trees alike is a part, it is the convergence of trees' enduring prominence in photographic history and popular culture that has led to a deepening of thought around how photographs and trees might be further (re)considered.

PLANT, MATERIAL AND PHOTOGRAPHY

More specifically, however, it is the incorporation of plant material within creative processes and/or the use of research into the biological functionality of plants and its translation to photographic practice, that has begun to emerge as an important component of creatively representing plants, furthering a material and often site-specific bond between subject and object, plant and photograph. Lens-based and/or cameraless artists such as Hannah Fletcher, Uriel Orlow, Almunda Romero and Karel Doing, for example, all feature and discuss the plant-as-agent within their practice, drawing inspiration from subjects such as the components of a plant's material, the environment within which the plants

6 M. Barnes, *Into The Woods: Trees and Photography* (London, Thames and Hudson, 2019), p. 3.

7 K. Doing, *Research* (2019): https://phytogram.blog/research/ (accessed 29 Dec. 2023).

are embedded and include their material trace, or their collaboration with the physical plant itself, all within the process of image-making.[8] These photographic processes, although existing in contemporary culture often as a response to the climate crisis, simultaneously derive from the origins of photography, positioning the vegetal world as an enduring component of the history and development of photographic practice.[9]

My own work is positioned within this body of creative praxis, what Marder and Aloi call 'de-objectifying aesthetic strategies' wherein the plant is considered less as a passive subject and more as an active participant or collaborator.[10] This approach is largely a response to scholarly discussions within disciplines such as critical plant studies that seek to re-address the balance between the relationship of plants and humans, itself informed by the concept of plant intelligence.[11] Among these discussions, questions are asked that include but are not limited to: how can plants (within art) not be reduced simply to their human uses or relations?[12] In other words, are there ways in which the identity of plants that are the subject of artistic enquiry can be more fully

8 Specific works of note related to the artist/photographers above are: Hannah Fletcher's 'Circles: A Record of our Time', a series of soil-based chromatographs that photographically display the level of carbon in the soil of London plane trees; Uriel Orlow's 'The Memory of Trees', a series of large-scale black and white photographs that depict trees as witnesses of history; Almunda Romero's 'The Pigment Change', a four-part series of what she describes as image-objects and photographic experiences that question human relationships to nature, sustainability and (re) production in the context of the climate crisis; and Karel Doing's 'Phytography', an on-going practice-based research project that engages with plants on a physical and chemical level, enabling the interaction of phyto and photochemicals.

9 Ideas surrounding the resurgence of old or camera-less forms of photography within modern day practices, either as a resistance towards commercial or manufactured forms of photographic processes, or as exemplifiers of photography as a handmade process, are discussed in more detail by Lyle Rexer in his book *Photography's Antiquarian Avant-Garde: The New Wave in Old Processes* (New York. Harry N. Abrams, Inc. Publishers, 2002).

10 G. Aloi and M. Marder, 'Getting entwined: A foray into philosophy's and art's affair with plants', *e-flux notes* (2023): https://www.e-flux.com/notes/552884/getting-entwined-a-foray-into-philosophy-s-and-art-s-affair-with-plants (accessed 3 Jan. 2024).

11 P. Gibson, *The Plant Contract: Art's Return to Vegetal Life* (Leiden: Brill, 2018).

12 P. Gibson, 'The herbarium: Coloniality, indigenous knowledge and the eucalyptus' (paper presented at Phytogenesis II: Provocations of Plants, Philosophy and Photography, University of Plymouth, 23 March 2022).

incorporated within the process of their representation, therefore decentring their human relations without fully excluding them? Rather than photographs being made simply to depict plants, how might photographs made *with* plants function to disrupt ideas that construct the vegetal kingdom as merely the backdrop to human action, rather than a stimulating, generative and responsive collection of entities within their own right?[13] The definition of the term 'made with plants', in this context, differs depending on the artist in question. However what it does signify is a philosophical shift in the way in which artists conceive and engage with plants as living entities with their own rights, while simultaneously living both within and outside of physical and conceptual human boundaries.

CLOSING THE GAP ON NATURE-CULTURE RELATIONS

In part, these new (or re-emerging) correlations between plant-based imagery and the plants that inspire them are a response to the historical and hierarchical distance placed between humans and plants, which has also come to define, or explain, aspects of the current and ongoing climate emergency.[14] When thought of in terms of traditional art practices that utilise plants as subject matter, this historical positioning conjures up questions as to how art can play a part in disrupting, or reinforcing, ideas of distance between humans and the natural world.[15] At a conference on photography and plants at the University of Plymouth in 2022, the critical plant studies scholar Prudence Gibson laid out several preliminary and explorative guidelines for how art might interact with plants for the engagement to be mutually beneficial, as a means to resist contemporary art practice falling victim to replicating extractive or exploitative techniques that end up harming human-plant relations either physically or philosophically.[16] Among them were terms and their descriptions such as: un-contained – the acknowledgement that plants are beyond human control; sensual – the knowledge that

13 T. Ingold, 'The temporality of the landscape,' *World Archaeology* **25** (2) (1993): 152–74. https://doi.org/10.1080/00438243.1993.9980235

14 S. Mancuso, *The Nation of Plants* (London: Profile Books, 2021) pp. 53–71.

15 Gibson, 'The Herbarium'.

16 Ibid.

FIGURE 2.
Major Oak, Sherwood Forest, Nottingham, from the series 'Arboreal Encounters', Author, 2021. 21 x 29.7cm print on 29.7 x 42cm paper. Oak bark tannin-toned cyanotype on Langton watercolour paper.

plants are enmeshed within a wider ecosystem that shares and distributes nutrients and knowledge; distributed – an acknowledgement of their vastness across both space and time; irreducible – to not be reduced simply to their human uses or relations; and changeable – to understand that plant life, just like human life, is constantly changing and adapting.[17]

Such ideas of art merely replicating, whether consciously or unconsciously, the political, cultural, commercial and social extraction of plants for human consumption (whether literal or metaphorical) can arguably be a danger to radical, proactive change in the ways in which humans engage, respond and adapt to the natural world and the changing

17 Ibid.

climate.[18] If humans are to put into practice genuine radical change to shift perspectives and by extension action towards the importance of preserving and protecting vegetal life, as a creative practitioner it would be hypocritical not to at least try to think about such extractive, or what Michael Serres refers to as parasitical, relationships to the natural world and how they can be avoided throughout the artmaking process.[19] Placing plants front and centre within creative practice, and therefore ascribing them greater status, is a political act. Art that therefore draws attention to this ascription can also be thought of as political and, in turn, as a metaphorical cog in the mechanism of how public perception of plants, and by extension climate change, can be potentially shifted.[20]

PHOTOGRAPHIC PHYTOGRAPHY: ESTABLISHING METHOD AND PRACTICE

Before embarking on theory, it is important to outline the methods, processes and ideas involved in the production of prints within *Arboreal Encounters* and how they engage with the ideas laid out above. Each arboreal portrait begins with a medium format negative made on-site after a recce of the tree and its surrounding environment. This negative is then processed by myself at home and scanned to digitise it. The digital positive is then inverted to resemble a negative and edited to increase its contrast. This inverted image of the tree is then printed onto acetate, creating a large-format negative. After this is done, cyanotype solution is painted onto A2 watercolour paper and left to dry. Once dried, the acetate negative is placed on top of the prepared paper and exposed to the sun to make a print, after which it is washed in water to fix the image. The print is then left to dry and mature for two to three days before being bleached in a mix of baking soda and water, removing the traditional blue pigment of the cyanotype. The bleached print is then washed to rinse away any residual bleaching solution before being left for anywhere between one to five hours to tone in a bath of tannin that I extracted from oak bark by submerging it in boiling water, using

18 Gibson, *The Plant Contract*.

19 M. Serres, 'The natural contract', trans. Felicia McCarren, *Critical Inquiry* **19** (1) (1992): 1–21. https://www.jstor.org/stable/1343752.

20 Gibson, *The Plant Contract*.

the resulting liquid. Each print for each arboreal portrait follows this routine and amounts to around five to seven days of work. This also accounts for experiments in the correct time of exposure on the day of printing so as not to risk the failure (such as under- or overexposing) of expensive large-format prints. To expand on this process, I will now lay out certain aspects of my photographic methodology to explore the ways in which it engages with notions of vegetal thinking, beginning with the first stage of production, the negative.

Phase I: The negative

As every tree grows within a different environment, is surrounded by differing levels of vegetal life and is privy to a varying level of conservation methods, the conclusions I have drawn from my original experiments back in 2019 are that both ideas and actions, especially surrounding composition, must adhere to each location and therefore to each individual tree. With this approach I resist implementing a specific template of photographic engagement and unnaturally forcing each tree into a premeditated structure. Instead, I mould myself and my vision to the location I am within, encouraging a form of embodied practice and preventing my own actions from artificially re-contextualising the trees and their environment.

As my travel to each tree is conducted within a certain timeframe, I therefore become vulnerable to things such as inclement weather conditions (for the *Major Oak* portrait, for example, the negative was produced during pouring rain – see Figure 1), which can expose my practice directly to the elements and therefore to uncontrollable environments. Effectively this requires me to approach each photograph and each individual tree with an openness to and acceptance of whatever I might encounter. Over time, this has become incorporated into my methodology: to choose ways that, rather than creating a series of reproducible actions and environments, instead open me up to instinct and a certain level of reciprocity between myself, the location and the specific tree with whom I am interacting. However, it also signifies putting theory into practice by centring the tree while simultaneously rejecting a certain level of artificial control over the production of plant-based images; exposing myself and my body to the conditions and environment within which the tree lives, therefore, reliquishes some level of human control.

Paradoxically, as the creative practice has grown and evolved, thinking of the trees more or less as human subjects has become part of my method to imagine how to develop photographs *with* trees, rather than of them. As the artist Lindsey French, in their 2016 article 'Weak media, photocentrism and gestures towards transgressing the self', notes, 'to know a plant's name is not to know a plant'.[21] In short, understanding and retaining knowledge of a plant's identity does not stop at simply knowing the name ascribed to it. But how might one know a plant? For me, considering the trees as something more familiar to my own being, rather than consigning them to the domain of otherness, opened new ways of interacting with them. Much as I would ask questions to a client or a friend who was sitting for a portrait before I made an image with them, I began to conceptualise knowledge gained around the historical and biological aspects of the trees I was studying as an investment in the background and historical knowledge of my subjects. As I learnt of the specific genus, their particularities, their linkages to national history, their various uses as a material and as a cultural symbol, and their organic functionality – i.e., the ways in which oaks conceive and construct their own world – new forms of photographic engagement sprung forth in my imagination. The theoretical reasons for this will be expanded on more deeply later; however, in short, the importance of adaptation to the trees and their environment come from ideas surrounding the treatment of trees as individuals, not as mere vegetal clones or replicas of each other.

In part, even though my use of pronouns to refer to trees as 'they', rather than 'it', somewhat reproduces anthropomorphic language, I have personally found it shifts their existence as being purely 'other', opening them up to becoming other forms of living beings in the world.[22] This linguistic strategy, although seemingly small, has made it much more difficult to 'other' them as simply another form of set dressing in the grand theatre of human life.[23] Ideas such as these feed directly into notions of engaging with trees as more-than-human, not to replicate anthropomorphic or romantic tendencies, but to establish a specific

21 L. French, 'Weak media, photocentrism and gestures towards transgressing the self,' *antennae* 37 (2016): 77.

22 R.W. Kimmerer, *The Democracy of Species* (London: Penguin Books, 2021), pp. 16–20.

23 Ingold, 'The temporality of the landscape'.

relationship with them that incorporates their human and vegetal identities holistically.

Furthermore, by using analogue processes combined with organic material within *Arboreal Encounters*, the oak trees are conceived as participants and collaborators and in so doing become agents in the process of their visual representation. The decision to work *with* the trees, rather than simply using their image as an illustration of philosophical enquiry, is an essential part of my creative methodology which attempts to address and reconcile some of the risks outlined above.

This is, as it were, an example of thinking and making 'phytographically', a term constructed from the word *phyto*, meaning 'plant' in Latin, and the suffix *graphy*, meaning either 'the study of' (Latin), or 'drawing' (Greek). Through a series of thought experiments I came to its construction via Sir John Hershel's original name for photographs made using plant and flower matter called 'phytotypes' which has since fallen out of fashion in favour of the term 'anthotypes', mostly due to the more popular use of flower petals (the Latin for flower being 'antho') to create images.[24] Although this process was conceived independently, the term existed prior to this in relation to both literary and lens-based practices. Within filmmaking, the term is more closely associated with interdisciplinary artist and academic Karel Doing who coined the term 'phytography' as both a philosophical and practical method of engaging with plants through cinema as a means of co-creation between them, enabling the interaction between the phytochemical properties of plants and photochemical emulsion.[25] A separate, but just as interesting and relevant, usage of the term refers to a form of plant writing or what Patricia Vieira refers to as 'phytographia'; an encounter between the plants' inscription in the world and the traces of that imprint left in literary works.[26]

24 Y. Gapper, 'John Herschel's vegetable photographs c.1841–1843 and the environmental infrastructures of photography', (paper presented at The Materials of Photography Symposium, the Victoria and Albert Museum, London, 13 Sept. 2023).

25 K.S. Doing, 'Ambient Poetics and Critical Posthumanism in Expanded Cinema'. Ph.D. Thesis, University of the Arts London, 2017.

26 P. Vieria, 'Phytographia: Literature as plant writing', *Environmental Philosophy* **12** (2) (2015): 205–20.

Phytography, as I have engaged with and conceive of it, combines the act of making photographs, as well as its history, together with notions of vegetal thinking and study, resulting in photographic images that are made intentionally *with* the subject matter of their focus. Rather than concerns around plants and their relationships with human life being built around images as contextual relevance, phytographs imagine ways in which such concerns can become embedded within the images themselves, acting as material embodiments of the plant, its environment, and the ideas that formulate around them. In essence my use of the term phytography is a combination of the historical and contemporary vision of photographs that exist alongside the plants that inspire, inhabit and influence them, as well as referring to ways in which a more mechanically perceived form of creative practice can be thought of and utilised more ecologically.

Phase II: The print

After the roll of film has been filled and the negatives processed, the cyanotypes produced from them generate, when thinking phytographically, some interesting, metaphorical parallels. As a combination of my initial interactions with the tree (both in person and through the camera), the negative's rendering into a large-format digital acetate and its transformation into a cyanotype, the print, even at this early stage, is worked further into notions of material embodiment by its exposure to the sun. As cyanotypes are made and rely upon a high level of ultraviolet light to properly produce a print, *Arboreal Encounters* is seasonally restricted to the late-spring and summer months, coming into bloom much like the leaves and flowers more generally associated with the cyanotype process and aesthetic. Although UV lamps can be bought and used to compensate for the lack of ultraviolet light in winter and autumn, the size of my own prints makes it difficult in terms of both space and money for this to be viable. The result of this, however, is that the secondary aspect of *Arboreal Encounters*, the production of a cyanotype print, is once more rooted within a release of human control and adherence to climate and season, retaining the symbolic relationship between both plants and photographs co-reliance on sunlight.

My human reliance on the seasons and more specifically the sun's assistance as a tool for printmaking is conceived here as another mode of balance between aspects of the creative process that I cannot

FIGURE 3.
Big Belly Oak, Savernake Forest, Marlborough, Author, 2021. 21 x 29.7cm print on 29.7 x 42cm paper. Oak bark tannin-toned cyanotype on Langton watercolour paper.

control (e.g. plants, weather, seasonal change) together with those I can. Working under these conditions and exposing myself to the unpredictable aspects of the natural world, it is difficult not to describe or think about my working methods as a form of vegetal practice, even if they are primarily conducted under human conditions. To Gibson, this way of working functions as a kind of rewilding of the mind, releasing preconceived ideas of trees and land as property and instead conceiving them as living, breathing, co-habitant entities.[27] In addition to this, however, what emerges from this form of practice is a disruption of human-plant relations that focus on the effects of humanity upon the natural world,

27 Gibson, *The Plant Contract*, p. 56.

and instead a turn towards an understanding of how both species might inform and influence each other.[28]

To put this in terms of *Arboreal Encounters,* the prints can be thought of as a kind of membrane that absorbs both human and vegetal action together within one single entity, constructing it as a kind of plant-human hybrid.[29] By doing so, the tree's representation within the print no longer exists singularly as a result of human vision or just to impress and display an aspect of organic material extracted from the natural world. Instead, the images become a combination of both these qualities and in turn materialise such concepts of heritage trees as constructed by both the cultural and organic, in that their organic and cultural associations are fibrously interwoven through the material of the print. Photographically speaking, the tannin also creates visual associations to both Talbot's calotypes and the use of sepia, a tonal process used in historical processes and associated widely with antique photographs. While the inclusion of tannin was not an intentional method to cast sepia tones and artificially mimic historical photographs, the result nevertheless creates the effect of age upon the prints and therefore inadvertently impresses this concept upon the viewer. However, the visual effect and direct inclusion of tannin within the photographic process is not just a visual reference to Talbot's calotypes, the patent on which was granted in 1841, but also an organic one. To create the calotype process, Talbot used a solution containing silver nitrate and gallic acid harvested from the galls of oak trees to produce a technique that prepared photosensitive paper, but also the print's enhancement post-exposure, which would later become known as 'developing'.[30] As a result, the images, through this historical lens, visually reflect the historical context of the trees, their old age, but also the origins of photography. Considering that history and myth have also played a part within tree management and preservation practices to help identify and elevate each tree within my study to historical status, it could be said that the visual effects of the tannin, its visual reference and its application to the print, function to reproduce such ideas symbolically.[31]

28 Ibid.

29 Gibson, *The Plant Contract*, p. 58.

30 K. Doing, *Research*.

31 Forestry Commission England, *Operations Instruction No. 31.*

As the tannin affects the tone and therefore the visual structure of the print, it could also be said that one literally views and therefore perceives each tree through an aspect of the tree itself. The tannin, as a layer, acts as a translucent barrier between the human looking at the print and its human representation beneath its tonal impression, functioning like a lens between them. As the tannin was previously part of the bark of the oak, there is also a curious correlation between the print and the tree when thinking about notions of materiality and form. Tannin, when found within oak trees, functions primarily to protect them from predators or from fungal and bacterial infection. When oaks are pliant and young, the volume of tannic acid flowing through their frame can prevent excessive and potentially fatal grazing by filling their stems and leaves with a bitter aftertaste and making them unpalatable for munching insects and animals alike.[32] Although invisible to the human eye, as this process happens within the interior anatomy of the plant, the photographic process of *Arboreal Encounters* reveals and visually references a highly important aspect of the lifecycle of the tree that enables them to survive over centuries, much like the mythic, cultural stories that have protected them and prevented their felling. To take the example of Figure 4, depicting the Queen Elizabeth I Oak, the tree's royalist associations with the Tudor Queen are derived from a story of her allegedly shooting a deer from beneath its branches during a visit to the Cowdray Estate in 1593.[33] It is a rare example of trees that bear royal names due to the monarch's proximity to the area, in that there is evidence for her visitation within the estate archives that places her near the tree in place and time.[34] To name a tree from a monarch's visit is to embed their visitation within the land, to draw royalist connections between the crown and aristocratic families that are aligned politically, and to ascribe such associations visually. To fell the tree is to therefore cut the ties and visibly sever the family's sovereignty over the land. That the oak has survived 430 years after the event that elevated its value is a

32 D. Oakes, 'Oakes on Oaks: Introducing out 56(ish) trees', *Trees a Crowd* (2021): https://www.treesacrowd.fm/56Trees/ (accessed 4 Sept. 2023).

