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Landscape Metropolis #10

Urban Forestscapes

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Editorial

Articles

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SPOOL is a journal initiative in the field of 'architecture and the built environment'. It puts a strong emphasis on specific topics, so-called threads: Landscape Metropolis; Energy Innovation, Cyber-physical Architecture, Narratives, Evidence & Method, and Expo. These topics refer to existing and upcoming research programmes/interests in Europe and beyond, and ensure a steady stream of potential copy. Treating these topics as threads within one journal allows SPOOL to focus on the interrelationship between the fields, something that is often lost in specialised journals. SPOOL welcomes within this framework original papers and associated open data on research that deal with interventions in architecture and the built environment by means of design, engineering and/or planning.

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Cover images
Front: Arsenal Oasis, Fall 2020. Platanus specimens anchor a new bosque planting, with Salixs takes prepared for understory planting to follow. A micro-scale pocket of 'fertile section' anchors the Platanus and kick-starts the accumulation of the herbaceous layer. (Photo: Sarah Cowles, Benjamin Hackenberger, 2020).
Back: Landscape fragmentation in Norrland. As the pressure mounts on extracting more resources, the spatial and programmatic complexity of the multilayered landscape increases. Increasingly difficult to navigate for the reindeer herders and increasingly complex to plan and manage. While in cities we dedicate significant resources to planning, designing, and public participation, the question remains—who gets to plan the increasingly complex landscape of the North? (Drawing by T. Kokins, 2023).

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EDITORIAL

Urban Forestscapes

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This issue of SPOOL elaborates a designerly perspective on urban forestry. Evidence has increased rapidly in the recent years to confirm the agency of trees and urban forests to cure a number of ills besetting urban societies. An expanding range of disciplines, in varying and novel combinations, are turning to an urban version of forestry to re-configure green (and grey) infrastructures, re-write neighbourhoods, re-purpose derelict territories and re-vitalize disparate peripheries. As such, in the face of the growing number of challenges facing cities globally, we see that urban trees and forests are becoming increasingly central to spatial planning and design practise. And yet, with all this work done on the environmental, ecological, technical and recently also urbanism-related aspects of urban forestry (cf. Journal of Landscape Architecture 1/2023), its site-specific, spatial, aesthetical, and cultural dimensions have received less attention in research. For us as SPOOL editors, this is an invitation to focus on trees and forests from the vantage point of landscape architecture and the related thread of SPOOL, called 'landscape metropolis'. This thematic thread addresses the dynamic, composite, and layered urban landscape with all its biotic and abiotic elements from a design perspective, with the intent to transcend the conventional city-countryside dichotomy, and to understand landscape as a permanent underlying subtext of the urban condition, with repercussions into the remotest corners of the globe. From a landscape metropolis perspective, cities are understood as complex territorial mosaics where the conventional categories of urban and non-urban give way to a mix of material environments in various stages of 'naturalness', or to put it another way: natures in various stages of becoming 'cultured'. Building on the potentials of an alternative reading of the urban territory then, in this issue we feature a number of select authors who elaborate on this condition, expanding on a designerly frame of knowing and doing in urban forestry. Publication formats also help: besides regular papers, visual essays are featured as a lesser-known yet highly appropriate category of exploration for design research.

Urban Forestscapes in the Metropolitan Mosaic

We want to speculatively call our designerly approach to urban forestry 'urban forestscapes'. This term is inspired by the inter- and transdisciplinary research platform SLU Urban Futures at the Swedish University of Agricultural Sciences, which labels one of its investigative alleys 'urban forestscapes'. We welcome the epistemic elusiveness of the term as it allows for a multitude of interpretations and invites for many actors of different disciplinary inclinations to meet around a common concern. According to SLU Urban Futures, whose member and forest scientist Dimitris Athanassiadis joined us as associate editor, the concept of urban forestscapes 'provides a way to emphasize how forests intersect with urban processes across the landscape, interacting with places, people, meanings, and materials' (SLU Urban Futures, https://www.slu.se/en/Collaborative-Centres-and-Projects/slu-urban-future/regional-hubs/umea-hub/getting-our-cities-right-3---reflections/). One of the potentials of the term urban forestscapes is its presentation of an alternative trope to the prevailing dichotomy of forest/nature versus urban/culture; a dualism that

plays out in the way forests and cities are seen and imagined – and subsequently projected, shaped and managed. Despite the apparent fusion of the two realms in the term urban forestry, we see that forest and city are seen and designed in a traditional way and in complementarity to each other, and at worst in relative isolation. The subtext to much of the theory and practice from the forestry (life sciences) side of things is that the urban forest needs to become more like a natural forest, while the subtext for engineers, architects and urbanists continues to speak to visions of the city as infrastructural system, collection of artifacts and human-centred environment free from the constraints of the natural world. However, the urban territory has been the setting of all kinds of connections and conflations between nature and urban life, with tree complexes and tree mosaics interwoven with the form and identity of urban places, neighbourhoods and cities, and in turn their social and cultural machinations.

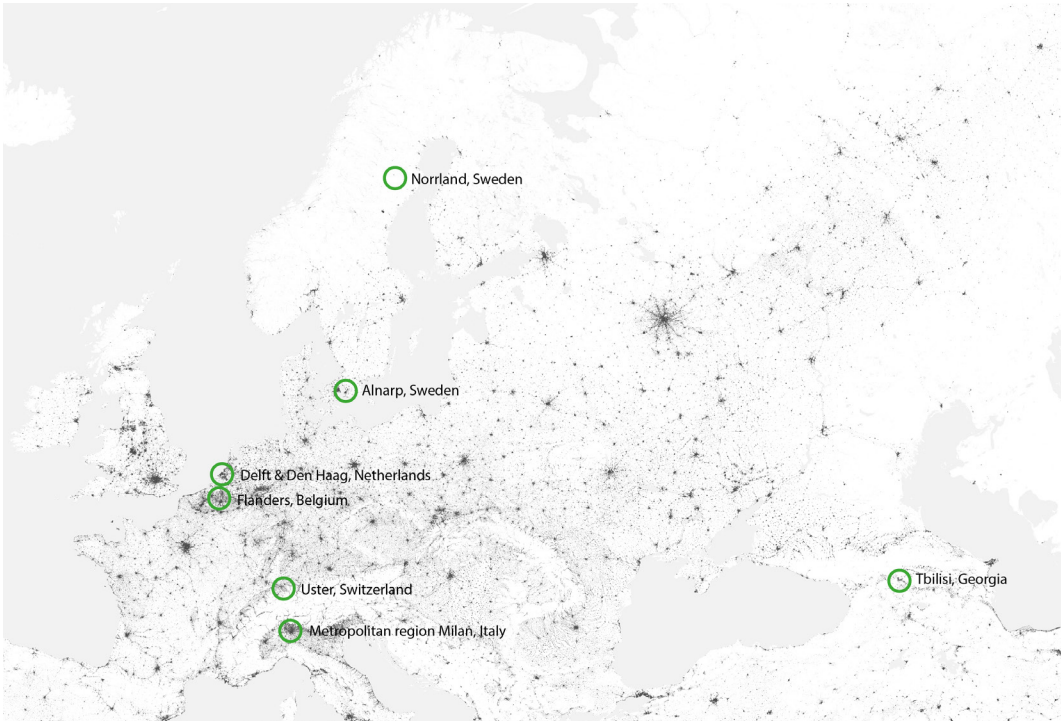

FIGURE 1 Locations of the urban forestscapes addressed in this issue of SPOOL, within the landscape metropolis of Europe and adjacent regions (illustration by Michiel Pouderoijen, TU Delft, on a map by Copernicus Global Land Service: Land Cover 100m and Esri; Garmin International, Inc. World Water Bodies.

Experience and Experimentation

A critical thematic that comes to the fore through the lens of urban forestscapes is the centrality of human experience (of forests, of cities and of their hybridizations), and the role of imagination and the sensorial in how we experience 'tree-dominated spaces'. Thus, we open this issue on a visual essay by **Winogrond** who unfolds what might be called 'the subtle art of urban forest design', in the Swiss city of Uster. The innovation of the project lies in a new interpretation of functional woodland clearings with a design language of reduction and simplicity. Not the forest has been designed but its void: the design focuses not on planting trees but on exposing the existing qualities of a particular place in the vast and complex mosaic of the urban region, over time.

Two other visual essays explore designerly approaches for the making of urban forests, through hands-on experiments. **Cowles** and **Hackenberger** narrate the afforestation of the hillsides of Tblisi, Georgia over the years, to bring new life to the remains of the mono-cultural forests of the Soviet era. Site-specific plantations, new drawing tools, civic engagement, and rigorous monitoring over time allowed them to formulate design guidelines beyond the generic, yet transferrable to other places in search of designerly principles for urban forestry. A similar in-situ approach characterises the hands-on study of urban soils at different locations in the Dutch city of The Hague, to understand how they can be best prepared as a foundation for the design of future urban forestscapes. This comparative case study by **Gauthier et al.** also distinguishes itself by synthesising and communicating sites, methods, tools, and lessons learned through a powerful visual approach, inviting for replication elsewhere.

We are happy to feature six papers from very different parts of Europe which do not only reveal the geographical, ecological and cultural differences in Europe, but also the complexity of the problematique on a larger landscape scale. What are the dimensions of the European metropolitan afforestation project, and how does this inform our understanding of urban forestscapes?

Researching through Living Labs and Large-scale Urban Projects

In their paper **Andreasson** and **Dahl** observe that urban forestry practice is dominated by systemic approaches such as ecosystem services or nature-based solutions. Offering fieldwork results from the study of select sites of the 'Landscape Laboratory' of SLU's Alnarp Campus in Southern Sweden, the authors note the potential of landscape architecture to complement the gaze of the forester and ecologist by elaborating on the social, recreational, and spatio-temporal dimensions of urban forestry. **Vanautgaerden** and **Gobbato** Liva elaborate on similar issues in the context of their work on Flanders' ambitious reforestation and afforestation programme. They reveal how a characterization of the territory couched in the term urban forestscapes resonates with a hybrid planning practice developed to realize woodland expansion goals in this highly (sub)urbanized region in Belgium. The development of a tailored coalition-building process, connecting policy and governance, different levels of scale, and various institutional and private stakeholders are strategies that underline and work with the hybrid nature of the territory. Zooming into a neighbourhood scale in Flanders, **Wambecq** and **De Meulder** draw on the results of a design studio on the Western Witness Hill of Leuven in their exploration of the potentials of the concept of the 'forest figure'. They elaborate the depth of relations particular to this site and vernacular practices of urbanization and woodland establishment and management over time. Their concept of the forest figure is a three-pronged strategy to overcome urban and forest fragmentation through new alliances of territorial curatorship where forest and urban spaces are conceived as joint projects by inhabitants and other land managers.

Unveiling Political Narratives and Historical Evidence

In her paper on the Forestami initiative for metropolitan territory of Milan, Italy, **Pastore** stresses the need for multiple modes of organization and dynamic socio-spatial processes. She points out the preeminent role of forging novel and diverse networks of stakeholders, to successfully navigate the complexities of large-scale metropolitan forestry initiatives. Another paper focusing on the political stances of urban forestscapes comes from the boreal landscapes of Northern Sweden where the urge for a 'green transition' dominates the political agenda and gets implemented in the urban realm through the trend of building

with timber. **Berríos-Negrón**, **Redeker** and **Kokins** reveal the impact of this seemingly 'green' and 'locally resourced' building material on the wooded landscapes of the region and dismantle the 'green' narrative as an argument in favour of extractive industrial practices. They call for a comprehensive regional framework and corresponding local competence, giving agency to both human and non-humans most affected in their livelihoods and habitats.

In the final paper of this issue **De Jong** and **Van der Velde** reveal the historical foundations of designing urban forestscapes. In their analysis of tree plantings in the city of Delft between the sixteenth and the nineteenth century they note that trees became a foundational component of urban spaces, resulting in a huge variety of group, line and volume arrangements across and beyond the city walls. They stress the need to understand the longue durée as a foundation for future design practice that would take inspiration on both the large-scale design of forestscapes in the landscape metropolis, and the micro-scale of individual trees and plantations, and the interaction of these components, including the human experience.

This takes us back to the start, to the sensorial qualities of urban forestscapes. These qualities have been lauded since the early stages of urbanisation, can rightfully be called a landscape architectural design tradition with manifold benefits for all forms of life, and they deliver a strong argument to place designerly approaches centre-stage in the ongoing European metropolitan afforestation project. The term urban forestscapes can be understood as a mind-opener, a call to think and act together from various perspectives, galvanized by a sensitive and designerly mindset. The suffix 'scapes', in this respect provides a useful linguistic tool for research and practice to allow for porous boundaries and integration of knowledge across the disciplines and professions working with the topic. It also allows transversal fluidity, for 'thinking out of the box', to access new epistemic grounds, and for the intellectual openness needed to keep the box open for a while, along evolving transdisciplinary scholarship.

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Wildwood Plaza

A Forest Sense

Robin Winogrond [1]

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Abstract

Wildwood Plaza (Robin Winogrond, 2013) reclaims a tiny, residual forest fragment on the city's edge, transforming it into a recreational space with the power to act as catalyst of the forest imagination. Due to the unique characteristics of forests our imagination has the ability to transform even the most mundane woods into a moving experience. Wildwood Plaza searches to reinterpret these characteristics to become not only rational recreational spaces, but ones in which the immersive, poetic character dominates the experience. The innovation of the project lies in the new interpretation of functional woodland clearings. The design language is one of reduction and simplicity. Not the forest has been designed but its void, the silence of the space has been given character, thus opening up the landscape qualities of the seemingly valueless forest fragment to the urban perception.

Keywords

Forest space, immersive experience, immateriality, landscape architecture, materiality, phenomenology, urban forestry, woodland clearing.

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Introduction

> Nowhere {but in the woods} are the two great contemporary modes of reproducing reality, the word and the camera, more at a loss. {The woods} defeat view finder, drawing paper, canvas, they cannot be framed; and words are as futile, hopelessly too laborious and used to capture reality. (Fowles 2010, p. 59)

Referring to the impossibility of conveying the forest experience to another via camera, written words, or painting, Fowles describes how ungraspable the entirety of this experience is. This is even more true if the forest is a remnant tucked within the metropolitan landscape. Today, in ever-shrinking landscape territories on the edge of town, the urban dweller searches for powerful and sensual experiences of 'landscape' and 'nature' just steps away from home. As 'calm' becomes an increasingly rare luxury in contemporary life, residual forest fragments on the urban edge hold the potential to fulfil this contemporary need if only they are recognized as such. The design of *Wildwood Plaza* (Robin Winogrond, 2013) aims to unlock this potential and transform the leftover fringe into a forest experience.

At the edge of the Swiss city of Uster, *Wildwood Plaza* reclaims a tiny wood of not more than 10,000 square metres, transforming it into a recreational space with the power to act as a catalyst for our forest imaginations. Switzerland is a small country composed of a tightly woven mosaic of tiny landscape types, among them leftover woodlands, both privately and publicly owned. Often on the city's edge, these fragments exemplify the merging of urban and natural environments into a metropolitan landscape mosaic. How can we reclaim, re-code, and reinterpret these spaces to become not only rational recreational areas within the urban context but also to draw out their immersive, poetic potential? How can the enigmatic forest experience that Fowles described become a part of the urban realm?

The history of forest imagery in Switzerland is characterized by a duality between the rational and the irrational, the pragmatic and the poetic. For centuries, forestry laws and maintenance regimes have shaped this imagery. Trees large enough to yield profits are regularly felled to make way for young trees. Today, on the urban fringe, young groves of trees are omnipresent, while Swiss romantic paintings of forests attest to their potentially mesmerising beauty and our attachment to the power of this landscape type. Due to the unique characteristics of forestscapes, imagination has the ability to transform even the most mundane patches of woods into moving, if not magical, experiences. *Wildwood Plaza* seeks to reinterpret these characteristics, transforming rational recreational space into an immersive, poetic experience. The innovation of the project lies in its new interpretation of the banal *Waldplatz*, or functional seating spaces within the woods. *Wildwood Plaza* immerses one in the sensation of the forestscape while almost invisibly providing leisure uses. In the design, the recreational voice bows to the forest, tucked into its enveloping experience, which has the ability to simultaneously activate all of our senses, body, mind, and spirit.

To this aim, the project's concept and design language were inspired by several phenomena that might be summed up as: the archaic voice of forests, the forest sense, and dissolving light and space.

FIGURE 1

Wildwood Plaza. Wildwood Plaza reclaims a tiny, residual forest fragment, transforming it into a recreational space with the power to act as a catalyst for our forest imaginations. The project subtly inserts public space into an existing woodland, allowing its strong characteristics to be the main narrative and experience of the space. The natural history of each of the three woodland clearings, which has shaped their imagery and experience, is thus brought to expression. (Photo by Valentini, D., 2014).

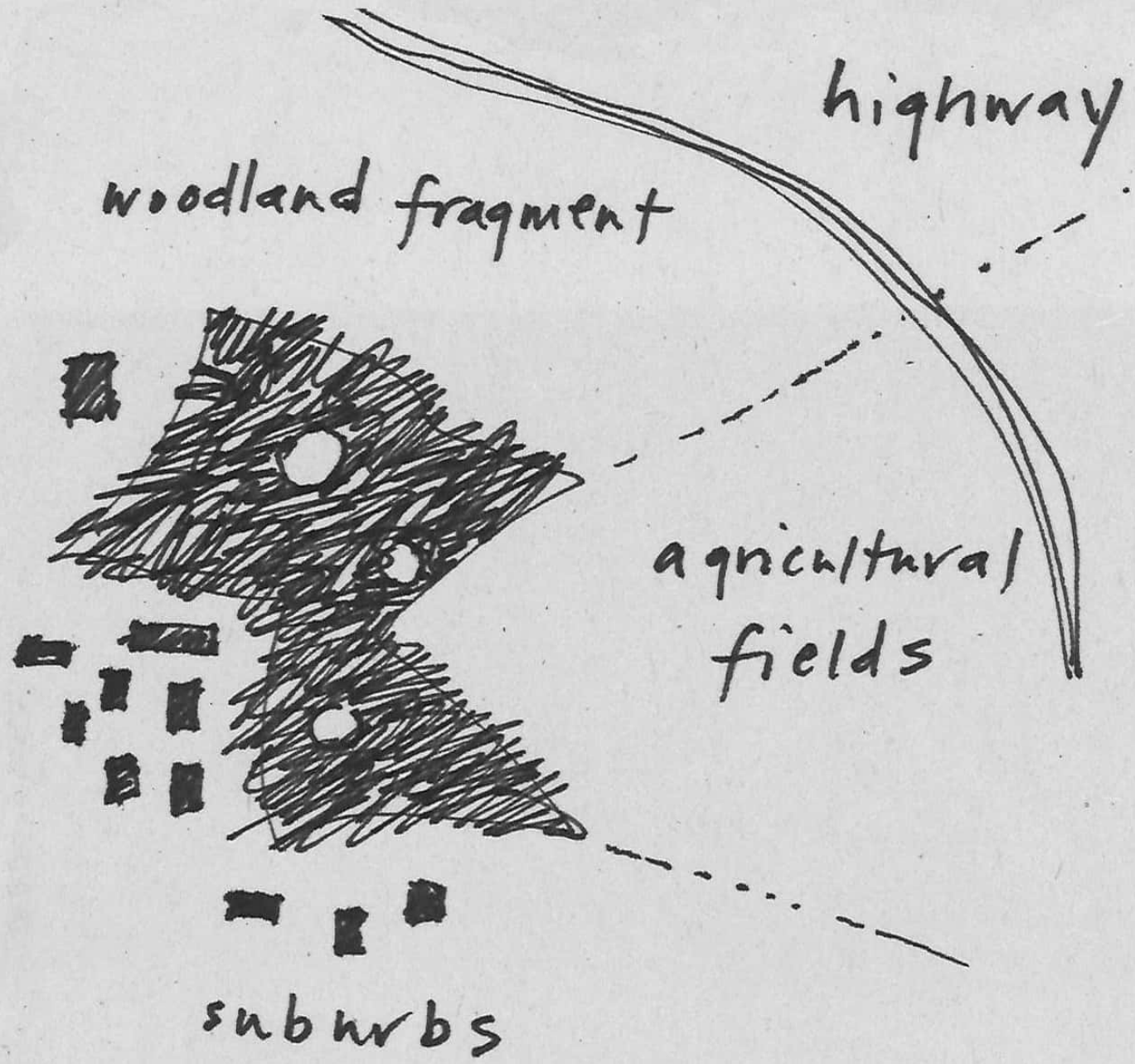

FIGURE 2

Task, Site, Design Response. In 2012, landscape architect Robin Winogrond was hired with the pragmatic planning task of creating a path traversing a small forest to connect suburban housing with the nearby 'open landscape' of walking paths, agricultural fields, woodland patches, and highways. In addition, the brief called for a recreational forest experience. In Switzerland, people often say, 'let's go for a walk in the woods,' generally referring to the generic experience of walking among standardized forestry-planted and maintained trees, standardized benches, and grilling stations, which are happily accepted as a natural experience. However, studying the tiny woodland site revealed three vividly contrasting forest types, just a few hundred meters apart, each showing strikingly different imagery and experiences of being in the woods. They created a display of nature as a processual creature of response, expressing their ephemeral conditions over time. (Drawing by Winogrond, R., 2013)

FIGURE 3

Three Existing Forest Imageries. Local foresters explained that these forest imageries were the direct result of the two strongest hurricanes to sweep through Europe in recent history: Vivian in 1990 and Lothar in 1999. On the protected side of the wooded hill, stately climax Beech trees (Fagus sylvatica) remain standing, creating a cathedral-like space. On the most exposed eastern slope of the hill, the beech forest was completely razed to the ground. Young beeches have since reappeared, forming a dense jungle of pioneer vegetation. On the third slope, shallow-rooted trees were violently torn out of the ground, creating an almost apocalyptic scene where trees struggle to survive, their trunks twisting, deforming, and shooting upwards towards the light. (Photos by Winogrond, R., 2013)

FIGURE 4

Eichenwald. Swiss romantic paintings of forests attest to their potentially mesmerizing beauty and our attachment to the power of this landscape type. This iconic painting captures both a factual, detailed account of each leaf, as well as the entirety of the millions of leaves creating the forest perception. Together they make up the richness and ungraspability and what Fowles calls the explorability of forests. (Fowles 2010: 56)

FIGURE 5

Der Bauplatz wird Gerodet. For centuries, woodlands were a central natural resource for Switzerland, regulated by a myriad of strict forestry laws. Their development as a renewable resource was viewed as crucial for economic survival. Values such as beauty, biodiversity, or recreational experience have only recently been recognized as qualities that forestry should uphold, often provoking resistance from foresters. (Painting by Humbert Mareschat, 1585-86. Courtesy of Bernisches Historisches Museum)

FIGURE 6

The Archaic Voice of Forests. The title Wildwood Plaza refers to the convergence of semi-natural wildness with urbanites seeking to embrace this sense of the wild in increasingly brief moments of free time. Even young, artificially forested trees, no matter how scraggly, seem to possess the archaic and iconic power to transcend mere visual appearance and directly resonate with what John Fowles describes as the green man within us: 'There is something in the nature of nature, in its immediacy, its apparent transience, its creative vitality, and hidden potential, that closely corresponds with the wild, or green man, in our psyches; and it is something that vanishes as soon as it is reduced to [...] a mere classifiable object' (2010, p. 51). Their inherent wild energy is akin to the timeless natural forces of fire or water. The design elements of the project therefore take a visually subordinate role to the woodland itself. (Photo by Winogrond, R., 2013)

FIGURE 7

Dissolving Space and Light. Forests enable dwellers to quickly surrender to the pleasure of disorientation that woods offer. Forest spaces are densely occupied by trees, yet we can move through them, our bodies swiveling in all directions, focusing on nothing in particular. With no fixed front, back, left, or right, we enter a state of drifting, losing our spatial orientation. Forests have the power to immediately immerse our senses, our embodied selves becoming absorbed even in the smallest patches of woods. Adding to this disorientation is the dissolution of distinction between objects and empty space. Instead, there is an endless layering of minute spatial details created by thousands of individual leaves. The imagery of leaves and their interstitial spaces captivates our minds and challenges our perceptual clarity. (Photo by Winogrond, R., 2013)

FIGURE 8

Being and Circumstance. This phenomenological quality of dissolving light and space resonates with the work of artist Robert Irwin. He has explored the perceptual dissolution of figure and ground, object and context in much of his artwork. In his untitled installation at Wellesley College, USA, a low brushed steel wall is positioned in front of a lake, nestled into the landscape beneath a grove of trees. The shapes of the leaves are cut out of the steel, with the negative spaces between them left as solid steel. This visual effect transforms the typically solid leaves into voids that dissolve into the dancing light reflected from the water behind them. Conversely, the usual voids, such as fragments of sky and light between the leaves, become an almost imperceptible, changing presence of brushed steel. His piece mimics the dazzling effect that experiencing forest spaces has on us. (Installation by Robert Irwin, 2008 © 2024, ProLitteris, Zurich)

FIGURE 9

Recomposing the Forest. The objective of Wildwood Plaza evolved into creating a serene environment where the storytelling of the forest could speak with its own voice, facilitating an embodied experience – the universal experience of a forest, alongside the deeply personal sensations it invokes. Towards this aim, the project reconfigures the materials of the forest itself to be seen in a new light. One must look twice. At first glance, it appears unremarkable, yet it introduces a language we have not encountered before. The emphasis on simplicity and reduction highlights the diversity of forest imagery. Here, there is nothing to do but gaze at the surrounding woods. The design focuses not on the plaza itself but on its void, imbuing the silence of the space with character, inviting an intuitive grasp of forest ambiance. Wildwood Plaza is simply a place to sit and observe the growth of the woods. (Photo by Kleindienst, R., 2017)

FIGURE 10

Paving and Seating: The Imagination of Matter and Material Immateriality. In the design, materiality and immateriality are treated with equal importance. The project's imagery and materials mimic the forest itself. Paving and seating seamlessly blend into their surroundings, ensuring that the forest remains the primary experience. The tree trunk paving encourages visitors to tread lightly on the semi-natural floor, to connect deeply with the place. Irregularly shaped acacia trunks, sourced from local fallen or felled trees, showcase the unique growth of each tree. The concept for the paving drew inspiration from concrete imitation wood pavers found in local DIY building supply shops, as well as historic wooden paving blocks used in old Swiss factories. The head forester of the city was consulted to construct the woodland floor, which initially provoked his anger. He lamented that in his youth, there was no need to destroy woodlands to create recreational spaces; simply walking or playing in the forest sufficed to experience the agglomeration or urban periphery woods. (Photos by Valentini, D., 2014; Winogrond, R., 2012)

FIGURE 11

Three Circular Clearings. Uniting the three clearings is their circular form, subtly revealing and highlighting the distinct differences in forest imagery. Within each clearing, there is an expression of unique voice and history, shaping its identity through dimensions, height, topography, density of greenery, edge density, and the form and expression of vegetation. The circular void functions as a 'looking glass' or all-encompassing cyclorama. As we move around it, there is no need for a focal point. The form underscores the multi-directional, non-directional, and anti-hierarchical experience of forests. Rationally, the clearings offer a simple place to sit. Phenomenologically, the interplay of light and shadow, the density of a space that is simultaneously full yet penetrable by our bodies, becomes an irrational task of drifting and being captivated in its own right. (Plan by Winogrond, R., 2013)

FIGURE 12

The First Clearing. On the western slope of the wooded hill, strong climax trees weathered the hurricanes, sheltered and preserved. Below their grand silver trunks and lofty crowns lies a clearing described by Baudelaire as a 'temple of living pillars' (as quoted in Fowles 2010, p. 58), embodying the visual and emotional power of old trees as archetypes. Light filters through the dense leaf canopy from above, casting a luminous glow. The small open space of ten metres diameter accentuates the towering verticality of this cathedral-like forest space. Massive roots, with their irregular and organic strength, disrupt the pure geometric form of the circular clearing. In autumn, the golden beech leaves illuminated by sunlight intensify the natural grandeur of this simple space. (Photo by Valentini, D., 2014)

FIGURE 13

The Second Clearing. The Beech tree, with its robust root system, contributes to both the creation of the majestic climax forest in the first clearing and the vigorous young pioneer vegetation in the second. The perimeter of this plaza is bordered by a dense, impassable jungle of delicate beech pioneer growth. The void of the clearing is carved into this jungle. Selected trees of other species, such as Wild Cherry or Alder, are deliberately left standing within the void, disrupting both the geometric clarity of the circle and the homogeneous image of the beech forest. This largest and flattest circle, measuring 20 meters in diameter, is situated closest to the main path and adjacent to a boy scout cabin, intended for their use. Here, the created intimacy fosters a sense of gathering, socially charged as a distinct spatial room within the forest structure. (Photo by Valentini, D., 2014)

FIGURE 14

The Second Clearing in winter. In winter snow, the clearing undergoes a visual abstraction akin to a black and white photograph. The slender, chaotic, vertical trunks of the young pioneer Beech growth imbue the scene with a wild and untamed imagery. Simultaneously, they create a uniform filter through which the seating elements are faintly perceptible. (Photo by Valentini, D., 2015)

FIGURE 15

The Third Clearing. On the northern slope, the third and middle-sized plaza is situated amidst the most intricate woodland imagery shaped by past storms. The aftermath resembles an apocalyptic scene, where wild, irregular, and sloped topography bears witness to the history of glacial melt. Deformed trunks, water shoots, and rhizomes sprawl in all directions, each struggling for survival. Accordingly, the design of this clearing highlights and showcases its contorted trees, unusual topography, and sloping ground plane. Here, hurricanes violently uprooted shallow-rooted trees, revealing the peculiar beauty of nature's deformation and adaptation. Trees with shallow root balls, torn from the ground, lie like fallen giant brooms, grasping for light. During the preparation for construction, it was challenging to persuade the foresters to appreciate the deformed trees as a deliberate quality to be showcased. (Photos by Valentini, D., 2014)

FIGURE 16

Patina, Decay, Vandalism: What client wants to see their project disappear? Between the initial construction captured in the first photos from 2013 and the subsequent image from 2017, a series of transformative processes have shaped the Wildwood Plaza project—experiences we can learn from, appreciate, or lament. Weathering has revealed the poetic beauty of patina, with the woods taking on a subtle decay. The boy scouts' decision to build fires directly on the paving has left charcoal marks, human traces etched into the space. Unfortunately, the conceptual insights and specialized maintenance practices unique to Wildwood Plaza were not passed on to new city officials. Consequently, the decision was made to remove the deformed trees prominently displayed in the third clearing, deemed flawed and unsightly by foresters. The project now gradually recedes into its natural surroundings. Biodiversity increases day by day as mushrooms and moss spread across the decaying clearings. This prompts reflection on when and how to decide on renewal. Should the project undergo rejuvenation, or should its disappearance be seen as a natural performance piece orchestrated by nature? (Photo by Kleindienst, R., 2017)

FIGURE 17

The Forest Sense. 'For a scientist like Humboldt, who was trying to understand nature, [...] the dualism between the external and internal world...was the most important question. Humans were like citizens of two worlds, occupying both.' (Wulf 2015, p. 35). Imagination mirrors our inner world. Landscape architects build space outside of the body. The inner and outer world have an inseparable relationship, as this quote expresses. The forest sense is the meeting of a person with a place, yet not about human uses but the inter-dynamic between forest and the phenomenon of our perceptive experience. The project therefore reduces the design inputs to the essential characteristics and experiences of the woods themselves.
To circle back to the topic of urban forestscapes and their duality of rational and irrational characteristics, it seems appropriate to heed the cautionary words of our forest sage, John Fowles, one last time. 'Achieving a relationship with nature is both a science and an art beyond mere knowledge [...] and I now think beyond [...] transcendentalism. [...] I do not believe nature is to be reached [...] by turning it into a therapy, a free clinic [...] The subtlest of our alienation from it [...] is our need to use it in some way, to derive some personal yield. We shall never fully understand nature [...] until we dissociate the wild from the notion of usability.' (Fowles 2010, p. 39). (Photo by Winogrond, R., 2015)

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Do You See the Forest for All the Trees?

Searching for Alnarp's Urban Forestscapes

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Abstract

Recent sustainability agendas come with the dual mission of responding to climate change and the loss of biodiversity. One strong trend is the increase in the number of trees in urban environments, initiatives often agglomerated under the label of urban forestry. The main focus of this article is to contribute to the development of this discourse by exploring the designerly aspects of urban forestry. This is done by unpacking the concept of 'urban forestscapes' as a dynamic and relational concept, derived from a landscape perspective that opens up to spatio-temporal, synthetic, and trans-scalar approaches, and further developed through a process of embedding the research both in relation to literature and *in situ*. Two wooded areas are studied at the Alnarp campus of the Swedish University of Agricultural Sciences (SLU), in the Malmö-Copenhagen conurbation. The campus holds the first landscape laboratory in Scandinavia, a real-world experimentation site dedicated to the study of urban forestry and woods. The article suggests a recognition of the interpretative openness of the concept in addition to its hybrid qualities with the synthesizing power of overcoming divisions like that of nature/culture or forest/city. The results include insights into experiential characteristics of urban forestscapes as well as methodological considerations.

Keywords

Alnarp, campus plan, design research, document analysis visualization, field work, landscape architecture, urban forestscapes

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Introduction

With COP15 in Montreal resulting in an agreement on biodiversity (United Nations Environment Programme [UNEP], 2022), and the European Commission's (2022) proposition of a new law on nature restoration, the natural environment is once again the battlefield for environmental policy measures. Forests are part of what is usually thought of as a natural environment, even though the forest industry has impacted ecosystems to a level that is far from 'natural.' Still, the romantic notion of the human–forest relation lingers, not least in the European north where non-fiction books like David Thurfjell's (2020) *Granskogsfolk: hur naturen blev svenskarnas religion* (People of the Fir Forest: How Nature Became the Religion of the Swedes, our translation) become bestsellers, fuelling a nostalgic forest agenda.

Urban forestry, on the other hand, has long been dedicated to research on urban trees, often in terms of technical and management issues of individual specimens, resulting in, for example, the Nature-Based Solution Institute's (n.d.) proposed concept, '3-30-300,' advocating for more trees and green spaces in cities, or the United Nations Economic Commission for Europe's (2019) 'Trees in Cities Challenge' campaign pledging greener, more sustainable, and more resilient cities through tree plantation. In urban forestry discourse, systemic model approaches, such as ecosystem services or nature-based solutions, are often applied (Bosch et al., 2017). We, researchers in landscape architecture and the authors of this paper, observe that such models often pay less attention to dimensions of site-specificity and aesthetic, spatial, and experiential qualities than they do to economic, ecological, or technical dimensions.

Building on American professor of landscape architecture Elizabeth Meyer's (2008) argument about the importance of aesthetics and beauty in the realization of sustainability agendas, we fear this decreases the impact of recent investments in tree plantations as broader contributions to society's green transition. Meyer argues that 'designed landscapes need to be constructed human experiences as much as ecosystems' (2008, p. 21). Hence, this paper's first aim is to study two constructed wooded areas in the landscape laboratory at the Alnarp Campus in Sweden that hold plenty of experiential qualities in what can be considered to be urban forestscapes. Furthermore, Meyer calls for 'multiple forms and forums for caring and learning about the impact of our actions on the planet: some visual, some textual, and some experiential' (ibid.). Inspired by Meyer's call to action, we use design research as our methodology, which allows us to address the paper's second aim, which is to unpack the concept of urban forestscapes through images, literature, and fieldwork. Design research allows for a meandering exploration (Seggern, 2019, p. 17) from which we interpret our findings in terms of both conceptual development and the biophysical reality of urban forestscapes and their representations (Tang, 2021).

Our guiding research question is: Engaging with academic literature, grey literature, and fieldwork, what synthetic understandings of urban forestscapes can we extract, and how can such *-scapes* be studied to emphasize spatial and experiential qualities?

Context: the Alnarp Campus

To unpack the concept of urban forestscapes, we chose to explore two wooded areas at the Swedish University of Agricultural Sciences' (SLU) campus situated in Alnarp, in the Malmö-Copenhagen conurbation—not only the home of a reputable higher education institution but also the location of the first landscape laboratory in Scandinavia. The Alnarp Campus measures roughly 130 hectares and hosts approximately 1,200 students and 500 employees. The configuration consists of an 'inner' and an 'outer' campus [fig. 1]. The latter also includes the surrounding agricultural landscape, which is important for understanding the spatial context.

Alnarp Campus is not only a site for education and research but also has a long history as a forest and is believed to have been forested for 10,000 years. The inner campus offers a complex setting where the southern and western parts are dominated by a multitude of integrated areas characterized as forest, woodland, and/or park. One important area is the Alnarp Landscape Laboratory (ALL). ALL is a '1:1 scaled experimentation in real life' (Nielsen et al., 2023a, p. 25), and its presence on campus is of relevance to our study as it 'combines complementary research on ecology and aesthetics' (Nielsen et al., 2023a, p. 46) while it acts 'both as a biophysical entity with a physical form, and as a phenomenon, a mindscape, to be experienced by humans [...] in an otherwise chaotic urban fringe landscape' (Nielsen et al., 2023a, p. 59).

Why Alnarp can be considered 'urban' is not self-evident at first glance. When approached by bike, bus, or car, the distance from the surrounding context becomes salient as you pass through the agricultural fields and enter the inner campus and what is commonly referred to as 'the green island' (e.g., Akademiska Hus, 2019, p. 38; Lomma kommun, 2016, p. 14). It does not, however, take much zooming out before one realizes how embedded Alnarp is in a 'fragmented urban landscape' (Sieverts, 2008), situated at the border between three municipalities, in addition to roads and busy motorways in all directions, and within ten kilometres of both Malmö and Lund, both university cities and Sweden's third and twelfth most populated cities, respectively. Indeed, we consider the Alnarp Campus a relevant site for exploring the concept of forestscapes in an urban/peri-urban setting (Kowarik, 2005) [fig. 1].

FIGURE 1 The southern and western parts of the inner campus (within the red dashed line) are characterized by forest/park structures, surrounded by a landscape dominated by agriculture (yellow dashed line). (Image by the Authors; orthophoto by Lantmäteriet 2023)

The campus has evolved over time to respond to new demands from education and research, in addition to changing aesthetic and functional ideals, creating a unique and intertwined environment designated for work, study, and recreation. The continuous development of Alnarp as a university campus has, in recent years, been mapped out through the production of Campus Plans by the public agency responsible for most university campuses in Sweden: Akademiska Hus (AH). The latest Alnarp Campus Plan from 2019 has a projected timeframe spanning until 2030 (Akademiska Hus, 2019). In addition to this, several supplementary investigations and visions have been developed. Of particular relevance here is the study by French landscape architect Michel Desvigne in 2020 (MDP, 2020). Parallel to this, the municipality has both the mandate and the responsibility to develop comprehensive plans for its territory, including a more detailed masterplan for Alnarp, which was drafted in 2016 (Lomma kommun, 2016).

Research: Exploring Forestscapes in Text and Field

The Literature Study: Forestscapes in the Written

Forestscapes as a concept is rather recently established (Ekers, 2009; Komulainen, 2010; Clemente, 2023). The novelty of the concept spurred a broad literature search, as 'a literature review can be a useful strategy for initialising new inquiries' when there is 'a lack of clarity or consistency in the use of a particular term or concept' (Demming et al., 2011, p. 146). The initial literature search was done using the following search terms in combination: forestscape*, forest, *landscap**, 'landscape architect*,' 'urban forest*,' urban*, civilization*, *cultur**, and *natur**.

Forest

Based on the literature study, we can conclude that there is almost no resemblance of what could be defined as natural forest ecosystems in Europe (Konijnendijk, 2008; Ritter, 2011a). The relationship between human culture and the forest can be understood as such that the presence of the latter has been a fundamental precondition in the development of the former (Ritter, 2011b). Another indication of this intimate—albeit antagonistic—relationship would be the modern occurrence, or at least concept, of 'city forests' (Konijnendijk, 2008), 'urban forests' (Konijnendijk, 2005; Kowarik, 2005), and 'urban forestry' (Bosch et al., 2017; Simson, 2017). Furthermore, German botanist Ingo Kowarik (2005, p. 5) suggests that woods, woodlands, and forests are under the influence of various values simply based on their proximity to urban areas: the further from an urban area, the lesser the social functions of the forest and the higher the economic production value.

By tracing the etymological and conceptual origins of the forest back to ideas of 'nature,' most of which derive from geography (Castree & Braun, 1998; Smith, 2008; Braun, 2009), via 'forest' (Harrison, 1992; Hansen & Ovesen, 2011; Boris, 2012; Meeus, 1995), we, in contrast, perceive forestscapes to be a dynamic

concept closely related to our understanding of landscape. We agree, for example, with Swedish landscape architecture professor emeritus Roland Gustavsson et al. (2023a) that there is great potential for landscape architecture to contribute social, recreational, and spatiotemporal values to the study of urban afforestation and forestry, often overlooked by both foresters and ecologists (p. 104). We also acknowledge that, together with agriculture, the human-induced domestication process of forests in many contexts has been, and still is, an important driving force and 'the architect of the landscape' (Meeus, 1995, p. 61).

Scape

Scape, the second syllable of the concept of forestscapes, 'is essentially the same as *shape*, except that it once meant a composition of similar objects, as when we speak of a fellowship or a membership' (Jackson, 1984, p. 7, emphasis in original). On the one hand, if we understand the origin of *–scape* as sprung from an anthropocentric and static view of landscape originating in arts and further refined through the development of modern society (Lowenthal, 2007; Olwig, 2009; Antrop & Van Eetvelde, 2017; Descola, 2013; cf. Jackson, 1984), we can also understand the reason for the multitude of new –scapes.

This can then be explained by a need to further demarcate specific attributes that are not prominent enough (with)in the conventional understanding of landscape. On the other hand, from the perspective of landscape architecture, there is a particular interest in continuously developing the sometimes 'paradoxical' concept of landscape itself (Jorgensen, 2015). The European Landscape Convention (European Council, 2000) has contributed to reinvigorating such work by incorporating social and ecological processes related to both the physical and the perception of landscape. Another example of such could include looking beyond simply 'land-based conditions' (Lee & Diedrich, 2019, p. 91; Lindholm, 2011).

Looking back into the etymological roots of landscape, Jackson (1984) suggests that, in Old English, it was not uncommon to have 'compound words using the second syllable—*scape* or its equivalent—to indicate collective aspects of the environment,' while adding that it is 'as if the words had been coined when people began to see the complexities of the man-made world' (Jackson, 1984, p. 7). This does not imply *per se* that what *–scapes* means, and how it is used in today's discourse, is the same as it was in Anglo-Saxon times (Höfer & Trepl, 2010; Olwig, 1996).

Can we, in line with Braae and Steiner's (2019) suggestion, contribute to 'a more direct understanding of the interrelationships between land and *–scape*, between the material and the constructed, the embodied and the discursive without necessarily supplanting one with the other' (Braae & Steiner, 2019, p. 4) and instead explore a similar tension in forestscapes? We acknowledge, in line with, for example, Swedish landscape architecture researcher Lindholm (2011, p. 6), the ambiguity and/or vagueness that we attribute to the many variations of *–scape*. Additionally, we see our work as an opportunity to embrace 'relationality' (Braae & Steiner, 2019, p. 3) and to avoid limiting our perspectives, but rather the opposite—to stay open to the fact that what we are looking for is not 'objectively given' (Appadurai, 1996, p. 33) nor yet entirely known to us.

Dissolving Dichotomies through a Landscape Perspective

Simplified divides and fixed categorizations are commonly used to define *something* in relation to *something else*. *Nature/Culture* and *Forest/City* are two examples of such exhausted opponents. German landscape

architecture scholar Martin Prominski highlights that '[n]ature, ecology, and landscape are important reference concepts for landscape architecture. Traditionally, all three have been considered polar opposites from culture or humanity, in a dualistic relationship' (Prominski, 2014, p. 6). Along the same lines, nature(s) and cities can be defined antagonistically, especially with the acceleration of urbanization, which has resulted in nature being removed from daily life for an increasing number of people (Konijnendijk, 2005, p. 33). This change—our alienation from nature—has been discussed by, for example, Bruno Latour (2006), who suggests that the unifying power of nature has been replaced by the dividing power of culture [fig. 2].

