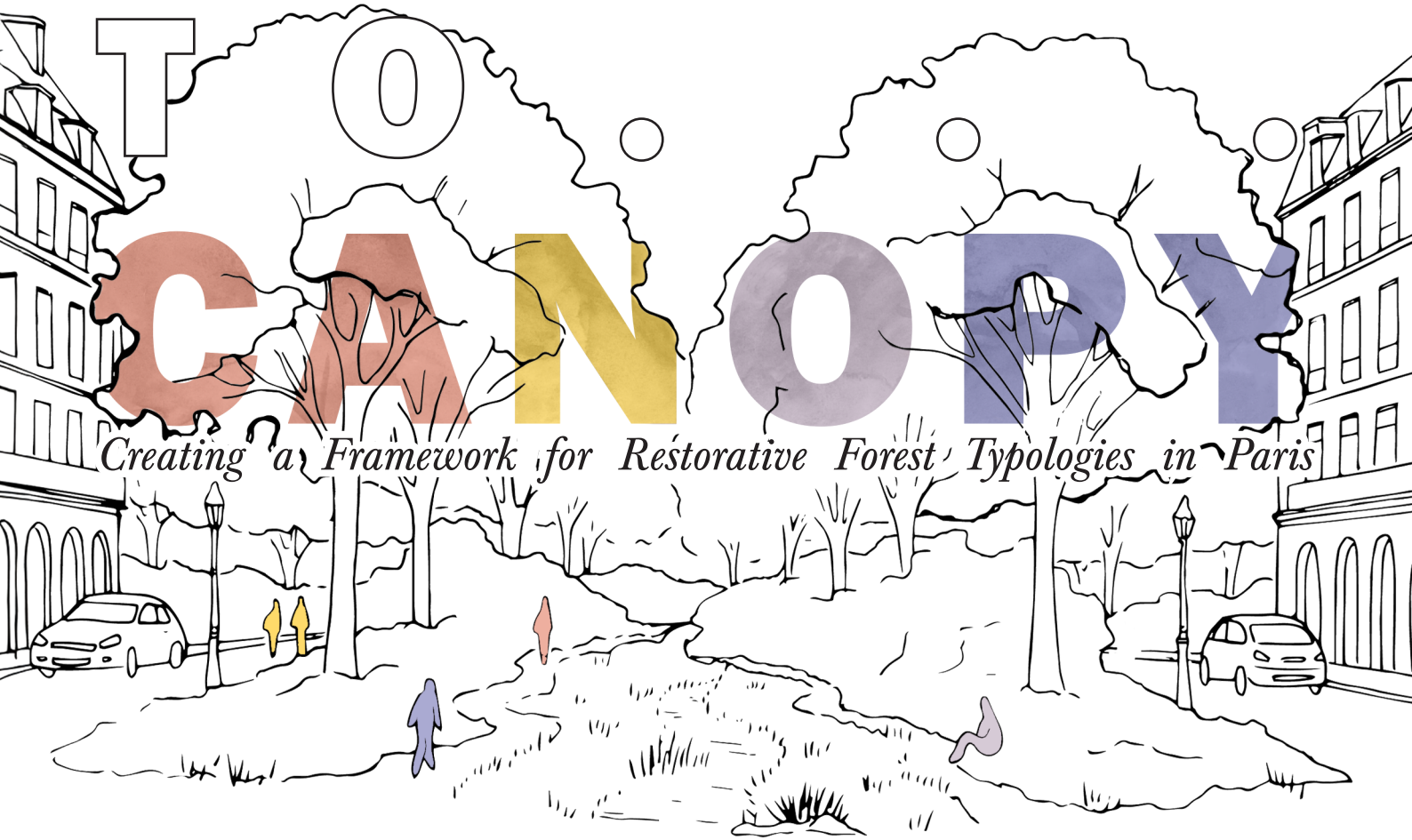
FROM CONCRETE TO CANOPY

Creating a Framework for Restorative Forest Typologies in Paris



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Abstract

Urban forests are increasingly planted for their climate and ecological value, yet their potential to support mental well-being remains underused in most urban greening strategies. This thesis explores how restorative urban forests can be systematically designed and implemented to address psychological needs, using Paris as a testing case.

This thesis begins be developing a typological framework grounded in environmental psychology and landscape architecture. Drawing on theories such as Attention Restoration Theory (ART), Stress Reduction Theory (SRT), Biophilic Design, Shinrin Yoku and the Perceived Sensory Dimensions (PSD's), four universal forest typologies are defined: the Refuge Forest, Healing Forest, Social Forest and Focus Forest. Each typology is linked to specific emotional and sensorial needs in our modern cities; such as withdrawal, recovery, connection and cognitive clarity.

These typologies are then translated into the Parisian context through spatial analysis, in situ testing and design research. Within this dense city, the forest typologies are adapted to work within the existing infrastructural networks and urban morphology. The Healing, Social and Focus Forests are reimagined as linear interventions inserted along mobility corridors, while the Refuge Forest takes the form of compact, immersive pockets within the city.

The result is a multilayered system of forest interventions that not only enhances urban ecology and environmental resilience, but also addresses mental health at the scale of everyday experience. By integrating emotional restoration into the logic of urban forestry, this thesis proposes a new design language: one that expands the role of trees from climate infrastructure to psychological infrastructure, reconnecting the city with the human need to pause, breathe and feel.

Contents

PLANTING

Fascinations

Living in Metropolitan Cities; Mental & Physical Health

This thesis is inspired by some of my own fascinations; forests, metropolitan cities and mental health; especially the combination of the three. In this thesis I want to bring these topics together to fuel my research and design. As a child, I grew up near the Postbank and Veluwe, which where often the places I visited with my parents and sister for walks on Sunday mornings. It's something I have always really enjoyed. Now, living in Delft, I miss that forested environment. The cities in the more urbanized part of the Netherlands, like Delft, are bigger, louder and have more everyday pressures then, per example, the smaller town of Doesburg where I grew up. There's less space for nature here, which I think is a shame. For me, nature, especially the forest, has always been the place to escape to whenever I felt the need to recharge mentally. For me, forests and green spaces are very important in big cities, especially because of all the extra stress factors that come with urban life and the mental strain. In my thesis I want to focus on a metropolitan city and explore how integrating more forested spaces could help support the mental health of its residents.

I've always loved visiting forests wherever I go or travel to. On the right page, you'll find some of my favorite photos of forests that I've taken along the way.

Forests

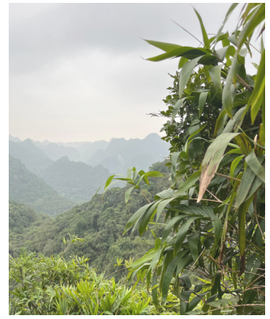
Living conditions in Metropolitan cities

Mental Health

Tanah Rata, Malaysia

Barchem, Netherlands

Cat Ba, Vietnam



Cat Ba, Vietnam

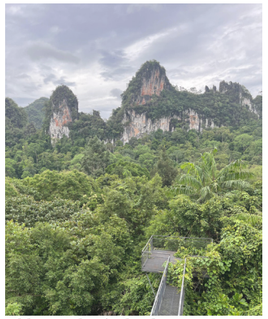
Nho Quan, Vietnam

Soi Saket, Thailand

Tuek Chhou, Cambodia

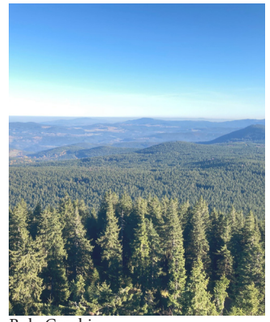
Ko Lanta, Thailand

Lochem, Netherlands



Khlong Sok, Thailand

Madeira, Portugal



Buk, Czechia

Prologue

In today's cities it is increasingly difficult to find places where the mind can slow down. The rhythm of urban life is fast, loud and dense, and leaves little room to slow down and pause. Mental health issues rise in populations, which makes this question even more urgent: what kind of spaces do we need to stay mentally well in our cities?

This thesis explores that question through the lens of trees and urban forests. While green infrastructure is gaining recognition again in urban policy, it is often Qguided by ecological and climate-driven goals. The emotional purpose of forests and their capacity to calm, focus, connect or restore, is rarely part of this discussion. And yet, this is precisely the extra psychological layer that could make forests essential to the future of urban life.

Working within the field of landscape architecture, this thesis aims to bring those dimensions together. It tries to connect environmental psychological theories with spatial design by translating theory into tangible restorative forest typologies and proposes a new way of thinking about trees in the city. Not just as environmental assets, but as part of the mental infrastructure in urban life. It can be a step towards reimaging the city; not just as a place to live, but a place to breathe, restore and feel connected through the quiet presence of our oldest friend; the tree.

...a step towards reimaging the city; not just as a place to live, but a place to breathe, restore and feel connected through the quiet presence of our oldest friend; the tree.

Problematique

Mental health challenges, such as stress, anxiety and depression are becoming increasingly prevalent in our society and modern world. The challenges are particularly acute in dense urban areas. These areas are characterized by dense population, environmental stressors and a limited access to high quality green space. In Europe, over 70% of the population lives in cities where mental health issues occur way more frequently then in rural areas; partly due to reduced opportunities for immersive experience in nature (Sørensen, 2013).

The design of modern cities often prioritizes infrastructure, efficiency and economic growth at the expanse of human well-being (Stokols, 1992; Evans & Wener, 2007). This modern way of urban planning contributes to urban environments that are becoming increasingly inhospitable to both physical and psychological health. One key factor of this development is the disappearance and degradation of accessible, high quality green space, especially where they are most needed. These green spaces suffer significantly from rapid urbanization and their loss happens even due to the growing evidence that trees and green infrastructure play a crucial role in mitigating stress, restoring cognitive capacity and promoting overall well-being.

From an urban forestry perspective, trees are widely valued for their environmental benefits such as cooling, air purification and water regelation. These function are often well integrated into urban planning and policy and landscape architecture. However, the psychological and emotional value of trees, such as reducing stress and cognitive restoration, often receives much less attention in these strategic plans and frameworks for the planning of cities or in landscape architecture overall. Research on these psychological benefits is growing, but is rarely translated into concreate design objectives of strategies.

This emphasis om ecological and climate functions is also reflected in the current green infrastructure strategies of Paris, the design site of this thesis. In current municipal plans of Paris like Plan Canopée (Ville de Paris, 2020) and the "Plan Climat" (Ville de Paris, 2021), trees are primarily used as a tool for climate adaptation, biodiversity enhancement and air quality improvement. Thereby they respond to urgent environmental challenges. The priorities are crucial and well justified, particularly due to the city's exposure to heat stress and pollution. However, these plans, like many other plans, currently do not explicitly incorporate this mental and psychological potential of urban trees. Nor do they consider how tee-based systems can be designed to support mental restoration. This suggests an opportunity. Rather than replacing these existing objectives, a mental health perspective on these plans could enrich Paris' urban forestry strategies and can contribute to a better understanding of what urban forestry can offer at this mental layer.

The issue addressed in this Problematique, urbanization, has led to the fragmentation and reduction of high quality green spaces, which increases psychological vulnerability among urban residents (Vujcic et al., 2017). Without sufficient tree canopy and meaningful contact with natural environments, urban dwellers are more likely to experience chronic stress and isolation. In addition to this, environmental stressors such as heat and air pollution, that can both be mitigated by urban forests, compound these mental health risks (Fenger, 1999; Lungman et al., 2023). This highlight the urgent need to approach urban forestry not only as an environmental necessity but also as a public health strategy.

The city of Paris provides a relevant case for this thesis study. It has a very high urban density, a relatively low canopy cover and limited green space. Thereby, city has a lot of the pressures facing urban forestry in these European metropolitan cities. According to Copernicus Urban Atlas data (2018, calculated by author in QGIS), central Paris contains only 16,75% green space, of which 10,26% is concentrated in just two large forested parks: Bois de Boulogne and Bois de Vincennes. This uneven distribution leaves many neighborhoods, especially in the center, underserved in terms of their ecological but also psychological benefits.

Environmental indicators further support the relevance of Paris as a case for this thesis. Paris reports an average Air Quality Index of 43, significantly worse than Londen (28 AQI) and Amsterdam (34 AQI) (Air.Plumelabs, n.d.). In the European Union's 2023 Quality of Life Report, Paris ranks among the lowest for satisfaction in terms of air quality, noise levels and overall urban cleanliness. These environmental stressors are also reflected in broader perceptions of life in this city. For example, Okulicz-Kozaryn and Valente (2018) describe Paris as "a livable but unhappy city". This because it scores very low in their research on both place and life satisfaction. In this comparative ranking of Western cities, Paris appears at the bottom of the graph and is therefore metaphorically referenced as a 'fool's hell' by the authors.

Considering all of these conditions, Paris is used in this thesis as a testing case for the development of a theoretical framework for restorative urban forests. This framework is rooted in environmental psychology and case studies of healing landscapes. It aims to connect scientific knowledge on psychological restoration with the practice of urban forestry. By integrating emotional well-being into strategic designs, this project aims to propose a new way of thinking about urban forests; not only as climate infrastructure, but as a vital component of a healthy and emotionally supportive urban life.

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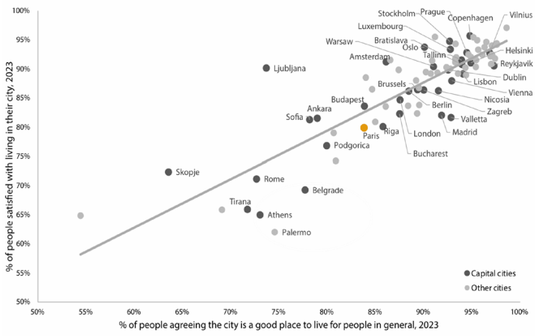

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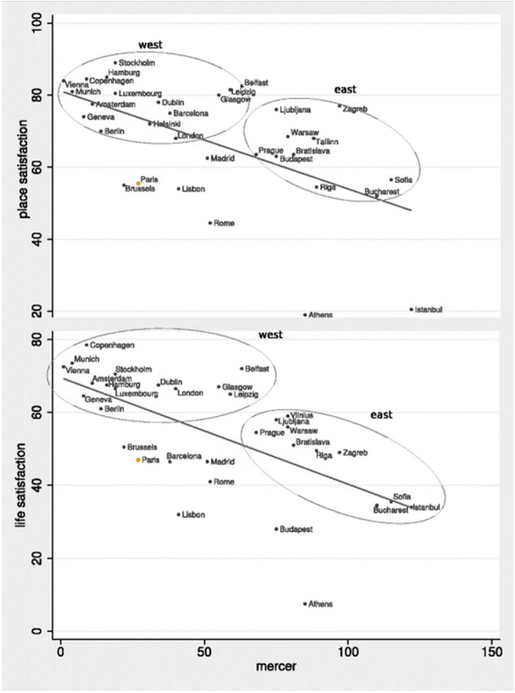


Research Questions

As urban populations grow and cities keep facing environmental and social pressures, there is a renewed interest in integrating nature into the urban fabric. Not only to support ecological sustainability, but also to foster human well-being. This thesis explores how urban forests can be strategically designed and implemented in Paris to optimize psychological restoration for its residents. Central to this thesis is the General Research Question:

"How can a theory-driven typological framework for urban forests be designed and implemented in the city of Paris to optimize residents' psychological restoration while contributing to the reinvention of Paris as a sustainable, evolving urban space?"

This guiding question aims to connect two ambitions; improving the mental and emotional health of urban residents through restorative green spaces and reinforcing Paris' broader goals of sustainability and urban renewal. To support this GRQ, three Specific Research Questions are formulated. The first sub question is as follows, and explores the foundational psychological value of nature in urban context:

1. *How can the integration of nature, through elements like trees, within urban landscapes support human mental health, foster emotional recovery, and strengthen the connection between people and the natural world in cities?"*

This question draws from Attention Restoration Theory, Stress Reduction Theory and Biophilia, which collectively highlight how exposure to natural environments can reduce stress, restore cognitive resources and nurture a deeper emotional bond with nature. These frameworks provide the conceptual grounding for how specific natural elements can support psychological wellbeing in dense urban environments.

Building further on this foundation, the second Specific Research Question considers how such restorative qualities can be actively designed into urban forests:

2. *What role do urban forests play in shaping mental health outcomes, and how can their design be tailored to address specific psychological and emotional challenges within urban environments?*

Here, the focus shifts towards the experiential and spatial dimensions of urban forests. Theories such as Shinrin-Yoku and the Perceived Sensory Dimensions highlight the importance of multisensory, immersive and emotionally responsive environments. These perspectives are further enriched by case studies of therapeutic landscapes which demonstrate how forests and gardens can be structured to meet a range of emotional and sensory needs.

The third specific question integrates these insights into a concrete design strategy.

3. *How can a framework for urban forest typologies be developed, based on relevant theories and precedent studies, to address the psychological needs of city residents and create restorative spaces?*

This question synthesizes the theoretical insights from SRQ 1 and SRQ 2 into a coherent conceptual framework of urban forest typologies. The resulting typologies respond to specific emotional needs and are grounded in theory while being adaptable to different urban conditions. In addition to this, the theories and cases from SRQ 1 and SRQ 2 inform a set of design elements that are embedded into each forest typology to guide its spatial and sensorial form.

These three questions from the theoretical backbone of the thesis. They establish the academic and conceptual basis for an understanding how urban spaces can promote this much needed psychological restoration. In the next phase of the thesis, a set of progress questions/steps are introduced to help make this framework applicable and to guide its implementation into the Parisian landscape.

Throughout this thesis, the term 'forest' is used not in a strictly ecological sense, but as a conceptual and design-oriented term:

Forest:
The concept of 'forest' in this thesis refers to a system characterized by the presence of trees, ranging from dense woodlands to linear formations and individual trees, all ofW which contribute to a larger (urban) forest. While this system does not constitute a 'natural' forest, it seeks to emulate the ecological, sensory, and psychological benefits typically associated with forests, integrating these qualities into the urban context.

Method Description

On the next page, you'll find a diagram outlining the method of my research. The topic of this thesis stems from my personal fascinations and the Problematique, which together form the basis for the general research question (GRQ) on the left. On the right side, you'll see the 4th progress step, which focuses on site selection.

The left arm of the diagram shows the GRQ, which splits into two specific research questions (SRQs). SRQ 1 will contain most of the theoretical framework and will discuss theories like SRT, ART and Biophilia. The second specific research question will involve literature research on the practice of Shinrin-Yoku, embedded research and two case studies; Octavia and Nacadia. The embedded research in this SRQ includes a Shinrin Yoku excursion and a quick analysis of my own forest photos to gain a better understanding of the concept of this research question.

In SRQ 3, the first generation of the restorative forest typologies is formed. The knowledge gained from SRQ 1 and SRQ 2 will be integrated here to develop these typologies. This information will then inform progress step 7, in which this framework for the typologies will be tested out and questioned among the residents of the city of Paris.

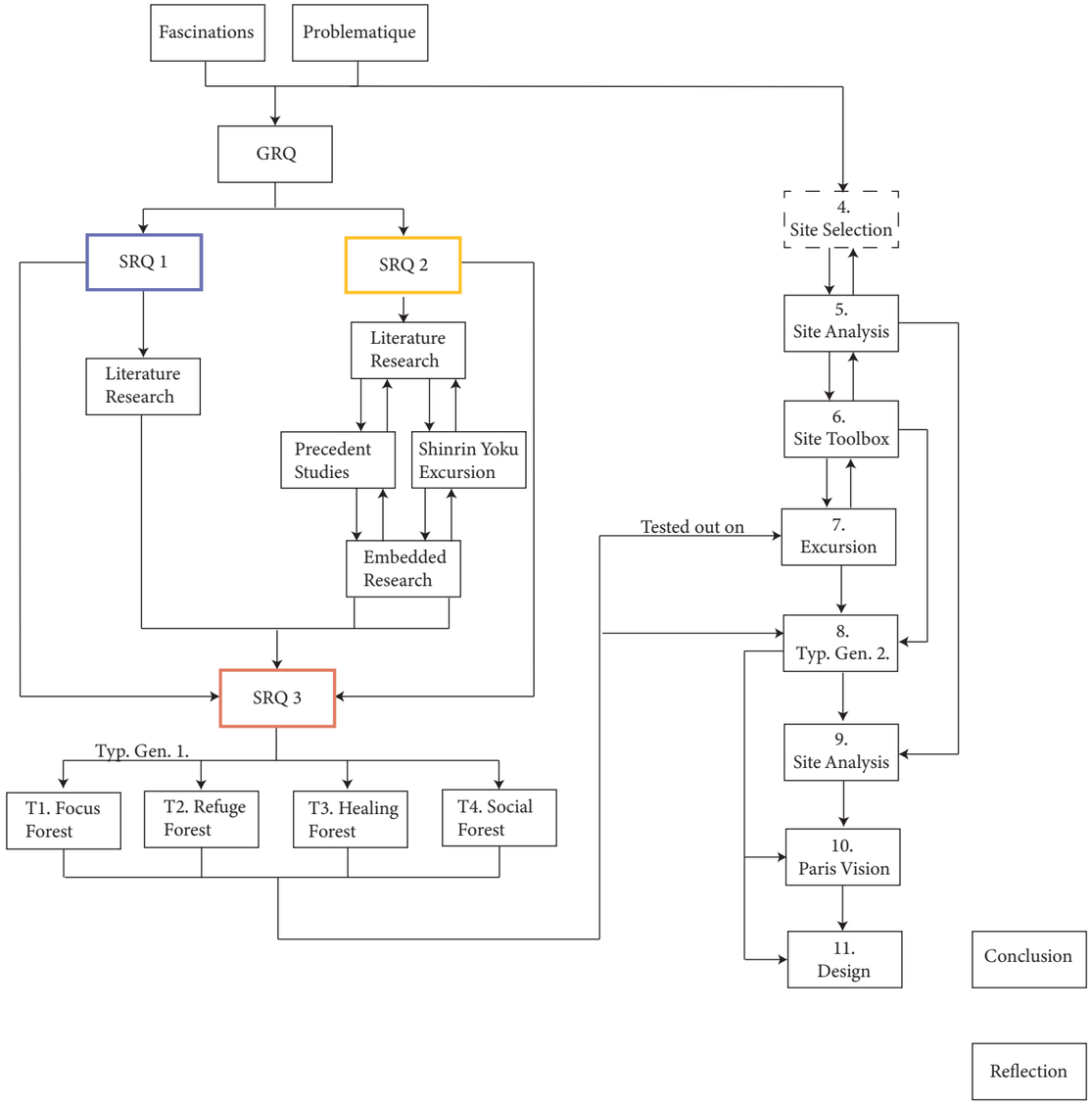
The 4th progress step (can be find in the Appendix), site selection, is driven by the Problematique. Different cities in Western Europe were analyzed to identify a suitable candidate for the concept developed in this thesis. Once the city is chosen—Paris—the diagram progresses to step 5: Site Analysis. The analysis done in this step will inform a Parisian Toolbox (step 6). This toolbox will be combined together with the first generation of typologies, and the results of step 7 Excursion, to create a second generation of typologies in progress step 8.

Based on the formation of the new typologies, some additional analysis will be done in step 9 to gain a deeper knowledge of the site so that the thesis can progress into step 10 and 11; Paris vision and design.

1. *How can the integration of nature, through elements like trees, within urban landscapes support human mental health, foster emotional recovery, and strengthen the connection between people and the natural world (in cities)?*

2. *What role do urban forests play in shaping mental health outcomes, and how can their design be tailored to address specific psychological and emotional challenges within urban environments?*

3. *How can a framework for urban forest typologies be developed, based on relevant theories and precedent studies, to address the psychological needs of city residents and create restorative spaces?*



Progress Diagram

The image on the right shows the Progress diagram. The thesis will consist of 4 parts; planting, growing, shaping and shredding. In the thesis I will work with 3 research methods; research about design (part 1), research on design (part 2) and research by design (part 3).

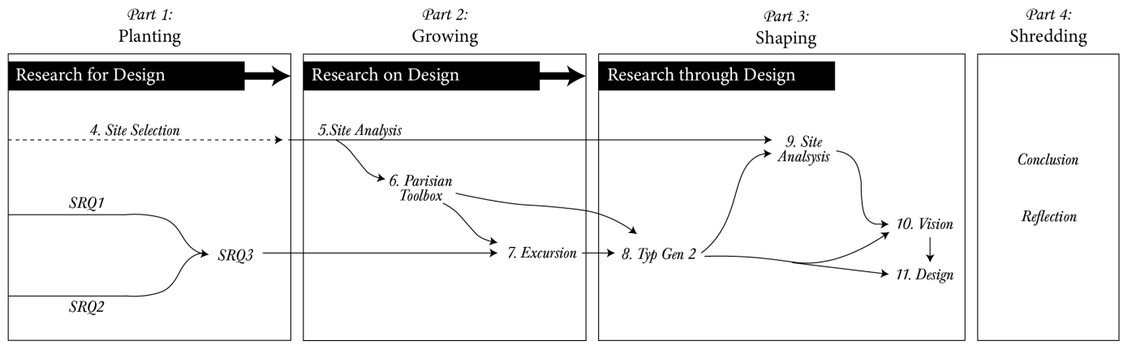
Part 1: Planting (Research for Design)
This section of the thesis lays the theoretical foundation for the rest of the thesis. It contains the research questions, Problematique and theoretical framework. It introduces key theories to this thesis (SRT, ART, Biophilia, Shinrin-Yoku) and SRQ's 1, 2 which will together form the first generation of forest typologies in SRQ 3.

Part 2: Growing (Research on Design)
Part 2 applies to research from part 1 into a specific case; the city of Paris. In this part, Paris will be analyzed to create a Parisian toolbox. This part also contains insights and findings from an excursion in which the first generation of forest typologies has been questioned among the residents of Paris.

Part 3: Shaping (Research through Design)
This phase combines research with design and redefines the first generation of the typologies into a second generation based on further analysis, research and the findings from the excursion. This will be further explored into a design for the city of Paris.

Part 4: Shredding
This part will be about concluding and reflecting.

The progess steps (also corresponding to the methodology) numbered in the diagram are as follows:



4. What are the conditions in Western European cities regarding tree coverage, mental health, and living environment, and which city would make a strong candidate for the application of this urban forest framework? (outcome the city of Paris)

5. What are the key characteristics and layers of Paris that should inform the development of an urban forest typology framework?

6. How can insights from an analysis of Parisian green spaces be formed into a design toolbox that captures their unique identity and can later guide the implementation of the urban forest typologies framework into Paris?

7. What insights do interviews with Paris residents during a field excursion provide about the effectiveness of the initial urban forest typologies, and how can these findings guide their refinement?"

8. How can insights from the field excursion inform the development of a second-generation of urban forest typologies, building upon and refining the initial typologies?

9. What additional analyses are needed to evaluate and refine the second generation urban forest typologies for Paris?

10. How can the second generation urban forest typologies be translated into a vision map that spatially guides their implementation across Paris?

11. How can detailed site-specific designs be developed from the vision map and second-generation typologies to inform the implementation of urban forest interventions in Paris?

Specific Research Question One

"How can the integration of nature, (through elements like trees), within urban landscapes support human mental health, foster emotional recovery, and strengthen the connection between people and the natural world in cities?"

Central to this thesis is the connection between humans and nature. This is something that has long been recognized in different disciplines; ranging from psychology and environmental studies to urban panning and general public health. Especially in the recent decades, this topic has been very important and has highlighted how natural environments positively impact human well-being. This theoretical framework explains how natural elements, like trees, contributes to mental restoration, stress reduction and emotional healing by explaining different key environmental psychology theories and cultural practices that articulate the importance of high value green spaces in a dense urban environment like Paris.

Rapid urbanization and thereby increased sensory overload in cities have led to a growing disconnect between humans and natural systems (Beatley, 2011). As people spent more time in urban environments that are dominated by noise, pollution and other urban stressors, psychological fatigue and chronic stress have become more prevalent public health concerns (World Health Organization, 2020). In response to this, a lot of research and design has been done to understand how reintroducing natural elements into our daily urban lives might counteract these effects. Urban forests are central to this approach (Nowak & Dwyer, 2007). The presence of trees in urban spaces has been proven to provide significant mental health benefits, including stress reduction and mood improvement and to enhance cognitive function (Ulrich, 1983; White et al., 2013). Trees have a great impact on bettering the living environment in a city by e.g. reducing urban heat islands, improving the air quality and by creating shaded spaces for relaxation and recreation which is crucial for enhancing urban residents' well-being.

This framework integrated Attention Restoration Theory (ART) (Kaplan & Kaplan, 1989; Kaplan, 1995), Stress Reduction Theory (SRT) (Ulrich 1983;1993) and Biophilic Design (Kellert, 2008) to build an understanding of the background for designing environments that promote physical well-being. These theories are used in the practice of Shinrin-Yoku (forest bathing), which emerged in Japan as a nature-based health intervention and offers an interesting view on environmental healing (Miyazaki, 2018; Li, 2010). Trees are a a component in the practice of forest bathing and have been proven to contribute to lowering cortisol levels, boosting immune system function and enhancing emotional resilience (Li et al., 2010; Miyazaki et al., 2007) (more about this in SRQ2).

Understanding the theories behind mental restoration and emotional recovery is crucial in shaping the forests and green spaces of which there is a crucial need in the cities of tomorrow. The insight drawn from this framework will guide the design of emotionally meaningful forest typologies that align with the psychological needs of humans living in a dense urban environment like Paris.

"Nature holds the key to our aesthetic, intellectual, cognitive and even spiritual satisfaction." – E.O. Wilson (1984), Biophilia

Attention Restoration Theory

Attention Restoration Theory (ART) was first introduced by Kaplan and Kaplan in 1989. This theory proposes that natural environments have restorative effects on the attention of humans. According to ART, the mental fatigue experienced from extended mental work can be restored through exposure to nature. This is particularly relevant for activities requiring 'directed attention' which is the effortful concentration needed for everyday tasks such as problem solving, decision making, multitasking and, for example, writing a thesis. This theory proposes that natural environments offer a setting where the brain can recover from this mental fatigue by engaging in 'effortless attention', which is naturally triggered by elements found in nature. Because of the activation of this effortless attention the brain gets provided with an opportunity to rest and recover, thereby restoring mental energy and cognitive function.

Kaplan uses four key components of a restorative element:

Being away – This component is about having a sense of 'being away'; the experience of psychological distance from one's usual tasks or surroundings. A restorative space allows people to mentally 'step away' from everyday tasks that demand directed attention so the brain gets a break from overstimulation and everyday responsibilities. This element does not require literal travel; nearby green spaces can also provide this sense of escape. Also urban trees can help with the feeling of being away. (Kaplan & Kaplan, 1989).

Fascination – Restorative environments must capture attention effortlessly, what Kaplan & Kaplan call 'soft fascination'. With this they mean subtle, engaging stimuli such as the sound of rustling leaves, patterns of light and shadow, moving water of the movement of the clouds. These elements hold attention gently without requiring mental effort which allows the directed attention system to rest and recover, making this essential for mental restoration.

