Urban Foresting

Research plan

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Title

Depressurise urbanization through integration of forest ecologies in the urban environment

Keywords

Urban foresting, Amsterdam, tree, urban ecology, forest ecology, nature inclusi-ve, biodiversity

Content

Research introduction

In today's world, time seems to be moving faster and faster with cities growing exponentially in size and human inhabitants.[1] As a result, land and resources are devoured to enable the growth of these continuous cities. Due to the urbanization, digitalization and people tending to have a busier schedule the relation between man and nature has been displaced, in which we outsource native living species to places outside the city.[2] However, these living species provide a lot of advantages for the urban environment on an environmental, social, ecological, and economical level. For example, they reduce pollution, absorb CO_2, regulate temperatures, and thus create a more healthy, pleasant and safe urban environment.[3]

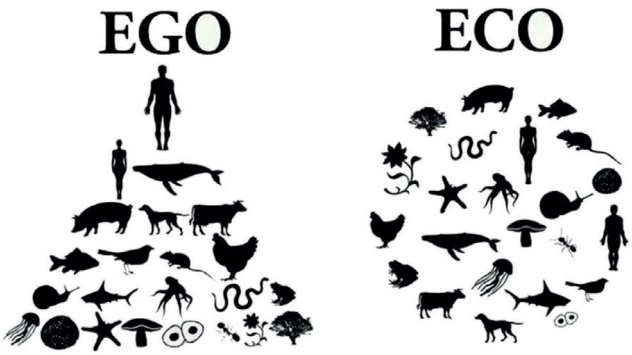

Figure 1: Disconnection with nature.
(Dijkstra 2020)

Problem statement

In the continuous city urban developments put pressure on the surrounded landscape and the urban landscape, often neglecting the existing ecologies and native living species. As a result, the unbalanced ecology accelerates the reduction and extinction of plant and animal species, or even in some cases forcing certain species, forcibly removed from their natural habitat, to invade urban areas that are foreign to them.[4] Peter Wohlleben is a German forester and writer that promotes ecologically and economically sustainable forest management. Wohlleben states that: "When we pursue nature protection, we are not protecting nature, we are protecting ourselves." [5] An interesting example is Chernobyl, where despite a nuclear disaster in 1986 that made the city inhabitable, the forest has grown back and taken over the abandoned city 30 years later. Forests and other living species have survived for thousands of years without human protection, whereas we need the forests and living species to protect ourselves and our living environment against for example, extreme weather conditions.

1. Bairoch, P, *Cities and Economic Development*, translated by Christopher Braider., 1988

2. IVN, "Over Tiny Forest®," www.ivn.nl, accessed October 10, 2021, https://www.ivn.nl/tinyforest/over-tiny-forestr.

3 & 4. Stefano Boeri et al., *A Vertical Forest Instructions Booklet for the Prototype of a Forest City = Un Bosco Vertocale ; Libretto Di Istruzioni per Il Prototipo Di Una Città Foresta* (Mantova Corraini Edizioni, 2015).

5. Peter Wohlleben, *HIDDEN LIFE of TREES : What They Feel, How They Communicate?Discoveries from a Secret World.*, 2018.

