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Urban forests, forest urbanisms and global warming: Developing greener, cooler and more resilient and adaptable cities

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The necessity of plant life and forests in the city

The earth is in desperate and urgent need of more trees and forests. Throughout history, vast swaths of forests, complex habitats for animals and plants, have been indiscriminately felled to make way for agriculture, grazing, urbanization and infrastructure, and to provide wood for fuel, manufacturing and construction. Put simply, since sedentarization, there has been a long-standing tripartite system of occupation of the earth's land surface: forests, agriculture and urbanization. Human occupation and settling most often went hand in hand with the making of a clearing. Bringing land in 'culture' implies the replacement of nature. Forests have been—in most cases, with the exception of protection of royal forests, sacred groves, and even some common lands—on the losing side of the transformation of the earth's terrestrial surface. Later, forest conservation emerged out of pure pragmatism, when natural forest regeneration proved difficult and eventually became a threat to human settlement. There is an absolute necessity to reconfigure occupation patterns and to move away from monofunctional categorization once and for all. A fundamental break is required with deeply rooted traditions of deforestation—including its relationship to the foundations of landscape architecture.¹ Fortunately, deforestation and forest degradation are increasingly being challenged by activists from all walks of life and, tentatively but also increasingly, by progressive plans, policies and projects to combat the climate emergency, protect wildlife and defend the rights and lands of Indigenous peoples.²

A number of metrics have been developed around the world to promote reforestation and afforestation. But at the same time, according to the Food and Agriculture Organization of the United Nations, net forest loss (deforestation plus any forest gains in a given period) in the decade since 2010 was 4.7 million hectares per year. Deforestation rates were much higher: 10 million hectares of forest were cut down each year.³ Clearly, there are still significant strides to be made. As evolutionary biologist E.O. Wilson has proclaimed, we need to free half of the earth from human occupation to ensure its survival.⁴ Forests are key, as they host extensive biodiversity and have the capacity to self-regenerate. Fortunately, there is an ever-increasing urgency to maintain, restore and increase all types of forests, through sound stewardship, management, afforestation, reforestation, agroforestry, community forestry and the like, and to rebalance the earth's three primary occupation patterns—forests, agriculture and urbanization. In the case of forestry, this means not only increasing the quantity, quality (including the elimination of monocultures and the protection of old-growth forests) and resilience of species, but also fundamentally redefining the alliance between cities and forests. At the same time, reforestation and afforestation can be a more innovative and powerful response to the myriad of urban challenges.

In the premodern era, agriculture and the extraction of timber for construction were the main causes of deforestation. From the eighteenth century, major reforestation programmes in Europe addressed depleted forests. Later, as urbanization progressed, a complementary nature was developed within cities, with parks and forests adjacent to cities. In recent decades, there has been a growing understanding of the need for a hybrid nature and culture, leading to conservation and reforestation areas in the vicinity of metropolises, national parks and even human retreats (referring to the half-earth thesis of Wilson and others). There has been an increasing rediscovery and focus on the role of trees, forests and associated vegetation in urban areas themselves.⁵ Urban forestry was coined as a term in 1965 by Danish-Canadian Erik Jorgensen, who defined it as ‘the cultivation and management of trees for their present and potential contribution to the physiological, sociological and economic well-being of the urban society’.⁶ Initially, urban forestry was distinguished from urban green spaces with trees (gardens, parks and street trees) with a primary criterion being uncultivated ground vegetation. Nonetheless, urban forests, and more generally trees in the city, play a fundamental role in the adaptation of urban areas to the impacts of global warming and the climate crisis.⁷ As has become common knowledge, urban tree canopies cool urban heat islands (see Brent Greene and Wendy Walls’ contribution to this issue and their discussion of urban forests in Melbourne and Berlin in relation to the adaptation to excessive heat and drought) and offer pockets of shade, absorb carbon through photosynthesis, produce oxygen, filter air pollutants and even dampen noise. The root systems of urban trees help regulate stormwater and slow desertification. More generally, trees and urban forests, if evenly distributed throughout cities, can increase urban biodiversity and provide habitat for nonhuman species. The latter is particularly important in the context of an increasingly urbanized world with a corresponding loss of wildlife and biodiversity. According to a number of scientists, the world is embroiled in a ‘Sixth Mass Extinction’.⁸ Finally, urban trees and forests are also linked to a growing body of research into human health and environmental psychology.⁹ At the same time, the increasing attention to urban forestry should be critically understood in relation to both greenwashing and ‘green gentrification’—where neighbourhood improvements drive up property and rental prices and push out original residents—and should be (but rarely is) carefully managed.¹⁰ Forests must not be stripped of their deep ecological and cultural values and instrumentalized in urban transformation processes.