Extent – Extent refers to the sense that an environment is rich and coherent enough to feel immersive. Also small parks and spaces can evoke a feeling of extensiveness. This can be done through designing this space smartly; winding paths, layered vegetation and a suggestion of exploration. The space should feel like another world that provides continuity and a temporary escape from routine.

Compatibility – A restorative environment must align with the needs of a person visiting the space. The environment should feel easy to engage with, it must support what the user trying to do, whether that's relaxing, running, reading or just taking a walk. People should experience a 'sense of harmony' between them and the natural environment. When people feel at ease in a place, their attention can rest so that their directed attention can be restored.

This theory has also been supported and build on further by more recent research. For example, Berman. et al. (2008) found that humans who took al walk in natural environments showed significantly improved memory and attention compared to those who took a walk in an urban environment. Ohly et al. (2016) further confirmed that short-term nature exposure leads to cognitive benefits across various age groups.

In the context of this design thesis, ART emphasizes the importance of using the four key components of a restorative environment in a design. These principles suggest that an environment designed to allow humans to disconnect from daily stress can help them with their mental restoration by engaging their attention in effortless ways, providing a sense of expansiveness and by resonating with their intentions and needs. This is particularly needed in urban spaces where the need for mental restoration is most needed due to the high amount of urban stressors.

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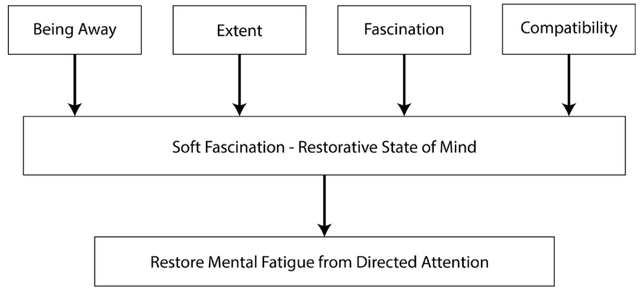

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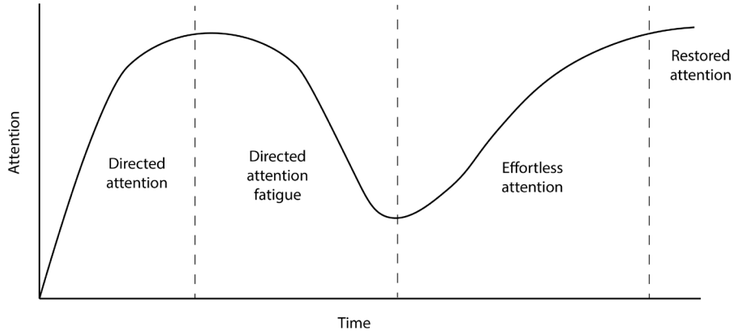

Attention Restoration Theory
(Kaplan, 1989, 1995)

Stress Reduction Theory

The Stress Reduction Theory (SRT) is developed by Roger Ulrich in the 1980´s and proposes that exposure to natural environments leads to immediate positive physiological and emotional responses. According to Ulrich (1983) exposure to nature can have an immediate calming effect by reducing physiological stress responses such as an elevated heart rate and blood pressure while also promoting relaxation. This stress reducing effect is believed to be both temporary and longer lasting which contributes to emotional recovery and a sense of overall well-being. According to Ulrich, the high levels of overstimulation in urban environments lead to increased stress levels which can have an harmful effect on both mental and physical health. Natural environments in contrast to this offer restorative qualities that help counteract these stress levels.

One of the key elements of SRT is that natural elements can improve relaxation by engaging in the parasympathetic nervous system (PNS). This nervous system is part of the autonomic nervous system and controls involuntary functions in the body, think of our heart rate and our digestive system. The PNS helps our body return to a calm and restful state after experiencing stress or physical activity (McCorry, 2007). This system controls the body's rest and recovery functions. Soft fascination, explained in ART, is also important in this process. In SRT, natural stimuli such as the sight of trees and water capture our attention in a way that also promotes recovery and reduces mental fatigue.

SRT states that nature offers a way of engagement that does not require active mental effort which allows humans to unwind and restore their mental and physical energy. Especially in urban environments, where stress is high due to noise, pollution and other urban stressors is it important to incorporate natural elements such as high quality green spaces, trees and water features to help mitigate these stressors.

Studies show that even short exposure to nature has significant benefit for reducing stress. The study of Ulrich in 1984 demonstrates that patients who where recovering from surgery in a hospital room recovered faster in a room with a view on nature then patients with a view of a brick wall.

SRT, just like ART, emphasizes the importance of creating environments that offer residents of dense urban environments to reduce their stress levels and promote their mental well-being and physical recovery. Integrating principles of SRT in landscape designs can help create spaces environments where individuals can recharge, relax and engage with nature in a restorative way. Research has shown that especially elements such as trees, water and natural light are effective in lowering these stress levels (Ulrich, 1984; White et al., 2010). According to this theory, these elements should be designed in a way that they are visually coherent and aesthetically pleasing. It is important to avoid chaotic overly complex scenes as they have the risk of overstimulation (Ulrich, 1991). The scenes should have a 'moderate complexity' and features that gently capture the attention of the visitor, think of rustling leaves and reflections of the water surface to support this wanted calm and restorative environment (Ulrich, 1983).

It is also stated that a sense of safety and refuge is essential in such a stress reducing environment. These feeling of relaxation and protection can be fostered by enclosure, clear sightlines and low disturbance. Especially water is an interesting feature in reducing psychological stress responses due to its calming sound and reflective qualities (White et al., 2010).

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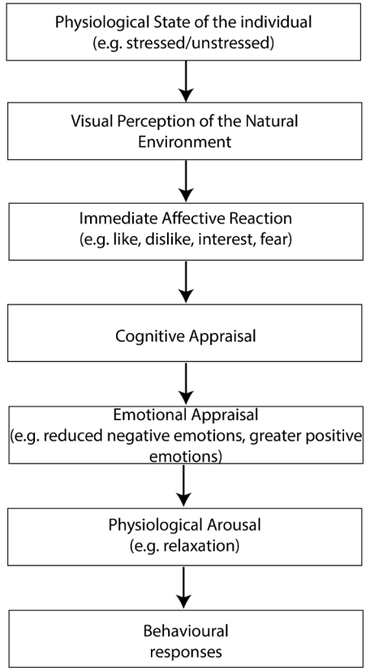


Stress Reduction Theory
(Ulrich, 1991)

Biophilia and Biophilic Design

Biophilia is a concept introduced by Edward, O. Wilson in the 1984. The theory suggests that humans have a deep rooted connection to nature that has evolved over millennia. Wilson argues that our affinity to nature is deeply rooted ('evolutionary hardwired') in our biology and that it plays an important role in our mental and emotional well-being.

Biophilic design in landscape architecture is about more then just a greening strategy of e.g. a city; it's about fostering meaningful and multisensorial relationships between people and place (Ryan et al., 2014). It's about recognizing how much the physical health and mental well-being of humans rely on the quality of our relationship with the world beyond ourselves of which we remain a part (Kellert and Calabrese, 2015).

Stephen Kellert (2008) emphasizes that biophilic design is a method for reconnecting people to nature though the spaces and places they inhabit. The design of a place should acknowledge the deep intrinsic bond between humans and the natural world. It's about combining nature, place and people as can be seen in the diagram on the next page. He states that the goal of biophilic design is to create places that resonate with the human evolutionary tendencies towards nature.

The landscape architect Ian McHarg quotes in this article that:

"The problem of man and nature is not one of providing a decorative background for the human play, or even ameliorating the grim city: it is the necessity of sustaining nature as a source of life, milieu, teacher, sanctum, challenge and, most of all, of rediscovering nature's corollary of the unknown in the self, the source of meaning."

This perspective shows that the role of nature in urban spaces is not only aesthetic but that it is a restorative tool to a deeper, and more intrinsic connection between people and their environment.

Stephen Kellert and Elizabeth Calabrese (2015) describe biophilic design as a way to integrate the human connection with nature into the build environment. To support this approach they outline six principles and 24 patterns in their article that serves as a guideline for applying biophilic design. However they are mostly architectural, some of them could also apply to landscape architecture mostly for designs in small dense urban spaces.

-Visual and non-visual connection with nature (sight, sound, smell and touch)
-Presence of water (moving and reflection in water)
-Biomorphic forms and patterns (organic shapes)
-Material connection with nature (use of natural materials and textures)
-Complexity and order (balanced, nature's structured diversity)
-Prospect and refuge (open views, sheltered, safe-feeling spaces)

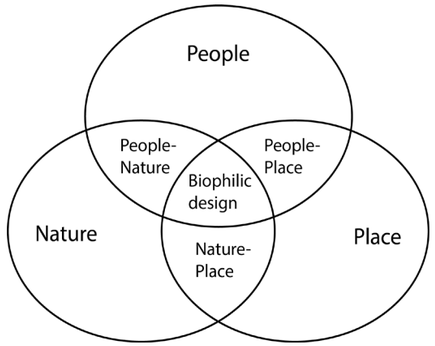
These principles and patters offer tools for designing environments that feel psychologically supportive, physically comfortable and emotionally engaging, especially in urban environments that are characterized by overstimulation and stress (Browning, Ryan & Clancy, 2014).

Biophilic design is rooted in the principles of Attention Restoration Theory (Kaplan & Kaplan, 1989) and Stress Reduction Theory (Ulrich, 1983). For example, the natural elements that support 'soft fascination' in ART are often used in biophilic design to create these immersive and engaging landscapes (Kaplan, 1995; Kellert, 2005). From the viewpoint of SRT, elements such as trees, water and refuge spaces contribute to a sense of calm and safety which reduces stress and supports mental recovery (Ulrich et al., 1991).

Trees are also a central element in biophilic landscapes. They do not only provide ecological services but they also support feeling of stability, rootedness and comfort which is essential in spaces that are designed to foster restoration and connection (Kellert, 2005; White et al., 2010; Haluza et al., 2014).

For this thesis biophilia and biophilic design offers a background for developing forest typologies that respond to emotional and social needs that foster restorative, engaging and meaningful experiences with natural environments for individuals living in a dense urban context. In these dense urban environments, where space for high quality green space is often limited, biophilic design can help to re-establish this

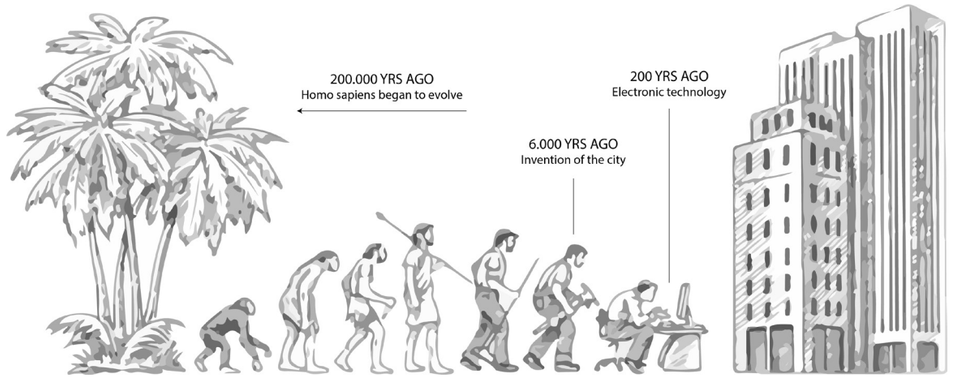
8.



Biophilic Design
(Stephen Kellert, 2008)

Biophilia
(Edward O. Wilson,1984)

9.



Conclusion

The first part of the theoretical framework in SRQ1 explores three theories that inform the cognitive, emotional and psychological impact of green environments: ART, SRT and Biophilic Design. Each one of these contributes to specific insights that can be translated into concrete, sensory-based design strategies that will be used later in this thesis.

Attention Restoration Theory (ART) proposed that natural environments support cognitive restoration through four key elements: fascination, being away, extent and compatibility (Kaplan & Kaplan, 1989). These principles can help guide the design of natural spaces that restore mental clarity and support gentle focus.

-Fascination refers to stimuli that softly draw the attention of the user without requiring mental effort; such as filtered views, subtle motion in foliage or diverse and dynamic natural textures.
-Being Away involves a spatial, but most important a psychological, distance from daily routines. This can be achieved by spatial transitions or paths that visually and experientially separate the user from their daily (urban) context.
-Extent relates to continuity and immersion; the environment that is visited must be rich and coherent enough to feel like 'another world'. This can be supported by layering, visual depth and connected circulation.
-Compatibility is about the users ability to act freely and comfortably in the space and that it matches the users needs. This can be supported by legible layouts and open multifunction areas.

Stress Reduction Theory (SRT) emphasizes psychological and emotional recovery through contact with safe and non-threatening environments. Ulrich (1993) demonstrated that visual access to natural elements like water, soft vegetation, and low stimulating landscapes can reduce blood pressure and anxiety. In design, this can translate to calm and soft environments, water zones, gently planting and diffused light. Also enclosure, such as vegetated buffers or canopy cover, plays a crucial role in creating these feelings of safety and withdrawal associated with SRT, especially in urban context. SRT also accounts for social needs; open, shared paths or benches that don't force interaction as these low-pressure shared spaces reduce social stress (White et al., 2010). ´

Biophilic Design takes a broader and more evolutionary approach and is rooted in the innate human tendency to seek connection with life and life-like processes (Wilson, 1984; Kellert, 2008). In design, it is about emphasizing sensory richness, seasonal variability, natural materials and signs of life; such as biodiversity, pollinator activity and organic decay. It also includes symbolic and cultural links to nature; such as memorial trees or familiar plant and tree species as these contribute to a sense of meaning and comfort (Browning at al., 2014). Design elements based on Biophilia include fragrant and textural planting, repeated natural forms, and exposure to natural growth processes as all of these contribute to emotional anchoring and attentional recovery (Haluza et al., 2014).

Together, these theories outline a coherent vision that nature restores us cognitively, emotionally and psychologically; and that this restoration can be actively supported through carefully designed spatial, visual and sensory elements.

While these theories provide a clear framework for nature-based design, they do not specify how these insights translate into spatial form or sensory experience. Therefore, in the next chapter, the focus shifts to applied framework such as Shinrin-Yoku, therapeutic gardens and sensory designed gardens. These can offer more concrete strategies for shaping these restorative environments based on use, zoning and perception.

Design Elements

ART

Fascination -> support soft effortless attention -> movement, filtered views, depth

Being Away -> encourage mental escape -> escape, transition

Extent -> create immersion and coninuity -> immersion, visual continuity

Compatibility -> match the users needs and support freedom of action -> freedom, open space, legibility

SRT

Physological restoration through calm and soft environments -> water features, soft planting, low stimulus zones

Reduce stress through enclosure and safety -> sheltered seating, enclosure, quiet zones

Low pressure shared spaces to reduce social stress -> shared spaces, open paths

Biophilia

Restoration through natural sensory richness -> scented zones, seasonal planting

Social interaction through shared experience in nature -> communitiy garden, shared green space

People are drawn to signs of life and growth -> wildlife traces, natural materials

Specific Research Question Two

What role do urban forests play in shaping mental health outcomes, and how can their design be tailored to address psychological and emotional challenges (within urban environments)?

Introduction

Urban forests and nature-based therapeutic gardens are an interesting and important way for addressing mental health issues in urban environments. Cities continue to grow which make the need for spaces that promote mental wellbeing increasingly important. Also nature based therapies, like Shinrin Yoku, have demonstrated their ability to reduce stress and enhance emotional health. This practice highlights the psychological benefits of being surrounded by trees, listening to natural sounds and experiencing fresh air, making this an interesting example on how urban forests can shape mental health outcomes.

This chapter also explores the concept of Perceived Sensorial Dimensions (PSD's) through two case studies. The first one is the Health Forest Octivia, which investigates the impact of different forest 'rooms' on psychological restoration through sensorial experiences. The second case study is The Nacadia Therapy Garden in Denmark, which support the rehabilitation of PTSD patients through nature therapy. Both of these examples illustrate how carefully designed forested environments can contribute to stress reduction, emotional healing and overall well-being.

Analysis Pictures

As discussed on SRQ 1; (Urban) Forests have the potential to influence mental Health outcomes by offering environments that can evoke a wide range psychological and emotional responses. The design of these spaces have a significant impact on how people feel, and interact with nature. As part of embedded research, and as an introduction to this chapter, I analyzed my own photographs of forest settings to explore how different elements like views, paths, and water can shape our experience and perception of the space. It is important to note that these findings and interpretations are based on my own personal perception and subjective experience of these spaces.

The first set of images focusses on **view, position and context.** The photographs captures the wide and far view from a higher point. This offers a sense of freedom and connection to the surrounding forest. From this elevated points, its easy to gain a broad perspective of the space, which creates a feeling of clarity, calm and security. This elevated point of view provides a clear sense of direction and the understanding of one's position in the landscape.

View, Position, Context

The second images, show the difference between a **straight and open path and a winding path.** The straight path offers a sense of direction and clarity, which helps to fucus the mind by providing a clear route through the landscape. In contrast, the winding path feels more adventurous and mysterious due to its unpredictability and therefor offer a sense of discovery.

The third images focus on water. **Water** features have a calming and restorative effect and offer a sense of tranquility and feelings of relaxation. The gentle sounds of water are calming and can reduce ones stress to promote mental clarity.

Straight/Winding Path

Water

The fourth set of images highlight **enclosed spaces**. These spaces can create a sense of safety and shelter and can provide a refuge from the chaos and stressors of urban life. This can offer a place for mental escape and a place to recharge in a more quiet and hidden environment.

Enclosed, Mystery

Shinrin-Yoku

Shinrin-Yoku, or 'forest bathing' is an example of how an (urban forest) can promote mental health within an urban environment. It is a Japanese practice that emphasizes slow and mindful movement through the forest through sensory awareness to create an immersive experience in the forest. It was originally introduced in the 1980's as a public health initiative as a response to rising burnout rates and urban stress due to rapid urbanization. Since then, the practice has gained global recognition as an evidence-based method for improving mental well-being (li, 2010). The practice is based on individuals engaging in all of the 5 senses; sight, smell, hearing touch and also taste. The goal is to foster a deeper connection with the forest and to thereby enhance feelings of calm, clarity and vitality (Miyazaki, 2018). For Urban Forestry, Shinrin-Yoku offers a lens for reimagining green spaces as therapeutic landscapes that support public health.

Shinrin Yoku aligns with the theories presented in SRQ1. According to Kaplan & Kaplan (1989) natural settings (like a forest) facilitate cognitive restoration by offering 'soft fascination' and a sense of escape. Ulrich et al. (1991) states that natural scenery reduces psychological stress. For landscape architects and foresters these theories suggest that restorative forested spaces can be 'created' through design features that align with these theories. Per example the use of layered vegetation, use of shadow and sunlight and meandering paths that can be used for slow speed walking. These elements disrupt the sensory overload of modern urban life and can create immersive spaces for stillness and presence (Berman et al., 2008).

Empirical studies have shown the impact of this forest immersion on stress reduction. Even short exposure to nature (particularly forests) has shown to lower cortisol levels, reduce blood pressure and improve heart rate variability which are critical factors for mental health (Park et al., 2010; Hansen et al., 2017). In dense urban context where urban stressors and sensory overload is high, these findings support the idea of dense urban micro forests as a mental health strategy. These tiny forests can be seen as 'restorative nodes' – small patches within the urban context that allow visitors to slow down and recover that operate as small sanctuaries that stimulate slowness and sensory engagement (Van den Bosch & Sang, 2017).

Trees are the key elements of Shinrin -Yoku, they biochemical and sensorial features that shape the emotional experience of the visitor. Many tree species release phytoncides (organic compounds) which, when inhaled, have been found to reduce anxiety and enhance immune function (Li et al., 2007; Tsunetsugu et al., 2013). In urban forestry, this can be strategically implemented by choosing tree species that are phytoncide-rich; like pine, cedar and cypress.

Shinrin Yoku is about a multisensorial experience, which is something that also could be implemented into a design. Rustling leaves, birdsong or different pavements create different sounds which create different sensorial experiences. Also the other senses; like touch, sight and smell should be highly valued and implemented into the design. These different sensorial layers can help individuals deal with overstimulation and emotional grounding. These sensory rich environments can serve a quiet refuges in the loud city for mental resilience (Korpela et al., 2001).

Also, the cultural roots of Shinrin Yoku offer a deeper meaning in its use in urban forestry. The practice is rooted in Zen and Shinto (emphasizing harmony with the natural world) which assumes an interdependent relationship between humans and nature which counters the anthropogenic bias often embedded in western urban design (Williams, 2020). Its about developing spaces that invite emotional bonds with our natural environment. This way of thinking reframes the forest into a dynamic healing environment which should be embedded in our everyday lives.

Shinrin – Yoku is traditionally associated with remote and biodiverse forests, however, these principles can also be applied in urban environments. Research shows that even small spaces; like local green spaces, can have the same restorative effects when approached with mindful intent (Bratman et al., 2015). This makes this practice an interesting lens to this thesis.

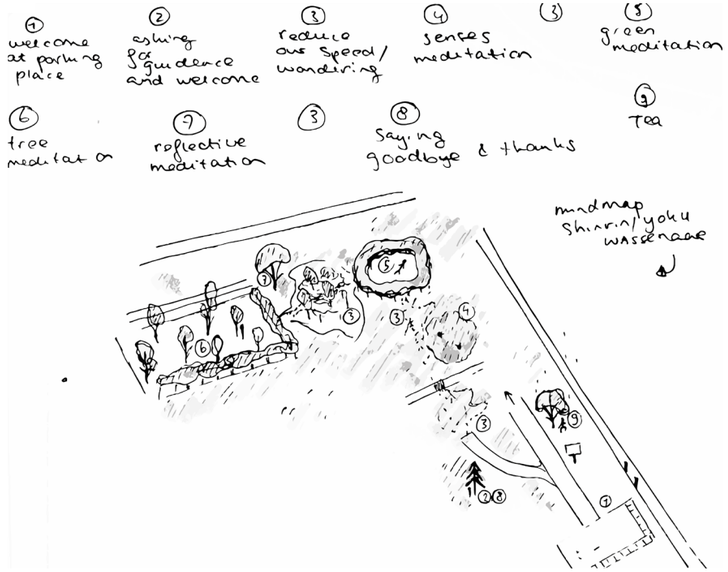
Shinrin Yoku demonstrates how (designed) natural environments can directly engage with our emotional and psychological well-being. It's not about a 'passive ' exposure to green, but it encourages an immersive and sensorial interaction with forest environments. It tries to slow people down and awaken their senses. It offers a model of how urban forests can not only be shaped to help with ecological and environmental health but also with the health of city residents. In the design of this thesis, I want to incorporate these principles and create forested spaces in which people are invited to experience a deeper and more mindful connection with nature.

As part of embedded research for this thesis, a guided Shinrin Yoku workshop was done and analyzed to serve as an example to explore how forest environments can support emotional well-being and support emotional well-being through an immersive and sensorial experience.

The mind map documents the spatial experience of the walk and tries to visualize the forest as different spatial 'rooms', such as a dense room and open room, that were used for different activities and meditations. Each room had different sensorial experiences, like enclosure, light, sound and underground textures. They all shape the experience and perception of the space as each of them highlight a different emotion on different moments of the walk. I aim to use these different spatial compositions of a forest as an inspiration for my own design in this thesis.

The poem serves as an intuitive translation of my own experiences of the workshop. It attempts to express the different emotions that can be felt during such an experience and my own perception of them. It tries to translate the feelings and awareness that such an immersive experience in a forest can awaken when one moves through a space with care and attention. It's about the potential that urban forests have to affect the mental well being of a person through small details and a mindset that invites slowness, presence and connection.

(Poem written on the base of authors personal notes and awareness of feelings and experiences, with assistance of AI)



We began at the edge of the forest,
where asphalt gives way to moss and leaf litter.
Silence wrapped around us–not the silence of absence,
but the presence of stillness.

We walked slowly, slower than felt natural at first,
guided by the voice of someone trained not in speaking,
but in listening–to trees, to wind, to breath.

"Ask permission," she said.
So I did. I asked the forest to let me in,
and it answered not with words, but with space.

We wandered.
Not to arrive, but to be.
To feel the bark's texture under fingertips,
to inhale the earthy breath of the forest,
to catch light dancing on water under a mossy bridge.

I sat beneath trees that held different energies–some soft, some stern.
We meditated not to empty the mind, but to fill it with green.
To let go of worries,
to become just another being in the web of branches and roots.

I cried–not from sadness, but from the beauty of their honesty,
how the forest had become a place of safe connection.
I felt the weight of their emotions,
and in that shared moment, we were all deeply seen.

I chose a tree–perhaps it chose me.
"What do you want to tell me?" I asked.
It didn't answer.
But I felt heard.

The rain started to pour heavily,
but the forest, still with me, felt like a warm embrace.
And yet–
I felt a tension.
Must we pay to remember how to be with the forest?
Can something ancient and shared be packaged and sold?

As I stood at the train station, drenched and grounded,
the rain fell relentlessly, but I felt warm–
a quiet calm within me,
the forest's presence lingering through the hum of the city around me.

Percieved Sensorial Dimensions

In this part of the thesis, two projects of health forests/gardens will be analyzed as a case study and inspiration for the design of this thesis. This will explore how the designs of these two green spaces, The Health Forest Octovia and the Nacadia Healing garden, shape mental health outcomes of its visitors. In these projects this is particularly done by the use of Perceived Sensorial Dimensions (PSD's). The framework of PSD's is a concept developed and discussed by different researches to show how green spaces with different qualities are experienced and valued. According to Stoltz and Grahn (2021) there are eight key PSDs that people perceive in green environments: Serene, Shelter, Natural, Cohesive, Open, Cultural, Social and Diverse. Each of these dimensions have unique sensory, spatial and characteristic that contribute ot a person's experience in a landscape.

-Serene: An environment that is calm, quiet and free from disturbances. These areas are meant to promote peacefulness and relaxation.

-Shelter: Spaces that provide a sense of safety and concealment. They offer a feeling of protection and a feeling of being enclosed and hidden.

-Natural: An area that conveys a strong sense of 'unspoiled' and 'natural' nature, including vegetation, water and natural processes.

-Cohesive: A landscape that is orderly, well-maintained and perceived as harmonious and legible.

-Open: An expensive area that offers a clear view and space to move freely it should create a sense of freedom and spaciousness.

-Cultural: A place that reflects the influence of humans; history, art. It should suggest cultural and historical continuity.

-Social: An environment that should facilitate social interaction, group gatherings and recreational activities.

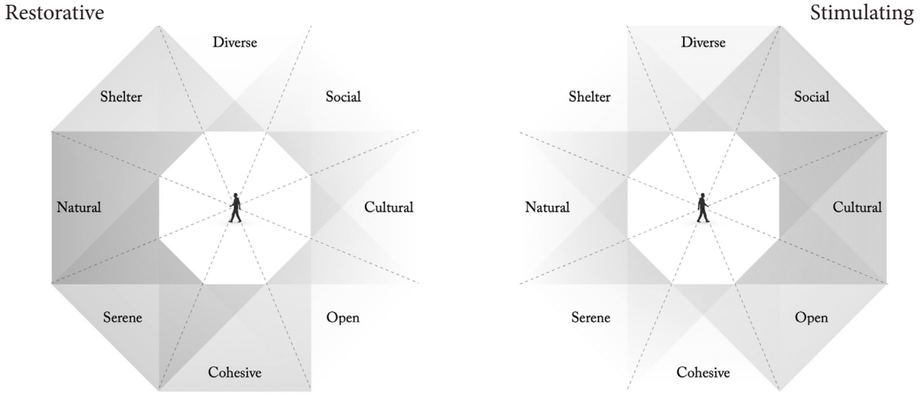
-Diverse: A landscape that includes a rich variety of sensory experiences, such as multiple plant and animal species, changing scenery and complex spatial layouts.

It is important to note that different versions of the PSD model have been proposed, such as the one by Stigsdotter and Grahn (2010). In the different versions the terms for the eight PSD's may vary. This thesis primarily follows the framework of Stoltz and Grahn (2021), however sometimes their might be (noted) overlap with a different framework, mainly the 'Rich in Species' PSD of Stigsdotter and Grahn (2010).

-Rich in Species: An environment with a high biodiversity. This dimensions supports fascination and mental restoration by offering a rich and stimulating natural experience.

Research has shown that some of these dimensions are strongly associated with stress reduction and restorative landscapes; like Serene, Shelter and Natural. Other ones are associated with a stimulating effect. This can be viewed in the diagram below. Natural environments are especially valued by individuals who experience high stress levels and stress (Grahn & Stigsdotter, 2010). These findings and this framework form an interesting foundation for the design of urban green spaces that aim to facilitate different mental health outcomes.

10.



The Health Forest Octovia

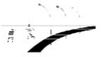
The Health Forest Octovia is a designed therapeutic environment that incorporates these PSDs into a spatial layout. The forest is build up and structured into eight different 'rooms', each one aligned with one of the PSD's to offer visitors a rich and diverse sensorial experience. The rooms include eight PSD's from which some differ a bit from the framework of Stoltz and Grahn (2021). The rooms include: Social, Prospect, Rich in Species, Serene, Culture, Space, Nature and Refuge (Grahn & Stigsdotter, 2010).

This project shows how this theoretic concept can be implemented as a tool to design. Each room in the forest is designed to evoke specific psychological responses. For example, the Serene room is meant to offer a sense of peace and calm through quiet surroundings and still water. The Nature room has untamed and wild vegetation and biodiversity which is meant to promote a sense of immersion into a wilder landscape. The Refuge room provides a sheltered and enclosed space that offers a sense of security and privacy.

Findings from this project state that people in general prefer the Serene room the most, this one is followed by Space, Nature and Rich in Species. However, individuals experiencing high levels of stress tend to prefer the rooms Refuge, Nature and Rich in Species (Grahn & Stigsdotter, 2010). These preferences align with the need for environments that provide safety, biodiversity and peacefulness, which are qualities that support emotional recovery and mental clarity (Grahn & Stigsdotter, 2010). Social and Prospect are less preferred by stressed individuals which indicates that open or socially active environments may not be the best for psychological restoration (Berggren-Bärring & Grahn, 1995; Grahn & Stigsdotter, 2010; Stoltz & Grahn, 2021).

This project shows the importance of considering and validating sensory and emotional needs in the design of urban green spaces. Particularly, dimensions such as Serene and Refuge are threatened by high density urban spaces and disruption. Their effectiveness depends on factors like size, isolation and auditory conditions which can all be threatened by urban densification (Berggren-Bärring & Grahn, 1995; Grahn & Stigsdotter, 2010).

11.