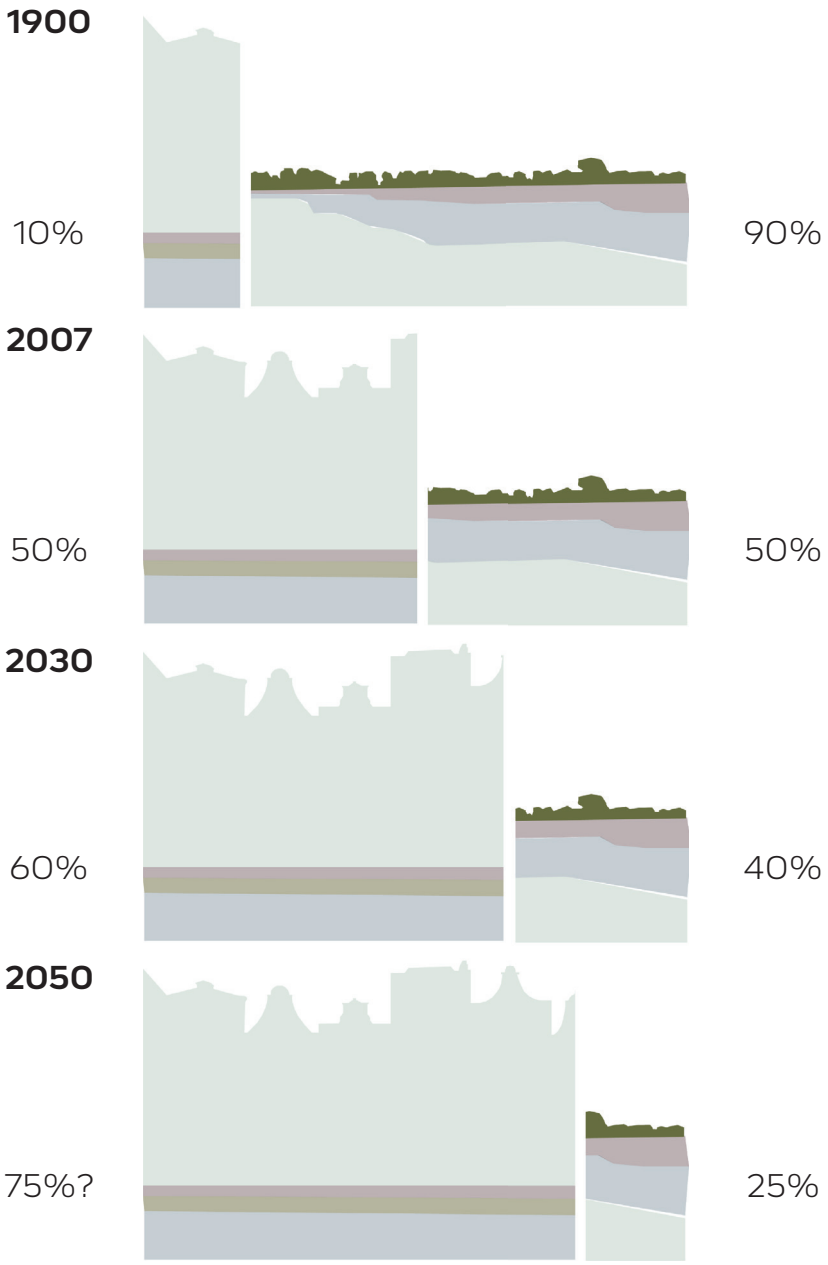

Figure 2: The continuous city
Authors own drawing

Shubhendu Sharma, inventor of the concept "tiny forests", has as mission to grow as many forests in cities as possible, to create a more healthy and comfortable living climate and in particular to create a closer relation between people and nature.[6] A research in Wales tested the value of trees and forests in the neighbourhood, which concluded that trees and forests have a positive value in what they symbolize in terms of their personal, local, community and cultural meanings.[7] However, a research by Roman shows that trees in the urban environment do not always have a positive impact. So can the placement, orientation and choice of species lead to damages, high maintenance, and costs, which can result in friction between residents in the neigbourhood.[8]

Stefano Boeri is an Italian architect that promotes the application of plants and trees in the urban environment to battle climate change. Boeri is known for the Bosco Verticale in Milan, the first vertical forest. He manifests that increasing the number of forests and trees in cities can help absorb CO_2, drastically reduce pollution, energy consumption and the "urban heat island" effect, improve the biodiversity of living species and make cities safer, more pleasant, and healthier.[9] However, vertical forests require complicated installations, building techniques and construction. For example, trees are unable to grow a complete root system, the structure must bear the weight and movement of the tree, and watering is computer-controlled in relation to different heights and orientations.[10] As the roots of the trees are not connected to each other and can't grow to full size, the trees can't support and communicate with each other.[11] The trees are therefore dependent on the computer-controlled system and the maintenance of people. The vertical forest concept contradicts the tiny forest concept of Sharma, who states with the "Miyawaki method" that the best forest management is no management. After ten years of growing the tiny forest is able to sustain and take care of its own as one organism, in contradiction to the vertical forest, which is a collection of individual trees that are highly maintained.

In conclusion, urban forests and native living species have several advantages in the urban environment, on environmental, social, ecological, and economical levels. However, these advantages and values between buildings, residents and the urban environment are often separated, while they have the opportunity to be connected and enhance each other.