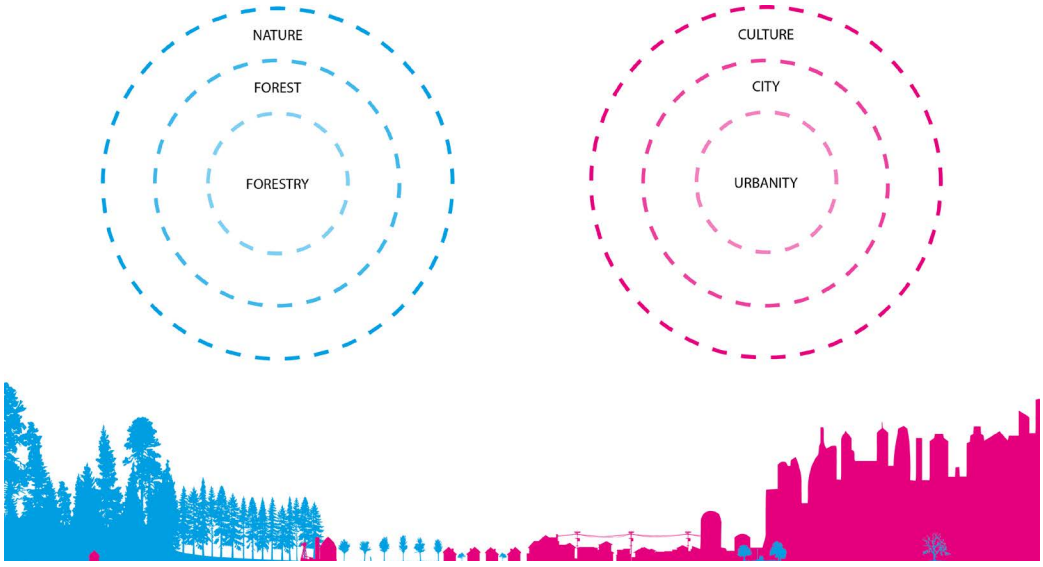

FIGURE 2 The antagonistic relationship between Nature/Culture that lingers in discourse. We suggest that the concentric diagrams have a dual meaning. First that there is a shift in abstraction between the inner and outer circles suggesting that Nature or Culture is a more general—and not necessarily spatial—concept than Forest or City, and Forestry or Urbanity. Second, that there is a gradient of commodification—building on Dennis Cosgrove's (1985) theories on the commodification of land through the subjugation to urban control of territories—between the inner and outer circles with both Forestry and Urbanity being closely linked to the production of goods and/or monetary values. (Image by the Authors)

The Document Analysis: Alnarp's Forestscapes in Representation

The initial literature study resulted in the production of a conceptual matrix that has been used for the document analysis and, partly, in an initial stage, also in the fieldwork. The model consists of two gradients. One of the axes ranges from 'nature/forest' to 'culture/urban,' while the other axis spans from 'real/shape' to 'representation/abstraction' [fig. 3]. The document analysis focused on documents developed during the ongoing Alnarp Campus development process to allow for 'finding, selecting, appraising (making sense of), and synthesising data' (Bowen, 2009, p. 28). Two out of three documents are written in Swedish, and the most common translation of the words/concepts has been used when analysing them. In analysing the grey literature, we have used the following words: nature/*natur*, culture/*kultur*, forest/*skog*, landscape/*landskap*, -scape/*-skap*, city/*stad*/*tätor*t, and urban/*urban(t)* [fig.3–5]. When processing the results, we have focused on interpreting in what way and context they are being used and what that might imply for the understanding of the campus area as forestscapes. The three documents consist of: (i) *Masterplan for Alnarp* (Lomma kommun, 2016), 39 pages; (ii) *Alnarp Campus Plan 2019–2030* (Akademiska Hus, 2019), 25 pages; and (iii) *Landscape Analysis and Development Strategy* by Michel Desvigne Paysagiste (MDP, 2020), 65 pages.

The *Masterplan* stresses the importance of Alnarp with 'its park, its garden, its surrounding landscape, its houses, and its people' (Lomma kommun, 2016, p. 2, our translation); a place where people can enjoy both nature and culture. Searching for 'forest' in the document results in 30 hits, out of which nine refer to names of organizations or geographical locations. In many instances, 'forest' is used to convey the historical development of the area (Lomma kommun, 2016, pp. 10, 12, 22). The area's high nature and culture values are connected to the long continuity of the area being forested, but in the text, the authors also recognize that there is a shift from the area being thought of as having a 'natural' forest to a more horticulturally characterized park or garden-characterized forest. Another shift that can be detected in the document is how the area evolved from having had a regional relevance as a place for harvesting resources, like, for example, firewood, to the present understanding of the area's regional importance for recreational purposes. This might be interpreted as a shift from looking at Alnarp through a lens of nature to a lens of culture, leaving behind the idea of a forested site in favour of understanding Alnarp as a landscape where the synthetic relationship between forest, people, and cities emerges.

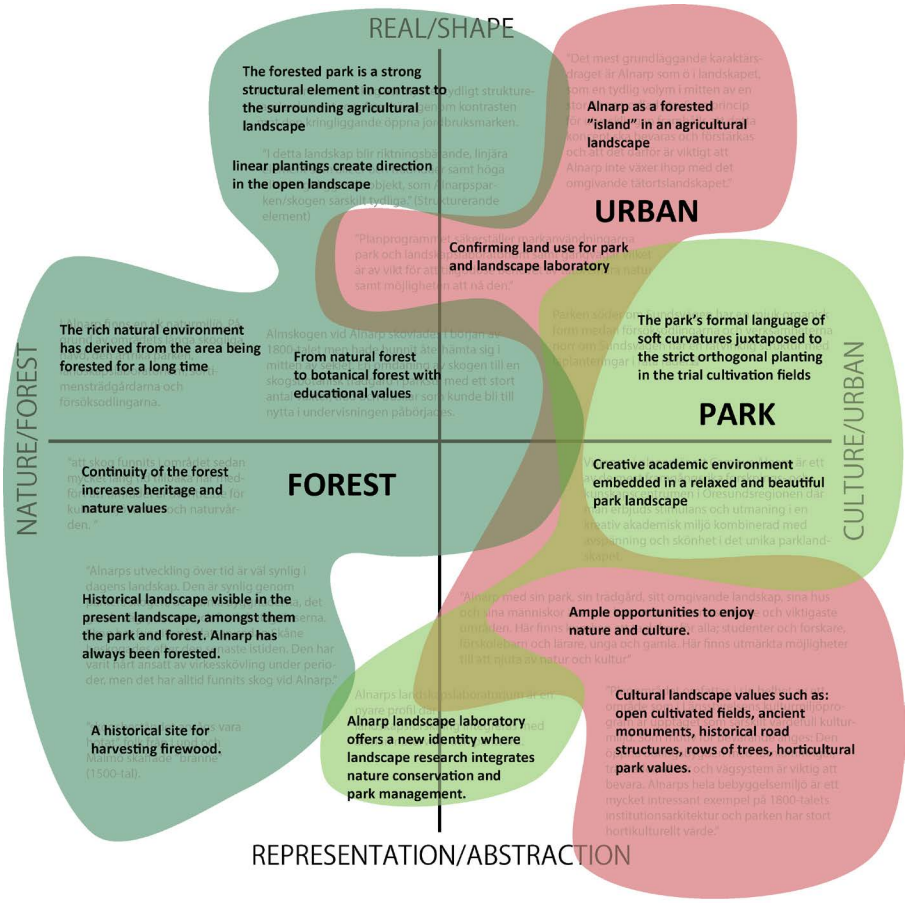

FIGURE 3 Document analysis of the Masterplan by the Lomma municipality reveals a dominating understanding of the campus as a natural and/or a forested site, both in terms of forests as physical objects versus theoretical concepts. The landscape laboratory, which one of the two studied areas form part of, is positioned in the overlap between 'park' and 'urban', with quotes that points toward new hybrid understandings of wooded space. (Image by the Authors)

The park/forest, gardens, the landscape laboratory, testbeds, and experimental farms all contribute to the richness of the 'natural environment' (Lomma kommun, 2016, p. 35). The social values of Alnarp are also apparent when using the search term 'park,' which renders 73 hits. 'Park' is used on several occasions with reference to recreational and outdoor values, in particular for the surrounding towns. But the term is also used to convey spatial characteristics and qualities like 'park landscape,' 'park-like,' or 'park-style.' Searching for 'urban' confirms the area's ecological importance and a place for recreation in an urbanized region. 'City' yields 45 hits, all of which are about housing. Searching for 'urban' returns no hits. 'Culture' yields 63 hits, many of them referencing various documents relating to cultural heritage. In general, the cultural heritage of buildings is separate from that of park/forest. Both are described in the document, and both are understood as equally important, but the lack of connection between the two is evident [fig. 3]. In summary, the analysis of the *Masterplan* reveals a strong attention to aspects related to Alnarp as a forested site, in addition to its value as a green island in an urban landscape. We interpret this as a recognition of the Alnarp Campus as an elusive site with hybrid qualities through the entanglement of forest, people, and cities.

Alnarp Campus Plan by Akademiska Hus

The *Alnarp Campus Plan* highlights the importance of the unique cultural and natural values of the area while still acknowledging that the main focus is on the built environment and not the landscape as a whole. Alnarp is further identified as being situated 'strategically' in an expanding urban knowledge region between the two university cities of Lund and Malmö (Akademiska Hus, 2019, p. 9) while also being close to the coast of Öresund in an area rich with archaeological sites from the Stone and Bronze Ages (p. 10).

Searching for 'forest' results in nineteen hits. The majority of these hits refer to formal names of geographical locations or organizations. A couple of the search results point to Alnarp's long continuity of accommodating forests and the natural and cultural values that they offer. In one case, the contrasting effect between Alnarp's forested silhouette and the surrounding landscape is referred to as a 'landscape architectural feature' (Akademiska Hus, 2019, p. 33, our translation); that is, it is understood as an architectural element of value that impacts the spatial experience.

The park, with its biodiversity, is said to dominate the campus together with the gardens and the surrounding natural land and contributes to its unique beauty and atmosphere. Searching for 'park' yields 81 hits. The results almost consistently refer to Alnarp's historic park environment and the strong identity-creating values it produces. The park is also mentioned as an important meeting place and helps to tie together the otherwise scattered buildings/structures. The importance of the park for recreation is emphasized. Several photographs (p. 12) and a plan (p. 13) highlight characteristic 'landscape rooms' and buildings. While the photographs all contain both vegetation and built objects, the plan only includes information about the location of the park.

The connections and the meeting places provided by the park and cultural environment are emphasized as important for the campus, in addition to the surrounding agricultural landscape. Creating and strengthening functionality, while retaining the qualities of the existing cultural environment, is seen as a challenge for future development (Akademiska Hus, 2019, pp. 26, 34). The fundamental idea put forth in the plan is that the campus' character as a 'green island' is to be enhanced (p. 38), and the environment will be developed to facilitate meetings, knowledge exchange, and buildings that promote SLU and a more sustainable lifestyle (pp. 28, 30).

In summary, the *Alnarp Campus Plan* reveals a strong focus on the campus as a park and less as a forest. The plan emphasizes, in various ways, the values that the green environment contributes to, such as identity, work environment, recreation, and as an armature or connecting tissue for an otherwise fragmented built structure [fig. 4].

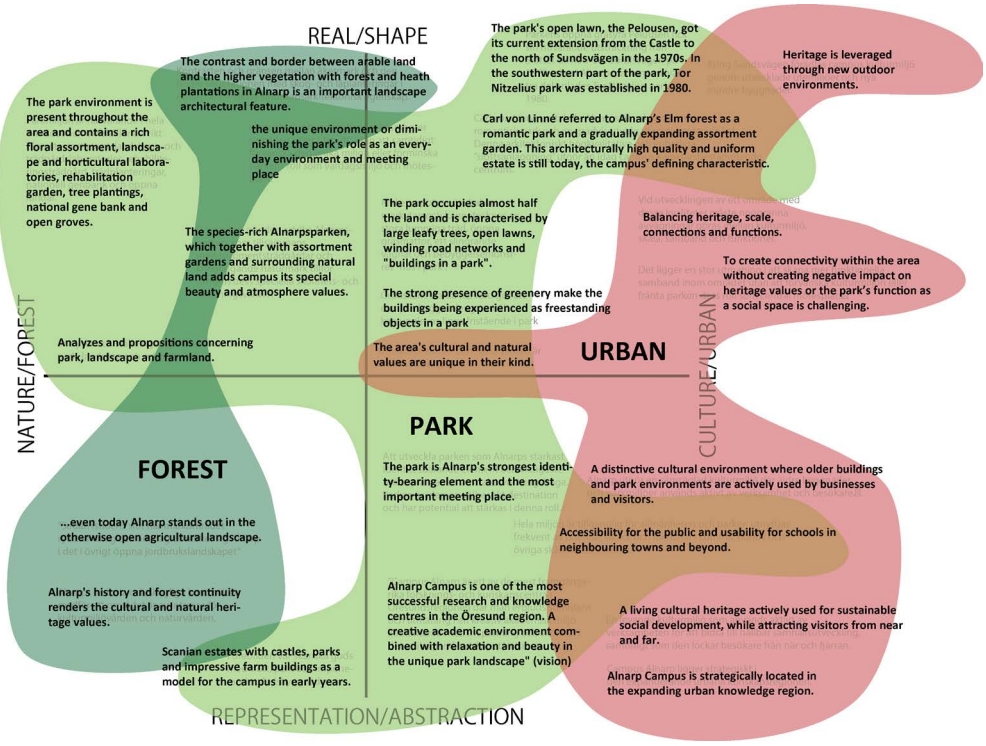

FIGURE 4 Document analysis of the Campus Plan reveals a strong focus on the campus as a park and less as a forested site. The green environment at the campus is argued to be of value for the surrounding communities but also to have a positive impact on the university's identity and reputation. (Image by the Authors)

Desvigne's Alnarp Campus Landscape Analysis and Development Strategy

Michel Desvigne Paysage was granted the commission to study the Alnarp site in 2020. The concept of 'urban' is used in the document when discussing the location of the campus in what is defined as a suburban landscape. Alnarp is identified as being situated 'in the middle of a suburban landscape without a defined identity' (MDP, 2020, p. 6) and the architect concludes that the inner campus is dominated by 'forest,' including the park (40%) and agriculture (40%), while only 20% is occupied by buildings (p. 14). They further argue that the suburban landscape is lacking identity due to its structural weaknesses.

Searching for 'forest' in the document results in ten hits. One of them comments on the fragmented wooded spaces in the nearby villages and towns. The study highlights the campus' edges and emphasizes the experience of the forest from the outside, from the surrounding agricultural fields. The feeling from within includes a strong presence of motorways and various traffic-related noise pollutions. Alnarp as a forested site is leveraged in the vision based on the overall idea that Alnarp is an island in the surrounding landscape, and as such, the forest is vital as a contrast. The forest's structure and spatial experience are elaborated on, as the study is proposing both the forest to be the focal point of the island with a path around it, but also that the forest can offer other spatial qualities, like being immersed in a forest clearing.

Informed by Desvigne, we recognize that there are several different ways, not least scale-dependent, to experience the forest and to exist in relation to it. This suggests that the forest is not only a backdrop in a larger regional landscape or a habitat for valued species but also a structural element that offers a gradient of spatially embedded experiences: a forestscape. In summary, the landscape analysis performed by MDP, in contrast to the other documents, describes the campus and its surrounding conurbation as lacking identity. In addition, the focus is on the forested environment from an explicitly spatial perspective [fig. 5].

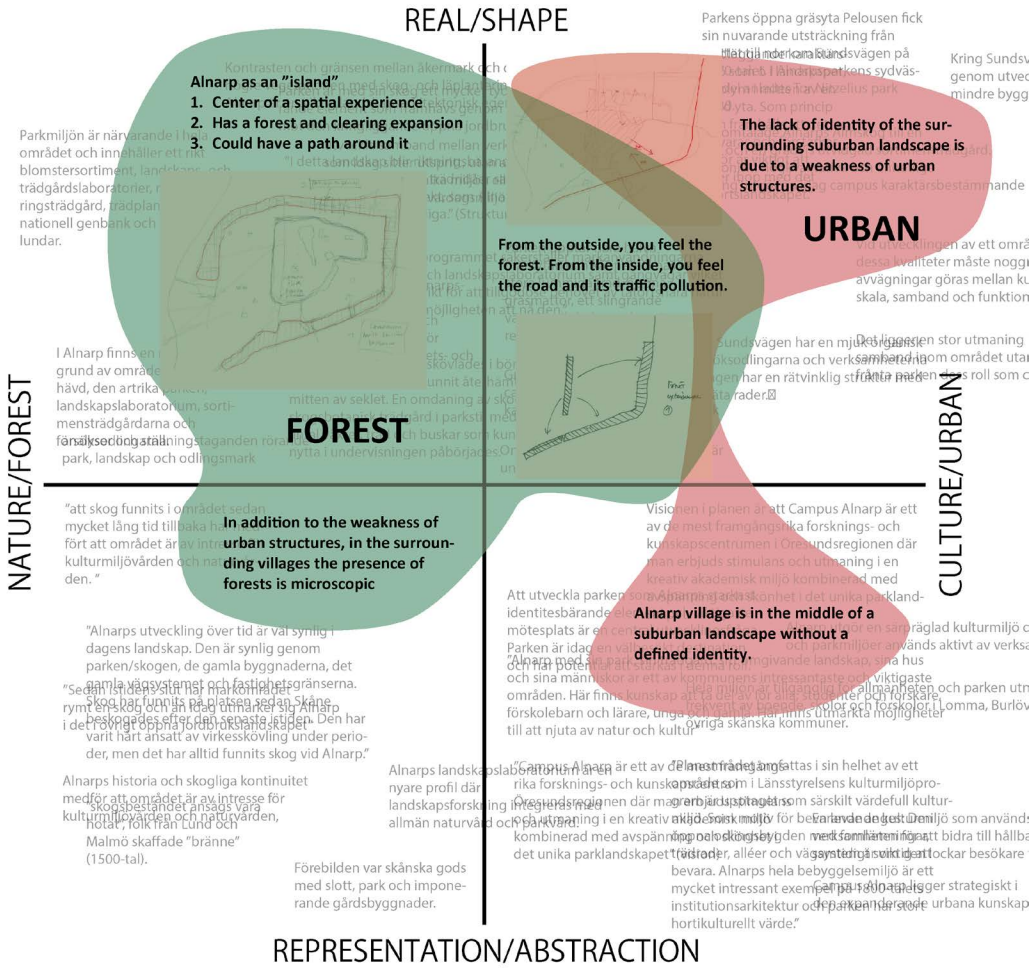

FIGURE 5 Document analysis of the Landscape Analysis reveals that the analysis mainly focusses on the campus area as a (forest)scape with a few comments on the surrounding built landscape. (Image by the Authors)

The Fieldwork: Alnarp Forestscapes in Physical Reality

To further explore our understanding of urban forestscapes, we decided to step out of representation and into the real world, into what we speculate could be understood as forestscapes: the ALL. Fieldwork included several visits to the two wooded areas on campus that are referred to as 'forests' in maps, plans, and literature: Alnarp Västerskog and Magnoliaskogen (Gustavsson et al., 2023b; Akademiska Hus, 2019). Within the two areas, we identified our two sites [fig. 6], where we decided to deploy our fieldwork. These sites were visited three times during a time span of almost eight months, from early April to late November.

FIGURE 6 An overview of the inner campus with the Tiny Pear Patch (1) and the Magnolia Woods (2) outlined in red. (Image by the Authors; ortophoto by Lantmäteriet 2023)

Comparing the fieldwork to our previous research activities, we acknowledged an apparent strength in the human scale provided by being in the landscape that the document analysis lacks. While the 1:1 scale offers a certain experience of a site—and the aerial view offers another scale of a top-down planning perspective—the scalar gradient in between is much more challenging to represent. Indeed, we found that the concept of urban forestscapes can enable new/different approaches to perceiving different sites through our actions in and interactions with it (European Council, 2000). Thus, by looking for 'what a particular concept may *mean*, we have gained insight into what it can *do*' (Bal, 2002, p. 11, emphasis in original).

The Tiny Pear Patch

We walk through dense plantations of birch trees. The white stems flicker like barcodes. When the mix of species changes, and we start to see traces of human interaction, we know we are getting close. The tiny patch is a stronghold disconnected from the larger plantation by a six-metre-wide setback. We push our way through the dense stand that demarcates the perimeter of the tiny patch and are embraced by neatly ordered stems. This time, we look upward towards the sky through the atrium-like opening in the canopy, a perfect square of trees intersected by a cylinder of light. Another visit. Fall. This time, the floor of the patch catches our attention. Pears everywhere in various degrees of decomposition. The first impression of the site, dominated by its geometry, has been transformed into an experience of living matter.

FIGURE 7 Top: Plantation system and profile diagram showing the character of the site. Middle: The Tiny Pear Patch can be found at the north-western corner of the campus, in the northern part of the Landscape Laboratory (Alnarp Västerskog). Bottom: The seasonal changes affect how the -scape is experienced (From left to right: spring, summer, autumn and winter) where the presence of the surrounding agricultural landscape (north and west) is the most prominent influence. (Image and photographs by the Authors; ortophotos by Lantmäteriet 2023)

The 360m^2 pear patch is situated in the north-western part of the campus and the western part of the landscape laboratory commonly referred to as Alnarp Västerskog and consists of Common Pear (*Pyrus communis*) trees planted in 1998. The choice of species was made partly as a homage to the nursery school that was situated in the area up until 1993 and also as a design choice, where similar relatively small monoculture squares, like floating islands in the bigger system of stands, can be found.

The patch has a clear outside and inside, which can be experienced both from within the patch and from the outside. The relationship between the patch and its surroundings is distinct, with a small but clearly outlined grass-covered void surrounding it on two sides, east and south, while the agricultural fields are spread out to the north and the west. There has been little to no maintenance in the stand other than a thinning that was performed as part of a student course in 2020, where approximately five trees were removed from the very centre of the patch, creating an atrium-like room that can only be experienced if one is on the inside. The atrium posits an example of an 'interior room' (Gustavsson et al., p. 107), opening up the patch vertically and inviting the sky in [fig. 7]. The lack of formal entrances makes it easy to miss. The 'floor' is sparsely covered with grass and moss. In fall, it is full of fallen pears. The unutilized harvest of this stand amplifies the patch as an artefact with values beyond its horticultural production. Indeed, the contribution of the patch consists of bloom and beauty, and fruit for visitors both human and 'more-than.'

Situated anonymously at the very edge of the landscape laboratory, it is not evident why anyone would have a reason to visit. The scale of the patch and its apparent hostility from the outside also contribute to keeping visitors from ever really being engulfed in the patch. One might say it is a very architectural place. A scape. Experiencing 'The Tiny Pear Patch' contributes to our understanding that urban forestscapes do not need to be clearly defined when it comes to the diversity of species, dimensions, or scale.

The Magnolia Woods

Sloping slightly downhill, the gravel road runs along the hawthorn hedge that delimits the original extent of Alnarp Park. In the park lurk majestic oaks and beeches, their branches reaching far above us. The Magnolia Wood is located across the road as an elongated stripe of dense vegetation. Beyond it is the motorway. We access the thick vegetation through a garden gate—how peculiar to enter a wood through a gate. We stay on the meandering paths; anything else would be impossible due to the flamboyant greenery. Field layer, bush layer, canopy layer. Everything seems to grow out of control. Are the gates protecting the wood from us or us from the wood? A glade makes us exhale, almost with relief. A perfect circle with benches and a few free-standing trees offering shade contrasts with the sound from the motorway. How different our summer visit is to our previous visit. In spring, the ground was quiet, but the sky was full of lavish magnolia blossoms. This wood shows off during all seasons.

The first phase of Karl-Evert Flinck's Magnolia Wood ('Magnolia Woods,' for short) was established as a 1.2-hectare standalone extension of the Alnarp Landscape Laboratory in 2007, with two main foci in mind. The first intention was to develop a wide array of new and unique Magnolia hybrids previously untested in a northern European setting, and second, to present Magnolias in a—from a horticultural point of view—unfamiliar way, in a woodland vegetation system rather than as solitaire trees, mimicking their natural habitat (Gustavsson et al., 2023b; Sjöman et al., 2023).

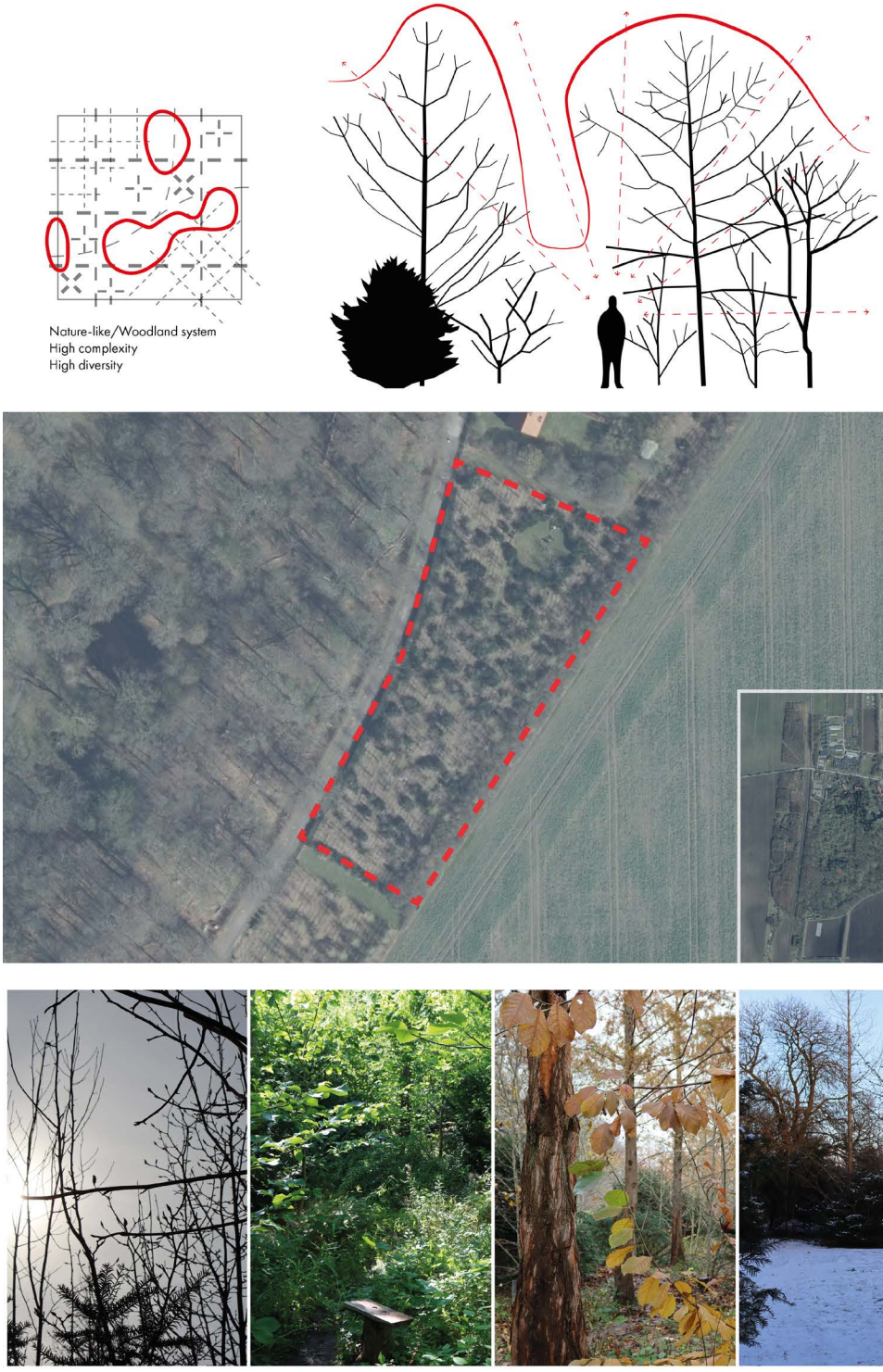

FIGURE 8 Top: The complex woodland system and profile diagram of the site. Middle: The Magnolia Woods is situated at the south-eastern edge of the campus, only separated from the park by a small gravel road Bottom: The seasonal changes affect how the -scape is experienced (from left to right: spring, summer, autumn and winter), especially the sense of diversity, the multi-layered aspects of the vegetation, and the presence of heavily trafficked roads both to the south and to the east (E6). (Image and photographs by the Authors; orthophotos by Lantmäteriet 2023)

In addition to the Magnolias (*Magnolia var.*), Hybrid Larch (*Larix* × *marschlinsii*), Dawn Redwood (*Metasequoia glyptostroboides*), and Pedunculate Oak (*Quercus robur*) were used as nurse trees, which 'will be gradually removed in order to give the magnolias more space to develop…' (Sjöman et al., 2023, p. 300). Some will remain as protection against frost and wind. There is also a smaller proportion of yew (*Taxus baccata*), whose evergreen contributions become especially distinct during the winter season.

There are no real 'interior rooms' (Gustavsson et al., 2023a, p. 107) inside the forest as of yet, other than the big round grass lawn, which is situated close to the northernmost entrance. A sense of wilderness is much more present during visits from late spring to early autumn because of the lush and layered vegetation. The site is experienced through a walk either from the northernmost to the southernmost entrance, or vice versa, which slightly limits how it can be approached and appreciated. It is easy to get to, but the 'Magnolia Woods' itself is not easily accessible, depending on the physical functioning of the visitor, weather/season/time of year, etc. The variety of species contributes to the impression that this is very much a site in an ongoing process, that it can be revisited continuously, and that the experience will change over time [fig. 8].

Experiencing the Magnolia Woods adds to our understanding by suggesting that urban forestscapes are not only about their location, dimensions, or mix of plant species. The atmosphere—influenced by such diverse facets as motorway noises, inaccessible vegetation, and excess blooming—adds to the experience of the wood as part of a commodifying culture of urbanity. Hence, experiential aspects must be considered part of an emerging definition of the concept of urban forestscapes.

Conclusion

Guided by our research question on what synthetic understanding of urban forestscapes we can extract from literature studies, document studies, and fieldwork, we put forth a theoretical and an experiential aspect. Through the literature study, we conclude that the concept invites interdisciplinary knowledge exchange and production if we recognize that it can be seen as a shared concept of forest- and landscape-related disciplines, with their etymological and/or disciplinary *heimaten*, respectively. Our fieldwork added to the understanding of the concept by clearly pointing towards the insignificance of numeric data otherwise common in sustainability agendas.

The second part of our research question on how to study forestscapes emphasized spatial and experiential qualities and validated the importance of dynamic qualities. Integrating time-based aspects in an interdisciplinary study also poses the challenge of representing four-dimensional and 1:1 scale. The intended method for documenting our fieldwork, a matrix, turned out to be too static, lacking the necessary complexity to capture and communicate our experiences. It turned out to better communicate the result of the document analysis.

In conclusion, we find that the concept's usefulness lies in what and how it allows us to 'designerly' approach spatial and experiential qualities of the landscape in which it is embedded. It invited us to reconsider the activities and techniques for fieldwork, literature, and document studies that were continuously developed and applied. The trial and error of our search for urban forestscapes in literature and in the physical reality of the Alnarp Landscape Laboratory led to previously unidentified research methods, questions, perspectives, and insights. It prompts future research into the question of how to represent dynamic qualities of landscapes, in particular urban forestscapes, and their socio-ecological and spatial processes.

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Co-creating Flemish Forestscapes

A New Practice

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Abstract

The paper explores the implementation of the afforestation programme in Flanders since 2019. Framed by the authors' situated knowledge, it recounts the diverse strategies and tools of the programme, aimed at realising 4,000 hectares of new forests by 2024. With a focus on collective and systemic efforts, the paper outlines three operational domains to analyse the coalition-building process at regional and local levels: setting the institutional space, infrastructuring afforestation in spatial practice, and tailoring design tools for urban forestscapes. It explains how, beginning with the creation of the regional Forest Alliance coalition, a set of policies, soft power mechanisms, and designs have been promoted to accelerate the realisation of (sub)urban forest projects. In doing so, the article proposes a discussion on the forest metropolis as a contextualised cultural project, capable of aligning forest policies with urban forestry initiatives, as well as converging the urbanisms of territorial and domestic spheres, and positioning designers as crucial interfaces between these diverse realms.

Keywords

Afforestation programme, Flanders, forest urbanism, urban forest typologies, landscape architecture, spatial agency

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Introduction

The paper examines the implementation of the afforestation programme in Flanders since 2019, drawing insights from extensive case study research. The authors have assumed varied roles within the programme's development, serving as a policy advisor responsible for overseeing its execution, and a designer and academic collaborating closely with the programme. Informed by the authors' situated knowledge (Haraway, 1988), the paper presents and analyses the evolution of the programme's actions and processes, focusing on the collective and systemic efforts.

Central to this exploration is a fundamental hypothesis: the afforestation project in European urbanising territories necessitates convergence mechanisms across intellectual, technical, political, socio-economic, and natural dimensions. It compels us to bridge the gap between forest policy and urban forestry, both in practical implementation and as an academic discipline. Additionally, we assert that the evolving governance and design paradigms of co-creation and landscape offer essential perspectives for effectively narrowing this divide. To this end, the paper presents the diverse levels of co-creation and landscape design integral to the programme's evolution, by conceptualising it in three primary operational domains.

- **Setting the Institutional Space for Afforestation**: This section investigates the initial phase of the programme with the formation of a regional entity termed the Forest Alliance, built around the programme's quantitative objectives and associated generic tools and implementation strategies. In this stage, the groundwork for a multi-level governance structure and culture conducive to urban afforestation is laid. This involves mobilising key stakeholders from the public, private, and environmental sectors, aiming to converge their knowledge, capacities, and enterprises toward a singular objective: fostering more forest in Flanders.
- **Infrastructuring Afforestation in Spatial Practice and Coalitions**: The dynamic interaction between the regional afforestation programme and sub-regional spaces is introduced. The programme's trajectory shifts towards recognising localised areas and area-based processes as opportunities to reinforce the afforestation effort and organise it around the quality question in spatial development and landscape design.
- **Tailoring Design Tools for Urban Forestscapes**: This section delves into the programme's most recent stage, focusing on the development of a distinct urban forest typology. The typological approach unveils and elaborates on a series of challenges inherent to Flanders' urbanization culture, which afforestation must urgently address. It aims to stimulate further debate and afforestation initiatives from the regional to the domestic sphere and private gardens, presenting design(ers) as the interface bridging these divergent yet interconnected realms.

Flanders as a Context: Understanding Cultures of Spatial Production

Since the beginning of its mandate in October 2019, the Flemish Government has aimed to create 4,000 hectares of new forests and woodlands by 2024, with a larger vision of achieving 10,000 hectares by 2030 (Vlaamse Overheid, 2020). This afforestation policy serves a dual purpose: fortifying existing natural assets in Flanders' urbanized landscape and responding to the growing demand for both social services and ecological welfare (Gobbato Liva & Migotto, 2024).

Albeit the pandemic and climate crises have accelerated social and ecological motivations, the objective of expanding forests is not at all new in Flanders. Afforestation has lingered on the political agenda for decades, but its implementation reached a deadlock. Annual afforestation efforts were limited to around 60 hectares, insufficient given also the substantial deforestation taking place without adequate compensation. Forest inventories revealed a consistent forest area of approximately 140,000 hectares in Flanders from 2000 to 2020, maintaining a stable forest index of 10.3% (Govaere & Leyman, 2022). Flanders stands out as one of Europe's least forested regions, with urbanization posing a significant threat to natural habitats (European Union, 2019).

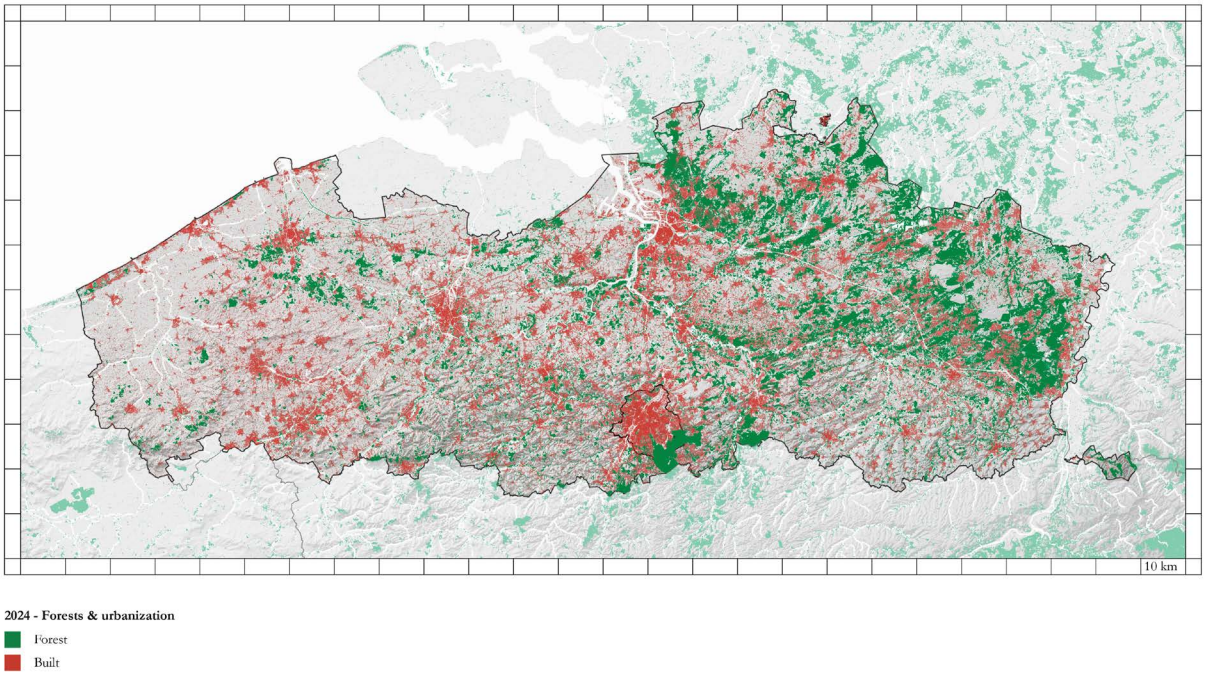

FIGURE 1 *Forests & urbanization in Flanders.* The Flemish 'nebular city' stands out as one of Europe's least forested regions with the highest soil sealing and land take rates. (Image by Federico Gobbato Liva, Andrea Migotto, 2024)

This situation is unsurprising in one of Europe's most fragmented and densely populated territories, where urbanization places ecosystems and land availability under intense pressure [fig. 1]. Decades of neoliberal planning have turned the Flemish territory into a chaotic urban landscape characterised by private land ownership models of small parcels, unregulated sprawl of low-density dwellings, intensive agriculture, and widespread road infrastructure. This has led to the privatisation and fragmentation of both urban and natural landscapes (De Meulder et al., 1999). Observing the woodlands, the average size of forest and nature clusters in Flanders is less than 1 hectare (Schneiders et al., 2020). Additionally, 60% of Flemish forests are on private land, managed independently of the public Agency of Nature and Forest (ANB), limiting the impact of habitat management and public regulations (Govaere & Leyman, 2022).

What is commonly called the Flemish 'nebular city' describes the morphological structure of sprawl and the horizontal urbanization of Flanders (Dehaene & Loopmans, 2003). However, the term 'nebular city' or 'sprawl' befits not only Flanders' territory but its governmental landscape as well. Since the 1970s, the Flemish Government has engaged in a continuous process of internal organization reform following a dispersed and sectoral tradition (Voets & De Rynck, 2006). This compartmentalisation resulted in a

fragmented relationship between the Flemish Government and institutions operating at the local scale, with each governmental agency designing its regulations, procedures, and financial schemes independently to support local projects (Pelgrims & Hondeghem, 2003; Putsey et al., 2003). The scarcity of land intensified competition between government agencies, often leading to unintended consequences such as land-price inflation and resource-intensive processes (De Rynck & Janssens, 2023).

The afforestation programme, from its early stages, had to grapple with these contradictions. It necessitated a cohesive multi-level governance structure to support quantitative and qualitative procedures for securing land and implementing afforestation initiatives, while also navigating dispersed institutional and spatial realities. To tackle these objectives in a region characterised by urban sprawl and with limitations in coordinating sectoral policies with the local level, a process of co-creation has been initiated. In this process, top-down policy and soft power mechanisms were conceived, designed, and jointly executed to strengthen cooperation across governance levels, governmental and non-governmental actors (Carmona et al., 2023).

Setting the Institutional Space for Afforestation: From a Quantitative Agenda to the Creation of the Forest Alliance

In pursuit of realising 4,000 hectares of new forests by 2024, the Flemish Minister of Environment and Spatial Development initiated an ambitious programme, necessitating a tenfold acceleration in forestry initiatives compared to past legislations. While deemed feasible (Departement Omgeving, 2018), achieving this goal demanded a systemic shift in collaboration methods across public administrations and a broad spectrum of involved organisations and actors. Moreover, it required the development and systematisation of tools to support programme governance and implementation.

Setting up a Co-creation Pathway

To lay the foundation for the afforestation programme, four key governmental agencies, namely the Department of Environment & Spatial Development (OMG), ANB, the Research Institute for Nature and Forest (INBO), and the Flemish Land Agency (VLM), were tasked in 2019 with creating a draft document and to unite into a joint taskforce under the auspices of the Ministers' Cabinet. It was a careful move away from entrenched compartmentalised modus operandi, aimed at fostering the exchange and consolidation of knowledge, instruments, and resources among the administrations.

ANB, as the principal owner of nature areas in Flanders, brings substantial expertise in forest policy and management, (financial) instruments, and field presence. Paired with VLM's role in rural development policy, the programme leveraged legal means such as Flemish land banks for land transactions critical to accelerating forest projects. INBO contributes scientific rationale and research, while OMG facilitated the joint taskforce setup and maintains a facilitator role through integrated design and planning.

Launch of the Programme as a Collective Effort

The official launch of the programme in spring 2020 was marked by negotiations with civil society and the extension of the taskforce to key players in Flanders' forestry. This collective effort involved stakeholders such as BOS+, Bosgroepen (Forestry Groups), Natuurpunt, Landelijk Vlaanderen, and representatives of municipalities and provinces. An agreed-upon partition of the afforestation targets and a strong political and financial commitment from the Flemish minister were the outcomes of these negotiations (Vlaams minister van Omgeving Zuhal Demir, 2019).[1]

To reinforce cooperation among these governmental and non-governmental actors, several partnership tools and mechanisms were implemented. In the first year, a neutral agent, 'Bosintendant', was appointed to coordinate and build trust within the partnership, soon officially named the Forest Alliance (Bosalliantie). A charter agreement clarified roles, and multiple tools for internal knowledge sharing and process coordination were established.

The Forest Alliance then implemented a series of joint strategies and tools, focusing on aspects from mobilising society through communication campaigns or awarding Forest Labels (Bosalliantie, 2020), to securing planting stock, removing legislative barriers, or installing user-friendly procedures (Agentschap Natuur en Bos, 2020). Most importantly, subsidies have been significantly augmented to encourage the planting of new forests on suitable land. Also, a comprehensive set of procedural and financial tools has been employed to catalyse land acquisition for afforestation. A pivotal component was the establishment of a new Land Bank specific to the programme. The VLM thus could systematically undertake land purchases and transfers, also addressing medium-term afforestation after land exchanges or the expiration of agricultural lease contracts (Vlaams Pachtdecreet van 13 Oktober 2023). Finally, the Forest Alliance has a unique monitoring system, accessible at bosteller.be, to transparently track newly planted forests, forest compensation, as well as the surface area of land secured for future afforestation.

Infrastructuring Afforestation in Spatial Practice and Coalitions

Moving beyond the initial phase, where internal governance and essential tools for a collective quantitative effort have been the focus, it became increasingly important to emphasise the qualitative aspects of forest development. The programme document already drafted general objectives and strategies in this regard (Vlaamse Overheid, 2020). Besides an emphasis on native and climate-smart forest qualities, a major concern has been to improve Flanders' overall forest structure and thus to yield the optimal location of the new forests.

1 The negotiation resulted in an agreed indicative partition of the quantitative afforestation targets, assigning specific goals to various entities, including Flemish (1,250 hectares) and local governments (750 hectares), nature conservation associations (750 hectares), Forestry Groups (750 hectares), and private landowners (500 hectares). The Flemish minister demonstrated strong political engagement by underpinning these ambitious goals with financial support (120 million euros) (Vlaamse Overheid, 2020).

Among the targeted strategic locations, expanding existing forest and nature complexes has been the most successful strategy for establishing new forests so far. This sector-based approach benefits from well-established practices and financial mechanisms. It follows a logic of land acquisition, ownership, and long-term agreements between the Flemish government (ANB) and nature organisations, which both own most large nature units in Flanders (Vandekerkhove, 2013). Strengthening existing ecological areas has thus effectively met quantitative goals, with ANB creating about 950 hectares of new forests since winter 2019, and nature organisations adding 400 hectares (Agentschap Natuur en Bos, 2020).

Other afforestation practices are harder to implement. Initiatives to reinforce valleys as green-blue networks, connect small forests, or create accessible forests near (sub)urban centres would require more careful integrated planning focusing on landscape quality. Potential locations lay dispersed in the Flemish territory and interface with multiple other land uses. These efforts face challenges like fragmented ownership and equally complex negotiations, and the varying needs and intentions of non-forestry sectors and specific localities.