Nr.	PSD name	Images	Key nature qualities and features
1	Social		• Possible to watch entertainments • Possible to watch exhibitions • Possible to visit a restaurant or a simpler open-air restaurant
2	Prospect		• Plane and well-cut grass surfaces • Vistas over the surroundings • Cut lawns
3	Rich in species		• Several animals, like birds, insects, ect. • Natural plant and animal populations • Many native plants to study
4	Serene		• Silent and calm • No bikes • It is possible not to come into contact with too many people
5	Culture		• Decorated with fountains • Decorated with statues • A wide range of foreign plants, ornamental plants and kitchen plants
6	Space		• Spacious and free • Possible to find areas not crossed by roads and paths • Lots of trees
7	Nature		• Nature like • Wild and untouched • Free growing lawns
8	Refuge		• Many bushes • Kept animals that children and adults may feed and pet • Sandpits

12.

Healing Garden Nacadia

The Nacadia Healing Garden is situated at the university of Copenhagen and is another good example on how therapeutic forested landscapes can be tailored to address psychological challenges through sensorial qualities. This garden was developed as a nature-based therapy garden meant for individuals suffering from stress related illnesses. It also integrates the PSD framework and theories such as ART and SRT into the design (Stigsdotter, 2015).

The garden features a range of areas that align with the PSDs, however they are not as spatially divided as in Octovia. Still, aspects of the PSDs Serene, Refuge, Rich in Species and Nature are emphasized. There are for instance densely planted zones which offer privacy and concealment (Refuge) and zones with diverse vegetation witch provides a sense of immersion in biodiversity (Rich in Species). The Serene dimension is supported by water features, quiet zones and secluded seating areas and supports relaxation (Grahn & Stigsdotter, 2010).
In addition to this, the garden is divided into four distinct zones which all have different sensory and therapeutic experiences (Stigsdotter & Grahn, 2011).

-Area 1. Serene: This area combines the Rich in Species and Refuge PSDs, which creates a quiet and private space. It features small, winding paths and secluded spots for patients to sit alone and experience nature more private. This zone is designed to be the least demanding environment as it offers spaces for private sensory experiences and emotional restoration.

-Area 2. Forest Garden: This zone supports a bit more social interaction and includes activities like horticultural activities. It keeps a balance between serenity and social engagement, this allows patients to connect with other's while still benefiting from the calm natural scene.

-Area 3. Open/Social: This area is designed for larger group projects and activities. It introduces a more social environment to the patient. It supports collaboration and communal interaction, fostering a sense of belonging and sharded purpose.

-Area 4. Meadow: This is the most open and least sheltered area in the garden. There are no spaces for refuge and is the most demanding zone.

Patients naturally move between the zones based on their mental state and recovery. Early in the treatment they often stay in Area 1, but if they start to improve they start to move through the zones towards more open spaces like Area 3 and 4. This showcases how a garden design like this can support different psychological needs for different mental states (Stigsdotter & Grahn, 2011; Corazon et al., 2019).

13.

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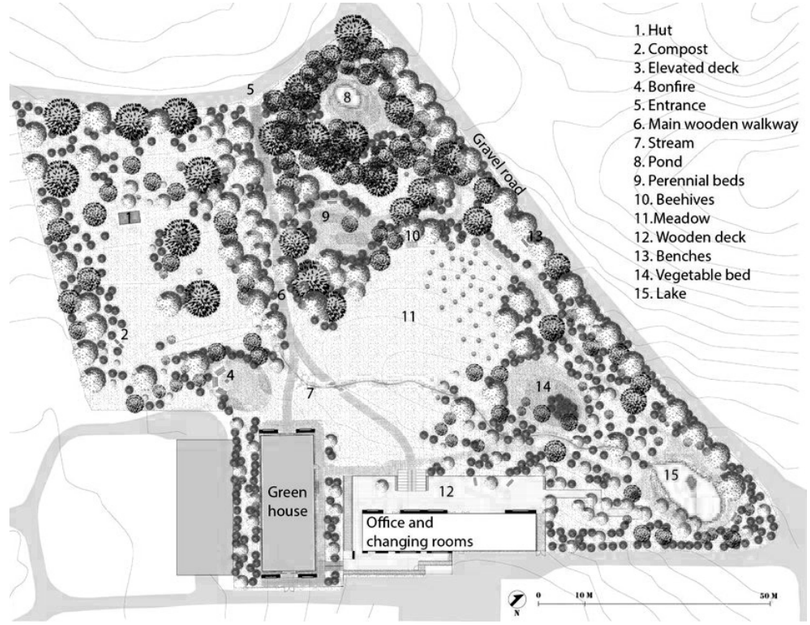


Conclusion

In SRQ 2, the second part of the theoretical framework, applied frameworks and theories; such as Shinrin-Yoku, Perceived Sensory Dimensions, and the therapy gardens were analyzed to extract design strategies that translate these theories into spatial interventions. These sources offer layered and practice-based insights that helped move away from abstract theory to more implementable design language.

Shirin-Yoku highlights the restorative power of slow, immersive multisensory experience in nature. This Japanese practice demonstrates that mindful presence in forests, without goals or demands, support physiological calming and emotional balance (Miyazaki, 2018; Park et al., 2010). Design insights gained from this practice are the use of fragrant vegetation, stillness and quiet to create a meditative environment, gently animated elements; like rustling leaves or filtered light and the use of unstructured forest paths that invite the visitor to wander and reflect. These environments help shift the attention inward which allows space for calm awareness. Also, the feeling of safety and calmness can be emphasized by using enclosure and subtle stimuli.

The Nacadia therapeutic garden model (Stigsdotter & Grahn, 2011) offers a structured approach to healing landscapes by dividing space into functional zones; a therapy and reflection zone, retreat, and active engagement zones. Each zone is defined by different aspects such as sensory intensity and clarity, spatial rhythm and emotional alignment with the users state. For example, retreat zones offer enclosure and low stimulus for a vulnerable state of mind, while the active engagement zone is more open and social. The zones support self-regulation and intuitive movement through the landscape to allow users to find the right setting at the right time.

The Perceived Sensory Dimensions, developed by Grahn, Stoltz and Stigsdotter, are used in the Octovia Heath Forest. They define 8 (9 used, 1 from a different model) recurring experiential qualities in green environments and are each linked to specific psychological needs and patterns of use (Stoltz & Grahn, 2021; Grahn & Stigsdotter, 2010). Each one of these, has different design elements that can be used to design for these different qualities and goals of space.

-Serene environments are calm and stable and are often supported by elements such as still water, and gentle (vegetation) movement.
-Sheltered spaces offer enclosure and protection. Typically through canopy cover or dense planting that creates a sense of withdrawal from urban life.
-Natural environment express ecological processes; spontaneous vegetation, deadwood and sings of decay to provide cues of wilderness and self-regulation.
-Cohesive spaces are structured and harmonious. They are made legible through repeated patterns, consistent materials and a clear spatial rhythm.
-Open dimensions refer to spaciousness and visibility. Large clearings, long sightlines and axial views contribute to orientation and social comfort.
-Cultural reflects memory, tradition and symbolic meaning in the landscape, such as community gardening, memorial trees, art or interpretive signage.
-Social environments support interaction and presence of others and are often marked by shared benches, gathering nodes and accessible pathways.
-Diverse spaces combine sensory variety and (textural) richness with variation in planting, height, color, form and ground surface.
-Rich in Species refers to biodiversity; mixed species planting, pollinator friendly meadows and ecological complexity to signal life and vitality.

These dimensions can help guide the development of diverse spatial qualities in the design process to help guide the connection of emotional needs to a tangible form.

In conclusion, urban forests that are designed through a lens of sensory, emotional and psychological responsiveness can function as effective environments for mental restoration. The case studies of Nacadia and Octovia illustrate how spatial zoning based on sensory clarity and variation allows people to navigate intuitively according to their state of mind. Shrin-Yoku confirms immersion, biodiversity and multisensory richness are essential components for mental well-being in forested spaces. These theories and concepts show that these healing environments are not just 'green' but strategically designed to support presence and mental recovery.

Design Elements

Shinrin-Yoku

Restoration through multisensory immersion in nature -> scent, stilness, water

Safety and calm via enclosure and subtle stimuli -> shaded areas, enclosure, framed paths

Nacadia

Reflection and therapy through structure and rhythm -> quiet rooms, sequiential layout

Gentle sensory experience for psychological healing -> immersive planting, minimal stimuli

Psychological safety through buffer and withdrawal -> retreat zones, woodland pockets

Engagement through (low-key) shared activity -> flexible edges, active zones

Right setting at the right time -> Intuitive movement -> emotional alignment zoning

PSD's

Serene -> calm, stable environment, reduve arousel -> still water, gentle movement

Shelter -> enclosure provides safety -> canopy, vegetated buffers

Rich in species -> biodiverisy signals health and vitality -> mixed planting, flora and fauna

Natural -> signals of wilderness, ecological function -> spontanious vegetation, wild

Cohesive -> coherence creates clarity and order -> repeated structure, consistent materials

Open -> spaciousness supports overview and informal use -> clearings, sightlines

Cultural -> connecting to meaning and memory enhances comfort -> art, symbols

Social -> environments for social interaction -> benches, gathering nodes

Diverse -> Variation supports exploration and engagement -> variety

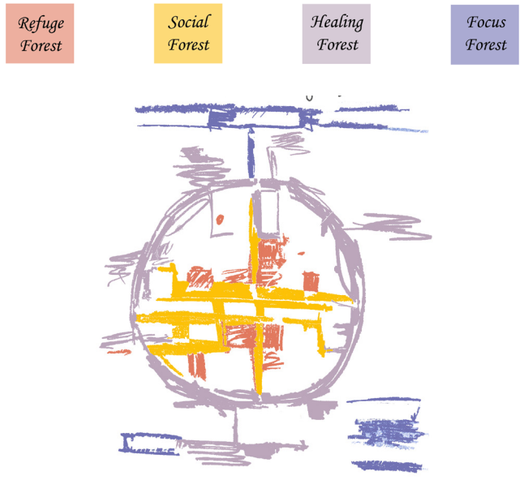
Specific Research Question Three

What types of urban forests can be conceptualized and developed based on the analysis of relevant theories and precedent studies?

As stated in the Problematique, mental health challenges, like stress, anxiety and depression are becoming increasingly prevalent in modern urban environments. The challenges are particularly pronounced in cities with a high population density, noise and a limited access to high quality green space which contribute to a heightened level of psychological strain. This lack of access to green space, in combination with the urbanization tendency to prioritize economic and functional growth has created environments that exacerbate mental health issues which leaves the residents of these areas vulnerable to physical as well as mental stress (Sørensen, 2013; Stokols, 1992).
As noted before, urban areas like Paris face challenges related to both environmental quality as well as the well-being of their inhabitants. Green spaces that are very important for promoting this mental health by mitigating environmental stressors, like noise and air pollution, have been diminished due to rapid urban development. This has led to feelings of isolation, frustration and anxiety among urban populations (Vujcic et al., 2017; Fenger, 1999).

Building on the theoretic framework and analysis done in the previous research questions, this chapter introduces a framework of four restorative urban forest typologies – Healing Forest, Refuge Forest, Social(Connection) Forest, and Focus Forest. These four typologies aim to address the diverse and critical needs of urban residents by providing spaces that respond to their various emotional and psychological needs.

The design and implementation of these forests types in urban environments is driven to help improve the urban fabric in dense environments to support the mental health of it residents. The four typologies come from an understanding and idea that different people require different forms of interaction with nature and forest to recover from stress, improve mental health, foster social connections and maintain cognitive clarity. The typologies are developed based on the theories and concepts discussed in earlier chapters; like ART, SRT, Biophilia, Shinrin-Yoku and the case studies from Nacadia and Octovia.
Each typology responds to a different urgent need in todays urban environments. They are as follows:



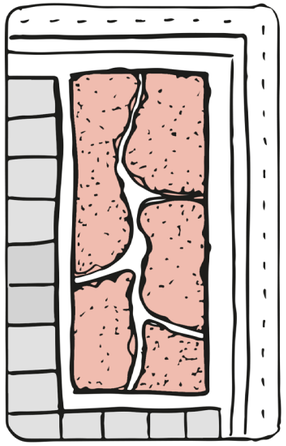
Spatial layout of the typologies within a ‘standard’ city structure

-**Refuge Forest:** Responds to the need for solitude and stress relief.

In urban environments, nowadays characterized by high levels of noise, visual clutter, and sensory overload, spaces for solitude and withdrawal are increasingly important. In response to this, the Refuge Forest typology offers spaces for solitude and mental restoration by providing low-stimulus environments that allow the visitor the recover from mental-fatigue and over stimulation: ‘a retreat for sensory overload’. Unlike the ‘Healing Forest’ typology, the Refuge Forest is envisioned as a small-scale, almost ‘pocket’ forest which weaves within the dense urban fabric of a city. Their purpose it so provide immediate access to green space and seclusion in de midst of the urban chaos.

The idea for this forest typology resonates strongly with the Refuge, Serene and Natural Perceived Sensory Dimensions (PSDs), which describe enclosed, quiet and secluded area that provides a sense of safety and personal space (Grahn & Stigsdotter, 2010). This type of forest also aligns with area 4 in Nacadia: the contemplation and retreat zone, which is also more secluded, offers high enclose and has limited visual and auditory stimuli.

Theoretically, the Refuge Forest draws on ART from Kaplan & Kaplan (1995), and emphasizes the restorative qualities of ‘soft fascination’ and environments that allow the mind to rest and recover. Additionally Ulrich’s SRT (1984) support the value of visual calming green spaces in reducing psychological stress responses . Research in the practice of Shinrin – Yoku also shows that even short exposure to forest and nature can lower cortisol levels and sympathetic nervous activity which underlines the relevance of such forests for stress management in urban environments.



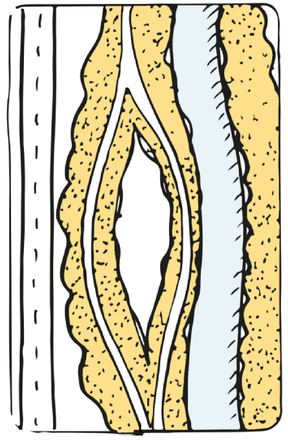
In the midst of a dense urban jungle, the Refuge Forest offers a peaceful sanctuary, where the noise fades, and the soul finds solace in the quiet embrace of nature.

-**Social (Connection) Forest:** Responds to the need for social interaction and physical activity.

Living in urban environments nowadays, especially in high density neighborhoods, can foster feelings of isolation due to the limited access to green space for activities and social gatherings. The Connection Forest responds to this need of humans for community, shared activities and meaningful interaction. This typology is designed to promote social bonding and physical movement in a forested and natural context. It promotes spontaneous encounters and recreational activities, which is in line with the Social and Space PSDs, which are characterized by expansive, open areas that invites free movement and provides room for collective engagement (Stigsdotter & Grahn, 2011).

This typology aligns with Zone 3 in the Nacadia Healing Garden; the active engagement room, the place that fosters movement and social expression. It is also rooted in the Biophilic principle which states that humans are evolutionary inclined to flourish in settings that support social interaction and nature exposure, which in turn improves social ties and mental health (Kellert & Calabrese, 2015). Research shows that accessible, high quality green spaces in cities can significantly reduce feelings of loneliness and promote psychological well-being (Zijlema et al., 2017; Kabisch et al., 2024). These spaces contribute to an increased life satisfaction and foster strong social networks, which are essential for human well-being.

By encouraging group activities and shared experiences in natural environment, the Social Connection Forest helps strengthen the social cohesion and thereby helps reduce the negative effects of urban isolation. The typology also connections Stress Reduction Theory as this theory suggests that exposure to nature can reduce psychological stress witch leads to a sense of calm and relaxation. This further enhances the potential for social interaction in these spaces, which contributes to emotional resilience (Ulrich et al., 1991). Finally, this typology supports public health objectives by supporting physical activity, which strongly improves cognitive performance, overall health and mental well-being.



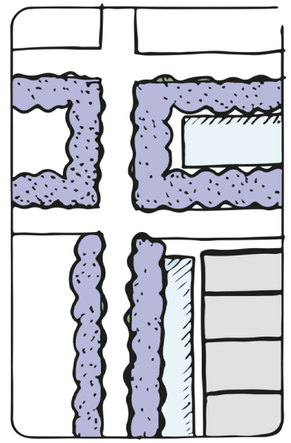
The Social Forest sparks spontaneous connections, drawing people into a space where movement, laughter, and shared experiences flow freely beneath the canopy of trees.

-**Focus Forest:** responds to the need for mental clarity and cognitive restoration.

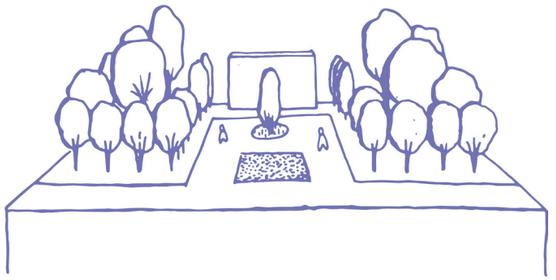
As living in urban environments becomes increasingly overstimulating and digitally mediated, the need for environments that promote mental clarity grows. The Focus Forest responds to this need by offering structured natural spaces in which cognitive restoration, mindfulness, creativity and concentration can occur. This forest typology is characterized by visual coherence, rhythm and predictability; it supports mental rest through structured and low-stimulus environments. The Focus Forest is effective for individuals to restore focus and concentration due to the spaces that facilitate solitude and reflection.

This typology aligns with the Attention Restoration Theory which states that natural environments allows individuals to recover their cognitive functions by providing low-stimulus settings that are restorative and support attention recovery through 'soft fascination' (Kaplan & Kaplan, 1989). This typologies encourages this restorative function by providing calm and well structured green spaces that encourage mindful engagement. The Focus Forest responds to the PSDs Culture & Cohesion. The Cohesive PSD is reflection in the orderly and harmonious layout of this forest which will foster a sense of security and orientation which are essential qualities for mental restoration. The cultural dimension is addressed by the integration of human elements such as art, traces of history and cultural symbols that will provide a sense of emotional engagement and rootedness which can deepen the reflective experience and enhance emotional engagement (Stigsdotter & Grahn, 2011).

Research support that exposure to structures and aesthetically rich nature improves cognitive performance but also enhances reflective thinking and emotional regulation. Barman et al. (2008) shows that natural environments that contain clear, undistracting stimuli can enhance focus, creativity and overall cognitive function.



The Focus Forest invites the mind to find clarity, where every step and every leaf whispers a quiet call to creativity, restoring both attention and calm.

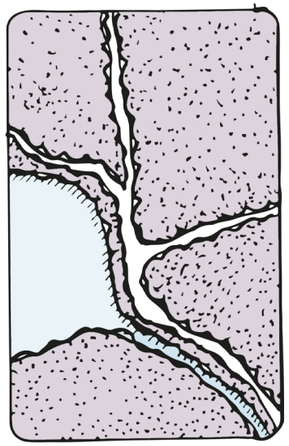


-**Healing Forest:** supports the need for emotional recovery and well-being.

The healing forest addresses deeper psychological needs for emotional regulation, recovery and therapeutic engagement. Unlike the Refuge Forest, which provides a short-term escape within the urban fabric, the Healing Forest has a larger scale and is designed for immersive and prolonged experiences. This typology is ideally located at the city's edge or peri-urban zones, where there is more space for a larger forested area. This typology aims to provide a multi-sensory and biodiversity-rich environment to support slow, but affective processes of restoration.

The Healing Forest correspondents to the Rich in Species, Serene and Nature PSDs (Stigsdotter & Grahn, 2011) which are known for their positive impact on mood, fascination and a feeling of emotional safety – important for affective restoration. This forest typology aims to be quiet and undisturbed to engage the senses of the visitor without overwhelming them.
The Therapy and Reflection (zone 2) and Contemplation and Retreat (zone 4) zones in Nacadia are an inspiration for this forest typology. These zones feature softly enclosed spaces with diverse vegetation, tree groupings and water bodies designed to enhance introspection, reduce social pressure and enhance a feeling of safety with is important for emotional processing (Stigsdotter et al., 2017).

The Healing Forest is also grounded in the practice and philosophy of Shinrin Yoku. This practice encourages slow movement and sensory immersion in forested environments, which supports psychological and physiological healing and can reduce symptoms of anxiety and depression (Li et al., 2019). Additionally, the Biophilia hypothesis of Wilson (1984) shows the evolutionary and psychological importance for humans to connect deeply with nature and its positive effects on emotional healing. The Healing Forest tries to combine these theories and practices to create a 'therapeutic' forest design that offers a form of environmental care to support long-term mental well-being.



The Healing Forest is an immersive haven, where the soul slowly surrenders to the therapeutic rhythm of nature, offering a deep, restorative retreat from the pressure of the outside world.

Why?	Urban Stressors	Connect and stay active	Mental fatigue	Emotional recovery
A need for:	Solitude & stress relief	Social connection & fysical activity	Focus & mental clarity	Healing & emotional recovery
PSD's	Refuge Serene Natural	Social Space	Cohesion Culture	Serene Rich in Species Nature
Theories	ART SRT Shinrin-Yoku	Biophilia SRT	ART Berman et al., 2008	Shinrin - Yoku Biophilia SRT
Nacadia Area	Contemplation & Retreat zone	Active Engagement zone	Therapy & Reflection zone	Therapy & Reflection zone Contemplation & Retreat zone
Inspiration	Pocket Forests	Community Forests Urban Parks	University Forests Japanse Gardens	Therapy Forests
	Refuge Forest	*Social Forest*	*Focus Forest*	*Healing Forest*

Design elements from the Theoretical Framework to guide the design of the Forest Typologies

Shelter -> enclosure provides safety -> canopy, vegetated buffers

Reduce stress through enclosure and safety -> sheltered seating, enclosure, quiet zones

Psychological safety through buffer and withdrawal -> retreat zones, woodland pockets

Safety and calm via enclosure and subtle stimuli -> shaded areas, enclosure, framed paths

Fascination -> support soft effortless attention -> movement, filtered views, depth

Serene -> calm, stable environment, reduve arousel -> still water, gentle movement

Being Away -> encourage mental escape -> escape, transition

Natural -> signals of wilderness, ecological function -> spontanious vegetation, wild

Rich in species -> biodiverisy signals health and vitality -> mixed planting, flora and fauna

Physological restoration through calm and soft environments -> water features, soft planting, low stimulus zones

Restoration through multisensory immersion in nature -> scent, stilness, water

Restoration through natural sensory richness -> scented zones, seasonal planting

Diverse -> Variation supports exploration and engagement -> variety

Compatibility -> match the users needs and support freedom of action -> freedom, open space, legibility

Low pressure shared spaces to reduce social stress -> shared spaces, open paths

Gentle sensory experience for psychological healing -> immersive planting, minimal stimuli

Social -> environments for social interaction -> benches, gathering nodes

Engagement through (low-key) shared activity -> flexible edges, active zones

Cultural -> connecting to meaning and memory enhances comfort -> art, symbols

Open -> spaciousness supports overview and informal use -> clearings, sightlines

Cohesive -> coherence creates clarity and order -> repeated structure, consistent materials

Extent -> create immersion and coninuity -> immersion, visual continuity

Right setting at the right time -> Intuitive movement -> emotional alignment zoning

Reflection and therapy through structure and rhythm -> quiet rooms, sequiential layout

People are drawn to signs of life and growth -> wildlife traces, natural materials

Character of the Typologies

In dense urban environments, green forested spaces should not only play a role in providing restorative environments, but they should also contribute to ecological health and sustainability. The four typologies are designed to cater to different human emotional needs, but their different spatial characteristics can also support ecosystem services within the city.

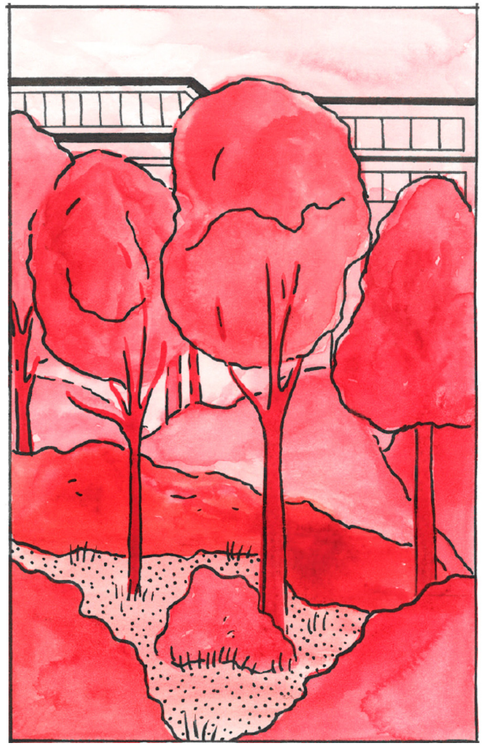
The Refuge Forest is a small-scale and secluded sanctuary that is embedded within the dense urban fabric of the city, which provides a retreat from the noise and chaos of the city. They will be located in high density areas with heavy infrastructure and city demands in which these enclosed spaces offer an escape to these urban stressors. These forests are quiet, calming and feature natural elements and a dense tree canopy cover. This can help reduce the urban heath island effect and improve the air quality of the city while buffering the city noise. The dense structure will also support a rich biodiversity, providing habitats for wildlife in the city by offering ecological stepping stones, and will offer essential ecological services such as water infiltration and buffering against pollution. The calming scents , natural sounds and quiet atmosphere will enhance the forest's role in stress reduction so that it benefits both human well-being as urban ecology.

The Healing Forest is designed to offer a larger, immersive forested space for emotional and physical restoration. Their location will be outside the city center, on the outskirts, or within large public parks. This typology will consist of multi layered woodlands, which will be rich in native species and understory planting and groundcover. This will create an almost 'natural' forest system which will create an extensive wildlife habitat. Gently winding trails will guide the visitors through diverse natural areas, ranging from more dense to open areas. Integrated water features (streams, springs, shallow ponds) will serve as focal points for reflection as well as natural filtration and buffering systems. This dense biodiverse system will therefor support a system of natural water management, enhance air quality and cool the city, while also promoting an emotional, almost therapeutic, restorative landscape.

The Social Forest is designed as a community-oriented gathering space to foster interaction, reduce isolation and build a sense of belonging. These forests will be typically located in public parks, and social hubs (like shopping promenades, a river, transport hubs) and along infrastructure lines to work as a connector between the different typologies. It will feature forested areas as well as more open areas for group gatherings and activities. The trees used for this typology will be focal interesting trees, but also native, food producing trees to encourage community interaction. This typology will have broad pathways for mixed use; so visitors can run, walk and cycle. This vegetated space will help cool the city and filter air pollution. The fruit trees, shrubs and flowering trees are pollinator-friendly to support insects and other wildlife. Thereby, the Social Forest will not only enhance social interaction but it also contributes to local biodiversity while fostering a stronger connection between people and the environment.

The Focus Forest addresses mental fatigue and the need for focus by offering refreshing and inspiring environments. This typology is ideally places in areas with high mental demands, such as industries, universities, museums and libraries. If features straight, predictable lines of trees and clipped hedges to create a structured atmosphere. The minimal understory vegetation will keep sightlines clear to allow an unobstructed, focal experience without too much distractions. While the environmental benefits of the typology might not be as high as for the other typologies, it still plays a role in reducing the urban heath island by proving shade and cooling. The extra green space in the city also helps filter out more air pollutants to improve air quality. Overall, the Focus Forest is a space that provides mental restoration while also contributing to a more sustainable urban environment.

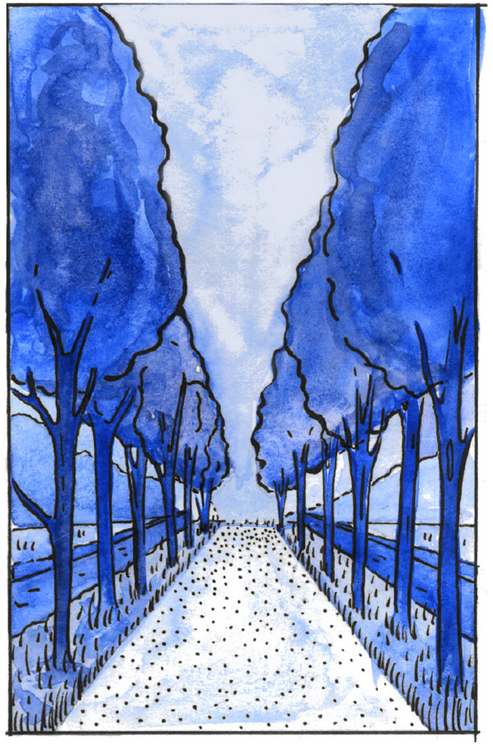
Refuge



Social

Healing

Focus



GROWING

Project Analysis

Problem Statement

Paris is a city that has gone through a lot of changes and urban renewal since its early days. However, the city faces a lot of challenges nowadays, and is therefore maybe in need of a new change; a so called "Grandé Project'. This project is something that will be explored in the design part of this thesis. This project will respond to issues that now face the city of Paris. Mainly the decreasing and lack of urban green space in the city which worsens issues like the urban heath island effect and air pollution caused by traffic congestions. This lack of high quality green space causes an environment that lacks sufficient spaces for rest, recovery and sensory engagement resulting in a decrease in mental health (Vujcic et al., 2017).

The issues of the urban heath island effect is particularly worse in a city like Paris due to its dense and concrete infrastructure and buildings. These absorb and retain heath and thereby raise local temperatures negatively impacting public health (C40 Cities, 2015). Paris also experiences high levels of traffic congestions which contribute to a lot of air pollution. This road traffic is responsible for a significant share of the local pollution in Paris, contributing up to 60% of PM10 levels (Viana et al., 2013). Poor air quality in a city has been linked to a wide range of negative mental health outcomes (RCPsych, 2023). Findings like these, highlight again the urgent need for a city like Paris to try to reduce and better these problems by creating more restorative green spaces to improve both the physical and mental well-being of its residents.

Paris is a city that is always in transformation, and especially nowadays, it has a lot of greening projects happening to take steps in greening the city. Its mayor Anne Hidalgo has introduced several progressive plans and policies. These initiatives and projects, discussed in this chapter, show that Paris is already taking some of these important steps forward. However, these efforts remain fragmented and lack integration within a comprehensive and connected green network. There may be need in Paris for a Grandé urban forestry project to realty and effectively address to city's environmental and social needs.

Anne Hidalgo

Anne Hidalgo has served as mayor of Paris since 2014, she became the city´s first female mayor. She was re-elected in 2020 and has played an important role in reshaping the city towards a greener Paris. Her focus has been on reducing car dominance, improving walkability and the city's cycling infrastructure. She is recognized internationally for her climate efforts. (UN, 2020) (Mayors of Europe, n.d.).