33 Miles, *The British Oak*.

34 M.C. Questier, *Catholicism and Community in Early Modern England: Politics, Aristocratic Patronage and Religion, C.1550–1640* (Cambridge: Cambridge University Press, 2006) pp. 170–74.

testament to the sociocultural power that can be held over specific trees and enable their survival.[35]

What occurs inside this combination of organic and cultural associations within the print is a series of interesting and complex overlaps that are worth briefly reviewing. Firstly, the tannin within the tree acts as a protective component against biological invasion, functioning more or less in the same way as the cultural associations that surround the heritage trees as they both intentionally prevent the tree from dying. Secondly, the tonal outcome of the print as a result of the tannin performs visual associations with antique or historical prints, therefore acting as referents to the age of the trees and to the myths that elevate them to heritage status. As these myths function, both historically and through contemporary tree management practices, to protect the trees from damage, it could be said here that the as the tannin moves from one material to the next, it transfers and visually transforms many of its protective functions from within the body of the tree into the body of the print.

THINKING PHYTOGRAPHICALLY: THEORY, PLANTS AND PHOTOGRAPHY

Referencing these organic processes that are significant to the trees and are symbolically replicable through photographic methods has become an important means to visually demonstrate how photographic prints can hybridise human-plant relations. Thinking through how photographic material can channel certain vegetal functions can extend the ways in which the end creative product can more materially embody its subject and in turn disrupt and challenge notions of vegetal objectification through the artistic process.[36] By removing certain levels of human control through art making, notions of vegetal agency naturally bubble to the surface, shifting attention away from the human and towards the plant.

Of course, the idea of making photographs without some level of human intervention comes with its own set of difficulties, but this is also not my intention. As I have said earlier, rather than beginning this

35 Jones and Cloke, *Tree Cultures*.

36 Gibson, *The Plant Contract*.

project with ideas of removing or excluding human action, the purpose of *Arboreal Encounters* and the project at large is instead about balance and inclusion. By introducing an element of an oak tree into the print that visually represents it, poetic and practical lines are not just worked through methodologically but also theoretically. To Martin Barnes, trees are intrinsically bound to the practice of photography due to their co-reliance on the 'transformative qualities of light'.[37] As both plants and photographs are light-dependent entities, these poetic and practical lines suggest an intriguing potential into the ways in which plants and photographs might come to interact beyond simple representation. Such comparisons between plants, photographs and light are also highlighted by the theorist and critic Eduardo Cadava, who argues that there is a particular rapport between philosophy, photography and plants, derived from their shared heliotropism (the movement of an animal or plant towards a source of light), both taking 'their life from light'.[38] This shift in perspective away from the camera or the light-sensitive subject as a passive object provokes questions around the actions of photography as being not 'just receptive or open to light but actively mov[ing] towards it; it does not simply receive an imprint from the light, but seeks it out'.[39]

These ideas of photographic action mimicking the actions of heliotropic plants curiously implies a kind of agency in photographic methods, or at the very least a resistance to the camera as a passive entity. Whether chemically through light sensitive solutions, or physically through the reflection of light through the lens, both suggest the intended photographic action of being drawn to (or turning towards) and therefore recording light onto the intended surface or object. Although this is not to suggest that the camera is a sentient being, framing the camera with this kind of theoretical agency allows an interpretation of its functions, such as the forming of light into an image, as mimicking and making visible the organic function and process of photosynthesis, the formulation of light to food.

Light in this sense is being used two-fold: as a metaphor to describe 'the light of reason', and therefore of philosophical thought, and

37 Barnes. *Into The Woods*, p. 3.

38 E. Cadava, *Words of Light: Theses on the Photography of History* (Princeton: Princeton University Press, 1997).

39 M. Henning and J.T. Mikuriya, 'Light sensitive material: An introduction', *photographies* **14** (3) (2021): 382–83. https://doi.org/10.1080/17540763.2021.1962230.

light as a tool to make photographs.[40] As Barnes notes in *Trees and Photography*, light gives life to plants via chlorophyll, therefore interconnecting photography and plants through their shared mechanical and organic dependence on light as a life-giver.[41] If we are to think of this in relation to methods of photography and of the cyanotype process, which is reliant in some form on the presence and power of the sun, both photographic and photosynthetic processes signify and illuminate the transformation of light from one form to another. This is, in some sense, a generative process for both the plant and the photographic print because of their continual 'turning' towards the sun, resulting in prints that sit at the intersection of human-plant relations (or as plant-human hybrids); images made from, within and to some extent by the environment itself. As all my printmaking for *Arboreal Encounters* was produced within my parents' garden, I was also able to use collected rainwater from a series of water-butts positioned around their bungalow to wash and fix the prints post-exposure, as well as during the bleaching and tonal process. This additional aspect of utilising a component of the natural world, a by-product of weather conditions, within the processing of photographic prints, rather than the more easily accessible mains water supply, is yet another example of how photographic prints can become literally saturated with meaning and by the environment within which they are made.

Thinking of the combination of this photographic process together with the theoretical discussion above, some interesting observations emerge. Firstly, photographs made in this way directly engage with the landscape from which they are created and therefore generate a material connection between object (the photographic print) and subject (the plant). As I am unable to use the physical trees within the production of prints due to their age and protected status, the tannin extract could be thought of as a substitute in lieu of physical plants to maintain this material connection between subject and object. Furthermore, these photographic prints engage in an interesting conversation around the difference between an objective, distanced interpretation of a subject, and the subject's direct interactions with the surface (and fibres) of the print. It could be said, therefore, that using physical parts of the

40 Ibid.

41 Barnes, *Into The Woods*, p. 3.

FIGURE 4.
Queen Elizabeth I Oak, Cowdray Park, Midhurst, Author, 2021. 21 x 29.7cm print on 29.7 x 42cm paper. Oak bark tannin-toned cyanotype on Langton watercolour paper.

tree within the process of artmaking provides the plant with a sense of agency that informs the resulting print, and by extension how the viewer meets and interprets the image.

Returning to theory, this practice could be thought of as an intentional disruption of what the American botanists James H. Wandersee and Elizabeth E. Schussler call 'plant blindness', or the 'inability to see or notice plants in one's environment'.[42] This form of cultural clouding towards aspects of the natural world that are not of immediate relevance to an individual (such as a fallen tree blocking a pathway or a road), is not just the result of modern-day living but also, they argue, the condition of a longstanding and misguided 'anthropocentric ranking of plants

42 J.H. Wandersee and E.E. Schussler, 'Preventing plant blindness', *The American Biology Teacher* **6** (2) (1999): 82–86. https://doi.org/10.2307/4450624.

as inferior to animals and thus, as unworthy of consideration'.[43] In short, the prints don't just feature and centre the trees and their human relations, but also the ways in which the trees function, live and survive. By choosing photographic methods that also perform in similar ways to plants (or symbolically so), consistent references are drawn to the ways in which culture and nature interact with and influence each other.[44] In 2021, aspects of plant blindness were drawn more specifically in relation to photographic processes by professor of art history, Elizabeth Howie, through her analysis of Michael 'Nick' Nichols' photograph of the President, a 3,200-year old giant sequoia, the second largest tree known in the world, for *National Geographic*. As Nichols had to overcome many obstacles and preconceptions around how to photograph a 247-foot tall tree – the main issue being that, as it lives within a forest and is therefore surrounded by a multitude of flora that make up its biocommunity, it therefore cannot be visually isolated through traditional photographic methods – the processes that were developed as a direct result of working with the tree as an individual challenged Nichols own plant blindness and in turn created a photograph that endures as a resistance to it through its reproduction.

Concepts of reproduction are not just considered digitally, however, but also through the printed image and more specifically using plant-based paper and its material linkages to trees. To Howie, not only the making of the image 'but also its printing and distribution challenge plant blindness', continuing that 'the printed photograph asks the viewer to interact with it in specific ways that may cause us to consider plants as beings rather than things'.[45] Although it may be unpleasant or morbid to think of pictures of trees being reproduced and represented through the processing of dead ones, a counterargument could suggest how such a method reinforces and rematerialises notions of regeneration – a subject generally associated with the natural world.[46]

In this sense, my own portraits of trees challenge plant blindness in almost every aspect of their production. In the case of cyanotypes, the

43 Ibid.; Mancuso, *The Nation of Plants*.

44 Gibson, *The Plant Contract*, p. 56.

45 E. Howie, 'Contesting plant-blindness with photography: Michael Nichols's portrait of a giant sequoia,' *Photographies* **14** (3) (2021): 529. https://doi.org/10.1080/17540763.2021.1960411.

46 Ibid.

printed image combines such concepts of prints and their material origin as the direct product of pulped trees together with other, symbolic, aspects of print-making that refer to certain plant-based functionalities, such as the act of photosynthesis. This is further deepened through the introduction of tannin that not only acts as an aesthetic property and historical reference but also as a lens through which the image is perceived and interpreted. As the tannin was extracted from bark, the paper made from trees, the cyanotype process simulates aspects of leafy photosynthesis, the prints could be thought of almost as a material and photographic reconstruction of the oak tree itself. In essence, the oak as photograph.

CONCLUSIONS: TOWARDS A METHOD OF PHYTOGRAPHY

As the images in *Arboreal Encounters* are a result of experimentations, human control has often been given up consciously in favour of being led by the plant and the way in which it interacts with different substances, materials and objects. My decision to research certain aspects of the oak tree and how certain substances and parts of its anatomy might be utilised or interacted with to make photographs is an intentional part of my methodology and another means through which I have placed myself to the side, rather than at the centre, of artmaking. In this way I am both led by the plant through experiments in which substances like tannin might interact with certain materials, but also thinking vegetally around how photography might provide a porous boundary in which parts of the oak might both materially and aesthetically exist in ways that are not extractive or exploitative of its identity or of the natural world at large. Human action is of course not absent from this process and my own decisions to follow certain routes and to close others off are informed by both aesthetics and theory. Although this is the case, there is a certain level of allowance given to the plant and its interactions with the materiality of photography that inform those decisions.

To place the production of plant-art within contemporary life, whether approached as the plant as subject, the plant as material, or

both, is also to consider its possibility as a direct emergence of abject human failure.[47] As Gibson notes,

> We have failed. We, the humans, have not been cautious enough — we have not taken care. Our failure is moral. Our failure is critical. But this is not the time for doom and gloom.[48]

However, although such ideas may be deeply rooted in notions of failure, this is not, as Gibson says above, the time for doom and gloom. To once more take the plant as the point of departure, art can play a distinct role in regenerative modes of thinking, feeling and engaging with plants and the wider vegetal world. As art begins to explore and incorporate more plant-based modes of making, concepts regarding plant intelligence and plants as separate, independent beings that deserve respectful approaches to working with them will more naturally become as consumable as the artwork itself. To return briefly to the beginning of this paper, there are indeed inherent risks with making images with plants that do not simply repurpose or reimagine extractive or parasitic methods that centre the human, as well as capitalist notions of over-consumption.[49] In this sense, when accumulating plant material for the production of photographs and the resulting prints, I view my own gathering as similar in method to how foragers engage with the landscape in ways that dually nourish the human and the plant. To Robin Wall Kimmerer, such sustainable practices can have useful properties for the foraged plant by de-crowding dense areas of growth that end up regenerating it, therefore providing a mutually beneficial environment.[50] If one is, therefore, to truly engage with concepts of plant intelligence and its incorporation into creative methods, one must also confront the complexities of relations between plants and humans. By choosing to explore such concepts through photographic practice, which carries with it several symbolic and practical functions reminiscent of the plants it represents, visibility is given to both ideas and actions that operate within the vegetal world that may well have been invisible for many beforehand.

47 Gibson, *The Plant Contract*, p. 113.
48 Ibid.
49 Kimmerer, *The Democracy of Species*, pp. 31–33.
50 Ibid.

This over-arching emphasis on both the concept of the oak tree as photograph and, by extension, the phytograph as a resistance to concepts of plant blindness demonstrates two things: a) how creative practice can function as the conduit through which plants can communicate their functions and therefore their independence from human life and culture; and b) how thinking vegetally around methods of art-making can produce or, at the very least refer, to acts of plant-human hybridisation that both highlight and support the balance of human-nature relations.

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A Journey through Soviet and post-Soviet Plant Entanglements

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ABSTRACT

This essay aims at unravelling Soviet and post-Soviet livelihoods and landscapes by looking at plant entanglements. It is about my own journey as an anthropologist and about leitmotifs I encountered across the post-Soviet space in almost two decades of fieldwork in Russia, Ukraine, Central Asia, and the Caucasus.

KEYWORDS

Caucasus, Central Asia, post-Soviet, fruit crops, food

This essay aims at unravelling Soviet and post-Soviet livelihoods and landscapes by looking at plant entanglements. It is about my own journey as an anthropologist and about *leitmotifs* I encountered across the post-Soviet space in almost two decades of fieldwork in Russia, Ukraine, Central Asia and the Caucasus. It thus talks about hunger, abundance, ruins, imagined paradises, seduction and temperance; about beauty, survival, mobility, migration, conquest and destruction; and about plants in general and fruit crops in particular.

HUNGER AND ABUNDANCE

Two years ago, I participated in a meeting of anthropologists in Bolzano, Italy. The place was well chosen, as Bolzano was home to one of the founding fathers of modern anthropology, Bronislaw Malinowski, author of *The Argonauts of the Western Pacific* (1922). At this meeting, I had a table conversation with a colleague who had conducted fieldwork in Nigeria. He was very emotional about his experiences and told me how seeing starving children had changed his attitude toward food. He declared that he was disgusted by the fuss made about sophisticated cuisine, and he maintained the opinion that food was for nourishment – and that any other approach to nutrition was ridiculous and an immoral luxury. I was very much impressed by his words and afraid to order a dessert. His account made me ponder, and I started to compare my own completely different fieldwork experience with what he had said.

FIGURE 1.
Fruit assortment. All photos by the author.

In my research area, the most terrible famines of recent history happened in early Soviet times. Between 1930 and 1933/34 an estimated 3.5 million people starved to death in Ukraine, more than 3 million in Russia, and more than 1.2 million in Kazakhstan. While historians do not fully agree on whether these famines were intentionally used by authorities to exercise power, the collectivisation of agriculture as part of Soviet policies clearly played a significant role in these disasters (Cameron 2018; Davies and Wheatcroft 2004; Graziosi 2015; Kuromiya 2008; Pianciola 2004; Rudnytskyi et al. 2020).

But although these famines, which were preceded and followed by other times of scarcity, have left traces in the collective memory of Soviet, post-Soviet, and post-post-Soviet people, I never felt that abundance, luxury or feasting of any kind was reprehensible in Russia, Ukraine, Central Asia, or the Caucasus. To the contrary, across post-Soviet Eurasia I observed the same 'cult': the veneration of good food – and of fruits, herbs, and vegetables in particular. These were always described to me as the most aromatic, the healthiest, and the most beautiful – if not on earth, then in the area – and I was urged to taste all of them . . . which I did shamelessly.

A few weeks after my conversation in Bolzano I visited my colleague Togzhan in Merki. Merki is a very small Kazakh town at the foot of the Tian Shan Mountains, a five- to seven-hour ride from Almaty. It is very far away and different from Bolzano. But there are – nevertheless – some commonalities: complicated access routes, breathtaking landscapes and good conditions for growing apples. In fact, Kazakhstan is recognised as the cradle of apples, which had to travel a long way and undergo many adaptations before getting as far as South Tyrol and into strudel.

When I arrived in Merki, it was the last day of the spring festival Novruz and the beginning of Ramadan. I was immediately urged to participate in a banquet, and I felt I was back in the field: back to a familiar assortment of food that evokes so many associations; back to large bowls of fatty meat, potatoes, soup, *plov*, salads, herbs, bread, pastry, sweets and fruit; and back to all the stories that come with them.

RUINS AND STRAWBERRIES

The next day, Togzhan and I decided to visit the former local fruit-crop *sovkhoz*. Like the *kolhoz*, the collective farm, the *sovkhoz*, which was state owned, was a component of socialist agriculture and had to be re-organised – privatised or turned into a joint-stock arrangement – after the Soviet collapse. The *sovkhoz* of Merki was succeeded by an organisation called TOO Opythnoje Khosjastvo Merkenskii, which on that day was closed because of the holiday.

As in many other places in Central Asia and the Caucasus, the remnants of Soviet infrastructure in Merki present a sad picture. Buildings fell into ruins, the irrigation system crumbled, and former agricultural fields were transformed into barren lands. Looking at these relics makes me feel melancholy. They remind me of post-apocalyptic science fiction scenarios, where a few survivors try to extract resources from what was left behind by a past civilisation. I have seen many such places: public buildings, transportation facilities and industrial plants, reminders of a huge, enthusiastic, but failed attempt to implement a modernisation project that in Soviet times was imagined as heaven on earth.

When Togzhan and I were strolling around on the former *sovkhoz* territory, we saw two people planting apple trees on a plot. The plot was surrounded by an ugly concrete wall and included the skeleton of an old greenhouse. Was this a survival of Soviet Eden, of paradise, of the socialist version of the biblical 'enclosed garden'? We tried to get the attention of the planters, who finally invited us, the ridiculously hand-waving anthropologists, to enter through a squeaky metal gate.

Inside, the couple looked at us with curiosity and then showed us the apple trees and the work they did breeding and planting them. It turned out that this former *sovkhoz* territory was now their private plot, which they used for their own produce. Occasionally, they sold some of the young trees and surplus apples, but this was not enough to make a living yet. Most of the time the couple relied on the man's modest income as a teacher and the woman's job at the former *sovkhoz*. They now live in a former *sovkhoz* building, and although it was Ramadan, they invited us for lunch and covered the table with fruits and jams. They were especially proud of their homemade strawberry *varenje*, a juicy syrup-strawberry compound. As we were appropriately thrilled,

FIGURE 2.
Soviet Eden at the foot of the Tian Shan Mountain.

the host told us a story of a Kazakh emigrant who had come back from America – very understandably so – just to eat these strawberries.

SEDUCTION AND APRICOTS

Such strawberry stories are very common in the post-Soviet space. Not all of them are about strawberries, of course. There is a Russian saying that more or less translates as 'any place is better than the place where we live' (*vesgdje lutshe gdje nas njet*). It expresses a general dissatisfaction of post-Soviet people with their living conditions, which never meet expectations, no matter where one ends up. Usually, this is about politics and society – at home or abroad. However, in contrast, wherever you go in post-Soviet Eurasia, there is apparently no better place to be

for trying an edible species. As I witnessed many times, people become poets when describing the colours, textures, flavours and tastes of their harvest, and they have compassion for those poor people in the West, the poor Americans and Europeans, who will never see, feel, smell or try these culinary sensations.