Nevertheless, in recognition of the multiple benefits of urban forests in relation to global warming, public health, biodiversity and other issues, large-scale tree planting in urban areas has been recommended at international, national and local levels.¹¹ This has been underpinned by the development of a range of metrics at different scales—from area to neighbourhood to household canopy cover.¹² However, large-scale tree planting only makes sense if it is done properly, and if it is followed by proper management and stewardship—which are both at least as important as planting, given that mature trees provide more benefits.¹³ In addition, in the face of intensifying global warming and other challenges to trees—such as extended periods of drought, more frequent occurrences of pests and diseases, and extreme weather events—there needs to be greater collaboration among scientists, policymakers, designers and managers (see this issue’s article by Max Piana, Nicholas Pevzner and Richard Hallett and their discussion of adaptive management, combining the expertise of foresters with that of landscape architects). Numerous cities have developed (or are in the process of developing) so-called nature-based solutions—part of the hybrid nature/ city re-enactment—including million trees programmes,¹⁴ incentives for green roofs (and even façades),¹⁵ touting the importance of private gardens,¹⁶ and ‘smart’ streets that include tree planting.¹⁷

But experts, including landscape architect, scholar and practitioner Rosetta Elkin in her thought-provoking book *Plant Life: The Entangled Politics of Afforestation*,¹⁸ warn that good intentions can also mask business as usual—continued deforestation, capital extraction, land theft and environmental degradation. Elkin’s focus is on drylands and larger than urban areas, but she nonetheless reveals broader notions of how trees have become ‘artefacts’ and ‘units’ in global climate-policy accountancy, standardized and commodified (including the notion of ecosystem services), where humanity has largely failed to appreciate the ‘aliveness’ and agency of plants. She contends that ‘plant life’ is misread, misunderstood, exploited and eradicated as trees are largely reduced to ‘plant material’. Elkin’s writing builds on earlier work by the likes of Anna Tsing and Donna Haraway, who speak of a ‘plantationocene’—a monocultural approach to large-scale cash crops that simplifies ecologies and minimizes disturbances, but creates vulnerabilities and often requires (polluting) pesticides and fertilizers.¹⁹

Other scholars, including Stefano Mancuso,²⁰ Suzanne Simard²¹ and Tamir Klien,²² have recently made progress in documenting how plants are subjects (organisms) rather than objects, and have provided novel insights into the relationships of trees to soils, landscapes (including other trees) and humans. Their research focuses on the communication and social life of trees and plant ecologies and their ability to adapt intelligently to changing environments. They have brought into focus the importance of subsurface forest networks comprised of roots and fungal mycelia that support interspecies communication and nutrient exchange. The growing understanding of the complex relationships between trees and other plants, and the consideration of the agency of plants, is increasingly reflected in urban forestry decisions related to, for example, design, species selection, establishment practices and understanding and developing plant systems rather than individual trees (see Jorg Sieweke's contribution to this issue, where he refers to Simard's insights and underscores the potential of 'unintentional landscapes' and spontaneous vegetation—as opposed to 'model' urban trees, bred in nurseries—on urban terrain vague sites, and explains how ruderal vegetation introduces a potentially homeopathic dose of the half-earth mantra within urban contexts.)

The expansion, conservation, management and stewardship of urban forests also needs to consider political, social and cultural contexts, as highlighted by authors such as Sonja Dümpelmann in *Seeing Trees: A History of Street Trees in New York City and Berlin*.²³ Dümpelmann underscores the deeper meaning of plants and trees and their capacity 'to lift the human spirit, provide pleasure and psychological well-being and foster identity',²⁴ delving into how planting choices are made in relation to both poetry/aesthetics and political leanings/power. Her work dovetails with the extensive research into the social, cultural and political dimensions of urban trees—including the importance of grassroots tree planting as part of wider social justice and civil rights activism in relation to environmental justice.