As Sharma said, while talking about the tiny forest in Zaandam: "Why not assist the nature to take over? Afterall, we are a part of it!" [12]

6. IVN, "Over Tiny Forest®," www.ivn.nl, accessed October 10, 2021, https://www.ivn.nl/tinyforest/over-tiny-forestr.

7. KAREN HENWOOD and NICK PIDGEON, "TALK about WOODS and TREES: THREAT of URBANIZATION, STABILITY, and BIODIVERSITY," *Journal of Environmental Psychology 21*, no. 2 (June 2001): 125–47, https://doi.org/10.1006/jevp.2000.0196.

8. Lara A. Roman et al., "Beyond 'Trees Are Good': Disservices, Management Costs, and Tradeoffs in Urban Forestry," *Ambio* 50, no. 3 (October 4, 2020): 615–30, https://doi.org/10.1007/s13280-020-01396-8.

Figure 3: Chernobyl 30 years after the nuclear accident
(Kijk, 2016)

9 & 10. Stefano Boeri et al., *A Vertical Forest Instructions Booklet for the Prototype of a Forest City = Un Bosco Vertocale ; Libretto Di Istruzioni per Il Prototipo Di Una Città Foresta* (Mantova Corraini Edizioni, 2015).

11. Peter Wohlleben, *HIDDEN LIFE of TREES : What They Feel, How They Communicate?Discoveries from a Secret World.*, 2018.

12. IVN, "IVN Tiny Forest Minidocumentaire," www.youtube.com, February 17, 2021, https://www.youtube.com/watch?v=f-uu-ohBk1MO&t=573s.

Objective

The focus of the thematic research is on the application of urban forests in the building environment and the possibility to connect flows and ecologies between residents, buildings, and forests. By mapping the flows and ecologies, it might be possible to create circularities and advantages between the residents, buildings and forests that support or benefit from each other.

Thematic research question

Overall design question:

How to design an urban (vertical) forest that works as one super organism, within the boundaries of buildings and the urban environment?

The design assignment regards the Havenstad of Amsterdam. The municipality of Amsterdams urban strategy is the "manifesto of the shingles", in which they manifest that a city that grows must be able to breathe.[13] A strategy that connects with the objective and question of the design assignment. The Havenstad is located in between three of the shingles and therefore an interesting location to showcase an urban neighbourhood where forests and the urban environment are integrated together. In the thematic research, the focus is more specific towards the ecologies and flows, and the boundaries of buildings and the urban environment. The goal of the thematic research is to gain knowledge and data on how to design an urban (vertical) forest that works as one super organism within the boundaries of buildings and the urban environment.

Thematic research question:

How can urban ecologies and forest ecologies be integrated?

Sub questions:

What are the flows and ecologies in the urban environment?
What is the structure of a forest and how does it work?
What are the native tree species, their properties, and requirements in the urban environment?