The Armenian jazz musician Gary Kesayan, whom I got to know during my first fieldwork in Armenia in 2010, is such a fruit-and-vegetable poet and a gifted storyteller. He told me how, after the dissolution of the Soviet Union, he tried to make a career in the United States. Although he was successful at doing so, he missed his homeland – especially its tastes and flavours. When he returned to California after a holiday, he usually filled his suitcase with apricots. One day, the American airport customs dogs sniffed them out. The customs officer was all alert: he thought, as Gary reported with satisfaction, that the dogs had found drugs. Gary had to unpack his suitcase. He held the apricots under the officer's nose, and the man was so enchanted and seduced that he wanted to taste them and let Gary pass.

The American customs officer is in good company. Throughout history, even gods and goddesses have been tempted by a variety of fruits. The pomegranate, for example, seduced Eve, whose apple was likely a pomegranate, Persephone, and – in a less mythical way – Gregory Levin. While Eve was chased from the Garden of Eden for trying the forbidden fruit, Persephone was tied up in Hades for six months each year because she ate six pomegranate seeds in the underworld (Frazer 1906–1915). Levin's life was equally complicated – and a very Soviet one. Born in 1933, he survived the famine in besieged Leningrad, weathered the turbulence in Stalin-era academia, and finally, in the 1960s, became chairman of the laboratory of subtropical fruit cultures at the VIR Turkmen Agricultural Station in Carrigalla, Turkmenistan. Until the 1990s, he dedicated his life to pomegranates and created the largest pomegranate collection in the Soviet Union and worldwide. After the Soviet collapse, Levin shared the fate of many Soviet intellectuals: he became an emigrant and – as he had a Jewish background – moved to Israel, the holy land, which for him became a 'botanist's exile from Eden' (Levin 2006).

Most Western European and American readers will hardly understand the kind of obsession and relationship with a fruit crop that drove Levin and that drives many people in Eurasia. Some Europeans were

once obsessed with spices or stimulants like coffee, tea and tobacco (Dalby 2002; Schivelbusch 1990), but the relationship of Americans with the apple, for example, is a rather sober one. There is no exaltation of smells and tastes, no lavishness and Bacchanalia. If we believe Pollan (2001), what the American Protestant pioneers of the Western frontier liked about the apple was that the available varieties (unlike those in Bolzano and modern Kazakhstan) were unenjoyably sour. Drinking apple cider was no threat to pious modesty and simplicity. The pomegranate, by contrast, is the ultimate symbol of excessive luxury, cherished in local visual arts and handicrafts and sung about in traditional and contemporary fairy tales, poetry, and music.

SURVIVAL AND POMEGRANATES

In Armenia the pomegranate, along with the apricot, is (as in some parts of the Middle East and Asia) considered a national symbol. It grows in the wild and is cultivated in private gardens and on farms. It represents fertility, prosperity, abundance, life, and happiness, but also blood and death. It is associated with the Armenian Apostolic Church, whose numerous and diverse members are compared to pomegranate seeds, united under one rind, and the fruits are blessed in the New Year's ritual and smashed at weddings, as the bursting seeds promise a wealth of children, husbandry and community (Stepanyan 2014). The pomegranate is thus associated with individual and collective survival, as is also reflected in stories about survivors of the Armenian Genocide who endured death marches to Syria by appeasing hunger[1] with one pomegranate seed per day.

Such accounts can be interpreted as parts of a powerful 'mythico-history' (Malkki 1995) that links modern Armenians to stories from the past, local customs and values, and agricultural and vegetal environments. Comparable roles are played by the apple in Kazakhstan, the walnut in Kyrgyzstan (Schmidt and Dörre 2011), and grapes in Georgia and Moldova (Regniez 2016). These crops are locally and translocally used as national, ethnic, and religious symbols, as objects of ritual practice and economic exchange, and as items of everyday consumption,

1 For the role of starvation during the Armenian Genocide see Shirinian (2017).

FIGURE 3.
Pomegranate wish tree in Tbilisi, Georgia.

extending beyond the boundaries of pre-Soviet, Soviet, and post-Soviet experiences and relationships.

In William Saroyan's short story 'The Pomegranate Trees' (1940) the pomegranate is linked to Armenian diasporic identity. Saroyan, an Armenian American descendant of genocide survivors, tells the story of his uncle Melik, who bought a plot of land in the desert of the Sierra Nevada to grow pomegranates. After some struggles, lack of profit forces Melik to give up the orchard, and the trees tragically die. According to Stone (2017), the trees thus become a symbol of the 'unattainable and unrealistic dream that will ultimately fail' and an 'image of beauty, but not productivity'.

From a rational point of view, indeed, the pomegranate is not the best choice to make a profit and secure one's survival. Although the pomegranate has occasionally been labelled a 'super food' because of its

anticarcinogenic urolithin content, its nutritional importance is rather small. Noah, the first farmer working the fertile post-Flood Ararat plain, was wise enough to cultivate vineyards instead. But Saroyan's story – in my opinion – is not about economic gain. It is about beauty and a diasporic longing for the things left behind: customs, values, agricultural practices, and vegetal environments; it is about a feeling that is shared by many people in Eurasia who have lost their homes due to persecution, civil wars, deportation, systemic collapse, and economic reasons. Melik plants the orchard to establish a perfect environment and an alternative home, but because of the Californian cacti and desert plants, because of external forces in an alien environment, this desire cannot be satisfied. Home remains a paradise lost, migration an exile from Eden.

Still, fruit, be it pomegranates, grapes, or apricots, can bridge temporal and geographical distances, unite dispersed peoples and relate fragmented histories. Human-plant relationships tell us something about – sometimes hidden – global connections: about the bond between the homeland and diaspora and migrant communities and about the links between the past, present, and future.

CONQUEST AND GRAPES

In all eras, planting trees has always been a way to make a claim on land. Pioneers on the American frontier validated their claims by planting apple trees (Pollan 2001), and around 300 years earlier Hernán Cortés did something similar in Mexico using pomegranate trees (Stone 2017). From Mexico, eighteenth-century Spanish settlers brought the conquistadores' pomegranates farther north to Texas, Arizona, and finally California, where in the twentieth century – just a funny coincidence – they were joined by Soviet cultivars from Turkmenistan. Seeing his lifetime achievements going to seed, Levin, the Soviet botanist, sent the varieties he had bred to the USDA National Clonal Germplasm Repository at the University of California, Davis (Levin 2006), from where they were distributed to American farmers – in a region that is home to the largest Armenian diaspora community in the United States, the place where Saroyan wrote his story about Melik.

Usually, however, plant entanglements have a less peaceful story to tell. Conquest and gardening are an ancient couple. Both result in the

intentional and unintentional diffusion of plants by mobile people and individuals – conquerors, migrants, traders, and travellers. In the sixteenth and seventeenth centuries, Western colonisers, who perceived the local ecologies of their overseas colonies as a threat, started to transform 'wilderness' into European landscapes (as we can see in North America) (Gosh 2023) and, like the Assyrian emperors, thereby displayed their power and creative potency (Dalley 1999, 2013; Grayson 1996). In the ancient past until the Middle Ages, planting was considered a cosmic act of creation, and to this day, well-tended gardens and landscapes represent harmony, social order, and the victory of civilisation.

Starting in the 1920s, the Soviets planted representative parks, gardens and avenues of trees, which became part of urbanisation and modernisation projects. The Soviet approach was driven by Marxism, historical materialism, and a strong aspiration for modernisation, reflected in urbanisation projects: Bishkek in Kyrgyzstan, Almaty in Kazakhstan, Moscow in Russia, and many other cities in the Soviet republics received a new layout including a lot of civilised green space. In this spirit, chief architect and city planner Alexander Tamanyan implemented a master plan for Yerevan that transformed the former city of gardens into a model-like Garden City as proposed by Ebenezer Howard. The garden city provided good living conditions for the Soviet working class and embodied enthusiasm for societal change and progress (Ter Minassian 2007).

Alas, conquest and transformation have a dark side, too, and go along with destruction and cutting down trees. Since antiquity, cutting down olive trees has been an established method to destroy the enemy's subsistence, and during the recent Karabakh War, Armenians who had to leave their homes cut down fruit trees on their properties before leaving them to their enemies.

The reasons for destroying plants can be manifold – sometimes seemingly absurd. Between 1985 and 1987, the Soviets eradicated hundreds of thousands of hectares of vineyards, just because wine made from grapes tastes better than frontier cider – with the consequence that the average Soviet male citizen of the 1980s lived twelve years fewer than his (Protestant or non-Protestant) American equivalent. Alcoholism was widespread and said to cause a loss of one third of Soviet agricultural production. Gorbachev's radical anti-alcoholism campaign, which was successful but is remembered as a catastrophe by wine makers and

FIGURE 4.
My colleague's vineyard in Kakheti.

consumers, attacked the roots of the problem: the vineyards in the Soviet republics of Moldova, Ukraine, and Georgia (Bhattacharya et al. 2013).

One collateral victim of the campaign was Pavel Golodryga, another scientist like Levin, who had dedicated his life to the development of forty new grape varieties at the Maragach Scientific Research Institute of Viticulture and Winemaking in Yalta, Crimea. Golodryga, who earlier in his life was awarded the Order of the Red Banner of Labour, committed suicide.

Another desperate felling took place in the 1990s for a completely different reason. In these years, Soviet parks – including Yerevan's greenbelts – fell prey to the need for firewood. This destruction of the 'black years' was interpreted as an ultimate symbol and climax of societal collapse. Ironically, the felling continued after the economic transition because of a new construction boom, which was a consequence of the

neoliberal privatisation and commercialisation of public space. New elites and oligarchs across post-Soviet Eurasia started to invest in elite housing and got into fights over trees with environmentalists, protesters and residents (Gurchiani 2022).

Much of what happened in post-Soviet Eurasia can be expressed by talking about plants. In Tashkent the new elites planted conifers, which did not survive the Uzbek climate, and instead of replacing them, the dead trees were sprayed green to look attractive (Olma 2020). In Georgia, the oligarch Bdzina Ivanishvili had many old and impressive trees dug up to replant them in his semiprivate garden. In Armenia, the massive felling of trees in the city centre was countered by the Armenian Tree Project, a diaspora-sponsored NGO.

PASTS AND FUTURES

Both the Soviet legacy and the Soviet collapse cast long shadows. More than twenty years after the dissolution of the Soviet Union, my colleague Louise observed the mass extinction of apple trees in the Kyrgyz countryside. These trees had been gifted to farmers by the Soviet government and now, after some decades, had reached the end of their lifespan, their death being a symbol of the redemption of Soviet rule.

Eurasian viticulture, on the other hand, has come back to its ancient glory, at least in Georgia, where the production and the ritual (and profane) consumption of wine are seen as part of the national identity. A few months before my journey to Bolzano and then to Kazakhstan I travelled to Georgia for a short fieldwork trip. Much had changed since my previous stay. People now talked about the war in Ukraine, Georgia's position with regard to Russia, and the influx of Slavic newcomers. My friends and colleagues expressed anxiety, dissatisfaction with their own government, and anger that Georgia had not been granted European Union candidacy status.

The purpose of my visit was to find out how the Covid-19 pandemic had impacted local shuttle and bazaar trade – but, somehow, I ended up harvesting grapes in my colleague's vineyard in Kakheti. There, I worked side by side with his huge family and the young women who usually work in his sister-in-law's beauty salon. The women, including myself, cut the grapes, while the men loaded the harvest on a trailer. There was

FIGURE 5.
Quevri.

FIGURED 6.
Before nightfall.

a lot of teasing, chatting, and flirting, and by 10 a.m. everyone was exhausted. Under the beating sun and by the sweat of our brow we had picked 2.5 tons of grapes.

A small part of the harvest was crushed in a wooden trough and poured into a traditional *qvevri*, a huge clay amphora almost completely buried in the ground, which had been excavated under a house from the 1970s and had thus proven to be earthquake resistant. Accompanied by singing and music, my colleague's daughter, the youngest participant, was allowed to start stomping and was then joined by other women. The first juice, according to protocol, was served to the grandmother, the oldest participant, thus continuing local traditions that might originate in the pre-Soviet past. She praised ex-president Saakashvili and made some toasts wishing that unmarried people present would get married and that the current government would be hung on the nearest tree. Then, modern technology – an automatic baler – took over, while people prepared for a lavish traditional Georgian *supra*, a banquet and feasting ritual.

After a short ride, we gathered at tables scattered along a brook in a small forest at the edge of a monastery. We had *shashlik*, fruit, a lot of wine, toasts, dancing, and singing. We celebrated the unchanging rhythms of life. At nightfall, the dogs, who had been strolling around all day, gathered into a pack and attacked. They jumped on the table and stole the food. Although nobody was hurt, there was panic, and while the dogs were distracted, the human party flew to their cars and hit the road back home.

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A Birch Memory Web

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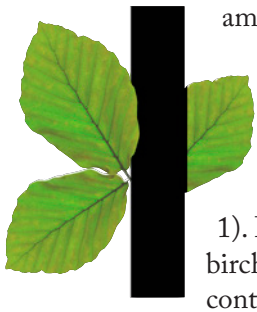
ABSTRACT

This narrative non-fiction essay explores the profound and intricate connections between personal memories and birch trees throughout the author's life. Set against the backdrop of various significant locations, from the Soviet Union and Ukraine to Finnish Lapland, the narrative intertwines the author's childhood experiences, family history and adult reflections. Birch trees serve as poignant symbols of continuity and resilience amidst the backdrop of political and personal upheavals. The essay delves into how these trees evoke strong emotions and memories, highlighting their unique role as carriers of individual and collective histories. By examining the interplay between nature and memory, the author offers a deeply personal perspective on the importance of preserving natural environments not just for their ecological value but also for their capacity to hold and evoke human experiences.

KEYWORDS

trees, emotional connection, personal history, biodiversity



I am a 44-year-old scientist. I have never been so far north, but today I find myself in a small village, Äkäslompolo, located in Finnish Lapland. Unlike other places, where islands of nature are found among the flows of people and infrastructure, here, a human still feels like a guest among endless forests and swamps (Figure 1). I am sitting on the floor of a wooden house, holding a birch leaf in my hand. I just selected it from an envelope containing many similar leaves, as instructed by the leader of retreat workshop on writing about trees and memory. While the other participants were doing the same, my mind quickly identified the species as *Betula pendula*. Perhaps this is my professional inclination as a botanist with over twenty years of experience, where I automatically try to identify the species of plants before appreciating their beauty, smell or other qualities.

Next, our facilitator asks us to consider our leaves attentively, to touch and twist them. I do not see anything special in my green leaf, though it is larger compared to the others I saw in the envelope. Its sides are not equal; the right side is clearly bigger than the left. Additionally, the second-order veins of my leaf are not symmetrical, although in almost any botanical book, these veins always appear to start from the same place

FIGURE 1.
Finnish Lapland near Äkäslompolo village (8 June 2024). Photo by author.

on the central vein. This is absolutely surprising to me because I have never paid attention to this detail in nature: I mean the correspondence of book illustrations with the real fact, in terms of where the veins of the leaf begin and how they are arranged. We then exchange our leaves and do the same, examining each new leaf in our hands. In these new leaves, the situation with the veins is similar to what I had observed in my own leaf.

The next group of questions from our facilitator concerns our views on the possibility that trees preserve our memories. With my practical mind, I do not dwell on the philosophical aspects of this task. Instead, I seek answers grounded in my understanding of the world's structure. For me, there is no doubt that trees indeed are keepers of memories. This memory is stored in their tree rings, showing us, for example, which winters were especially cold and when they were very

warm. Additionally, trees have individual memories in the form of injuries from blows or frost damage. Also, by analysing their DNA, we can find out what evolutionary path they followed or how they have migrated around the planet as a result of climate change. To me, this is all irrefutable.

We continue observing our birch leaves, and many of us record our impressions in our notebooks and mobile phones. Some are trying to draw their leaves, while others are simply tracing their contours. When we finish, I decide to place my leaf in my notebook, preserving it as part of my herbarium. However, I can already hear new questions from the workshop leader, and they are personal in nature. We are asked to remember when we first saw a birch tree in our lives, what we especially remember about it, and similar things. Honestly, I can barely hear the facilitator's voice now, as I have plunged deeply into a web of memories. This brings up a sudden wave of my psychological trauma. My vision is blurring and losing focus. It seems that I have lost control over my body. At the very least, I no longer care what happens to it. But I feel that I am on the verge of tears...

My memories take me back to a time when I was very young, perhaps four or five years old. I stand on the sofa, gripping its back, peering through the veranda window at two green birch trees that line the street in front of my grandparents' house. It's the Soviet Union, in a small mining village near the Zapadnaya mine in Donetsk, Rostov region, Russian Soviet Federative Socialist Republic. This house and its garden were my entire world back then. I was not aware of the realities of the totalitarian state. They said on TV and radio that everything was fine, and Soviet athletes delighted in their victories and records. There were also quite a few songs. Most of them were loud, cheerful, energetic, life-affirming, only occasionally with a drop of sadness or romanticism. Of course, a significant part of them were about communists or Komsomol members building a better world by sacrificing themselves.

Though I missed my parents, who came to us from Voroshilovgrad only on weekends, my grandmother cared for me devotedly and fed me delicious meals. My favourite dish was her boiled rice with pork and onion gravy. It was a relatively simple dish that I tasted many times later in canteens or when visiting friends or relatives, but no one could cook it as deliciously as my grandmother. She also often baked crumpets, which I enjoyed eating with a variety of homemade jams made from

raspberries, strawberries, apples, pears, currants and cherries, washing them down with compote made from fresh fruits that were available in our yard, as well as a sprig of mint. I do not know why, but when grandma cooked, she often grumbled, especially at grandpa. So cooking time was not the best for communicating with her.

The aforementioned birch trees were our pride. My grandfather had acquired them long ago, making our yard distinctive (Figure 2). In the steppe where Donetsk is located, birch trees are uncommon, but they thrived near our home. Their white bark distinguished them from the other ornamental and fruit trees in the area. In the summer, their long drooping branches swayed in the wind and, in the fall, the leaves turned bright yellow. I especially liked when they formed catkins, which in my native language are called 'earrings', because of the similarity of their forms to chain earrings. This was so unusual compared to other trees. Birch catkins appeared in the summer, overwintered until spring, and then, with the onset of warm weather, opened up to reveal yellow anthers.

FIGURE 2.

Author's grandfather near his house in Donetsk (1960's). Though already planted, the birch trees are not visible here, they grow in front of the house, to the right of grandfather. (Author's collection).

I recall one early spring when a truck from the mine brought us several tons of coal to heat the stove in the house. As it was being unloaded, the truck caught several branches of one birch tree, severely damaging the bark. A few days later, as soon as it got warmer, sap began to issue from these wounds. Its flow was so strong that a small puddle formed on the asphalt where it dripped. I was very concerned, perceiving it as if the tree were losing blood. Even though the tree could have dried out because of this, everything worked out. The birch continued to grow, making us as happy as before.

I do not know why my grandfather chose birch trees to plant near our house. Perhaps they reminded him of his homeland, the village of Malygino in the Pskov region, where these trees were common. When he died, I was 22 years old and had just moved to Kyiv. Gradually, our birch trees began to dry out. I do not remember the exact chronology, but about ten years later, when my childhood home was sold and my grandmother moved to live with my parents in Luhansk, the new owners cut down the almost withered trees.[1] This fact was not only terrible for me, but also quite symbolic. It was like the final point in the story of my beautiful childhood. Yet, in my memory, they continue to live, their branches still swaying in the wind, and I visit my lovely grandparents in the house of my childhood over and over.