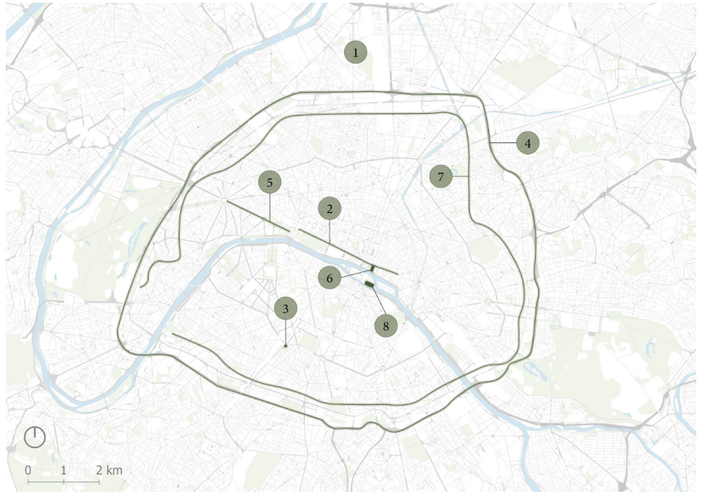
"10 Ans de transformation de Paris" published in 2024 states that under the leadership of Anne Hidalgo a lot of transformations and changes have been made in the past decade. Especially in terms of environmental transitions. Air pollution has been reduced by 40% thanks to the development of 1300 kilometers of bike lanes which promotes cycling over car dominance. The city introduced 25 hectares of new parks and 150.000 trees are planted since 2014. This has already enhanced biodiversity and has provided residents with more green spaces. The riverbanks of the seine also have been part of the city´s starting transformation. The banks have become more pedestrian friendly and the river has even made suitable for swimming for the Olympic Games in 2024 (City of Paris, 2024).

15.

(Feferberg, 2024)

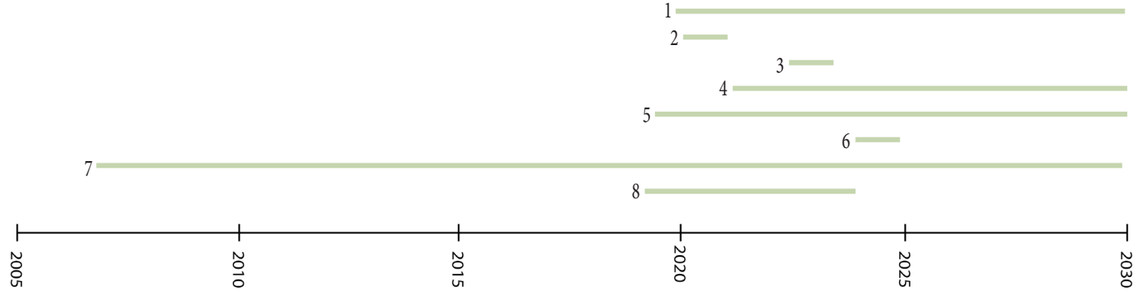
Recent Greening Projects

As stated above, Anne Hidalgo has been involved in a lot of projects and initiatives in greening Paris, also in terms of urban forestry. In this chapter some of these projects will be reviewed since they are a step in the right direction and can serve as an inspiration for the project explored in this thesis.



Projects:

1. Plan Canopée
2. Rue de Rivoli Transformation
3. Urban Forest at Place de Catalogne
4. Green Buffer along the Périphérique
5. Transformation of the Champs-Élysées
6. Hôtel de Ville Forecourt Transformation
7. Petite Ceinture Rewilding
8. Notre-Dame Revitalization



1. Plan Canopée
A plan to plant 170.000 new trees in the city of Paris by 2026; especially species that are heat resistant. This responds to Anne Hidalgo's need to make the city more 'bio climatic' to be able to respond better to climate change (Bloomberg, 2023).

2. Transformation of Rue de Rivoli
Rue de Rivoli is a road cutting through classical and medieval Paris that connects monuments, museums and public places. The road has been transformed after Anne Hidalgo's re-election in 2020. The rue has been transformed have less car traffic and to be more pedestrian and bicycle friendly (Viewpoint Vancouver, 2020).

3. Urban Forest et Place de Catalogne
A 4000 m2 urban forest featuring almost 500 trees has been planted at Place de Catalogne located in the 14th arrondissement. This project aims to improve the air quality, enhance biodiversity and to provide green spaces for the community. It has been officially opened in the spring of 2024 (Paris Secret, 2024).

4. Green buffer along the Phériphérique
Paris is transformation boulevard Phériphérique into a 'green belt' to improve the air quality and to reduce the pollution emitted by the excessive car infrastructure. The plan involves planting 70.000 trees and 10 hectares of green space by 2024 (European Commission, 2022). One lane of the boulevard is now dedicated to public transport and shared mobility to reduce the daily traffic by 80.000 vehicles. Over 50.000 trees have been planted and the traffic speed has been reduced to 50 km/hours (Paris Urban Planning Agency [APUR], 2024). The project hasn't been finished yet because of regional authorities still discussing its impact and potential adjustments.

5. Champs Élysées
Paris is changing the city's most famous Champs-Élysées as of 2025. The goal is to create a greener and more pedestrian friendly avenue. It wants to half the car traffic and increase the number of green spaces and trees planted at the avenue to make the area more sustainable. The project is expected to be finished in 2030, however some changes have already been made ahead of the 2024 Olympics (Willsher, 2021; Champs-Élysées redesign, 2021).

6. Hôtel de Ville Forecourt Transformation
The forecourt of Hotel de Ville, Paris City Hall, was transformed into an urban forest in 2025 as part of the bigger goal to ingrate more green spaces into the city's urban context (APUR, 2025)

7. Petite Ceinture Rewilding
The petite ceinture is a former railway track that goes around Paris. It has been rewilded to function as a network of green spaces, providing more areas for nature, wildlife, pedestrians and cyclists.

8. Notre-Dame Area revitalization
Due to the fire in 2019, the area around the Notre Dame has been transformed by adding 160 trees. This plans aims to improve water retention, reduce heat and to make the area more sustainable. The area is created to compliment the cathedral's restoration and to create a more pleasant environment (APUR, 2024)

5. Transformation of the Champs-Élysées

16. 

1. Plan Canopée

19. 

2. Rue de Rivoli Transformation

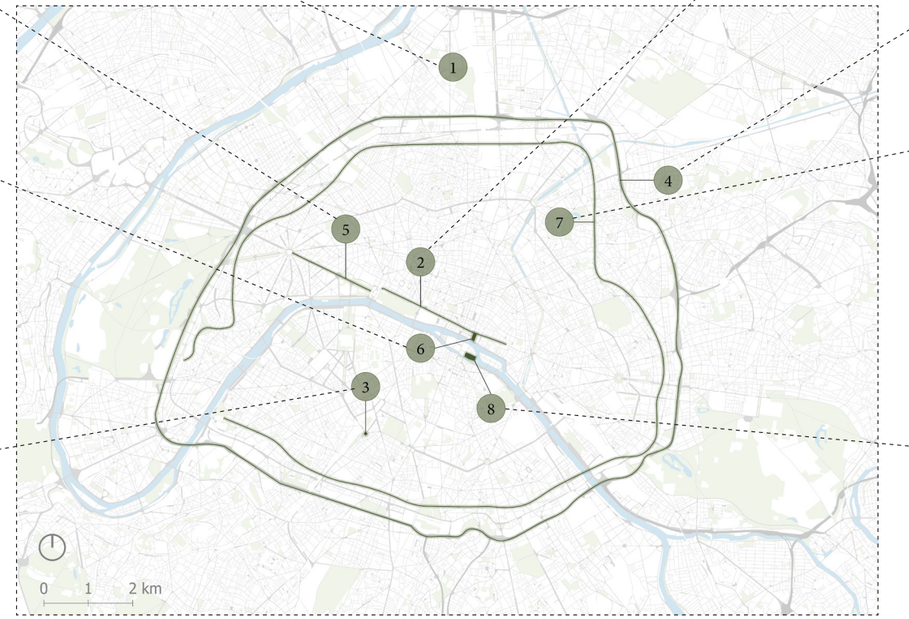
20. 

4. Green Buffer along the Périphérique

21. 

6. Hôtel de Ville Forecourt Transformation

17. 



7. Petite Ceinture Rewilding

22. 

3. Urban Forest at Place de Catalogne

18. 

8. Notre-Dame Revitalization

23. 

Historical Analysis

This historical analysis explores the evolving and everchanging relationship between Paris and its green spaces throughout history. The analysis focusses on some key periods of urban development and their impact on the landscape of the city. From the early fear and separation of nature during the Frankish and Gallic period, through the controlled appreciation of nature in the Hortus Conclusus, to the highly structured and symbolic gardens of the Ancient Régime. Paris' approach to green spaces has shifted drastically through time. Of which, the French revolution caused a turning point when the royal gardens started to become communal spaces. Through the post-revolutionary Haussmannisation of Paris and the development from these urban renewal projects towards modern Paris. Through this historical progression, the development of dominant green spaces have been mapped underneath the urban expansion maps in the timeline. The different emotional needs discussed in this thesis (healing, social, focus and refuge) are also mapped in the timeline to visualize how they were represented in these spaces during each era through time.

Looking to the future of Paris, this historical perspective informs the future of green spaces in Paris, particularly as the city continues to prioritize sustainability, accessibility and biodiversity. This thesis project aims to contribute to this ongoing evolution by exploring how the different forest typologies can be integrated into the urban fabric of Paris. By understanding how these typologies have been represented historically, we can learn from the history of Paris to not only respect Paris' rich heritage but also to enhance and honor it.

The goal for this project in this thesis is to make a design for the city that will create a progression of all of the lines illustrated in this timeline, so that the new forested Paris will meet the evolving needs of its residents. The design will draw on this rich historical context and make sure that the past of Paris and its green spaces is respected while also addressing the challenges that these modern times and the future bring. The project aims to be mindful of history but also focused on the future by creating more restorative and sustainable forested environments of which there is a need.

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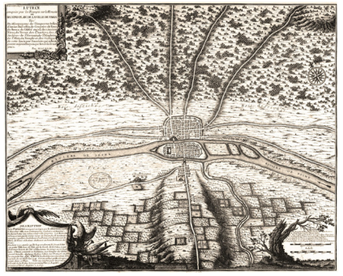


1180

Frankish and Gallic
The first settlements of Paris where along the seine. France villages developed in clusters of organized and ordered buildings and streets that were separated from the forested areas of the land by meadows and croplands (Adams, 1991). This shows that the relationship with the forest in that time was fearful; it was seen as a dark, uneasy and threatening. According to Adams, (1991) the venture into the forest was at risk of 'losing one's soul, this illustreated the deeply ingrained unease towards wild nature during that time.

Medieval era
In the 12th century a new and more appreciative relationship with nature started to emerge. In poetry, tales and songs was written about 'the sensual pleasure' and the beauty of nature (Adams, 1991). Mostly monasteries started to cultivate enclosed gardens (hortus conclusus) from which they were still able to shut the 'untamed' nature outside. These gardens allowed monks to experience nature in a controlled way. These gardens took various forms and resulted in different gardens including orchards, cemeteries and herb gardens (Aben & de Wit, 2008). The enclosed garden became a symbol of spiritual retreat and a way of structuring nature into manageable, meaningful forms (Wassenberg, 2019).

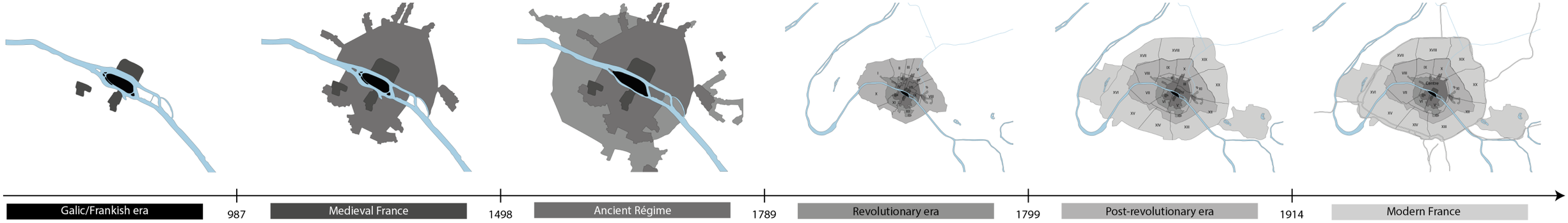
Ancient Régime
Under the leadership of Louis XIV gardens started to 'move beyond castle walls' and became expressions of absolute power and control over nature. An example of this are the gardens of Versailles, designed by André le Nôtre, with a strict geometric layout and monumental scale. These formals gardens extended the authority of the monarch into the garden by symbolizing status, hierarchy and discipline (Adams, 1991). Features like long sight lines, geometric layouts and placement of sculptures and fountains where deliberate representations of order, control and authority (Hunt, 1992)

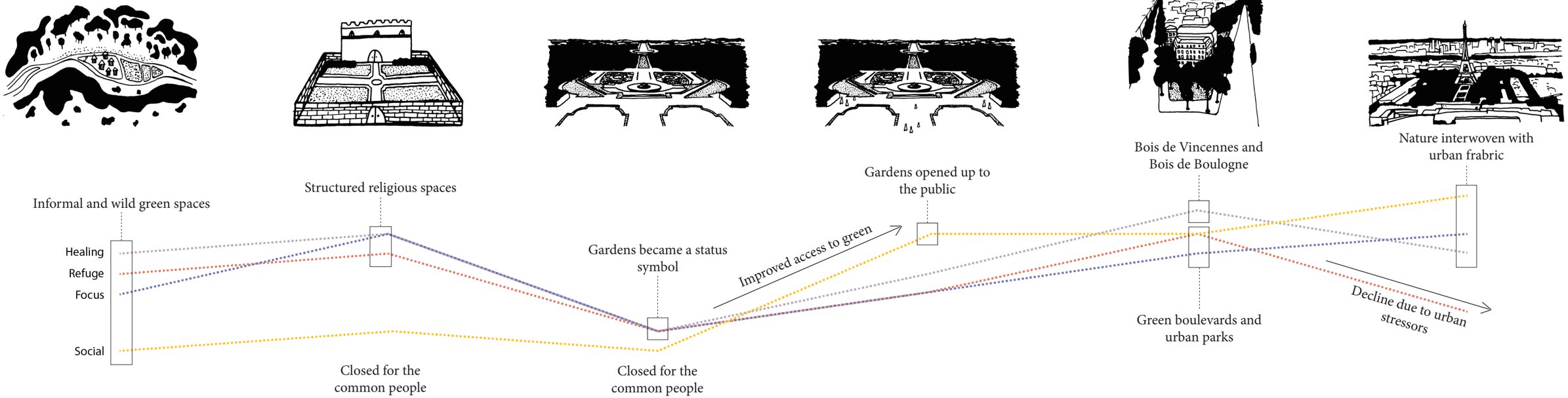
Revolutionary era
The French revolution led to the opening of previously exclusive royal gardens to the public. This led to the democratization of green space; the formal gardens became communal spaces (Adams, 1991) which aligned with the revolutionary ideals of liberté, égalité, fraternité (Hobsbawm, 1990). Access to nature became no longer a privilege of the elite but a symbol of shared national identity and freedom (Spary, 2000). Formals gardens became places where all citizens could walk, gather and reflect which moves away from the garden as symbols of monarchial power. There were not a lot of green spaces created. The revolution focused on repurposing and opening up existing gardens. Former monastic gardens were neglected and lost their original religious function (Loughlin, 2001)

Post Revolution
Paris got reshaped after the revolution. Baron Haussmann's urban renewal projects reshaped Paris into a city with wide boulevards and large public parks. These spaces where designed to improve the public health through better air quality while also offering green spaces for walking, relaxing and social interaction. Also Bois de Boulogne (1852) and Bois de Vincennes (1860) were created. Napolean III envisioned these big green spaces as two lungs for the city where the population of Paris could enjoy nature, and engage in leisure activities. The Bois de Boulogne was designed for the bourgeoisie while Bois de Vincennes was more intended for the working-class (Jordan, 1994). The parks where port of a broader effort from Haussmann to make green space more prominent in urban planning (Loughlin, 2001).

Modern era
In the modern era of Paris; green infrastructure continues to evolve towards multifunctionality, sustainability and accessibility. Street trees and urban parks are essential components of the green structure of the city and provide benefits such as cooling air and biodiversity support while it also serves social and recreational functions (Beatley, 2011). Nature is not viewed as separate or threatening anymore but is integrated into the urban fabric (Beatley, 2011).

Timeline


Galic/Frankish era
987
Medieval France
1498
Ancient Régime
1789
Revolutionary era
1799
Post-revolutionary era
1914
Modern France


Informal and wild green spaces
Healing
Refuge
Focus
Social
Structured religious spaces
Closed for the common people
Gardens became a status symbol
Closed for the common people
Improved access to green
Gardens opened up to the public
Bois de Vincennes and Bois de Boulogne
Green boulevards and urban parks
Decline due to urban stressors
Nature interwoven with urban frabric

Site Analysis

The Layered Landscape

The Paris Metropolis is a layered landscape that has been shaped by centuries of interaction between humans and the natural landscape. To gain a quick understanding of this landscape, a flat analysis was done; using the layered landscape approach. By analyzing these components individually, this analysis tries to look at the different patterns, but also the opportunities for integrating new green spaces and forested areas within this densely build up city.

Six primary layers are analyzed, each providing different insights into the landscape structure. First of all, the **forest layer.** This layer shows a fragmented but very significant and important green network. It is dominated by the two large 'lungs' of Paris; Bios de Vincennes and Bois de Boulogne. These areas along with some other woodlands form big ecological patches in the landscape. However, they are not connected with each other as they are limited in this possibility due to the densely build up other layers. There lays a lot of potential in expanding and linking these patches to each other through strategic interventions.

Another important layer are the **waterways**; particularly the Seine functions as a backbone and big structural element of the city. This natural corridor defines the geography of Paris but also offers a lot of opportunity for the creation of green corridors through the city. Especially the broad and expansive quais that run along the Seine offer a lot of potential for the creation of these green spaces. These wide roads could be developed into linear green spaces to create blue-green corridors for ecological and recreational benefits.

The **infrastructure layer** is build up by a large network of roads, railways and highways. These infrastructure lines connect different areas of the landscape, but the lines also lead to fragmentation. This infrastructure network takes up a lot of space within the city, and especially with Paris' efforts to reduce car usage, there is a big opportunity to repurpose some of these areas for green uses.

The city's strong metro network further supports this idea and offers an alternative to car-based transportation to reduce to use of urban roads. Paris can integrate ecological corridors by converting these car-dominated streets into green spaces.

The **industrial zones** are often located along the riverbanks and at the urban outskirts. These areas are often dominated by hard surfaces and industrial buildings; a lot of pavement and concrete. These also offer an opportunity to (re)introduce green space. Some of these areas could be repurposed or transformed into recreational or therapeutic green areas; such as nature parks and community garden to provide much-needed green spaces to surrounding neighborhoods.

The most dense layer of Paris is the **urban fabric layer**. Especially the historic core is very dense and limits the possibility of large-scale green spaces. However, the potential here lays in the small scale interventions: such as pocket parks, smart re-use of e.g. vacant lots or maybe even rooftop gardens. These small interventions could contribute to the overall green structure and enhance ecological and social value, also in the dense center of the city.

Finally, the **tree heigh layer**, shows that the majority of tree canopy coverage are in the forested regions of the city. Another thing that shows up are the tree lined streets; influences by Haussmann's grand boulevards and urban planning. Trees tree-lined avenues were designed for both the aesthetic of the city but also for the air quality and do thereby contribute to the green infrastructure of Paris. The biggest potential here lays in expending the tree cover in areas where the canopy is sparse and leads to an uneven distribution of green space. This presents an opportunity to improve the equity of green space access throughout the metropolis.

Forest

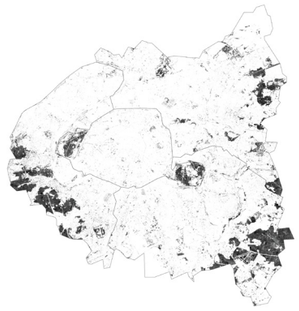
Waterways

Infratructure

Industry

Urban Fabric

Tree Height



This structural analysis shows both opportunities but also constraints. The dense urban fabric of Paris strongly limits the potential of adding a lot of green space or forest into the city. However, the Seine and the infrastructure lines offer potential for integrating (bue-) green corridors into the city. The effort to reduce car traffic in Paris also provides an opportunity to build on this and repurpose some of this space for green infrastructure and linear forest systems to strengthen the ecological structure of the city, but also improve the livability in the city and offer much needed green spaces for the residents of Paris.

The Green/Forest Structure

Building upon the four forest typologies derived from SRQ3: Refuge, Healing, Social and Focus, developed from literature and precedent studies, this section examines the green structure of Paris at the metropolitan scale. The aim is to identify how these typologies already work within the green structure of Paris and how they align with the emotional and sensory functions outlined in these typologies. As part of this analysis, I have proposed an initial hypothesis about the spatial forms in which these typologies most likely appear.

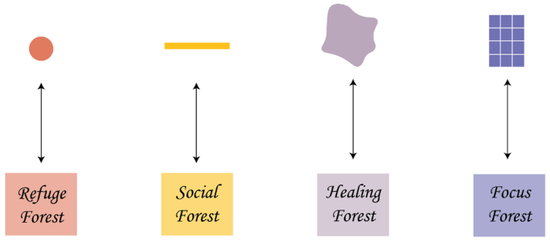
I hypothesize that Refuge Forests are mostly represented as small and isolated green patches that are woven within the urban fabric of the city to offer small pockets of nature that serve as retreats from urban stressors. Healing Forests are expected to emerge as bigger and expansive planes and to function as green areas that provide restorative experiences, mostly outside the dense city center. The Social Forests are compared with lines, (but also urban parks), that facilitate movement and connection among people and that function as green corridors. Lastly, the Focus Forests are anticipated to appear in the form of grids; classical Parisian gardens that offer the structured lay-out proposed in this topology.

Based on this analysis, I aim to develop a 'Parisian Toolbox' for each typology to gain a deeper understanding of the Parisian characteristics of these green spaces. This will help guide the implementation of the theoretical typologies in the context of Paris and to help them fit within the unique context of Paris.

Hypothesis:

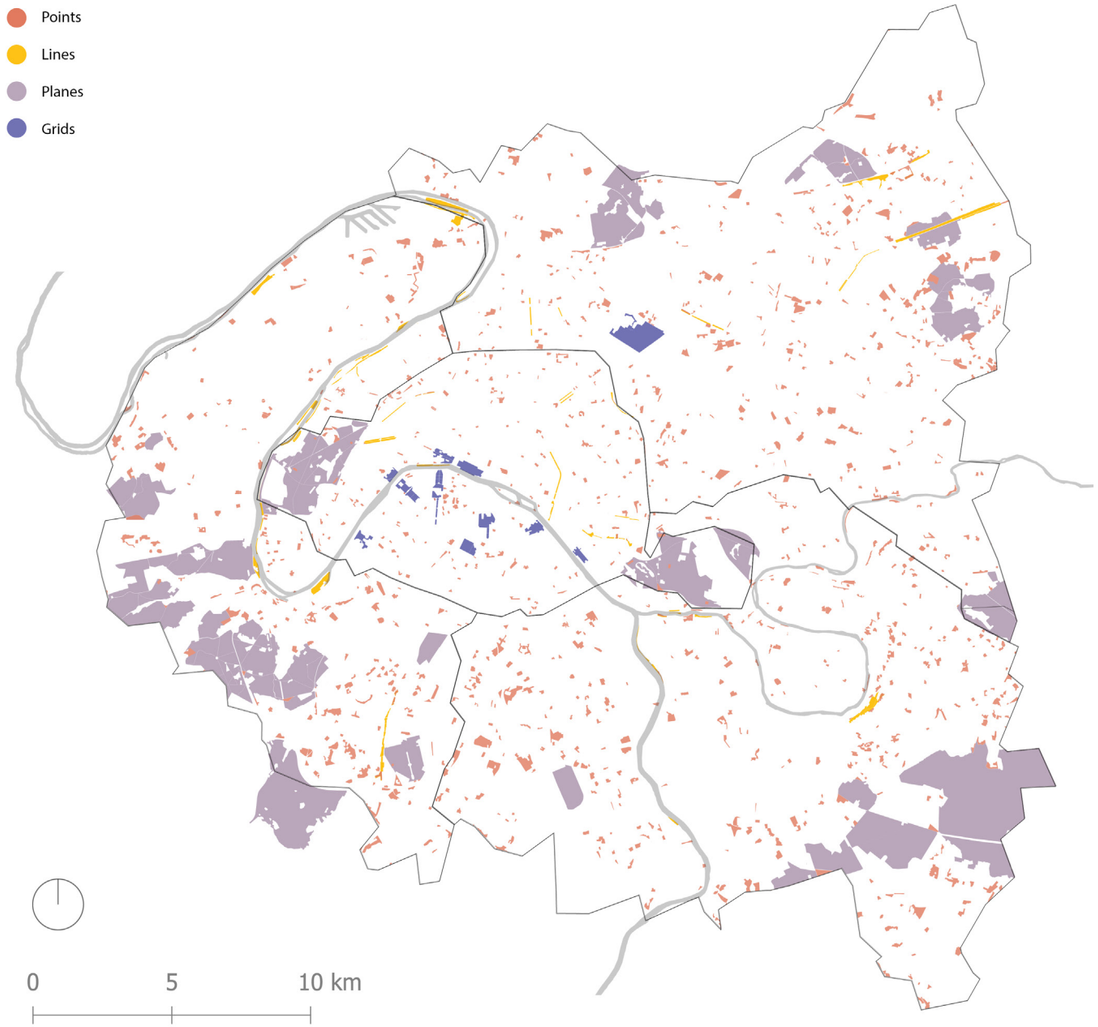
"The four forest typologies—Refuge Forest, Healing Forest, Social Forest, and Focus Forest—are predominantly represented in Paris as points, planes, lines, and grids."

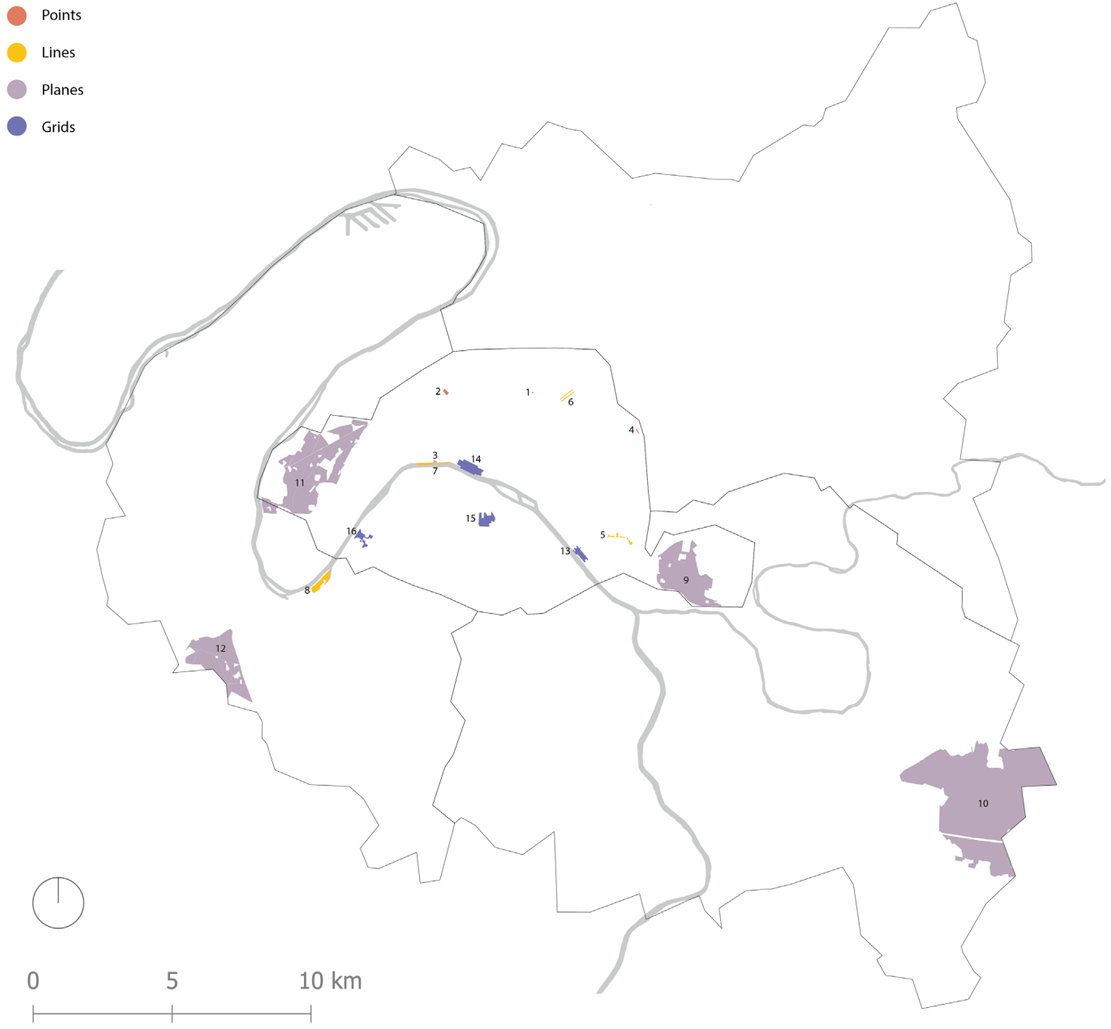
Parasian Toolbox



'Standarized' Toolbox

The map on the right shows the green structure of Paris. It shows these four typologies and their division in the metropolis of Paris.





To further explore the division of these green spaces, I have selected four parks/forests of each category to do a further analysis on. These sites have been chosen for their representative characteristics and their spatial form that shows their association with each typology.

The chosen sites are:

Points:

1. Le Bois Dormoy
2. Square des Batignolles
3. Jardin de la Nouvelle
4. Porte des Lilas Pocket Forest

Lines:

5. Le Promenade Plantée / Coulée Verte René-Dumont
6. Bassin de la Villette
7. Berges de Seine
8. Île Saint-Germain

Planes

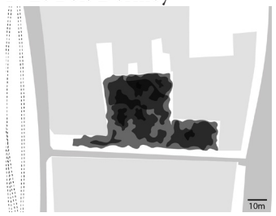
9. Bois de Vincennes
10. Forêt de Notre-Dame
11. Bois de Boulogne
12. Forêt de Meudon

Grids:

13. Parc de Bercy
14. Jardin des Tuileries
15. Jardin du Luxembourg
16. Parc André Citroën

Points

1. Le Bois Dormoy



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2. Square des Batignolles

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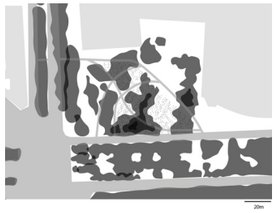
3. Jardin de la Nouvelle



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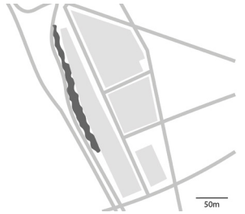
4. Porte des Lilas Pocket Forest



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Refuge Forests; for now conceptualized as Points, are small, enclosed green spaces that provide retreats within the dense urban structure of Paris. These areas are often hidden ways from their busy surroundings and offer seclusion and tranquility to individuals in need of refuge from the city's urban stressors.