Legacies of settling with/in forests, plantation and urban armatures

Settling with and within forests has occurred for millennia. Indigenous forest-dwelling communities are part of a larger set of nature-culture worldviews and narratives, all deeply intertwined with socioecologically-articulated settlement practices. Ecologists, foresters and anthropologists consider the world's numerous Indigenous forest-dwelling groups—including the 'church forest' inhabitants of Ethiopia, the Pygmy groups in Cameroon and the Democratic Republic of Congo, the settlements of the Guarani in the Atlantic Forest (in Brazil, Argentina, Paraguay and Uruguay), the Amazonian groups predominately in Brazil, Peru and Colombia, the numerous Adivasi communities in India and numerous ethnic groups in Southeast Asia's highlands—to be forest guardians and keepers of valuable ecological knowledge regarding forest stewardship.²⁵ However, drastic changes in land occupation, particularly the continued conversion of forests to agricultural or urban land, threaten not only forest cover but also the practices, embodied knowledge and even the existence of many ethnic groups. The development of eighteenth-century forestry as a science of taming nature paralleled, as James Scott explained, the ordering of society by the state and the definition of citizenship in nation-building projects. In the colonial context, this was clearly articulated. Scientifically underpinned colonial forestry projects simultaneously ordered nature and were 'policies of rounding up undesirable minorities'.²⁶ As in so many areas, postcolonial policies to this day largely mimic colonial ones. Forest-dwelling communities, despite reaching significantly large populations, remain stigmatized as 'other', backward communities. However, many of their understandings of nature-cultural relationships and the coexistence of human and nonhuman species demonstrate variations in age-old and sophisticated ways of 'occupying the world' (also understood as economic morality).²⁷ They provide inspiration for the contemporary issue of urban forestry and forest urbanism (see this issue's article by Zeba Amir and Bruno De Meulder on the transhumance of the Van Gujjars in the Indian Himalayas, and Vu Thi Phuong Linh's *Thinking Eye* documentation of Khmer traditions of living with the inundated forests of Cambodia's Tonle Sap Lake). Forest urbanism is understood as a symbiotic form of settling within forests.

Throughout the history of urbanism, there has almost always been an interweaving of plantation structures with urban armatures and tissues. Indigenous communities, such as the aforementioned Van Gujjars, demonstrate one of the many archetypes. Cities have been embedded in forests, and forest tissues complemented urban fabrics.²⁸ Traditionally, forests have formed the counterfigure to the city. Throughout the seventeenth to the nineteenth century, there were monumental realizations in which nature and city were surprisingly present and intertwined. In Karlsruhe, Germany (hunting) forests were

an early planning instrument for a counterfigure to the royal city. Ildefons Cerdà's original plan for Barcelona's Eixample included an eastern forest belt, not unlike Georges-Eugène Haussmann and J.C. Adolphe Alphand's complementary restructuring of Paris and development of the Bois du Boulogne and the Bois de Vincennes. Boston's 'emerald necklace' interweaves public spaces and larger green lungs of the city with parkways that link a patchwork of neighbourhoods to the copresence of nature. For centuries, forests have been planned and systematically exploited and maintained, often more extensively and sophisticatedly than the urban planning of the same period. Early on, forests required management because of their rate of exploitation, while cities simply took up more and more space, especially as excessive suburbanization took hold. The city (and suburbanization), itself an unsustainable element, has historically been embedded in a (sometimes artificially created) nature.

In the twentieth century, several cities developed an explicit urban forest relation, particularly in early 'garden city' experiments. Variations of the Garden City Movement have left a built legacy of canonical forest urbanism projects across the globe, including Forest Hills Gardens in Queens, New York (1909 by Frederick Law Olmsted Jr. and Grosvenor Atterbury), Jardim América in São Paulo (1913 by Barry Parker and Raymond Unwin), Canberra Forest City in Australia (1914 by Walter Barry Griffith), Sokol Plan in Moscow (1923 by Nikolay Markovnikov, Alexi Shchusev and others), Waldseidlung Onkel Toms Hütte in Berlin (1926–1932 by Bruno Taut, Hugo Haring and Otto Rudolf Salvisberg) and Sunila (1936–1938, 1947, 1951–1954 by Alvar Aalto).