13. BOOM Landscape and ARCAM Architectuurcentrum Amsterdam, "De Amsterdamse Scheggen Manifest," 2019.

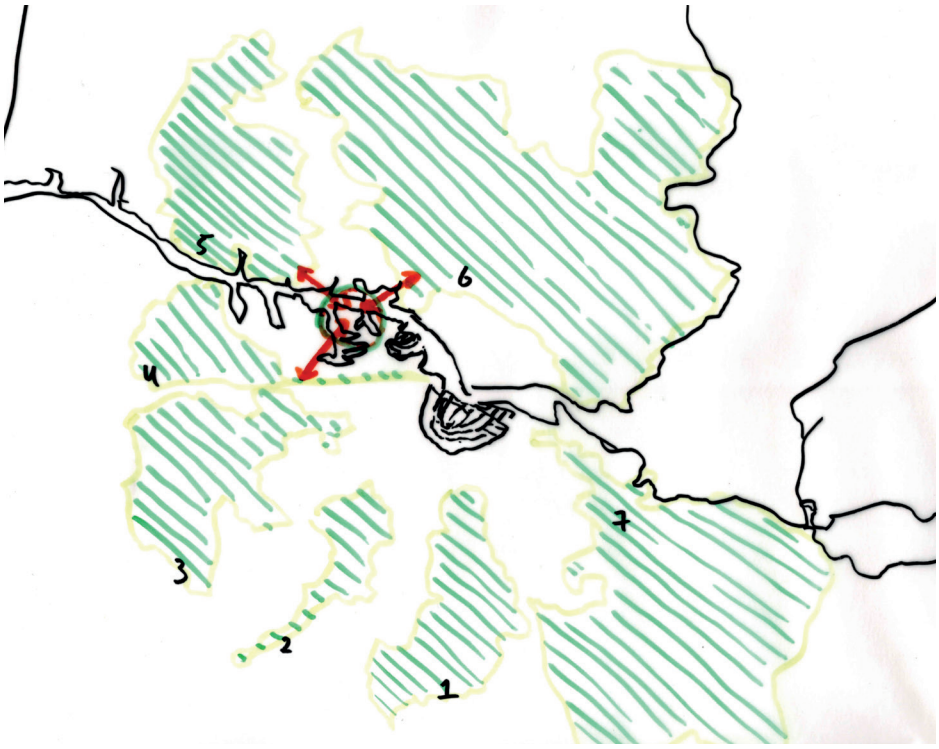

Figure 4: Manifesto of the shingles
Authors own drawing

Glossary of key terms

To delineate the research, some key terms have to be defined. The term ecology is used to describe the relations of organisms to one another and to their physical surroundings. The term 'urban ecology' refers to the study of ecosystems that includes humans living in cities and urbanising landscapes. It investigates ecosystem services which are closely linked to patterns of urban development. Urban ecology has been used variously to describe the study of humans in cities, nature in cities, and the coupled relationships of humans and nature. [14]

A forest is an ecological system (or biotic community) dominated by trees, in which the primary objective of forest ecology is to understand what controls the patterns of distribution and abundance of different organisms in forests.[15]

Another significant distinction is the difference between nature and native living species. There are various different definitions of nature, so defines the van Dale dictionary nature as everything on earth not made by man.[16] However, the relationship between nature and human influence is particularly debatable. Unaffected nature can no longer be found in the Netherlands. In fact, great parts of 'nature' as we know it, for example heathland and flowery grasslands, is the result of centuries of human influence.[17] Williams clarifies the relation between humans and nature. He states: "we are all part of nature, and our physical beings comprise many of the same elements and rhythms that make up the world around us. Yet, while we are part of nature, we also see ourselves as distinct from it, standing outside, if not above, the rest of the natural world". [18] Therefore, the term nature defines the different layers of the landscape and the native living species including humans as part of the natural world. Native living species are used to describe plants, insects, birds, trees, microorganisms, and animals which originally live or lived in the corresponding region, excluding humans.

14. Wilfried Endlicher et al., "Urban Ecology - Definitions and Concepts," 2007.

15. Timothy J. Fahey, "Forest Ecology," *Encyclopedia of Biodiversity*, 2013, 528–36, https://doi.org/10.1016/b978-0-12-384719-5.00058-7.

16. "Natuur," in *Van Dale*, 2021.