For a moment, I am taken back from my childhood memories to our retreat, where something is happening, but the energy of my memories is so strong that I am unable to focus. My consciousness is again carried away from Finnish Lapland, thousands of kilometres to distant and familiar lands. Now I am in the village of Verkhnya Orikhivka, or Dobryanka, as the locals call it. I am 12 or 13 years old. The Soviet Union no longer exists; we live in a newly independent Ukraine. My grandparents, whom I mentioned earlier, are only sixty kilometres away, but now they are in Russia. My hometown, Voroshilovgrad, has recently been renamed Luhansk.

1 A picture from Google Earth where even the stumps from our birches are no longer visible (August 2019): https://earth.app.goo.gl/?apn=com.google.earth&isi=293622097&ius=googleearth&link=https%3a%2f%2fearth.google.com%2fweb%2f%4048.32124571,39.88002859,174.07138062a,0d,81.82841692y,86.84676377h,77.00298792t,0r%2fdata%3dIhoKFnJVVjJBLWlySzQyaUY4LUZ2N19xd3cQAjoDCgEw

My grandmother, my father's mother, lives in Dobryanka. My grandfather, my father's father, recently died in a motorcycle accident and was buried. Paradoxically, there are also two birch trees near my grandmother's house. I do not know where they came from, but whenever we drive from the city to the village by car and I notice these two birch trees, I know for sure that we are where we are expected and always welcome.

You must understand that there are no birch trees in the natural environment here either. This territory is a kingdom of agricultural lands, steppes and gorge forests with a completely different set of trees and shrubs. Therefore, the birch trees here are just as special, their branches swaying gracefully in the wind too. However, we rarely admire these trees from the window, as they grow next to the almost blank wall of my grandmother's house. There is a single window on that side, but we do not often look out of it, except perhaps to see when a truck arrives to deliver bread to the village or to check the time by the passing local buses.

My aunt, who lived next to my grandmother, sometimes collected leaves and buds from these trees and, in winter, added them to a mixture of herbs, brewing aromatic tea that we drank with honey. Several times in the spring, my father extracted birch sap from these trees, carefully sealing the holes with a special garden varnish afterward after. Drinking fresh birch sap was a unique experience for me. It was refreshing and reputedly very healthy. I even had associations that I was drinking living water. Although birch sap was sold in large jars in post-Soviet stores at any time of year, the taste of the store-bought version was completely different. It resembled lemonade: sour a bit, but at the same time quite sweet. Nothing special, like a new soda with sugar.

My family also loved to relax and take breaks while working in the garden or apiary in the shade of these birches. It was incredibly comforting to escape the bright, hot sun, drink some cold water and sit in the cool shade for a while. During these breaks, we often discussed the latest news and made our plans. My father dreamed of finishing building a house next to my grandmother's house, and planned who would stay in which rooms when my sister and I would come to visit with our families. We also discussed what I should become in the future. At that time, no one knew that I would be a botanist, although my interest in nature was already clearly visible. We chose between a biology and chemistry teacher, an agronomist and a doctor.

FIGURE 3.
The remaining birch near my grandmother's house in Dobryanka (2020s). Author's collection.

FIGURE 4.
Already considerably grown young birch on a pile of coal (2020s). Author's collection.

Later, one birch tree completely dried out and was cut down (Figure 3). But nearby, on a pile of coal, a new one, very small, appeared, apparently from a seed (Figure 4). It was able to grow in this unusual place because any other plant species, especially grasses with thick turf, were absent there. No one competed with it for resources. Therefore, its task was reduced to finding the most necessary conditions for life and development: light, moisture, heat. The appearance of this new birch was entirely unexpected, and we treated it with trepidation, afraid of harming it in any way. Fortunately, we succeeded – now there is a new full-fledged tree in our yard.

Unfortunately, it has already been eleven years since my grandmother passed away, and ten years since I have been unable to visit Luhansk and my beloved village nearby. I cannot see my native land and our birches because Russia, once a good neighbour with many relatives, has turned into an insatiable occupier with many enemies. This aggressive country with its neo-imperial politics has taken my close people, home, friends, childhood and youth – I am able to save only memories. It is even hard for me to breathe when I think about the situation. However, the old and young birch trees near my grandmother's house continue to grow in my memory. How I long to see and touch them again. It seems that this can calm my mind and heal the painful emotional wounds, although I am not ready to go to the ongoing war for this yet. I continue to arrange my life in Finland, developing my scientific career, with a feeling of guilt and an amputated part of my soul.

During my childhood, there was another birch tree besides those in my grandparents' yards. I will call it a connecting tree. It was not one of my own, and I was in close proximity to this tree only a couple of times in my life, but it has since become significant to me. This birch grew in a forest plantation along the railway that connected Luhansk, Dobryanka, and Izvaryne, the last village on the border with Russia, near Donetsk. A local Hungarian-made train, legendary to me, ran along this railway. We called the train Diesel. In the nineties, when our car broke down and bus travel was expensive and irregular, Diesel was the most reliable transport to reach my relatives, both on my father's side and my mother's. There was only one train and route; the only difference was the duration of the journey.

My dad first showed me this birch tree from the train window. It was unique along the entire road, the only one with white bark that

stood out in spring, winter and autumn among the planted maples, ash trees, oaks, robinias and elms. In the summer, when all the trees turned green, it was harder to notice this birch from the moving train. I only approached it a couple of times, as I mentioned above, when my dad and I were hunting in those places. But standing next to it, I did not feel anything unusual. Seeing this birch tree from the train, though, always meant that we were approaching Dobryanka, or it signalled that I would be in Donetsk in a couple more hours. I do not know what is happening with this tree now. It might no longer exist in reality, but it still plays an important role in my birch memory web.

Later in my life, more and more birches appeared. I have countless memories related to these trees and entire birch forests from the field practices in the East of Ukraine during my student years, as well as from Kyiv and its surroundings, and the Chernihiv region, where many important events of my adult life took place. Now, living in Finland, I am completely surrounded by birches (Figure 5), but am pleased when I encounter other types of trees. Nonetheless, my attachment to these white-bark trees remains unwavering. Returning to the birch leaf received during the retreat in Lapland, I realise that my childhood memories form the main veins of my web, while the memories from my adult life are the smaller venules within it.

When the retreat session ended, I continued analysing my emotions and the workshop as a whole. I do not know exactly why our facilitator chose birch leaves for our work. Perhaps it was because these trees are more common around our retreat house in Finnish Lapland, in taiga or boreal forests as a whole. But it is also likely that he knew everyone originally from the Northern Hemisphere has memories connected with birch trees.

I try to think of other species of plants and animals, but none of them evoke such strong memories and emotions in me. While I could easily build memory webs with linden, lilac, walnuts, cows, sheep, goats, hares, and many other familiar trees, shrubs, herbs, birds and mammals, none have the same impact.

I remain shocked now because I had never thought before about how much information, memory and emotion from people with different backgrounds is preserved in biological species. This realisation could be an additional motivation to protect certain species, individual trees

FIGURE 5.
Birches near my rented apartment in winter time (Oulu, February 2023). Photo by author.

or even entire natural areas as carriers of memories for individuals or even generations.

If you think about the trees who have witnessed your life, they will trigger memories too, won't they? A whole world of our history wrapped up in the existence of their branches.

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Mykyta Peregrym is a botanist with nearly 25 years of experience studying plant diversity, specialising in rare, endangered, and invasive species. His expertise extends to citizen science initiatives, biodiversity data collection, nature conservation and herbarium management. Most of his academic career was based in Ukraine, where he worked in prominent academic and university botanical gardens in Kyiv. He has also held international roles, including as a postdoctoral researcher in Hungary and a visiting researcher in Slovakia and Kazakhstan. Since December 2022, Dr Peregrym has been actively engaged in scientific and creative pursuits at the University of Oulu, Finland.

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Conversations with Trees: The Experiences of an Arboreal Pilgrim

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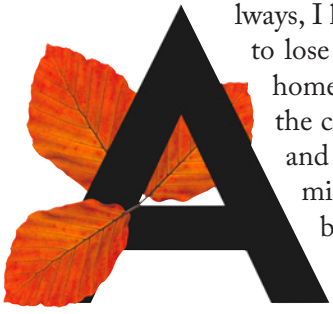
ABSTRACT

This is a tale of my connection with trees, a connection from which conversations arose. My aim is to chart my journey from tree-lover to tree-listener and to share the wisdom of the trees. I do not offer any explanation for these experiences, though I will express my sometimes confused and uncertain responses, my questions and concerns, my attempts, as a person who sits more on the side of science than spirit, to make sense of what happened. Ultimately, as I hope these conversations will demonstrate, I decided that what I gained from the trees was more significant than the how or the why of it.



lways, I have loved trees. As a child, a wanderer, I tried to lose myself in the wooded areas around our rural home in England's south-western peninsula. Under the canopy of oak and ash, the understory of hazel and hawthorn, I had the magical feeling of swimming through green light. And I felt, strangely, both thrilled and safe. That is a feeling I rediscovered 30 or so years later while volunteering for a conservation organisation. The mysteriously enlivening peace of woods.

The longer I spent with trees, the more profound the feeling-state, and I wanted to understand it. So I researched, and this eventually led me to seek out the counsel of a Druid, Harriet Sams. She invited me to go to a tree and, when outside the reach of its canopy, to ask the tree if I could enter. She said, 'Notice how you feel outside the canopy, at the very liminal point and when under the canopy.' Next, I was to ask the tree if she were willing to teach or guide me, and, if the response were positive, to express my questions or concerns and simply wait to see what arose. That opened the door, and I eagerly crossed the threshold. Messages were slow in coming and, at first, I wasn't sure if I was confabulating. I stuck with it, curious and excited. Subsequently, I have done this many times. On some occasions, there has been no response. On others, I have felt comforted, supported and guided. On many, I have indeed conversed with trees.

Of course, I am not a trained Druid, nor do I claim to be any kind of shaman, or to have paranormal abilities. Instead, please accept these

conversations in the spirit in which I offer them: as truthful representations of the experiences I have had sitting with trees.

The accompanying photographs, not of exceptionally high quality as they were taken with a smartphone, re-assert the individuality of the trees. Each one is a being embedded in landscape and community; embodied in his or her own distinctive way. They were taken for the same reason that others photograph their friends: as mementos of times shared with loved ones.

COPSE OAK – C.250-YEAR-OLD *QUERCUS ROBUR*

This tree has been of great support to me during difficult times. There is a comfortable fork between two roots, where I sit and lean back against the trunk, as though embraced by the tree. After speaking to Harriet,

FIGURE 1.
Copse Oak.
Source: Author.

and asking the Copse Oak's permission, I sought his counsel, telling him that I have all these ideas and sparkling thoughts and while they feel connected, it is as if they are entangled, rather than in some kind of logical chain, and they go nowhere. Like a whole forest of mycelium without any trees.

He seemed to think this was fine. Then he said, 'Oh… You don't have as much time as we have.'

I agreed and said I needed to know what to do sooner than a tree would.

The Copse Oak said, 'You must find the trees [by which I understood he meant any beings] and give them what they need, which is not necessarily what they want.'

I asked, 'Don't trees know what they what?'

The Copse Oak replied, 'Where there is absence, how can anyone know what should be there?'

When I asked what I needed to give, what was needed, all I got was 'heart'.

That seemed as far as I would progress on that line of inquiry.

I sat in silence.

A bee flew in and out of a tiny space between my foot and one of the oak's roots. She was feeding her brood. Blue tits called warnings and blackbirds sang. A loud crow flew over. A buzzard circled, looking down. An old field maple creaked; the fallen bough of an ash, still attached to the stem, groaned. Insects buzzed and whizzed. Swifts screamed high, high above.

I told the Copse Oak (CO) that I wanted to feel a sense of true belonging.

> CO: You do belong here. I'd be happy for your bones to fall at my base and return to the earth.
> Me: I'd like to belong while I am alive.
> CO: Don't you feel as if you belong?
> Me: Yes… but the poplars are dying [in this particular wood] and the world's all wrong!
> CO: First, all things die. Second, you cannot belong in a world that does not exist. Only in the world that does. You belong AND everything is wrong.
> Me: Staying with the trouble?[1]

1 I had recently been reading Donna Haraway's *Staying with the Trouble: Making Kin in the Chthulucene* (Durham, NC: Duke University Press, 2016).

CO: If you like. By the way, have you ever seen a tree afraid?
Me: No… I didn't know trees were afraid. What of? Chainsaws? Death? Pests?
CO: We are only afraid of being unrooted [sic]. We fear for our roots.

This conversation, through originating in my personal neurotic sense of always being an outsider, helped me through enhancing my understanding of very different beings, trees. Place matters. Connection to place is paramount. No tree grows in an ideal position: each tree contends with shade, distributed nutrients and minerals, periods of drought or waterlogging, pest infestation, lightning strikes. Yet the tree exists, seeks to flourish, in the world that he finds himself in. That world, the agency of the world, informs the tree's becoming. The form of the tree is a record of the life lived in that place at that time. Relationships and compromises, solutions to societal problems turned into oak. Further, the tree himself, while moulded by the agency of the world also, it seemed, plays an agential role in creating the environment in which he co-becomes. This hypothesis seemed to be supported by some of the comments of the oldest tree I regularly visit.

KING OAK – C.700-YEAR-OLD *QUERCUS ROBUR*

When King Oak (KO) spoke, he did so slowly. The conversation was dreamlike. I asked him how he had survived so long, outside a wood and so, maybe, without a vast supportive interconnected mycelial system.

KO: I am so old that I support my own support system.
Me: We humans don't do that!
KO: Maybe you are not old enough. You should worship trees.
Me: I think the Druids did.
KO: Well, they were old.
Me: But they were in the past!
KO: Humans were born again when they began to make things that they should not make; and they have not grown out of their infancy.
Me: What shouldn't we have made?
KO: Things that trees don't want to be.
Me: What *do* trees want to be?
KO: Safe houses. We like to be safe houses. Not barriers, not weapons, not transport.

FIGURE 2.
King Oak, detail of the trunk.
Source: Author.

This conversation had taken some time. Although I felt safe and welcome, I also felt nauseous, drugged, as though I couldn't remain any longer without passing out or being physically sick. Considering this now, I still cannot explain the physical sensations, the hallucinatory vibe. However, I have felt a similar disquiet with ancient pollards.

There is something decidedly *other* about them. Pollarding, a pruning system involving the removal of the upper branches, can extend the life of a tree, with the process giving a boost of vitality. Like coppicing or cutting back roses. I get that. But there is an odd aura about these trees; a kind of concentration and a 'holding', as though their energy is constrained. So, while there is a deep acceptance about the shape they now are, there seems also to be an intense focus on compensating for the losses suffered. Each branch is an investment as well as a source of energy. Their removal must be, initially, traumatic. And yet it seems as

FIGURE 3.
Pollard at Burnham Beeches.
Source: Author.

though the arboreal response is always one of post-traumatic growth. The level of resilience is stunning.

FIGURE 4.
Detail of Stag's Head Oak.
Source: Author.

In Ancient Woodlands, like Burnham Beeches[2] in Buckinghamshire to the west of London, you see many pollarded oaks and beeches. The real veterans hollow out, letting the inner wood rot and provide sustenance for invertebrates, while the living outer wood acts as an ever more stable structure. Sitting with these trees, I experienced a profound insight – and one that we humans seem to struggle with: the blessing of being hollow. The words start to merge. The trees are hollow; they are hallowed; they are holy. Yet, although I was granted this wisdom when I sat with the pollards and wrote the messages down as they were given to me, I forgot, as you will see. Indeed, trees often repeat, in new ways, the same teachings. Their patience seems to be limitless.

In the Beeches, I met one oak tree who touched me deeply. The Stag's Head Oak – the upper branches are dead and rise into the sky like the antlers of a stag – showed me the incredible creativity and artistry of dying and ageing – how counterintuitive! The architecture of the tree, hollowing in places, dropping some branches, having others as bare steeples of grandeur, richly leafed elsewhere… he was an autopoetic masterpiece. The incredible vitality that enables the tree to keep creating during the corrosive period of decline. I sensed the majesty of his swirls and folds. The strength of the embrace and the hold. And the absence within that allows the forms of inner wood and internal structures to be seen. It is his breaking open that releases his essence.

'It's all about what you do with your dying,' he said to me.

When I left this tree, I could not turn my back on him and walk away. I found myself stepping backward, like a courtier departing from a monarch, and then falling to the ground, denimed knees hitting soft earth and my head bowing. The tremendous power. Allow yourself to feel such power and the energy of it is destabilising. On my knees before an ancient tree and speechless. Or almost speechless. 'Thank you,' I was saying. And, 'I'm sorry!' How can a human not be sorry? The force of it left me stunned.

The conversation with another tree focused more on what we do with our living.

2 https://www.cityoflondon.gov.uk/things-to-do/green-spaces/burnham-beeches-and-stoke-common/visit-burnham-beeches (accessed 1 May 2024).

MOTHER OAK – C.250-YEAR-OLD *QUERCUS ROBUR*

Mother Oak is another hedgerow tree, on the boundary between two golf courses. I asked her how she had survived through the centuries, as most of the surrounding trees were less than half her age. She said, 'By inhabiting the borderline.'

I understood that she wasn't simply referring to the boundaries between our human-created parcels of land. Instead, she was pointing to a deeper truth: that trees live between realms. Between air and earth, making life from fire and water. Trees are elemental alchemy. Deeper still, her message pointed to the creativity of existing in the in-between places. Between birth and death; heaven and earth; the material and the spiritual; the sacred and the profane. The place where dichotomies dissolve into non-duality.

She seemed open to further questioning, so I asked how we humans should live. No hesitation: 'Take only what you need.'

'But,' I said, 'There are so many of us… what happens, how do you cope if there are too many trees?'

She said, 'There cannot be too many trees as trees cannot grow where there is not space and light.'

A sense of discomfort arose in me. That response seemed cold, uncaring. I was defensive, despite my concerns about human population. So, I asked her, rudely, abruptly, if she was at all compassionate.

The force of her reply was like my cells being invaded by the essence of tree. I felt as if I had been in the centre of a split-micro-second tornado and then enveloped into safety, into complete loving-kindness. I felt profoundly accepted. By a tree.

Shuddering, I was silent for a while. Hearing birds and foraging bees. Iron striking rubber. Golfers talking as balls led them from a mown lawn to a shaved lawn.

The moving, restless animal world. The abstract, hard-to-compute human-animal world.

I asked, 'What is knowledge?'

And she said, 'My knowledge is wood. I am my knowledge. I know what has been and what has been becomes me. There is no knowledge without happening. No knowledge without place.'

That made sense to me – and now that I bring these conversations together, I see that this is a consistent message. One the trees had to

FIGURE 5.
Mother Oak.
Source: Author.

tell me again and again. Consider the Copse Oak's comment about the tree's fear of being 'unrooted' and the King Oak's claim that he supports his own support system.

When I got up to leave the Mother Oak, I put my hand to her bark, wanting to say something, something right, but the tree cut in, telling me that there was nothing I could tell her of my heart, for when we connected, in that zinging moment of mutual acknowledgement, the connection was made… like fungal fibres… complete and lasting.