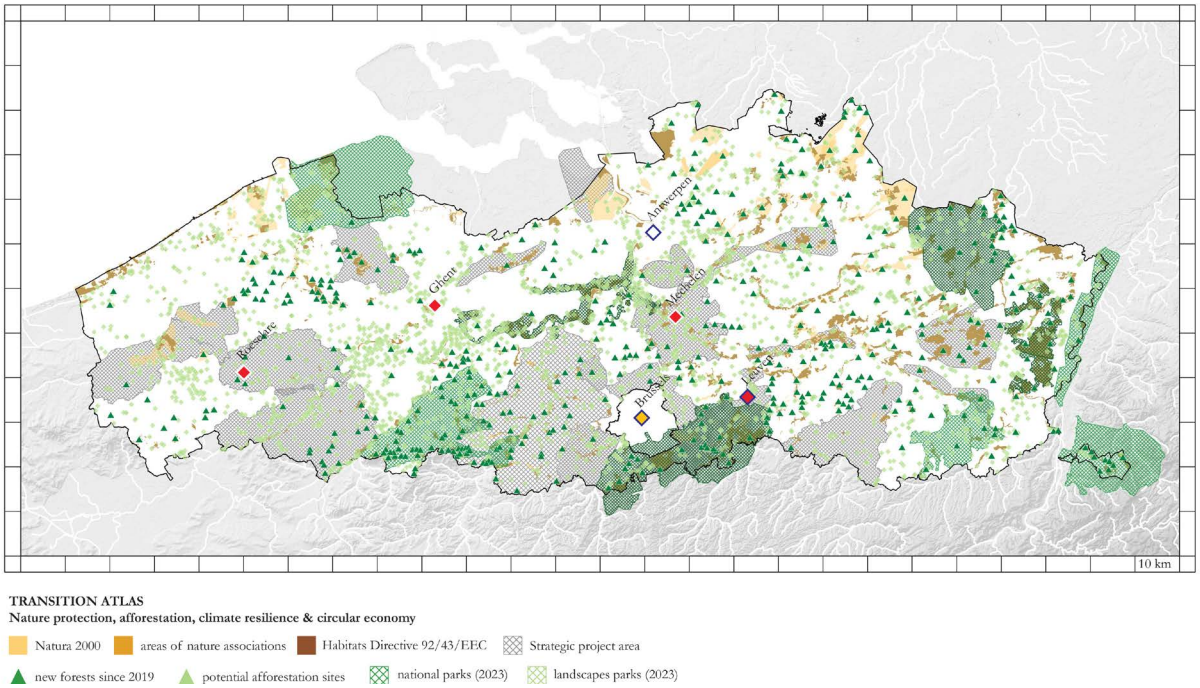

FIGURE 2 *Transition Atlas*. The map shows the main nature protection and afforestation initiatives. The afforestation projects proposed since 2019 are presented in green, showing extended initiatives throughout the region. In addition, designated national and landscape parks along with ongoing area-based processes are identified as fertile ground for afforestation projects to grow. (Image by Federico Gobbato Liva, 2024)

To spur afforestation projects on these less obvious but no less important locations, strategies and tools have been developed for mobilising capacity within ongoing area-based processes [fig. 2]. Especially processes facilitated by the Flemish Government have been targeted, such as Strategic Spatial Projects and Territorial Development Programmes by OMG or Land Development Projects by VLM (Department Omgeving, 2024b; VLM, 2024). These processes take years to decades of government collaboration to implement integrated spatial strategies. During this time, coalitions obtain significant area-based knowledge and project capacity. The intention was therefore twofold: getting afforestation on the highest agenda of these ongoing area-based processes and infrastructuring cooperation mechanisms (Björgvinsson et al., 2012) in favour of afforestation among actors in a much more localised and operative setting.

A first evident tool for setting the agenda and identifying priority areas is the shared GIS database, which maps afforestation potential in Flanders. This analysis highlights afforestable lands within the Natura 2000 network and green designations, introducing regional landscape quality based on existing spatial frameworks. In addition, an in-depth review of the implementation rate of spatial plans, nature directives, and city forest policies identified locations with unmet afforestation objectives – once decided upon but never executed. For these priority areas, additional landscape design and vision-building trajectories are being activated to qualify potential afforestation sites and speed up implementation and coalition building.

The Case of the Dender River Basin

In 2020, the Dender River basin emerged as a significant priority, with an estimated 730 hectares of outstanding afforestation objectives and circa 450 hectares of unrealised wet nature targets. These figures prompted the establishment of a new trajectory to accelerate the implementation of green-blue infrastructure in the area with afforestation as one of its main components. The Territorial Development Programme (T.OP) Dender, an ongoing initiative coordinated by OMG and the province in collaboration with nine municipalities along a 40-kilometre stretch of the river, provided the essential framework (Department Omgeving, 2024c). ANB agreed to strengthen its partner role in this programme, jointly pulling off the green-blue trajectory and scaling up its regular nature development activities in the area.

Landscape research and design, operating at various scales, have been instrumental in supporting the partnership's perspective on qualitative green-blue transformations. The river basin saw the drafting of an overall green-blue structural vision and implementation plan, while on the smaller scales, the designs of a dozen local projects demonstrate integrated ambitions and secure funding. Ongoing projects exemplify a range of integrated strategies, such as combining erosion measures with water buffering and afforestation to expand an existing urban forest, or wetland restoration coupled with sewage works, surface rainwater drainage, and the creation of new valley forest (Department Omgeving, 2024d).

The spatially nested green-blue infrastructure designs interestingly addressed afforestation objectives alongside the typical water challenges of the river valley [fig. 3]. Forests in this sandy-loam region serve as effective buffers against floods and drought by retaining water. Landscape design thus played a crucial role in integrating diverse conditions into multifunctional design proposals and navigating between scales and coalitions at each level. Through this approach, investments reinforce one another, multiply, and afforestation became a logical component to be considered in any green-blue project.

ANB and the local nature organisation also heightened their regular nature development efforts, creating 45.86 hectares of new forest in the T.OP Dender focus area using additional resources from the afforestation programme. They expanded green-blue infrastructure by acquiring land for new forests, particularly in lowlands and riverbanks near existing forests. While causality remains uncertain, the results suggest that intensified collaboration, along with landscape design and the tools from the afforestation programme, have been a catalyst for afforestation initiatives in the Dender focus area. Afforestation rates have doubled compared to the Flanders average, with local authorities playing a significantly more active role.

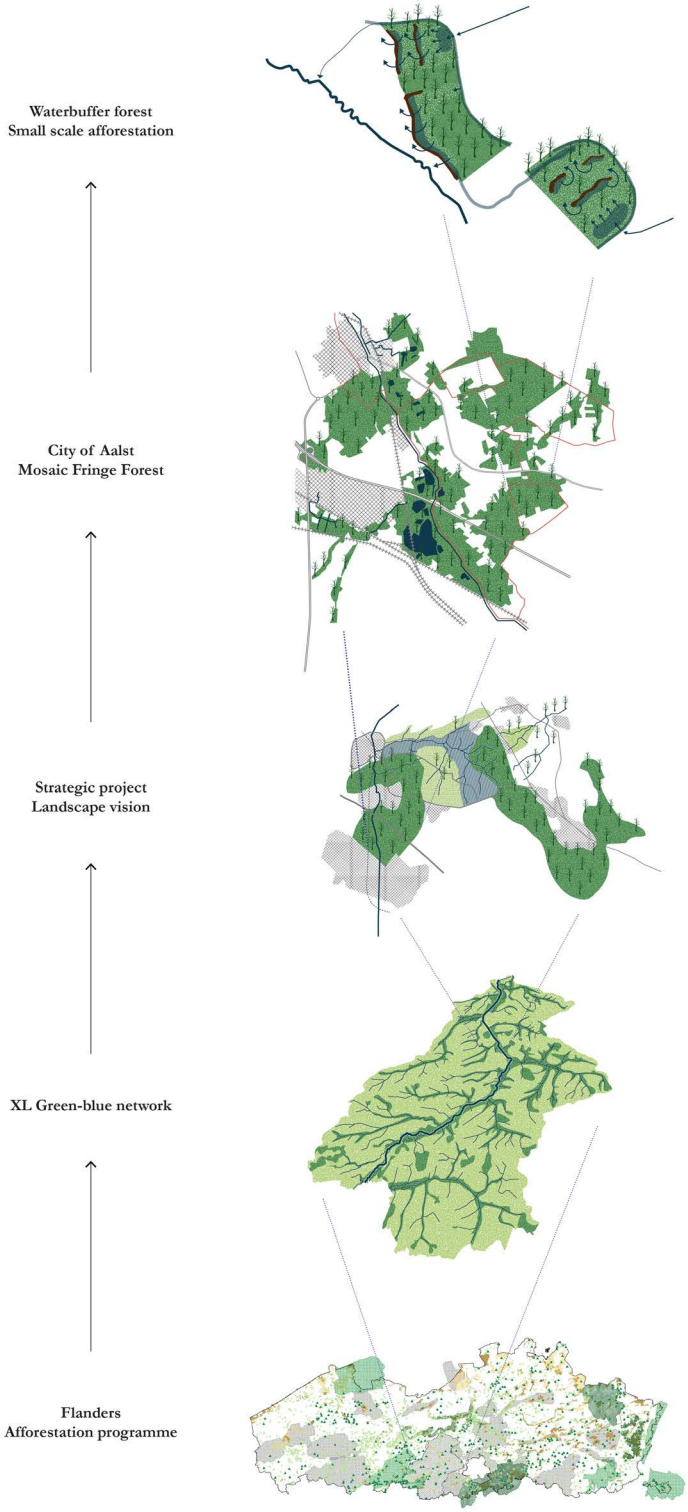

FIGURE 3 *A project of projects.* The drawing illustrates the integration of forest and water design across various scales within the area-based development project in the Dender river basin. It highlights the interconnectedness between the green-blue network programme at the river basin level, the landscape vision realised through a strategic project coalition, connecting Aalst with neighbouring urban centres, down to the city of Aalst's efforts to develop a mosaic fringe forest with one of its recent afforestation initiatives: a small-scale waterbuffer forest. (Image by Federico Gobbato Liva, re-elaboration from T.OP Dender, 2024)

Agency of Landscape Design

As the Forest Alliance engages in area-based strategies, the level of co-creation becomes more specific, also presenting a broader spectrum of challenges and potential conflicts. While alliances primarily involved actors from the forestry sector at the regional level, aimed at fulfilling quantitative objectives, the scope has now expanded to include municipalities, provinces, citizens, landowners, and farmers within integrated projects where afforestation plays a central role. A mediating perspective centred on landscape quality has become crucial for integrating ecological and technical parameters, ecosystem thinking, climate adaptation, as well as time and spatial concepts to shape the interaction between forests and localised urban transformation processes. Similarly, urbanists and landscape architects now act as facilitators and mediators, enabling active participation. They use design and scenario-building techniques to orchestrate empowering dialogues and negotiations among stakeholders, expanding their agency beyond mere design outcomes (see Figure 4).

FIGURE 4 *Urban-forest dialogues.* Looking from the urban towards the forest, a mediating perspective centred on landscape quality is crucial for effectively integrating diverse challenges and potential conflicts associated with land use and the stakeholders involved. (Image by Federico Gobbato Liva, Andrea Migotto, 2023)

In this context, design practices go beyond envisioning or unveiling novel local environments with forest tactics. They become a means to test the Forest Alliance's tools for organising coalition interactions at various scales. By focusing on landscape qualities, the afforestation programme has evolved into a stewardship of design activities, serving as a process for 'infrastructuring' a common practice that situates afforestation within diverse settings, such as river valleys and agricultural plateaus (Bjögvinsson et al., 2012).

Tailoring Design Tools for Urban Forestscapes

The area-based approach to forest projects has injected fresh perspectives into multifunctional land use, forest concepts, and stakeholder engagement, all of which are now integral components of the afforestation programme. A pivotal challenge lies in enhancing the participation of local authorities in public afforestation initiatives, traditionally overseen by the Flemish government and nature organisations. It has been essential to demonstrate to local authorities the positive impact of forests on the quality of life for citizens and the resilience of their territories to climate change. Securing land for new forests poses another critical hurdle, for which the potential availability of land on the (sub)urban interface came into focus. Local authorities have substantial land ownership, estimated at approximately 7,000 hectares suitable for afforestation, particularly within built environments. Moreover, aligning with the Flemish Spatial Policy Plan's objective to achieve 'no net land take by 2040' (Bouwshift) (Cabus, 2018), approximately 30,000 hectares of surplus land, created in the 1960s and 1970s, awaits repurposing for nature or agriculture (Departement Omgeving, 2018).[2] Shifting focus from agricultural land to restructuring the built environment through future forest-urban projects presents a potential solution. To harness this opportunity and encourage the involvement of local authorities in afforestation, the Forest Alliance is intensifying its efforts to conceptualise (sub)urban forest environments.

The implementation of multifunctional forest types, as observed in the Dender River Basin case, has however highlighted a gap between urban forestry discourse (Borelli et al., 2023) and the culture of design practice. By addressing spatial design processes through landscape forest figures, the relationship between detailed forest knowledge and dispersed urbanism in Flanders remained untackled. While academic research has explored the morphological aspects and typological potential of forest-urban interfaces (De Meulder et al., 2019; Wambecq, 2023), a more accessible and systemic catalogue was needed to operationalise this knowledge. Such a catalogue should facilitate experimental reflection and convey design tools to integrate forests with other components of the landscape metropolis, including housing, private gardens, industry, infrastructure, water streams, and agriculture. Addressing these elements could enrich the afforestation programme by reversing the gaze, not only from outside to inside or from the forest towards the urban (as inherited from the initial quantitative approach) but also by considering the urban environment's viewpoint toward the forest.

Initially, a systematic categorisation of various multifunctional tree-rich infrastructures from diverse spatial projects was undertaken, resulting in the compilation of 30 forest and urban green structure types. The purpose of this collection was to foster dialogue among the different stakeholders involved in the programme, including public administrations, designers, and technical experts, thereby stimulating the realisation of pilot projects (Bos+ et al., 2021). Stemming from interdisciplinary debate and collective experiments, the primary objective evolved into constructing a shared knowledge base on the 'multifunctional potentiality' (Carlisle et al., 2014) of especially the most forest-like categories: an operational guide for implementation, management, and the cultivation of new cultural understandings regarding forests in urbanizing areas. To this end, a second assignment coordinated by the Forest Alliance yielded a more accessible guide in the form of graphic novels (Department Omgeving, 2024a; Programma Meer Bos voor Vlaanderen!, 2024). These novels gather and represent specific insights and qualitative

2 Approximately 30,000 hectares of undeveloped land designated in the 1960s and 1970s for 'hard' development such as infrastructure, housing, and industry, are now considered unsuitable for further development to achieve no net land take by 2040. The current land use, including agriculture, fallow land, and wilderness, will be reassessed to align with priority objectives such as water management, afforestation, nature development, and (local) agriculture. Claiming this open land partly for afforestation poses fewer conflicts compared to, for instance, land designated for agriculture, particularly as it is often more fragmented and scattered within urbanized areas.

aspects of Forest Types. Summarised through the following points, this graphic elaboration presents the state of the art in tailoring design and co-creation tools for novel practices of Forest Architecture in Flanders.

Re-sourcing an Architecture of Trees (Leonardi & Stagi, 1982)

In support of the Forest-Ecogram of Flanders (Ecopedia, 2023) and the list of indigenous tree species for new forest plantations (The Council of European Communities, 1992), each tree's physical characteristics are synthesised through pictograms. Seasonal variations in canopy colours, growth dimensions, and flowering and fruiting cycles are represented [fig. 5]. These arboreal traits have a direct influence on the environment they construct and their symbiosis with the subjects that inhabit it. Impacting factors like scents, shade, and edible fruits are thus qualities that become available in a dialogue between designers and more-than-human users.

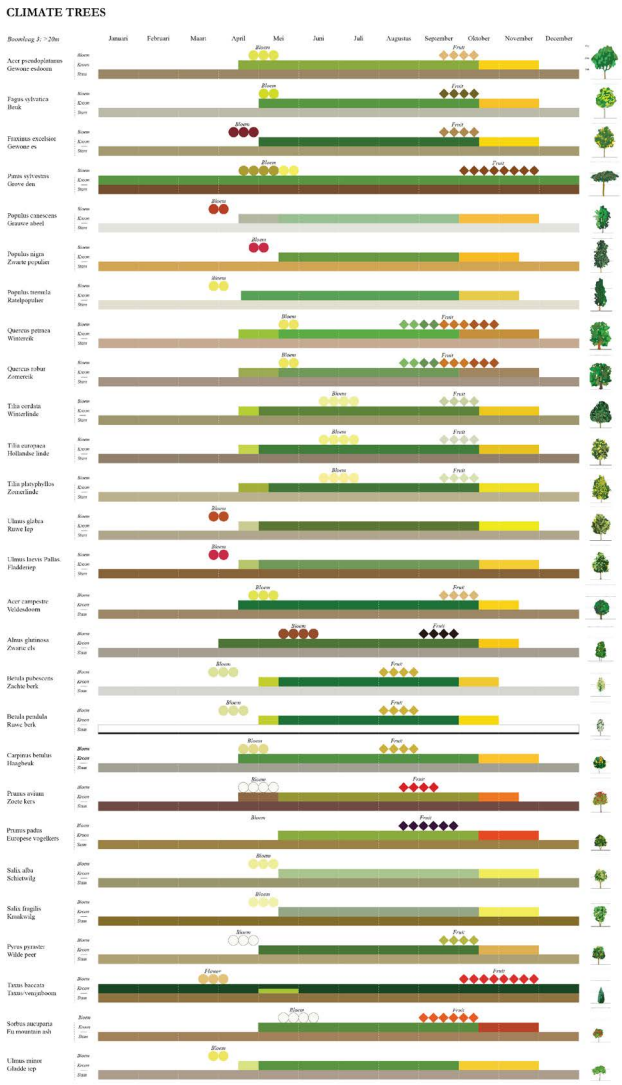

FIGURE 5 *Architecture of Trees.* Seasonal variations in canopy colours, growth dimensions, and flowering and fruiting cycles become qualitative objectives and tools developed and employed by the Forest Alliance. (Image by Federico Gobbato Liva, Andrea Migotto, Kilian Paterson, 2023)

Mobilising Private Gardens Domains - Every Space Counts

Gardens are often confined to the private sphere and overlooked on large-scale maps (Van Delm & Gulinck, 2011). Yet they play a pivotal role in shaping landscapes as a myriad of small decisions taken in these spaces aggregate into the larger-scale context (Dewaelheyns et al., 2016). Covering approximately 20% of Flanders' land area (9% in single-family dwellings), these private spaces hold significance. Graphic scenarios depict urban-forestry strategies for de-sealing collective spaces and defragmentation. These scenarios provide a preliminary toolbox for collaborative urban forestry in the private domains of the dispersed Flemish context.

Prototypes of Bio-Political Welfare (Programma Meer Bos voor Vlaanderen!, 2024)

The synthesis and illustration of five main spatial types is proposed as urban forest prototypes for stimulating the production of social and ecological welfares. These include the largest part of the thirty categories identified in the original report, yet they include them in a more holistic narrative, depicting how life could be imagined in these different forest-urban settings [fig. 6].

FIGURE 6 *Prototypes of Bio-political Welfare.* Graphic novels for five main spatial types depict how life could be imagined in different forest-urban settings. These novels gather and represent specific insights and qualitative aspects of forests in residential neighbourhoods, forests for the safeguard of water resources or flood control, forests supporting health care, forests as biomass reserves structuring life at industrial parks, and forests as collective and shared services in the urban fringe. (Image by Federico Gobbato Liva, Andrea Migotto, Kilian Paterson, 2023)

- **Residential forests (Boswijk)** – Urban forestry in residential neighbourhoods and the transfer of development rights for reserved housing parcels.
- **Infiltration and water-retention forests (Waterbufferbos)** – Collective forestscapes for the safeguard of water sources, drought measures, or flood control.
- **Health-care forests (Zorgbos)** – Afforestation of health care campuses linked to strategies for aging-in-place in the context of villages.
- **Corporate forests (Bedrijfsbos)** – Biomass reserves complementary to a densification of productive activities within existing industrial allotments.
- **Mosaic fringe forests (Stadsrandbos)** – Collective forests and shared services in the 20th-century belts around cities.

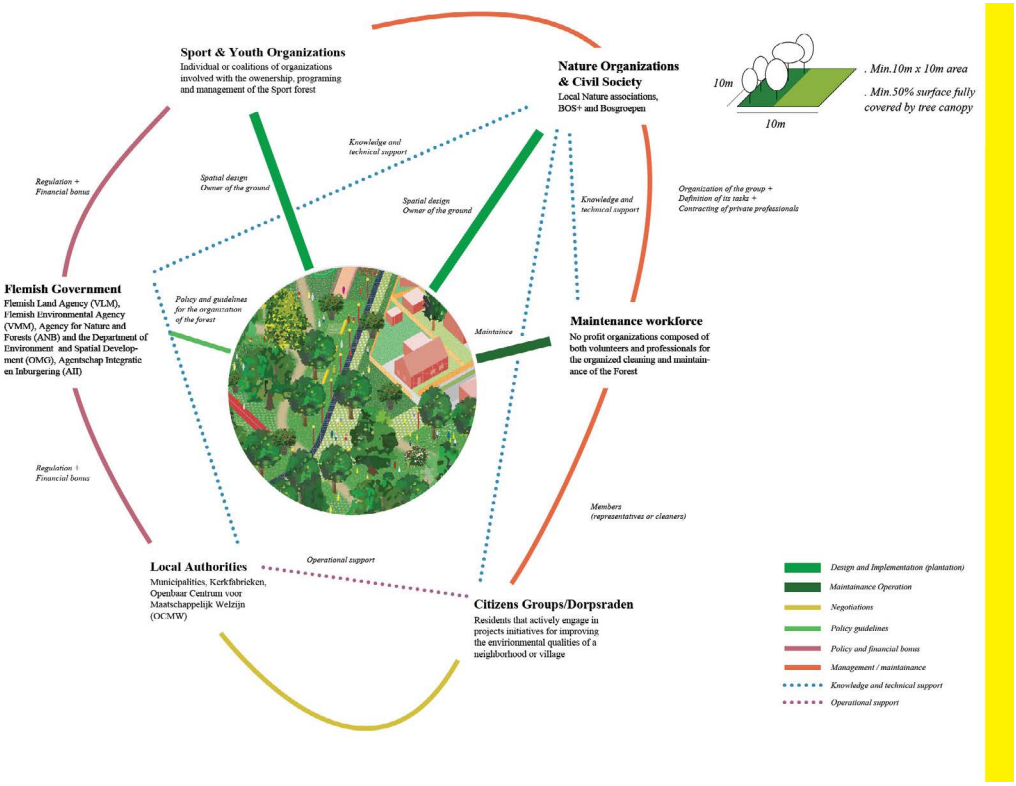

FIGURE 7 *Forest-Platforms.* Tailored stakeholder coalitions accompany each forest type, serving as prototypes to activate local participation trajectories. The image shows the prototype of the forest platform for the Mosaic Fringe Forest. (Image by Federico Gobbato Liva, Andrea Migotto, Kilian Paterson 2023)

Forest Platforms

Tailored stakeholder coalitions accompany each forest type, serving as prototypes to activate local participation trajectories [fig. 7]. Focused on involving local government branches, professionals, associations, and citizen groups, these platforms enable local spin-offs from the Forest Alliance. They could contribute to root communal practices of urban forestry, making it feasible and facilitating spillover into broader social enterprise (Manzini, 2014).

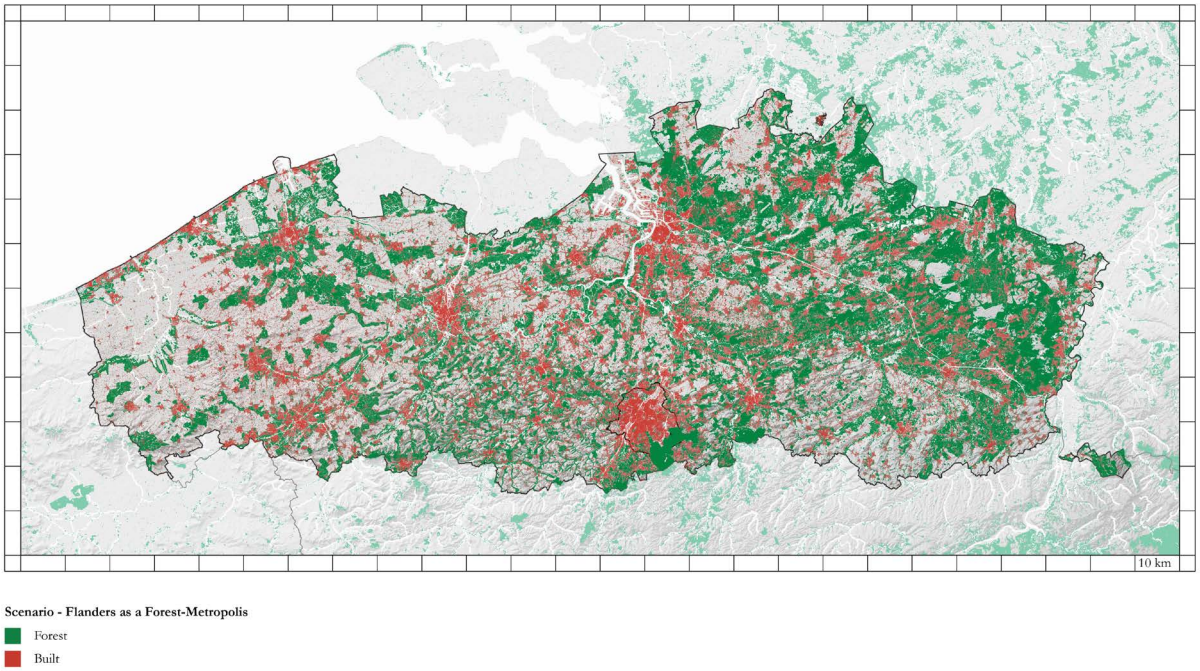

FIGURE 8 *Scenario - Flanders as a forest metropolis.* What if forestscapes would become the main way to increase the quality of life and nature within and around cities and throughout the territory? The map outlines potential locations for multifunctional forest types and tactics at a regional scale. (Image by Federico Gobbato Liva, Andrea Migotto, 2024)

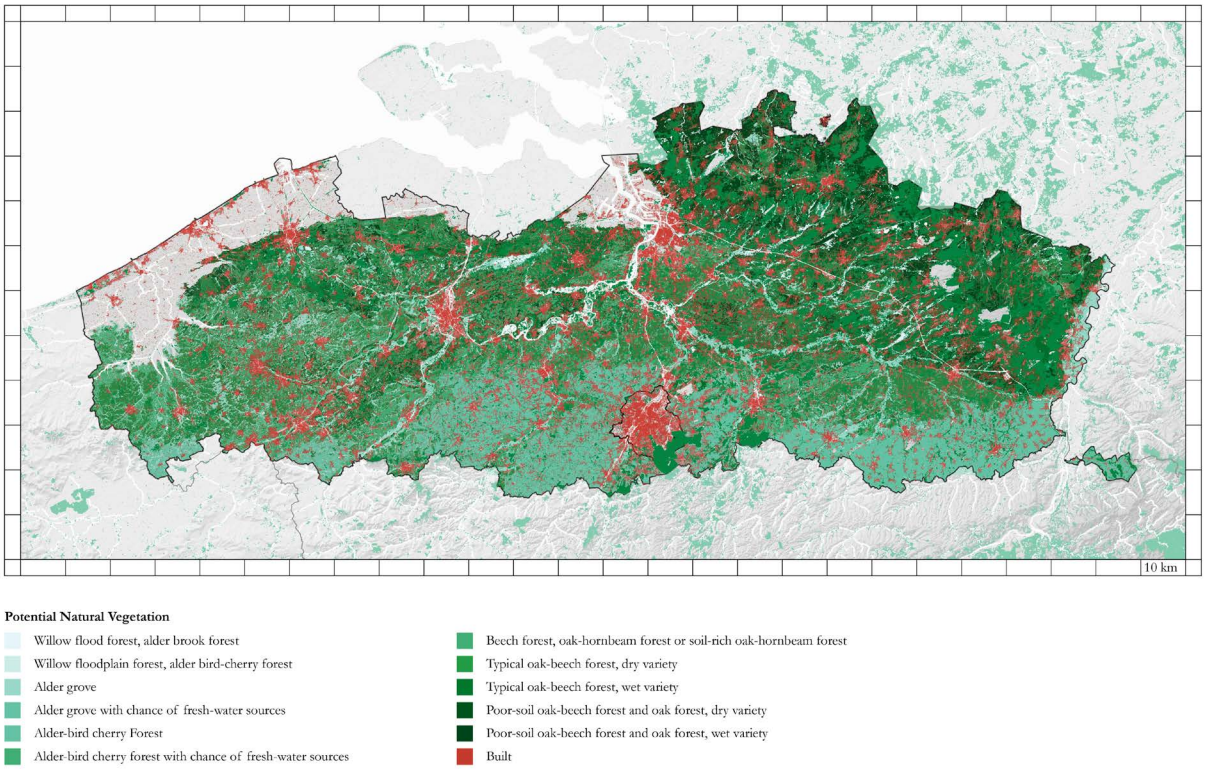

FIGURE 9 *Scenario - Potential vegetation.* This scenario overlays the existing built fabric with the layers of the potential vegetation map. In all unbuilt areas, forests spontaneously emerge with various types of forests based on the original soil characteristics. It excludes the soil disturbances that may have occurred due to urban activities or other intensive land use, which would also affect the vegetation. (Image by Federico Gobbato Liva, Andrea Migotto, 2024)

Extending Metropolitan Forestscapes

Lastly, a scenario map envisions a hypothetical future for Flanders where forest-urban landscapes, or forestscapes, become the main way to increase the quality of life and nature within and around cities and throughout the territory [fig. 8]. This map outlines potential locations for multifunctional forest types and tactics at a regional scale, while assuming densification strategies for the built fabric. The existing forests are combined with the potentially afforestable lands within the Natura 2000 protected areas network and green designations. The map also integrates previous cartographic work like the map of potential vegetation of Flanders (De Keersmaeker et al., 2013) [fig. 9], the map of Forest Urbanism (Wambecq, 2023), and the classification of built fabric typologies in the RURA project (Pisman et al., 2021).

Discussion: Foundations of the Forest Metropolis

Despite the collaborative efforts by the Forest Alliance and substantial investments in the afforestation strategy, the Flemish government will not achieve its projected quantitative objective. Based on the previously described actions, approximately 1,900 hectares of net new forests will be created in Flanders within one legislative period, while another 940 hectares of surface area is secured and available for afforestation during the next legislation (Agentschap Natuur en Bos, 2020). In comparison to the former average of 60 hectares per year, the Forest Alliance clearly catalysed a systemic change, now capable of creating at least 600 hectares of new forests annually, while exploring the large-scale qualitative potential of creating new forest-urban interfaces in the Flemish territory.

To sustain this change in Flanders' landscape metropolis, (sub)urban forests and active local authorities have become a critical piece of the afforestation strategy. Yet, existing practices and knowledge, as well as the overall approach to afforestation, still largely adhere to traditional sector-based cooperation and forest arrangements based on natural geological conditions. While the Forest Alliance has begun to emphasise a multifunctional and spatial perspective at the urban-forest interface, it seems key to further integrate forest policy with urban forestry and intersect urbanism with landscape architecture.

In exploring the need and tools for more coherence or merging, and truly develop a sustainable afforestation practice within this urbanized territory, a valuable step would be to delve into other recent European national or regional afforestation programmes. A quick scan suggests for instance similar challenges, though different approaches, in the Netherlands and Italy (AA.VV., 2022). While the Dutch national strategy (Boosten et al., 2020), akin to the Flemish approach, attempts to integrate urban forestry from the start, in Italy the National Forest Strategy (Pettenella, 2022) and the Parco Italia, a national design-based urban forestry programme (Lempi, 2023) seem to be following separate paths. In either context, up till now, working with urban forest types does not easily align with current definitions and policies related to forestry. (Technical) questions emerge regarding legislation, design, and maintenance of forests as public spaces or multifunctional landscapes (Van der Slikke & Van Benthem, 2023).

Examining other afforestation work would also help to evaluate and understand the pros and cons of the very specific position that the Flanders' programme takes. Most importantly, the programme explicitly commits to a co-creation pathway. It is hence significant that the regional afforestation targets were shared between the key players in Flanders' forestry, and not delegated and divided between more decentralised

authorities like the provinces in the Netherlands or the metropolitan urban areas in Italy. These key players then move back and forth between local and regional afforestation actions, weaving together multiple types of forest projects and coalitions. The choice for a web instead of territorial subdivisions may be unconscious. Yet, the Forest Alliance deliberately incorporates ongoing area-based processes to identify fertile grounds for afforestation projects within the territory, as exemplified in the Transition Map [fig. 2]. In interaction with the layers of natural geological characteristics [fig. 9] and spatial policies concerning urban and nature development [fig. 8], the capacity of coalitions steering area-based processes seems to co-define the foundation of the forest metropolis at the regional level.

Furthermore, the programme started organising a field of operation intersecting urbanism with landscape architecture. The success of this approach (and possible contribution to the landscape metropolis discourse) can be analysed on the interplay of three strategic dimensions. Combining a basket of tools that range from soft power mechanisms to more top-down law-making, the programme applies formal and informal governance tools (Carmona et al., 2023) to support the co-creation process, encouraging quality in landscape design and setting the context for effective short-term project implementation. In addition, it coordinates and tests the effectiveness of these tools within area-based strategies to organise the forest at different spatial scales. It recognises how the Flemish condition of dispersed urbanity implies a condition of dispersed knowledges which are available on the territory and ready to be harnessed (Viganò et al., 2018). Starting from these knowledges and their agency, as opposed to the simple interests of stakeholders, coalitions are united in the re-configuration of (sub)urban space through forests, through landscapes, and through projects. Thirdly, it elaborates on narratives and transformative design scenarios by insisting on scales and spaces a human community can relate to (Gobbato Liva & Migotto, 2024). In other words, it seeks to question the intersections between recurrent spatial arrangements of the territory and the culture and practices that are produced in the 'domestic' and in daily life. In this sense, the elaboration of the forest typology is not intended to be a fixed or universal set of solutions. Instead, it is viewed as an ongoing exploration of the role and potential of landscape design in reforming the categories and the practices that govern how we live and work.

Lastly, the programme has a tight focus on creating new forested environments, which can be questioned. In particular, the vulnerability of existing forests is not tackled, nor patterns of timber consumption and global supply chains. Ongoing deforestation in Flanders for new developments, as well as high wood imports primarily for the construction sector, leading to deforestation elsewhere, underscore the need for incorporating productive and circular concepts into the afforestation programme. How can afforestation in the landscape metropolis be considered successful when it does not contribute to a transition of material practices? Developing on such questions may imply an exchange with some cases of metropolitan afforestation that are being developed and discussed in contexts other than Flanders. It challenges some of the assumptions upon which the discourses of landscape urbanism and metabolism have been developed in the past. In proposing a discourse on afforestation and landscape, seen as attempts to re-naturalise the environment of the metropolis, one should pay attention to not induct dualistic views on nature and culture that result in dismissing the intentionality of humans which are acting within and throughout the transformation of these landscapes (Moore, 2014; Peleman et al., 2019).

Conclusion

Considering the architecture of the European landscape metropolis, what can we learn from the collective process the Forest Alliance has advanced to address the wide array of afforestation possibilities in the urbanized territory of Flanders? At the regional level, the spatial strategy is limited to defining broad qualitative goals aimed at improving the forest structure in Flanders, from expanding and connecting existing forests to green-blue networks and ensuring forests near (sub)urban centres. A preliminary landscape qualification was added using regional GIS analysis that incorporated existing spatial frameworks like the Natura 2000 network and green designations. But it is especially at smaller scales that the Forest Alliance activated the landscape architectural dimension, initiating additional landscape design and vision-building trajectories for priority areas. To operate at a more localised level was deemed essential to fully grasp the complex dynamics of the Flemish nebular city and to speed up implementation and coalition-building efforts.

Consequently, rather than aiming for a metropolitan forest as a regional landscape form, the afforestation programme is concentrating on a collection of separate projects. The forest metropolis adopts a multi-scalar nebular structure, framing afforestation projects from extending big nature complexes as regional infrastructures, to creating forests as components in interweaving technical green-blue networks, to local multifunctional urban forestscapes (re)structuring our daily living environments. Of even greater significance are the layered co-creation processes that come along with these projects and equally encompass scales and multiple professional dimensions. These processes are transitioning from a collective effort, uniting mainly the forestry sector around a shared (quantitative) objective, towards genuine communal endeavours.

In Flanders, constructing the forest metropolis thus means infrastructuring the nebular field of coalitions at work in area-based processes, connecting their local knowledge and capacities with the afforestation project through tool development and design. The integration of landscape qualities like spatial continuity, proportions, geological and urban structure occurs through the interactions among coalitions at various scale levels, designers, and the socio-ecological arrangements of localities where forest projects are implemented. Activating and reinforcing these interactions in a multitude of co-creation processes is what defines the forest metropolis and is imagined as the establishment of a new and common afforestation practice.

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The Forest Figure as Strategic Tool for Urban Transition

Research-by-Design on the Hollow Roads of the Western Witness Hill of Leuven

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Abstract

If the ambition of the Flemish territory is to become more forested, then an approximation is needed between forest and urbanization processes. Forest expansion can only be realized by developing a new understanding between forest and urbanization. This article discusses urban design explorations that stimulate a spatial transformation grafted on the forest as a structuring element of the Western Witness Hills of Leuven, through the 'forest figure'. The forest figure is explored as a concept able to incorporate and mould urban and forest ambitions into a workable spatial frame.

Keywords

Forest Urbanism, Landscape Architecture, Landscape Urbanism.

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Introduction

Forest in Flanders

Flanders is poorly forested, as are many dispersed territories in Europe. Hovering between 10% and 13%, depending on the measuring technique, its forest stock is well below the European threshold and ambition of 30% (Agentschap Natuur en Bos, 2018; Aggestam & Pülzl, 2018; Bos+, 2018). The forests that exist are highly fragmented. There are now over 100,000 private forest owners, on average possessing a forest with a size of just 1 ha, adding up to about two-thirds of the total forest area. This has led to the infamous quote by an unknown author: 'In Flanders, if we find a forest, we run a road straight through it so we have two forests instead of one' (Mens en Ruimte, 1996, p. 15).

The urban fragmentation of the territory went hand in hand with forest fragmentation, suggesting that both are the result of similar spatial dynamics. Both urbanization and forest also appear in a similar spatial configuration: many small patches of forest interlock with dispersed settlements and urbanization, sporadically interrupted by larger urban cores and forests. The 'logos' – the interface between the forest and the urban as described in the influential work of Harrison, *Forests: The Shadow of Civilization* (Harrison, 1992) – could potentially be strong in such spatially interlocking matrices, if both urban and forest systems are conceived to be mutually enriching and not the accidental result of urbanization processes. Other authors have been advocating for such more productive approaches (Konijnendijk & Van den Bossch, 2008; Konijnendijk et al., 2005; Rekittke, 2023; Shannon et al., 2023). In this article, we aim to explore a practical approach to the construction of a strong interface between the forest and the urban.

Forest Figures: Agents of Forest Urbanism

In land-use planning in Flanders, relations between forest and the urban are typically described by the distance between them, by the size and potential uses that can be hosted in the forest, and by the forest's spatial distribution in relation to urban densities (Randrup et al., 2005). The research on *Forest Urbanism in the Dispersed Flemish Territory* demonstrates, on the other hand, the necessity of (intermediate) 'forest figures' in a forest-inclusive urbanism (Wambecq, 2019, pp. 46–48, Manifesto) that breaks through classic land-use boundaries. Forest figures are defined as the result of historic interplay between forest and urbanization, where both find the essence of their functioning in a stable and productive coexistence due to the negotiated joint spatial frame.

In the vernacular urbanization of Flanders, before spatial planning and urbanism became dominant, the relation between forest and the urban existed in the form of ever-evolving lineages of such forest figures (Wambecq, 2019). In the fluidity of (collective) self-organization and self-sufficiency, the forest was continuously reinvented as part of the urban environment (Wambecq et al., 2023). When land-use planning was adopted in the 1970s, these fluidities became irregularities and were purged out of the territory systematically over the last 50 years. All the benefits of the fluidities, many shared with the concept of urban forestscapes, were lost [fig. 1].

FIGURE 1 The construction of a collective housing project illustrating the purging of forest and trees as part of the private and public landscape, in Rotselaar.

This article discusses the potential of the forest figure as a strategic tool for urban transition towards such an urban forestscape that stems from a vernacular depth of relations, seeking historic continuity and structural embeddedness in the territory's spatial complexity, while countering the more recent functional divide between the forest and urban development. Considering that the relation between forest and the urban is not linear but cyclic and thus 'reversible' or 're-mouldable', deeply rooted relations of spatial curatorship between forest and the urban can be re-activated, and new solutions for the ecological and social crises found by re-contextualising them within the frame of the forest figure, while fundamentally building a greener, more forested, and healthier territory. The forest figure might therefore be a strategic tool towards the realization of an urban forestscape.

Research-by-Design on the Western Witness Hill of Leuven

The Western Witness Hill of Leuven, further addressed as 'the Witness Hill', was the topic of a research-by-design at the postgraduate Masters of Human Settlements (MaHS) and Master of Urbanism, Landscape and Planning (MaULP) of KU Leuven. It fell prey to generic suburbanization between Leuven and Brussels and is emblematic of the post-war development of the dispersed Flemish territory. The research hypothesized that social and ecological ambitions could be addressed simultaneously within the forest figure of the hollow road.

The Forest Figure of Hollow Roads

The historic system of hollow roads, created by centuries of cattle moving up and down the steepest, northern edge of the Western Witness Hill, was defined as a potential forest figure [fig. 2]. The hollow roads connect the foot of the Witness Hill with the ridge, offering a dramatic transition from the enclosed valley to the open field on the hill's ridge. To maintain structural stability, their steep edges are most often generously planted and forested. The systemic appearance of forested hollow roads created a continuous forest along the northern edge of the Witness Hill with unique picturesque and ecological qualities.

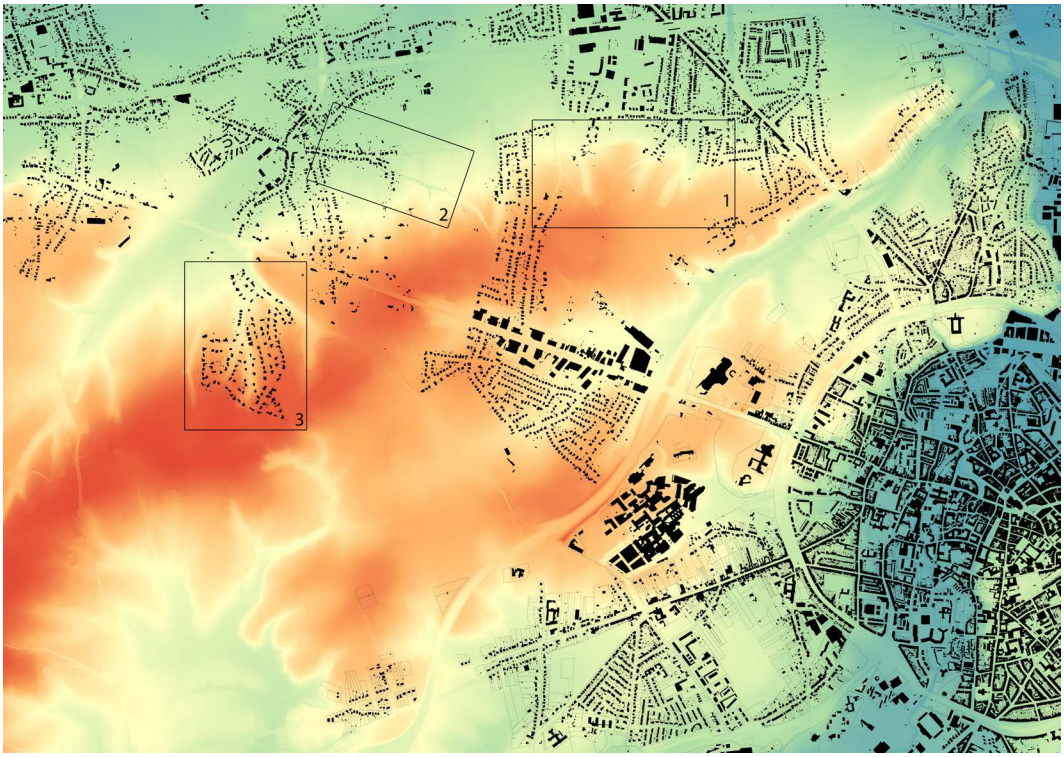

FIGURE 2 The hollow roads of the Witness Hill is clearly readable as deep cuts in the topography. The discussed cases are indicated by rectangles, along the northern edge of the Witness Hill. (1. Herent, 2. Winksele, 3. Schoonzicht, Bertem).

In the 1930s and late 1940s, the Witness Hill was mainly agricultural land with the large Bertem forest. When post-war urbanization in the form of allotments arrived in the 1970s, the system of scenic hollow roads between the valley and the plateau was partially cannibalized by the construction of houses and allotments [fig. 3]. In their attempt to follow common construction norms along the road and to allow car entry onto driveways, the hollow road topography was strongly modified, the forest along the edges removed, and the typical, noisy, cobblestones replaced by easy-going asphalt. Where the urban tissue colonized the hollow road, its identity was suppressed. Emblematic forest appearances disappeared for generic individual inhabitation. Publicly accessible forest was substituted by extensive private gardens.

The historic and future importance of the hollow road in defining the identity of the Witness Hill is undeniable. The design research investigated the concept of 'forest figures' through hollow roads as a geographic particularity of the Witness Hill, formed by the interplay of natural and cultural forces that can be recalibrated to serve the social-ecological ambitions of the territory and contribute to the construction of an 'urban forestscape'.