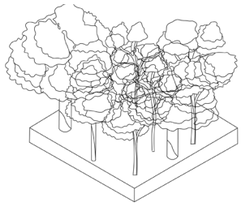
1. **Le Bois Dormoy** is a hidden pocket forest within a high-density urban area. This site features wild, and almost unmanaged vegetation which creates a feeling of seclusion. It has winding and unpaved paths and an uneven topography which creates the impression of a 'natural' world. It creates a physical and sensory isolation from the noisy streets and city which offers a sense of escape and protection.

2. **Square des Batignolles** is an English landscape-style park that has layered planting, dense tree canopy cover, shrubs and changes in its enclosure. Visitors can move between those different areas; from sunlight openings to shaded corners, which reinforces the feeling of discovery and privacy. The park also has a central point which is surrounded by dense vegetation which adds an auditory layer of calming water sounds with enhances its refuge quality.

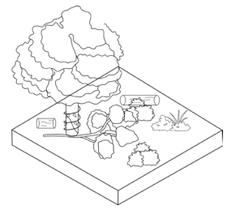
3. **Jardin de la Nouvelle** is situated between busy avenues. It is a small-scale garden with dense and lush planting to create a peaceful retreat. The garden has winding paths, dense greenery but also historical sculptures and other artificial elements; like grottoes, which gives it an almost romantic atmosphere. The garden offers a sense of otherworldliness which supports the feeling of refuge.

4. **Porte des Lilas Pocket Forest** is a pocket forest near major infrastructure traffic. This site offers dense plating that forms a strong visual and auditory barrier. It shows how this typology can work together with infrastructure lines as this site shows how dense planting can screen the visitor from nearby stressors; like a road.

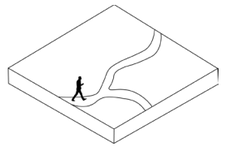
In these selected Refuge Forests, there is a common emphasis on dense, layered plating to create visual and acoustic barriers from the urban environment to offer a sense of escape from the surrounding urban density. The designs have winding paths and secluded corners for exploration and intimate experiences. The contrast between the wild and biodiverse vegetation with the surrounding urban environment further enhances the feeling of refuge. These small forests offer a retreat from the overstimulation of the city and can provide a natural and emotional sanctuary.



Dense tree canopy cover

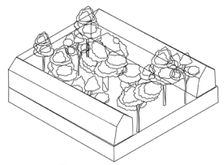


Wild



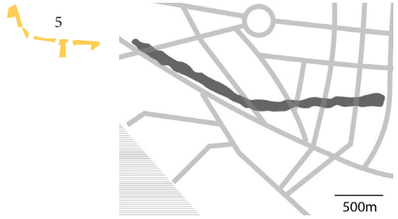
Winding paths

Biodiversity



Dense urban farbic

5. La Promendade Plantée



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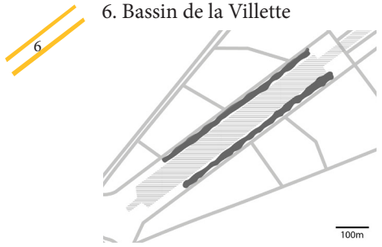
6. Bassin de la Villette



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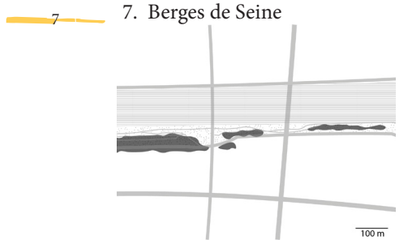
7. Berges de Seine



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8. Ile Saint-Germain

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Social Forests, for now identified as Lines, are green corridors designed to promote interaction, movement and social gatherings. The spaces connect people and neighborhoods through continuous landscapes that stimulate activity and socialization.

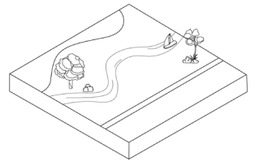
5. **Promenade Plantée / Coulée Verte René-Dumont** is a linear park on top of an old railway viaduct. The park alternates between open and enclosed sections and therefor offers a diverse social atmosphere. The elevated pathways provide unique views over the city while parts that are more enclosed due to denser vegetation offer more private and hidden away zones. The structure shows how the re-use of old infrastructure lines can help by greening the city.

6. **Bassin de la Vilette** is an elongated waterfront park that is structured around a canal. It has open lawns and wide embankments for lounging, playing and activities. One side of the canal features livelier spaces for events and markets, while the opposite side offers a calmer area with grassy slopes for more relaxed gatherings.

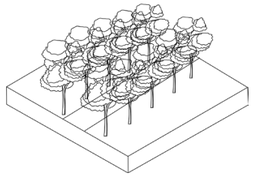
7. **Berges de Seine** follows the riverbank of the Seine and also transforms a former vehicle infrastructure into a pedestrian and more cultural space. the continuous linear flow of the path encourages movement like jogging, cycling and strolling. The park uses modular furniture, pop-up art installations and markets to make it a vibrant area for informal encounters and community cohesion.

8. **Île Saint-German** is a green island along the Seine. The park features pathways, lawns, playgrounds and recreational areas. The layout along the river and its open areas offer spaces for group activities, while the more shaded and vegetated areas offer areas for smaller social clusters witch promotes a layered social landscape.

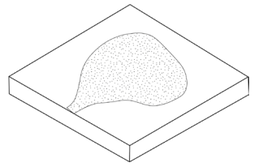
These (linear) social spaces in Paris are designed to facilitate movement, interaction and community connection. The spaces are often aligned with the riverside or tree-lined promenades witch creates an inviting atmosphere for social engagement of leisure activities. The open spaces in these parks offer versatile environments that can accommodate a wide range of activities. The big and wide linear pathways guide movement but the more forested spaces also offer areas for rest or withdrawal along the way. The integration of arts and markets further enhance their role as social hubs. Some of these parks also re-use existing infrastructure lines and transform old railways or roads into social and vibrant green corridors.



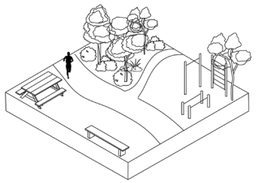
Riverside



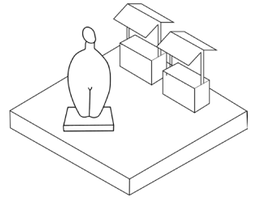
Tree lined promenades



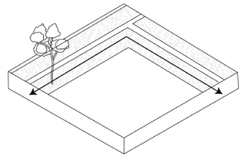
Open space



Versatile spaces



Arts & Markets



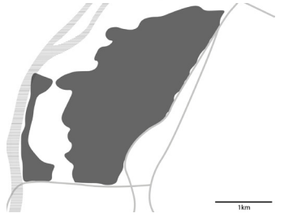
Lineair pathways

Planes

9. Bois de Vincennes

10. Forêt de Notre - Dame

11. Bois de Boulogne



12. Forêt de Meudon

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38.

Healing Forest, in this analysis Planes, are expensive and immersive environments which aim to promote mental and physical restoration. These forests are serene environments witch offer multisensory engagement. This can help the visitor to gain an emotional connection with nature witch supports stress reduction.

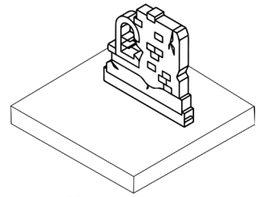
9. **Bois de Vincennes** is one of Paris' largest green spaces. This park offers a diverse landscape and is buildup of dense forests, open lawns, lakes and islands. Its trail network allows visitors to take long restorative walks through the diverse landscape and immersive themselves in nature. Historically, Bois de Vincennes was a refuge for leisure during the Napoleonic era and has since then evolved into a green space that is accessible to all.

10. **Fôret de Notre-Dame** is an expensive woodland in the metropolitan area, a bit outside the center of Paris. This forest also features a diverse range of landscapes and ecosystems. It has dense forested areas but also open meadows. The forest has serene pathways which stimulate deep reflection and exploration to encourage visitor to reconnect with the natural world. The site once belonged to the Nôtre-Dame in the middle ages and served as an old hunting ground.

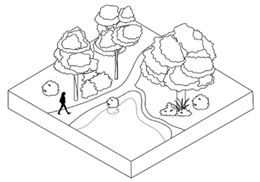
11. **Bois de Boulogne** also mixes wilder woodlands with lakes and meadows, which offer different sensorial experiences. This park also offers a lot of recreational activities, like boating and cycling. The visitor can engage in these activities or take a long restorative walk through the diverse trails and landscapes.

12. **Forêt de Meudon** is located just outside Paris and is also a large-scale and dense forest with offers restorative solitude but also has a rich biodiversity. The forest's natural quality and wildness enhance its healing properties and thereby offers an escape from urban stress.

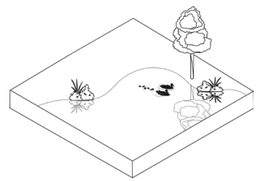
The Healing Forests in Paris offer diverse landscapes that offer sensorial and immersive experiences that promote emotional and mental restoration. These expansive green spaces have serene landscapes with a diverse flora and fauna and soothing water elements which creates ideal environments for this immersion in nature. The small and meandering trails in these parks encourage slow movement through the forest to unwind and reflect. The wild and natural quality of these spaces, combined with their biodiversity, provides a rich environment for exploration and mental restoration.



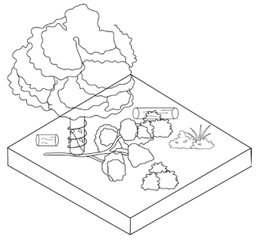
History & Culture



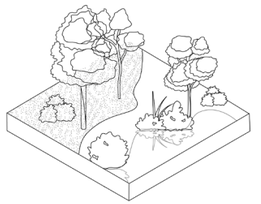
Restorative Trails



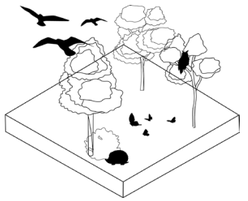
Water



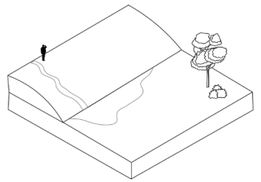
Wild



Diverse



Biodiversity



Viewpoints

13. Parc de Bercy

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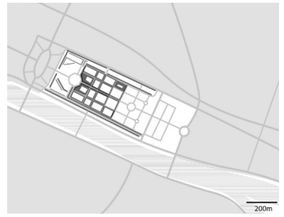
14. Jardin des Tuileries



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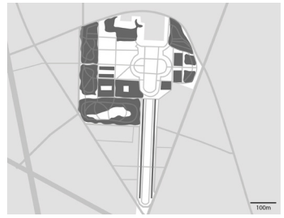
15. Jardin du Luxembourg



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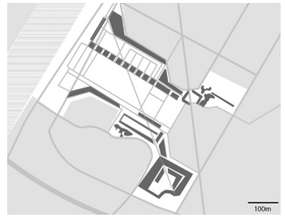
16. Parc André Citroën



42.

Focus Forests, in this analysis compared with Grids, are highly structured and geometric landscapes. This typology aims to foster concentration, clarity and intellectual engagement. These spaces encourage calm reflection and focus through formal layouts, symmetry and strong sight lines.

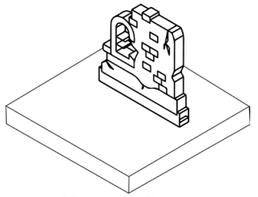
13. **Parc de Bercy** is a park that integrates historical references with a rational grid design. It has zones for vineyards, formal gardens and water terraces that are separated but also linked with straight pathways. These clear pathways guide the visitor through the sequence of different landscapes and experiences. The vineyard gardens pay homage to the parks history and association with wine trade.

14. **Jardin des Tuileries** is one of Paris' oldest formal gardens and has a clear axial planning and symmetry. The park has straight and wide pathways with sidelines to major landmarks, such as the Arc de Triomphe and the Louvre which focusses the attention of the visitor. The park has courts with fountains in the center and ordered alleys that offer predictable and calming experiences.

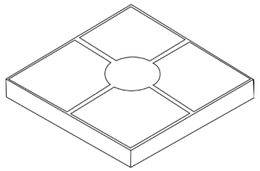
15. **Jarin du Luxembourg** is a prime example of a formal French garden and therefor also has geometric patterns and regular tree arrangements. It has some diverse areas, like flowerbeds, but they are all structured within a clear, symmetrical and consistent layout which promotes a sense or order. The Medici Fountain has classical statues and flowing water and serves as a focal point but is also a calming auditory element.

16. **Parc André Citroën** is a park that is divided into different and distinct garden rooms with different thematic experiences and all offer different sensorial qualities. The park has large open spaces but also geometric pathways, clipped hedges, linear water features and formal planting systems to add structure and organization.

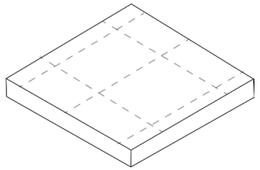
The Focus Forests (Grids) are characterized by their organized and symmetrical layout which encourages structured movement and focused reflection. The parks have clear, geometric layouts and strong sightlines and offer a sense of clarity and mental focus. The layout of these parks guide the visitor though a predictable and organized landscape which reduces sensory overload and promotes concentration. These green spaces offer a unique atmosphere where visitors can engage in deep thinking and focused activities.



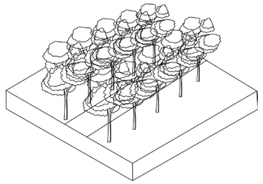
History & Culture



Central point



Geometric layout



Tree lined promenades

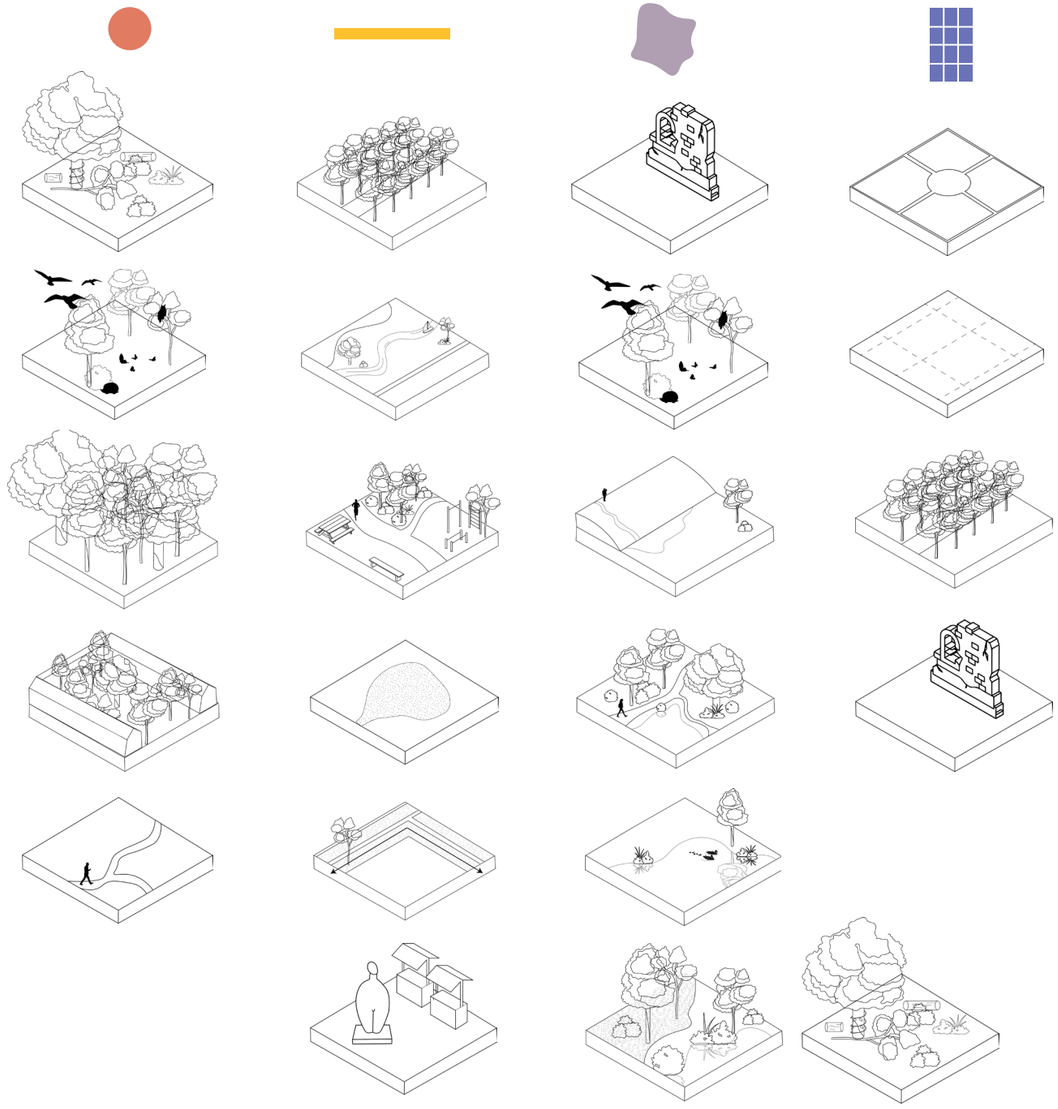
Parisian Toolbox

This page presents the toolbox as a conclusion derived from the previous analysis of Parisian green spaces. Each forest typology – Refuge, Social, Healing & Focus – has been translated into a set of spatial and sensory design elements that can later be used to guide the implementation of new forested spaces. By extracting the characteristics of these green spaces, such as dense tree cover in Refuge Forests, linear promenades in Social Forests or symmetrical layout in Focus Forests, the toolbox tries to connect the theoretical understanding of the typologies with concrete design strategies.

While each typology has its own defining qualities, it is important to recognize that these categories are not strictly separate in the real world. Many green spaces in Paris are actually a layering of the typologies and offer diverse experiences that change with visitor perception, activity and context.

For example, Bois de Vincennes, provides spaces that can serve both Refuge and Healing functions. Its forested areas and lakes offer emotional restoration, while its smaller and more enclosed corners can foster a sense of seclusion and protection. Similarly, the Jardin du Luxembourg, while clearly a Focus Forest according to its geometrical layout and structured planting, also facilities Social interaction thanks to its open seating areas and communal atmosphere. Even a linear park, like Promenade Plantée, demonstrates a hybrid character. The park is designed to promote movement and social connections, however, some areas of the park are densely vegetated and quiet – aligning with Refuge-like qualities. And these overlaps are present in a lot of the other parks as well.

Even though this analysis has been done based on the categories, the forest typologies should actually be seen as dynamic frameworks; they can be interlinked and adapted. The toolbox derived from this analysis are organized by typology to clarify their main focus, however it does show some overlapping elements, like 'wild' or ' history & culture'. This overlap shows how green spaces can support the different typologies at once. Especially in Paris, where space is scarce and where different cultural and historical layers form the landscape, this flexible approach is essential. The goal of this toolbox is to offer clear and adaptable design tools that can help guide the implementation of the theoretical typologies in to the city of Paris.



In Situ-Testing

To test out these four typologies, an (embedded) research exercise in the city of Paris was conducted. The goal was to explore how the different types of green, but also urban spaces, are emotionally perceived by the people living in Paris and to test how the typologies resonate with the people living there. To do this, residents of Paris were interviewed based on a set of visual collages, each made to represent the atmosphere and design qualities of the four forest typologies.

-**Typology 1. Healing Forest:** A wilder, biodiverse forested landscape with flowing water to show its tranquil and sensory rich character and thereby its restorative quality.
-**Typology 2. Focus Forest:** A formal Parisian garden, with a symmetrical layout, neat flower beds and historic elements, like the fountain and statue, to suggest structure and clarity.
-**Typology 3: Social Forest:** A linear riverside park along the Seine, where tree-lines paths, open areas and social activity illustrate the movement, social interaction and versatility of this typology.
-**Typology 4: Refuge Forest:** A compact and densely vegetated pocket forest nestled between infrastructure evoking protection, enclosure and an escape from the urban density of Paris.

In addition to this, four other collages were presented during the interviews, to test if they prefer the green and more forested areas over urban areas. These collages show two more urban typologies in Paris; a busy street and a public square. The other two collages show an open lawn, and one blank 'other' collage for a situation in which the interviewed person feels like none of the typologies apply. To enrich the visual collages, the tiles from the toolbox elements derived from the green/forest space analysis were also placed within the collages.

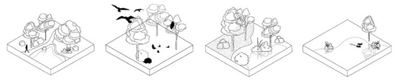
Various sites across the city were visited, from Bois de Vincennes and Bois de Boulogne and other selected green spaces to the city center itself to visit universities, busy streets and public squares. At these locations, people were asked to take part in an interview. The participants were asked to place four stickers, each representing a typology, on the collage that for them best captured the atmosphere of that typology. Red for Refuge, Yellow for Social, Blue for Focus and Purple for Healing. This simple and intuitive method allowed the people to connect emotionally and visually with the typologies without further knowledge of the framework.

The diagram on this page shows the expected distribution of responses in a diagram. It serves as an hypothesis for how people might intuitively relate the different spatial qualities of the collages to the stickers of the forest typologies.

On the next page, the collages used during the excursion are displayed. Each one integrates visual references to the spatial qualities and the toolbox elements to evoke the specific atmospheres of each typology.

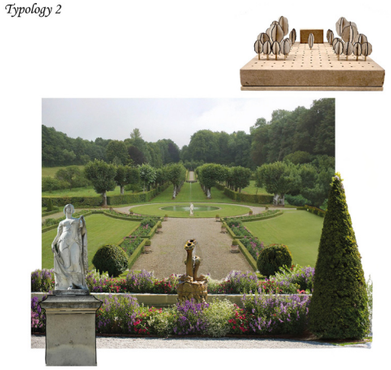
Shown Forest Typologies

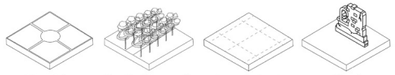
1. *Typology 1*



Restorative Trails *Biodiverse* *Diverse Landscapes* *Water*

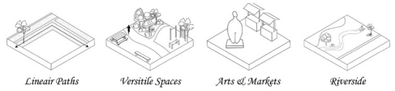
2. *Typology 2*





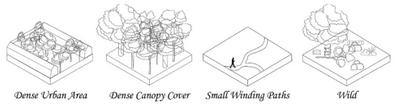
Focus Points *Tree Lined Promenades* *Geometric Layout* *Historic*

3. *Typology 3*



Lineair Paths *Versitile Spaces* *Arts & Markets* *Riverside*

4. *Typology 4*



Dense Urban Area *Dense Canopy Cover* *Small Winding Paths* *Wild*

Shown Other Typolgies

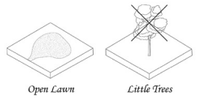
5. *Square*

Square in Urban Area *Little Trees* *Arts & Markets*

6. *Busy Street*

Street in Urban Area *Little Trees* *Arts & Markets*

7. *Lawn*



Open Lawn *Little Trees*

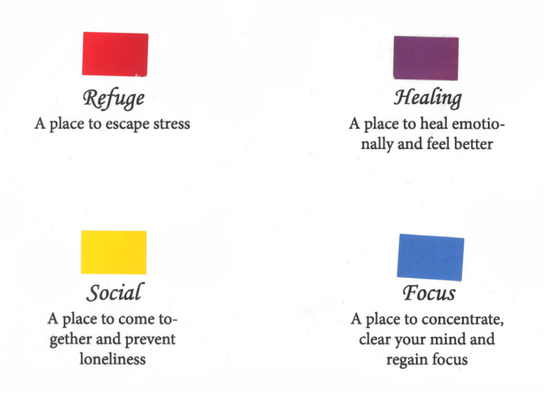
8. *Other*

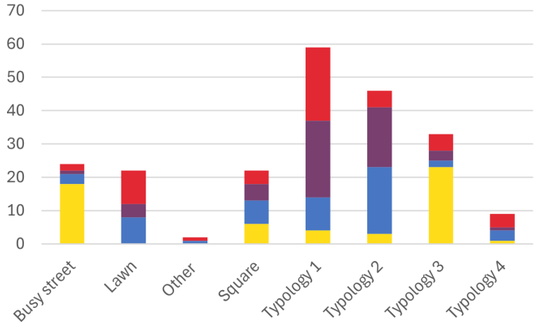
Results Interviews

In total, 217 stickers were placed on the collages during the interviews, this means that 55 persons were interviewed. The results reveal that there is a strong overlap between the different typologies.

-The **Healing Forest** collage received the highest number of relevant stickers (red and purple), showing that the participants strongly associate this natural and wild setting with Healing and Refuge.
-The **Focus Forest** collage also aligned quite well with the expectations, however it also showed a high number of purple (healing) stickers, suggesting that people associate these symmetrical and classical gardens with both focus and calmness.
-The **Social Forest** collage did clearly met its intended typology and received the highest number of yellow (social) stickers.
-The **Refuge Forest** collage received the fewest stickers. According to the interviews the reason for this is that this collage indicates a 'place of movement' with a too small scale, which does not correspondent with a space that people want to be when needing connection, refuge, healing or focus.
-The **other collages** received way less stickers then the Forest Typologies which shows that the residents of Paris do prefer the more green and forested spaces over these urban typologies when in need of one of the four emotional needs associated with the four typologies.

These results show that the framework should be seen as a layered and flexible tool for the design of these forested spaces. They can interlink and connect as different people have a different (emotional) perception of these spaces. It shows that, in practice, people can perceive spaces as simultaneously restorative, social, protective or contemplative depending on different factors as their personal needs, preferences or the context and moment





Conclusion / Discussion

While the sticker results reveal value patterns and insights in the relation of the Parisians with their green spaces, the conversations and field observations also provide a critical view and nuance in how these spaces are actually sided in daily life.

Many people liked the idea of this thesis of implementing more forested areas in the city of Paris, mostly like the typology of the Healing Forest. However, some of them refrained from placing their stickers there due to their distance to the city center. They highly valuated parks like Bois de Vincennes and Bois de Boulogne due to their character, but they criticized their accessibility and were thereby not likely to visit these spaces often. These forests were perceived as too far and not easily or quickly reachable, especially during moments of stress, anxiety and loneliness. Also the use of the metro was mentioned as people didn't prefer the use of this transportation to reach these areas.

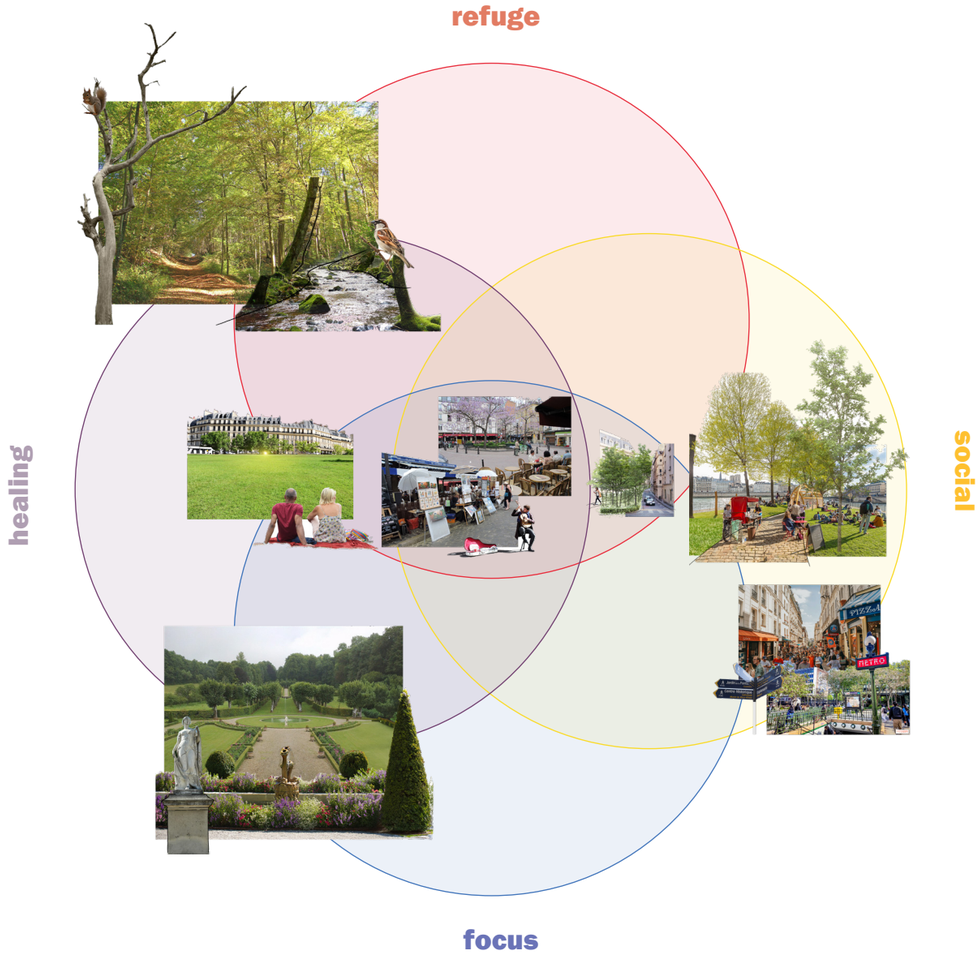
Also some other barriers came up repeatedly; most parks close too early, which makes them unavailable in the evening or at night. Also sitting on the grass is often not permitted, which limits the spontaneous and informal use of these green spaces, which resulted a lot of sticker placement on the Lawn Typology during the interviews.

The Focus Typology college received a lot of blue and purple stickers during the interviews, but observations of these green spaces revealed that these spaces are often crowded and busy, especially during good weather and, maybe, because of the holiday in France, during this excursion. During the site visits of these classical parks, these spaces seemed to took on more of a social character. People were still reading, walking alone and even meditating, however they were doing this in a highly populated context. This raises the question: does the function of 'Focus' fall away in these gardens when the space is too large or overcrowded?

There were also challenges in interviewing the Parisians due to the language barrier. A lot of them didn't manage to engage in a conversation in English. Younger people and students were generally more open, which is why most of the stickers were pasted by this generation, however the biggest part of the conversation and reasoning for pasting their stickers was still done in French which limited asked questions during the interviews besides them pasting the stickers.

The concept of this thesis and the idea of integrating more forested areas into Paris was highly appreciated among the people that were interviewed, especially among the students. They did really feel the need for more green spaces in their city, especially in the center itself, to make it easy to visit during their daily lives. The findings of the field observations and the interviews really emphasize the need for these urban green spaces, especially easily accessible ones.

The diagram on the right shows the results of the interviews in a Venn diagram. This image shows how interlinked they are. How bigger the images, how more stickers the typology received.



Take Away

The key take away from this excursion are first of all the results of the interviews, but also the gain of a deeper recognition of the extensive and diverse green spaces that are already present in the city of Paris. Paris is already quite a rich city, especially in terms of its beautiful classical gardens. These classical parks have a significant place in the urban fabric of the city, and are widely used and appreciated by Paris' residents. Also, the larger parks such as Bois de Vincennes and Bois de Boulogne are beautiful and immersive landscapes that are also highly appreciated and much used. However, their distance from the city center limits their accessibility and poses challenges by the interviewed persons for regular use.