17. M Hermy, Geert De Blust, and M Slootmaekers, "Natuurbeheer (2004)," 2004.

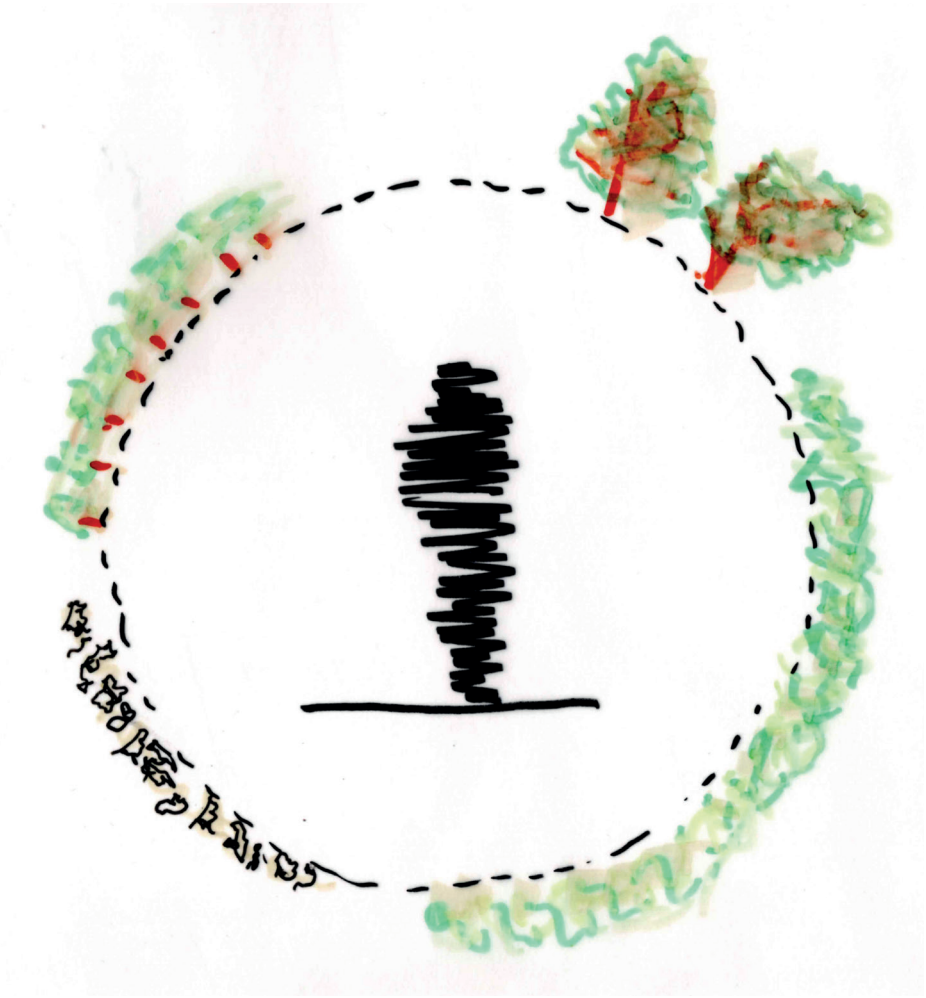

Figure 4: The search for a fixed relationship between the number of people and the number of trees, plants and animals present in the lived space.
Authors own drawing

18. James C Williams, *Understanding the Place of Humans in Nature*, 2010.

Theoretical framework & positioning

In December 1928, the Austrian artist Friedensreich Hundertwasser was born. Hundertwasser was a painter, sculptor, architect, and ecologist that preached the idea of a new biological architecture, based on the presence of trees in houses (Die Baummieter), capable of establishing a fixed relationship between the number of people and the number of trees present in any lived space.[19] He was an environmental philosopher with a focus on the Ecological Self. The Ecological Self is an abstract idea describing an awareness of what is normally termed the (narrow) ego. The concept is based on a criticism of individualistic or atomistic conceptions of the self and proposes an alternative view which embeds humans intrinsically in nature. Hundertwasser's The Five Skins of Man presents his view of the human being as an essentially embedded self with five 'skins'. [20] The model is a tool to help with Self-realisation, reflecting on and practice an alternative, more ecological lifestyle in all areas of life.

The Italian architect Stefano Boeri was 16 years old when Hundertwasser was walking in the middle of the streets through the city Milan with a small oak tree in his hand making a case for an organic architecture. At that time Boeri thought of ecological and environmental issues as irrelevant and superfluous. However, 40 years later Boeri is manifesting an architecture that aims to revolutionize the relationship between trees and humans in an urban centre. The idea of Bosco Verticale occurred after the research of Alehandro Zaera Polo which explained that 94% of the tall buildings in the world built after 2000 were covered in glass, resulting in the radical idea of two towers not covered in glass but in leaves, leaves of plants, shrubs but especially the leaves of trees. [21] Architecture has the potential to battle the mineralized city, through multiplying the places for the generation of plant biodiversity and wildlife within the denser urban areas. However, this alone won't be enough to limit the pressures of urbanization, therefore there is a need for "urban forestry" where architecture is not just a frame or focal point for nature but which is created together with it, becoming inseparable. [22]

Forester Peter Wohlleben is an expert on forests and trees. In his book "the hidden life of trees", Wohlleben describes how trees in forests communicate with and support each other, share nutrients with those who are sick and warn each other of impending dangers. He also describes the importance of the root network and the processes of life, death, and regeneration within the forest, which functions as one giant organism.[23] Shubhendu Sharma is fascinated by the eco-

19. TEDx Talks, "Trees in the Sky - a Vertical Forest in Milan: Stefano BOERI at TEDxTirana," *YouTube*, June 4, 2014, https://www.youtube.com/watch?v=jH4Q6ddchPc.