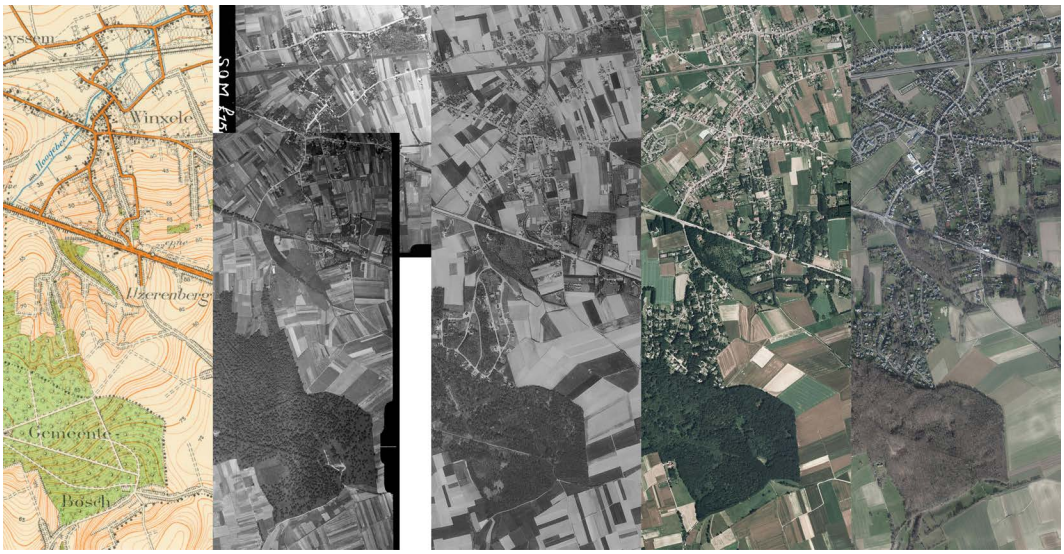

FIGURE 3 Historic evolution between Bertem forest on the ridge and Winksele village in the valley, and the evolution between urban and forest. From left to right: the 1930s topographic map (NGI), aerial images from the 1940s, 1970s, 1990s, and 2020.

Base Ambition: The Forest Figure (of the Hollow) Road Builds Forest

The image quality of the hollow road where houses are constructed has been reduced to a norm-abiding, generic street profile without any articulation, identity, or ecological value. To acknowledge the importance of the hollow road means reinstating its base ecology and associated image quality of lush green, ecological continuity, seemingly undisturbed by urbanization, supporting mainly the scale of the pedestrian and bikers. The ecological disruptions of the driveways are subverted while reinstating the scenic, low-speed, cobblestoned path in a lushly planted environment [fig. 4]. In fact, such a project represents the minimal ambition of ecological restoration, tackling environmental urgencies like flooding (through the adjacent flat driveways) and biodiversity loss, yet leaves the urban structures largely untouched.

FIGURE 4 Simulation of the new ecological system of the hollow road, with the restoration of its picturesque experience.

A forest figure seeks to find contemporary continuity and innovation based on its historic qualities. If this base condition is met, then the forest figure can play other, more ambitious roles in the transformation of the territory. The forest figure is therefore, first and foremost, before anything else, the start of a forest.

FIGURE 5 System of ancient connections, interlocking with the hollow roads and the forest ecology.

Increased Ambition: The Forest Figure (of the Hollow Road) Reorganizes the Way We Move through and Experience the Territory

The hollow road is also a space of mobility. First, it was traversed on foot, then with cattle, horse with carriage, and finally, today, by bike and most often by car. Only slow-paced mobility allows for complete immersion in the experiences offered by the hollow road. If we consider the ecological restoration of the hollow road as a *conditio sine qua non* for the future and success of the forest figure in the natural ecosystem of the Witness Hill, then its ability to incorporate sustainable modes of mobility as part of an extended network for movement is indispensable.

In Winksele, at the north-western edge of the Witness Hill, a road leading away from the village centre towards the plateau splits into two hollow roads that cut sideways into the Witness Hill. The hollow roads can barely be recognized. Their sloped edges are subtle or transformed into hard edges of the front garden or pushed to the back of the back garden of the urban development through intense terrain remodelling. As with many hollow roads, the street profile is normalized with an asphalt road deck and small, underused sidewalks. They are part of the system of ancient connections across the territory that hold enormous potential as a robust and efficient soft mobility network [fig. 6]. The transformation of the hollow roads would strongly contribute to this ambition.

FIGURE 6 Plan of the existing and proposed hollow roads.

The forest figure recalibrates the balance of space between hard and soft mobility. The forest figure is not dogmatic. It does not seek to chase away the car yet complements a more modest role of the car with a strongly improved and performant soft mobility network (electric bike, bike, pedestrian...). In addition, the generic streetscape is refitted as a hollow road with topographic articulations, consolidated by lush vegetation. A wide collective streetscape emerges [fig. 7].

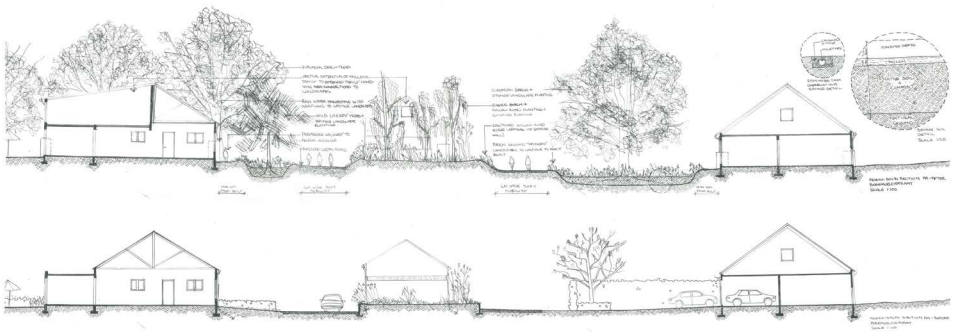

FIGURE 7 Section of existing and proposed hollow roads, evidencing the set of interventions to increase the readability of the hollow road and its experiential quality as a space of soft mobility.

FIGURE 8 Existing plan of the allotment Schoonzicht, with its typical suburban layout of street loops and single-family villas.

Enhanced Ambition: The Forest Figure (of the Hollow Road) Stimulates and Organizes Urban Renewal

The housing allotment Schoonzicht occupied a deforested piece of the Bertem forest. The seemingly typical allotment road structure was, in fact, a system of hollow roads now formalized as norm-abiding streets [fig. 8]. The large parcels with equally large houses represent an immense built capital but a small social capital. Many people here have their own swimming pool in the garden, while the same number of people inhabit one collective residential apartment block from the 1970s close by, sharing one common swimming pool. Both are built in the same period but clearly represent different cultures of inhabitation.

FIGURE 9 Vision plan for the neighbourhood with the articulation of an inhabited forest-scape, grafted on the hollow roads as functional and experiential space.

Now is the time to imagine the transformation of the allotment. Most houses will soon need reinvestment. Large gardens and over-dimensioned houses provide ample flexibility to reshuffle the relation between nature and built and introduce a typological diversity that better represents the current societal constitution with many diverse forms of inhabitation like single-person houses, living and working combined, assisted living, or co-housing. The recalibration grafts itself on the common identity of the forested slopes of the Witness Hill and the hollow roads that function as the lifelines of the neighbourhood [fig. 9].

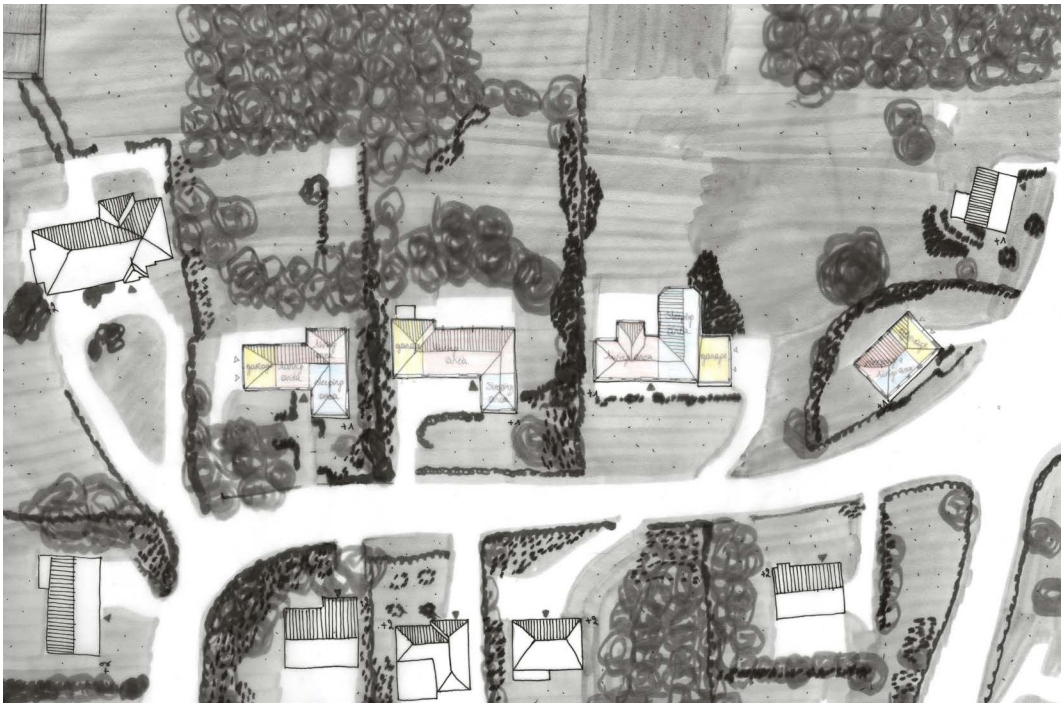

FIGURE 10 Existing piece of the Schoonzicht allotment, showing several villas and their individual organization of space.

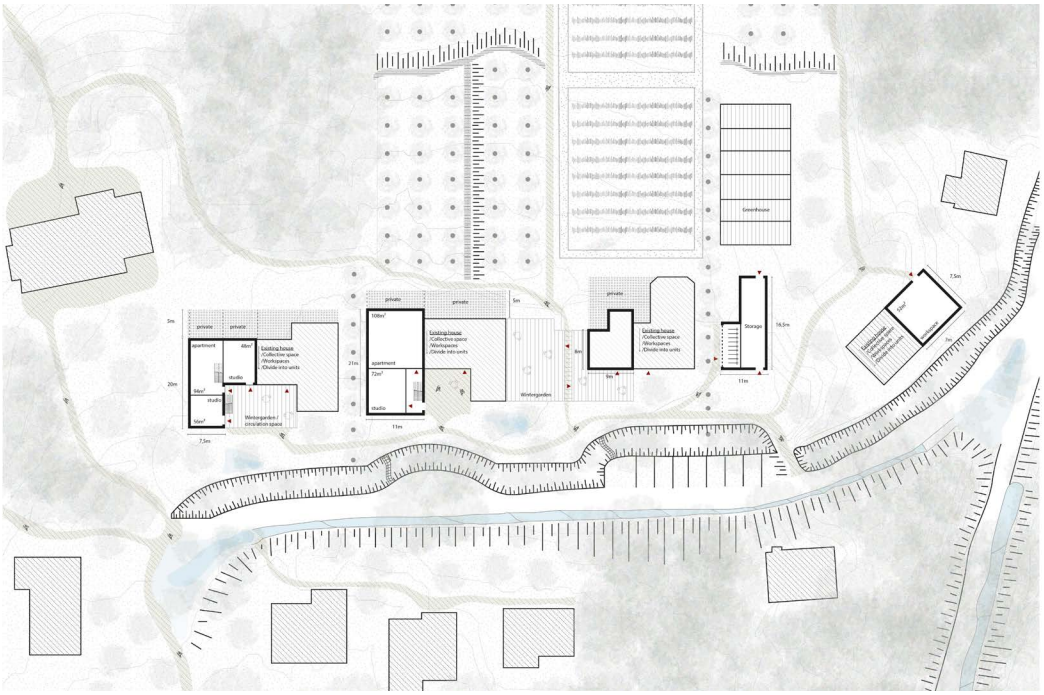

FIGURE 11 The aggregation of four villas with collective water management, productive spaces, gardens, grafted on the reenforced hollow road as the lifeline of the neighbourhood.

A piecemeal transformation starts by retaining only the hollow roads for car mobility, excluding all other redundant loops and curves, often serving only one or two houses, that are consequently decommissioned and demolished. The newly established accessibility imposes an intelligent aggregation of the houses. Front lawns and driveways are combined in collectively organized gardens – with a protective *talud* that recreates the slope of the hollow road – that serve a common entry for three to even twelve houses, depending

on the location [fig. 10]. The aggregation of the built infrastructure fits different housing typologies. Four small families in their oversized villas will gradually give space to more than ten families that benefit from collective workspace, car-sharing, leisure and community gardens, or even kitchen and living spaces. Large garages with punctual extensions accommodate a contemporary working culture of living with an atelier, office, or commercial space [fig. 11].

The re-articulation of the hollow roads creates a sense of place and belonging in an allotment that is otherwise collectively unarticulated. Today, nothing exists between the anonymity of the car going in and out of the neighbourhood and the privacy of the single-family villa. The system of the hollow roads as public space induces an intermediate level of aggregation where people live together within a small collective when wanted, or in privacy when needed. The character of house aggregations depends on the local context. Contrary to the allotment, which is, if anything, not contextual but generic, the project of aggregation introduces a new collective identity. The public structure of ecological hollow roads then consequently accommodates a variety of identities.

On the ridge, for example, just arriving on top of the Witness Hill, a small community of twelve houses is formed that adopts the agricultural identity of the ridge. The streets are decommissioned and transformed into a common, collective landscape of community gardens, framed by the bordering forest. Again, this new contextual reality with a clear ecological premise supports the densification and diversification of urban typologies that stem from the previous villas and that allow for forms of inhabitation [fig. 12].

FIGURE 12 The aggregation of twelve villas leads to a small agricultural community, embedded in the forest frame, inscribing itself in the ecological-productive ecosystem of the Witness Hill.

The aggregation of houses and transformation of the public space can evolve autonomously. Both public and private realms, each at their own pace, build towards a common identity for the former allotment. Urban transition is realized by revealing its system of forested hollow roads that carry a new logic of mobility, that supports the ecology in the form of forested edges and water buffer space, and that induces a new scale of aggregation between the houses. The new, densely organized urban form, in its turn, supports the consolidation of the forest as a collective, natural capital. An urban forestscape appears.

Ambitioning Urban Transition Through Forest Figures

We might argue that the current-day situation of the above-mentioned allotment is, in any case, already an urban forest-scape, made by the large private villas and their mildly forested gardens. We might equally argue, though, that they do not fundamentally contribute to the urban ecosystem of the Witness Hill. The current organization of the allotment cannot safeguard the ecological functions of the forest due to its privatized and selective nature. It does not represent a common natural capital in service of a broader community. In addition, the urban system functions at low efficiency. Extended streetscapes with management-intensive sewers, drainage systems, sidewalks, and parking spaces merely serve the private monofunctional residential space. Such allotments are therefore neither forest nor urban.

In practice, the simplicity of juxtaposition of forest and the urban is often conveniently abused as 'ecological', 'sustainable', or similar, yet it is insufficient to realize a long-lasting, productive relation between both. An urban forest-scape, as we would expect, should carry the values as explored in the forest figures of the hollow road, seeking relational complexity between the forest and the urban. A sustainable urban forest-scape can be successful if constructed, organized, and managed through forest figures.

The forest figure exemplifies the possibility of a deep bond that serves as a carrier of the urban forest-scape. The forest figure is therefore, at first, a space agent, or agent space, as Paola Viganò states, acting in its own ambitions and legitimacy towards ecological and social integration (Viganò, 2024, p. 115). Through its agency, transformation is imaginable and tangible, inviting the necessary disciplinary fields and actors to participate and uphold the constructive ambitions, and define negotiating principles in close collaboration. The forest figure is a collaborative framework. Renouncing the simplicity of simple juxtaposition of forest and urbanization as an urban forest-scape, the forest figure represents systemic complexity where both forest and urbanization interact through natural and cultural processes. For example, the forested gardens are extensions of the forest where ecology depends on the individual expressions of the inhabitants (fences, species, management…); the inhabitation is dependent on the conditions created by the surrounding forest (architectural style, light, humidity, heating concepts…). The forest figure is the conceptual carrier that reorganizes the necessary transformations towards consolidated, coordinated systems. A key concept is the transition towards collectivity that allows components of the system to be pieced together. The new collective dimension is fuelled by the social transition towards more diverse inhabitation, including smaller housing units, collective living solutions, work-live rebalancing, and even urban ambitions with the inclusion of services that serve the collectives. The forest figure collects these transformations and matches them with its own historic spatial repository, reinvigorating its structuring role in the (now also urban) territory.

The increasing levels of ambition for the forest figure (of the hollow road) suggest gradual transformation through the piecemeal integration of ambitions. Even if urban transition happens slowly, we can start it tomorrow by strengthening the hollow road's ecological structure, inserting it, whenever possible, into the soft mobility network of the region. At some point, the urbanization will aggregate to accommodate new urbanities, allowing structural support for the consolidation of the forest figure. If we truly believe that the quality of a forest figure lies in the deep bond between forest and urban development, based on an undeniable geographic figure such as the hollow road, and much beyond their simple spatial, static juxtaposition, then we must allow this bond the necessary time to grow deeply again, at the pace of a growing forest. The current state of the forest figure of the hollow road is, in that sense, just a temporary state of uncoordinated natural and cultural processes that we must gently, and if possible, more forcefully, reorient to converge again.

We must be realistic, though, about forging such a new deep bond between the forest and urbanization. It requires a drastic change in the way urbanism is practized. Different professionals need to converge towards a common project around ecology, mobility, urban development, agricultural and productive spaces, crossing different municipalities. A key factor in the potential success of forest figures is the operational scale, as the space agent, as mentioned before. The hollow road as a geographic feature, and the appearance of the system of hollow roads along the northern slope of the Witness Hill, have defined scales and spheres of intervention around which stakeholder coalitions can be built that work on a project-by-project basis, and not through generic, normative legislation. House owners can be incentivized in the process of change, although a slow transformation process can be expected. More than 50 years of spatial fragmentation cannot be undone easily. The re-aggregation of privatized land will require creative solutions that overcome difficulties of individual interests, uncoordinated timings, and legislative constraints.

What Makes an Urban Forestscape?

The essence of the urban forestscape lies in the forces that make such a concept possible, namely if an entity exists – a collective of inhabitants, a motivated public administration – that organizes and manages the continuous equilibrium between forest and its inhabitation. The forest figure is a strategic tool that can create and manage this equilibrium. Urban and forest fragmentation can be overcome by new collective alliances of territorial curatorship. Forest and urban spaces are managed as joint projects, by their direct inhabitants and other actors that assume responsibility for the collective space. We must not underestimate the potential of inhabitants to take care of their environment when they aggregate towards a common goal. This is the essence of what the forest figure as a tool aims to achieve. Secondly, the forest figure represents the identity that defines the direction of the urban and forest processes towards the deep bond. There is no final image about how the forest and the urban coexist in the forest figure, but only a continuity of practices, based on the forest figure's identity, that always steer towards an equilibrium between the forest and the urbanity that sits within it. Thirdly, and finally, the forest figure can only maintain its transformational relevance if it evolves into a broad, sustainable ecosystem as both an ecological and social project. It must therefore contain both interventionist capacity and territorial impact, meaning not every forest-urban coexistence is easily operationalized as a forest figure. Identifying promising and substantial forest figures is therefore an indispensable first step towards true potential urban forestscape. The construction of an urban forestscape through forest figure(s) will provide a solid base for its success in the long term.

Conclusion

The above-mentioned design explorations all build on the forested landscape of the Witness Hill to induce transition to an ecologically embedded and socially corrected urbanity. They aim to overthrow the established mode of urbanization that is detrimental to its environment, monofunctional, monotonous, and generic. We believe that the concepts of the forest figure of the hollow road, as presented in this case, form a base for many other possible forest figures, well beyond the context of Flanders.

Forest figures are defined as the result of historic interplay between forest and urbanization; identifiable within a specific spatial frame and scale, making them apt as tools for urban transformation since a clear working frame exists and even a curatorship by inhabitants can emerge; able to re-invigorate a deep and practical bond in which both forest and urban form can coexist and enforce one another through mutual respect; strategic as they can address not only ecological issues but integrate social reconfigurations within their operational scale.

If an urban forestscape is constructed as the aggregation of many forest figures, then the forest-urban balance is locked in these operational units, creating a long-lasting base of success for the urban forestscape.

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Building Biodiverse Urban Forests in the Post-Soviet City

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Abstract

This visual essay outlines how Ruderal, a studio based in Tbilisi, Georgia, has developed new approaches to urban forestry applicable to the legacy of Soviet-era forests. The collapse of the Georgian Soviet Socialist Republic and the resulting rapid privatization led to the reduction and degradation of Tbilisi's public spaces. Ruderal's approach to urban forestry is presented in three projects: the Mtatsminda Pilot Project (including Narikala Ridge), the Betania House Forest Garden, and the Arsenal Oasis Project. The projects illustrate how a new practice of urban forestry has grown from the limitations and opportunities of Tbilisi's urban context. Ruderal's practice pursues interventions at multiple scales along the following forestry principles: 1) grafting into baseline conditions; 2) utilising and expanding the 'fertile section'; 3) incorporating genetic diversity and species competition.

Keywords

Biodiversity, Georgia, Landscape architecture, Tbilisi, urban forestry, urban soils, species competition, forest management.

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Introduction

Contemporary urban forests are products of a city's history, revealing material conditions, scientific histories, and politics. Understanding these conditions, which are entangled with the growth of an 'urban forest,' can reveal opportunities to amplify the biodiversity and ecosystem health of future urban forests (Nilsson, 2012). This visual essay outlines how Ruderal, a studio located in Tbilisi, Republic of Georgia, has developed approaches to urban forestry specific to the history and milieu of a post-Soviet city.

Ecologists use the term *ruderal*, from the Latin *rudus* (rubble), to describe disturbance-adapted species. By naming our studio Ruderal, we open a field of practice that probes multiple interpretations of the term: thriving in a context of scarcity; resilience in the face of disturbance; and privileging adaptation over stasis. Ruderal's work is about 'making do' within and 'doing more' beyond what is at hand to rebuild and adapt forestry knowledge networks.

In the 20th century, as Tbilisi grew, environmental planners applied Soviet-standard methods to improve the city's environment. From the 1920s–1930s, foresters planted pine trees throughout the city and surrounding areas, continuing through the 1950s–1960s. During this period, Stalin ordered the mobilization of the 'Great Plan for the Transformation of Nature,' an afforestation project to combat erosion and unstable water supplies throughout the semi-arid landscapes of the eastern USSR. Stalin's Plan endorsed the 'nest-method' approach of the agronomist Trofim Denisovich Lysenko, who advanced the now-disproven theory that individuals within a species could act collectively and even sacrifice themselves to protect plantations (Brain, 2010). In this context, officials in Tbilisi established a monoculture of *Pinus nigra* on Mtatsminda and Narikala Ridge, using dynamite to blast terraces of planting 'pockets' into the mountain's steepest slopes.

Anecdotal evidence suggests Tbilisi's Soviet city planners intended for this afforestation to address issues like wind speed, air quality, summer temperatures, and landslide hazards, and even designated swathes of land for the flow of fresh air and rainwater infiltration zones to prevent catastrophic flooding. Several large-scale landscapes, such as Lisi Lake, Tbilisi Sea, and Mtatsminda Mountain, were afforested to provide these ecosystem services. The pine plantations are now experiencing infestations of pests and fungi, causing their decline. These landscapes are further threatened by privatization and development of housing and commercial use, attenuating the climate services once provided and weakening the efficacy of state-sponsored urban afforestation.

A result of the dissolution of the Soviet Union and the subsequent period of political chaos was a loss of institutional and individual knowledge of forestry; Georgia suffered mass emigration and brain drain; experts and instructors had to find work elsewhere. There are gaps in local knowledge and materials necessary to design and build biodiverse urban forests.

More recently, the Georgian Dream party (elected 2013) has directed attention and funding to renew urban open spaces. This attention to public space has been both political—to win votes for the party by promoting parks and greening—and situational—in response to disturbances such as the Vere Ravine flood of 2015 and the die-off of monocultural pine plantations that surround the city.

Ruderal was established in 2018, during the period of renewed interest and attention to public open space. Tbilisi Mayor Kakha Kaladze's agenda includes greening and renewal of the city's major boulevards and renovations of Vake Park and Miziuri Park, destroyed in the 2015 flood. These projects are co-funded by donor banks and city development agencies, such as the Tbilisi Development Fund and the Municipal

Development Fund, which are in turn funded by international funds such as the World Bank and Asian Development Bank (under the Liveable Cities Initiative).

Biodiverse afforestation projects present a logistical and cultural challenge for cities that have been shaped by monocultural approaches and economic collapse. Ruderal's Mtatsminda Pilot Project, the Betania House Forest Garden, and the Arsenal Oasis Project are presented as case studies in which local and technical knowledge are combined with a landscape architectural approach to create a more biodiverse, spatial, and beautiful urban forest practice.

This visual essay illustrates the Soviet planting projects around Tbilisi in the mid-20th century and the firm's approach to urban forestry projects between 2020–2023. Our research, design, and material practice in these projects have provided several key takeaways for contemporary practices of urban forestry. We organise these takeaways into three approaches to urban forestry, presented in the visual essay.

FIGURE 1

Terraced planting in the hills above Tbilisi, 1951.
Ruderal's Approach 1: **Grafting into Baseline Conditions**: Most post-Soviet cities were designed with robust urban and some degree of peri-urban forestry. Attending to the species composition, formal conditions (e.g. terraces, rows, allees), planting methods, and environmental context of Tbilisi's existing urban forest plantings allowed us to amplify existing plant communities rather than replace them entirely. Native forests of oak, beech, hornbeam, and ash that once blanketed the hills surrounding Tbilisi are limited to steep riparian zones. Soviet methods of afforestation focused on replacing deforested and overgrazed slopes around the city's perimeter with a limited range of evergreen species organized on keyline rows. The predominance of *Pinus nigra* in this planting approach has led to an abundance of pine-dominated patches interspersed between heavily grazed pasture land. These monocultural patches are vulnerable to pest and fungal infections, which have increased drastically over the past 20 years.
Ruderal's Approach 1a/ **Interpreting soils and planting histories**: On Mtatsminda and Narikala, the monoculture of pines altered the chemical composition of the soil, facilitating their dominance and precarity as a vulnerable monocultural forest. Ruderal uses strategies that shift these soil cultures by introducing understory and "cover crop" layers, nurse plantings, and temporary irrigation. These strategies are crucial to the success of new forest communities. (Photo: National Archives of Georgia, 1951)

FIGURE 2

Plantations around Tbilisi. Several plantations around Tbilisi include multiple species, complicating the evidence of Moscow's influence over forestry projects within the Georgian SSR. In some areas, such as Lisi Lake near Tbilisi, planting was organized in rows segregated by species, which established more diverse plant communities that now support a wider range of species. (Photo: National Archives of Georgia)

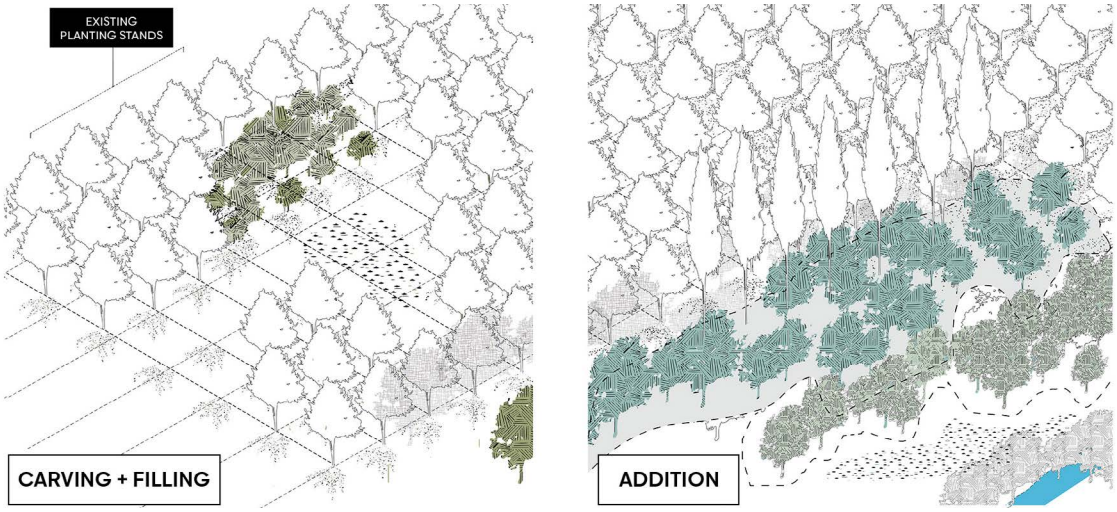


FIGURE 3

Mtatsminda Pilot Project.
Ruderal's Approach 1b/ **Plant communities approach**: In our projects, local botanists and biologists recommend species adapted to the specific conditions of each project. Ruderal selects from the palette of suitable trees and shrubs provided by these experts to showcase culturally important species in ecologically compatible plant communities (Gustavsson 2004). These plant communities were further adapted to create novel planting communities interplanted with existing patches of trees. The Mtatsminda Pilot Project was an exercise in carving out swathes of dying pines and partially filling in the gaps left behind with a diverse array of saplings to create patches of greater biodiversity that grow alongside the remaining pines. The project also incorporated 'additional' planting communities in response to wetter areas. (Diagram: the authors)

FIGURE 4

Narikala Ridge in Spring 2023. Patchwork of plant communities.
Ruderal's Approach 2/ **Utilising and Expanding the "Fertile Section"**: Much of Tbilisi's peri-urban landscape is steep and rocky. Historical practices of deforestation and over-grazing have fundamentally altered soil conditions in these landscapes, and heavily mixed and compacted soils of the city's dense neighborhoods lack the necessary nutrients for a healthy forest. Improving pockets of soil fertility can help small patches of forest thrive in built areas. Pockets of "fertile section" are areas of fertile soil in the milieu of compacted and sealed urban soils. These fertile pockets already exist within the city, and many more can be inserted, uncovered, and nurtured.
Ruderal's Approach 2a/ **Utilising the fertile section**: In order to create the midcentury pine plantations, Soviet workers created planting pockets and terraces in the rocky and steep slopes. On Mtatsminda, these pockets of fertile soil host a range of plantings, including new saplings, extant *Cedrus deodara*, and pioneer species including *Celtis caucasica* and *Cercis occidentalis*. (Drone photo: Luka Tavzarashvili, 2023)

FIGURE 5

Narikala Ridge, in central Tbilisi in Spring 2023. In the existing urban condition, hot, dry, exposed patches are directly adjacent to cooler, darker, and wetter patches hidden under well-established stands of *Cedrus deodara*. (Drone photo: Luka Tavzarashvili, 2023)

FIGURE 6

Narikala Ridge, in central Tbilisi in Spring 2024. (Photo: Ejvind Spence, 2024)

FIGURE 7

Narikala Ridge. Narikala Ridge: New planting is interspersed between the stands of *Cedrus deodara* and areas dominated by *Celtis caucasica*, establishing productive competition through a diverse range of plant adjacencies and species layering. These specimens, along with a pioneer herbaceous layer, intensify an interplay of light and dark spaces along the existing path. (Photo: Ejvind Spence, 2024)

FIGURE 8

Narikala Ridge. (Photo: Ejvind Spence, 2024)

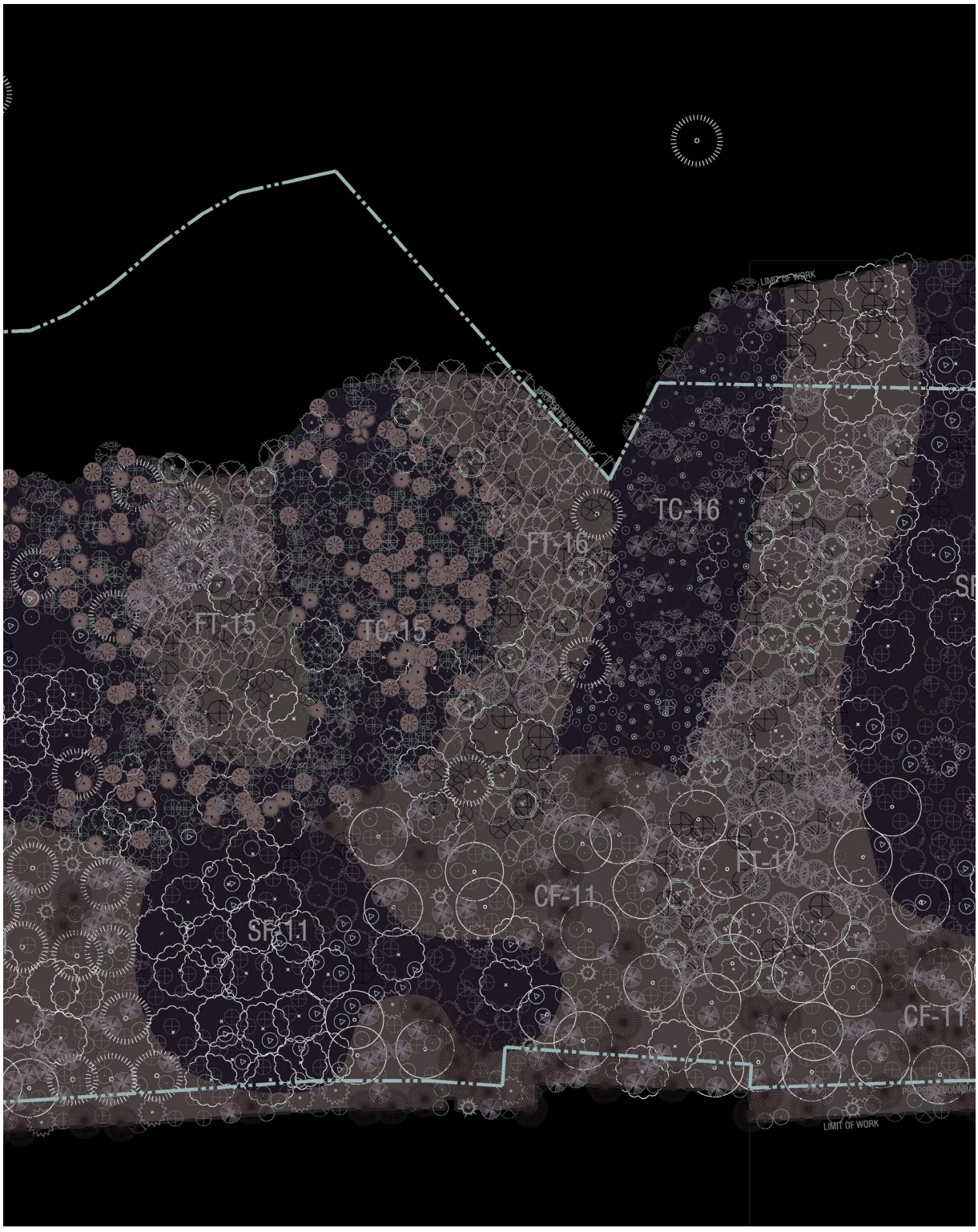


FIGURE 9

Scripting with Grasshopper. Scripting with Grasshopper facilitated rapid modelling of forest patches on the digital terrain model to account for the existing trees and plant communities that the new forest would be grafted into. The script also allowed us to adjust the species composition of each 'zone,' test species adjacency rules, and retrieve planting quantities instantly. This facilitated rapid iteration and communication between stakeholders and allowed us to design with aesthetic, technical, and logistical concerns simultaneously. (Drawing: the authors)

FIGURE 10

Okrokana South Slope. Pre-planting condition of the Okrokana South Slope, immediately after the removal of diseased patches of Pinus nigra. The patterned herbaceous layer reveals spillover from the nutrient-rich soil from Soviet-era planting pockets, organized along the original planting terraces and reinscribed by the movement and grazing patterns of local pasture animals. These pockets of fertile soil provide important footholds in which new plant communities establish. (Photo: Christian Moore)


A.2
A.3
A.1
B.1
B.2

FIGURE 11

Arsenal Oasis, Fall 2022.
Ruderal's Approach 2b/ **Expanding the fertile section**: In many cases, existing soils must be rehabilitated, often without the intensive use of soil amendments. Ruderal utilizes early-succession plant communities to strategically build organic material and microbial communities within these soils. Intervening in existing water flow patterns represents an impactful means of grafting into baseline conditions and initiating ecosystem processes that expand the fertile section. On a former military base that looms over the centre of Tbilisi, the removal of one section of a ruined concrete foundation allowed water from a broken pipe to flow across one of the terraces and into a series of lateral channels cut through the dry plateau before rejoining a wetter area below. Where water was pushed laterally along the terraced landscape, it now flows across the plateau, establishing a new wet ecosystem on a dry terrace.

(A.1) 20–30-year mid-successional dry terrace edges.

(A.2) 20–30-year mid-successional terrace edge fed by 2-year water channels;

(A.3) early-successional 2-year water channels;

(A.4) 10–20-year wet terrace edge. An eroded roadside ditch runs along the lower part of the image;

(B.1) 20–30-year mid-successional wet ditch with established woody species;

(B.2) early-successional ditch with few species;

(B.3) an informal impoundment pond with reedy species. Experimenting with links between these topographical elements informs the placement or removal of new terrace edges with a goal of densifying the patterns of the future forest by amplifying the fertile section. (Drone photo with annotation: the Authors, 2022)

FIGURE 12

Arsenal Oasis, Fall 2020. Platanus specimens anchor a new bosque planting, with *Salixs* takes prepared for understory planting to follow. A micro-scale pocket of 'fertile section' anchors the *Platanus* and kick-starts the accumulation of the herbaceous layer. (Photo: the authors, 2020)

FIGURE 13

Arsenal Oasis, Summer 2021. The expanded herbaceous layer starts to build up organic material and superficial roots, collecting wind-eroded soil and seeds, adding nutrients and establishing a seed bank within the previously sealed base course of the demolished building's concrete pad. (Photo: the authors, 2021)

FIGURE 14

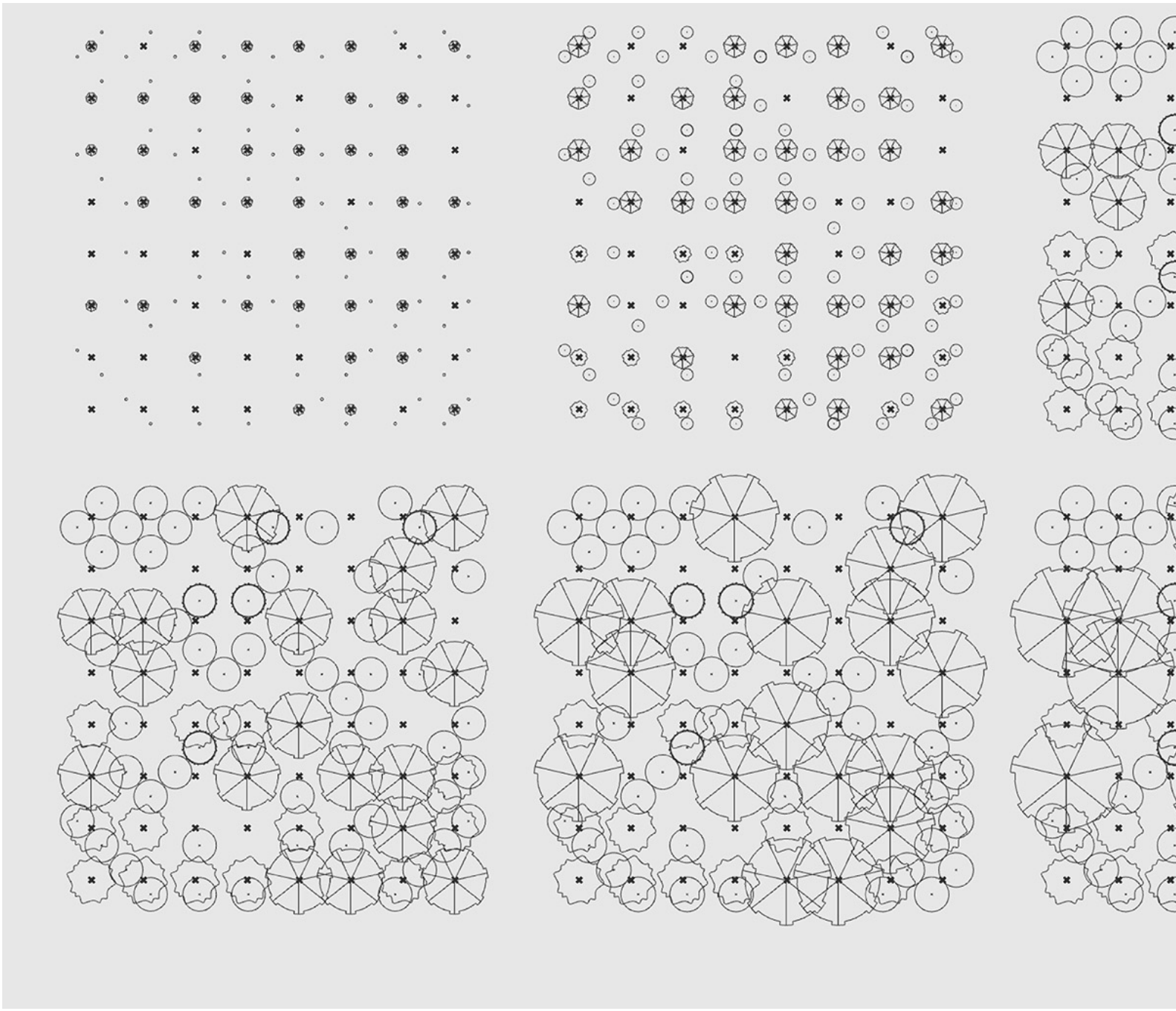
Arsenal Oasis, Spring 2023. The annual organic layer dies, decomposes, and accumulates around rocks and piles of soil surrounding the *Platanus* plantings. As the *Salix* grow large enough to compete with the *Platanus* canopy, they will be coppiced. (Photo: the authors, 2023)

FIGURE 15

Arsenal Oasis, all 2020 and Summer 2023. The 2-year-old channels demonstrate the impact that topography, particularly the practice of counter-sloping, has on spontaneous vegetation. On the north side, these trenches detain water from the cascade, while most on the south receive only runoff from precipitation. (Drone photo's: the authors 2020, 2023).