The interviews also revealed how interconnected the different typologies are as different participants gave different stickers and meaning to the same spaces depending on their emotional needs. For some, a classical garden might serve as a place for focus, as for other it may fulfill a need for healing and emotional restoration. These findings suggest that the relationship between the typologies and the emotional responses are even more interlinked then initially anticipated.

Concerning these insights and results, it might be relevant to shift the focus of this thesis a bit. Instead of proposing the creating all of the four typologies as entirely new green spaces, the focus should also lay on recognizing and enhancing the existing ones. The goal should be to optimize the functionality and accessibility of the exciting and well working green spaces, such as Bois de Vincennes and Bois de Boulogne, while introducing elements of these spaces into the dense urban center, for example in the form of lawns, to lure people to these parks.

This leads to the development of '**Typologies Generation Two**' in the next part of the thesis: Shaping. This new framework would focus on seeing what is already there in Paris and to make these spaces more accessible. It also involves looking at what typologies lack in Paris and in creating these spaces where there is space and need for them. By using the strength of the already existing spaces while trying to fill in the gaps of the lacking typologies, this approach aims to optimize the emotional and functional value of Paris' green spaces to ensure that they will better serve the diverse needs of the city's residents.

SHAPING

Typologies Gen 2

Adjusted from Excursion and Analysis

The development of 'Typologies Generation Two' is a conceptual shift in this thesis. Rather then only aiming to introduce new forested spaces into the dense urban fabric of Paris, the next part of the thesis will focus on building upon the qualities of the existing green spaces and on enhancing their accessibility to integrate these urban green spaces better into the daily lives of Parisians. The initial and conceptual qualities given to the original typologies in SRQ3 will still be applicable to the new typologies and remain valid and relevant. However, the excursion, interviews and analysis made it evident that people perceive and use green space in different and personal ways. A classical Parisian garden might evoke focus and clarity for one person, but can be healing and calm for another person. The multiplicity of this interpretation will be embraced in this new framework.

The spatial analysis already revealed that Paris has a already quite rich green structure, but the bigger green spaces – like Bois de Boulogne and Bois de Vincennes – are often located outside the dense inner center of the city. The urban core, where stressors such as noise, air pollution and crowding are most concentrated (Apur, n.d.; C40 Cities, 2015) lacks forested environments that can offer emotional but also environmental restoration. This new generation of the typologies proposes new spatial principles for the typologies, and will try to translate the characteristics of some of the initial forest typologies into linear green infrastructure; 'forest lines' that will fit better within the urban fabric of the dense city.

The Healing and Focus Forests, are already quite strongly represented in Paris in the form of the large classical gardens and the large forested parks. These typologies will not be implemented in the form of new green urban areas but as experimental corridors to take their characteristics and benefits into the city. These linear forests will reflect the spatial qualities of their respective typologies. The Focus Forest lines will follow the symmetrical, formal and geometric design of its initial typology to follow these principles of clarity and structure seen in this 'Barok-like' landscapes.

The Healing Forest Lines, in contrast to Focus, will be more irregular, and will have more natural planting to evoke a wilder and more immersive atmosphere. These corridors will serve as pathways and as sensory routes that are symbolic to their typology. The corridors will guide the users towards the larger green spaces associated with that typology. For example, a person drawn to structure may intuitively follow a Focus Line that leads to a classical formal garden, while someone in need of restoration may be drawn down a Healing Line leading to the more organic and immersive landscapes of Bois de Vincennes.

The concept of using these infrastructure lines align with Paris' broader ambitions for urban transformation, particularly with those in the domain of mobility. In the recent years, under the leadership of Mayor Anne Hidalgo, as analyzed before, the city has launched a lot of projects aimed at reducing car dominance to prioritize pedestrians and cyclists, but also green space and trees. The implementation of the 'Zone à Trafic Limité' (ZTL) in central Pris is a significant example of this and shows the city's efforts to remove traffic from the city to reduce pollution and to promote livability (Hidalgo, 2019). Also, the expansion of 'Plan Vélo' which included hundreds of kilometers of new cycle paths, reinforces the ideas of infrastructure serving mobility but also experiential functions. (City of Paris, 2020).

Also other initiatives (also discussed in the analysis) such as the pedestrianization of streets near major landmarks (Plan Paris de la Mobilité, 2020), the transformation of the riverbanks of the Seine into car-free spaces (Paris City Council, 2019), and the development of 'urban forests' at city landmarks (Paris City Council, 2019), further illustrate how Paris is actively changing its city. These initiatives and efforts provide concrete opportunities to build further on these ideas and implement the forest typologies along repurposed roads and infrastructure lines to turn them into meaningful ecological and emotional corridors.

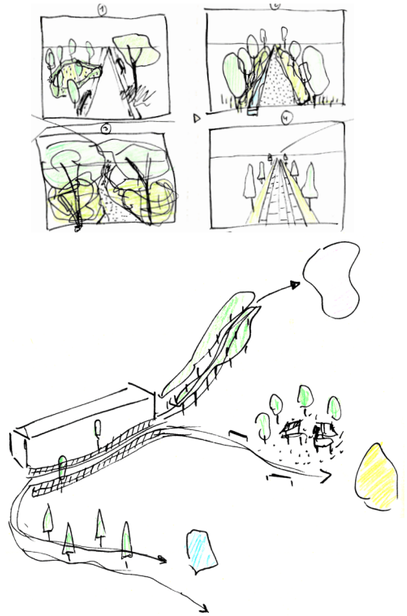
The Social Forest Typology fits best within the city along the riverbanks of the Seine, which already function as vibrant and social spaces or along already prominent social boulevards and promenades, such as, per example, the Champs-Élysées, Boulevard Sain Germain – and Boulevard Haussmann (however they can also have a Focus character due to their straight layout). These wide boulevards are already spaces that promote social activities and community interaction and can be enriched by reducing the car traffic and more planting to transform them into big green corridors. The broad quais along the Seine also present a unique opportunity for the implementation of the Social Forest Typology. These already expansive and pedestrian friendly quays are already key public spaces and could also be transformed into big social ecological and green corridors, also serving the function of being a green axis in the city.

The Refuge Forest Typology will continue to take the form of pocket forests in the city; small, densely planted and enclosed green spaces ideal for solitude and withdrawal from urban stressors. These forests can fit within the urban fabric, where there is space, or they can be strategically placed and inserted into the other typologies to support diverse experiences as small nodes along the bigger lines.

In summary, this new generation of the typologies proposes a new framework that is more adapted to the specific context of Paris. It maintains the core principles of the initial typologies but tries to respond to the spatial reality of the city while building on existing policies and plans to create a new and forested Paris.

To support the idea of the new typologies, a further analysis of Paris' existing infrastructure lines will be done to refine and adapt this new concept were needed. The focus will lay on identifying and understanding the concept of the different infrastructure typologies, like rues, boulevards and promenades, to identify and test which types of infrastructure lines can support which typology to create a coherent and accessible green network for the city. Additionally, a potential Refuge Forest analysis will be done to identify areas within the city that could be greened and work as these pocket forests.

A sketch showing the idea of different infrastructure lines with different characters leading to different green spaces.



Problems & Potentials per Typology

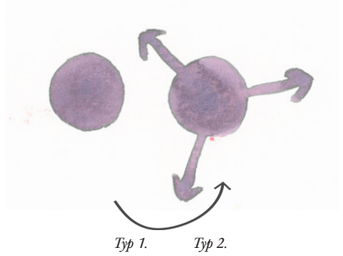
Healing Forest

Problems

- Stress and sensory overload peak in the dense city
- Immersive natural spaces are not part of daily urban life
- Limited space is available for large new restorative areas

Opportunities

- Healing qualities can extend into the city through linear green routes
- Lines allow gradual transition from urban intensity to natural calm
- Sensory-rich corridors fit well within narrow, con strained spaces
- Make healing accessible through everyday move ment, not isolated destinations



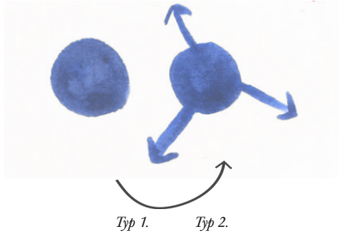
Focus Forest

Problems

- Urban spaces often lack rhythm, structure, and orient ation
- Focus-promoting green areas are disconnected from daily use
- Existing formal spaces are static and limited in reach

Opportunities

- Lines can express clarity, repetition and symmetry through planting and layout
- A sequential spatial experience enhances mental focus during movement
- Translating formal garden principles into routes improves urban legibility
- Linear focus spaces support calmness in motion, not just in stillness



Social Forest

Problems

- Social interaction is hindered by fragmented and car-dominated public space
- Many urban routes lack greenery, comfort, and space to pause or gather
- Existing walking paths often feel unsafe or uninviting for informal use

Opportunities

- Social experiences unfold naturally along shared green routes
- Linear form allows continuous, walkable, and enga ging environments
- Green corridors support gathering, movement, and informal exchange
- Enhancing social use doesn't require new parks, just better daily routes

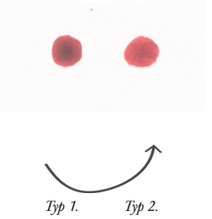
Refuge Forest

Problems

- Calm, enclosed green spaces are scarce in the dense city
- Existing public green is often open, exposed, and overstimulating
- There are few dedicated places for solitude, reflection or quiet retreat

Opportunities

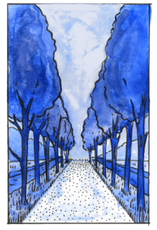
- Point-like pocket forests offer spatial contrast within busy urban fabric
- Dense planting and enclosure create a sense of pro tection and calm
- Refuge pockets can be placed in underused or lefto ver spaces
- Small-scale forests can enrich other typologies as still, hidden nodes



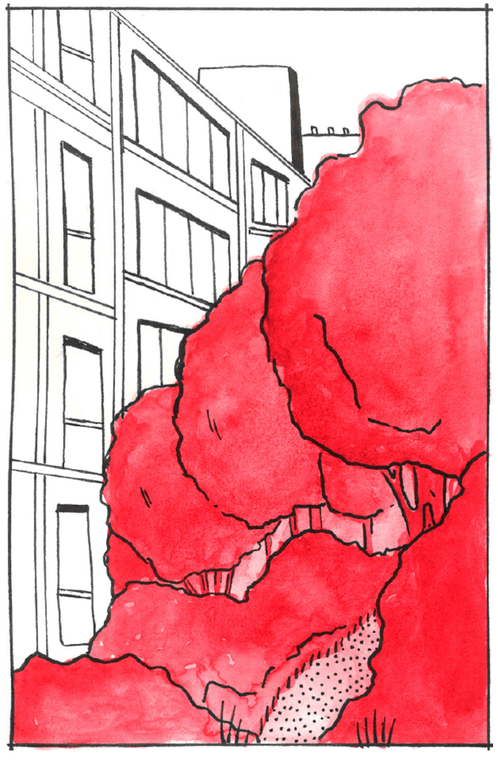
Refuge

Social

Healing



Focus



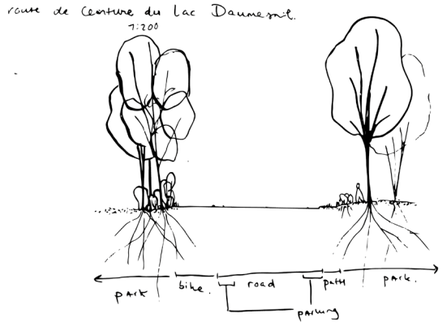
Infrastructure Analysis

Introduction

The transformation of Paris does not only depend on adding trees and vegetation, but also on reimagining the city's existing infrastructure. This section explores how the various streets, paths and roads of the city can serve as carries of these new forest typologies. This analysis focusses on the six most dominant and frequently occluding infrastructures types in Paris – allée, avenue, boulevard, quai, que and route. The analysis is done supported by a map showcasing their distribution across the city and two sections for each type, to examine their form, and use in the city. This analysis will be used to find out their potential and to see whether they resonate with one of, or multiple, of the forest typologies.

Route

Motorable land communication route established outside built-up areas. (Larousse, n.d.)



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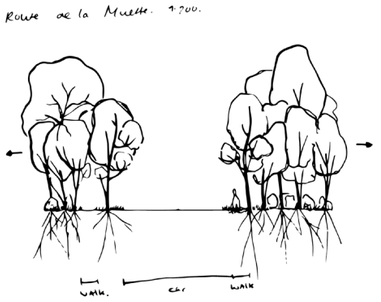
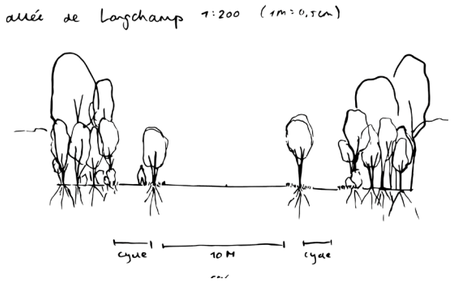


44.

Allée

A fairly wide path, lined with trees and greenery, which serves as a place for a walk or as an access road in a garden, a park, a wood, etc. (Larousse, n.d.)

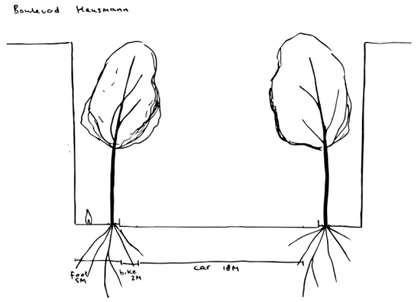


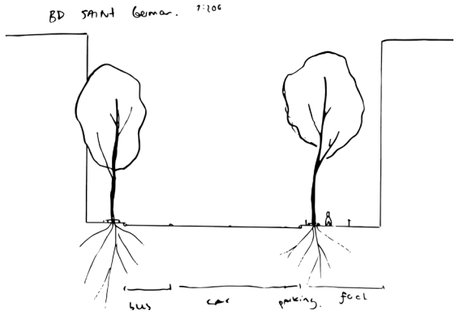
45.

46.

Boulevard

Spacious road established in the cities on the site of the ancient ramparts.
Wide urban thoroughfare planted with trees. (Larousse, n.d.)





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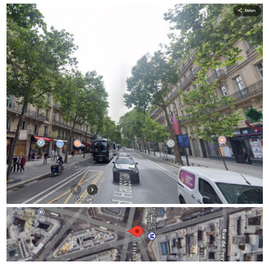

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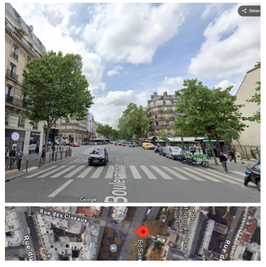
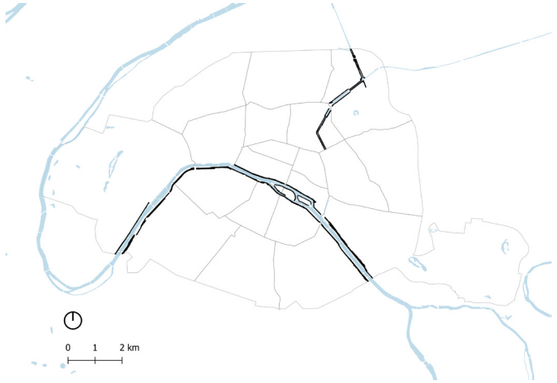
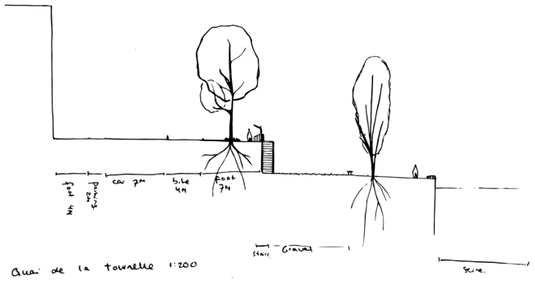
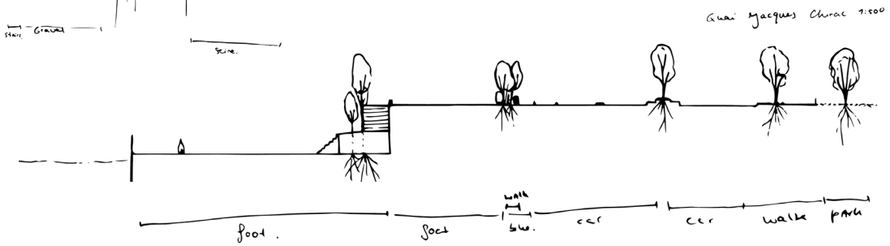


Quai

Lane along a waterway.
Name given to certain streets bordering a watercourse in a city. (Larousse, n.d.)





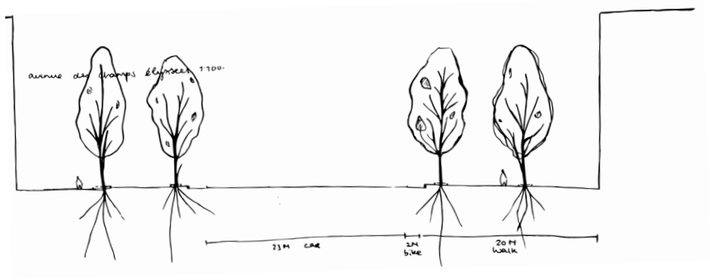


49.

50.

Avenue

A wide alley, usually straight and planted with trees, leading to a house, an official building, a public place.
Wide urban road, most often lined with trees. (Larousse, n.d.)



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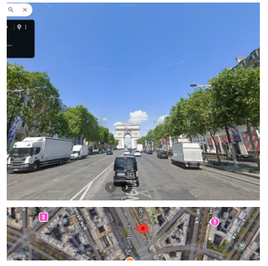
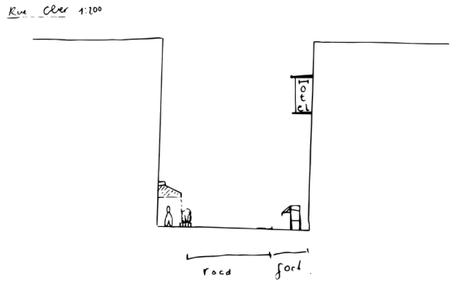


52.

Rue

Road traffic within an urban area, usually bordered by houses, buildings, enclosed properties. (Larousse, n.d.)



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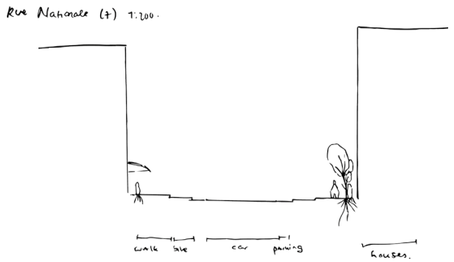


54.

Findings

As can be seen in this analysis, Paris has a layered network of infrastructure lines, from monumental boulevards to the smaller and dense rues. This network offers an interesting framework and guideline for the implementation of the Forest Line typologies. Each type of street reflects a unique combination of spatial characteristics and differ in terms of their width, enclosure, tree presence, water access and historical function. These different characteristics make some street types more suitable for specific typologies them other street types. The potential for transforming these streets into forest corridors highly depends on the local context, but with analysis these road types, some broad patterns start to emerge.

Allées are narrow to medium-width pedestrian oriented routes and are often embedded within parks or natural environments. Historically they were used for promenades which is reflected in their wide and tree-lined structure. Allées were inspired by the formal garden tradition of the 17th century, particularly the wide tree avenues in the royal gardens, like those in Versailles. They were designed for leisure walks and engagement with nature (Muller, 20212). The allées often follow water edges or they are framed by dense vegetation. Their location is often in or near green areas and they are often used for walking, strolling or jogging. This slow paced use makes them particularly suited for a transformation into Healing Forest Lines. However, the more structured Allées, like does in or leading to formal gardens could also align with the Focus Forest typology due to their symmetrical layout and clarity.

Avenues in Paris are grand, tree-lined throughfares which were historically designed for formal uses and display. Avenues became prominent in Paris in the 17th and 18th centuries as part of efforts to create monumental cityscapes and to facilitate grand lines. They were designed to frame views, promote symmetry and to highlight architectural landmarks (Muller, 2012). They are often wider than standard streets, and have both pedestrian sidewalks as roads for vehicular traffic. Their axial design, rhythmic planting and strong visual direction provide a sense of structure and orientation, qualities that makes them strong options for Focus Forest Lines, especially when they are connected to cultural or historical destinations. However, just like the allées, when their spatial context leads more to a natural or restorative space, an avenue could also function as a Healing Line; especially in less touristic areas.

Boulevards are major arteries in the urban grid of Paris and are characterized by their wide cross sections through the city and social character. The concept of the boulevard in Paris was formalized in the 19th century during Haussmann's renovation and redesign of the city. The boulevards were intended to improve traffic circulation, increase public heath by opening up the city and to provide space for public gatherings and commerce (Jones, 2004). The boulevards hosts cafés, shops, benches and big sidewalks that already support a very social character as people can gather and stroll here. Because of this, boulevards are a clear choice for the Social Forest Lines. They offer the opportunity to enhance greenery while preserving their identity as commercial and social hubs.

Quais are roads that follow the curves of the Seine that vary from high-traffic roads to pedestrian promenades. Historically, the quais were developed along the Seine as part of the expansion of the city. The quais were used as routes for trading as the riverbanks were essential for the transportation of goods, but also people by boat in the 17th and 18th centuries. Over time, many of the quais have been transformed into pedestrian spaces. (Jones, 2004). Their unique characteristic is their position along the water, which provides strong sensory and visual engagement. Many of them have been reclaimed from traffic in recent years and to now function as public spaces for walking, cycling and chilling. The width of these riverbanks and their scenic setting make them highly suitable for Social Forest Lines.

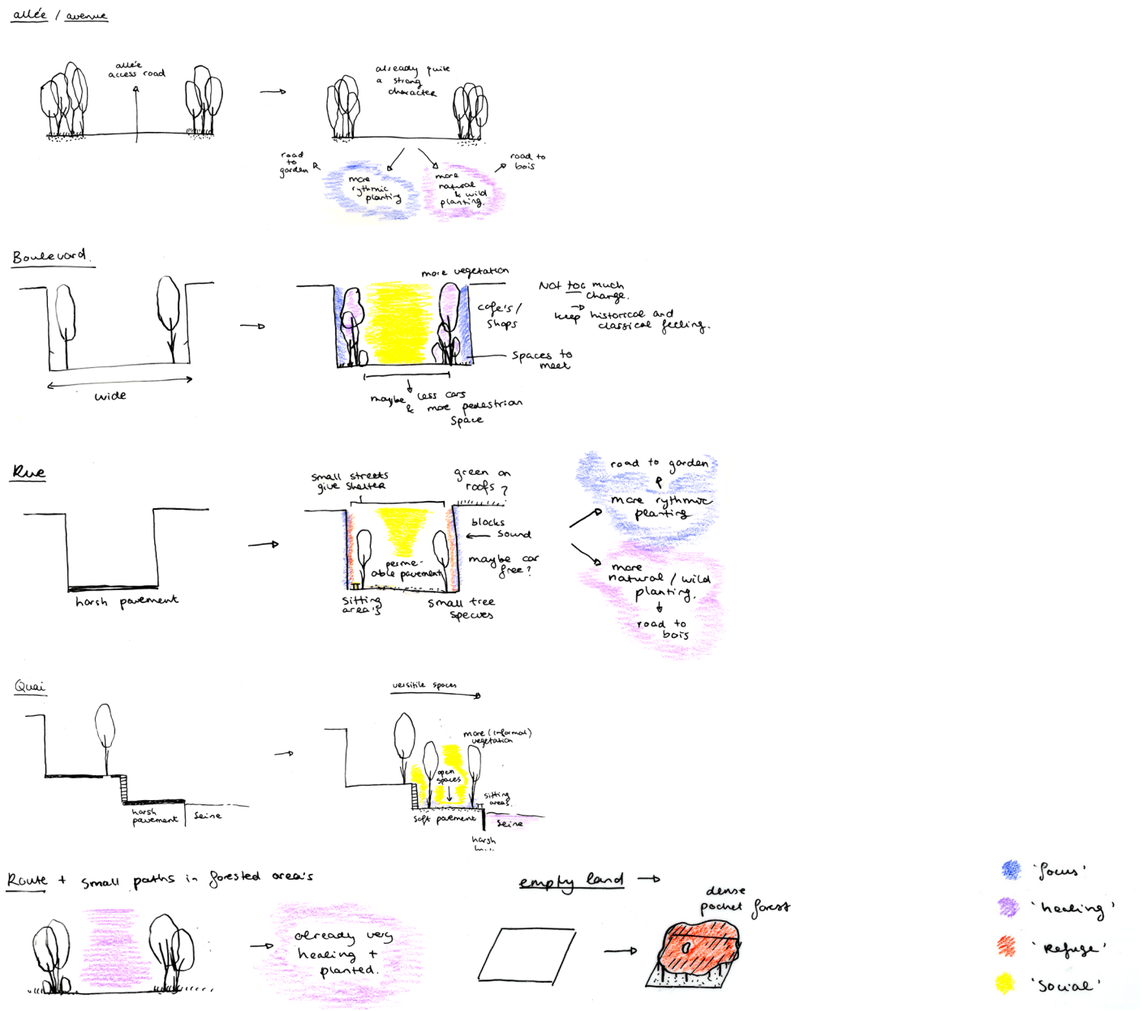
Rues are narrower and more enclosed by dense building edges and mostly lay in the neighborhoods of Paris. Rues have their origin in the medieval period when the layout of Paris was characterized by their narrow layout shaped by pedestrian and horse cart traffic. There are part of the organic growth of Paris, which is a contrast with the later planned streets like boulevards (Jones, 2004). The rues are often mixed-used and have limited space for greenery. Their character varies from quieter streets to busier shopping corridors and their spatial constraints limit their potential for transformation into forest lines. However, smart and selective choices could still offer space for small interventions, but in most cases their tight set up and the intensity of use makes them less practical for the application of a typology in this concept.

Routes are distinct from other typologies due to the reason that they traverse in Paris's large parks; Bois de Vincennes and Bois de Boulogne. Their history dates back to the 19th century when these urban parks were developed were these pathways had the function of serving for recreation and leisure walks. The routes were part of the larger effort to create public parklands to encourage leisure strolls and to provide spaces for urban dwellers to engage with nature (Jones, 2004). They are embedded in green context, lightly trafficked, and surrounded by vegetation. They have a scenic quality due to their tree framed character in a less urbanized environment. These qualities make the routes ideal suited for Healing Forest Lines, as they are already places of slow movement and sensory restoration, therefor; minimal transformation of the routes will be needed to have them work as Healing spaces.

Conclusion

While each infrastructure type has its own spatial and social characteristics which can align with certain typologies, their transformation into the Forest Lines does not need to be exclusive or fixed. Intersections between the typologies are possible, as well as gradient transitions and layering. For example, a boulevard may integrate a Refuge pocket forest. Or an avenue can begin as a Focus Line but evolve into a Healing way as it enters a park. Even within one dominant typology, qualities of another typology can still be embedded, as depicted in the design sketches on the next page. Furthermore, the Refuge Forests are best suited for underutilized areas, e.g. vacant land, where there is space for this dense forest.

First Design Ideas



Overview

	Characteristics	*Historical Context*	*Location*	*Typology Fit*
Allée	Pedestrian - Oriented Embedded in parks / along water Shaded, quiet, immersive, naturalistic or formal	Used for promenades and leisure in green areas and estates	Parks and near water →	Healing Forest Lines Formal ones: Focus Lines
Avenue	Grand- scale, tree lined, axial, formal structure, connects landmarks	Designed for royal use, Huassmann's plan emphasized symmetry and vistas	Radiate from central points; lined with cultural institutions →	Focus Forest Lines or Healing Lines depending on context
Boulevard	Wide section, social acitivity, central medians	Developed under Haussmann to structure modern Paris	Ring-like stuctures in urban core →	Social Forest Lines
Quai	Lineair waterfront, scenic, relaimed from cars, often wide	Used for transport and trade; increasingly pedestrianized	Follow Seine and canals →	Social Forest Lines
Rue	Narrow, enclosed, varied use, spatially limited	Core of Paris, mixed use and limited room for expansion	Dense urban fabric troughout neighborhoods →	Less suited for large interventions
Route	Natural park roads, light traffic, surrounded by trees and nature	Originally rural or park baesd: integrated into new green areas	Inside parks →	Healing Forest Lines

Typologies placed on their corresponding infrastructural types- according to the table on the left.

Possible Refuge

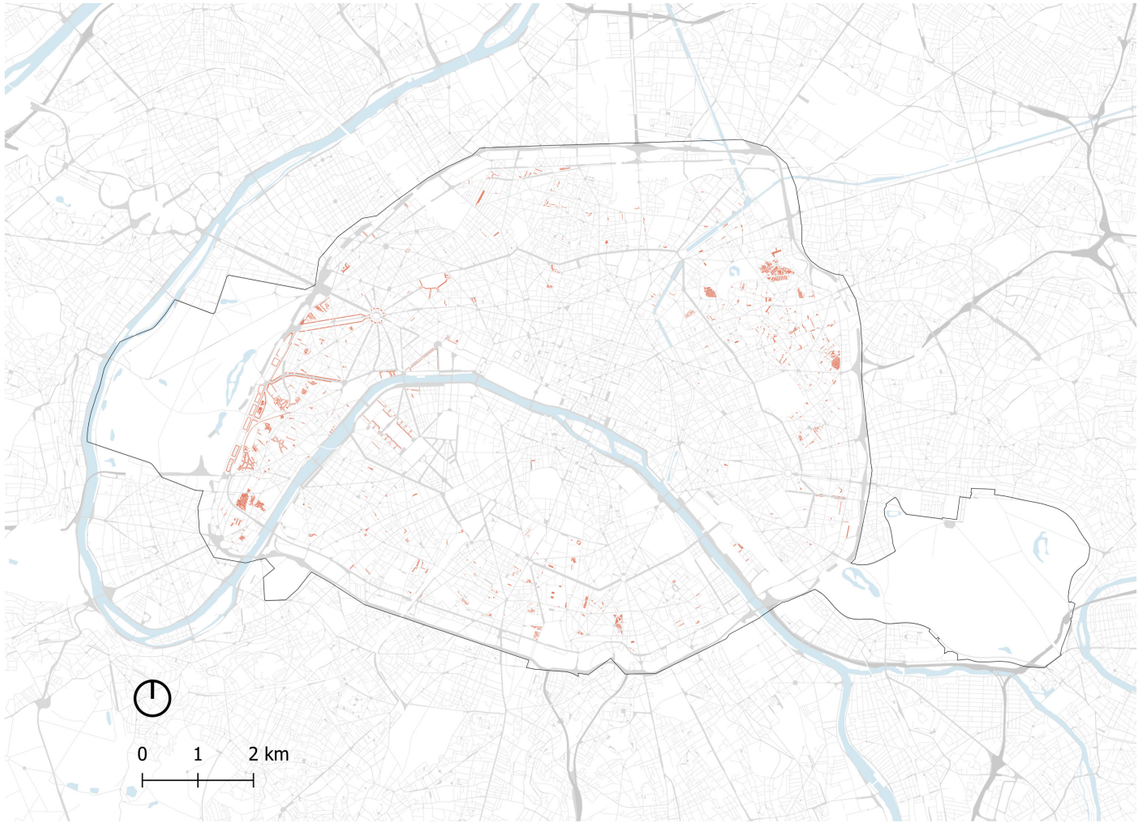
In order to identify potential locations for the implementation of the Refuge Forest, the dataset PLU - Espaces Libres à Végétaliser (ELV) provided by Ville de Paris (n.d.) has been consulted. This dataset contains areas within the land use of Paris that are recognized as having potential for future greening interventions. These spaces consist of various open, of partially developed sites such as vacant lots, residual spaces or zones with a low existing vegetation cover.