20. Nir Barak, "Hundertwasser - Inspiration for Environmental Ethics: Reformulating the Ecological Self," *Environmental Values* 26, no. 3 (June 1, 2017): 317–42, https://doi.org/10.3197/096327117x14913285800689.

21 & 22. Stefano Boeri et al., *A Vertical Forest Instructions Booklet for the Prototype of a Forest City = Un Bosco Verticale; Libretto Di Istruzioni per Il Prototipo Di Una Città Foresta* (Mantova Corraini Edizioni, 2015).

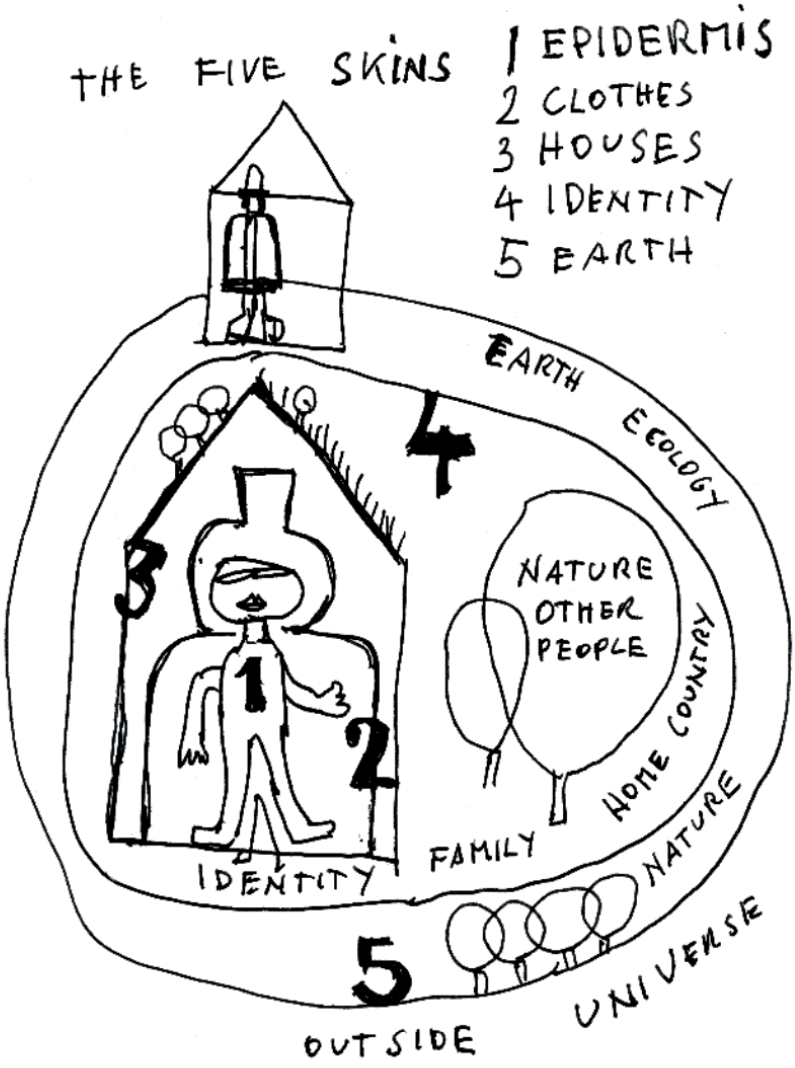

Figure 5: Friedensreich Hundertwasser, *The Five Skins of Man*, 1998
(Barak, 2017)

23. Peter Wohlleben, *HIDDEN LIFE of TREES : What They Feel, How They Communicate?Discoveries from a Secret World.*, 2018.

logy and forest techniques as well. Sharma was inspired by the forestry method of the Japanese tree expert Akira Miyawaki. Dr. Miyawaki developed a method for restoring natural, indigenous forests in the 1970s. Sharma translated this method to the urban environment, in which the new technique can create a native forest with a full functioning forest ecology within ten years instead of 100 years. [24]