FIGURE 16

Malkhaz Sardlitsshvili's nursery. Malkhaz Sardlitsshvili's nursery in Didi Toneti in early spring, nestled on a south-facing plateau 30 km southeast of Tbilisi. Where traditional afforestation projects rely on the limited genetic stock of industrial nurseries, new urban forests can integrate the genetic diversity of the rural landscape. Project information and rapid visualization tools help incorporate multiple, smaller nurseries and allow for adjustments based on changing numbers of available trees in a complex sourcing network. This flexibility and complexity supports a meaningful level of genetic diversity in urban forest projects. (Photo: Giorgi Kolbaia)



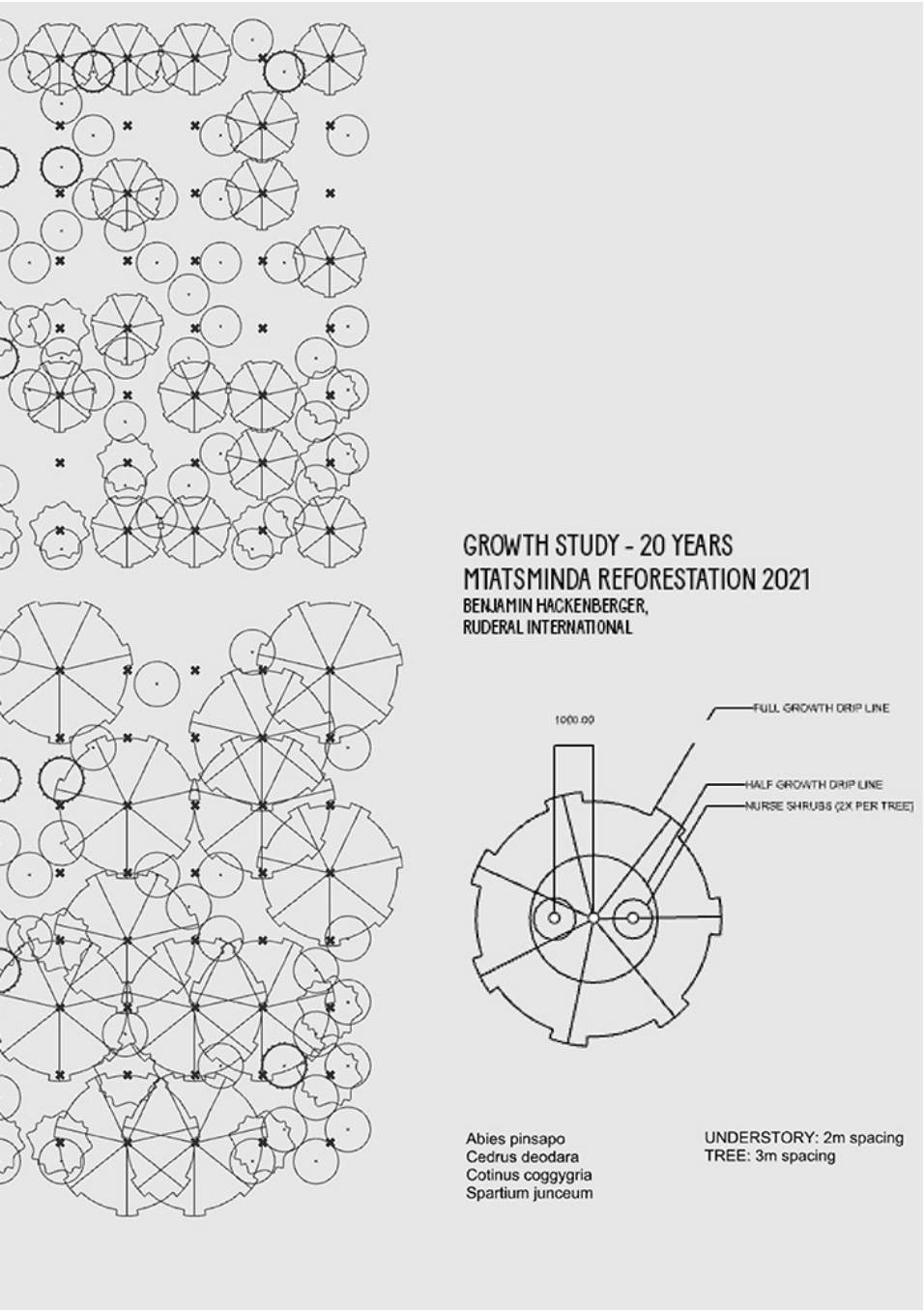


FIGURE 17

Growth simulations with simplified parameters. Ruderal's Approach 3/ **Incorporating Genetic Diversity and Species Competition**. Urban trees in Tbilisi are typically planted in anticipation of full growth stage, and sourced from foreign nurseries with limited genetic diversity, creating a divide between the diverse landscapes of rural Georgia and the new urban canopy. Designing with species growth behaviors in mind and planting species from a wider network of Georgian nurseries can improve genetic diversity, and strategic competitive relationships can maintain biodiversity. Growth simulations with simplified parameters allow for rapid vizualisation of species composition at different stages of succession. These models allow us to study and communicate key time-based principles such as nurse planting and shade and nutrient-based competition. Conventional forestry approaches suggested a wider spacing of trees, but these models enable closer planting of younger trees by facilitating planned succession and tree removals. They also allowed us, in a context of supply limitations, to optimize the survival chances of less available species Ruderal's Approach 3a/ **Quantity and genetic diversity of tree supply**: Suppliers for ecological planting in Georgia are limited, but are scaling up to meet new demand, as at Malkhaz Sardlitsshvili's nursery in Didi Toneti. A diversity of small suppliers introduces logistical complexity but bolsters genetic diversity. Ruderal responded to the challenge of working with several suppliers with limited inventories by linking models of forest plantings in Grasshopper to quantities of available plants. This helps to account for nursery lead times and allows us to quickly adapt to inventory changes and add new suppliers. In addition to incorporating information about complex nursery stocks, planting projects can employ digital tools to model this complexity over time. (Drawing: the authors)

FIGURE 18

Pollard Park. An experimental drawing exercise completed by Michael Cafiero, Kira Clingen, and Benjamin Hackenberger within the framework of Teresa Gali-Izard's course 'Erasing the Line While Drawing' at the Harvard University Graduate School of Design in Fall 2019. The drawing visualises a set of rules for incremental planting, pollarding, and coppicing that respond to the growth behaviour of olive and poplar trees. These types of drawing exercises inform sets of dynamic planting and management rules to be tested against actual growth patterns. With a grasp of these tools for management, designers can plan for a dynamic plant community, supporting a wider range of species and a deeper engagement with the carbon cycle. (Drawing: Michael Cafiero, Kira Clingen, and Benjamin Hackenberger)

FIGURE 19

Pre-planting condition of the Betania project, in an exurb of Tbilisi. Like many in Tbilisi's expanding peri-urban territory, this residential plot is situated on former pasture land between forest and a small valley swale. After its conversion to residential, the plot was maintained as low-intensity turf for several years.
Ruderal's Approach 3b/ **Anticipating and incorporating shorter tree lifecycles**: Ruderal's work includes planning for the introduction of other practices of management including coppicing, pollarding, and harvesting (Jönsson and Gustavsson 2022). These practices can anticipate tree life cycles and are less catastrophic than community collapse caused by unanticipated senescence or disease. In the Mtatsminda Forest Project, removing and disposing of wide swaths of vegetation cover was a shock to the wider community. Planned maintenance can anticipate succession and allow for the benefits of increased biodiversity in the five to ten year mid-successional period while reducing the risk of catastrophic community collapse. Encouraging some degree of early- and middle-stage succession by designing occasional coppicing, pollarding, and tree removal can lead to a more spatially dynamic and biodiverse urban canopy. (Drone photo: the authors)

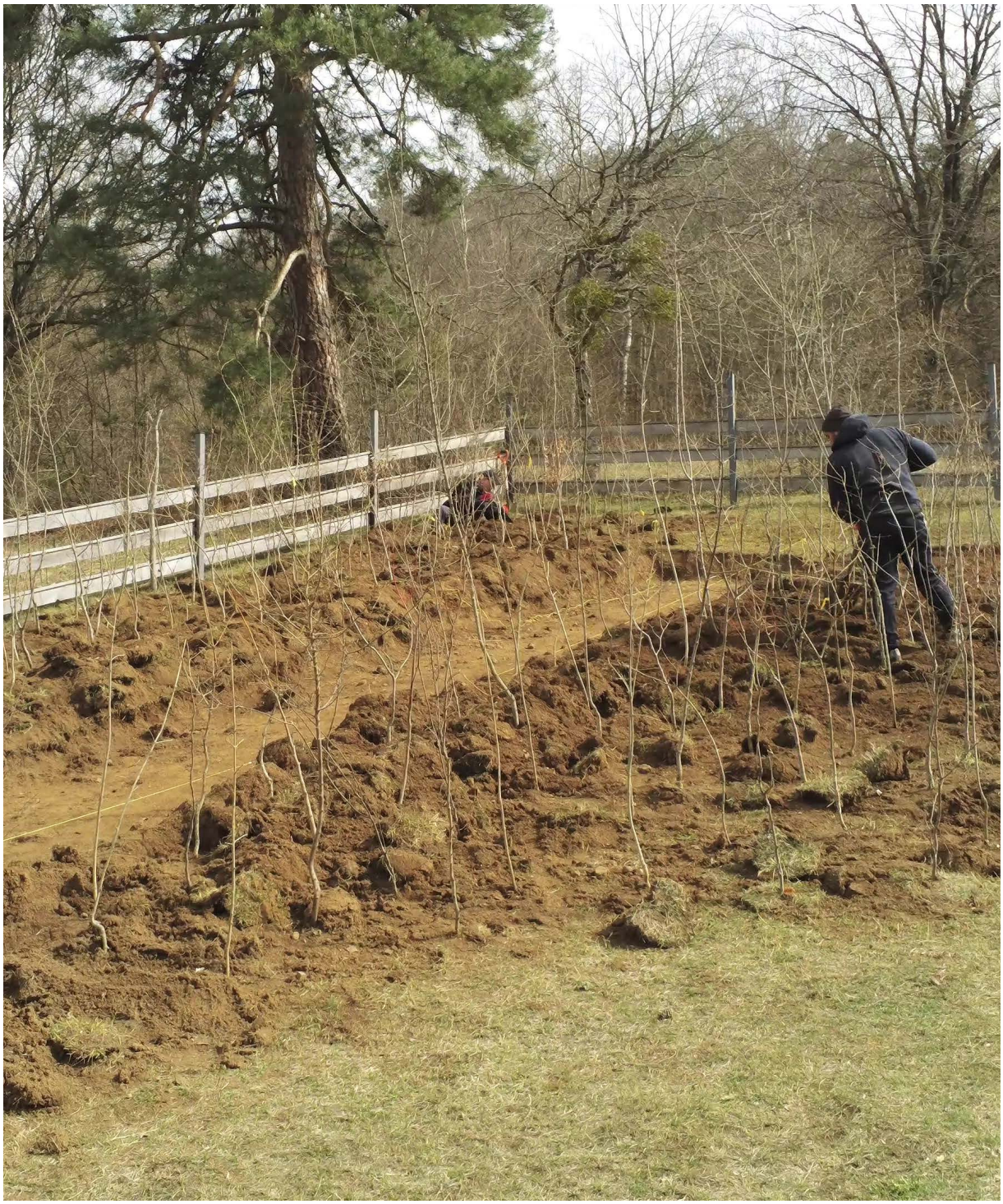


FIGURE 20

A new forest thicket. An intensive planting of forest species brings the foliage and canopy of the surrounding forest into the territory of the residence. This new forest thicket is composed of *Fagus orientalis, Corylus spp., Fraxinus orientalis, Acer campestre, Carpinus orientalis, Tilia caucasica, Prunus cerasifera*, and *Quercus iberica*, among others, juxtaposed against the existing forest behind, composed mainly of *Carpinus* and *Fagus orientalis*. Overplanting smaller forest patches in anticipation of thinning through competition, pruning, and coppicing leverages plant behaviour to establish forest soil conditions. 'Cover-cropping' with a nitrogen-fixing herbaceous layer accelerates this process in nutrient-poor soils. The intensive planting also brings the forest to the house, providing a novel proximity to forest species that celebrates the textures of the forest and avoids an overly domestic or picturesque composition. (Photo: the Authors)

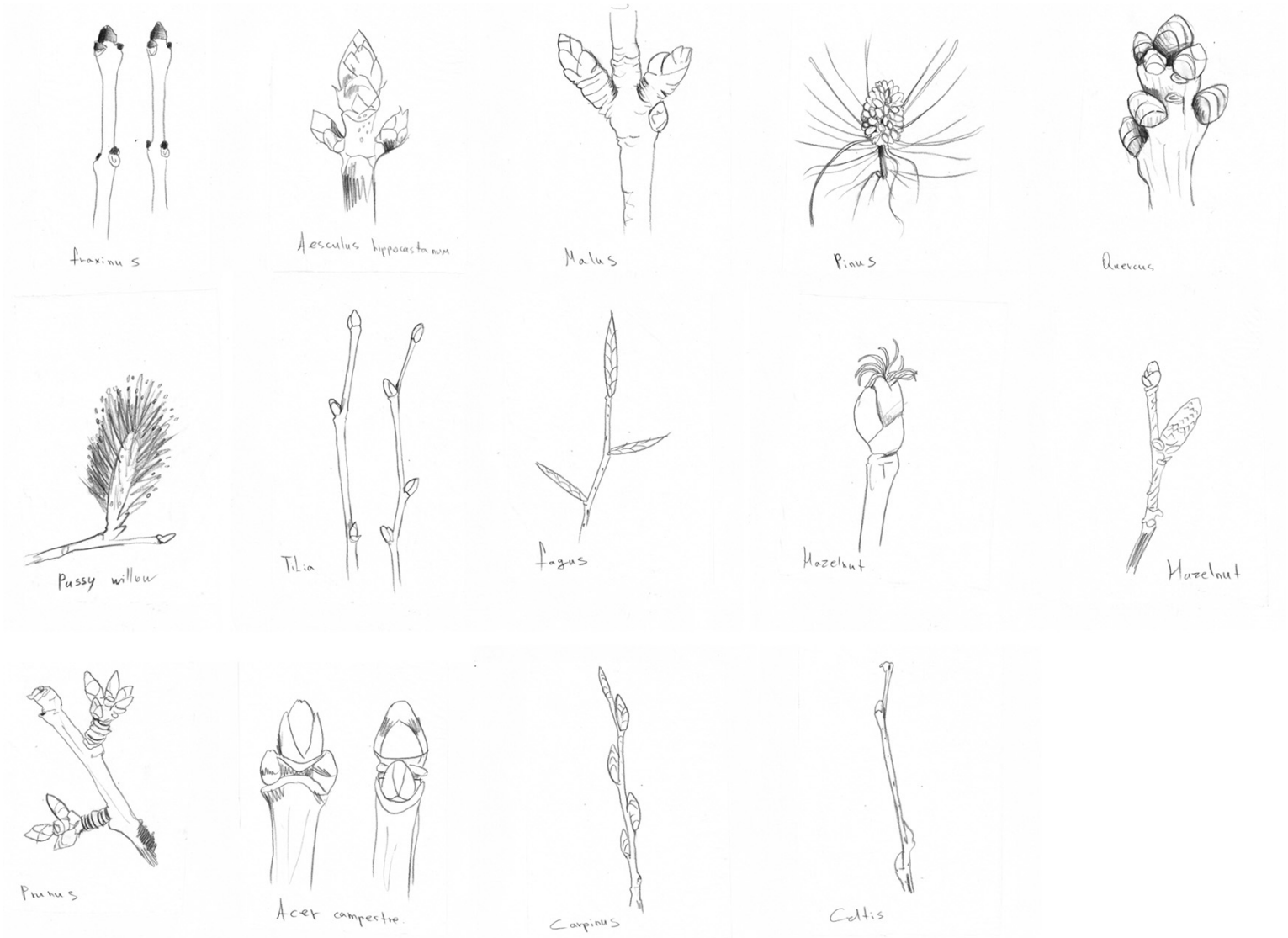
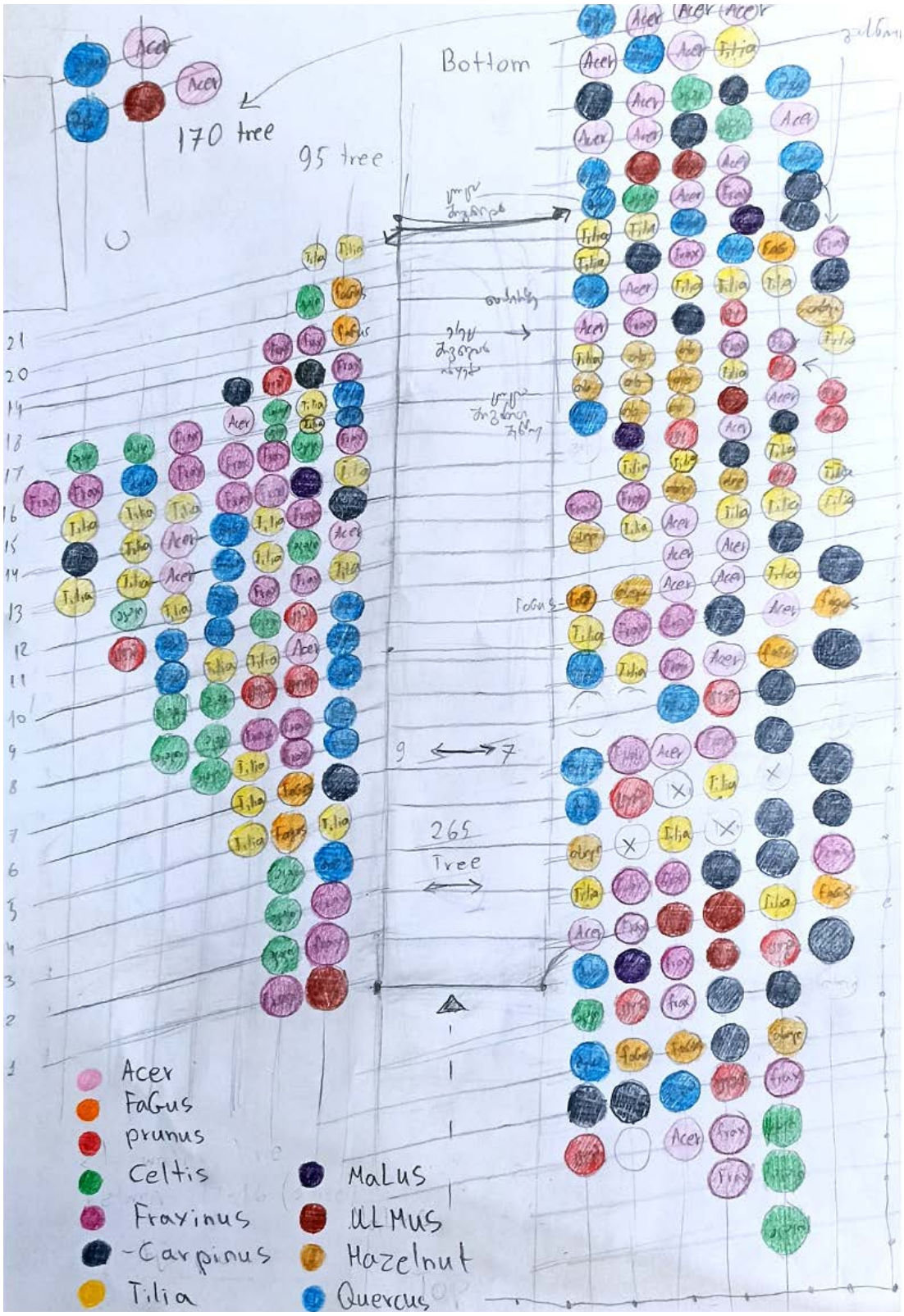


FIGURE 21

Field documentation. Field documentation carried out before and during planting identifies species by their dormant bud forms and records their location in the mini-forest, relative to other species. This documentation became the basis of studio-based experimentation in plan diagrams (see opposite page). (Field sketches: Iveta Chxikvadze)


Bottom
170 tree
95 tree
265
Tree
9
7
Acer
FaGus
prunus
Celtis
Fraxinus
Carpinus
Tilia
MaLus
ULMus
Hazelnut
Quercus

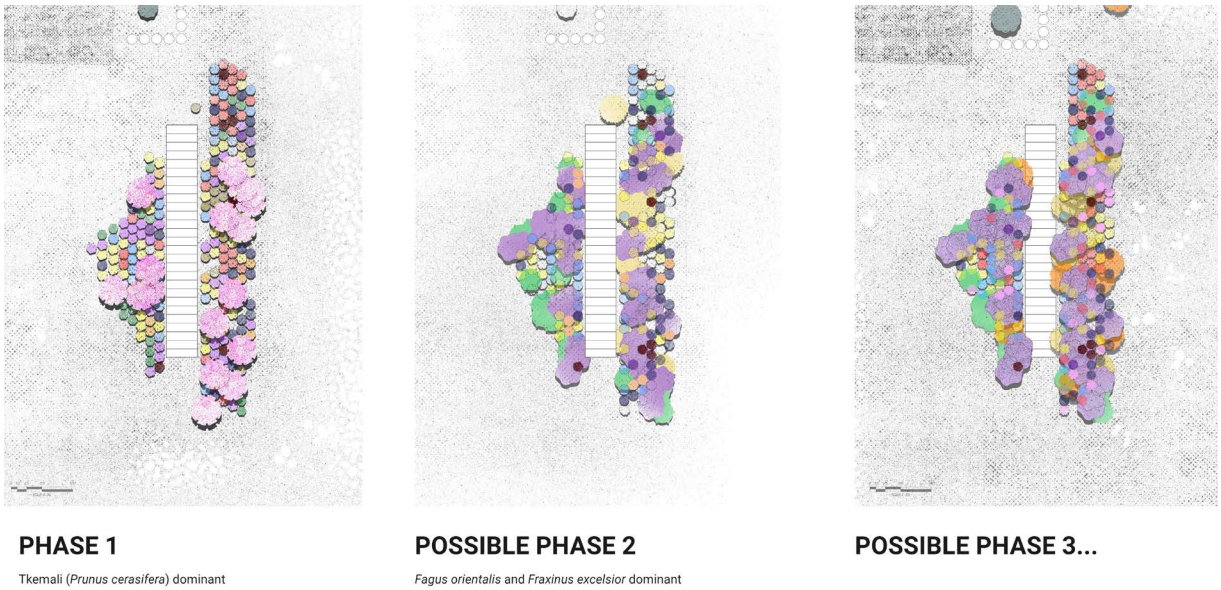


FIGURE 22

Possible scenarios. Diagram of possible scenarios for species growth and intervention over time. Planned pruning, coppicing, and pollarding allow us to speculate on competitive species behaviours and create scenarios for canopy succession. In this scenario, *Prunus cerasifera* (light pink) is coppiced before 'Phase 2,' allowing for the potential emergence of *Fagus*, *Acer*, and *Carpinus* as dominant species. These drawings are to be compared to actual growth rates in the field to plan for future canopy phases. (Drawing: Iveta Chxikvadze)

FIGURE 23

Up-close observation of the stages of plant growth and competition. The exaggerated density and close proximity of the planting encourage up-close observation of the stages of plant growth and competition, bringing a small slice of forest complexity into the spaces we live. By facilitating this proximity and designing with strategies that understand plant communities as dynamic ecosystems, we can amplify the biodiversity and value of urban forests. (Photo composition: the authors)

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Planning, Planting, and Maintaining New Urban Forests in the Metropolitan Area of Milano

Case Study of Forestami

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Abstract

Urbanization presents profound challenges to environmental sustainability, characterized by the depletion of green spaces and the degradation of urban ecosystems. Acknowledging the pivotal role of urban forests in mitigating environmental degradation and enhancing urban life quality, cities are increasingly adopting participatory approaches to afforestation. This paper explores the relationship between research and the practical implementation of urban forests, emphasizing the significance of constructing a robust network of stakeholders.

The case study selected is the research project called Forestami, which aims to plant three million new trees and shrubs within the metropolitan area of Milan by 2030. This initiative promotes green infrastructure, ecological connections, and related ecosystem services; improves the public health of citizens; increases urban and peri-urban permeable surfaces; and protects and expands territorial biodiversity. By examining the interplay between research insights and on-the-ground implementation, this paper underscores the critical importance of forging a diverse network of stakeholders to navigate the complexities of urban forestry initiatives. Through this collaborative framework, cities can cultivate resilient and vibrant urban ecosystems that enrich the lives of residents while safeguarding the environment for future generations.

Keywords

Engagement, land use, trees, urban forestry, urban planning.

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Introduction

Urbanization presents profound challenges to environmental sustainability (Eckert et al., 2014), characterized by the depletion of green spaces and the degradation of urban ecosystems. Acknowledging the pivotal role of urban forests in mitigating environmental degradation and enhancing urban life quality (Van den Berg et al., 2007; Bratman et al., 2012; Keniger, 2013), cities are increasingly adopting participatory approaches to afforestation (Cernea, 1989). This paper explores the relationship between research and the practical implementation of urban forests, emphasising the significance of constructing a robust network of stakeholders involved.

The case study is the research project called Forestami, which aims to plant three million trees and shrubs within the metropolitan area of Milan by 2030. Promoting green infrastructure, ecological connections, and related ecosystem services, the Forestami initiative also aims to improve public health, increase urban and peri-urban permeable surfaces, and protect and expand territorial biodiversity. The project started in 2018 with the aim of mitigating the effects and risks caused by climate change and improving overall air quality.

Urban forestry, encompassing strategic planning, tree planting, and management, aims to bolster ecological resilience, enhance air quality, mitigate urban heat island effects, and foster biodiversity (Lafortezza et al., 2009; Ekkel & de Vries, 2017; O'Brien et al., 2017). Traditional top-down approaches to urban forestry often overlook community engagement and fail to address the diverse needs of local residents. In contrast, a participatory model for urban afforestation advocates for the active involvement of community members, stakeholders, and local organizations across all stages of the reforestation process. This model prioritizes community empowerment, social inclusion, and collaborative decision-making, thereby ensuring the enduring success and sustainability of urban green spaces. By examining the interplay between research insights and on-the-ground implementation, this paper discusses the critical importance of forging a diverse network of stakeholders to navigate the complexities of urban forestry initiatives. Through this collaborative framework, cities can cultivate resilient and vibrant urban ecosystems that enrich the lives of residents while safeguarding the environment for future generations.

Territorial Analysis: Città Metropolitana di Milano, Italy

The Città Metropolitana di Milano (CMM) is a densely populated area in Northern Italy, with a population of 3.25 million inhabitants (ISTAT, 2023). The Municipality of Milan, the capital of the Lombardy Region, accounts for 42% of the population of this territory. CMM encompasses 133 municipalities with a total surface area of 1,575.65 square kilometres, approximately 6.6% of the Lombardy Region (Milan Metropolitan Area, Metropolitan Observatory, accessed December 2023). From the analysis of different land uses, data related to CMM shows that approximately 41% of the territory is urbanized, equal to approximately 645 square kilometres, while 52% remains agricultural land. Only 7% is designated as forests (data processed by DUSAF 6.0) [fig. 1].

CMM is characterized by dense urbanization in the northern part, interspersed only with small enclosed agricultural plots, and numerous urban parks and gardens scattered throughout the residential fabric, including the prominent presence of Parco Nord Milano. These spaces are dedicated to leisure, free time, and recreational activities, defining the quality of this environment. The southern part of CMM is distinguished by the presence of Parco Agricolo Sud Milano, established in 1990 to protect agricultural fields from erosion due to urban development. Today, it primarily hosts agricultural production, covering an area of 47,000 hectares.

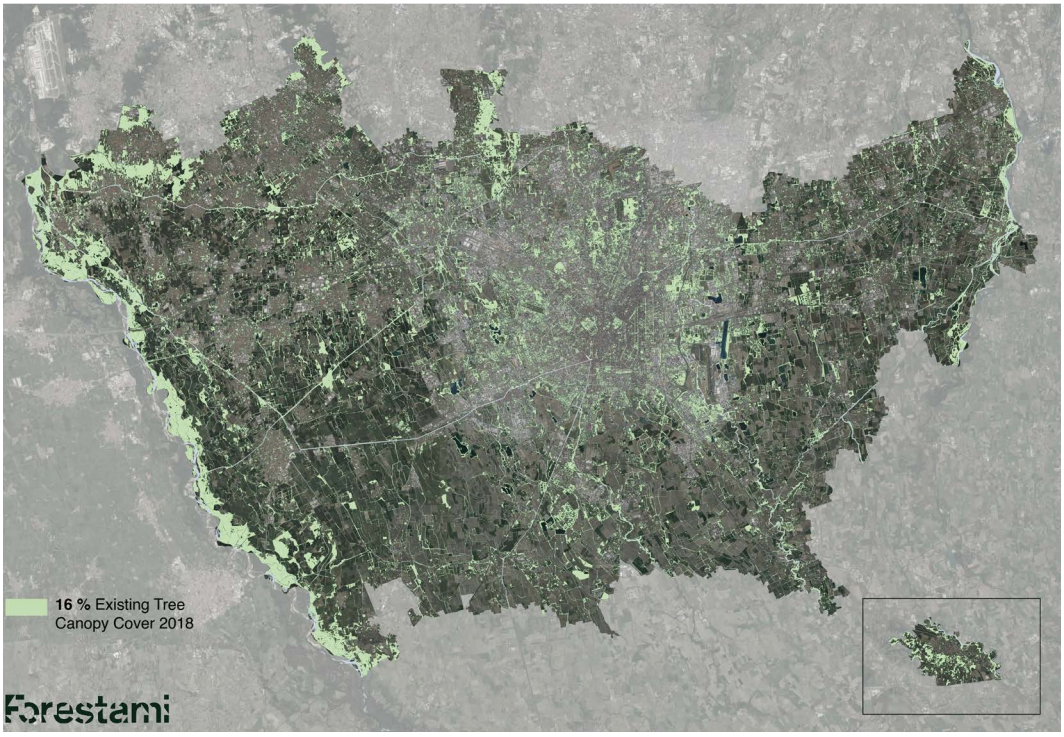


FIGURE 1 *Existing Tree Canopy Cover, Città Metropolitana di Milano, 2018.* Elaboration by Politecnico di Milano Lab SimUrb Laboratorio di Simulazione Urbana Fausto Curti

Steps towards Afforestation

Priorities

When initiating a project aimed at planting three million new trees and shrubs within a densely urbanized environment such as the CMM, defining the initial set of priorities within the afforestation strategy becomes crucial. This process connects the importance of increasing natural capital with addressing specific territorial challenges and provides a potential roadmap for the spatial planning of new plantations.

Therefore, the research initially focused on studying the characteristics of the CMM in relation to spatial information concerning permeable/impermeable surfaces, water runoff, urban heat island effect, and population density. Two specific research areas were developed for the project: (i) data regarding the existing tree canopy cover and (ii) the percentage of the population with accessibility to existing green spaces contributing to the well-being of people.

Tree canopy cover serves as an indicator of vegetation density, widely used in the literature as an alternative to simply counting the number of trees. It accounts for the actual consistency of vegetation in an area, representing the projection of tree crowns on the ground. Within the count of tree canopy cover, only trees with a tree canopy are identified, indicating that they are alive and in good health. Various calculation methods exist to obtain tree canopy data, with the precision of estimates depending on available data. For estimating the tree canopy cover of the CMM, satellite images were primarily used to provide an initial assessment of existing greenery through the calculation of the Normalized Difference Vegetation Index (NDVI), indicating the vitality of greenery. Through research conducted in collaboration with LabSimUrb of Politecnico di Milano, it was determined that the existing tree canopy cover of the CMM was 16.58%.

Equitable distribution of urban green space has long been a topic of research, given the increasing relevance of ecosystem services and their impact on people's well-being (Feng et al., 2019). Accessibility, measured in terms of time and physical distance, to open spaces is essential for well-being. Studies demonstrate that residing in green neighbourhoods and having daily exposure to trees reduces stress levels and physical fatigue (Marselle et al., 2021; Ward Thompson et al., 2016; Wolf et al., 2020). Accessibility serves as a key indicator for measuring the equity of spatial distribution of urban green spaces, directing policies and investment decisions for new projects. Accessibility to a space refers to the ability to overcome resistance, such as travel time and distance required to reach a location (Páez et al., 2012). Through spatial analysis of the different databases, the research conducted found that within the Metropolitan City of Milan, 37% of the residential urbanized surface area is accessible within 300 metres of publicly accessible green open spaces. All these studies and analyses formed the baseline for our priority strategy, providing a roadmap for the areas of intervention.

The Potential

The second step involved the analysis of the territory's potential to accommodate trees and shrubs by considering different land uses and understanding the capacity of the CMM to host trees [fig. 2].

The approach taken was to construct a programmatic scenario wherein the design is not dictated by a specific project but rather by the availability of areas suitable for tree planting. The study analysed and provided estimates of afforestation across 21 project focuses. Initially, afforestation scenarios were developed based on the categories of urban and peri-urban forestry identified by the Food and Agriculture Organization (FAO) in its Guidelines publication on Urban and Peri-urban Forestry (2016).

After contextualising these categories and their associated afforestation actions to the territory of the Metropolitan City, the main urban and peri-urban afforestation strategies were identified. These were useful for the subsequent development of project focuses and the consequent identification of areas and pilot projects.

The project focuses were identified by a working group based on several main criteria: (i) the maximum potential for afforestation achievable based on technical and territorial knowledge pertaining to the project; (ii) the social and symbolic significance of certain land use categories; and (iii) the clear identification of stakeholders with whom dialogue is necessary.

The relevance of this study is to:

- Provide a sound background to the capacity of the CMM to host three million new trees and shrubs;
- Facilitate specific initiatives across various project focuses through the development of sectoral projects and policy instruments, promoting interventions;
- Make the mapping openly available to all, allowing for the precize and localized verification of suitable areas, starting from the larger areas and proceeding on a municipality-by-municipality basis.

The analysis revealed that more than three million new trees and shrubs could be accommodated. In total, planting three million new trees and shrubs corresponds to an increase in tree canopy cover from 16% to 21%.

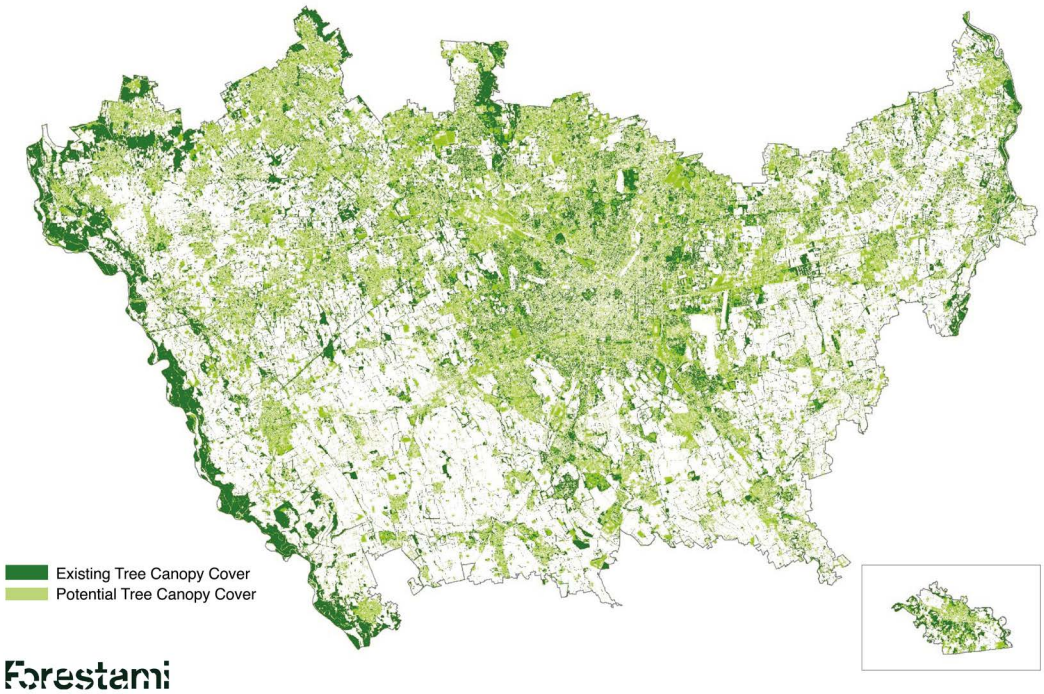


FIGURE 2 *Potential spaces for tree planting*, Città Metropolitana di Milano, 2019. (Elaboration by Politecnico di Milano Lab SimUrb Laboratorio di Simulazione Urbana Fausto Curti)

The Willingness to Plant

The third element, an ongoing process, involves the collection and design of the transition of the CMM into an urban forest. To achieve this, the research group is engaging in discussions with the different municipalities in CMM (133) to identify areas that may be involved in the urban forestry process. This activity is fundamental to the entire process as it defines the challenges, relations, and characteristics of different territories and creates a strategy for afforestation, providing a design framework for the entire metropolitan area.

To engage the municipalities, the research facilitates one-to-one discussions with the technical and political sectors for each municipality. In March 2019, the Metropolitan City of Milan managed the distribution of a questionnaire, resulting in initial feedback from administrations regarding the availability of areas for urban afforestation interventions. This allowed for the first expressions of interest from the municipalities towards the project and the opening of initial dialogues.

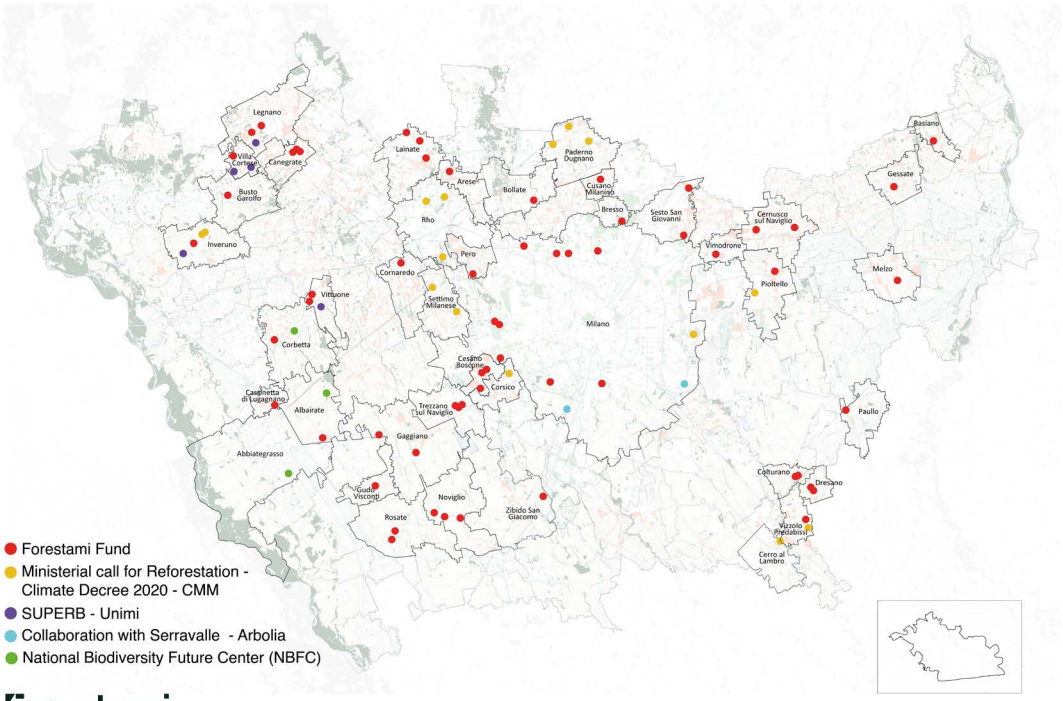
The engagement of local entities has also been supported over time by actors within the territory who advocate for interests and activities sensitive to urban afforestation themes. Within this framework, project presentations and roundtable discussions have been organized, constructing a potential agenda for collaborations and synergies.

The main operation representing the activity of engagement and dialogue with the territory is based on the construction of detailed reports tailored for each individual municipality. Starting from the areas identified by municipalities as potential intervention sites, strategies and shared visions are developed to help visualize the ecological transition of the territory. Engaging with existing or updated urban planning instruments is the other fundamental aspect for the realization of shared strategies, providing the real technical and political intentions of the transformation of the territory on which we can imagine the ecological transition.
The emerging themes and needs of the local areas are rearticulated within complex scenarios where municipal resources intersect with other possible interventions, involving different entities, often private, as well as existing and planned territorial projects with synergies with the themes addressed.

The Planting

At the end of 2019, the Municipality of Milan, the Metropolitan City, Parco Nord Milano, Parco Agricolo Sud Milano, and ERSAF (Regional Agency for Agriculture and Forest Services) signed a joint Memorandum of Understanding with Politecnico di Milano. These partners then worked together with Fondazione di Comunità (a third-sector organization) to establish a fund, Fondo Forestami, which provided capacity for collecting donations from private entities. In early 2020, thanks to the initial donations, the first plantations started in the Metropolitan City before the planting season finished.

Parallel to that, a technical committee comprising representatives from Parco Nord Milano, Parco Agricolo Sud Milano, ERSAF, the Municipality of Milan, and Politecnico di Milano was formed, with the objective to oversee the plantations. This committee is responsible for overseeing the design, coordination, and evaluation of all projects directly funded by Fondo Forestami. The committee, thanks to a Memorandum of Understanding signed with Fondazione di Comunità, works with territorial social cooperatives and is responsible for designing, planting, and maintaining the plantations for a period of five years [fig. 3].



Forestami

FIGURE 3 *Tree planting map within Città Metropolitana di Milano since 2018 by Forestami.* (Elaboration by Politecnico di Milano, Forestami research group)

Planting trees and shrubs includes the specific study of the area, its context and functions, and the choice of the layout and species, which follow a very specific methodology.

In most cases, areas predominantly targeted for urban afforestation projects consist of green spaces, both small and large, which have become part of the public heritage through various urban transformation processes. These areas are often found in residential or industrial contexts, having undergone construction activities and subsequently transferred to municipal ownership. Their soil is often highly compacted and mixed with debris residues. Additionally, they may include remnants around roads and roundabouts (urban and peri-urban), with poor soil and environmental quality due to high temperatures near infrastructure.

As for urban parks, the main aspects to consider include: the park's character (whether predominantly naturalistic or recreational), the size of the interior space that could accommodate new plants, and park usage elements. The specific history leading to the construction of the area in question is also relevant in guiding project design.

Among the areas better adapted to hosting plants with a high level of successful plantation are agricultural and uncultivated areas. Most interventions conducted by Forestami in these types of areas have yielded very satisfactory results due to the presence of a good organic soil component. Uncultivated areas are those no longer involved in agricultural production for various reasons. Therefore, if publicly owned and not subject to urban planning interests, municipalities designate them for renaturalization interventions, often integrating and revitalising spontaneous growth that has occurred over time due to lack of cultivation.

In the case of agricultural fields, the decision to convert all or part of the area to forest/tree-lined areas/ hedgerows is carefully evaluated in collaboration with municipalities. Factors considered include location, context relationship (peripheral or interstitial), and the potential contribution to agroforestry structure implementation and ecological and environmental connectivity at the urban and territorial scale.

Interventions carried out by Forestami so far mainly fall into the aforementioned types of areas precisely because they are considered among the most appropriate to accommodate new plants. However, there have also been experiences of plantations [fig. 4] in more challenging environments, such as disused and/or degraded areas. These areas require significant efforts and resources for actions such as depaving, cleaning the area of various objects, and careful agronomic species selection for compromized soils. These are complex areas of work that, together with the broader issue of depaving hard surfaces (roads, parking lots, squares, etc.), represent the highest ambition of afforestation projects in terms of city transformation: making room for nature by reversing the physical structure of the soil from impermeable to permeable.

Working with Nature-Based Solutions (NBS) in these environments is very challenging, as it involves not only high implementation costs but also dealing with what lies beneath the asphalt. A significant issue affecting many urban areas, particularly streets, is the presence of underground utilities, often without precise technical information. Along with overhead power lines, the utility system strongly influences the implementation of afforestation projects, affecting tree placement and species selection.

For these issues, the research group of Politecnico di Milano plays a fundamental role in proposing and experimenting with new forms of regeneration and space redevelopment, increasingly bridging the gap between study, opportunity, and application.

However, the evaluations and choices of areas to initiate urban afforestation projects and interventions are also the result of a process of engagement with the territory. This involves aligning all necessary elements to ensure that the Forestami project accompanies and promotes change, not only in the physical aspects of places but also in cultural aspects. This helps to foster greater awareness and a change in perspective among those who support it, from administrators to individual citizens.

To date, 63 interventions have been carried out by Forestami Fund, while 88 interventions have been implemented through the collaboration among the entities since the establishment of the project.

The Tools

To actively provide space for the trees, two main tools have been created to sustain the change. The first refers to the engagement with the municipalities to have an official commitment to the project. The second element regards the creation of a repository of all the information, a unique geospatialized database comprising all the information related to the project.

Memorandum of Understanding

To officially engage the municipalities, a Memorandum of Understanding has been in place since 2020, "to pursue the construction of a strategic vision on the role of nature in the Milan Metropolitan Area, encompassing, enhancing, and valorising all major green systems within the Metropolitan City perimeter by planting three million new trees and shrubs by 2030. This is aimed at making the metropolitan territory

more resilient and effectively addressing issues related to climate change, while also increasing the natural capital and biodiversity of this territory" (MoU, Protocolli di Intesa Forestami, 2020).

The protocols outlined commit the involved municipalities to several key actions:

- Provision of public spaces: This involves the concerted effort to design and develop public spaces to improve natural capital. These areas will likely be targeted for interventions aimed at enhancing natural ecosystems, biodiversity, and environmental quality.
- Sharing a general framework of reference: The municipalities agree to share and use a comprehensive framework provided by the Polytechnic of Milan. This framework serves as a guide, offering prospective scenarios, ongoing projects aligned with the objectives of the Forestami initiative, and potential areas within private property that could accommodate interventions aimed at enhancing natural capital. This framework is intended to be dynamic and regularly updated.
- Implementing Forestami objectives: Through a Memorandum of Understanding, the municipalities commit to adopting the objectives and purposes outlined in the Forestami project. This entails integrating Forestami strategies into their own planning tools and collaborating throughout all stages of project development.

Collaboration and provision of technical information: The municipalities pledge to collaborate closely in all phases of the Forestami project, providing necessary technical information to facilitate accurate planning and effective implementation of interventions aimed at increasing natural capital. This cooperation ensures that the project progresses smoothly and efficiently.

Overall, the protocols emphasize collective actions among the municipalities to advance the goals of the Forestami project, integrating environmental objectives into urban planning and fostering collaboration between public and private stakeholders for the enhancement of natural capital. The project frameworks in which pilot projects are identified should be understood as dynamic and ever-evolving fields of action, thus subject to potential changes. The materials produced represent a platform for exchange and openness to new forms of implementation, support, and management of identified interventions; an exchange that indissolubly brings together technical and political aspects toward a shared approach.

FIGURE 4 *Tree plantations.*

The Database

To sustain the information provided by the different municipalities and all the other involved actors and institutions, a territorial database has been constructed to systematize and locate all collected information, thus generating data to support territorial investigation and scientific monitoring. The project focuses underlying the Forestami research are thus designed based on the areas identified by the municipalities and parks as possible areas for increasing natural capital. Often, it is through comparison and exchanges with the research group that the project frameworks are enriched through possibilities that were not initially identified by the same partners. This might involve proposing more specific projects and processes to be promoted, not only with the resources initiated by Forestami but also involving other actors. These might include landowners, farmers, companies, other private entities, and directing authorities.

Representation of areas potentially subject to urban afforestation interventions within an overall framework at the municipal scale. These areas include:

- Interventions financed and implemented through the Forestami project.
- Afforestation areas identified by the municipality and parks. These areas, whether public or private property, are identified during interactions with relevant entities and are categorized as follows:
  - Afforestation areas: These are areas potentially suitable for afforestation interventions, where the location and specificity of plantations depend on the type of project to be developed and yet to be defined.
  - Rows and hedges: These refer to potential planting of rows and hedges with identified intervention locations. These interventions often occur along existing or planned routes or involve the revitalization or establishment of existing rows or hedges.
  - Reflection areas: These are areas of varying natures and extent that could potentially undergo future afforestation interventions. It is important to initiate processes for activating and engaging potential stakeholders.
  - Other local afforestation projects: These are areas affected by ongoing or planned afforestation projects/interventions within the municipality or parks that have a synergistic and complementary role with the project framework built with Forestami.
- Afforestation areas identified by private entities. These are privately owned areas (individuals or groups of citizens, companies from the industrial and agricultural sectors, landowners, etc.) that may be subject to afforestation interventions due to their synergy with the project framework. Such interventions can be carried out according to Forestami's quality requirements and objectives using private resources, thus falling within the activities included in the project.