The ELV dataset offers an indication of possible sites where these small-scale Refuge Forests could be implemented. However, this map does not represent all opportunities within the Parisian urban context. Many additional locations, such as courtyards, sidewalks, and small urban voids may also be suitable for the integration of a Refuge Forest. The ELV data therefore serves as a starting point to explore the spatial potential for this typology within the dense urban fabric of Paris.

In combination with the infrastructure analysis, which mapped the linear potentials for Social, Healing and Focus Forest lines along existing infrastructure types, this analysis of possible Refuge spaces allows for a more complete identification of different scales and typologies of forest interventions. Together, these layers provide a spatial framework that combines both the linear and point-based opportunities for integrating forest elements into the existing fabric of Paris.

Building upon this these spatial potentials, a tree species analysis was conducted to define to specific character of each forest typology. For each type, tree species were selected that reflect the intended emotional experience while also considering factors such as sensory qualities, ecological functioning, seasonal dynamics and their existing presence within the Parisian planting palette. The outcomes of this analysis are presented in the following section, and can serve as a design tool, providing a framework of species that can be applied and adapted to strengthen the restorative qualities and character of each typology.

Possible Refuge Forests



Tree Analysis

In addition to the spatial analysis of the infrastructural and refuge potentials, an inventory of existing tree species in Paris has been conducted. This analysis aims to provide insight into the current tree composition and to support the species selection for the proposed forest typologies. Based on available urban tree data, the 20 most frequently occurring tree species in Paris have been identified. These species are represented in the bar chart below, offering an overview of the most dominant species within the city.

This inventory shows that a relatively small group of species dominates the urban tree population of Paris. As illustrated in the bar chart, Platanus (plane tree) is by far the most abundant species, which reflects its historical use as a robust and climate-adapted street tree. Other frequently occurring species include Aesculus (horse chestnut), Tilia (linden) and Acer (maple), which are commonly planted for their seasonal dynamics, aesthetics qualities and their adaptability to urban conditions. Beyond these dominant species, a more diverse range of genera such as Styphnolobium, Prunus, Fraxinus, Quercus, Pinus and several others contribute to the botanical variety of the city. The lower part of the distribution includes species such as Corylus, Malus, Gleditsia and Betula, which nonetheless also offer interesting sensory and ecological potentials for specific design purposes.

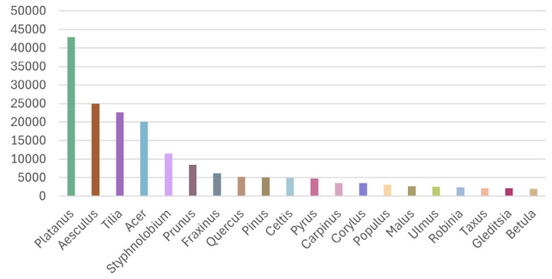
In addition to this species diversity, some spatial patterns can be observed within the distribution of these tree species. Platanus, for example, dominates many of the central boulevards and avenues due to its historic role in Haussmannian street design. Aesculus, Acer and Styphnolobium frequently appear both in streets and parks, while species such as Quercus, Pinus and Populus are more strongly associated with the larger parks and more natural green spaces. Other species, such as Prunus, Pyrus and Carpinus often occur as more isolated trees in squares and courtyards.

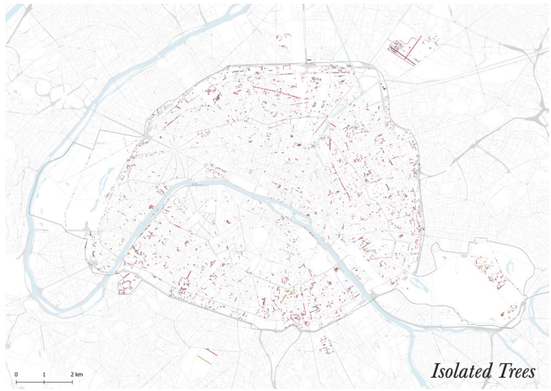
Furthermore, several species that are present in Paris are particularly suited for pruning and formal shaping, which makes them highly applicable within more controlled and strict environments such as the more classical Parisian gardens (associated with the Focus Forest). Species like Carpinus, Tilia and Platanus are frequently used in these classical gardens to create allées, hedges and structured canopies through pleaching, pollarding or topiary forms. Their adaptability to strong pruning allows for the creation of spatial order and rhythm which aligns with the visual and cognitive clarity targeted in these typologies.

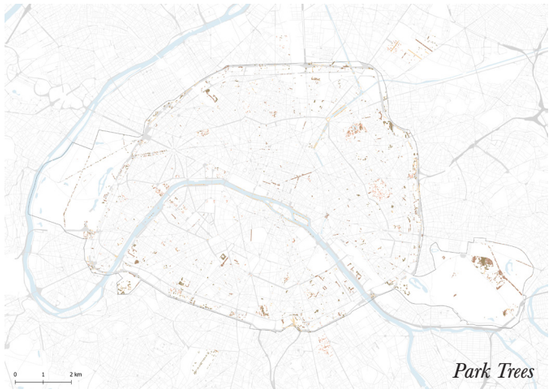
To further explore the distribution of these species, four maps are created. Each map illustrates the occurrence of the tree species within four categories.

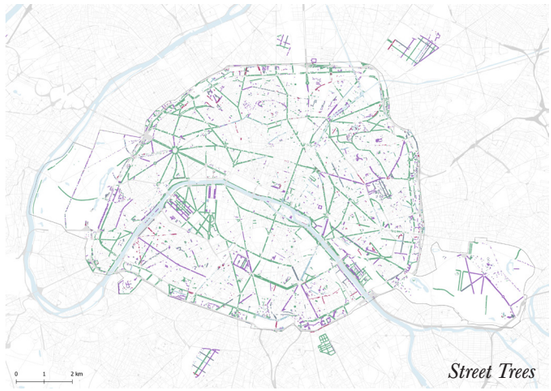
-Isolated trees (stand-alone specimens within squares, courtyards or small pockets),
-Street trees (linear plantings along roadways),
-Park & street trees (species occurring in both streets and parks),
-Park trees (species predominantly located within larger park areas).

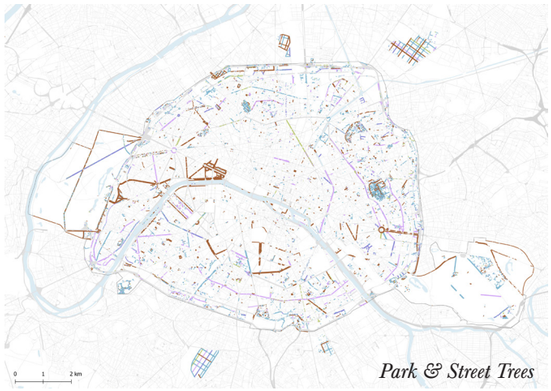
This analysis provides insights into the existing planting structure of Paris and can serve as a design tool but the species selection per forest typology based on their qualities, characteristics and their occurrence in the city of Paris.











Tree Catalogus

Based on the earlier spatial analysis and tree species inventory, a typology based species toolbox was developed to help guide the design interventions of the forest typologies within the Parsian Context. This toolbox builds upon the existing botanical situation of Paris while trying to translate the characteristics of the species into designs applications that address both ecological functioning and emotional experience. This toolbox builds upon the twenty most common tree species identified within Paris in the previous analysis. Rather than introducing entirely new species, this selection only works with the existing tree composition, to ensure feasibility and contextual integration.

Each of these 20 species was evaluated through a multilayered analysis (in the Appendix), considering their sensorial qualities, their cultural meaning, spatial expression and resilience in urban environments. Based on these evaluations, the species were assigned to one or more of the four forest typologies, depending on their sustainability to reinforce the intended spatial and emotional qualities.

The typology framework consists of:

- **Refuge Forest**: species that contribute to enclosure, shelter, protection, and the creation of intimate, small-scale microclimates that offer psychological refuge within the dense urban fabric.

- **Healing Forest**: species that enhance immersive, calming and sensorially rich environments, supporting emotional recovery through seasonal variation, soft movement and multisensory engagement.

- **Social Forest**: species that foster informal gathering, interaction, and flexible use, often characterized by light canopies, filtered shade and dynamic visual openness. Species that provide (seasonal) focal points through flowering, fruiting or autumn coloration.

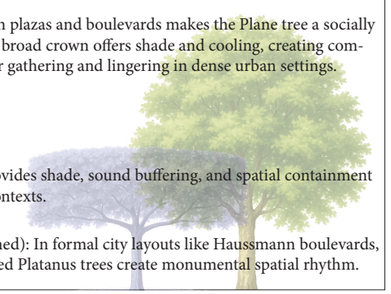
- **Focus Forest**: species that allow for formal compositions through clear structure, strong form, and pruning tolerance to support visual clarity, cognitive fucus and rhythmic spatial order.

This typology based species toolbox functions as a design instrument to compose typology-specific plating schemes that are both typology specific but also grounded in the existing urban flora of Paris. It should be noted that the species assignments remain indicative, as individual site conditions may influence the actual suitability of and application of these specific species.

Trees and their Typologies

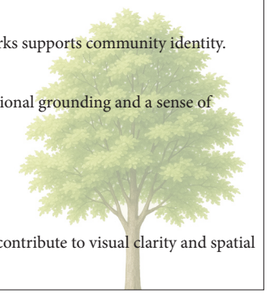
1. Platanus

- Widespread use in plazas and boulevards makes the Plane tree a socially iconic species. Its broad crown offers shade and cooling, creating comfortable spaces for gathering and lingering in dense urban settings.
- Broad canopy provides shade, sound buffering, and spatial containment in dense urban contexts.
- (pruned and aligned): In formal city layouts like Haussmann boulevards, aligned and pruned Platanus trees create monumental spatial rhythm.



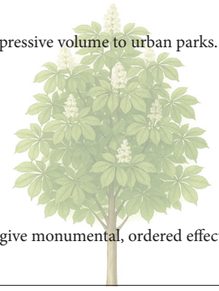
4. Acer

- Familiar presence in streets and parks supports community identity.
- Rich autumn foliage provides emotional grounding and a sense of seasonal rhythm.
- Clear form and strong leaf outline contribute to visual clarity and spatial order.



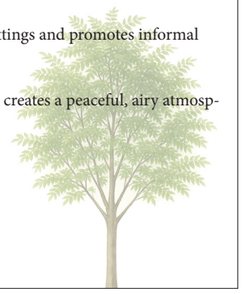
2. Aesculus

- Broad leaves and large flowers add expressive volume to urban parks.
- Strong vertical trunks and symmetry give monumental, ordered effect when planted along avenues.



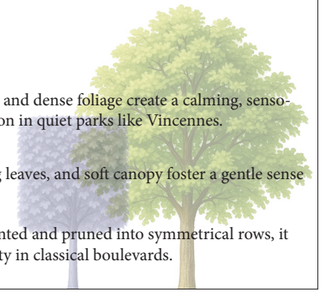
5. Styphnolobium

- Elegant appearance fits relaxed park settings and promotes informal gathering.
- Light, open crown with soft movement creates a peaceful, airy atmosphere.



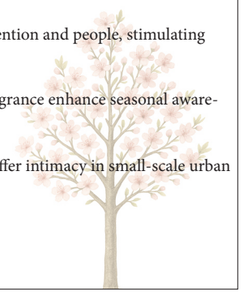
3. Tilia

- Fragrant summer blossoms and dense foliage create a calming, sensory-rich atmosphere; common in quiet parks like Vincennes.
- Familiar silhouette, rustling leaves, and soft canopy foster a gentle sense of enclosure.
- (pruned): When tightly planted and pruned into symmetrical rows, it creates rhythm and formality in classical boulevards.

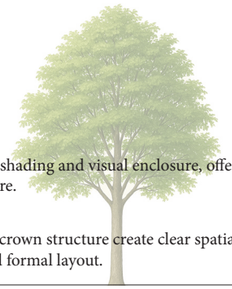


6. Prunus

- Celebrated blooming periods draw attention and people, stimulating seasonal social interactions.
- Striking spring blossoms and sweet fragrance enhance seasonal awareness and emotional resonance.
- Compact structure and gentle height offer intimacy in small-scale urban forests.

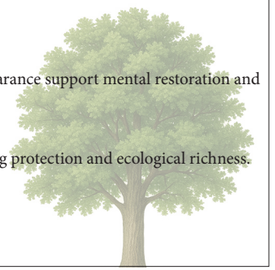


7. *Fraxinus*



- Dense summer foliage provides soft shading and visual enclosure, offering a quiet and protected atmosphere.
- Its upright growth and symmetrical crown structure create clear spatial rhythms, supporting orientation and formal layout.

8. *Quercus*



- Seasonal change and natural appearance support mental restoration and biodiversity.
- Dense and majestic, offering strong protection and ecological richness.

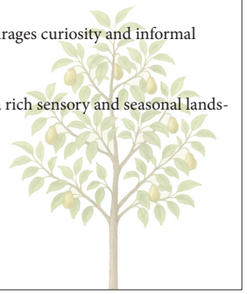
9. *Pinus*

- Aromatic needles and wintergreen presence maintain sensory engagement year-round.
- Evergreen canopy, forest scent, and enclosed feeling evoke wild, protective nature.

10. *Celtis*

- Durable in urban settings, commonly used in linear layouts like streets and promenades.
- Modest size and soft form suit quiet, inward-facing green zones.

11. *Pyrus*

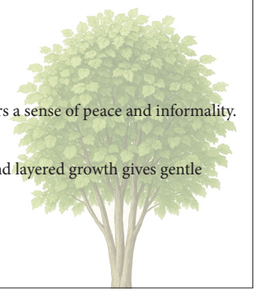


- Contributes to edible urbanism; encourages curiosity and informal interaction.
- Spring flowers and edible fruit create a rich sensory and seasonal landscape.

12. *Carpinus*

- Dense, natural structure makes it ideal for small forests with enclosed atmospheres.
- (pruned): Easily shaped into formal hedges or columns, perfect for baroque or geometric layouts.

13. *Corylus*

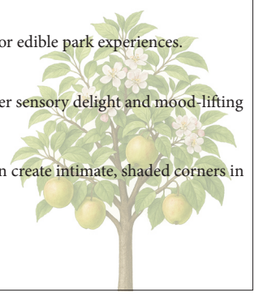


- Irregular, multi-stemmed form fosters a sense of peace and informality.
- Soft enclosure with low branching and layered growth gives gentle protection.

14. *Populus*

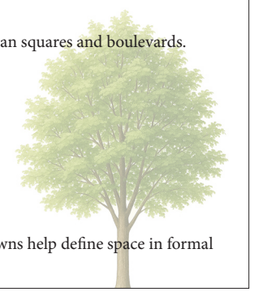
- In canal zones or large boulevards, their alignment can become iconic and socially engaging.
- Seasonal dynamics and shimmering leaves generate calming motion.
- Tall, slim trees with rustling foliage provide acoustic buffering and spatial protection.

15. *Malus*



- Highly ornamental; supports festive or edible park experiences.
- Fragrant bloom and vibrant color offer sensory delight and mood-lifting effects.
- Older or densely planted varieties can create intimate, shaded corners in pocket forests.

16. *Ulmus*

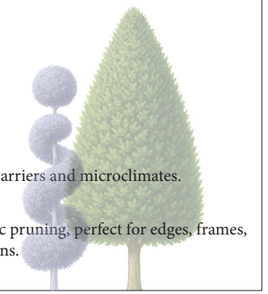


- Historically significant tree along urban squares and boulevards.
- (structured form): Tight, upright crowns help define space in formal compositions.

17. *Robinia*

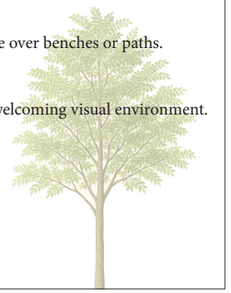
- Natural, friendly image and scattered leaf pattern create an inviting atmosphere.
- Light, unstructured appearance brings a playful, relaxed character to gathering areas.

18. *Taxus*



- Dense, dark foliage creates strong barriers and microclimates.
- (pruned): Exceptional for geometric pruning, perfect for edges, frames, or sculptural forms in formal gardens.

19. *Gleditsia*



- Light-filtering canopy provides soft shade over benches or paths.
- Gentle, airy foliage offers a delicate and welcoming visual environment.
-
-

20. *Betula*

-
- White bark and whispering foliage create soft visual and auditory stimulation.
- Loosely growing clusters generate shelter and seclusion in forest edges.
-

This typology-based tree catalogue offers a structured framework to support the design of the restorative forest typologies within the Parisian context. Based on the most common tree species in Paris, twenty species have been analyzed on their spatial, sensorial, emotional and ecological qualities. This allows for a selection of species that strengthen the intended experience, atmosphere and funatool that can be adapted to different spatial situations while remaining grounded in the existing forest of Paris by using common tree species.

Design Brief

"How can the seconed generation urban forest typologies be designed and integrated into the city of Paris to enhance the well-being of its residents?" (and address local environmental challenges)

Context
Paris is in the midst of a green transition; as stated earlier in this thesis. The city is actively reducing car dominance and introducing new green spaces, including street greening projects and new 'pocket' urban forests. But there are also long term strategies, such as Plan Canopée and Plan Biodiversité, that aim to increase the tree cover, enhance biodiversity and to establish more green corridors in the city (Ville de Paris, 2018; Ville de Paris, 2020). The ambitious plans do provide a solid policy framework, however, the implementations often remain fragmented as they are carried out as isolated interventions and pilot projects, rather than a city-wide green system. As a result of this, it loses its potential to be a continuous and sensorial space. The design part of the thesis focusses mainly on the dense urban core of Paris, rather than the wider metropolitan region. The need for the proposed restorative spaces is the most urgent in the compact center of the city where the high population density, limited access to nature and daily urban stressors strongly affect the well being of the urban residents.

Problem statement
The greening strategies in Paris (rightly) prioritize urgent goals such as climate adaptation, biodiversity and sustainable mobility; essential plans and shifts for the city's long term resilience. However, in such a densely build up city like Paris, there is also need to consider how green spaces and urban forests can support the mental well-being of its residents. The affective and restorative capacities of these green spaces – such as offering a healing, focus, refuge or social function - are often underrepresented in spatial greening strategies and therefor remain poorly integrated into the city's green structure. The presented vision and design in this thesis builds on the exciting ambitions of Paris, while introducing another layer; a forested green structure that not only strengthens the environmental performance but that also brings the emotional potential of these spaces to the foreground.

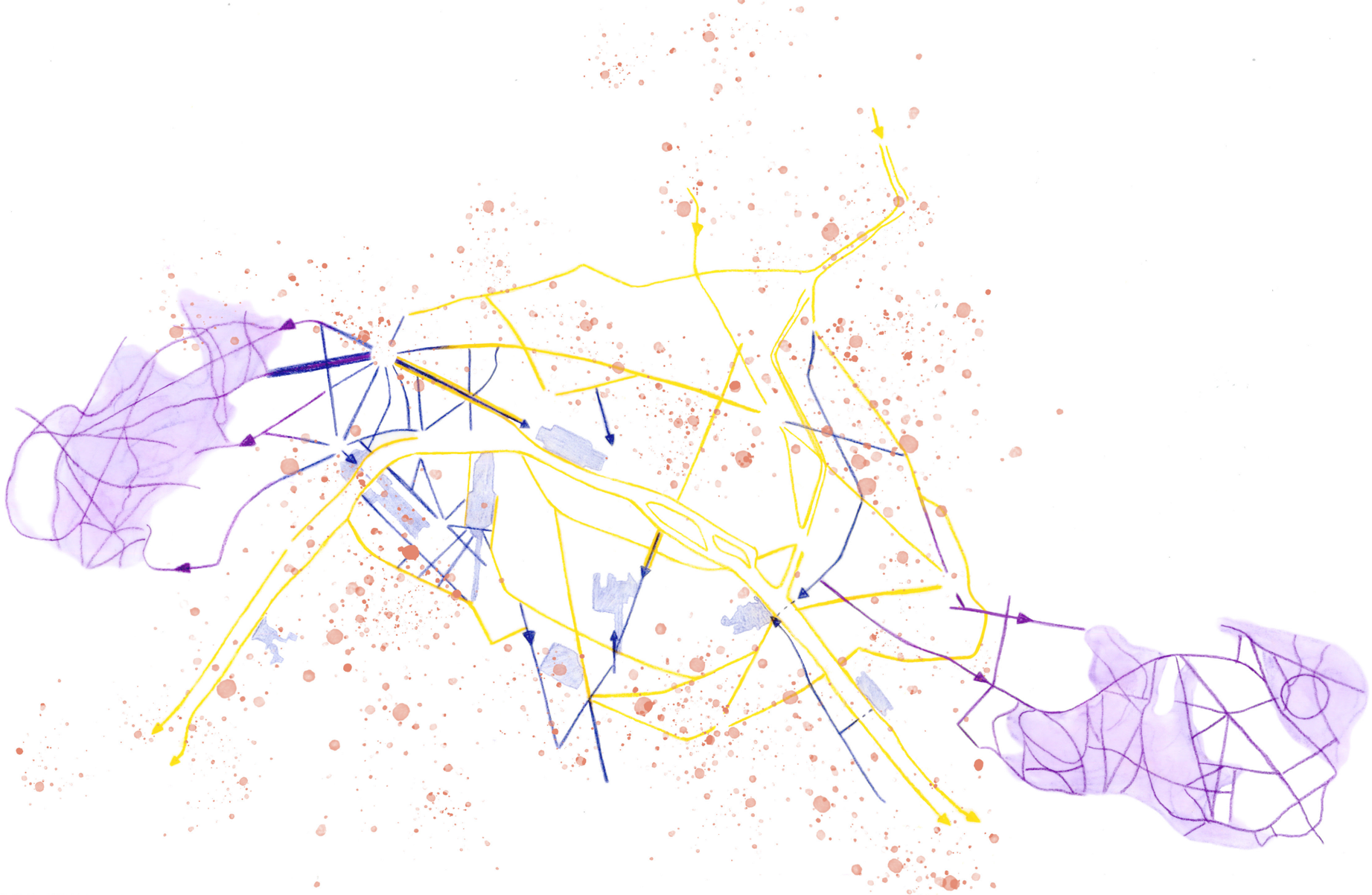
Objective
The goal of this thesis is to design a green structure for the center of Paris that is foremost emotionally meaningful but also spatially coherent. This will be achieved by through the strategic implementation of the four second generation forest typologies: Healing Forest Lines, Social Forest Lines, Focus Forest Lines and Refuge pocket Forests. The typologies are not added to the city as isolated parks and structures but are embedded into the existing infrastructure lines to transform these movement routes into emotionally supportive public environments.

Design Strategy
This thesis proposed a design strategy that aligns the four forest typologies with the existing infrastructural fabric of Paris. Each typology is linked to a specific street typology which makes the spatial logic of the city the foundation for these green forested corridors.
The strategy builds on current municipal initiatives but tries to shift the focus towards the experiential quality of these green spaces in daily urban life. Rather than adding isolated interventions, it proposes a connected forested structure that enhances ecological function while also actively supporting the emotional and sensory needs of residents to offer spaces for focus, restoration, social interaction and refuge along everyday routes.

City Vision

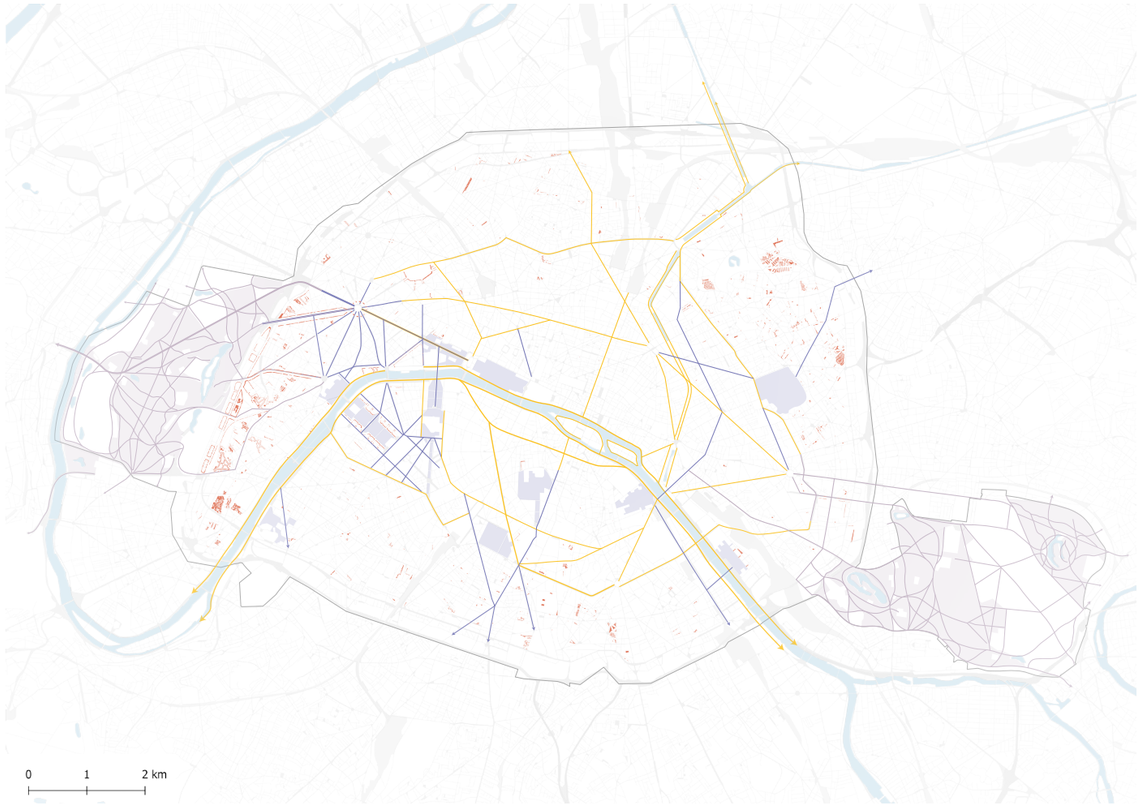
This vision map presents the conceptual idea of this project; the transformation of existing infrastructure lines into a network of new and emotionally differentiated green corridors. This vision focusses on integrating emotionally and sensory values into the spatial structure of the city. Each forest typology is represented again by the four distinct colors; purple for healing, blue for focus, yellow for social and red for refuge. Each one of the typologies has their own function and place within this new green system. The Social Forest lines are wide and central lines that work as a backbone of this green structure that carry urban and social activity. The Healing Forest Lines extend from here to the city's edges to lead people into Bois de Vincennes and Bois de Boulogne. The Focus Forest lines run along the formal gardens and the more axial avenues. At last, the refuge forests are the red dots scattered into the urban fabric for small points of retreat.

The Forest Lines act as carries of spatial identity and try to bring the qualities and atmosphere of the larger green spaces, such as the large forested parks and gardens, into the dense urban fabric. These lines serve both a connective as an experiential purpose. They link fragmented green elements but also offer sensory experiences that echo the character of their representative typologies. In this way, the Forest Lines intuitively guide people through the city towards the more immersive and expansive green structures.



Infrastructure as a Carrier

This strategy map translates the conceptual vision into a spatial proposal and show how the four forest typologies can be implemented across Paris' infrastructural layout. The typologies are assigned to specific infrastructure typologies like boulevards and avenues based on their width, location and social function. In this map the typologies are placed into the existing structures and context of Paris. The Healing Forest Lines follow the more peripheral routes and allées. The Social Forest Lines are concentrated along the Seine and its quays and around the public boulevards. The Focus Forest Lines are aligned with the formal avenues and axial lines in the city. The Refuge Forests are scattered as pocket forests in leftover and underused urban spaces. This strategy map function as a starting point for laying out the tree walking routes presented further in this chapter, and thereby the more specific zoom in designs. It shows how typologies intersect and overlap and how these structures can be embedded into everyday routes across the city.



The New Green Structure; a Biophilic network along the Seine

This map illustrates how the proposed forest typologies form a continuous and strategic green structure in Paris with possibility to stretch into the wider region. The green structure is anchored by the Seine and forms a new green-blue backbone for the city. The forest typologies are not isolated design interventions but link to existing green structures and are therefor part of a larger ecological system.

The Seine acts as a central spatial and ecological axis that links to major parks such as Bois de Boulogne and Bois de Vincennes. The Forest lines connect these two parks through the city and has the possibility to extend beyond the Périphérique. This integrated system support biodiversity corridors, pedestrian and cycling mobility and urban cooling while embedding emotional and sensory experiences along everyday routes.

The green structure reflects both a short term spatial strategy as a long termW ambition to shift towards a more biophilic and climate-adaptive city model. The map communicates the continuity and reach of this vision and positions the framework of the forest typologies as a structural way to shape Paris into the green and healthy city of the future.

A Walk through Paris

Design Concept

This design explores the idea of a 'restorative walk' through the city of Paris. This is done by proposing three walking routes that stretch from Bois de Boulogne in the west to Bois de Vincennes in the east. These three example routes serve as strategic illustrations of how the proposed typological framework can be implemented across different urban conditions.