The book "Ruimte voor de stadsboom" by Annemiek van Loon describes the current problems and values of city trees. City trees have become popular and are used in many new urban designs, however, now that we appreciate city trees more, they are doing worse. This is a result of the focus of the trees above the ground, neglecting the processes under the ground. In her book she describes technical information on how to design sustainable urban tree plantation.[25]

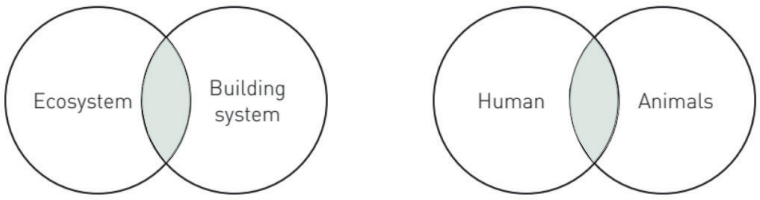

Figure 6: The gap in nature between native living species and the urban environment.
(Yuen 2019) Edited

As space in urban environments becomes more precious, planning for a nature inclusive infrastructure needs to be considered using a multi-layered approach to ensure effective urban foresting.[26] Therefore, the historical and cultural disconnection of the individual with nature needs to be redefined. Research into the ecologies of the forest and urban environment can help to place the ecological self in a new position within this framework, resulting in an urban environment and architecture that is created together with nature.