Dissemination

The dissemination of information and coordination among various institutions and citizens is another crucial activity. Since the inception of the project, the establishment of a database outlining plantation opportunities and monitoring the actual sites of plantation has provided valuable data and information to multiple institutions, research teams, and stakeholders. This facilitates the creation of new approaches to urban forestry, which is inherently complex in built environments. Establishing an urban forest requires the collaboration of diverse competencies from different backgrounds, all sharing the common goal of planting trees and shrubs.

Engaging the population is another essential aspect of the process. Since the inception of the project, the working group has designed various activities to create a community of interest, with the broad objective of recognising the importance of trees and shrubs for the liveability of our cities and being able to be part of this ecological transition. This engagement is achieved through joint plantation activities, initiatives like Scuola Forestami dedicated to kids in school, and Forestami Academy, a three-year programme dedicated to a large audience to increase knowledge in urban forestry, as well as programmes like Custodiscimi, which provided trees and shrubs to 5,000 citizens to improve knowledge on the species planted in CMM and the importance of caring for living species. These initiatives aim to create knowledge and communities that are aware of and empowered to take action to create, enhance, and protect urban forests, ultimately the biggest challenge to create substantial change in the CMM.

Discussion

Considering the vital importance of green spaces and tree-lined areas for improving physical and mental health, cooling the environment, enhancing air quality, increasing biodiversity, preventing floods, and boosting job opportunities, as evidenced by scientific studies, it is essential to examine some of the reasons behind the decline of urban forests in the decades preceding this project, as well as interventions to ensure a positive contribution of trees in our cities.

Three key barriers or complexities hinder tree planting in urban and peri-urban areas. The first is that trees require ample space to grow and thrive. However, in urban areas, green spaces are often contested due to various competing functions such as housing, commercial activities, production, and agricultural needs. Additionally, trees compete for space with infrastructure like roads, pavements, cycle paths, railways, and underground utilities. Building space for trees requires envisioning urban environments where vegetation is not confined to certain areas but is integrated as a fundamental component of the urban landscape. Addressing this challenge requires coordinated efforts across different departments and entities responsible for urban planning and management. Urban forestry must be viewed as a transdisciplinary sector that intersects with various domains, necessitating collaboration and coordination among stakeholders.

A second key barrier is that trees take time to develop and provide their full range of benefits. Unlike many other urban infrastructures with immediate impacts, the benefits of trees are often indirect and realized over time. While the initial investment in trees is relatively low compared to other infrastructure projects, the return on investment is not immediate. Careful nurturing, maintenance, and occasional replacement of trees are necessary to ensure their long-term viability and benefits.

A third key barrier is that trees are living organisms with their own needs and characteristics. Despite finding adequate space and securing funding for planting and maintenance, misapprehensions about trees persist. Concerns include potential hazards such as falling branches, clogged gutters from leaves, raised pavements from root growth, and obstructed visibility of commercial establishments. Additionally, trees may attract insects and animals, and certain species may produce allergenic pollen or toxic leaves.

Rebuilding a positive relationship with trees requires careful species selection, intensive educational campaigns emphasising the benefits of trees in urban environments, and fostering a sense of solidarity with trees amongst the public. Recognising the multifaceted benefits that trees bring to society and understanding the consequences of tree absence or scarcity are crucial steps toward fostering a harmonious coexistence between urban environments and nature, ensuring the sustainability of our cities.

Conclusion

The goal of planting three million trees and shrubs in the Milan metropolitan area is a joint endeavour, reflective of the complexity and interconnectedness of urban environments. In the face of pressing environmental challenges, the Forestami project emerges as a cornerstone of Milan's environmental transition.

Beyond its numerical target, Forestami transcends quantitative objectives to embrace a qualitative vision focused on enhancing and valorising existing and future green systems. At its core, Forestami is a testament to care, attention, participation, and shared responsibility through the act of tree planting.

Forestami seeks to amplify the myriad grassroots initiatives led by citizens, schools, associations, and environmental groups, harnessing collective efforts to improve the planet's future and the well-being of urban communities. From individual gardens and balconies to institutional spaces, everyone is invited to contribute to the greening of the CMM.

Yet, Forestami's vision extends beyond mere tree planting; it seeks to fundamentally alter the relationship between nature and the city across the entire metropolitan area. This paradigm shift needs widespread but decisive collaboration with the 133 municipalities of the metropolitan city and Milan's technical authorities.

To bolster natural capital, Forestami champions concrete actions aimed at promoting active and planned care of green spaces, ensuring the optimal delivery of ecosystem services and enhancing territorial governance effectiveness and quality.

With Forestami, the Milan metropolitan area pioneers an approach to urban forestry which could be applied nationally, fostering continuous woodland systems and vital tree networks that safeguard biodiversity, provide shade, mitigate urban heat, purify the air, reduce CO2 emissions, and enhance public health and quality of life for all residents.

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Tree Stands Between Forest and Plantation

Evolving Practices for Northern Sweden's Boreal and Industrial Landscapes

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Abstract

By contrasting three ongoing research projects along with complementary arguments, this paper explores mediating practices from environmental art and architecture perspectives in the context of industrial forestry and Sweden's 'green transition'. The general discourse on 'green transitions' significantly amplifies the cultural and economic values of forests within and beyond Sweden. This amplification turns forests into reflexive entities that compel broader value revisions, challenging the extractivist character of modern urbanism. An example is the recent public debate in Sweden about what distinguishes a 'forest' (skog) from a 'plantation' (plantage). The debate does not reinforce the binary divide between the terms. Instead, it is prompting renewed, if overdue, attention to suppressed Indigenous and rural ancestries, as well as to alternative narratives and techniques that rethink industrial forestry tropes. From that context, our arguments position our respective research works—regarding 1) tree nurseries and climate injustice, 2) the transnational timber industry, and 3) new resource economies for the built environment—in ways which form and encourage research intersections that recognize ancestral, physical, and temporal scales as a potential for enriching the model that is the Swedish 'green transition'.

Keywords

Ancestral knowledges, architecture, boreal forests, decolonization, environmental art, forest urbanism, green transition, landscape, Sápmi, self-sufficiency.

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From Urban Forestry to Forest Urbanism – Creating Regional Agency

For several centuries now, over half of the world's forests have borne the bulk impact of extractive practices as global industrialization has fragmented and reduced many of these natural, self-sustaining environments and their communities to resource commodities. This fragmentation and reduction took full effect in the late nineteenth and into the twentieth centuries, when disproportionate commercial, national, and transnational attitudes and policies led to, and continue to lead to, alarming trends in global deforestation and biodiversity loss (Holm, 2015, pp. 358–359).

Departing from this global context, we will here outline the current discussions on forestry and the industrial development of the 'green transition' in northern Sweden, while contextualising our respective, ongoing research projects within these discussions. Our projects investigate (1) the transhemispheric roles of 'tree nurseries' between the Caribbean and Fennoscandia that challenge colonial legacies of Western forestry and remediation; (2) architectural perspectives on the impact of transnational timber industries on landscapes—the case of Swedish forests in Latvia; and (3) an activation of the built environment to become more self-sufficient and reduce resource and landscape depletion in the context of the 'green transition' of northern Sweden.

Through our projects, we seek to address how current industrial policies—where forests are still defined as scaleless, endlessly regenerative resources at the service of modern urbanization—exacerbate attitudes that have largely ignored ancestral and Indigenous values, attitudes that still seem to apply to the boreal forests of Sweden. We present the research summaries together with these ancillary arguments to challenge the correlation between industrial practices, building developments, and climate injustice, while seeking to contribute to the broader, evolving 'green transition' of Sweden from the perspective of environmental art and architecture.

We begin by recognising that, while many sections of the Swedish Sápmi and northern Swedish cities have been exposed to mining and energy development, most have not yet turned to urban forestry and other nature-based solutions to mitigate and adapt to the impacts being ushered by this renewed demand for energy resources. What appears to be a vast boreal forest made up of Norway spruce, Scots pine, and some deciduous trees—mostly birch—standing mixed or alone, with lower vegetation of dwarf shrubs, ferns, and grasses, and a bottom layer of lichens and mosses (Arnborg, 1990), feels omnipresent in northern Sweden's built and largely unbuilt environment. It conveys a sense of bucolic abundance that allows many to overlook the difference between man-made and natural forests, the severe fragmentation that clear-cuts, mines, industrial developments, waterpower plants, and wind farms—and all of their supporting infrastructure—are currently producing, with significant impacts both above and below ground.

Expectations of urban and industrial growth, enabled by international investment, to create thriving communities are high. However, they often leave municipalities and other local actors in accommodating rather than negotiating or integrating roles, leading to a loss of areas with high ecological value, as in the case of the recent Facebook data centre development on Natura 2000 land on the outskirts of Luleå (see Ramos Caceres, 2024, p. 64), or the underperformance of wind park developments on reindeer grazing land (Björklund, 2024). Beyond the loss of forest, and thus the loss of CO_2 sequestration, biodiversity, and habitat, potential or expected (compensatory) benefits for those providing these lands often remain marginal or even fail to materialize, due to a variety of factors as diverse as wind conditions, lack of integrated planning capacity, return on investment, and so on.

By setting centre stage what is often coined the hinterland, we advocate for expanding the scale of urban forestscapes within the given boreal context of northern Sweden to a regional reading and, ideally, a propositional practice that enables stewardship rather than merely accommodating external demands. This is where forest urbanism—where the actual habitability of the built environment should be 'understood as a symbiotic form of settling within forests', as per Kelly Shannon, Chiara Cavalieri, and Cecil Konijnendijk (2023)—can be productive in offering an alternative perspective to the ongoing discourse of the 'green transition' as a primarily extractive practice of northern Sweden's rich natural resources. This requires a multi-layered, multi-scalar approach defined by different systemic boundaries to enable an integrated practice. Thus, inherent conflicts become entry points to a regional logic that incorporates the territorial dimension of forests, watersheds, and habitats, giving them agency beyond the anthropocentric and towards a more sovereign position to cope with the uncertainties of both climate change and market dynamics. The interfaces that define these negotiations as liminal and political spaces can be read metaphorically as in-between the forest and the plantation: not only as a common thread of our current research efforts but as a larger, shareable space for exploring the difficult contradictions between growth, resilience, and survival—a manifold challenge we face, and will continue to face, with the difficult legacies of colonialism and into the present future of global warming.

Standing between Forest and Plantation

Despite the increase in the general area of tree cover since the late 19th century, the area of old-growth or natural forests continues to decline at a high rate. For instance, in Sweden, depending on species and location, industrial thinning for bioenergy and other wood by-products can start as early as 25 years, followed by clear-cutting that can start at 60 years, with rotations of up to 120 years, with an average area of 4.3 to 5.2 hectares per clearing (Ramage et al., 2016), resulting in a total felling of 12.8 million cubic metres in 2022 (see Swedish Forest Agency, 2023). This is in contrast to Germany where the size of clear-cuts was limited to 0.5 to 1 hectare per clearing by 1999 (Röstlund, 2022). Such trends have led Sweden to a loss of 18.7% of old forests predating 1880 (>140 years old in 2020) between 2003 and 2019, implying their total disappearance by 2070 if this rate continues (Ahlström, 2022). Such industrial practices not only continue to fragment, damage, and scar the remaining natural and near-natural forests—with clear and irreversible impacts on greenhouse gas containment and sequestration (Mo et al., 2023)—but also significantly reduce the biodiversity of these lands, all despite policies advocating for increased forest conservation rates (Svensson et al., 2018). At the same time, climate change is affecting the Arctic, which is warming up at an unprecedented rate (Rantanen et al., 2022). These trends are causing concern and forcing public and private sectors to recognize both the scale of climate and hemispheric injustice as well as the wider conflict of interest that these extractive practices represent.

One effect of this recognition is the development of 'just-' and/or 'green transitions' designed to make core, economic-based improvements to present and future hemispheric, civic, and environmental policies with the aim of overcoming the challenges of global warming (see EU Green Deal, 2020). What has ensued, among other impacts, is a speculative increase in the market and ecosystem values of Fennoscandian forest lands. For instance, a recent assessment from the European Union states that for every €1 invested into land conservation and restoration, a return yield of €8 to €38 is to be expected (Niranjan, 2023). This kind of capital gain logic seems desirable at the outset. But there ought to be other ways of quantifying the values of living environments, especially when concepts such as urban forestry are commonly defined by often unquantifiable social and ecological benefits (Helms, 1998), rather than by monetized gains.

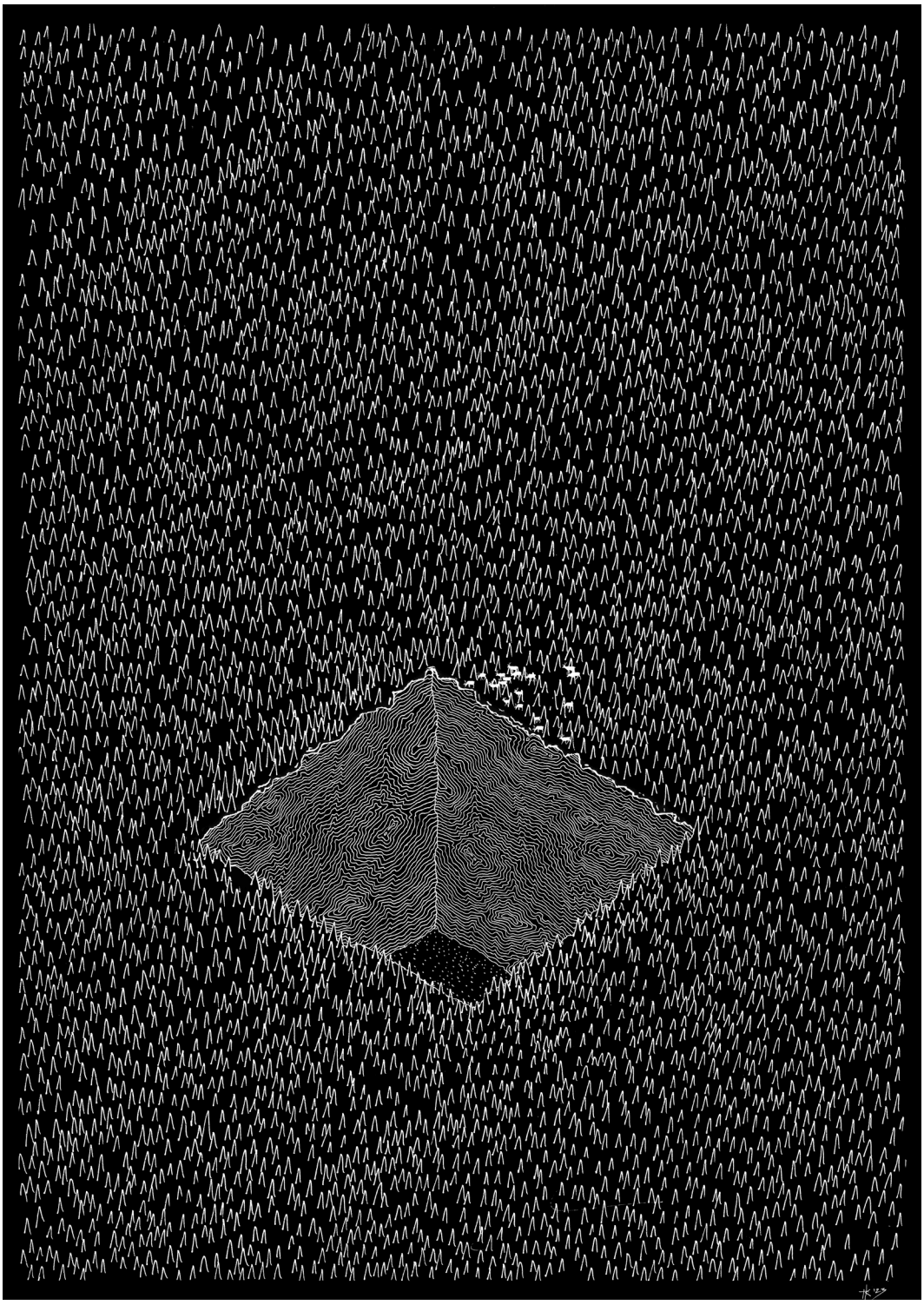

FIGURE 1 Landscape fragmentation in Norrland 1/3. Resource extraction in the form of mines and clear-cuts, energy and transportation infrastructure, farming, and urbanization all contribute to increased fragmentation of the landscape, hindering its ecological and cultural performance. From an Indigenous landscape-dependent practices point of view, they might be seen as large holes within our common asset—the forest. (Drawing by T. Kokins, 2023)

In northern Sweden, this heightening of values could be interpreted as one that is turning the boreal forest into a reflexive entity that is both: the initial landscape to be conserved while accommodating its current industrialization [fig. 1].

The inherent tensions are driven by the urgency—or, depending on whom you ask, the guise—of northern Sweden's so-called 'green transition'. In this urgent context of differing and disparate perspectives, the 'forest' becomes a physical and metaphorical emblem that simultaneously signifies various contradictions. Perhaps the most prominent of these contradictions is how forests (and the act of afforestation and reforestation) embody the broader aspiration to foster biodiversity as the only 'natural mechanism' with the scale and scope to mitigate the impending tipping points of global warming (Isbell et al., 2015; Steffen et al., 2018). Meanwhile, forests are also being exploited to increase the production of wood-based consumer products, building materials, and combustible biomass (see Sveaskog; Swedish Forest Agency).

One strong, contemporary example that encapsulates this contradiction is the public debate in Sweden about what is a 'forest' and what is a 'plantation' (see contrasting views in references to DN.se & SVD.se). In recent public debates, the way in which the state-owned forest industries and their ancillary businesses define a 'forest' has been confronted with arduous responses from Indigenous communities, scientists, and environmentalists, who hold up the term 'plantation' as a mirroring image and colonial object for self-reflection (Westberg, 2021). They argue that the promotion of 'managed-' or 'cultural forests', i.e., plantations, is not only misleading but historically toxic to the attitudes and understandings, as well as the techniques and policies—particularly in relation to Indigenous rights, labour, biodiversity, and bioenergy—required for their primary and proportional role in mitigating climate change (Moriggi et al., 2020).

Now, of course, each of these two terms—forest and plantation—represents multiple subcategories, with loaded hybrid definitions depending on the audience, discipline, or governing body. But for the purposes of this text, 'forest' here includes 'natural', 'old', 'ancestral', 'primary', 'continuous', and 'dynamic' forests. This refers broadly to self-generating environments where plant, animal, and human cultures have coexisted and continue to coexist in ways that respect the mutual timescales of entropy and renewal, carbon sequestration, and habitat, all inherent in biodiversity and large-scale planetary dynamic equilibria.

In contrast, 'plantation' refers specifically to the practice of segmenting and fragmenting productive forest or agricultural land into tree stands according to privatized and state interests. Plantations appear under the categories of 'cultural', 'managed', 'rotation', or 'multifunctional' forests which, in most cases, represent the systematic planting-to-harvest monocultural tree products within market-driven—as opposed to self-generative, evolutionary—timescales. The standardization of these management practices largely ignores the greater proportional complexity of biomes. This is driven by the conventional use of clear-cutting techniques, which, although advertized as innovative and efficient technologies, have led to increased degradation, scarification, and extinction. This is not only limited to the impacts on land, river, plant, and animal life, but it is also unjust and even traumatic for those who are unwittingly and/or forcibly drawn into industrial forestry systematization, severely limiting the prospects and urgency for increased biodiversity and equity.

Admittedly, these two definitions are neither technically hermetic nor are they limited to the Nordic region. And there are certainly many subcategories that stem between them, not least more recent and promising practices in agroforestry and regenerative forest management. Yet, Sweden's longstanding and increasingly influential role in forestry and the timber industry (regionally and globally), deeply linked to colonial histories of injustice to Indigenous First societies and regional nations, as well as the recent rush for—and unprecedented energy demands from—mining minerals and their coupling to emerging green industries in the northern counties, need to be taken into consideration. It therefore seems appropriate to actively stand and sense the forest and the plantation in the Swedish context. Such an active stance can offer a more informed analysis of the relationships and modes of representation between the rural and the urban, and the built environment and forests, and foster future cultural engagement that challenges the toxic legacies of industrialized landscapes in subarctic Sweden and beyond.

Perspectival Changes—towards a Forest Urbanism

Prominent examples from New Zealand, Brazil, India, Colombia, and Puerto Rico offer applicable insights into the values of ancestral knowledge for affirming life. These examples offer guidance for following Indigenous legacies that treat natural entities and deities, such as rivers and forests, just as any other living human being, under analogous jurisprudence of 'rights of nature' (see International Rights of Nature Tribunal). From an institutional perspective, one way to do this is to categorically include the Indigenous perspective in all research projects with a required role and percentage of funding, as New Zealand has done (Vince, 2006).

Across Fennoscandia (including Norway, Finland, and Russia), governments have slowly begun to develop policies that address the history and presence of the Sámi peoples of the region. In Sweden, the Sámi Parliament (Sámediggi) was established in 1977. In November 2021, the Swedish Sámediggi and the Swedish government agreed on a directive to create a Truth Commission. In the spring of 2022, the members of the Commission were appointed and are working according to the directive to '…identify, make visible, analyse, and highlight the consequences of the policies the Sámi people were subjected to. The Commission shall also disseminate knowledge about and raise the general awareness of Sámi history and how historical abuses affect the conditions for the Sámi today, participate in the general debate, and participate in different forms of education and information activities.' From these mandates within the directive, the key initial outcome of the Commission's work will be 'to propose measures that shall lead towards amends and change, to be presented by the latest on 1 December 2025' (see Truth Commission in Sweden, 2022).

And while we await these new, needed measures, it seems necessary to actively learn from what the Sámi communities have done over millennia to live and thrive in harmony with the boreal environment (Tunón et al., 2016). For instance, a better understanding of pre-colonial resource management in Sámi households (Norstedt et al., 2014) could be a meaningful component to initiate perspectival changes. Such knowledges and practices—for instance, the semi-nomadic coexistence of mountain communities with reindeer—remained a discrete, living material economy for centuries. But now, because of the intensification of industrial resourcing in response to accelerated climate change, these seasonal migratory herding practices are becoming more palpable and vulnerable, particularly in the northern counties (Län) of Västerbotten and Norrbotten (Sandström, 2016). Superimposed and delimited over Sápmi territories, these counties have become the focus of attention given their resource-rich environments, particularly in terms of wood for timber, pulp, and combustible bioenergy, for mining iron ore, and rare earth materials for batteries, as well as the rivers, where existing hydro and forthcoming wind power projects are expected to meet what is becoming an unprecedented increase in energy demand (Mueller, 2023).

These trends in resource extraction impacting Indigenous societies [fig. 1] are by no means unique to Sweden in the global context. However, the evolving discourses that recognize the cultural, and therefore the environmental values of ancestral, pre-colonial understandings and epistemologies of forest life (Kohn, 2013; Santos, 2016) seem to serve broader, applicable models of coexistence. By entrusting ancestral knowledges with long access to life with native and endemic species is a process that supports what can be characterized as a move towards a more-than-human nature (Haraway, 2016), yielding a kind of ontology for forests and their soils that supports fresh understandings of the personhood, inalienable rights, and life-affirming agency of natural entities (Cadena, 2018; Stengers, 2018; Puig, 2014).

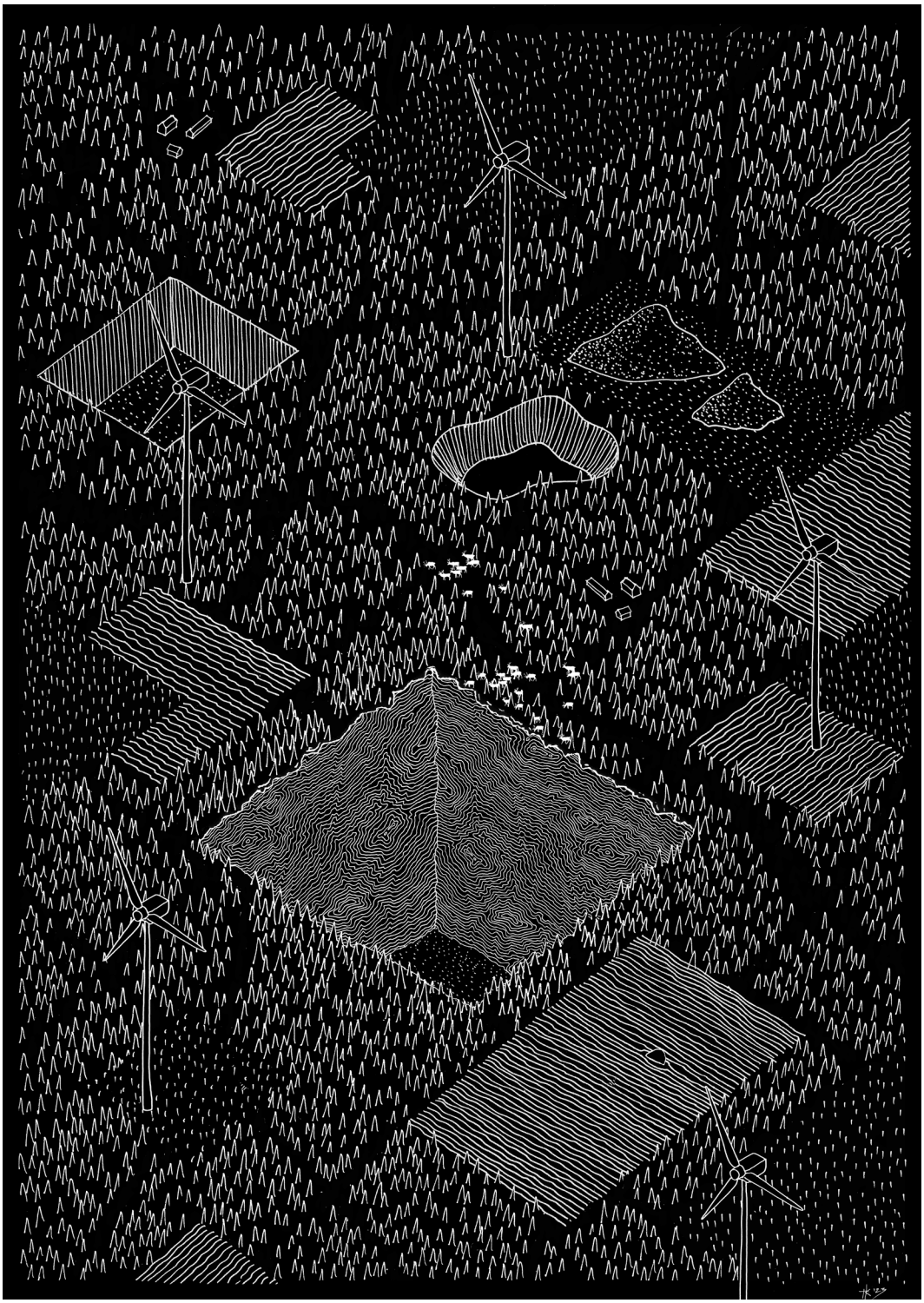

FIGURE 2 Landscape fragmentation in Norrland 2/3. As the pressure mounts on extracting more resources, the spatial and programmatic complexity of the multilayered landscape increases. Increasingly difficult to navigate for the reindeer herders and increasingly complex to plan and manage. While in cities we dedicate significant resources to planning, designing, and public participation, the question remains– who gets to plan the increasingly complex landscape of the North? (Drawing by T. Kokins, 2023)

Addressing development in the context of climate change and industrialization at this scale demands a regional perspective. So far, our research shows that northern Sweden does not have a collective regional plan (whereas other regions such as Skåne and Stockholm do). For now, it relies on the municipalities' comprehensive plans (which are not legally binding) and the individual region's sectoral responsibilities. The resulting territorial divisions create a need for comprehensive regional maps that visualize the landscape and its fragmentations through the industrialization of the land—from above and below—as a tool for negotiating development [fig. 2].

Modern, Western urbanization is a political, economic, and ecological complex that extends far beyond the boundaries of the literal 'walled city' (*urbus*). It is crucial to recognize that every building project is enabled by a distant landscape of material and labour economies that is largely invisible to the urban dweller. Every material element that makes up a building, including timber and steel, is extracted or harvested in a territory that lies beyond the view of those responsible for its development, from the architect and the client to the developer and the politician. In fact, every urban development project kickstarts a chain reaction of blurred social, material, and economic interdependencies and misunderstandings that profoundly destabilize what forests and the land can actually provide. The so-called walled city, or more precisely the compact city, becomes relevant as a counter-model to urban sprawl and further fragmentation of the landscape if we are able not only to reduce our demand for energy and resources but also, through self-sufficiency, to relieve the pressure on landscapes at large, which in the case of northern Sweden are the forests, the rivers, and the Baltic Sea into which they flow.

It is this reconfiguration of the urban that places northern Sweden in a precarious space between global warming and its third industrial transition. The inherent uncertainties about the achievability of the green transition call for a cogent and conscientious increase in resilience. Its heavy dependence on global markets and labour forces has already shown the capacity to halt planned developments in the 1970s and 1980s, with often detrimental effects on small cities (Mueller, 2023). These questionable dependencies, combined with the overwhelming energy needs being projected for the industrial sector, demand we take potential failure and consequential adaptation into account, raising the questions: what is Plan B? How can we buffer uncertainties associated with the highly ambitious yet fragile developments that lie ahead?

For instance, between now and 2035—according to Peter Larsson, the national coordinator for industrial development in northern Sweden—there will be a need for around 60,000 new housing units as a consequence of the projected influx of 100,000 new inhabitants to Norrbotten and Västerbotten (ibid., 2023). The capacity for this new built environment to reduce its significant production of CO_2 emissions and energy demand offers enormous potential and opportunities to rethink how we live and build (see IEA).

It is here that forest urbanism can become a productive term to reduce compulsive land use by giving agency to more-than-human perspectives, where forest landscapes are carefully re-envisioned as highly vulnerable spaces that can also continue to provide resources within a global economy in transition. By carefully speculating on future subarctic urban space through the notion of forest urbanism (Shannon et al., 2023)—where habitation is less a shelter and more a support structure for affirming life—we intuit that applicable notions and representations of non-monetized ecosystem services and of dynamic urban growth models can thrive, leading to cultural and climate resilience—less in the logic of financial growth—but in their ability to embrace the mitigating capacity of forests for resilience and survival (Skytt et al., 2021). With this reflexive horizon, three ongoing research efforts are summarized below.

Three Alternative Perspectives on Boreal Forests

To explore the contradictions between growth, resilience, and survival in global warming, three strands of research address the 'radical redefinition of settlement structures in relation to forests' (Shannon et al., 2023, p. 10).

I. Tree Nurseries—from Geoengineering to Environmental Remediation

It is increasingly obvious that the impacts of colonial and climate injustice are directly related to drivers of global warming. By experimenting with the 'tree nursery' as space, metaphor, and action, this arts research project looks to the shaping of pre-colonial imaginaries as forms of environmental and hemispheric remediations. Rooted in decolonial theoretical and sculptural approaches to the technological history of greenhouses (Konstfack / KTH, 2015–2020), the project is a continuation to an 18-month art and science research residency at the invitation of the local NGO Para La Naturaleza (PLN, 2021–2022), investigating the role of tree nurseries in the national, post-hurricane reforestation project in Puerto Rico (PLN 2021-22). With a network of five sites across the island, PLN uses tree nurseries as the main component of its conservation and reforestation efforts. The aim of PLN is to plant, condition, and propagate native and endemic seedlings to reintroduce species that either have been eradicated or are threatened with extinction due to the island's difficult colonial and industrial history, and the related detrimental traumata of recent unusually powerful hurricanes. In other words, the organization recognizes the need to process the trauma of slavery, mining, and subsequent agro-industrial expansion, while simultaneously pointing to them as driving forces of climate injustice. As a result, the tree nurseries and their respective biomes become spaces for re-imagining what these landscapes might have been like before European and North American colonization, all as a process of nursing and nurturing forth a proportional form of biodiversity.

From this material, and through the continued purview of the 'tree nursery', the current research will be processed through decolonial methods (Petti & Richardson, 2021; Cadena et al., 2018), where the reforestation of Puerto Rico may have relevant intersections with the ancestries, histories, and practices of forestry in northern Sweden. These will be explored and differentiated both through careful readings of the Sápmi territory and its forest communities and knowledges to learn alternative cultural practices and forms of forest stewardship (Sköld et al., 2015), as well as through river ecosystem restoration practices (Polvi et al., 2020). Here, the temporal and spatial scales between the aforementioned ancestral knowledges and the current industrial development tools and techniques—such as tree genetics and industrial seed and tree propagation operations—are set as cultural and technical values to be reviewed on various sites in Umeå and in Västerbotten county.

These materials will be set to challenge geoengineering as a last resort to environmental remediation. 'Geoengineering' (Demos, 2016; Kolbert, 2021; Malm, 2022) is defined here as the vast, scaleless technology to mitigate global warming. 'Remediation' is then treated as an index of multiple, transdisciplinary meanings pointing to conserving, nurturing, and challenging assumed knowledges and meanings. By discursively associating these terms through the tree nursery—as a potent metaphor, action, and space for recalling forest imaginaries (see Made You Look, 2022) and transhemispheric remediations (Berríos-Negrón, 2020)—multiple perspectives (Adamson, 2016) on landscape may be defined and redefined. The aim is for the act of tree nursing to see through the eyes of the forest, to culturally and scientifically explore the racialized framings of landscape (Yussoff, 2018; La Cour, 2022) inherent in the disproportionate logics of geoengineering that are currently exacerbating climate injustice.

II. Making Sustainable Forestry and Related Urban Resource Management Part of the Architectural Agenda

Since the fall of the Iron Curtain, Nordic forestry and timber companies have expanded their procurement of forest to the Baltic states and beyond. There are indications of land-grabbing by Swedish forestry companies in Latvia (Viesturs et al., 2018). Research by the authors (Kokins & Brown, 2023) reveals that 12% of all privately owned forest land in Latvia is now owned by Swedish stakeholders. The presence of Swedish forestry actively impacts local economic, cultural, and biological landscapes and fosters debate about what constitutes sustainable forest management.

This research aims to extend the debate on the impact of Swedish forest management culture beyond its national borders and to contribute to the development of a holistic, transnational perspective on timber resource accumulation and its short- and long-term implications. The project will produce a series of interviews, exhibitions, articles, events, spatial interventions (Kokins et al., 2024), drawings, and maps, both as experimental acts of dialogue and as printed media, including the drawings for this paper.

Architecture and the building industry can be viewed critically as contributors to extensive timber consumption, not only in terms of the physical use of wood but also as a driving cultural force influencing the demand for and perception of wood as a sustainable and green material. Yet, any built form—built in timber or otherwise—is part of a larger process of urbanization that drives the accumulation and consumption of forest resources nationally and internationally, with its ecological, economic, and social implications. The current discussions around Sara Kulturhus in Skellefteå, as one of the tallest timber buildings built with locally sourced wood, has created nothing less than the Bilbao effect of timber architecture for Skellefteå. However, it fails to incorporate in its narrative the void created by the clear-cutting of the adjacent forest [fig. 3]. A missing link that needs to be acknowledged and included in architectural and urban design methodologies, curricula, and evaluations.

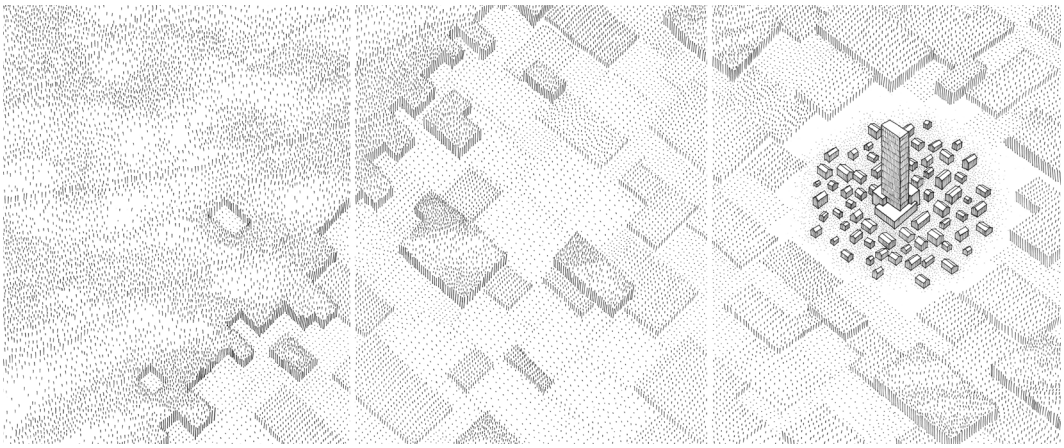

FIGURE 3 Forest urbanism of Norrland. The drawing calls for critical design methodologies where timber architecture is not only seen as a vessel of stored CO_2 but considers its embedded cultural and ecological impacts, such as the landscapes it produces. The tall tower may or may not resemble one of Europe's tallest mass timber buildings—the 20-storey high-rise Sara Kulturhus in Skellefteå, Sweden, promoted as built from locally sourced wood without showing the clear-cuts this has produced. (Drawing by T. Kokins, 2022)

By critically engaging with the Swedish forests in a wider Nordic-Baltic region, this research aims to contribute to and serve as a contextualized platform for discussion of the global trend of resource accumulation, which often neglects the urge to preserve biodiversity, cultural identities, and economic independence in the affected territories. It seeks to identify what is and what can be the role of architecture in its wider cultural sense in these processes.

III. Circling Back to the City—Reducing Pressures on Landscapes at Large by Increasing Self-sufficiency on the Building Scale

To explore how architecture and the built environment can contribute to reducing our overall ecological footprint by limiting our demand for resources and actively contributing to their direct production, the UMA lab *Designing Cycles at 64° - Interior Landscapes and the Water-Energy-Food Nexus*, a platform for research and education on circularity, explores how we can increase self-sufficiency at the building scale to cumulatively increase overall resilience within the given climate zone of the subarctic. In order to become more resilient to the inherent impacts of climate change, global crises, and resulting market volatility as repeatedly proven risk factors, there is an urgent need to become more self-sustaining, as well as the overarching need to reduce our energy and related resource demands. Therefore, the hypothesis of increased resilience through increased self-sufficiency can be applied to both scenarios: to the so-called 'green industrial transition' of Norrbotten and Västerbotten, and to its potential failure. This makes it a no-regret solution.

Deforestation, and its subsequent impacts on soil and water, can be seen as the initial failure modes of human civilization (Diamond, 2011). Activating the built environment by transforming buildings and their inhabitants from consumers to producers aims to reduce our multiple dependencies and thus extractive pressures on the surrounding landscape through circular models (Redeker et al., 2022). Using Bengt Warne's *Naturhus* model as a starting point (Fredriksson & Warne, 1993), greenhouse envelopes and extensions (GEEs) enable an extended growing season to reduce the heavy reliance on and impact of food imports (Yang et al., 2022), and passively reduce energy demand. Combined with snow- and rainwater harvesting, treatment, and reuse, and other approaches to resource recovery through nature-based solutions within buildings and in their immediate surroundings, a model of engagement and stewardship strives to reconnect with a vernacular practice.

Decentralized models of provision reduce costs, vulnerabilities, and the dependence on centralized infrastructure networks. This approach can be applied in both rural and urban contexts, both for the retrofitting of existing buildings and for new, ideally collective housing developments, cumulatively enabling a positive systemic impact. It is coupled to the urban model of compactness. GEEs can be realized with reused materials, linking to Umeå municipality's current establishment of a hub for reused building materials as part of its circular economy initiatives (see Umeå Kommun, 2022). Ideas around the region's abandoned timber buildings as a potential material storage outline another strategy to reduce the need for further deforestation. It offers a way forward from the built environment perspective to become more resilient to an increasingly fragile future, also for northern Sweden.

Forest Urbanism as an Action-oriented Response

Assigning conflicting roles to the forests of northern Sweden—where on the one hand forests must serve as carbon sinks and habitats, while also providing wood and minerals as key industrial-scale renewable resources on the other—is an ill-advized precondition for a green transition. This is highlighted by the fact that the European Green Deal still relies on the Swedish reforestation model to generate more so-called financial 'growth', while relying on more conventional infrastructure expansion and urbanization, which together will increase energy demand to unprecedented levels (Booth, 2020). These contradictions add

to the urgency of climate action. Again, it is understandable that short-term action is needed to develop key technologies to help create more efficient sources of energy and materials that could truly usher in an unsustainable transition. And even from a global, hemispheric perspective, it may seem reasonable to use wood and minerals in the Nordic regions as a responsible action to reduce the exploitation of land, resources, and labour in colonized and oppressed nations.

Yet it seems increasingly clear that these short-term tactics are directly counterproductive to the kind of emissions reductions needed to meet the targets of the Paris Accords. Moreover, these tactics only seem to import and promote the dysfunctional attitudes of extractivism and of financial growth. These conflicts of interest stand out as glaring blind spots in the bucolic and technocratic narratives being shaped by involved economic development conglomerates, no less for the northern Swedish Forest (see *More of Everything*, 2021), building on what has been coined as factoids 'which are notoriously multidimensional and scaled to all kinds of temporalities and all kinds of scenarios' (Morton, 2018). In these guiding narratives, space for criticality is often overwritten by urgency.

Recognising the specific development dynamics of northern Sweden, with its natural and near-natural landscapes currently transforming at an unprecedented rate, urgently calls for new practices. These demand cultural shifts that emphasize more-than-human perspectives and response-abilities to recognize, proportion, and make-real the kinds of transitions within the built environment that are needed for amending human relationships with nature. If we are to embrace a kind of 'forest urbanism', we might begin with a remediation of what biologically and culturally distinguishes primary forests from industrial plantations, to then include an understanding of the landscapes impacted by our resource extractions in the scopes of our architectural practice. Ultimately, this may enable us to reduce our overall impact on the landscape by changing the way we build and live.

For forest urbanism to become transformative as an action-oriented professional response to the academic perspectives developed in this paper, it is crucial to formulate a comprehensive regional framework and corresponding local competence. This needs to be based on a vision and mission formulated from within the region, which thrives on building communities that are increasingly resource-aware and self-sufficient, while giving agency to both human and non-humans most affected in their livelihoods and habitats.

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Urban Forest Living Lab - 'Urban Symbiosis'

Vital Soil as Foundation for Future Proof Urban Forestscapes - Experimenting in Real Time Locations with Different Actors in The Hague

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Abstract

This essay reports on a 'living lab' approach to develop a new understanding of below- and above-ground ecological processes as the foundation for robust urban forest habitats. This experimental approach includes a series of design and implementation projects in the city of The Hague, the Netherlands. In contrast to mainstream greening projects led by local governments, these experiments enable urban trees to form more robust forest-like systems by creating a symbiosis between soil (organisms), trees, plant communities, and species. As implemented reference projects are limited, a learning-by-doing methodology was adopted. A transdisciplinary team, consisting of landscape architects/designers, arborists, botanists, municipal and private green space maintenance organizations, has initiated, implemented, and monitored a series of pilot projects. Analysis of ten natural reference locations in the surrounding countryside has helped to define natural and forest-like soil conditions and plant communities for the three living lab locations in the city. Local residents have been engaged in the design, implementation and maintenance process. Sharing insights so far contributes to the transition of reconnecting soil, nature, and people in cities.

Keywords

Biodiversity, co-creation, landscape architecture, residents, soil health, transdisciplinary research, urban forest, urban green space, urban transformation.

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Introduction

We present an ongoing experimental design and implementation project in the city of The Hague, Netherlands—a 'living lab' aiming to develop a new understanding of below- and above-ground ecological processes as a foundation for robust urban forest habitats. Contrary to mainstream greening projects in local governments, this project allows urban trees to form more robust forest-like systems, providing a wide range of ecosystem services. As implemented reference projects are limited, we adopted an experimental, learning-by-doing approach. In a series of pilot projects, our transdisciplinary team has initiated, implemented, and analyzed/monitored symbiosis between soil (organisms), trees, and plant communities. Analysis of ten natural reference locations in the countryside helped define natural and forest-like soil conditions [fig. 1] and plant communities for three urban locations. The projects were established in close collaboration with landscape architects, arborists, botanists, municipal and private green space maintenance organizations, and local residents. By sharing our insights so far, we hope to contribute to the slow transition of reconnecting soil, nature, and people in cities [fig. 2].

In academia, there is increasing awareness of the importance of urban forestscapes and associated vegetation in providing essential ecosystem services (Livesley et al., 2016). Strengthening the network of local green spaces will result in biodiversity, public health, and climate adaptation benefits, as reflected in the 3-30-300 rule for urban forestry (Konijnendijk, 2022). Urban trees should not be isolated but given the opportunity to form forest-like systems with vital soils and natural planting communities. Such forestscapes are more resilient than isolated trees and create more sustainable living environments by enhancing public health, climate change adaptation, and biodiversity (Livesley et al., 2016). However, in the professional practice of local governments, city trees are often planted in isolation, as 'urban furniture', with little consideration of the actual and natural soil habitat [fig. 3] or planting communities (Smith et al., 2019).

The Dutch government recently introduced a new policy on strong soil and water systems (*Kamerbrief Water en Bodem sturend*, 2022). Local governments have also adjusted their long-term ambitions for urban green spaces. For example, the municipality of The Hague has embraced Konijnendijk's (2021) 3-30-300 rule (*Haags Akkoord*, 2023–2026). Furthermore, The Hague's tree policy document (*Gemeente Den Haag*, 2021) aims to develop a strong and resilient network of healthy forests and urban trees with large canopies and good growing conditions.