A social reform agenda drove many of the projects, while others were developed as leafy suburbs for elites. Over time, other programmes were also designed with an explicit relation to forests, particularly schools and sanitoriums—with the Waldschule für kränkliche Kinder (Forest school for sickly children) of 1904 in Charlottenburg by Walter Spickendorff and Alvar Aalto's Paimio tuberculosis sanatorium (1928–1933) as canonical examples. The health benefits of forests for children, in particular, are experiencing a revival of sorts with the global growth of contemporary 'forest schools'. The Finnish modern master Aalto was also at the forefront of designing post-war districts embedded in forests, the most well-known of which is Tapiola New Town (1962–1963, 1967). Lafayette Park in Detroit, by architect Mies van der Rohe, urban planner Ludwig Hilberseimer and landscape architect Alfred Caldwell (1950–1960s) is an American counterpart of the Finnish forest settlements, and the project was Charles Waldheim's primary case for building up precedence for 'landscape urbanism'.²⁹ Forests and urbanism were also developed in tandem in the famous plans for new capitals after the Partition of India, with Dioxiadis in Islamabad and Le Corbusier in Chandigarh powerfully linking green infrastructure with nation-building. The concept was extended to the entire city-state of Singapore when then Prime Minister Lee Kuan Yew launched the first tree planting campaign in 1963. This was followed by the Garden City programme in 1967 and the annual National Tree Planting Day in 1971 (see Bianca Rinaldi's *Under the Sky* contribution in this issue where she critically compares the development of Chandigarh and Singapore into forest cities).

Towards forest urbanisms

Fast-forward to today, and there is a clear mandate for more plants and forests in urban areas. Fortunately, the dichotomy of ecology/urbanism is being addressed in policies, plans and projects, and there is increasing discussion and understanding among foresters, land managers, landscape architects and urbanists, in dialogue with policymakers and a wide range of relevant stakeholders, and in discussions across disciplines. Strict definitions of disciplinary perspectives are being revised, including a broadening of Jørgensen's definition of urban forestry to include the introduction of new small urban woodlands (as advocated in the Miyawaki method, for instance), a broad idea of urban rewilding and even the coining of the term 'forest urbanism'. By the end of the 1990s, the formal naming of interdisciplinary fields had begun, with numerous terms preceding urbanism—landscape urbanism, water urbanism, ecological urbanism. All seem to reveal the inadequacy of urbanism alone, and the need to fundamentally address the nature/culture relationship. Forest urbanism was formally coined as a term in 2017 in the OSA at KU Leuven.³⁰ It goes beyond urban forestry and calls for the radical redefinition of settlement structures in relation to forests. Through case studies in the dispersed Belgian, Vietnamese and Cambodian territories, OSA research unravels not only the increased attention to ecology in urbanism in recent decades, but also the renewed interest in experimenting with different forms of urbanism. Bridging landscape architecture and urbanism, Forest Urbanism reimagines land occupation to transcend the tripartite system of forestry, agricul-

ture and urbanization through new hybrids and occupations of multiplicity. The cases build a critical understanding of the legacy of the interdependence of forest and urban dynamics, and design research has explored new morphologies and typologies to develop a more constructive forest-(agriculture)-urban interplay (see Wim Wambecq's explorations in Flanders in the *Thinking Eye* section of this issue). In practice, architects and landscape architects in France have conceived and developed projects that exemplify forest urbanism—including the Bordeaux Rive Droite (Right Bank) by Michel Desvigne Paysagiste (2005), Bois Habité (Inhabited Wood) by Agence Ter (2007) and the Grand Paris 2030 entry by Ateliers Jean Nouvel, Michel Cantal-Dupart and Jean-Marie Duthilleul (2008–2009).