24. Afforest, "MIYAWAKI METHOD of FOREST CREATION," n.d.

25. A Van Loon et al., *Ruimte Voor de Stadsboom* (Wageningen: Blauwdruk, 2003).

26. ARUP, "Cities Alive Rethinking Green Infrastructure," 2014.

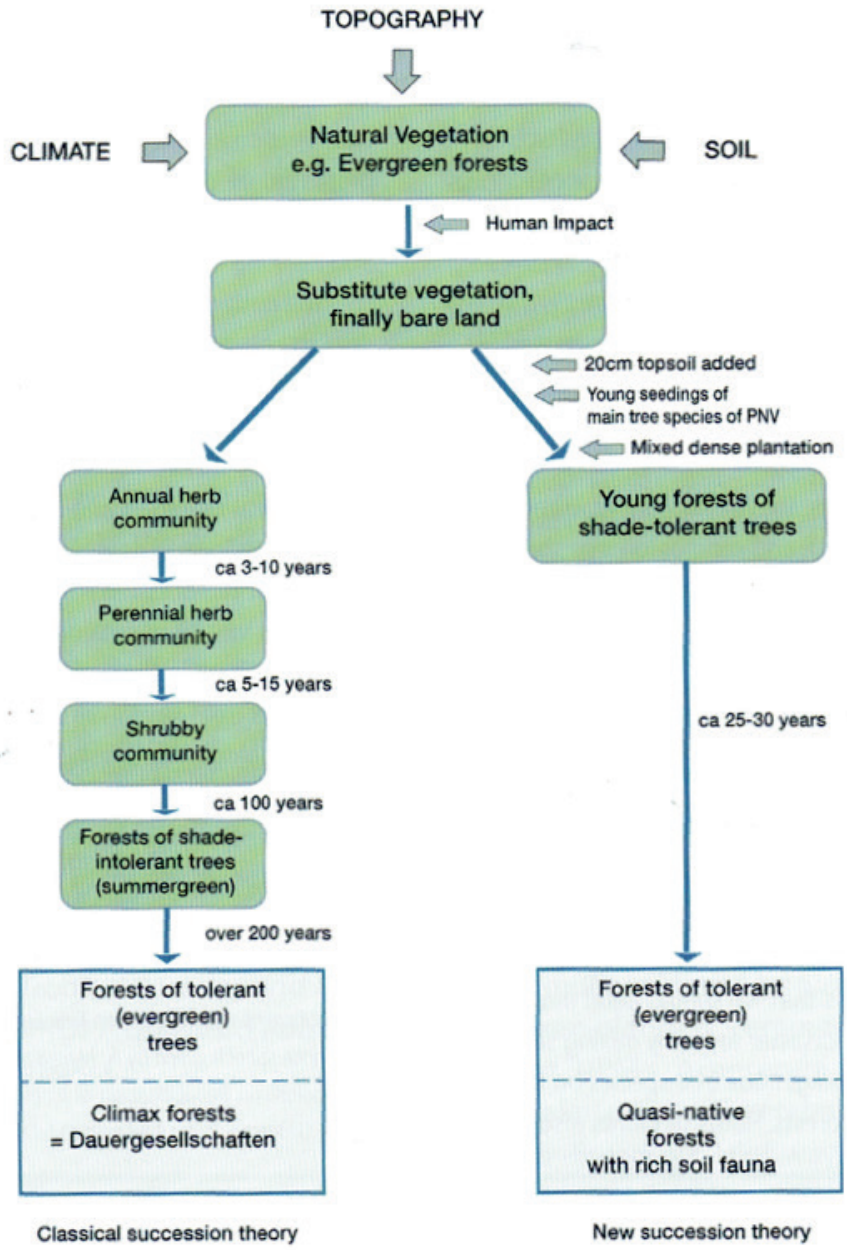

Figure 7: Comparison between Miyawaki's new succession theory and classical succesion theory
(Afforest, n.d.)

Research methods & matrix

- Case studies

Tiny forest Zaandam
Bosco Verticale

- Interviews

Tree consultant for the municipality of Amsterdam, Hans Kaljee
City ecologist of Amsterdam, Geert Timmermans
Both are interested in meeting me to answer my questions!

Urban Forestry TU Delft, Rene van der Velden
Urban Forestry TU Delft, Saskia de Wit
Urban Forestry TU Delft, Nico Tilli.
Nico Tilli is available for questions and more information.

Afforest company, service provider for creating natural, wild, maintenance free, native forests

- Literature

The hidden life of trees, Peter Wohlleben
A vertical forest un bosco verticale, Stefano Boeri
Ruimte voor de stadsboom, Annemiek van Loon
The architecture of trees, Cesare Leonardi and Franca Stagi
Green dream, how future cities can outsmart nature, Winy Maas, Ulf Hackauf, and Pirjo Haikola
Eerste gids voor natuurinclusief ontwerp, Maike van Stiphout
Hundertwasser : 1928-2000 : Personality, Life, Work, Wieland Schmied

Research question	*What data do you need?*	*How can this data be collected?*	*How will this data be analyzed?*	*What will be the expected results?*
1. What are the flows and ecologies in the urban environment?	-Information in processes and systems between buildings and residents and their needs. -Quantitative data on the resources used in the flows of the urban environment.	-Literature -Interview: Geert Timmermans	Summarizing and linking information from different sources.	A schematic overview of urban ecologies and flows. Raw datasheet with numbers to compare and integrate urban and forest ecologies. (Question 4)
2. What is the structure of a forest and how does it work?	-Qualitative data on forest structures and typologies -Quantitative data on the environmental impact of a forest -Understanding of the underground root network in a forest	-Literature -Case study; Tiny Forest Zaandam	Summarizing and linking information from different sources to acquire a clear theoretical framework.	Raw datasheet with numbers to compare and integrate urban and forest ecologies. (Question 4) A schematic overview of forest ecologies and flows.
3. What are the native tree species, their properties, and requirements in the urban environment?	-Qualitative & quantitative data of local tree species and their properties -Quantitative data on their requirements in the urban environment	-Literature -Case study: Bosco Verticale -Interview: Hans Kaljee & Nico Tilli	The data will be used and analyzed to create qualitative requirements of a design tool for practical application of urban trees.	A design tool including quantitative and qualitative data on which trees are available and applicable to design an urban forest or urban trees in the corresponding region of the design assignment, Amsterdam.
4. How can urban ecologies and forest ecologies be integrated?	-All of the above	-Not applicable	Compare data & schematics from question 1&2&3 to create an integrated urban forest ecology with the urban build environment.	An overview of possibilities on how to create an urban architecture which is created together and integrated with nature, instead of separated.

Figure 8: Research methods elaboration matrix

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	ASSIGNED TO	November					December					Januari				
	Date of first Monday	1	8	15	22	29	6	13	20	27		3	10	17	24	31
Deadlines											Holiday	Holiday	Assembeling	P2	P2	
What?													Presentation products	Thematic research	Preliminary design	
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