However, developing, designing, and maintaining robust urban forest habitats has not progressed as far in practice as in theory. How can these ambitions be realized in specific projects where, contrary to the mainstream approach, natural soil and environmental conditions form the basis for the design, establishment and maintenance of forest-like habitats? At the moment, well-described reference projects are lacking. Therefore, this project aims to answer the following research question: What is a new approach to designing, implementing, and maintaining novel, functional public green spaces that align with ecological conditions and processes above and below ground?

This essay describes methods and discusses lessons learned (on co-creation, maintenance, etc.), related to both successful and unsuccessful results. Identifying, analyzing, and piloting good examples on an accessible scale (a park, a square, or a street [fig. 1]) and starting a dialogue 'on-site' is a starting point for opening up to new ideas. Three pilot projects with different types of public space were developed in The Hague since 2020: a park (implemented in 2021, monitoring ongoing [fig. 12-16]), a square (implemented in 2022, monitoring ongoing [fig. 17-20]), and a street (ongoing preliminary test on the TU Delft campus [fig. 22]).

In these pilots, a flexible collective of participants was brought together to jointly tailor solutions for each project. Participants included designers, arborists, botanists, municipal and private green space maintenance organizations, and local residents. To provide inspiration for the three pilots, ten existing woodland areas in South Holland were studied [fig. 4]. These reference locations vary in form and environment: from old to young woodlands, wet to dry landscapes, and natural to anthropogenic soils. They provide ecological insights into the diverse regional plant communities and their successional patterns, both above and below ground [fig. 5].

So far, the first tangible projects have been implemented in The Hague, with an emphasis on valuing the knowledge of all parties and implementing a design methodology in the steps: (a) soil detemineration, (b) viatal soil development, (c) co-creation with locals [fig. 6-10]. This is a soft and gradual way of achieving an inclusive and ecological transformation towards better greening practices in the city. This encompasses a process of discovery for new nature types that could develop in urban settings, reflecting the local landscape. The pilots are tools to organize and start this process, serving as a bridge between the municipality's parks, landscape, technical, mobility, and maintenance units, and the people living, working, and learning in the district. The nature-based methodology has received positive feedback from different perspectives and seems logical to stakeholders and residents. However, working with urban space from the perspective of a new aesthetic and with less conventional maintenance to cater for more ecological and recreational value remains challenging. Quick results are often expected, but natural development takes time, which calls for managing expectations [fig. 16]. Continuous monitoring provides insight into the pilot projects' development and important information to stakeholders and site managers.

We hope that, in the longer term, this project will inspire evidence-based and bottom-up greening initiatives in The Hague, Delft and other cities, helping to create ecological networks of green and brown infrastructure benefiting inhabitants [fig. 22]. Scaling up within the broader context of climate action, the project provides practical knowledge for more intra-municipality dialogue and collaboration. We aim to contribute to urban forestscapes that grow over time, encouraging ecological succession and resulting in green spaces that promote health and well-being in dense urban environments. Projects like these can help citizens reconnect with the slow growth of trees, enhancing nature contact and reinforcing a sense of place and social inclusion centred around sound green space stewardship.

Acknowledgments

Residents who participated in the co-creation process. Biology B.Sc. students from Leiden University have been joining monitoring campaigns since 2020. René Hoonhout, Head of Green Maintenance at the TU Delft Campus.

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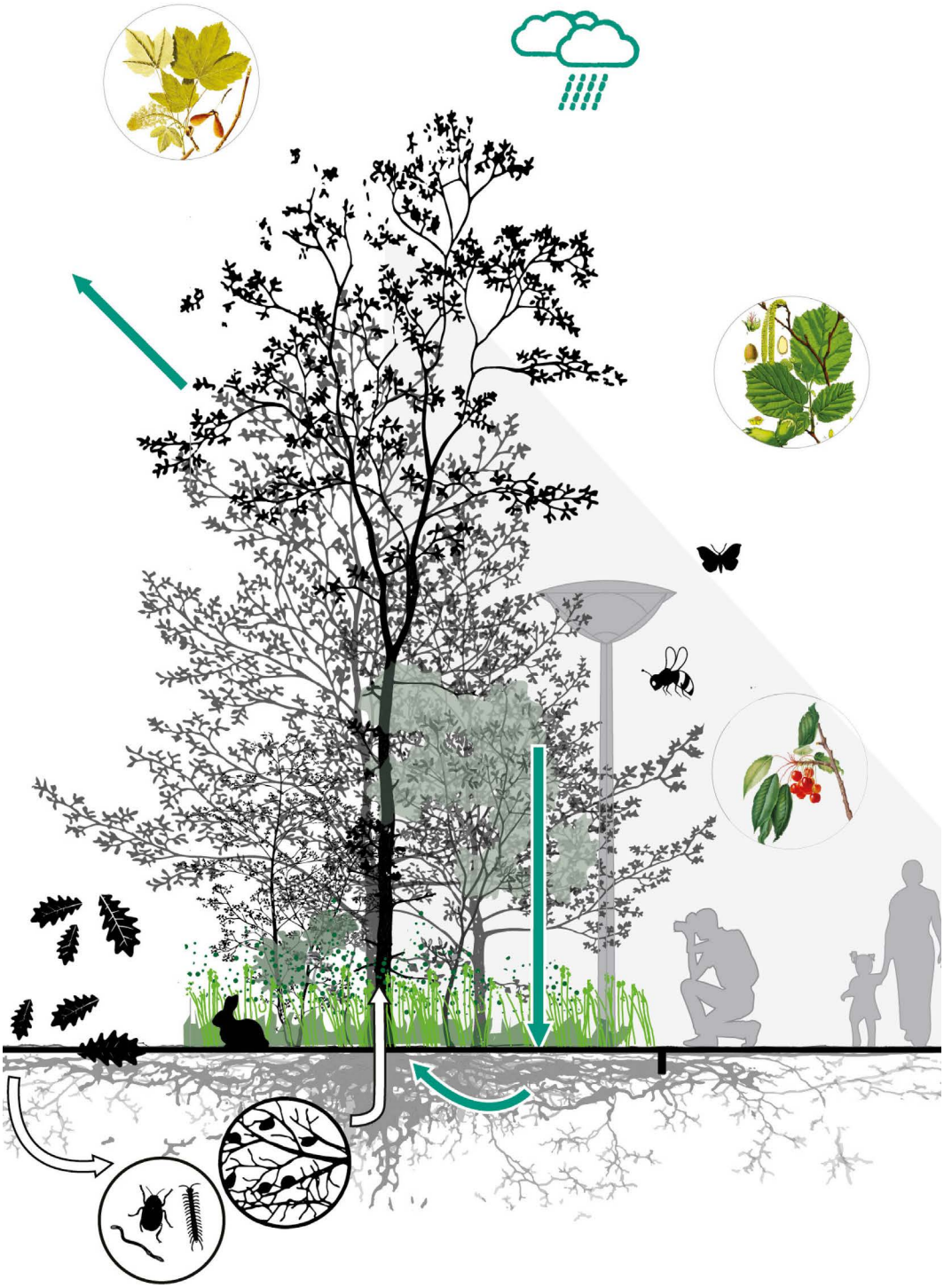


FIGURE 1 *Urban symbiosis*. An ongoing experimental design study and 'living lab' understanding below- and above-ground ecological processes as a foundation for urban forest habitats. Using an ecological focus as a starting point for designing public spaces, the project team aims to reconnect soil, trees, and people in urban environments and regain a sense of identity with site-specific nature types for a specific place.

FIGURE 2 *Crossover discipline research by design*. We propose a research-by-design collaboration between practice and science, exploring soil as a support for urban forestscapes, experimenting on soil life, and testing more diverse 'forest-like' plantations for contrasted cityscape typologies, setting up comparative studies.

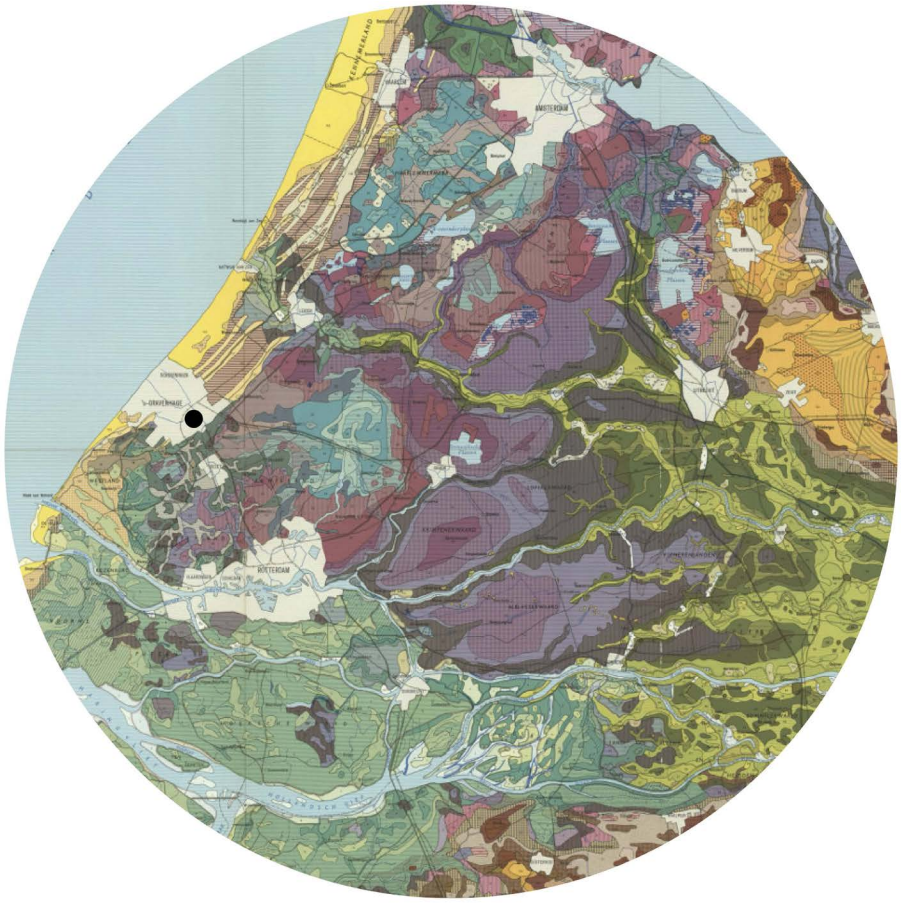
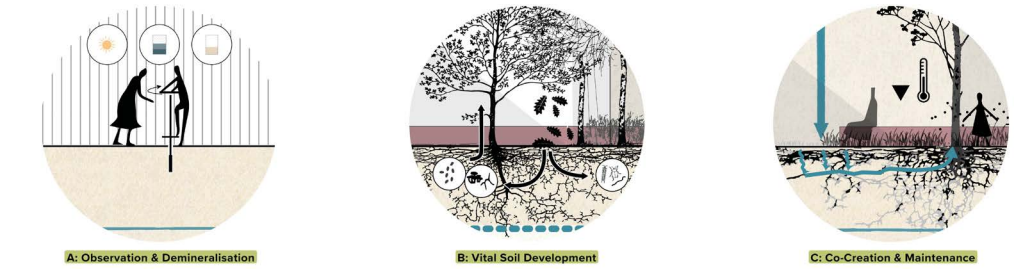


FIGURE 3 *Soil map of South Holland*. Soil maps are fascinating as they often leave blank spaces in urban settings. By having pilots in the city and reference locations outside the city, we hope to colour this type of map again: with very specific colours of soil for very specific nature for the people.

FIGURE 4 *Three living labs in The Hague and ten comparative locations in South Holland*. Together with the Municipality of The Hague, we are now working on three pilot projects, which represent three contrasted types of public space: a park, a square, and a street. The aim is to improve the living environment in the Laak district in The Hague and gaining knowledge for other cities. As a basis for the pilots, we first studied several forest sites in South Holland. These provide ecological insight into regional plant communities and their succession patterns.

FIGURE 5 *Example of monitoring at one of the ten reference sites: "Rotterdam Kikkerpad"*. The flora and fauna were monitored above and below ground. From these data, a specific plant community was determined, including the main target species for plants and underground insects, which was later used as a basis for the urban pilot projects.



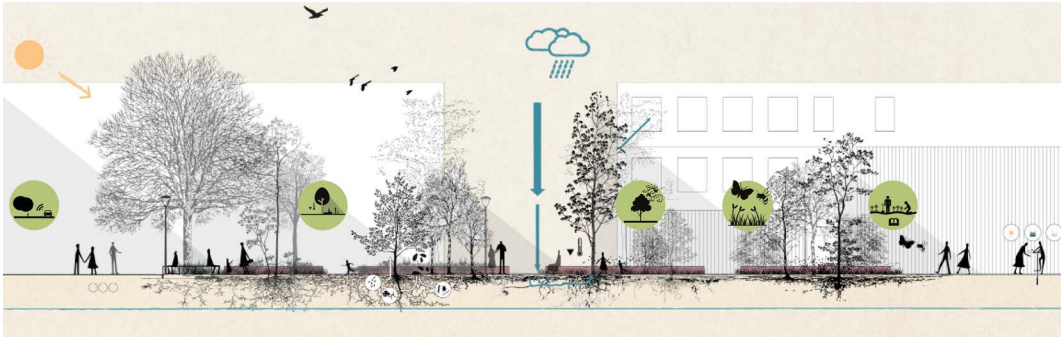


FIGURE 6 *A design methodology based on observation*. The degree of sunlight, shade, soil moisture characteristics, and soil type determine which natural habitat, its reference in South Holland, and its corresponding planting type are applicable for a specific urban location. Climate adaptation of the urban environment is therefore designed from the habitat of trees. Based on this initial analysis, three design principles were used in the pilots: A: soil demineralization, B: vital soil, and C: co-creation.

FIGURE 7 *Design principle A: observation and soil demineralization*. Soil demineralization is crucial when providing open spaces where generous, multi-stage planting can develop, and when allowing for biodiversity to flourish and proper rainwater drainage.

FIGURE 8 *Design principle B: vital soil development*. At the same time, we apply methods to develop a soil structure that is favourable to soil life. We install successive layers of soil materials (input or soil from the site) and plant materials of various kinds (woody debris, green waste, straw, leaf compost, etc.). This bedding reproduces the structure of forest soils, mimicking the natural process of humus production. Maintaining plant cover and/or mulching at all times of the year is then a next step to limit evaporation in favour of evapotranspiration.

FIGURE 9 *Design principle B: vital soil in constrained areas*. Close attention is paid to all technical solutions that will make it possible to link the various open soil spaces. To improve the soil in more challenging sites, for example, due to paving conditions and/or car traffic, techniques known as 'second soil levels' can be used; these retain water under the paving and allow more oxygen to penetrate the soil.

FIGURE 10 *Design principle C: co-creation and maintenance*. We aim to co-design and develop scenarios with inhabitants for the joint and locally appropriate development of nature in the city. In this way, we want to propose a realistic vision of what is feasible and can be expected under local constraints and the impacts of, for example, climate change. The aim is to enhance and protect these new green spaces but also to create gradients or transitions towards more cultivated areas that residents can make their own, creating an attractive nature-culture gradient in dense urban environments. Gradients and variation can be created through different types and intensities of management and for different recreational uses. To provide robust public spaces, more attention to detail is needed. For example, between wooded areas and pavements, rest areas can be created to ensure the transition between the mineral ground and the planted ground, with grass-covered joints.

FIGURE 11 *Three living labs in the Laak district of The Hague, including a pre-test on the TU Delft Campus: three types of public space*. The pilot examples demonstrate nature-based and realistic solutions to create good conditions for nature development on challenging typologies such as narrow linear streets, densely used parks, and car-dominated squares.

FIGURE 12 *Pilot project 1: Park Slachthuisplein – implementation 2021*. The project area is an existing park with existing trees adjacent to a planted street. The goal was to diversify the tree canopy and implement a 1,200 square metres forest strip at the edge of the park, as well as an ecological gradient from tall trees to smaller trees, shrubs, and herb vegetation. Human activities have deeply transformed the initial peat landscape. The water level is low, and the soil is sandy. The environmental conditions are extreme, with the heat island effect and wind. The planting palette is inspired by reference locations in the back-dune forest habitat, where similar environmental conditions can be found. Space is given to allow planted species and spontaneous ones to grow together to form an urban plant community. A succession strategy was set up, inspired by the dune forest community. Clumps of pioneer species such as *Betula pendula* and *Sorbus aucuparia* were planted in a protective, nourishing bed of shrubs and dune grasses. They will improve the soil and prepare it for slow-growing successors such as *Quercus robur* and *Acer pseudoplatanus*.

FIGURE 13 *Pilot project 1: Park Slachthuisplein – soil development*. A site-specific method to sustainably enrich the soil was defined. Instead of being replaced, the first 40 centimetres of the soil was mixed with specific compost, biochar, and worms. Soil profile rebuilding (Day & Bassuk, 1995; Heyman et al., 2019; Percival et al., 2023; Sax et al., 2017) was used to make the soil more fertile. A specific mix of compost, biochar, and earthworms was mixed through the first 40 centimetres of the soil (Darwin, 1882; Müller-Inkmann, 2020). The amount of compost was calculated to increase the percentage of organic matter from 1–2% to 4–5%. At locations with grass, the existing soil was somewhat more fertile than locations under pavement. These variations will result in slightly different microhabitats, microbiology, and plant species. A mulch layer did not fit into the budget, so we used litter and dead plant residues in the first autumn as a starter for a mulch/litter layer.

FIGURE 14 *Pilot project 1: Park Slachthuisplein – participation*. The local community was involved, with the participation of the Vadercentrum Adam for the construction of bird and bat houses that were placed on-site. After implementation, the site was closed for three months to allow soil and plants to develop before it was opened to the public. In the meantime, a banner was placed on the site explaining the design principles to residents.

2. Methodology

2.1 Study site

On the location of the Slachthuisplein (N 52° 03' 50.5" and E 4° 19' 20.9"), three different locations were determined: an area within the ganivelle fences with artificially composed soil (see Figure 1, location 1), an area within the ganivelle fences with soil enriched with biochar (see Figure 1, location 2), an area outside the ganivelle fences which contains soil composed of the soil that was present before the Slachthuisplein was redesigned (see Figure 1, location 3). The steel fences are temporary, they help in the early stage of growth of the seed mixture, grasses, shrubs and trees. Besides these fences, wooden fences are present to keep out humans and garbage. The soil composition in each area and the vegetation used is elaborated in section 2.2. Apart from the Slachthuisplein, another location outside the Hague is selected to function as a reference location: The Blink in Noordwijkerhout (N 52° 16' 41.9" and E 4° 28' 39.4"). This natural location consists of a dune-forest like landscape, after which the project is designed.

Figure 1. Overview of the locations at Slachthuisplein in the Hague. Locations 1, 2 and 3, where the samples were taken, can be seen here.

2.2 Experimental design

At these four locations, five randomly distributed samples were taken every two weeks over a period of 10 weeks. Thus, data of six visits to the Slachthuisplein and The Blink were collected. The random sampling is done, according to the *Sampling for Biostatistics* procedure, see section 2.5. (Micic, 2016a, pp. 15-24). The samples were taken, using Tullgren Funnels, or a so-called Berlese Apparatus (see Figure 2).

The samples were taken with the use of a small shovel (by hand), shoveling 20 cm into the ground. The soil was stored in the top jar of the Tullgren Funnel. The bottom jar was filled with 200 mL water, in which 20 grams of salt was dissolved. After sample collection, the samples were stored in a shed, creating a small home experimental design, due to Covid-19. Two heat lamps with 150W white light were placed above the twenty Tullgren Funnels. The distance between the heat lamps and the Tullgren Funnels was 60 cm. The warmth of these lamps desiccated the soil and the present soil animals were driven out, through the filter, to the bottom part of the Tullgren Funnel, where they would end up in the salty water. All materials used are described in section 2.4.

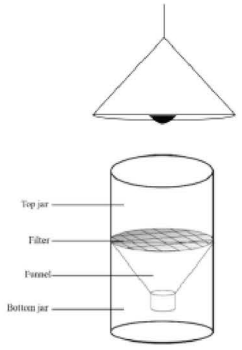
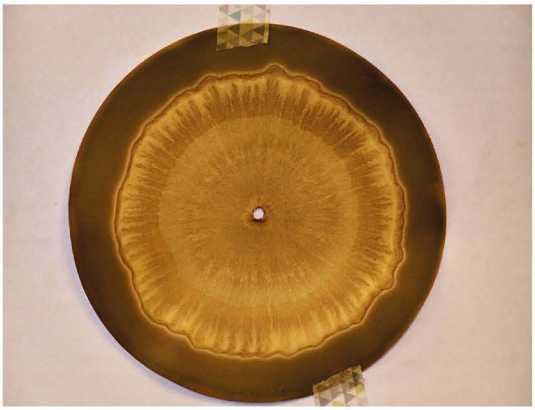
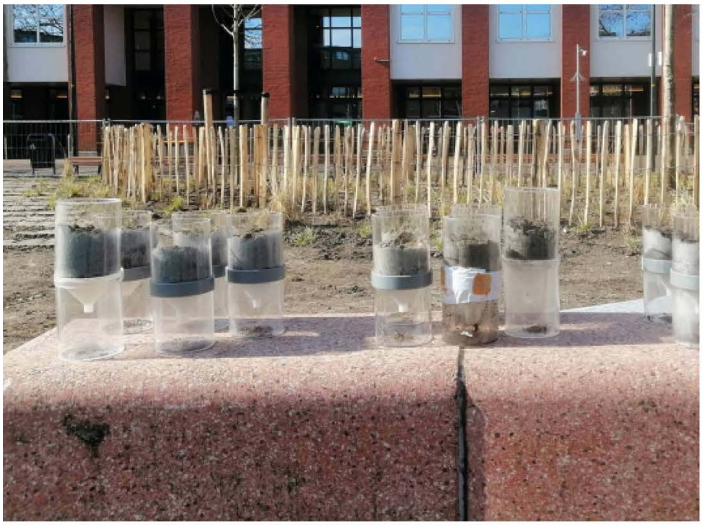


Figure 2. ***Schematic drawing of the used Tullgren Funnel.*** The image shows that the Tullgren Funnel consists of 2 compartments with a filter and a funnel in between. In the





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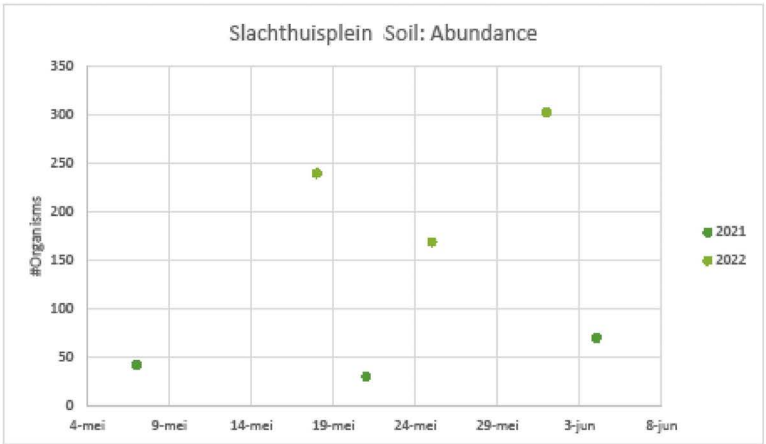

Figure 1a: Year two vs year one. The datapoints indicate three weeks of sampling at Slachthuisplein. For every dot, the number of organisms of three locations is taken together and presented as a datapoint.

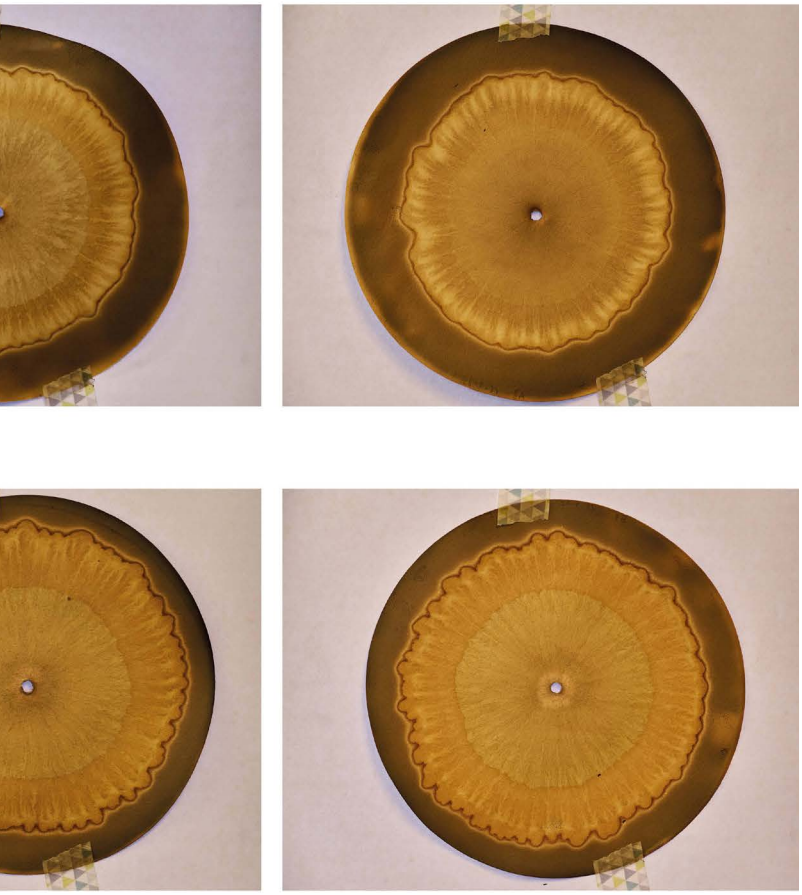

FIGURE 15 *Pilot project 1: Park Slachthuisplein – ongoing monitoring.* In collaboration with Leiden University and Naturalis Biodiversity Center, forest growth is being monitored. At this stage of the project, soil life development is the most important factor for the future development of biodiversity above ground. Looking at the planting palette defined in the design stage, insects attracted by the selected trees, shrubs, and herb vegetation are being researched. What is the common soil fauna associated with the selected forest habitat (i.e., the back-dune forest)? In this study, Tullgren funnels are used to extract soil fauna from the soil (Akoijam et al., 2013; Smith et al., 2008). These fauna crawl down through the heat of a lamp and fall into a liquid that preserves them. The third season of monitoring is ongoing to enrich the database, which will also serve the development of a maintenance plan.

Richness:

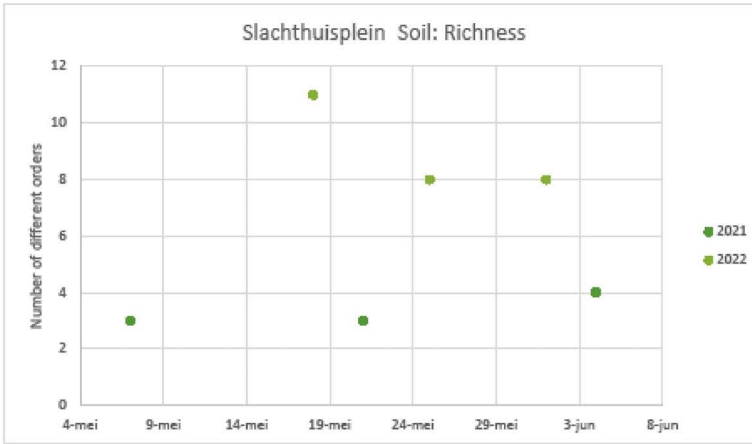

Figure 1b: Year two vs year one. The datapoints indicate three weeks of sampling at Slachthuisplein. For every dot, the number of species of three locations is taken together and presented as a datapoint.

FIGURE 16 *Pilot project 1: Park Slachthuisplein – constraints*. Some constraints occur during the maintenance phase. Parts of the dune grasses were mowed at the end of the first autumn, as well as parts of the herb vegetation, and removed from the site. Fortunately, nature is forgiving in a way; in the following spring, some dune grasses regrew, and many seeds were able to germinate. Thus, with an altered plant composition, the forest managed to develop. Another issue was people biking through planting beds to take the shortest route or parking their cars in planting beds. After planting some extra trees and shrubs and more mature herbaceous vegetation, these problems diminished over time and resulted in differences in herbaceous composition and height of vegetation.

FIGURE 17 *Pilot project 2: Square Van Musschenbroekstraat – implementation 2022*. Older trees in the city bring people together and contribute to the identity of a place. They are precious shelters for urban biodiversity as well as key actors in creating good living urban conditions by capturing large amounts of CO_2. The project area is a square acting as a stepping stone within the larger green corridor of the Van Musschenbroekstraat, a central street in the Laak District, The Hague. This project focuses on the 'Mother Trees' of the defined area, which includes five *Robinia pseudoacacia* (40 years old) and four *Aesculus hippocastanum* 'Baumannii' (60 years old). It is an exemplary pilot for tree care, focusing on soil improvement, understory development, and place-making under the canopy. Neighbours have asked for more greenery in the Van Musschenbroekstraat through a petition.

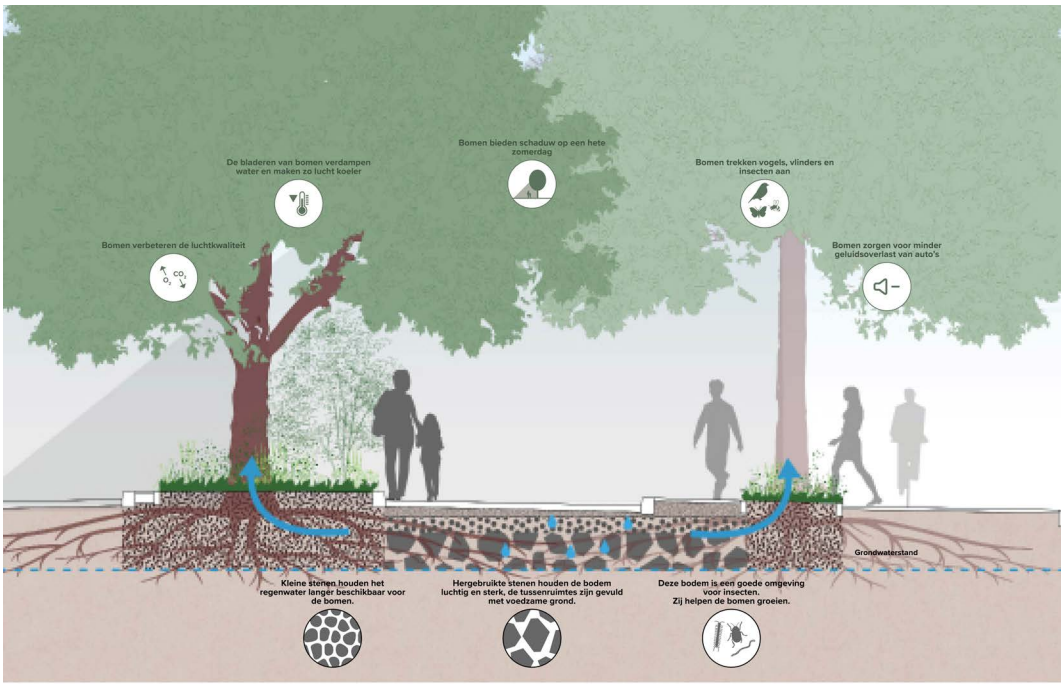

FIGURE 18 *Pilot project 2: Square Van Musschenbroekstraat – soil development*. The square consisted of an almost completely paved area with a parallel roadway with parking lots. In this situation, the trees grow on nutrient-poor sandy soil, and the roots 'eat' digested blossoms and leaves that end up in the soil through joints in tiles. This has resulted in many superficial roots up to four centimetres in diameter and heaving of pavement. We solved these problems by improving the soil and creating more space for roots. We applied soil profile rebuilding to a depth of 60 centimetres by using a special compost, earthworms, and a layer of five centimetres mulch (fraction 5–15 millimetres) for all trees and plantations. The percentage of organic matter increased from 1.5% to 4.5%. For the chestnut trees, we used a special technique that retains rainwater longer and improves soil aeration. The soil improvement consists of using the so-called Stockholm method (Embrén, 2009, 2015, 2016). Instead of using graded granite blocks of 100–150 millimetres, we used tiles and bricks partially released by converting pavement into planting beds. This 80 centimetres layer was made in three working passes. After each pass, the voids between these stones were filled with nutrient-rich soil. Elongation of roots and the thickness growth of roots are much less limited than in more standard structural soils. On top of this 80 centimetres layer, a clean 20 centimetres layer of 32–62 millimetres granite was used for rainwater storage and soil aeration. A geotextile, cunet, and brick were added to restore the parking lots and driveway.

FIGURE 19 *Pilot project 2: Square Van Musschenbroekstraat – co-creation*. As it is crucial that the urban forest is embedded in the community of a neighbourhood, the square design was tested on a scale of 1:1, presenting the project to the inhabitants and adjusting the design according to their ideas. The environmental conditions consist of low water levels, compacted soils from intense car parking, and micro-climate effects from the *Aesculus* (shadow).

FIGURE 20 *Pilot project 2: Square Van Musschenbroekstraat – ongoing monitoring*. The project is currently monitored in collaboration with Leiden University. In addition to soil organisms, we are researching which insects and in what quantity visit the site. Adhesive strips were used to trap insects. These strips were placed 1.0 metre below the lowest branch on the stem, out of reach of passers-by.

FIGURE 21 *Pilot Project 3 – Urban Bocage / Linear Forest – Implementation 2023: A pre-test in the TU-DELFT campus for possible applications in The Hague.* This project takes inspiration from a Dutch cultural landscape: the 'houtwallen' hedgerows/ wooded hedges (Müller, 2013a, 2013b), as a possible green solution for streets or boulevards. Today, these infrastructures work as barriers crossing cities. There are opportunities to turn these borders into public spaces when rethinking the road profiles and introducing linear forests as a missing link to connect parks and squares. The first urban bocage is tested on the Campus of the Delft Technical University. Two different types of plant communities were used. The first one is typical for the surrounding landscape, the second one can be found in France, about 400-500 km to the south with similar environmental conditions, but better adapted to climate change.

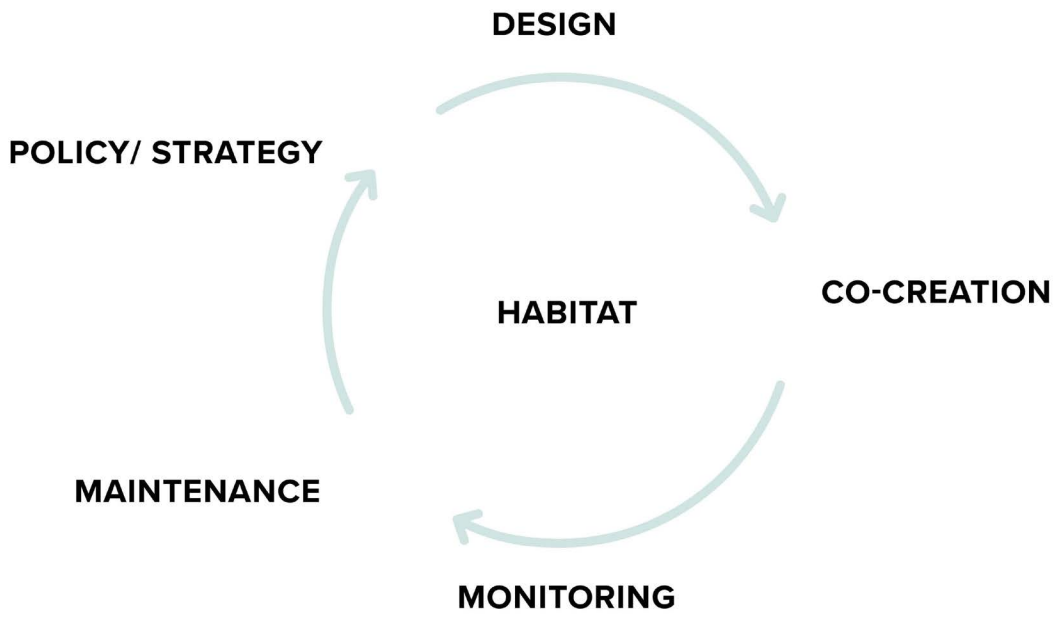

FIGURE 22 *Design process*. More than a toolbox for forestscape habitats, we intend to develop a methodology for a design process based on the relationship between the core concepts: habitat, design, co-creation, monitoring, and maintenance. In other words: how to design with natural processes in mind rather than defining a final picture.

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Plantations of the past

Tracing the Roots of the Urban Forest as Forestscape in the Early Modern Period of Delft 1500-1800

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Abstract

This paper expands on the term 'urban forest' through spatial historical research and via the concept of Forestscape. The city of Delft in the western part of the Netherlands is taken as a case study, with the sixteenth, seventeenth, and eighteenth centuries as the sample period. Based on a methodology examining the spatial history of Delft from both a processes and a patterns perspective, we identify six tree planting practices or 'afforestation events'. These plantings were integral to the early modern cityscape to the extent that the spaces in which they were planted were typologically incomplete without them. We identify tree plantings in group, line, and volume arrangements and posit these arrangements as a foundational scale in a multi-scalar understanding of the urban forest. The term 'plantation' formed the leitmotif for these plantings, interpreting natural features such as copses, groves, woods, and forests. The case study also demonstrates how, even in the early modern period, tree arrangements were established for a variety of benefits which ostensibly resonate with the contemporary notion of 'ecosystem services', but that were instead part of an alternative sensibility of what 'city' and 'nature' is. In this frame, the term Forestscape offers a way forward to retroactively interpret the historic urban forest and counter the current binary city-versus-nature discourse. We find that the collection of tree arrangements established in Delft in the period 1500–1800 presents a 'wooded watermark' of the city, which in many instances was reanimated with new tree plantings, demonstrating how parts of an urban forest can become a fixture in the morphology of the city and the lives of its citizens. At the regional scale, the extent of tree plantings around Delft with urban 'roots' extends far into the urban hinterland, while at the same time, trees and wooded areas with rural 'roots' extend well into the urban area. This condition opens a discussion on the inter-relationship between urban and rural realms and challenges the simplistic division between these two worlds apparent in contemporary spatial planning and design.

Keywords

Afforestation, Delft, forestscapes, garden culture, landscape metropolis, plantation, spatial history, tree language, urban forest, urban region.

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Urban Forestry: Scope and Historical Perspectives

The scope of urban forestry traditionally encompasses the variety of tree-based resources in cities, their location on the gradient from urban to peri-urban, and the various benefits they generate (Randrup et al., 2005). As such, urban forestry is seen as 'a strategic, integrative, and multi-disciplinary approach to the planning and management of tree resources in and around urban areas' (Konijnendijk et al., 2005). Despite increasing consensus on its scope and agency, however, there is continued debate about definitions, concepts, and terms (Randrup et al., 2005; Forrest et al., 1999). These debates reveal the range of definitions for terms such as 'urban forest' and the need for articulation and consolidation of core terms and concepts, particularly given the growing list of applications for the discipline. Among other things, urban forestry has been advanced as a novel approach to urban greenspace planning, design, and management (Miller, 1997), as a solution to a growing number of challenges cities face (Salbitano et al., 2016), and as a new perspective and model for what cities might become (Guallart et al., 2023). The value of clearer and sharper articulations of terms like 'urban forest' informs deeper understandings of the complex realm of cities and urban environments, not only for disciplines such as landscape architecture—commonly engaged in understanding, shaping, and managing the built environment—but also for those new to the urban realm. Reciprocally, landscape architecture can offer a critical contribution to the articulation of terms such as 'urban forest' and the related scope and agency of urban forestry. While much of the urban forestry discourse is dominated by functional parameters and system-based approaches aligned with forestry and ecology, less attention is given to what can be seen as the human dimension of urban trees and tree complexes: how we create and care for urban forests and greenspace, and how they, in turn, shape our daily lives. Dümpelmann (2019) highlights this relationship as a definitive condition for urban forestry, pointing to the enduring connection between humans and trees, as evidenced by the recurring use of terms such as 'amenity', 'ornament', and 'landscape'. The articulation of the human dimension is encapsulated in terms such as 'Forestscape' (see, for instance, Ekers, 2009; Leger-Smith et al., 2023). As such, this contribution supplements existing perspectives from the earth and life sciences with disciplinary perspectives from the applied sciences (landscape architecture) and the humanities.

An evident domain for better articulating the urban forest is historical spatial analysis. Examples of research, such as that by Forrest and Konijnendijk (2005), use a compound analytical prism to reveal the multiplicity of the (historical development of the) urban forest. From their discussion of some key examples, they elaborate on four topics in the lead-up to 'modern' urban forestry: peri-urban and urban woodlands, tree planting in parks and open spaces, tree planting in streets, and modern urban green planning landscapes. This work not only reveals a much longer pedigree of urban forestry practice (one that spans centuries rather than decades) but also that different historical iterations of the urban forest may exist simultaneously. More research into the particularities of this layered composition will help to elaborate on the distinction of the urban forest as compared to other forestry 'realms' (i.e., those beyond the urban). Other topics that come to the fore through historical research include the relationship between city and hinterland. Most urban greenspace plans tend to stop at administrative boundaries, thus overlooking the intricacies of the urban-rural gradient and the fact that trees and woodland features can extend far into the peri-urban and urban regional landscape (and vice versa). This hybridization—between rural and urban, nature and culture—is also archetypical of the urban forest (Dümpelmann, 2019, p. 5). Historical analysis can shed light on the development of the urban-rural gradient and the proper geographical extents of urban trees over time, thus being valuable in articulating the inherent fluidity of the urban-rural interface (urban landscapes in the countryside, rural and natural landscapes in cities) as well as informing leitmotifs for new urban regional visions wishing to extend beyond traditional planning entities and governance models. Another

critical theme in elaborating the urban forest through historical research via the lens of 'Forestscape' is an understanding of the motivations for the planting of trees in cities in the first place, and backdropping these interpretations of the collective ideas urban societies cultivate about trees, nature, and the natural world. What new understandings of the urban forest might we develop by looking through the lens of the people who inhabit them and for whom the urban forest has been established and maintained in the first place?

FIGURE 1 Map of Delft and surroundings from the early eighteenth century. This highly detailed map, known as the *Kruikiuskaart* after its makers, was commissioned by the local water authority *Hoogheemraadschap van Delfland*. (Map by Nicolaes and Jacob Kruikius, 1712).

Methodological Approach

Our methodological approach revolves around historical spatial analysis. Within this domain, we use a method combining research into historical spatial processes (the forces, institutions, and individuals who shape cities and territories over time) and related historical spatial patterns (the evolving physical fabric of an urban environment resulting from these processes) (see, for instance, Kostof, 1991). For this research, we used the city of Delft as a case study and present here results from the sample period 1500–1800[1]. Delft

1 This research forms part of a project entitled *Atlas van Boomstad Delft* (Atlas of Tree City Delft) that is planned for publication in 2025 (Van der Velde, De Wit and De Jong 2025). While the research project covered the period 1500-2000, we present here the period 1500-1800 as representing the earliest beginnings of the development of modern western cities as well as subsequent developments, which can provide relevant insights and conclusions for the research goals as well as testing the methodology.

is located in the western part of the Netherlands, midway between Rotterdam and Den Haag. It was one of the largest cities in the region of Holland in the sixteenth and seventeenth centuries and is typical of the dynamics and culture of this period (Niermeyer, 1944; Rutte & Abrahamse, 2014; Van der Gaag, 2015). Having been granted city status in 1246, Delft had a population of approximately 22,000 inhabitants by the sixteenth century. For the process part of the research, we carried out a synchronic analysis of archival material to document the various stages of urban tree plantings in Delft, resulting in summative texts on different stages. In addition to the study of maps, we accessed treatises and archaeological reports, travel descriptions, notarial acts, city descriptions, ordinances, illustrations, paintings, photographs, postcards, placards, design drawings, and planning visions. Relevant contemporary research and professional literature was also reviewed. The archives provide input for where, why, and how citizens, landholders, institutions, and administrative bodies carried out tree plantings in and around Delft in the period 1500–1800. To research the historical spatial patterns, we carried out a diachronic analysis of the sample period, elaborating this in cartographic reconstructions of urban tree plantings in the city and its surrounding territory. We synthesized these sources into a series of spatial plan projections articulating the synchronic dimensions of the development of the urban forest of Delft. An important motivation for choosing Delft as a case study is the large number of cartographic and other supporting visual materials on the early modern period (Van der Gaag, 2015). The Delft archive collection at the *Stadsarchief Delft* comprizes some 600 maps, plans, and related objects, as well as around 5,000 drawings, 4,000 prints, almost 68,000 photographs of a topographical nature, and some 30,000 construction drawings. Of these, maps formed a central source for the study. Various maps include detailed images of trees in various configurations, indicating their importance in this period (Van Rooijen, 1984; Den Dulk, 2021). Of particular note is the so-called *Kruikiuskaart*, illustrating the area called Delfland, which was the responsibility of the waterboard Hoogheemraadschap van Delfland and completed in 1712 by Nicolaas Samuels Kruikius (1678–1754) with the help of his surveyor brother Jacob [fig. 1]. Other valuable cartographic sources from this period include an early map of Delft from the *Civitates Orbis Terrarium*by Georg Braun and Frans Hogenberg from 1585, the *Delfi Batavorum Vernacule Delft* map by Joan Blaeu from 1649, and the *Kaart Figuratief* by Dirck van Bleyswijck from 1678 [fig. 2, fig. 3, fig. 4].