And I thought of my mother, who died in 1995, and felt the connection. Of my brother and sister-in-law in Devon, of my sister and my father, my close friends, and I felt the connection. I thought of the tame robin in my garden, of my dead and living companion-animals, of the fields and woods I frequent in this crowded island, of momentary passing special acquaintances (human, non-human and some of them places) and I felt the connection. Alive.

This is what really matters: the living connections between all earth entities. I sensed, in that moment with the Mother Oak, that my personal path toward wisdom involved re-establishing or reinvesting-with-mattering my entanglement with all else that is: the human, the animal, the plant and the place. This place, this earth-place, home. A planet made liveable by plants. A life made sustainable by trees.

And yet… I lose faith. I question. I misunderstand. And I forget.

I tried to work this through with a tree I call the Wayfarer Oak (WO).

WAYFARER OAK – C.200-YEAR-OLD *QUERCUS ROBUR*

Me: Why am I finding this quest for wisdom so hard?
WO: There are different types of wisdom. The wisdom to understand, the wisdom to decide and the wisdom to connect. That is the one you seek. The one that's related to connection.
Me: Oh… that makes sense and that is so helpful… but what is the wisdom of connecting?
WO: Being in touch, in conversation. Seeing how the communion enables two beings to come into existence through their mutual attention and entanglement. Creating each other as subjects through the acknowledgement of intra-action, through the recognition of connection. But the wisdom that arises from it is mind-altering: you accept that you become in the gaze of, conversation with, touch against, entanglement with the other. You accept that they are as much themselves as you are yourself.

FIGURE 6.
Wayfarer Oak.
Source: Author.

Me: OK… I know I am willing to connect with much… but I am intolerant when it comes to humans, not all the time or even most of the time, but far too often. I judge and resent.
WO: That's what bark is for.
Me: What?
WO: Trees are beings of many relationships and millions of connections. But we still need protection. To close off. You need more bark. But not too much. Too much bark and you start to jettison the living wood – which is something many humans do in their enforced separation from the world or from ideas they don't like. There is wisdom in determining how much bark is right. Maybe it's not unwise to separate from some other people.
Me: But I feel that I should be able to tolerate divergent viewpoints! I should not judge. I should be kinder!
WO: Why? You are not a god! You aren't expected to be able to withstand everything. You are expected to be vulnerable. But not too vulnerable. Bark is the answer to keeping out what you need to keep out. It's just that you can't expect bark to protect you from everything. Only the things you truly need to protect yourself against.

Again, you see similar themes arising: the recognition of entanglement and situatedness. At the same time, the Wayfarer Oak's forceful reminder that I am not some divine being who can be expected to cope with everything was new – and it made me laugh out loud. That is a lesson I try to call to mind when I feel grief over harms to and dismissal of the more-than-human. For I do struggle with others of my species. I feel frustration and anger. And yet, I am, of course, a human. As I walk through the fields and woods, the Flying People and the Four-Leggeds flee or hide. It is as devastating to see my kind do harm as it is to feel the results of that harm in the terrified responses of fellow earth beings.

Another tree helped me to experience a different reality – albeit just for few short minutes.

WATER WILLOW – C.80-YEAR-OLD *SALIX FRAGILIS*

FIGURE 7.
Water Willow.
Source: Author.

The Water Willow leans over so dramatically that I could walk up the main stem and position myself quite high up on an almost horizontal surface. I sat still and silent. A squirrel ran up the trunk to within a few feet of me, then turned onto another branch and scampered up and away. Some time later, a flock of tits flew into the branches above and around me. So close that I could hear their wingbeats. They made contact calls to each other. One gave an alarm call, and they all took off, but I didn't move, and they returned to forage in the tree. I was inside a bell jar of birds.

'This,' said the Water Willow (WW), 'is what it is like not to be human.'

I asked about the more-than-human: is it edenic or nature red in tooth and claw?

> WW: Neither. Dying is the other side of the same thing that is living; suffering is the other side of pleasure. These things cannot be unbound because they are not separate. They are one thing. Because you are born you die. Because you have pleasure you can also have pain. There are no morals here. No justice. No rules or balancing out. No accounting of what makes a life worth living. It is the is. Humans are the only creatures who rail against what is. Yes, all beings struggle to live and to avoid suffering. And anything any one of them does limits the options for another being, or harms that other being, or kills that other being. There is no living without dying, no living without suffering. It is the is.

I experienced a radical discomfort. It is *Unheimlich* to sit with the irreconcilably other. *Unheimlich* literally means 'not homey' – a feeling radically opposed to the sense I often had that for trees 'being-a-place' is so critical – and is translated as 'uncanny'. The uncanny had come up in a conversation with another oak tree.

GODDESS OAK – C.250-YEAR-OLD *QUERCUS ROBUR*

I named this oak on the bank of a pathway through a wooded area the Goddess Oak, as the hollowed-out area high in her trunk reveals shapes that form the face of a woman.

She had said, 'I want you to know about the uncanny. Things can seem unkind or unfriendly – but that is not the condition of the messenger: it is instead part of the message. The purpose of this is to stop you romanticising and sentimentalising the natural world. You need to learn how to tell uncomfortable stories.'

FIGURE 8.
Goddess Oak.
Source: Author.

I went back to her and sat again. I began by asking her about the nature of mystery.

GO: It is as it is. Transcendence lies in immanence.
Me.: It feels important to me. I am trying, always, to reach that transcendence. If, as you say, it is in immanence, then, well, how do I understand it?
GO: It just is. This is it.
Me: But…
GO: What more do you want than what is?
Me: I feel incomplete. Empty. Hollow.
[Note here that I had forgotten the wisdom of the pollarded trees at Burnham Beeches, who showed me the blessing of being hollow.]
GO: A hollow tree is strong.
Me: But I feel weak! I feel that I need to find this… this answer!
GO: What would you do if you were not in pain and afraid?
Me: Maybe I would do nothing.
GO: To do nothing is to be nothing.
Me: Are you saying that feeling hollow is… good?
GO: I am asking what you would do if you did not feel hollow.
Me: It can't be good to feel hollow! There must be something that would complete me!
GO: …
Me: [Frustrated] Can't you please share your wisdom with me?
GO: I always have and already do.
Me: What do you mean?
GO: Everything is everywhere at the same time.
Me: I don't understand.
GO: Look here. Right here, right now. You see a man-made reservoir and a man-made landscape. I experience the aurochs and lynx; the old wildwood; the generations of your kind hunting and then farming; the deaths of the trees to come and the rebirths of the world after that. It is always already here.
Me: Like… block time?
GO: If that is what you call it. I call it consolation.

Ah, and how I am in need of consolation.

There is one tree above all trees who is special to me.

In the front field of the Devon farm where I grew up, an old oak tree used to grow over a well. The farm dates back five or six centuries, and the tree was probably older. At the time, I didn't think about the oak much. I regarded 'it' as a landmark in the field. But in early 2023, I was being led in a guided meditation. We were to imagine looking at the moon and floating up to her. In my vision, I was lying under this old oak and seeing the moon through the leaves above me. When the meditation teacher suggested we let ourselves rise to the full moon, I felt

a resistance. I experienced, somatically, the roots of the tree stretching around me, embracing me, holding me to the earth. The tree's voice said, 'Stay, child. This is where you belong.'

Although the farm has been sold along with most of the land, my father still owns the field where the oak tree stood. My brother lives in a cottage opposite our old house. When I visited him and my sister-in-law after this meditation experience, I went out to the tree for the first time in 30 years.

GROVE OAK – C.350-YEAR-OLD *QUERCUS ROBUR*

The field is gradually turning to forest. The oak children of this great tree are spreading across the land. They have already filled the space between the far hedge and the tree. But I could walk under her vast canopy and sit in the saddle between the two stems, looking down at the well.

FIGURE 9.
Under the canopy of the Grove Oak.
Source: Author.

Ahead of me, under the canopy, was open space. And then, perfectly tracing the great tree's branches, which spread to the ground around her, was a ring of young oaks. I was in what will be a grove. When the old tree died, there would be a circle of oaks around an open space. This, I thought, must be how a Sacred Grove forms. The dancing graces around the goddess tree and, at her passing, the graces remain. I felt a deep sense of belonging. In my heart was the knowledge that I would live here again. Yet the knowledge was not book-knowledge or reason-knowledge: it arose from mystery. And, paradoxically, from simplicity. The simplicity of life, of belonging, of living and dying, of the regeneration always present in the process of ageing. And I came to understand that transcendence resides in immanence and cannot be separated out. Meaning lies in being, the eternal becoming of being. That is all. The Sacred Grove was not here and yet it was here. And I thought of a line in the book I was listening to, a reworking of the Arthurian legends: 'What of the King Stag when the young stag is grown?'[3]

In a state of dreamlike conviction I set up my wildlife camera just outside the canopy.

The following morning, I saw it had fired only three times. I was disappointed. So disappointed that I didn't even look at the films. My brother said, 'What were you expecting?' 'The King Stag,' I said. He laughed.

When I got back to my present home, I downloaded the films. The first was the wind in the leaves. The third was me collecting the camera. The second was a roe deer stag, walking straight up to the camera.

Six months later, I returned to Devon. Before I set out, my sister-in-law told me that the oak had fallen the previous November. I felt broken. And when I went to the tree, the sight of cracked limbs, of the divided trunk halved at the saddle where I had sat like a heart torn apart, of the twinned crowns brought low devastated me. The Grove Oak had been sundered in two by years of stronger-than-normal winter winds and the roots, weakened in waterlogged soil, had ruptured. The pair of trunks and the arch of the crown now marked the perimeter of the Sacred Grove, with the reaching branchlets extending around the

3 Marion Zimmer Bradley, *The Mists of Avalon* (New York: Ballantine Publishing Group, 2000).

southernmost semi-circle of young trees. I tried to draw upon facts. That fallen trees like this make great habitat. That there are more living cells in a dead oak than a live one. I watched and listened to a robin singing his sweet and melancholy song from the tumble of wood.

And then I sought to reach my mind into the tree. I was asking for, demanding something. Assurance that the promise that I will, one day, come home was not broken by the Grove Oak's breaking. Assurance that my summertime experience of transcendence in immanence when sitting with this tree was not just wishful thinking. Assurance that this is not some form of brutal proof that I have, over the last year, been confabulating. For how can there be mystery alive at the heart of the world if its messengers are toppled in their prime? If they are so brutally 'unrooted'? I lived the words of the Jesuit poet Gerard Manley Hopkins in 'I wake and feel the fell of dark, not day', a poem about his struggles with his faith:

> And my lament
> Is cries countless, cries like dead letters sent
> To dearest him that lives alas! away.
>
> I am gall, I am heartburn. God›s most deep decree
> Bitter would have me taste: my taste was me…[4]

The answer came to me like the final lines of George Herbert's poem 'The Collar', in which faith is regained:

> But as I raved and grew more fierce and wild
> At every word,
> Methought I heard one calling, *Child!*
> And I replied *My Lord.*[5]

In the fallen tree, I had believed I was witnessing the reflection of my shattered hope, hope that had begun to bloom between the spreading roots and boughs of trees. Yet that is to misunderstand. I remembered then, in the intensity of the moment, something that the Goddess Oak had said, 'I am not here to be your mirror. Maybe you are here to be mine.' The trees were not showing me who I was, they were offering

4 www.poetryfoundation.org/poems/44396/i-wake-and-feel-the-fell-of-dark-not-day (accessed 1 May 2024).

5 www.poetryfoundation.org/poems/44360/the-collar (accessed 1 May 2024).

a suggestion for how I *could* be. That realisation opened my being to the presence of the Other. I felt, rather than heard, as I battled with my heart in the face of this oaken *memento mori*, composure and acceptance from the fallen oak. This is the deepest wisdom: the capacity to be at peace in a broken state. To live well in a world of suffering. To embrace tranquillity in the Anthropocene. To accept that everything is everywhere, all at once. The Grove Oak as acorn, sapling, mature tree, fallen giant. The Sacred Grove of the future and the wildwood of the past. Living is all about what you do with your dying. This moment captured so much that the trees had been telling me over the past year. And it captured too the sense of mystery, of all that lies unknown and unknowable.

I cannot claim to live the trees' wisdom. For I am not at peace in this world of habitat destruction, biodiversity loss and climate chaos. I find it *Unheimlich*. However, what I have learned, and continue to learn, and what I experience when I sit, attuned and attentive, by one of the Standing People does provide consolation.

Issy Clarke is an independent researcher, broadcast journalist and conservation volunteer based in the UK. She writes on non-human animal cultures and relationships with the more-than-human, particularly free-living Animals and Plants. She enjoys sitting with Trees (and other non-human beings), and being receptive to their wisdom. Her work embraces the factual and scientific, the theoretical and ethical, and the speculative and imaginal.

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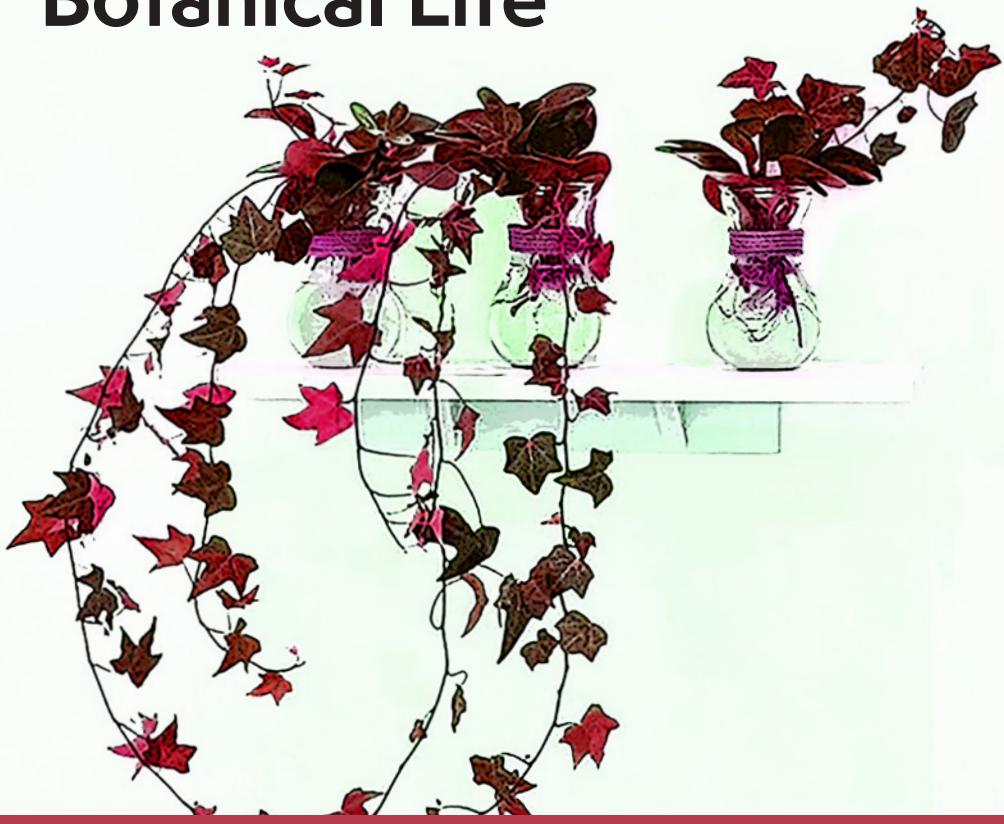
Minjie Wen

Plant Intelligence in Moist Spaces: Designing Data Visualisations of Botanical Life



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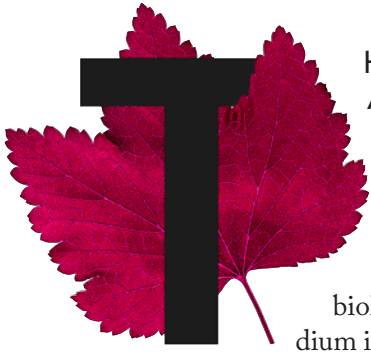
ABSTRACT

At the beginning of the twenty-first century, when the life sciences and computer science were in full bloom, new media practices based on computer technology were being integrated into living systems, for which new media artist Roy Ascott proposed the concept of 'moist media' – a medium born from the intersection of dry digital media and moist biological systems. This reflection on creative practice takes moist media as the context, plants as the medium, and botanical life as the research context. My digital art depicts the life phenomena of plants through data visualisation to explore the practical value of plants as creative media. The form, technology, and thematic elements of data visualisation of life can work together in the context of moist media to expand the space of communication between humans and plants.

KEYWORDS

moist media, data visualisation, plant intelligence, bio-art



HE PRESENCE OF MOIST MEDIA AS A CONTEXT

New media artist Roy Ascott introduced the concept of 'moist media' at the beginning of the twenty-first century to refer to 'the fusion of dry digital media and moist biological systems'.[1] The moistness of the medium is not the same as its purely biological nature but goes beyond the exclusivity of the medium to reveal a hybrid mode of existence and a blurring of the line between the digital and the biological. In the context of 'dry' silicon-crystalline computer technology combined with 'moist' living systems, 'moist media' is used by artists to explore infinite possibilities for creative expression. Artists have also shifted from single-media to interdisciplinary expression and have begun to explore the dichotomy between humans and nature, technology and biology, through the use of moist media, triggering new ideas concerning the ontology of art. The rapid development

1. Roy Ascott, *The Future is Now: Art, Technology and Consciousness* (Beijing: Jincheng Publishing House, 2012), p. 138.

of biological sciences has deepened our understanding of the value of life. Bio-artists attempt to communicate with living creatures through spontaneous communication from the creatures themselves.[2]

LIFE IN THE CONTEXT OF MOIST MEDIA: FROM MATERIALITY TO PROCESS

Presentation of the subjectivity of life

One of the characteristics of moist-media creations is the blurring of the boundaries between living beings and machines, living and non-living beings, and natural and human-made objects. Life evolves following the laws of nature. With the development of digital technology and biological sciences, living beings such as animals and plants are becoming the subjects of artistic creation in moist-media creation, capable of being 'unnaturalised' and reconstructed through specific techniques.[3]

Elowan (Figure 1), a project in the MIT Media Lab Fluid Interfaces, is a plant-machine hybrid (Elowan: A plant-robot hybrid).[4] Elowan is a form of controlled life, a plant that talks directly to machines. The plant uses its internal electrical signals to connect with the robot's extensions and drive them into the light. The project uses plants as electroactive systems. They are electrochemically excited to conduct signals between tissues and organs. This electrical signalling is generated in response to changes in light, gravity, mechanical stimuli, temperature, trauma and other environmental conditions.

Hong Kong academic Wang-Chak Chan has looked at cellular automata algorithms and optimised them. In 2015, he developed an artificial life system called 'Lenia',[5] a model that can evolve a variety of

2 E.D. Dottore and B. Mazzolai, 'Perspectives on computation in plants', *Artificial Life* **29** (3) (2023): 336–50.

3 C.R. John, 'Plant-art: The virtual and the vegetal in contemporary performance and installation art', *Resilience: A Journal of the Environmental Humanities* **2** (3) (2015): 40.

4 H. Sareen and P. Maes, 'Cyborg botany: Exploring in-planta cybernetic systems for interaction', paper presented at the 2019 CHI Conference on Human Factors in Computing Systems. New York, 2019.