It is clear that the need to develop urban forestry goes hand in hand with the ongoing need to transform urban building typologies—to incorporate all the benefits of urban forestry, but also to respond to new ways of inhabiting cities. Several architects and urbanists—including Stefano Boeri and BIG—have developed spectacular green buildings and urban districts. The Danish firm Effekt has developed both visionary proposals for forest urbanism and new housing typologies built exclusively with wood and designed to accommodate new family structures and forms of collective living. Academics and practitioners have similarly touted concepts like 'biophilic cities' and 'nature-based solutions'. Nevertheless, initiatives like these run the risk of (being used for) generic 'green-washing' unless, for example, issues of longer-term, sustainable management and stewardship are addressed. The overarching challenge of how to accommodate more urban populations with the simultaneous development of more urban nature instead demands the radical rethinking of paradigms. The earth's three primary land occupations—forestry, agriculture, urbanization—need to be hybridized and integrated to repair the damaging consequences of still-expanding monofunctionality. Scientists and designers alike need to more vigorously engage with the evolving array of policy tools, such as the transfer of development rights and land pooling. Multiplicity must (once again) become a guiding principle for territorial occupation and the copresence, across scales, of nature (forests) and culture (agriculture and settlement) in order to shift current regimes of land management towards a 'commons' or public goods perspective, where urban forests and nature in the city can literally be afforded more space. The contemporary challenge is to envision a robust forest urbanism that redefines ways of living and stewardship of the environment, taking into account the intertwined ecological and social sides of the challenge. Forests in their diversity—and as emblems of nature—are structures in which settlements can be embedded as a promising reversal of the contemporary urbanization paradigm. It is important to learn the right things from indigenous archetypical forms of settling with/in forests and to re-envision socioecologically articulated settlement practices.

Within this framework, a three-day international conference in Belgium in June 2022 brought together academics, practitioners and policymakers to intensively discuss and debate the role of urban forests and forest urbanisms in the context of global warming. It focused on issues related to planning, planting, designing and managing resilient urban forests and forest urbanisms that contribute to the mitigation of and (good) adaptation to global warming, all of which require interdisciplinary exchange and collaboration. The conference highlighted scientific, policy and design perspectives and brought together a diverse group of experts from many disciplines—(urban) forestry, ecology, agro-ecology, urbanism, landscape architecture, urban design and planning, among others—and geographical contexts. Although there were clear affinities between the disciplines, there remained wide gaps—particularly between those focused on empirical and evidence-based approaches and those developing design research. In an age of proclaimed collaboration, it is evident that there is still room for improvement in explicitly drawing on the expertise and motivations of foresters, policymakers and urban managers and designers (landscape architects and urbanists). There is a clear need for more cross-sectoral and transdisciplinary approaches and better collaboration among, for example, urban foresters, landscape architects, urbanists, ecologists and social scientists (as was the focus of the conference). This issue of *JoLA* offers a contribution to how to develop more integrative, transdisciplinary approaches to urban forestry, the greening of cities, bringing together concepts such as 'urban forest' and 'forest urbanism'. It delves into past and emerging knowledge (indigenous and scientific) to enhance not only management and stewardship but also forest/urban, nature /culture relationships.

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BIOGRAPHICAL NOTES

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Chiara Cavalieri, architect and Doctor of Urbanism (IUAV, University of Venice), is associate professor of Urbanism at the Université Catholique de Louvain (UCLouvain). Over the years, she has coordinated and directed several research activities and regional visions such as 'The Blue Space', Eurometropolis Lille-Kortrijk-Tournai (StudioPaolaViganò, Lab-U, EPFL Lausanne), 'The Horizontal Metropolis' (EPFL Lausanne), 'The Language of Water' (UCLouvain with Latitude), LABOXXI (Atlas, L'urbanisation du 20e siècle dans et autour de Bruxelles). She is currently developing research on water and landscape urbanism in transboundary urban territories, with a particular focus on mapping and representing the territorial dynamics involved.

Cecil Konijnendijk is an urban forestry scholar who currently codirects the Nature Based Solutions Institute, a think tank for the evidence-based urban greening. He is also an honorary professor at the University of British Columbia and a visiting scholar at Wageningen University. Cecil has published widely and has advised international organizations and local authorities in more than 30 countries on the development and implementing of urban forestry programmes and plans.

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