FIGURE 2 Map of Delft from the late sixteenth century. Trees are a highly conspicuous component of this early map depicting the cityscape of Delft. (Map by Georg Braun and Franz Hogenberg, 1581, from the *Civitates Orbis Terrarum*).

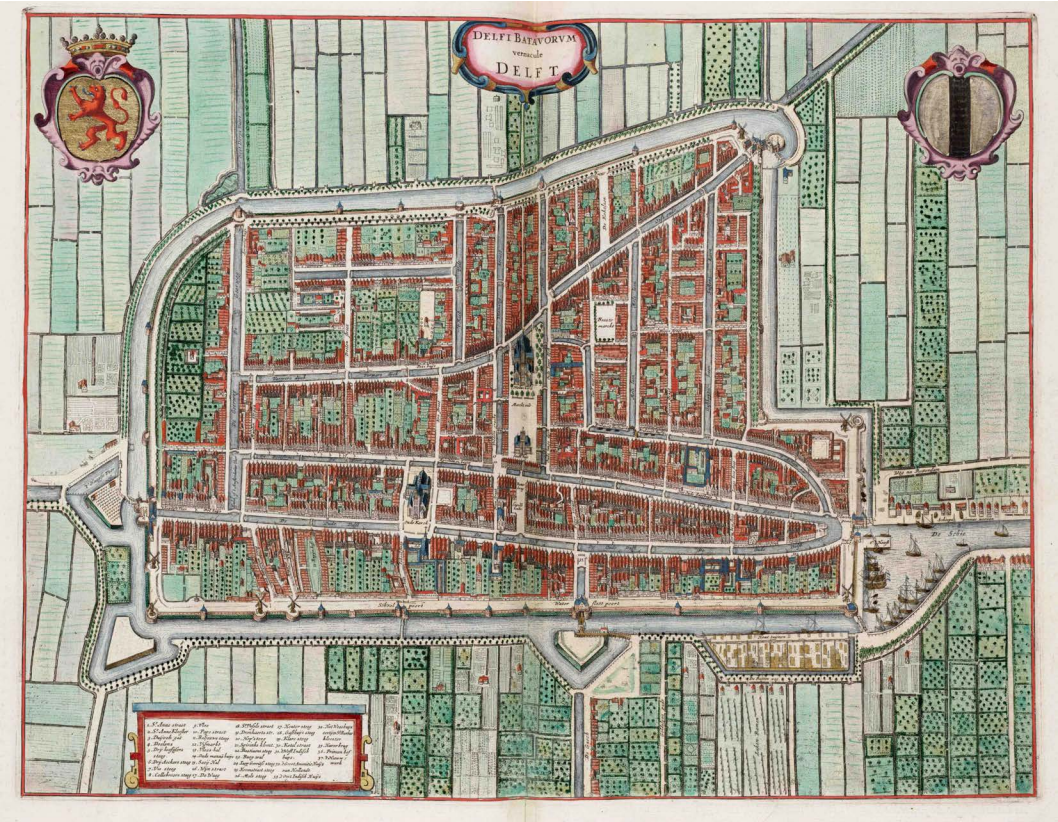

FIGURE 3 Map of Delft from the middle of the seventeenth century entitled *Delfi Batavorum Vernacule*. (Map by Joan Blaeu, 1649).

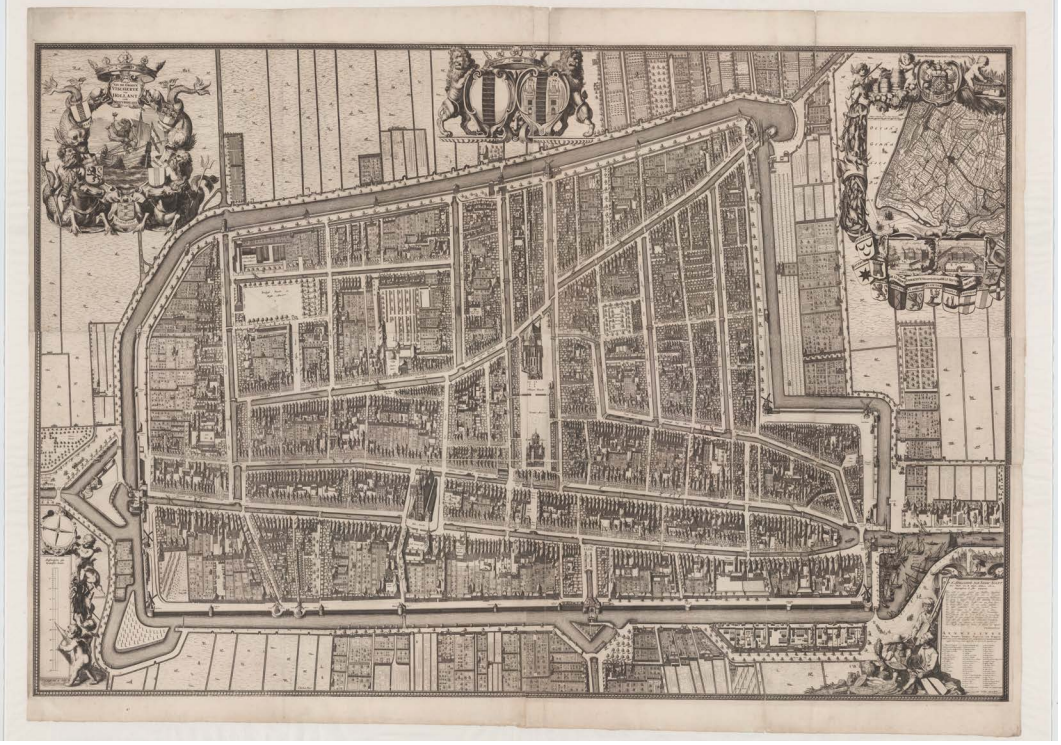

FIGURE 4 Map of Delft from the second half of the seventeenth century entitled *Kaart Figuratief*. (Map by Dirck van Bleyswijck with surveyors Jacob Spoors, draughtsman Johannes Verkolje, and engravers Johannes de Ram and Coenraet Decker, 1678).

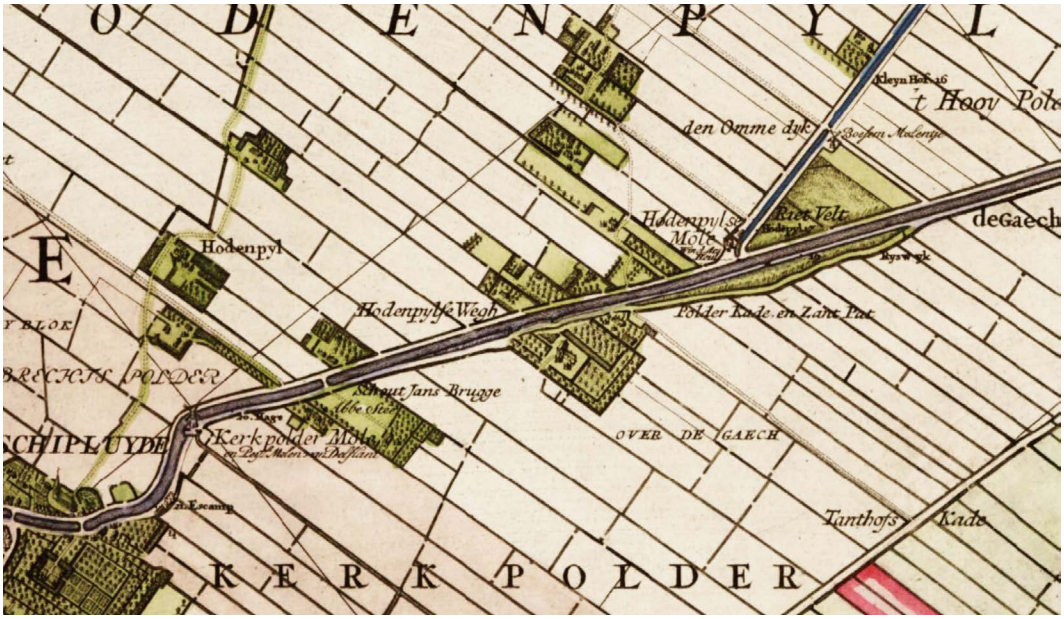

FIGURE 5 Section of the *Kruikiuskaart* map of an area to the south-west of Delft. The map section shows a mosaic of tree groups, lines, and wooded areas typical for the hinterland of Delft in the period 1500–1800. (Map by Nicolaes and Jacob Kruikius, 1712).

Hybrid Rural Trees

Various archival documents support depictions in maps such as the *Kruikiuskaart*, showing that a mosaic of tree groups, tree lines, and wooded areas was established in the hinterland of Delft early in the period 1500–1800[2]. Tree groups include farmyards, shelterbelts, wood coppices, decoy forests, orchards, *pestbosjes* (small, wooded plots where deceased animals with infectious diseases were buried), *geriefbosjes* (groves to provide wood for the farmer's own use), and *koebochten* (L-shaped woodrows used to herd and contain cattle for milking, etc.) (Buis, 1993; Landschapsbeheer Nederland, 2003). Many of these elements are visible in a sample area of the *Kruikiuskaart* [fig. 5]. A range of tree lines are also visible in this part of the map, including coppice plots on island strips in peat extraction areas and narrow strips of land planted with trees to mark the boundaries of plots of land and as shelterbelts (woodrows). This landscape was further complemented by larger tree volumes (expanses of woodland of various kinds) whose function is not always clear but, given the location and period, were either production woodlands consisting of one or two tree species in a regular planting arrangement, *grienden* (willow coppice), plots of deciduous species under coppice management as fodder for livestock, coppices mixed with mature trees (middle woods), nurseries for ornamental or other purposes, or orchards (Jansen & Van Benthem, 2005; Busz & Hine, 2001).

2 These plantings replaced the pre-settlement ('natural') landscape around Delft, which given the underlying soil types and hydrology would have included oak-elm-ash woodland on the banks of waterways, ash-willow woodland between the creeks on clay soils, and alder-birch woodland on the swampy peatlands. These woodlands gradually disappeared in the period 500-1500, when the land was progressively drained to create pastures and croplands and towns and cities began to appear.

Despite their connection to agrarian use, many of these wooded features were connected to urban life, either directly in the form of firewood, building materials, game, or produce, or indirectly as wood-based products destined for use in cities like Delft.

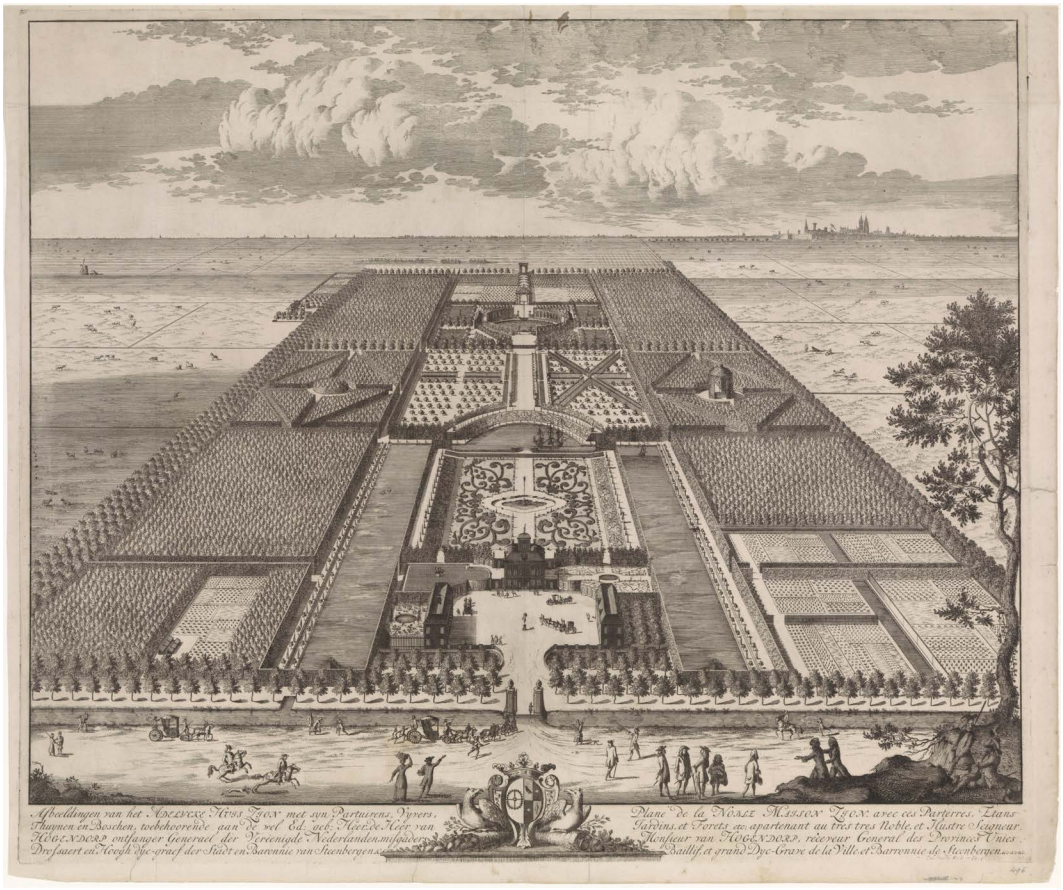

FIGURE 6 Bird's-eye depiction of the Sion manor house north-west of Delft, early seventeenth century. This aerial perspective depicts how avenues and plots of the country house were planted out with trees in a variety of arrangements. (Engraving by Pieter van Call II, ca. 1725).

Tree Plantations in an Urban Hinterland

From the early seventeenth century, wealthy city dwellers began building country houses and pleasure gardens in the landscape around Delft. Some were founded on former monasteries and castle farms, such as on the site of the former convent *Sancta Maria in Monte Sion*, where a large complex of trees was established as part of the formal garden composition of the country house Sion [fig. 6]. In the course of the seventeenth century, a series of country estates and pleasure gardens emerged along the Delftse Vliet waterway towards Leiden [fig. 7] (Buitenhuis, 1983). A kilometres-long series of tree complexes also emerged in the Rijswijk estate zone between Delft and Den Haag. Together, these trees provide the impetus for what can be seen as the first wooded features around Delft that were exclusively the result of urban culture and practices. The emergence and expansion of these country estates also triggered demand for seedlings of new and interesting species and subsequently the rise of a plant nursery industry in the seventeenth century (De Jong, 1993, p. 191; Den Dulk, 2021).

FIGURE 7 Country house Pasgeld on the Vliet, mid-seventeenth century. Trees follow the contours of the bridle path along the canal while other trees frame the manor house. (Painting by Jan van der Heyden, c.1660 © Royal Collection Enterprises Limited 2024 | Royal Collection Trust).

Tree Avenues for an Urban Region

To connect these country houses with Delft, linear tree configurations in the form of tree avenues were planted. Rows of trees were also planted along connecting roads and canals between settlements, as part of a broader development of tree plantings along canals, towpaths, and connecting roads. The main watercourse of the area—the Schie (canalized in stages between the tenth and fourteenth centuries)—was lined with trees by the late eighteenth century (Abrahamse, 2016). Tree planting (and its maintenance) along the Delftse Vliet fell under official municipal authority from 1783 (Abrahamse, 2016).

Tree Lines for an Expanding City

Closer to Delft, a radial array of tree lines appeared in parallel with the development of the regional tree avenues, emanating from the city fortifications out into the landscape. This network can be understood as a distinctive wooded figure, much like the spokes of a wheel, which defines how the city of Delft started to develop outside its city walls with trees as its basis. Such avenues began at the city walls, which were also planted as part of the fortification system and offered a fresh wood supply in case of siege (Steenbergen, De Jong, & Van de Vlist, 1997). A circumferential road just beyond the city moat was also lined with a double row of trees and provided access to institutions such as the *Pesthuis* (Lazar or Leper house) [fig. 8].

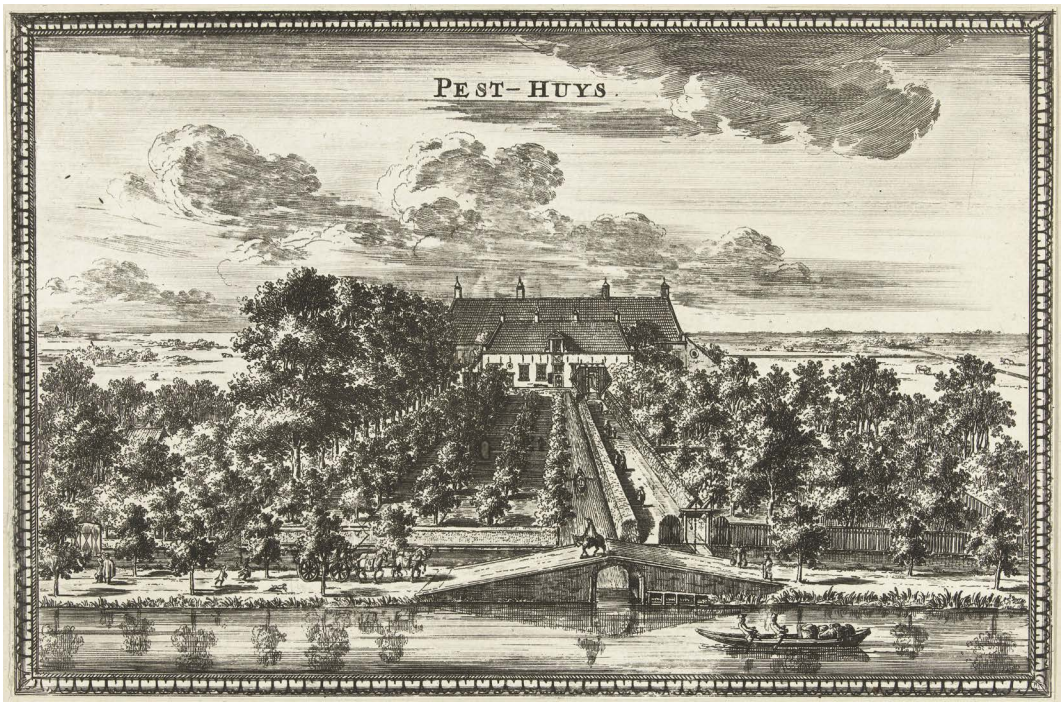

FIGURE 8 View of the Pesthuis near Delft, late seventeenth century. Tree planting may have been intended to purify the air around the Pesthuis. (Engraving attributed to Coenraet Decker, 1678 – 1703).

Tree-lined Allotments, Pleasure Groves, and Orchards

Alongside the trees on the 'tree wheel', a variety of tree arrangements could be found in extensive garden complexes in and beyond the city walls. Composed of numerous tree-lined allotment gardens, these complexes emerged to the west, southeast, and south of the city. Functionally, they were the result of population growth in the seventeenth and early eighteenth centuries and the scarcity of space within the city walls to grow food. These zones were also the location of tree plantings in ornamental gardens established by Delft's burghers. Examples of these gardens can be seen on the *Kaart Figuratief* from 1678, drawn in detail in plots on either side of the *Laan van Overvest* [fig. 9]. From the analysis of maps and archive material, we also establish that many trees were planted in the more than 200 orchards situated to the west and east of the city, and along the Schie to the south, by the end of the seventeenth century. All these allotments, pleasure groves, and orchards were furthermore bordered by wood-rows, resulting in many tens of kilometres of tree lines.

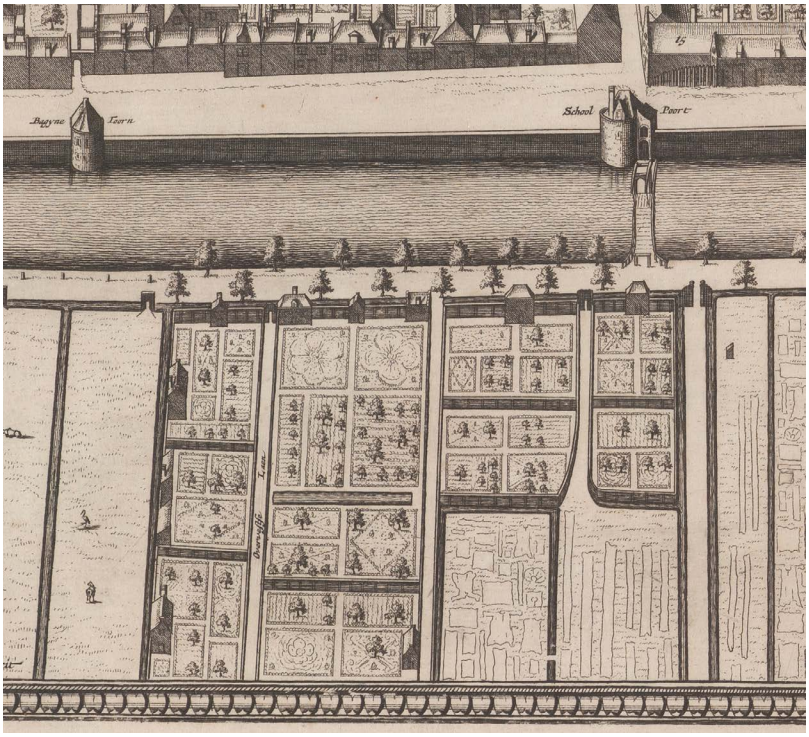

FIGURE 9 Avenue of Overvest, excerpt from the *Kaart Figuratief*. The map shows gardens with tree plantings just outside the city walls and along the towpath opposite the defense walls. (Map by Dirck van Bleyswijck with surveyors Jacob Spoors, draughtsman Johannes Verkolje, and engravers Johannes de Ram and Coenraet Decker, 1678).

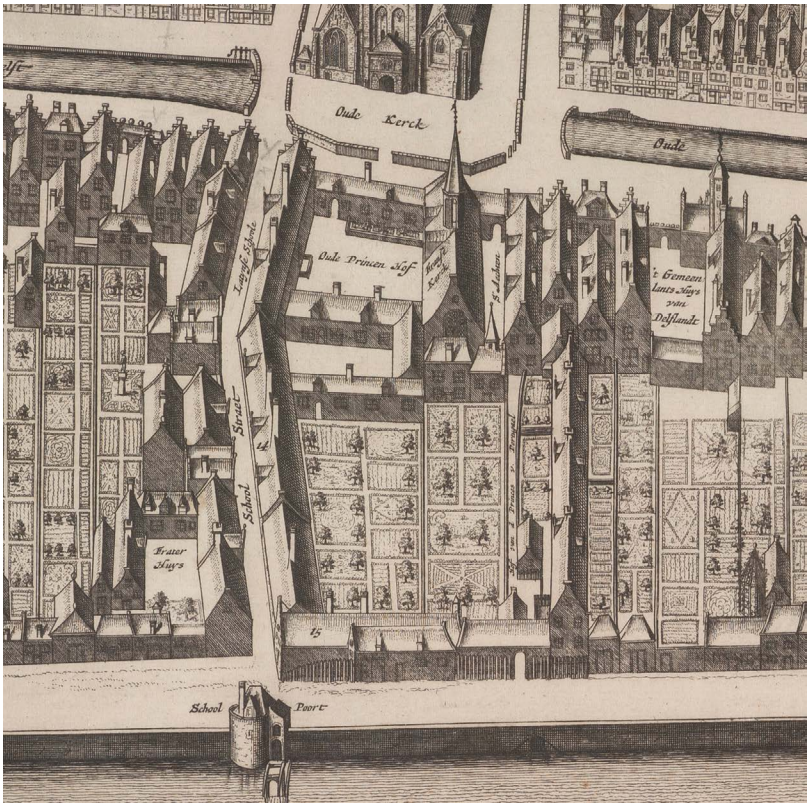

FIGURE 10 Section of the *Kaart Figuratief* depicting the St. Agatha cloister. Trees in the courtyard of this large cloister show how the city was as much a landscape as a built environment.

FIGURE 11 Courtyard scene Delft, mid- seventeenth century. The integral nature of trees growing in rear gardens and courtyards are depicted in this painting by Pieter de Hooch of a typical domestic scene in the seventeenth century show trees were an integral part of the cityscape. (Painting by Pieter de Hooch,1658-1660).

Courtyard Trees

By the end of the seventeenth century, a diverse typology of green spaces existed within the city walls, with trees as defining features, both in public and private areas (Hart, 2009). The *Kaart Figuratief* shows trees in one of the oldest monastery gardens–the St. Agatha Klooster–which grew into the largest monastery in Delft in the sixteenth century [fig. 10] (Soutendam, 1882). Other plantings were established in former Catholic monasteries, where fruit trees stood in enclosed ornamental and utility gardens, and in private gardens and courtyards throughout the city. Large trees appear in paintings, such as those by Pieter de Hooch [fig. 11].

FIGURE 12 View of the Oude Delft, mid- seventeenth century. This painting shows how lines of trees were integral to the cityscape of Delft in the period 1500–1800. (Painting by Jan van der Heyden, ca 1660).

Tree-lined Streets and Market Squares

Lines of trees along canals and streets were an increasingly visible addition to the cityscape of Delft in the period 1500–1800, as were tree plantings in market squares [fig. 12]. In the course of the seventeenth century, city authorities progressively assumed responsibility for planting and upkeep of tree plantings in the city's public spaces, such that by the end of the seventeenth century, three-quarters of its canals were lined with trees, and all of its market squares included some form of tree planting. To keep up the supply of the growing number of trees needed in public spaces, a dedicated tree nursery was established just north of the city.

Patterns of Urban Tree Establishment

Building on this synchronic analysis and through the study and comparison of various maps of the period[3], we reconstructed the cumulative spatial extent of Delft's tree configurations for the city and the

3 Cartographic reconstructions based on analysis of maps by Blaeu (1649), Van Bleyswijck (1678) and Kruikius (1712). Sources supplemented and validated by archival documents, cityscapes and paintings of the period.

surrounding territory for the period 1500–1800[4]. The city and regional scale maps present a composite representation of the configurations, functions, and location of the urban forest of Delft in the period 1500–1800. We mapped tree plantings in their respective geographical locations across the city and the territory at the scale of the configuration. A second layer in the mapping focused on the motivations for tree establishment. The cartography was carried out at two different scales: at the scale of the city and at the scale of the city region. The maps omit other topographical information except for permanent waterbodies, a layer that functions primarily as an orientational device [fig. 13, fig. 14].

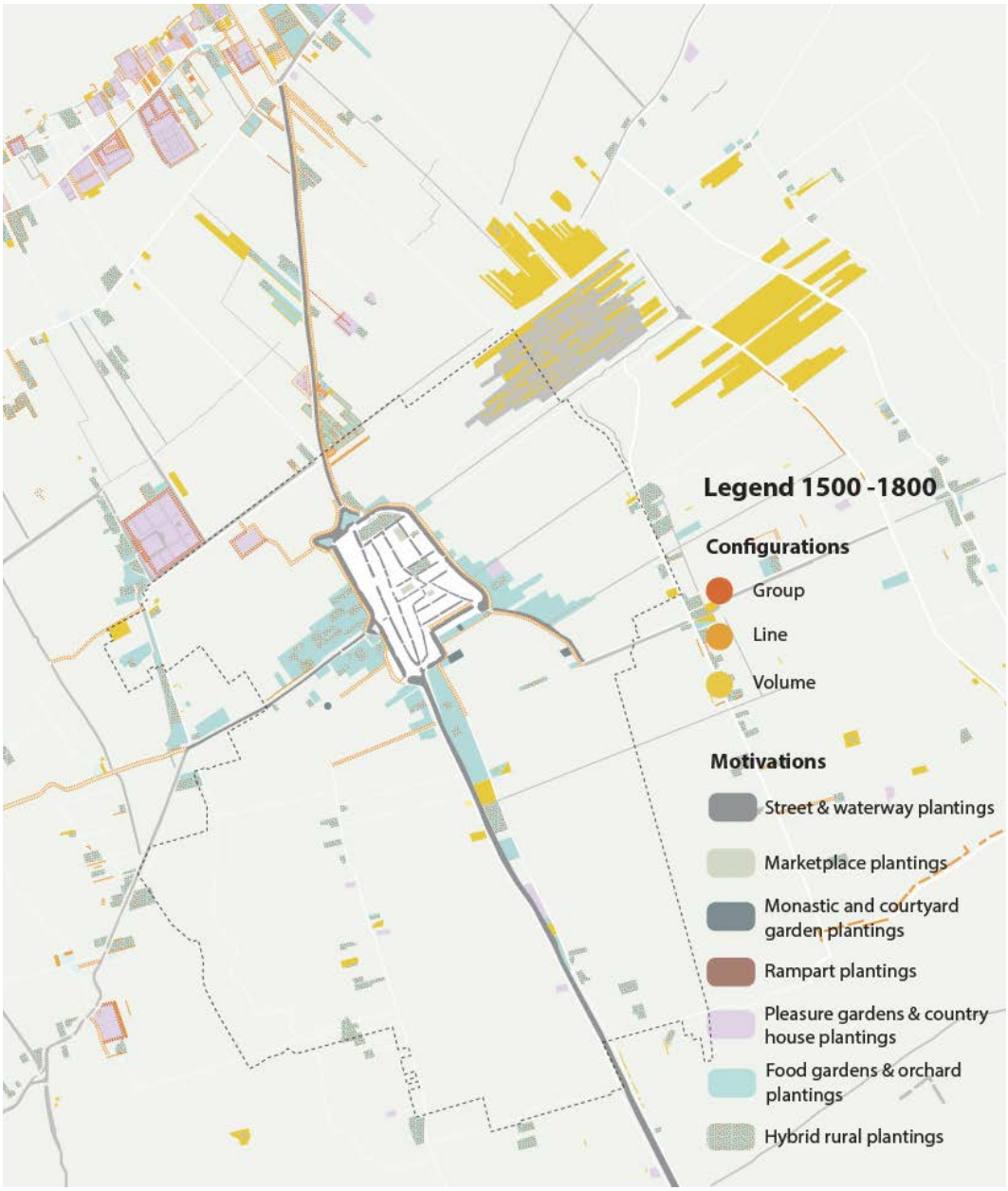

FIGURE 13 Cartographic reconstruction of tree configurations and their various motivations, at the regional scale (Delft and larger hinterland). (Drawing: Jantine van Halsema, René van der Velde, Erik de Jong).

4 For this research we focus on the configuration scale given its relevance for the method, as compared to the specimen, ensemble or system scale.

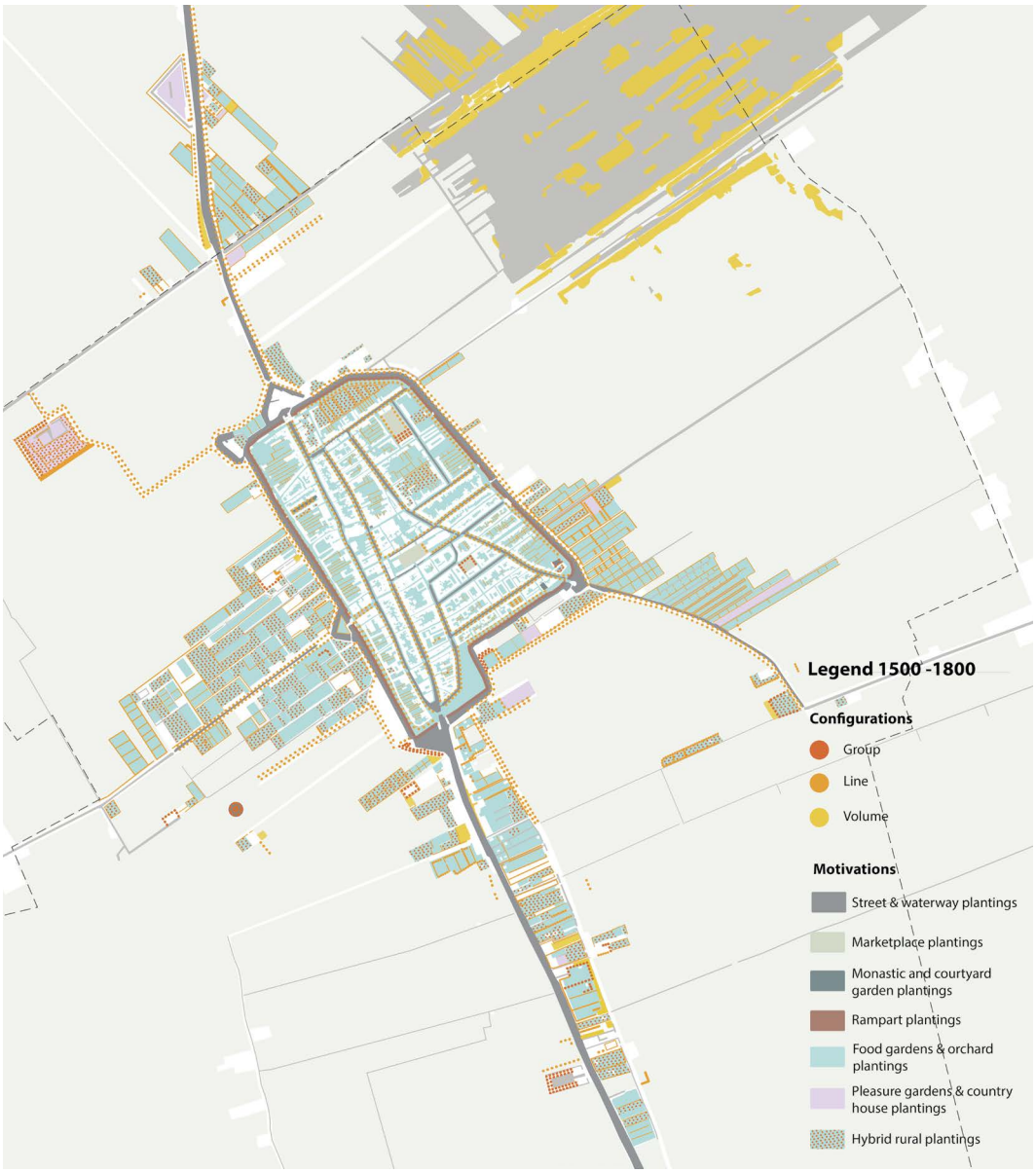

FIGURE 14 Cartographic reconstruction of tree configurations and their various motivations, at the city scale (Delft and surroundings). (Drawing: Jantine van Halsema, René van der Velde, Erik de Jong).

Tree Canopy Cover

From the two reconstruction maps depicting the early development of the urban forest of Delft, we identified a significant area of tree cover developed in the period 1500–1800 that can be directly or indirectly attributed to urban practices, activities, and/or conditions. While the source material is not accurate enough for an exact calculation of the total area of canopy cover in this period, we estimate that at least 10% of the land area of the territory (regional scale map) was covered by (planted) tree canopy, and approximately 20% of the mapped area in the city-scale map. These estimates indicate that in the early modern period, tree plantings, at least in the city and its immediate environs, became an increasingly integral part of the fabric of Delft in the period 1500–1800.

Trees Defining Urban Spaces

Given the relative distribution of trees on the city-scale map, trees played an important role in the cityscape. This appearance of the early modern city of Delft challenges abiding conceptions that nature and natural features were largely absent from cities in this period and that, as environments, they were opposite (and opposing) to rural and natural landscapes. This conclusion is supported by travel descriptions (of comparative cities in Holland) at the time. During his 1696 visit, William Mountague marvelled at the number of trees in Dutch cities, whose presence made him write: 'The Dutch are great Improvers of Land, and Planters of Trees, of Ornament as well as Profit' (Mountague, 1696). His observations also indicate that these plantings may have contrasted with situations elsewhere, suggesting that cities like Delft were more wooded and perhaps even somewhat atypical for European countries of the period.

Type and Configurations of Tree Plantings

Analysis of cartographic material for the reconstruction maps resulted in three basic types of tree planting arrangements identified: lines of trees, groups of trees, and volumes or areas of trees. At the city scale, linear plantings of trees were profuse in number and distributed across the city and in clusters outside the city walls. Linear tree plantings are a familiar arrangement in the sample city of Delft in the early modern period. The ubiquity of the tree line, as also emerging in other studies (see, for instance, Woudstra & Allen, 2022), establishes them as the baseline arrangement of the urban forest. Tree lines are by far not the only wooded features in the early urban forest of Delft, however. We found considerable group and volume plantings in the source maps; hybrid vegetation forms particular to the emerging tree stock of Delft.

Motivations and Typo-Morphological Situations

We furthermore found the different sub-category configurations of line, group, and volume tree plantings to vary in terms of the motivations for their planting and the locations they were planted in, leading to a range of distinctive typo-morphological categories. For the period 1500–1800, we identified six types of tree plantings with a distinctive functional and related typo-morphological specificity: *Straat- en grachtbomen* (plantings along streets and waterways), *Plein/Marktbomen* (marketplace plantings), *Hofbomen* (monastic and courtyard garden plantings), *Vestingwerkbomen* (rampart trees), *Siertuin/Buitenplaatsbomen* (pleasure gardens and country house plantings), and *Moestuinbomen* (food gardens and orchard plantings). These categories indicate that in the early modern period, tree plantings were an integral part of the domestic, social, commercial, and institutional life of the city of Delft.

Rural-Urban Complex

In the regional scale map, we identified a seventh category–*Weiland/landbouwgrondbomen* (hybrid rural tree plantings). Drawing on literature and archive research, we included these plantings as they were shown to be interrelated to urban requirements or practices. From the reconstruction maps, combined with other planting types from the city-scale map, the extent of woodland features with urban roots played out across most of the ten by ten-kilometre area depicted by the *Kruikiuskaart*.

Discussion and Conclusions

Afforestation Events and the Early Modern Cityscape

The synchronic analysis reveals a series of tree plantings in and around Delft in the period 1500–1800 which, given their scale and intentionality, may be considered as 'afforestation events'. Except for the hybrid rural trees, these episodes were driven by forces and practices in the urban realm and by urban figures, communities, and institutions active in Delft in the period. In terms of numbers and types of developments, and drivers for tree establishment, these events expand on existing reviews of the historical development of the urban forest in Europe. There is also evidence of a strong interrelationship between tree plantings and the city as a built environment, whereby—in contrast to common conceptions of greenspace as relatively autonomous features in cities—trees were integral to the architectonic space of the city. In this period, a cityscape emerged in which trees formed a foundational component of streets, canals, squares, courtyards, and fortifications, to the extent that these spaces were typologically incomplete without them. The underlying biophysical conditions seem to have played a passive or minor role in these creations. The integrality of trees in the cityscape stands in stark contrast to the abiding image of cities projected through their architecture only. The role of trees in the development of urban spatial types also extended to the tree plantings in orchards and allotment gardens, along the many roads and waterways leading to and from the city, and in the estates and gardens in the urban hinterland. These spaces, in which trees form the critical architectural component, represent the genesis of novel urban (greenspace) types emerging in the early modern period in western cities like Delft.

'Plantation' as Spatial Archetype of an Emergent Urban Forest

From the cartographic reconstructions, we derive that linear tree arrangements were common in Delft in the early modern period and that a variety of group and volume planting arrangements were also commonplace. These tree arrangements share characteristics that have a strong relationship to garden culture and, within that, to the concept of 'plantation'. As arrangements, tree plantings in avenues and along canals beyond the city walls were spatially comparable to those along canals within the city walls, while plantings on country estates resonated with plantings on marketplaces and city walls, and tree groups on the edge of the region paralleled those growing in gardens and courtyards within the city walls. These commonalities are the essence of the concept of *plantagie* or plantation. At the end of the eighteenth century, gardener Knoop proposed the concept of plantation to describe places or gardens planted in an order, i.e., regularly, as opposed to wild crops and trees not created by human hand (Knoop, 1790). As also elaborated in other gardening and architecture treatises of the time, order for Knoop meant symmetry and succession in straight lines (avenues, rows of trees along canals and fortifications, single or double). It referred to trees in *carrés* (markets, courtyards) or in symmetrical planting arrangements (triangle, quincunx, rectangle). Order radiated distinction, beauty, utility, and ornamentation (De Jong, 1993). A plantation, according to Knoop, is a deliberately planted place, connecting utility with entertainment, profit with ornament as basic givens. As an important cultural activity for both city and countryside, garden culture created the conditions for tree plantings, with botanical science and horticultural craft as its allies (De Jong, 1993). These arrangements may be understood as architectural interpretations of natural features such as a wood, a copse, a grove, and a forest (Hunt, 2000).

From Plantation to Urban Forest Syntax

A further discussion on the concept of plantation can be contextualized within emerging insights on urban Forestscapes. Building on the concept of 'tree language' coined by De Josselin de Jong (2009), De Wit and Van der Velde (2024) observe that, like every language, a tree language has a vocabulary that forms part of the wooded narrative of an urban environment. This wooded narrative plays out at different scales, from the individual tree to the tree arrangement, to multiple arrangements forming ensembles, to a collection of ensembles forming wooded areas at the scale of a city quarter or city (ibid., 2024). In this way, tree language offers a framework to back-cast to the historical development of the urban forest and its genesis in the concept of plantation. Our conclusion is that from its beginnings as a foundational syntax of tree arrangements, the urban plantation has evolved to include different scales in a multi-scalar tree language particular to the urban realm. In application terms, challenges such as health and liveability can benefit from this (historical) spatial understanding of the urban forest, whereby species, arrangements, ensembles, and wooded areas are critical scales in making places, neighbourhoods, and cities to be valued and appreciated. As De Wit and Van der Velde (2024) note, the structure and character of an urban forest are critical in providing a meaningful agent for urban life, and that tailoring measures to build on the existing can strengthen the relationship between greenspace and quality of life in cities. This stance resonates with an important category of ecosystem services as developed by the Millennium Ecosystem Assessment (2005): cultural services, which include cultural diversity, spiritual values, knowledge systems, educational values, inspiration, aesthetic values, social relations, sense of place, cultural heritage values, recreation, and ecotourism.

Ecosystem Services in a Historical Perspective

The concept of plantation also helps to place the current focus in urban forestry on concepts such as nature-based solutions and ecosystem services in a historical perspective. In contrast to the implicit narrative in these approaches that cities are largely devoid of nature (and thus in need of nature-based solutions), the case study city of Delft demonstrates how already in the early modern period, an urban forest was emerging with trees planted for aesthetic appreciation, for the birds and insects they attracted, for the fibres, firewood, tannin, fodder, and fruit they produced, for their positive impact on shade, wind, and air quality, and for their effect on health and social interaction. This fact by no means cancels out the need to continue with nature-based measures in cities, but it does call for a better understanding of the nature of—and in—cities (such as its urban forest) and a tailoring of ecosystem solutions to those insights. These historic 'ecosystem services' were contiguous to an urban forestscape that articulated ideas about nature and cities by urban societies, which stand in stark contrast to contemporary viewpoints. Urban societies such as in Delft cultivated a worldview informed by garden culture, which brought forth hybrid urban spaces of which trees were an integral part. A Forestscape thus emerged, drawing on concepts and principles from garden culture and its associated infrastructure of gardeners, arborists, nurseries, and the like. The Forestscape of Delft was part of designerly ways of 'knowing and making', and ascribed a diversity of functional, social, and cultural meanings and experiences based on a wish for functional and ornamental order. Further study should reveal how, for 300 years, changes occurred in the motivations behind and configurations of the Delft urban forest, with some having a long span and others short-lived. How did configurations continue while land use changed? How did making and caring, adding, changing, and removing, as part of a dynamic process, keep the design of trees present in the urban fabric?

The Urban Forestscape as a Distinct and Extended Composite

Analysis of the reconstruction maps also presents discussion material on the extent and configuration of the early modern Forestscape of Delft, with implications for contemporary 'readings and writings' of cities and urban regions. From the reconstruction maps, we estimate that by 1800, Delft already had a tree canopy area covering almost twenty percent of the city-scale mapped area (a figure very similar to the current canopy cover of the city). This underscores how tree plantings were an integral part of the fabric of Delft by the end of the early modern period. The configuration of this canopy, a composition of tree arrangements, ensembles, and wooded areas unique to Delft, presents a 'wooded watermark' of the city, metaphorically speaking. The tree lines branching out from the city walls into the countryside like spokes on a wheel, for instance, are central to this footprint, as are the configurations of canal-side, courtyard, and marketplace tree arrangements. Many of these figures have endured beyond the lifespan of a tree in the sample period, showing that the location of trees has become a permanent fixture in the morphology of the city and the minds of its citizens. At the regional scale, the extent of tree plantings with urban 'roots' extends to the limits of the 22 by 22-kilometre area depicted by the *Kruikiuskaart*, effectively extending the city's 'wooded watermark' far into the urban hinterland. As such, Delft's emergent urban forest challenges contemporary projections of urban regions in which a sharp distinction is made between the city and the hinterland.
At the same time, in this same sample area, the existence of trees and wooded areas with their 'roots' in rural economies and practices extends at times right up to and even within the walls of the city. The early modern urban forest of Delft thus enables us to see the city and its agrarian environment as a complex and intertwined mosaic, opening a discussion on the inter-relationship between urban and rural realms since the early modern period. By extension, this phenomenon challenges the simplistic division between these two worlds apparent in contemporary spatial planning and design, as well as in other scientific and societal domains. The interrelationship of these separate worlds, for which the urban forest is one of its physical manifestations, resonates with emerging conceptual frameworks to understand, order, and act in dispersed urban territories via approaches such as Landscape Metropolis. In this concept, the urban region is posited as a dynamic, intertwined, and layered mosaic (Van der Velde & De Wit, 2009; Steenbergen & Reh, 2011).
As such, Delft's emergent urban forest challenges contemporary projections of urban regions in which a sharp distinction is made between the city and the hinterland.

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