5 B. Chan, 'Lenia and expanded universe', paper presented at the Artificial Life Conference Proceedings, MIT Press, 2005.

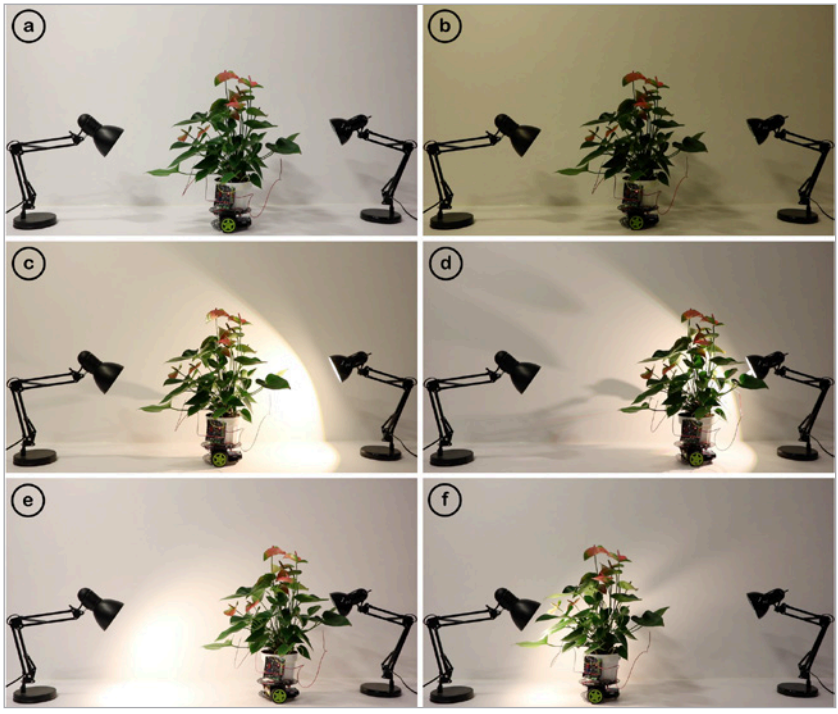


FIGURE 1.

Elowan: A plant-robot hybrid, 2018.
Source: MIT media lab/ Harpreet Sareen. License: CC-BY 4.0

life forms, with different kinds of organisms having very different forms, habits and movements. These digital organisms have the basic functions of a living organism: self-organisation, repair, metabolism and response to the external environment. So far, more than 400 species in eighteen families have been identified in the ecosystems formed by Lenia. Other cellular automata models in this project differ in that they are geometric, metadata-driven, fuzzy, resilient, adaptive and rule-generating.

In its exploration of life, biology shifts its focus from biological materiality (cells, proteins) to the processual nature of life (behaviour), and the discussion focuses on machine life. Discussions of how life emerges from machine structure, the behaviour of digitally mediated simulations

of life and the restoration of biological perception through human-made materials all fall within the realm of moist media. The absence of biological media in the latest presentation of moist-media works is gradually directing our attention to living things from biological materiality (cells, proteins) to life processuality (behaviour).

Life is being mediatised

Dr. Ivan Poupyrev, working at Disney Research, collaborated with Jonas Loh from Studio NAND, Philipp Schoessler and Munehiko Sato to develop *Botanicus Interactions* (Figure 2), where they invented a new capacitive touch sensor. It creates an electromagnetic field around an object and measures tiny perturbations in that field. By equipping humans and plants with rich touch and gesture sensitivity, new modes of interaction between humans and living plants are explored. It allows for rich and expressive interactions with plants. Depending on the physiology of each plant species, a wide variety of gestures can be allowed, such as sliding a finger over a plant stem, detecting touch and grip positions,

FIGURE 2.

Botanicus Interacticus. New modes of interaction between humans and living plants, 2012. *Source:* Munehiko Sato, with kind permission: https://satomunehiko.com/works/botanicus-interacticus/

tracking the proximity between the user and the plant, and estimating the amount of touch.

The Austrian-French artist duo Christa Sommerer and Laurent Mignonneau exhibited *Interactive Plant Growing* (Figure 3) at ZKM in the exhibition 'The Work of Art as a Living System'. The work simulates a living system in which real plants come into contact with or move in front of a screen to produce transformations in digital space, using algorithms that depict not only the form of the living organisms but also their evolution and growth. The technological devices designed by the artists produce virtual realities and immersive environments beyond the scope of previous experiences. Their work has become almost a classic of plant-based digital art, opening up new horizons for art to function as a living system.

The French philosopher Simondon describes the technological object as a part of human nature that has evolved through 'concretisation', thus

FIGURE 3.

Interactive Plant Growing , Christa Sommerer and Laurent Mignonneau, 1992.
Source: Photo © ZKM | Center for Art and Media, Photo: ONUK. By kind permission of the artists. https://zkm.de/en/artwork/interactive-plant-growing

emphasising the relationship between the object and its environment, which develops through mutual adaptation in an ongoing dialogue. Although we have already experienced the integration of machines and humans, the integration of technology into ecosystems is a concept that has yet to be realised. The highly developed sensory system that plants possess provides an opportunity for this. At the same time, plants can supply, regenerate themselves, emit and receive positive signals from the web. This is largely in line with the self-sustaining function that machines have always wanted to have. The artist therefore begins to think about how to create new symbiotic relationships, thus combining technological developments with our ecology on a more practical level, and then begins to explore the symbiotic and co-operative relationship between plants and machines.

DATA VISUALISATION PRACTICES FOR PLANT LIFE PHENOMENA

Based on Roy Ascott's view of 'moist Media', *The Light Humour of Plants* explores organic life systems as they manifest in virtual digital environments, drawing on the idea that the fusion of organic life-forms and machinery makes mechanical synthetic objects life-like and that organic life (such as the human body, plants, and cells) becomes more constructed and designed.[6] In short, this work is a dual-media expression of the 'life' of dry media and the 'existence' of living beings in the context of moist media.

The blend of dryness, representing the precision and structure of digital technology, with moistness, symbolising the organic and living aspects of biological systems, is indeed a fitting metaphorical proposition for the contemporary era. When we keep proposing cyborgs and cyberspace, I would also like to know if we can also have cyborg plants and plant intelligence. Therefore, my work explores nature and technology, life and non-life, in moist space. My works reflects on the close relationship between human activities and nature while observing the boundaries between organisms and machines, between natural and

6 E. Bartlem, 'Immersive artificial life (A-life) art', *Journal of Australian Studies* **28** (84) (2005): 95–107.

FIGURE 4.
Light humor of plants, exhibition site, 2023.
Source: Photo by author.

human-made objects.[7] *The Light Humour of Plants* (Figure 4) is my exploration of these issues, as well as the representation of organic living systems in a virtual digital environment. At the same time, the work also explores the tangible interactions between nature, data and humans.

For this work, I seamlessly integrated a real-world plant's living system into a virtual digital environment, establishing a sensing system within the plant. This system relays the data gathered by the plant to the digital realm, where it is subsequently transformed into a visual representation. The work is designed in parallel on the virtual and physical levels.

Virtual level: This level is invisible to the visitor and constitutes the system architecture of the work that performs data collection, processing and visualisation in the background. The system architecture is further divided into two subsystems: the collection and processing system and the visualisation system (Figure 5). All types of data that will

7 M. DelSesto, 'People–plant interactions and the ecological self', *Plants, People, Planet* **2** (3) (2020): 201–11.

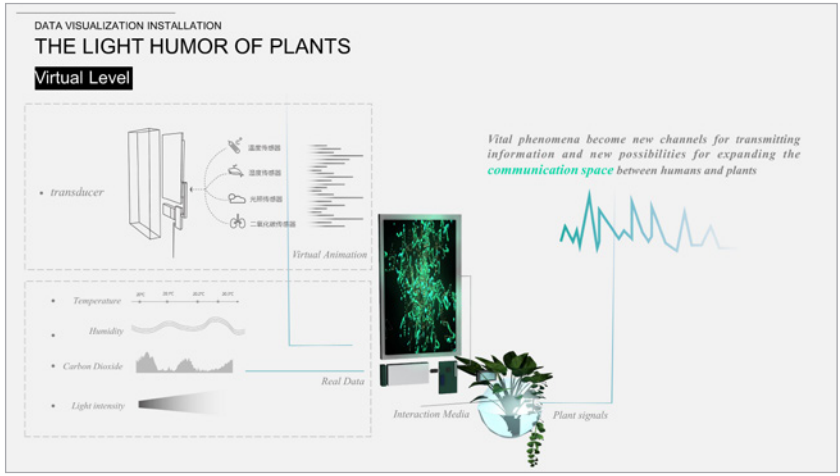


FIGURE 5.
Light humor of plants, Virtual Level Design, 2023.
Source: Drawn by the author.

be acquired at the virtual space level are processed, visualised and presented in real-time at the physical space level, creating an intrinsic link between the physical and the virtual. The visual content is continuously changed based on the real-time data.

Physical level: the physical spatial level includes the space around the work as well as the technical components that themselves perform the data visualisation output (Figure 6). These components include the 15.6 display and its customised enclosure, the Arduino hardware device, the sound and so on, which are used to convey the audio and video content. Their form and position are rationalised by design into the physical space in which the work is located, carrying much of the aesthetic quality of the work and providing a hybrid spatial experience.

All the elements of the physical and virtual layers come together to form the artwork *The Light Humour of Plant*. Changes in the environment around the plant contribute to the collection of data, which is integrated and eventually fed back into the overall art as part of the visualisation. The viewer who stays and gazes at the artwork can also interact with specific components of the artwork to change its form.

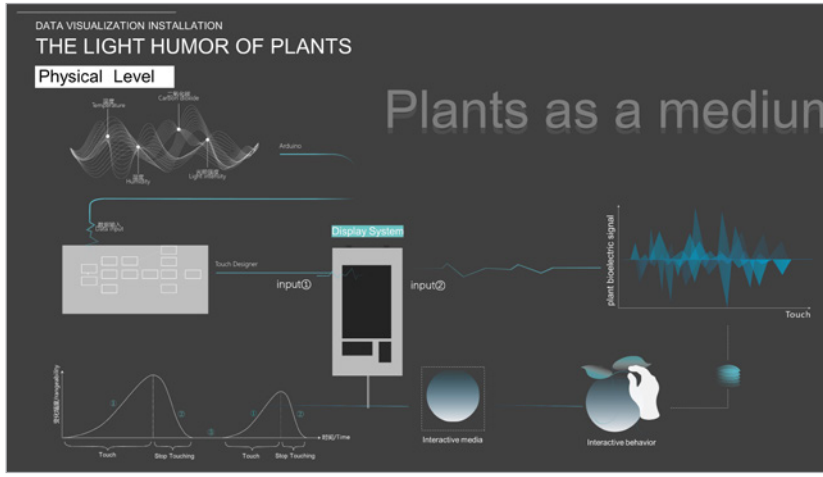


FIGURE 6.
Light humor of plants, Physical Level Design, 2023.
Source: Drawn by the author.

Environmental elements

Plants can perceive changes in the environmental data around themselves – environmental elements in the work refer to the visualisation of the four types of external data that affect the growth of life, namely temperature, humidity, carbon dioxide, and light, which are transformed into factors affecting the vision. In this work the four types of data are used to map in Touch Designer animation (Figure 7), to find the most matching data variables. The real-time data will have a real-time impact on the animation, and, when the participants watch the animation, they will be affected by the visual effects of the changing elements in real-time, feel the changes in the spatial environment that the plants are in and experience the changes in the subtle elements of the world that the plants feel.

In terms of mapping environmental factors to the representation of the work, temperature, humidity, carbon dioxide and light intensity have all been assigned corresponding visual representations or 'Data Mapping'. Specifically, temperature relates to particle colour and

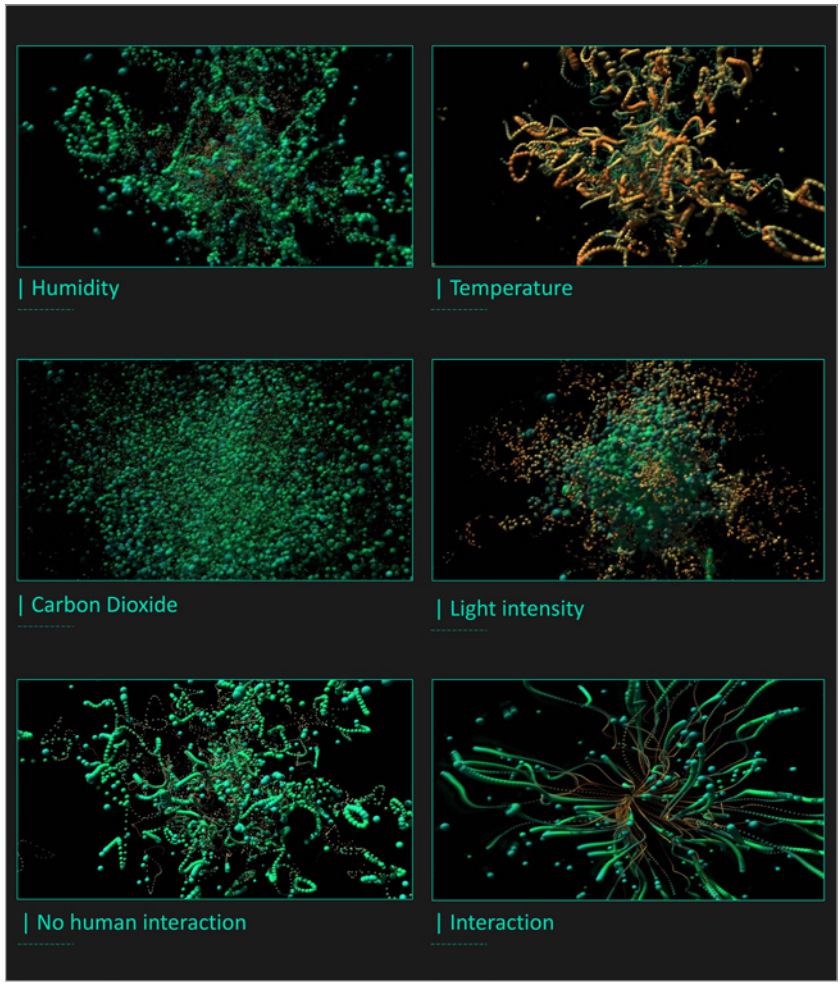


FIGURE 7.
Light humor of plants, Animation Run Logic Diagram, 2023.
Source: Created by the author.

humidity relates to the degree of penetration, often referred to as diffusion. When a person approaches a plant installation, they exhale carbon dioxide, which increases the carbon dioxide concentration in the vicinity. An increase in carbon dioxide concentration correlates with an

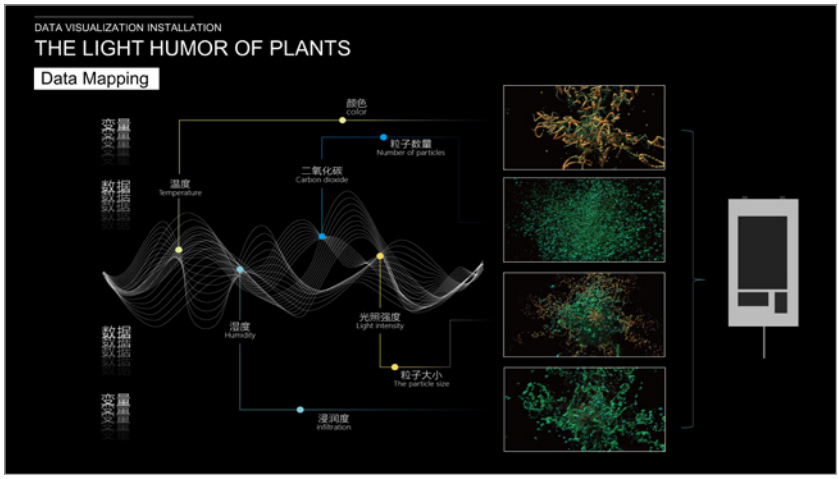


FIGURE 8.
Light humor of plants, Data Mapping, 2023.
Source: Drawn by the author.

increase in the number of particles detected. Similarly, light intensity corresponds to particle size – the greater the light intensity, the larger the particles (Figure 8).

Humidity and diffusion: humidity levels significantly affect the diffusion process, which in turn is directly related to the extent and speed at which particles travel through the environment.

Carbon dioxide concentration and particle number: as the carbon dioxide concentration increases, the number of detected particles increases accordingly, which clearly reveals a direct positive correlation between the two.

Light intensity and particle size: in visual representations, there is an intuitive link between light intensity and particle size, usually showing that the higher the light intensity, the larger the mapped particles.

Temperature and colour: an increase in temperature is often accompanied by a warming of colour, from cool to warm tones, providing an intuitive perception of temperature.

This 'data mapping' approach provides a dynamic and interactive visual experience that translates subtle environmental changes into a more tangible and interpretable form for the audience.

LIVING SYSTEMS DESIGN

The life element within the artwork captures the life phenomena of the plant, demonstrating a state that remains invariant despite fluctuations in external data. Utilising the L-system algorithm, the artwork autonomously generates a visualisation that encapsulates the plant's life cycle. This presentation dynamically illustrates the continuous transformation of the plant's three primary life states: cell division, growth and differentiation. In the animation to simulate the production of its three states (Figure 9), life starts from a single cell. Life begins with a single cell, gradually increases in size, divides and repeats this process over and over again. When the volume reaches a certain limit, it begins to differentiate morphologically, which is also a manifestation of evolution.

Interactive elements

The interactive element appears in the case of human interaction, where the participant touches the plant or container, and the individual plant, as a capacitive sensor, senses the human's touch and switches animation,

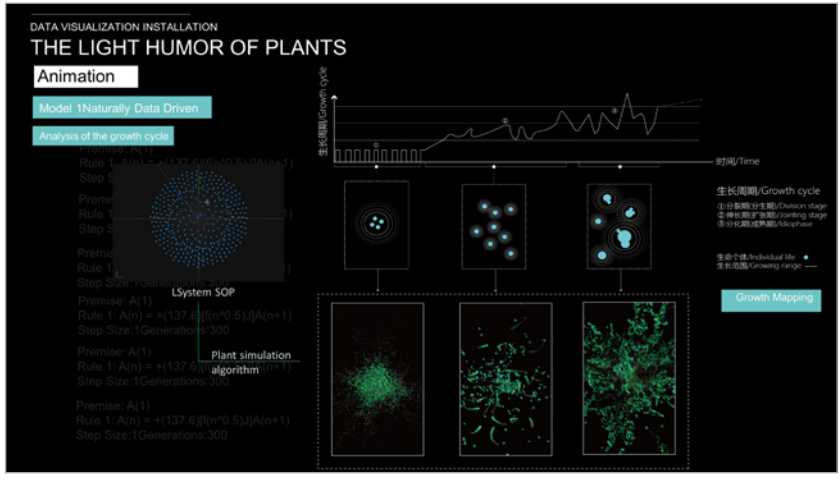


FIGURE 9.
Light humor of plants, Model 1 Naturally Data Driven, 2023.
Source: Drawn by the author.

such that the life animation in the case of uninteracted action is transformed into a human-centered agglomerative animation, where life elements are attracted by the human, and the animation is transformed from disordered animation to ordered. The life elements are attracted by the human, from a disordered animation to an ordered animation; life becomes a product of human discipline, some particles are still struggling and escaping, but most of the existing life elements have already changed into the form of human intervention. The data visualisation still influences the data of the animation, the data of the environment still influences the animation, and the human and the environment together constitute a change in the interactive elements.

Plants are natural sensors and extremely sensitive to all forms of energy flow. Whereas our bodies constantly produce electrostatic energy, this energy cannot be sensed. Plants respond to different touches by producing changes in their data. When a person touches a plant, invisible electrostatic energy acts on the plant leaves and prompts them to respond (Figure 10).

Participants can feel the 'language' of the plant's feedback when interacting (Figure 11), and the life forms generated by the work's

FIGURE 10.
Light humor of plants, exhibition site, 2023.
Source: Photo by the author.

FIGURE 11.
Light humor of plants, exhibition site, 2023.
Source: Photo by the author.

L-system algorithm are real-time visual reproductions of the plant's data. The system of reproduction gives the plant the ability to 'speak'. From the physical dimension, the work's ready link, real-time feedback, and constant online presence constitute a sense of presence with the viewer's mind and body. The relationship between the work and the audience is not only one of seeing and being seen but also a 'two-way exchange' of information, a process of culture and meaning-making. Through the encoding and decoding of plant data, there is a meaningful exchange and negotiation between the viewer and the plant.

In the process of communication, the audience will not only experience sensory feedback such as touch, hearing and sight, but will also be able to produce emotional communication in the true sense, and realise that plants have intelligence as well as 'feelings'.

CONCLUSION

Scientific and technological innovations have contributed to the development of new media, and moist media is based on biology and technology. The existence of moist media combines living organisms and computer technology, and utilises the expression of new media art to expand it from purely virtual space to moist space. The rise of moist media in new media art has broken through the boundaries of media itself, giving media and new media art unprecedented vitality, and challenging the traditional concept of art. The concept of moist media is changing the public's basic understanding of the concept of life.

The twenty-first century is heralded as the age of biology, characterised by a future that is notably 'moist' – a term that contrasts with the dry precision of software and hardware. The quintessential distinction of moist components lies in their irreplaceable essence of life. Humanity has reached a position where human life form and personality are no longer considered the sole vanguard of innovation and progress. Life has become the concept of creation, based on nature, combining bioengineering and science and technology; and contemporary new media art presents more new pictures of creation. With artists practicing in this open social and technological environment, the creation of fusions of technology and art will continue to have a meaningful role in the collision between the artist, the audience and the artwork – this process

is the combination of human and human, biology and technology. In today's increasingly technological art forms, there is a potential connection between human and organic life, and there are infinite possibilities in the space of future communication.

ACKNOWLEDGEMENTS

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Poetry

Megan Kaminski

Three Poems from *Blazing Star*

lazing Star explores the healing modalities of plants and the liberatory possibilities of radical tenderness through a queer ecopoetics of care with and for the more-than-human world. The poems reimagine interspecies communication and nonhuman encounters through transcorporeal embodiments in thick time. Care blossoms into speculative permutations of the body and self through an exploration of trauma, healing, and the more-than-human relationships we are always already engaging in, visioning new possibilities for belonging, love and family.

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PUSSYTOES

Antennaria neglecta

A webbing of string wrapped round fingers
passed hand to hand body to body each
thread whiskers to conclusion
                tidy arrivals
awaiting the next

                when you see
but can't say it yet read
        the signs early under hayed grass

I'm not sure what's coming but can feel
promise in bone as pussytoes' baby q-tips
stem out fuzzy plant paws

                remember
my own soft touch and get out the way

        years of compost layers of
dainty dresses and ghosts of former selves
ready-made for good use laying
new frame in less-traveled fields

IRONWEED

Vernonia baldwinii

You did it over and over again
walking tight circles into patterns
deep grooves into dirt
a cycle on repeat
until it broke creekside
polished stones
lapping up their own

in each repetition
a chance to break free
a permutation
that mothers a single body
spills
humble into tallgrass field

let it go
permission bare skin to imbibe afternoon sun

breathe into atrophied muscles and tired
limbs

select the seeds and give
us all a chance to see what flowers

OCOTILLO

Fouquieria splendens

What's said can
singe and burn itself out
ash nourishing
soil for future growth
anchored in shifting
weather

I make way into streets
into patches of green
find portals
in repeated refrains:
dawn enters
after night spring after winter
every May peonies bloom sloppy pink

with each remnant given away:
space for something new

what's made
can be unmade what cannot hold
was perhaps not meant to

from creation to survival and back again:
flood song moon song singing liquid clear

Megan Kaminski is a poet and Professor of Creative Writing and Environmental Studies at the University of Kansas. She is the author of three books of poetry, most recently *Gentlewomen* (Noemi Press, 2020), and two artist's books – *Prairie Divination* (Sunseen Books, 2022), a book of illustrated essays and oracle deck; and *Quietly Between* (A Viewing Project, 2022), a co-authored collection of poetry and photography. Her place-based sound, poetry and art installations have appeared at museums, public gardens and libraries across the country, and her poetry and essays regularly appear in literary magazines and journals.

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Evgenia Emets

Religar, from the Forest Time Project

This series of poetry emerged from deeply listening to seven plants who came to the stage at Estufa Fria, Lisbon, to participate in an artistic journey, speak to the people and express their messages through poetry. The *Religar* cycle is part of a larger project, Forest Time, which took place across two spaces, Estufa Fria de Lisboa – a botanical garden of tropical plants, and Monsanto Forest Park – a forest in Lisbon planted about ninety years ago, a biodiversity hotspot and a green lung of Lisbon. *Religar* explores seven plants and their ecological, historical, cultural and spiritual meaning – both in their place of origin and their extensive sphere of influence beyond. The plants' stories and messages are retold by the artist through poetry, a series of calligraphy works on paper and a set of immersive art experiences.

I approached this project by stepping into the space of Estufa Fria to go beyond the veil of colonial botany and mere technical descriptions, inviting the plants to join a council, a circle, to speak and reveal their true names and their true purpose of being here, as well as their message to humanity. I asked them the following questions, after which certain answers and guidance were given to me directly by the plants and put in the form of poetry. All the poems are written in the voice of the plant as if they were speaking to the human directly.

What is your name?
What is your journey?
What is your story?
What is your gift?
What is your essence?
What is your message?

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EMPTY YOURSELF
(Fatsia japonica)

What if I told you
You come to me
To empty yourself

Everything
That weighs you down
Throw it in the water!

Before you move
Further
Unaware
Step on my being
Judge
Classify
Speak as if you know
Without tasting bitterness
Or sweetness
Blow it in the air!

Stay with me
A minute
An hour
A day
A moon
A turn
Come back
As if you never
Spoke to me
Everything else
That pulls you
Out of this moment
Toss it in the fire!

Your clock
Your dates

Your calendars
Your deadlines
Your commitments
Your rush hours
Your being late
Your lack of time

Your horror
For the world
Disguised as unrest

Your fear
Of the unknown
Tagged as death

Your shame of what's
Been done
Reading regret

Your hate to
Need to box
Unmeasurable
Compost it!

Now I am grateful
Now I can teach you
What is your story?
What is your gift?
What is your essence?
What is your message?
Throw them in the water!

HAIPU'U PULU
(Cibotium glaucum)

My shadow that
Softens
Your wounds
Grows as my day
Slows
To patiently meet my ground
To meet the ones unseen

Pulu Pulu Pulu

My shadow that
Governs your strength
Simmers in our mother's belly
To nourish your hungry breath
Before it withers away
Doubting its own worth

Pulu Pulu Pulu

My shadow that
Guards your quest
Clears away
The tired time from your body
While you fall asleep
In the old crater's nest

Pulu Pulu Pulu

My shadow that
Calls your voice
Only your bones remember
Why did you wake up again?
To dream an impossible earth
In spite of the bleak prophecy

Pulu Pulu Pulu

My shadow
That speaks your law
The way you own your future
I own my home
Our soil always returns to us
What has been received by her

CHIRIC SANANGO
(Brunfelsia latifolia)

Slow down Slow down Slow down
Listen

All you have now
Is your heart
Every human moment of time
I hear it in the echo
Of my breath

Listen

I belong
To this very piece of dirt
With all my family
You do not know their names
But they know your pain

Listen

The nauseating fever
Of the world
Draws its claws
Into your chest
This sickness is not yours

If you melt it down
I will weave it into a song

Listen

Tour your heart
With me to the wild place within
Where your power
Has petrified into a rock
This is your finest medicine
Crush it
Grind it fine
Take it in

Listen

Chiric Sanango, *Brunfelsia latifolia*, Watercolour on paper, 2023, 162x114 cm

TARO
(Colocasia esculenta)

The greatest lifeforce of all
Grows from the centre of the earth
The womb of gravity
The bowl of kalo
An everlasting time
Once offered
Forever intertwined

Of all the stories
One has not been told
Our common root

Hold to that thread
Never let it go
It is your light
Through dangers of the path

Before the deepest darkness
Could be ever savoured

Before a blinded seed
Could be ever woken up

Before my way of being
Could be ever named

Before my presence
Could be ever witnessed in your dream

Before my body
Could be ever pounded into a meal

Before my gift
Could be ever doubted by your mind

Before my freedom
Could be ever claimed by greed

Before our thread
Could be ever split in two

Before the loom
Could be imagined – weft and weave

Before the outcomes of your verdicts
Could be ever shaken off

Before unspeakable
Could be agreed by you

Before the time has ripened
For us to hear each other

The greatest lifeforce of all
Grows from the centre of the earth
The womb of gravity
The bowl of kalo
An everlasting time
Once offered
Forever intertwined

Of all the stories
One has not been told
Our common root

PAPYRUS BOAT
(Ciperus papyrus)

The words I weave
Around you
Line by line
Come to protect

Your name
Vowel by vowel
Into a fine spell

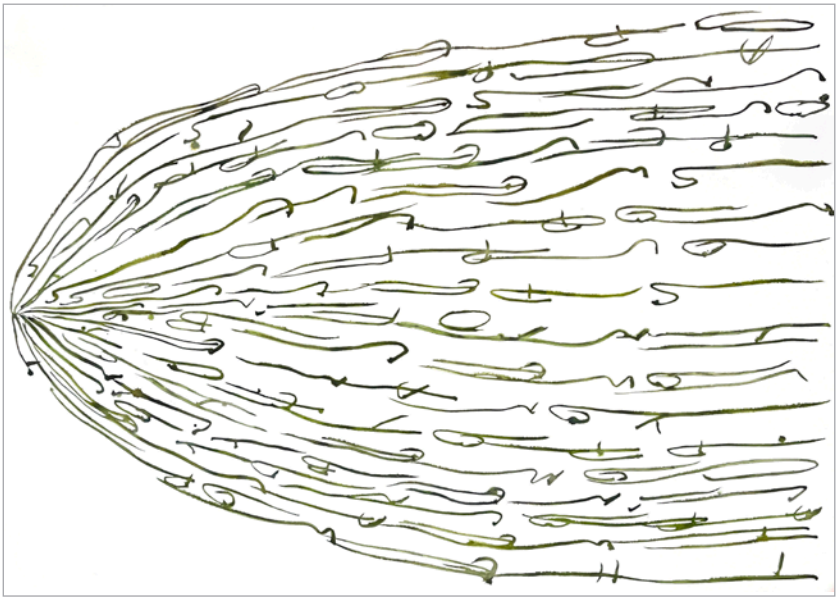
Our floating world
Swells and tides
Revere
Our journeys
Unsettled, free
Across the Great Green
Into the infinite

The clarity
I've soaked
Into my thirsty body
Shaped with your hands
What has been meant for you
Will be uttered
Distilled to sound

The void you
Reach in silence
Unroll your scroll
With light
Unriddle your life
Unravel your way
Healer of all kin

The muddiest water
Diluted with ills
Unwanted, wasted
Run through me
Into the clearest stream
Ripple by ripple
Renewed eternally

The times
I sailed with you
Land after land



Papyrus boat, *Cyperus papyrus*, Watercolour on paper, 2023, 114x169 cm

A vessel of visions
Made for you to return
Home
Your choice still remains

PEREGRINATION
(Coffea arabica)

"What you seek
Is seeking you"[1]

One road that comes from afar
Never travelled by you

1 Rumi

The longing for the present
What do you need to awaken?
What sort of alchemy needs to happen
Between us?

We both are
The points of departure
I am calling your being
Stirring ecosphere
Blending overtones
This path is liquid
Honouring tracks
Etched into the land

Our encounter cannot be hurried
Spiraling towards the centre
From both ends
I am not the goal of your journey
I am its guardian
Aid for your acute mind

There are two ways
Of knowing the world
By measure or by breath
You are your own apprentice
Radical reciprocity
Your sharpest tool

We are mutually responsible
To each other
The colour of magic
Is your choice
I am powered
By all the prayers infused
Into my grounds

I am offering them to you

RELIGAR
(Nicotiana tabacum & Nicotiana rustica)

Everything that you are not
Free yourself from it
To witness who you are
Besides
The body of bones
The nervous clumps
Of blood

Everything that I am not
Is just a moment of history
I fall to rise with you
To show you what
Powers you hold
I reach for you
To teach you

Everything that you heard
Enter your ears
Overshadows your growth
Examine deeply
The paths you cut
Traces left
Unquestioned

Every piece you disowned
Rejected mindlessly
Call back Call back
Assemble yourself
Around your breath
Song comes alive
In your throat

Everything that you took
In ignorance

Without permission
Has turned against your
Violence
Surrender
Do not fight

Everything that you hurt
Troubles your mind
Will be blown away
For when comes the time
Land heals herself
With the medicine
She grows

Religar *Nicotiana tabacum* & *Nicotiana rustica*, Watercolour on paper, *2023, 75x110 cm*

Evgenia Emets (b. 1979) is an international artist and poet working with forest ecology and community creating visual art, films, artist's books and large-scale ecological artworks. Eternal Forest (launched 2018), an ongoing multidisciplinary project, marks an integration of ecological thinking into her art. Eternal Forest is creating a network of 1,000 forest sanctuaries to be protected for 1,000 years through art and community. Eternal Forest has been presented in Portugal, Spain, Mexico and the UK: Bienal de Coruche in 2019 and CI.CLO / Bienal Fotografia do Porto, Roots & Seeds, Quo Artis, Barcelona in 2021, Pela Terra, an encounter for earth and community in Idanha-a-Velha, Portugal in 2023 and at Galeria Municipal do Porto, Jardins do Palácio de Cristal in 2024. Recent solo shows: 2022, National Museum of Natural History and Science and Botanical Garden of Lisbon, 2023, Forest Time, Estufa Fria and Monsanto Forest Park in Lisbon, 2024, Rewilding Time, Hall of Biodiversity – Ciência Viva Center, Porto. Evgenia's visual works and artists' books are in museums (Stella Art Foundation and MOMA, Russia), libraries (National Poetry Library, London, British Library and Gulbenkian Art Library) and private collections in the UK, Europe, Japan and Russia.

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Book Reviews

Daniela Kato

Hiromi Ito.
Tree Spirits Grass Spirits

Translated by Jon L. Pitt,
Brooklyn, NY: Nightboat Books, 2023. 192 pp.
ISBN 9781643621920

rom her very first poetry collection, *Somoku no Sora* (The Sky of Plants, 1978), plants have been at the root of the work of Japanese poet Hiromi Ito. Her poetry underscores her fierce and boldly innovative portrayals of the female body and sexuality, motherhood and childbirth. Plants gradually took centre stage in her writing after she settled in Southern California in the late 1990s and began a life of shuttling back and forth across the Pacific to take care of her ailing parents in Japan and her partner and children in the States. Ever since, Ito's wide-ranging explorations of the qualities, names, movements and potentials of plants have provided her with a prismatic framework to articulate a whole new set of pressing concerns: immigration, transnational travel and the boundaries between life and death, as well as the burdens that fall on women as caregivers due to gender and social expectations. In the Anglophone world, the author's international reputation now rests solidly on translations of the long poem *Wild Grass on the Riverbank* (2015; *Kawara-arekusa*, originally published in 2005) and the novel *The Thorn Puller* (2022; *Toge-nuki Jizo: Shin Sugamo Jizo engi*, 2007) by Jeffrey Angles.

Jon L. Pitt's luminous new translation of *Kodama-kusadama* (2014), *Tree Spirits Grass Spirits* (2023), is a crucial addition to Ito's growing plant-based international canon. Plants take on a more forceful, nearly

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obsessive, presence in this collection, comprising 22 pieces originally serialised in publisher Iwanami Shoten's periodical, *Tosho*. Ito acknowledges in her Afterword that, during the writing process, 'plants were the only thing that I noticed ... I had a strong feeling that I might actually be made of grass. More grass than human. Or that maybe I was a tree' (p. 162).

Such interplay between self and plant and, more importantly, the crossing of boundaries between self and plant is the spirit that informs the collection at multiple levels. While all of the poems are sustained pieces of creative and critical thinking, they do not fit any received notions of the essay, lyric or otherwise. There is a rhizomatic quality working within and across the texts that resists beginnings and endings, gates and fences. Hence, I find Pitt's comparison of their workings to a garden of limited explanatory value. The anarchistic, vegetal-like agency that narratively shapes the pieces seems to relish uprooting the garden's proprietary vigilance as a form and, instead, tends to seek landscapes where plants can be encountered and known on their own terms, despite the unsettling nature of these encounters.

The most paradigmatic and accomplished piece in this regard is, in my view, 'Covered in Grass, I Slept'. It might have inspired the choice of the book's intriguing cover art, a photograph of a giant and lacey tumbleweed sitting cryptically, at the centre of the frame, on a green lawn. The piece takes us on a journey across a windswept, dusty wasteland in northern California, as the narrator observes all manner of tumbleweeds doing their thing: getting stuck in fences and highway railings, drifting off towards the roots of trees, tumbling up to mountain tops and into fields of green. Here, interestingly, the narrative shifts from a travelogue to an intimate meditation on life and death, on vegetal agency and submission to elemental, cosmic forces:

> The tumbleweed is an object which cannot be called a plant. This is because they are not alive, and they are all dried out. And yet in this we find the cosmic law of plants in motion. As a result of many years of observation, I have discovered the cosmic law of plants: " Dying" is "Living", and "Living" is "Not Dying".' Although not alive, tumbleweeds move and turn and spread their seeds about. Spreading comes from the plant's own volition, but movement comes from the wind. Blown by the wind, plants simply tumble on. (p. 117)

And then, in a swift temporal-geographical movement from the past to the present, from America to Europe and back, we are taken

through a compelling natural and social history of the plants' arrival in the States, to learn that 'tumbleweed isn't merely a type of grass. It's a metaphor for those people who lived and died on those plains, blown by the wind. It's a reality, an existence, a fate that you can't run away from. It's a way of life, and a way of death.' (p. 118)

This profoundly evocative, rhythmical weaving of vegetal and human stories across multiple spaces and temporalities is a defining feature of most of the pieces in the collection, ranging from 'Respective Autumns' to 'Traveling with *Seitaka-awadachisō*'. Another astounding piece, 'Kudzu-san', revolves around the expression of plant desire through wild growth along a neglected riverbank, a vital space of both dispossession and transgression that often features in Ito's writing. Despite the widespread reputation of kudzu as a nasty invader, our narrator encounters the plant outside such judgements; instead, she playfully brings to the fore the affectively charged quality of the encounter:

> The tips of the vines were covered in fuzz, like puppies, and would sway back and forth, and even though vines *should crawl* along the ground, these would stand erect and move in close. They really seemed as if they were full of desire. My daughter was small, so she was able to laugh at them, but if I had been accompanied by a young girl that had already gone through puberty, I would have tactfully tried to ignore the vines' shamelessness, their salaciousness. (p. 132)

Even though the piece moves on, tangentially, to a learned exploration of kudzu-related tropes in Japanese myth and classical literature, we never lose sight of its deeply personal, embodied, contextual dimension as a memoir written by a Japanese woman in transit who conspires *with* plants to re-story her subjectivity *and theirs* across cultures. Again, this entangled situatedness is the hallmark of the whole collection, signalling an existence that refuses to be curated by worn-out tropes of domestication and that thrives on anti-authoritarian dissonance and disorder. The harsh winds that blow across the pieces are the pervasive, multisensory force sustaining and yet unsettling Ito's affective poetics of place. In 'Why I Killed the Pampas Grass', she writes: 'Leaving the house and coming back home was, for me, a regular, everyday occurrence. Shopping, picking up the kids, taking the dogs for a walk. Even though this was the case, whenever I returned home, I got the feeling I had returned to a wasteland. The wind blew through it.' (p. 71).

Reverting to the translator's illuminating preface, it is significant that Pitt should note that this transnational quality of the book makes it

already a work of translation: 'Ito writes often about plants not found in Japan, but for a Japanese audience. And when she *does* write about plants a Japanese readership would know, she regularly invites them to see these in a new environment' (p. xii). Here, Pitt thoughtfully addresses the complex challenges such circumstances pose to a translation aimed at an international audience, which attests to his fine qualities as a translator. He brilliantly captures Ito's flowery yet never gratuitous prose.

Tree Spirits Grass Spirits is a luminous read that will immensely reward those willing to give it the requisite time to grow, plant-like, on them. At a time when we are witnessing a fascinating narrative turn in cultural plant studies, researchers and practitioners interested in vegetal storytelling will find much to explore in Hiromi Ito's multistoried meditations with haunting, uncanny plants.

Daniela Kato is a Japan-based independent scholar with an academic background in the environmental humanities and training in ecotherapy. Through the lenses of autoethnography and storytelling, her research practice navigates the cross-fertilising hinterlands of folklore and mythology, the rural imagination and creative practices of place-making in community, with an emphasis on Japan and East Asia.

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Maura Flannery

Joela Jacobs and Agnes Malinowska (eds). *Microbium: The Neglected Lives of Micro-Matter*

Brooklyn, NY: Punctum Books, 2023.
ISBN 9781685711702, 148pp.
https://doi.org/10.53288/0396.1.00 Open Access e-book.

This collection of essays deals with microscopic living things in a way that stresses the metaphors that swirl around them. The idea was first explored as a panel at a literature conference and then crafted over several years as the authors honed their work to create a cohesive whole. This is what sets this volume apart from many collections and makes it particularly appealing. The eight chapters deal with small life in categories, some of which are unlikely to be found today in a purely scientific work. The first is called 'Animalcules', a word coined by Antoine van Leeuwenhoek in the late seventeenth century to describe the tiny but complex structures he observed with his microscope. Ada Smailbegović interprets the term to mean what we now call protists, one-celled nucleated organisms that are themselves the result of ancient bacteria that fused to form these sophisticated cells. This is one example of many in the book stressing the theme of life forms living within or around each other and having close interrelationships. The idea of individual life is questioned again and again.

A biologist might not have included a chapter on corals in *Microbium*, because they can grow so large, but they do spend the early portions of

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their lives as one-celled organisms. A pollen grain is small though it's not really an organism – rather it's the part of a flowering plant containing male sex cells. And protozoa are, as the author Dani Lamorte admits in her chapter on them, 'linguistic organisms' because it's a term now known to be a catchall including microorganisms belonging to a variety of different groups. It's a good example of a word that persists in the cultural imagination after its use scientifically has all but disappeared. These three fit into this volume because they're all physically small and have powerful impacts on our culture in many ways, from pollen's sexual connotations to the protozoan amoeba as a symbol of formless life that can devour other forms, to coral's role in creating almost mystical underwater realms.

Not surprisingly, because of the book's strong ties to literature, each chapter explores metaphors. Dani Lamorte is the lone artist included and she deals in visual metaphors. She writes about protozoa and in particular amoeba, one-celled organisms that many of us were introduced to in high school biology lab. They are perfect for such a purpose because their shape changing is visually intriguing and definitely fits into the old view of protozoa as tiny animals. An amoeba can engulf a smaller cell, turning the experience into a tale of predation. Lamorte uses Lynda Benglis's works in poured latex to explore the idea of formlessness as something uncontrollable and therefore threatening.

Comparison is fundamental to human thought. We learn by comparing the known with the unknown. This is especially evident in exploring an unseen world that was only found with the aid of lenses, and so is relatively new to human experience. Novelty drove discoverers like van Leeuwenhoek to explain these clearly living, moving things as small animals, or in the case of Robert Hooke as cells, small rooms. But this was only the beginning of the use of comparisons to describe and make sense of microorganisms, to view them in relation to what humans could see and also to explain their behaviours in human terms. Bacteria and viruses invade bodies and some even 'eat away' at tissue. The microscopic hyphae or threads of fungi can infiltrate wood and destroy it.

All these and other comparisons are explored in *Microbium* in a way that's appealing to those whose interests are far from the literary. Many works of prose and poetry are cited, in some essays more than others, but never to the point of losing the central message that understanding how we think about microbes will help us to question how we interact with other life forms and to consider what it is to be human. This is

evident in Damien Bright's chapter on corals. After their free-living early life, they attach permanently to a surface and grow to create multicellular and often massive structures in aquatic environments attracting many other organisms. Coral reefs are wonderful examples of the interplay among life forms, with many symbiotic relationships involved from the beneficial and mutualistic to the parasitic. If the environment changes, as with today's warming climate, benign interactions can turn destructive, something also obvious in human terms.

Another case of intimate associations is described in Helga Braunbeck's contribution on lichen, a form of life that is intrinsically relational. Microscopic algae or bacteria that photosynthesise – sometimes both – live within fungi and provide energy from the sun. This allows fungi to grow in environments that have little nutritional value, like tree bark or rock, rather dry habitats ordinarily inconducive to their symbionts. Lichen, though they grow slowly in size to become visible to the naked eye and seem inert, can have a powerful effect on rock structures. Acids washed out of them by rain slowly erodes rock so they are a force in geologic change. This brings up topics that arise several times in *Microbium*: space and time.

Microbes experience space very differently from larger organisms. As humans, we measure scale in terms of our own size, and usually little appreciate how differently a mouse, for example, encounters the world. More different still is it for a lichen in a very small and confined realm. To appreciate these other forms of life, we have to disorient ourselves and think in new ways about time and space. While lichen grow much more slowly than we do, they may be the longest living of life forms, some apparently being over 4,000 years old. Bacteria, though unseen, make up more of the mass of living things than any other form of life.

Even though these facts have been known for some time, they seemingly have failed to make a significant dent in our collective consciousness, which still considers humans as the earth's rulers and controllers. The authors of *Microbium* are attempting to destabilise those assumptions, a very tall order, but a necessary one if we are to find a way to continue inhabiting an earth increasingly assaulted in so many ways. This is the message at the heart of the book and is approached in a variety of ingenious ways that contribute to keeping the reader engaged. By the end we are left with the unsettling feeling that we have ignored a large part of the living world around us, that we suffer not just from a

lack of awareness of plants, a topic now familiar to many of us, but also lack of awareness of the very small.

The message is not just that microbes are unsung heroes building huge underwater structures, crushing rocks, and influencing environments, but that their negative effects have shaped how we think and act. The last chapter is on viruses. Written by Raymond Malewitz, it fittingly focuses on Covid-19 and some literary works that grew out of the pandemic. The conference that spawned *Microbium* was held in 2018, so its inception predates the pandemic and its sequelae. But it could not help but influence the authors who were painfully aware of the massive effects that can be produced by the absolute smallest form of life, one on the edge of non-life. Malewitz describes how viruses entered our cultural imagination long before Covid with such ideas as a computer virus. This is very much related to the medical concept we are now so familiar with of viral load, the amount of virus that needs to be present to produce symptoms of an infection.

Microbium is fascinating and readable with enough science content to make the arguments understandable. As a biologist, I've long appreciated the power of microbes, but now I have a greater admiration for the power of metaphors that have arisen from that world and have been used to describe and make sense of it. I now see how our ideas about microscopic life influence how we think about the larger culture. The book's major message is that we cannot ignore this unseen world if we are to change the world we inhabit for the better. I would highly recommend it even for high school and college students so they become more aware, early in their lives, that they live with a host of organisms that are unseen but significant creators of their world.

Maura C. Flannery is professor emerita of biology at St. John's University, New York and research affiliate at the University of South Carolina. She is the author of books and articles on biology, especially its relationship with art, in such journals as *Leonardo, Archives of Natural History,* and *Plants, People, Planet*. Her focus of interest now is on herbaria, collections of preserved plant specimens. She discusses these in her blog, Herbarium World. Her latest book, *In the Herbarium: The Hidden World of Collecting and Preserving Plants,* was published by Yale University Press in 2023.

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Laura Drouet and Olivier Lacrouts (eds). *Greenhouse Stories: A Critical Re-Examination of Transparent Microcosms*

Eindhoven: Onomatopee, 2024.
ISBN 9789083362106, 220 pp.

reenhouse Stories is a collection of essays, art and interviews by nineteen authors and artists who approach the different functions, designs and meanings of greenhouses from widely diverging perspectives. Shifting away from the celebration of greenhouses as examples of technical mastery and exceptional architectural feats, *Greenhouse Stories* invites a critical look at greenhouses as controversial agricultural production tools. The essays, both through text and color photos, offer a rich array of ways to think through various aspects of glass houses built to create artificial conditions for plants where every aspect of their life cycle can be controlled.

Along with solar arrays and windmills, greenhouses are often heralded as an answer to a sustainable future in a warming world. By eliminating insects, regulating temperature and monitoring water supplied to plants, growing plants in a greenhouse is purported to minimise the use of scarce water supplies and keep pesticide use down. Histories

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of greenhouses have focused on architectural splendour and technologies introduced via greenhouse construction such as iron framing and prefabricated modular building units. Much coverage of greenhouse agriculture concedes that, while upfront costs can be high, greenhouses can optimise the production of crops on a global scale.

The editors and authors of *Greenhouse Stories* would like readers to take a closer look. As the essays, interviews and photos in this volume reveal, there are significant environmental costs and hidden stories of exploitation associated with greenhouses. Through the glass windows of a greenhouse, one finds both reasons to celebrate the possibility of a more humble and meaningful connection to the Earth and other living beings as well as reasons to decry the exploitation of plants and people in the guise of technological solutions to ecological problems.

In their Foreword, the editors, Laura Drouet and Olivier Lacrouts, working under the pseudonym 'd-o-t-s', invite the reader to see beyond the iron-framed glass structures to notice the role of these edifices as 'controversial (agri)cultural production tools'. They place the greenhouse squarely at the centre of the modern desire to have everything immediately and warn of the alienating disconnect between humans and their native habitats that occurs when they enjoy roses in December or eat strawberries in January. The authors accomplish this shift in perspective through fifteen relatively short pieces that offer histories, investigative journalism and philosophical interviews. A concluding 'Annex' of photo essays highlights greenhouse-related art exhibits, further amplifying the cultural/social depth of the project.

The book should be read as a provocation rather than a traditional scholarly treatment. The book invites browsing and thinking rather than intellectual grappling with an argument, with all the attendant apparatus: although there are extensive endnotes for each chapter, there is no bibliography and no index. This does not mean that there is no substantive, well-informed claim. There is, rather, an urgent argument for thinking carefully about the ways nature is manipulated by humans through greenhouse technologies and the consequences, intended and unintended. The greenhouse acts as a microcosm of human tinkering with climate, light and soil. As such, the project urges a visceral, not just rational, engagement. Texts are presented alongside photographs, line drawings and exhibit storyboards that offer new ways into tales of art, oppression, curiosity and intrigue.

The main body of the book is organised into four parts: 1. Stories to Begin With; 2. Old Stories; 3. Current Stories; and 4. Stories of Renewal. Part One, 'Stories to Begin With', introduces the questions greenhouses evoke: What is special about these architectural marvels? What makes them problematic? What can they tell us about the state of human/nature relationships? In the opening essay, 'Cut Off', the editors offer a number of reasons to reconsider greenhouse technologies. In the nineteenth century, the botanical conservatory offered a space to retreat from increasingly polluted cities. For Europeans, it served as a 'window' into tropical, often colonised, places. But while Victorian conservatories continue to fascinate visitors, commercial greenhouses have sprung up in the background of the global food economy, growing food and flowers out of season and even out of soil. The following two essays in this first section lay out some of the underlying reasons to avoid running headlong into the thrill of greenhouse fixes. Louis Berrīos-Negrón in 'The Golden Spike is not the Nuclear Bomb', points to fundamental changes wrought by colonial and capitalist agriculture to demonstrate the kinds of global changes that justify the geologic periodisation of 'Anthropocene'. He argues 'This is not just made visible by square kilometres of industrial greenhouse superstructures sprawling in many parts of the world', but also by billionaires such as Elon Musk, Jeff Bezos, etc., 'who are not selling rocket ships, but peddling rendered, messianic greenhoused real-estate delusions on the Moon and Mars' (p. 34). The final essay in this first part, 'Trappings of the Greenhouse', is a conversation between three scholars loosely organised around the idea of a greenhouse as Eden, as an experiment in climate engineering or as a cabinet of curiosity.

The second part of *Greenhouse Stories* is a collection of three nineteenth-century histories. In 'Plant Horror in the Palm House at Kew', Kate Teltscher connects the brutality of plantation slavery and fear of native peoples to poisonous and carnivorous plants found in the tropical hothouses. Adriana Craciun, in 'Telling Stories with Plant Cases', explores the movement of plants via hermetically-sealed Wardian cases. To decolonise these cases, Craciun argues, we should turn to plants themselves, from breadfruit to ferns. In the last essay in this section, Penny Sparke claims that working in the greenhouse had a liberating effect for white, middle class women. This helped them forge new

identities as strong, capable individuals which played a role in demands for equality by the end of the nineteenth century.

In 'Current Stories', the third section, investigations into large scale greenhouse agriculture reveal serious downsides to greenhouse technologies and materials. Commercial flower cultivation has been deeply implicated in the use of pesticides and in monoculture production. Furthermore, most commercial flowers are genetically modified to be fragrance-free to make them last longer. The authors of 'The Cut Flower Industry', compare production in Kenya to smaller scale enterprises in Scotland to describe more environmentally responsible alternatives. The second essay in this section, 'Mar de Plástico: Europe's Vegetable Garden', centres on the source of vegetables and fruit for much of Europe: greenhouses in Almeria, Spain. Almeria gets plenty of sun but is also very dry. Growers claim that greenhouse agriculture preserves water, which is true; however, aquifers have already been so over-exploited that water shortages are threatening local wildlife. Furthermore, this vast greenhouse agro-industry produces a huge array of waste including plastic particles from the breakdown of greenhouse tarps, fertiliser run-off and 'phytosanitary' overspill (this includes pesticides and other chemicals used to create a 'sanitary' environment in a greenhouse). Even worse is the exploitation of a migrant workforce (from Morocco, Mali, Guinea and Senegal, etc.) living in makeshift shelters and vying for temporary, often dangerous, work as day labourers. The final essay in this section, 'Bright Nights: Greenhouses and Light Pollution', looks at greenhouse expanses – some of them taking up thousands of hectares of land – that grow food in very a short time frame. These brightly lit greenhouses consume a tremendous amount of electricity and confuse migratory birds and disconnect people from seasons and the night sky.

'Stories of Renewal', the fourth section of this volume, highlights case studies for positive change that can emerge from greenhouse horticulture. In 'Nurturing Community', 'Growing Resilience' and 'Keep Digging', authors describe experiments with greenhouses that draw people together. In Scotland's *The Tangled Bank* project, greenhouses were removed while one was converted to a pergola covered with local vines. By intentionally drawing attention to native plants, managers invited visitors to 'rediscover the specificities of the local flora'. In *La Serre* in Casablanca, Morocco, a greenhouse-like 'polytunnel' hosts social events, inviting cultural connections. Other examples are found in Parckfarm

in Belgium, Rochester Square in London, *The Greenhouse Project* in San Francisco, *La Serre dei Giardini* in Bologna, the *Mediamatic* in Amsterdam, and *Effet de serre* in Tunis. These installations invite questions as well as suggesting new ways of being. 'Growing Resilience' describes a farm in central France which aims for a resilient agroecology including a thoughtful use of greenhouses to diversify crops and restore the land. In the final essay of this section, a British daughter of Mauritian immigrants, Claire Ratinon, traces the tangled threads of the colonial project to find and reclaim her own connection to the natural world.

The last section of the book, entitled 'Annex', offers a history of the art installation that spawned the book as well as a rich collection of photo essays celebrating new uses for greenhouses. This edited collection grew out of events that took place in Soleuvre, Luxembourg, which was designated a European Capital of Culture in 2022. The homespun look of this modest book with the use of bright orange ink for quotes, line drawings, and chapter titles makes the scholarship look less serious than it is. The editors clearly want this to be a working book that engages a diverse readership and incites action. While the inception was local, the reach of these stories is global. The book is an intervention rather than a coffee table book.

The editors of *Greenhouse Stories* argue that growing plants and food in the highly-controlled, seasonless interior of a greenhouse divorces us from the natural cycles of growing seasons and separates most people from experiencing first-hand the land which nourishes us. They call on readers to resist the allure of 'climate control' via the greenhouse. The writers featured in this volume argue that we can better adapt to the vicissitudes of climate change if, instead of relying on technology to counter its effects, 'our efforts concentrated on reestablishing sensitive and lively relationships with the living world?' (20) This is a book that is 'good to think with', as anthropologist Claude Lévi-Strauss would say. But more than that, it is a stylish, hopeful, keen-eyed, creative and insightful volume that deserves a wide readership.

Tamara Caulkins is a historian of science and environmental history based in Ellensburg, Washington. She has researched eighteenth century French naturalists such as George-Louis Leclerc, Comte de Buffon (1707-1788), Director of the *Jardin du Roi* and author of the forty-four volume *L'Histoire Naturelle*, and Michel Adanson (1727–1806), first French botanist to travel to Senegal. Her book on diagrammatic notations for court dance and military drill in the Enlightenment in under contract with Brill. She is also in the process of researching botanical conservatories to understand how they informed ideas about climate during the eighteenth century. She is a co-editor, with Geoff Bil and Kathleen Gutierrez, of a volume on *Plants in Translation: Global Diasporas and Local Entanglements* under contract with the University of Pittsburgh Press.

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