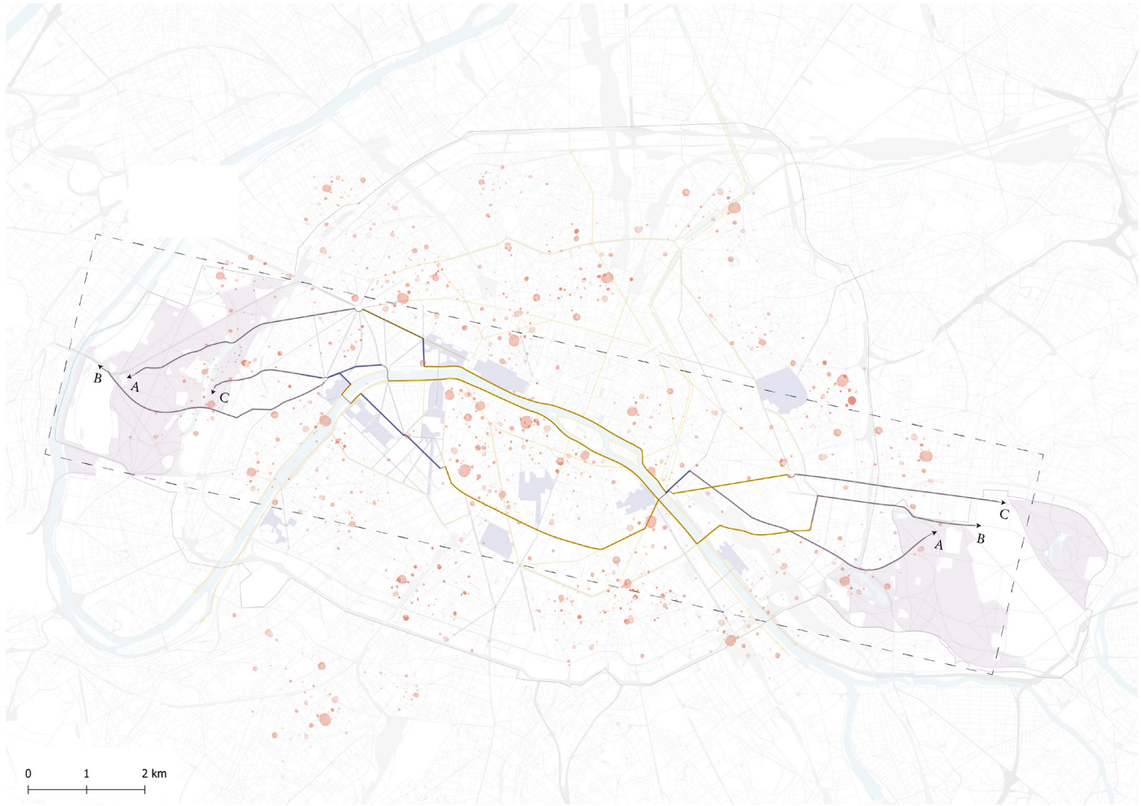
These three routes are selected to highlight the diversity of the Parisian spatial structures and to test the adaptability of the forest typologies in different contexts. Each route connects distinct types of urban infrastructure, such as quais, allées and major boulevards, and passes through varying spatial and sensory conditions. Together, they show how the typologies can be applied along existing infrastructural lines so that they can be embedded within the daily rhythm of the city.

By weaving through infrastructure, historical gardens and public spaces near the Seine, these routes offer layered experiences. They make visible how these forests will be used to transform the city not through isolated interventions, but through continuous and walkable systems. Along the way, transitions between the four forest typologies are shown to respond to their responding density, activity and atmosphere.

This concept also demonstrates how the framework works at the large structural scale of Paris but also at the small-scale plans and details. While only three routes are illustrated here, the strategy is expandible and countless other restorative routes and connections could be developed and designed throughout the city with the implementation of this strategy. 'A walk through Paris' shows a way of experiencing the new and afforested city.

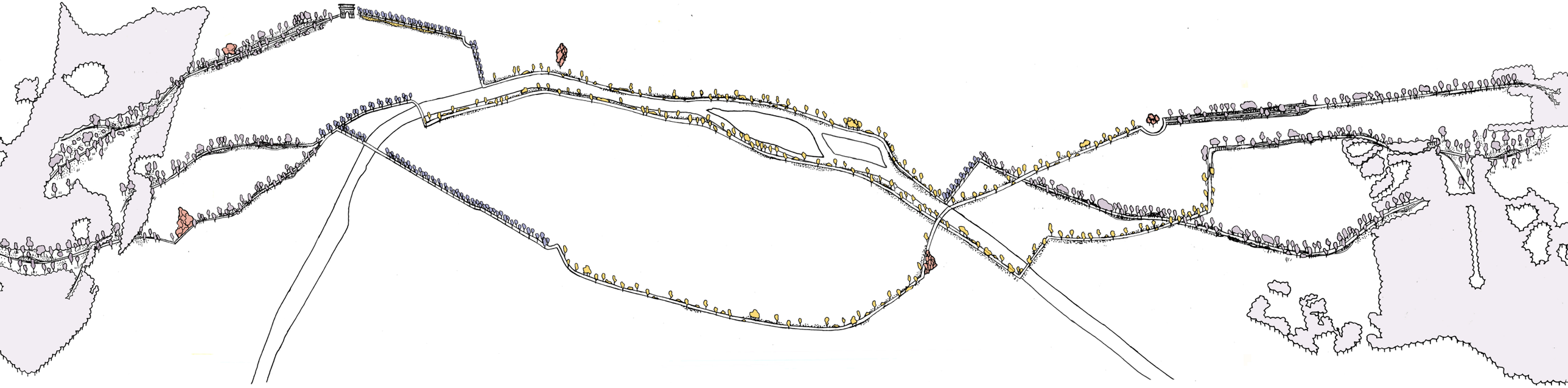
To further explore the spatial potential of the proposed forest typologies, six zoom in locations along the routes have been selected. These sites represent a variety of urban conditions and transitions, and will be used to develop quick, illustrative design studies in the form of plans and cross sections. These 'quick and dirty' plans are not fully detailed proposals, but are intended to show how each typology might manifest and work in that specific context. They are meant to highlight their spatial form, sensorial atmosphere and relationship with the surrounding urban fabric. Beyond their atmospheric and restorative character, these sketches will also reflect ecological and technical aspects of the design, such as tree species, and how their design aligns with the ongoing mobility transition in Paris. Together, they will help connect the emotional dimension of the typologies with their practical and environmental performance.

Three example routes



Design Visualisation Forest Lines

This drawing illustrates how the spatial experience along the three selected routes shifts through the different restorative forest typologies. As visitors move along the routes, typologies alternate and respond to the changing urban context, density and program. Healing Forest Lines offer immersive, calm segments with dense planting and layered canopies. Social Forest Lines introduce more open and vibrant spaces for gathering and informal interaction. Focus Forest Lines create moments of spatial order and rhythm through structured planting. And lastly, Refuge Forests provide small-scale dense and enclosed pockets within the city fabric. Together, these transitions shape a diverse and emotionally layered green network with different experiences embedded within the urban structure of Paris.

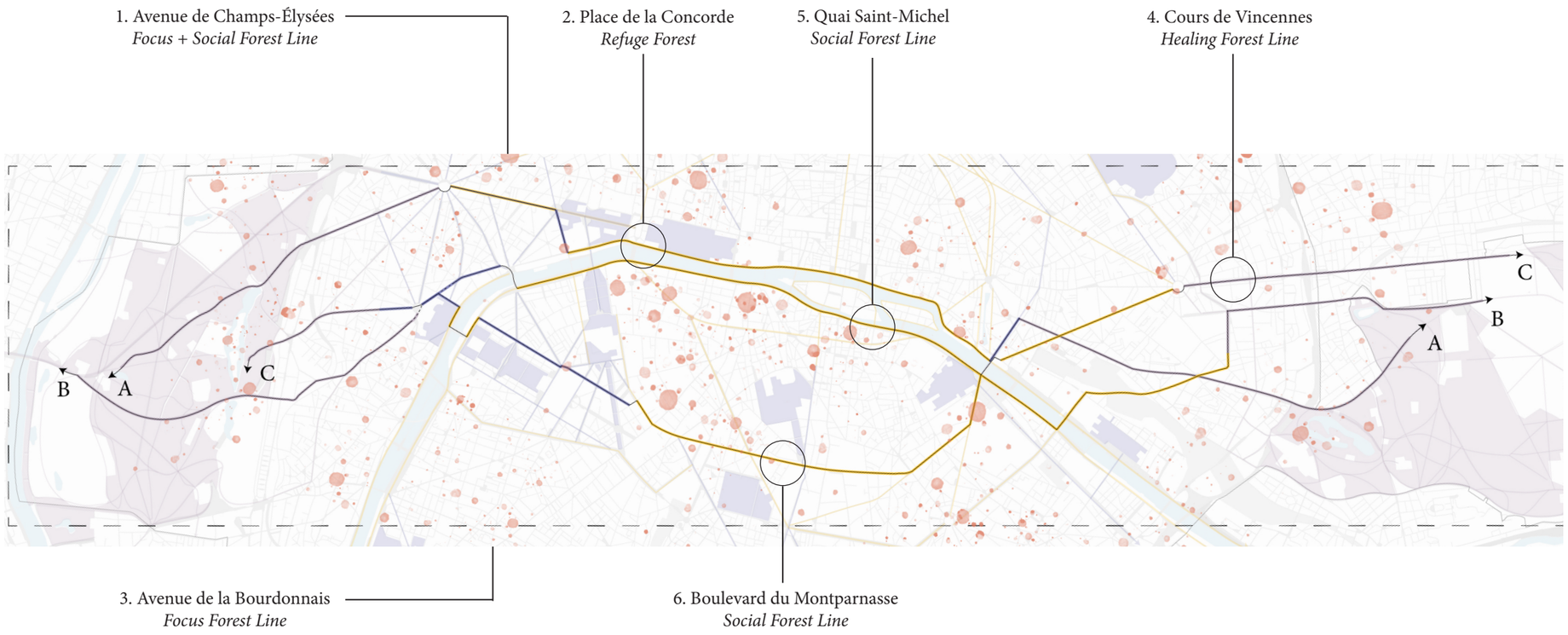


Zoom-in Designs

at Key Points

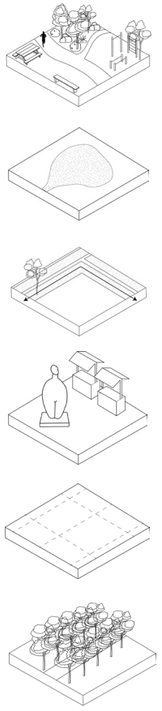
In the following section, the restorative forest typologies are explored through a series of zoom-in designs at six selected locations in Paris. Each location represents a different infrastructural situation within the city, such as boulevards, avenues, squares and quays and demonstrate how these structures can carry their specific forest typology. The applied typologies respond to the spatial structure and function of each infrastructure type and the context of the site, to strengthen the character and experience of each location.

The zoom-ins do not aim to present finalized design proposals, but serve more as spatial explorations that visualize how the forest typologies can transform the atmosphere and experience of the public spaces. Using the previously developed Parisian toolbox and design elements derived from the theoretical framework and case studies, each zoom-in location tries to translate the typologies into possible spatial situations that create emotionally supportive environments embedded within Paris.



Avenue des Champs-Élysées

The Champs-Elysées is one of Paris' most iconic boulevards and offers a highly formal structure that lends itself to the application of the Focus Forest Typology. The design emphasizes the strong spatial rhythm of the existing avenue by maintaining the symmetrical tree alignment, while introducing subtle variations in planting to soften the rigid geometry to also cater to the Social Forest typology. Parts of the roadway are reduced to allow for wider pedestrian areas and additional green space. The route creates structure and sightlines, but also resting spaces and gathering nodes to introduce elements of the Social Forest. In this way, the formal character of the avenue is preserved while allowing movement for more diverse spatial experiences to encourage both movement but also moments to pause within this highly structured urban setting.



PSD Cohesive
Repeated Structure

ART-Extent
Soft Planting

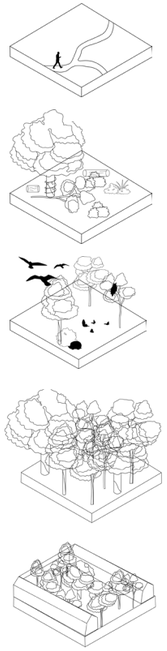
PSD Open
Clearings & Sightlines

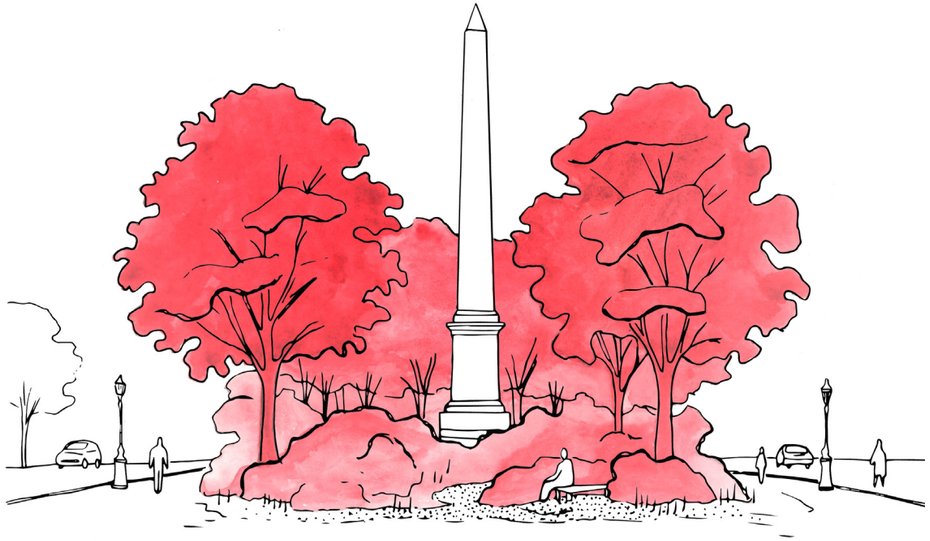
Ncadia
Active Zones

PSD Social
Gathering Nodes

Place de la Condorde

At the busy place de la Concorde, the Refuge Forest typology is introduced as a small woodland pocket within the dense traffic flows of the square. The design here creates an intimate, sheltered space framed by layered tree plating that provides a strong sense of enclosure. Meandering paths invite visitors to slow down and enter the pocket forest to offer a moment of pause and calm within the otherwise highly exposed urban area. The plating emphasizes natural layering, visual screening and spontaneous wild and biodiverse vegetation. This intervention creates a sheltered area within the otherwise open, monumental and busy setting of the square.





Nacadia
Woodland Pockets

Shinrin - Yoku
Framed Paths

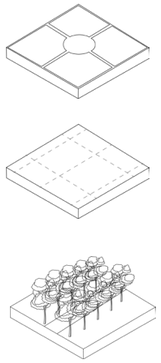
SRT
Sheltered Seating

PSD Shelter & Refuge
Enclosure

PSD Natural
Spontanious Vegetation

Avenue de la Boudonnais

The Avenue de la Bourdonnais provides a clear and highly symmetrical infrastructure line that allows for a strong application of the Focus Forest typology. The design reinforces the axial perspective and sightline towards the Eiffel Tower and emphasizes the visual continuity and spatial rhythm trough evenly spaced (pruned) trees. This strict repetition and consistent materiality creates a calm and ordered atmosphere which offers a sense of orientation and spatial clarity. This formal structure supports quiet movement and cognitive focus within the dense city while the sequential layout gradually guides visitors along the avenue towards the monumental endpoint.



Nacadia
Sequential Layout

PSD Cohesive
Repeated Structure

PSD Cohesive
Consitent Materials

ART Extent
Visual Continuity

ART Compatibilty
Legibility

Cours de Vincennes

The Cours de Vincennes offers the right spatial conditions to introduce the Healing Forest typology. The design transforms to wide boulevard into an immersive, nature-rich corridor with soft and diverse planting. Layered vegetation, seasonal variety and sensory stimuli sich as textures, colors, sounds and subtle water features, e,g. in the form of wadi's, invite visitors to slow down and engage within their surroundings. The irregular planting creates a more organic and enclosed atmosphere to offer a temporary retreat from the busy environment. Walking paths meander through the vegetation with allows for movement but also moments of rest, while the reduced traffic space increases the environmental sustainability of the boulevard.

SRT
Water Features

SRT
Soft Planting

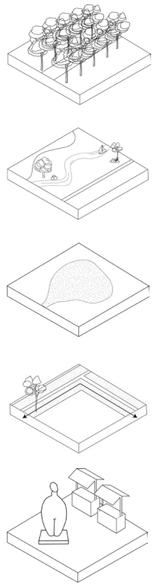
Nacadia
Immersive Planting

Shinrin Yoku
Sensory Engagement

Nacadia
Minimal Stimuli

Quai Saint-Michel

At the Quai Saint-Michel, the Social Forest typology will be applied to create an active and social public space along the Seine. The design introduces open pathways, flexible edges and shared spaces that encourage informal gathering and movement along the waterfront. The tree structure provides shade while maintaining visual openness towards the river. Seating areas, small terraces and more gently sloping edges create a varied topography that allows people to sit, walk and linger close to the water. The combination of active zones and seating areas support social interaction to embrace and make space for the urban business of Paris and to connect this more with the unique waterfront atmosphere of the city.



SRT
Open Paths

Nacadia
Flexible Edges

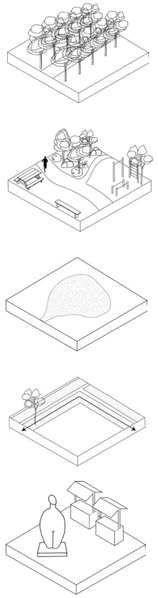
SRT
Shared Spaces

Nacadia Social
Active Zones

PSD Social
Gathering Nodes

Boulevard de Montparnasse

The Boulevard du Montparnasse offers a infrastructure line that is well suited for the implementation of the Social Forest typology. The design transforms the central area into an active and inviting public space, integrating informal seating areas, flexible open lawns and spaces for temporary markets or cultural events. The tree layout is intentionally more loosely structured to create a varied rhythm of open and more shaded areas that encourage spontaneous use and social interaction. Small flowering trees and seasonal plating add sensory variety and visual interest throughout the year, while the central pathway supports movement. The design creates a vibrant urban environment that can be used for everyday activities but also for moments of relaxation and encounter.



PSD Open
Clearings

PSD Diverse
Multisensory

PSD - Culture
Art & Markets

Nacadia Social
Flexible Edges

PSD Social
Gathering Nodes

SHREDDING

Conclusion

This thesis investigates how a theory driven typological framework for urban forests could be designed and implemented in the city of Paris to enhance psychological restoration, while also supporting the ongoing ecological and urban development goals. The project emerged from a dual observation: urban trees in Paris are mainly implemented and valued for their ecological and climate-related functions even though (growing) scientific evidence highlights their potential to support mental health and well-being. Based on theories from environmental psychology, case studies on therapeutic forested landscapes and site specific site analysis and research, a typological framework was developed that tries to connect emotional needs with spatial qualities.

The central research question to this thesis was:

How can a theory-driven typological framework for urban forests be designed and implemented in the city of Paris to optimize residents' psychological restoration, while contributing to the reinvention of Paris as a sustainable, evolving urban space?

To answer this question, the research of this thesis was structured around three sub questions. First, key concepts from environmental psychology were explored in SRQ1. These theories clearly explain how natural environments, like forests, can reduce stress, restore attention and foster emotional well-being.

Next, SRQ2 explored how these theories are applied in practice through case studies of therapeutic forests and healing gardens; the Health Forest Octovia and the Nacadia Healing Forest. These cases were analyzed in combination with the Perceived Sensory Dimensions, a framework to help identify spatial and sensory design principles for restoration.

In SRQ3, insights from theory and practice were synthesized into four universal typologies of restorative urban forests; the Refuge Forest, Healing Forest, Social Forest and Focus Forest. Each typology corresponds to a distinct emotional function, of which there is need in our modern cities. The range from protection and solitude to connection and mental clarity and are grounded in both scientific literature and observed spatial qualities.

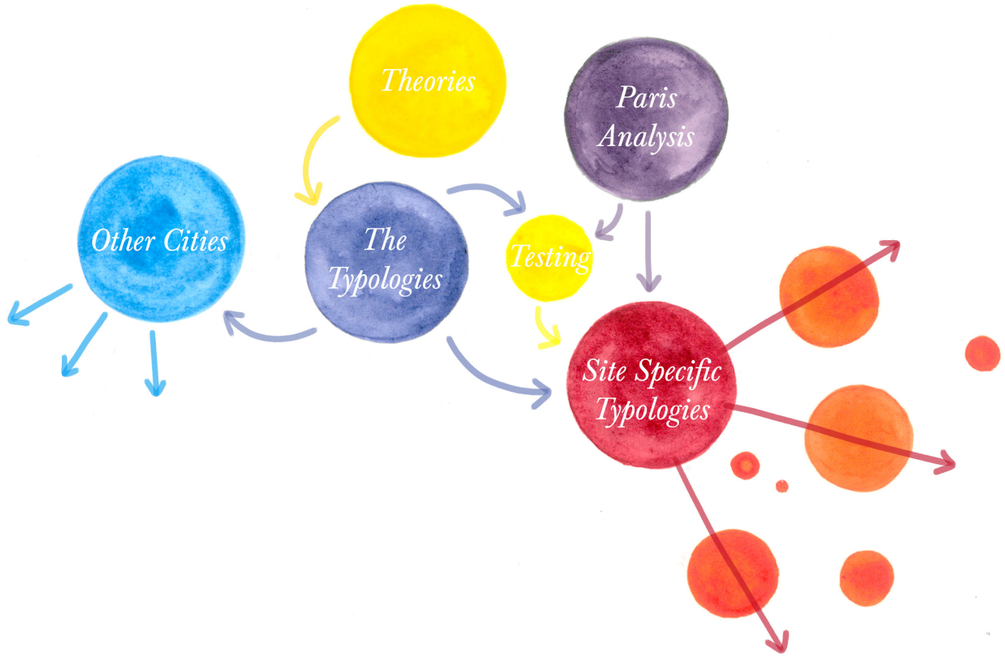
This 'standardized' framework was then applied to the context of Paris through spatial analysis and design research. In this translation step, the initial four typologies were adapted to the urban morphology and infrastructural patterns of Paris. The Healing, Social and Focus Forest were reimagined as linear forest interventions, integrated into existing infrastructure lines based on their spatial quality and function. The Refuge Forest was designed as a small, enclosed, pocket forest typology to offer stillness in the dense urban core of the city.

Together, these interventions form a layered green structure that contributes both to ecological resilience and emotional well-being. Rather than proposing a shift away from these very important climate and biodiversity focused goals, this thesis adds a complementary perspective: one that tries to also recognize the psychological dimension of urban forestry. By positioning restorative forests as part of the city's mental infrastructure, this thesis tries to expand the potential of urban greening. It reimagines trees not only as instruments of environmental care, but also as quiet, spatial companions in the everyday emotional life in the city.

So, to answer the main research question; a theory-driven typological framework for restorative urban forest typologies can be designed by synthesizing psychological theory and spatial case studies into four emotionally responsive forest types. In this thesis, these four types are; a Refuge, Healing, Social and Focus Forest. These can be implemented in a city like Paris by adapting them to local spatial systems, such as infrastructural lines, urban density and green space availability.

Although the was tailored to Paris, the typologies themselves are based on universal emotional needs and spatial principles which also makes them transferable to other urban contexts. Cities around the world that face similar challenges; density, overstimulation and mental vulnerability, could adopt, adapt or extent this conceptual framework to their own context and needs.

This thesis demonstrates that caring for mental health in dense urban cities does not require a separate system, but that this can also be done by rethinking what already exists. Urban forests that are designed with emotional awareness, can play a vital role in shaping more livable, humane, and resilient cities. As the pressure of urban life continues to rise worldwide, the need for spaces that restore the environment as well as the human mind, will only grow. Forests can guide that transition, one tree, one place and one person at a time.



Reflection

This reflection evaluates the results, but most importantly, the process of this thesis. The process involved lots of different steps; writing a theorical framework, conducting design research and case studies, and finally the designing itself. I will reflect on the effectiveness of my approach, how feedback shaped my process and what I have learned from my own work. This reflection critically considers the relevance of this thesis topic within the broader field and its balance between research and design. The two-self developed questions are included at the end of the reflection to further question the broader implications of the project.

My graduation project is done within the MSc Architecture, Urbanism and Building Sciences; the Landscape Architecture track. The lab that this thesis lies within in the Urban Forestry graduation lab. Urban Forestry is concerned with the integration of trees and forest into urban contexts; precisely what this thesis tries to achieve. Using the developed framework of the four forest typologies, the goal is to afforest the city of Paris in a city specific way. This topic aligns with the discipline of Landscape Architecture as it explores how spatial design can meditate the relationship between people, but also broader issues, such as mobility transitions and environmental resilience. This contributes to the idea that landscape architecture can address complex urban challenges through integrated and site specific designs. The forest typologies are designed to enhance human well-being and biodiversity but also spatial legibility across the city which aligns with the interdisciplinary character of landscape architecture. However, I did realize that my strong theoretical focus occasionally distracted from the actual design and experiential aspect of landscape architecture.

The initial start of my project was highly research-driven. The development of the first version of the forest typologies was based on literature from environmental psychology, biophilic design, sensory landscape theories and case studies. This rich theoretical base allowed me to define clear goals and spatial principles for each typology. These theoretical insights formed the foundation of the first version of the typologies and their conceptual framework.

Following this, I did a spatial analysis of the context of Paris to identity patters, limitations and opportunities for the potential of adding more green space in the form of forest to the city. This included a historical analysis of Paris' green development and a review of its current and planned greening (urban forestry) projects. The analysis of different green spaces in Paris, divided into distinct categories, let to the formation of a site specific toolbox. This was done to be able to look back at this toolbox when implementing the theoretical typologies to not lose a grip on the typical and important character of Paris.

The excursion to Paris was done in this phase to test out the initial typologies which led to the formation of the new (second generation) typologies due to the sticker interviews and on site observations. This marked an important shift of the use of abstract theories into placing the typologies into the real world and context of Paris with its own challenges and opportunities. This again, led to further analysis to make the base for the second typologies stronger and even more specific to Paris. This then led to the vision map and the design of the 'forest line' to show how this concept works and what is spatially looks like.

As described above; the process of this thesis was not linear, but kept moving and shifting between design, analysis, research and precedent studies. This aligns with the 'four-table method' that my first mentor René described in the first phase of the thesis. It states that these four methods should be done parallel to each other so one can feed back into another, rather than them being done in isolated steps. The interplay between these methods allowed this project to keep evolving, as I kept checking whether the theory worked within the design and visa versa.

My methodology allowed for a systematic translation of emotional needs into spatial tools and concepts. For this, I followed a very structured approach which sometimes led to a schematic way of thinking instead of a lot of creativity.
However, I do really value the wide range of methods I used for this thesis; literature studies, embedded research, the Paris excursion and the spatial analysis, as each one of them brought different kinds of insights. This diversity kept the thesis process rich and exiting, but also contributed to a sense of chaos at times. I often jumped from one topic or idea to another, changed directions more than once, and sometimes struggled to maintain a clear overview. While this jumping around helped me to explore different angles and eventually brought depth into the project, it also made it hard for me to keep the path from research and analysis to design clear, especially before even getting to the design phase. That is something that I now recognize as an area for improvement; finding a clearer line earlier on and allowing the design to take shape sooner in the process, especially experimenting with this.

My graduation project holds societal relevance due to the increasing urgency of addressing mental health issues within dense urban environments. Urbanization will keep accelerating and this makes access to restorative green spaces even more essential to support mental and physical well-being. By proposing this framework to afforest Paris, this thesis aims to make nature more accessible and meaningful, and directly integrated into everyday urban life.

Professionally, this thesis contributes to the evolving discourse on urban forestry and nature based solutions. It explores how urban forests can serve as multi-functional spaces that not only provide ecological benefits but can also mitigate psychological stressors inherent in city life. This project also offers spatial tools and strategies for other cities to adapt to similar city contexts that can potentially inform their policy and design.

Academically, this project adds to the body of knowledge on the human-nature relationship; especially within the field of therapeutic landscapes. It uses theories from environmental psychology and landscape architecture to create a theoretically grounded framework grounded in emotional needs.

Ethically, the project raises questions about inclusivity and accessibility. Who is this framework for? Who will use it and how can it be equitably distributed across the city? The framework strives for broad applicability, ongoing reflection is needed to ensure that these interventions respond to local needs and that is does not reinforce the existing inequalities in urban green space distribution.

This typology based framework is designed to be transferable, but will not be universally applicable. It will need to be changed and adapted for different cultural, climatic and ecological differences in other cities. For example, the experience of a healing forest in Paris will differ significantly from one in another city. In the appendix, the different green structures of other Western European cities can be seen. As imaginable, the application of these typologies will work very differently in one of these cities.

- **To what extent does designing for human emotional needs risk overlooking the needs of non-human species and the environment?**

Designing for human needs can definitely risk overlooking the broader context of environmental and planetary concerns if not approached with care. My framework aims to enhance well-being through the typologies, but it also became clear to me that these interventions should also contribute to topics such as biodiversity, climate resilience and environmental restoration. There lays a danger within designing landscapes solely for human benefits rather then acknowledging them as vital components of larger living systems.

As this thesis progressed, I realized that the environmental concerns became a bit of an underlying layer, rather than something un the foreground of the project. Especially as I became deeply immersed in the emotional and psychological dimension. However, I do strongly believe that this topic should go hand in hand with bigger environmental goals. I did try to keep thinking about this topic, and tried to ensure that each intervention was also rooted in broader environmental strategies; such as supporting biodiversity, promoting habitat continuity

or climate adaptive trees and planting. This topic remains an ongoing challenge and highlights the importance of this constant reflection and rebalancing between human-centered and more than human design and priorities.

- **How did working with multiple angles and changing topics throughout the process influence the development of your thesis?**

The process of this thesis was far from literature. I explored many different angles, topics and methods. I also changed the direction of this thesis multiple times, particularly in how I defined the forest typologies and their applicability to Paris. Initially, my thesis focused on solely on forest bathing and sensory design, with the idea of designing spaces for immersive and sensory-rich nature experiences. Later, I considered structuring the thesis around the topic of: 'Healthy Human, Healthy Forest and Healthy Planet', which explores the interrelationships between these tree domains. At a very early stage, I looked into comparing different forest types across the world; to aim for a more global scope.

All of these shifts did make to process somewhat chaotic which made it difficult for me to steer this thesis into a clear direction. Also choosing a Site was a major challenge as I struggled to decide between different locations, which delayed the start of my design phase. Eventually, I conducted a site selection analysis across various Western European Cities (can be found in the Appendix), which led me to choose Paris as the most suitable context.

Despite the chaos, this non-linear approach allowed the project to stay dynamic and layered. Each new angle added a different lens to the project; the literature grounded the conceptually, the Paris excursion made it more spatial and the design process brought is together in a vision. While it was overwhelming at times, the diversity of the methods and perspectives kept the process exiting and enriched the final outcome.

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Images and Figures

Image 1. Kamperman, L. (2025). Map of Paris generated in QGIS using Google Satellite imagery. Source: Google Maps (Imagery © Google, Maxar Technologies, CNES/Airbus, etc.).

Images 2. Okulicz-Kozaryn, A., & Valente, R. R. (2018). Livability and happiness in cities around the world. Retrieved April 16, 2025, from https://doi.org/10.1016/j.cities.2018.04.008 (Graphs reproduced from original article).

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Image 6. Kamperman, L. (2025). Diagram based on Stress Reduction Theory (Ulrich, 1991). Self-produced visual interpretation.

Image 8. Kellert, S. R. (2008). Biophilic design: The theory, science, and practice of bringing buildings to life. Wiley. (Diagram reproduced from original publication).

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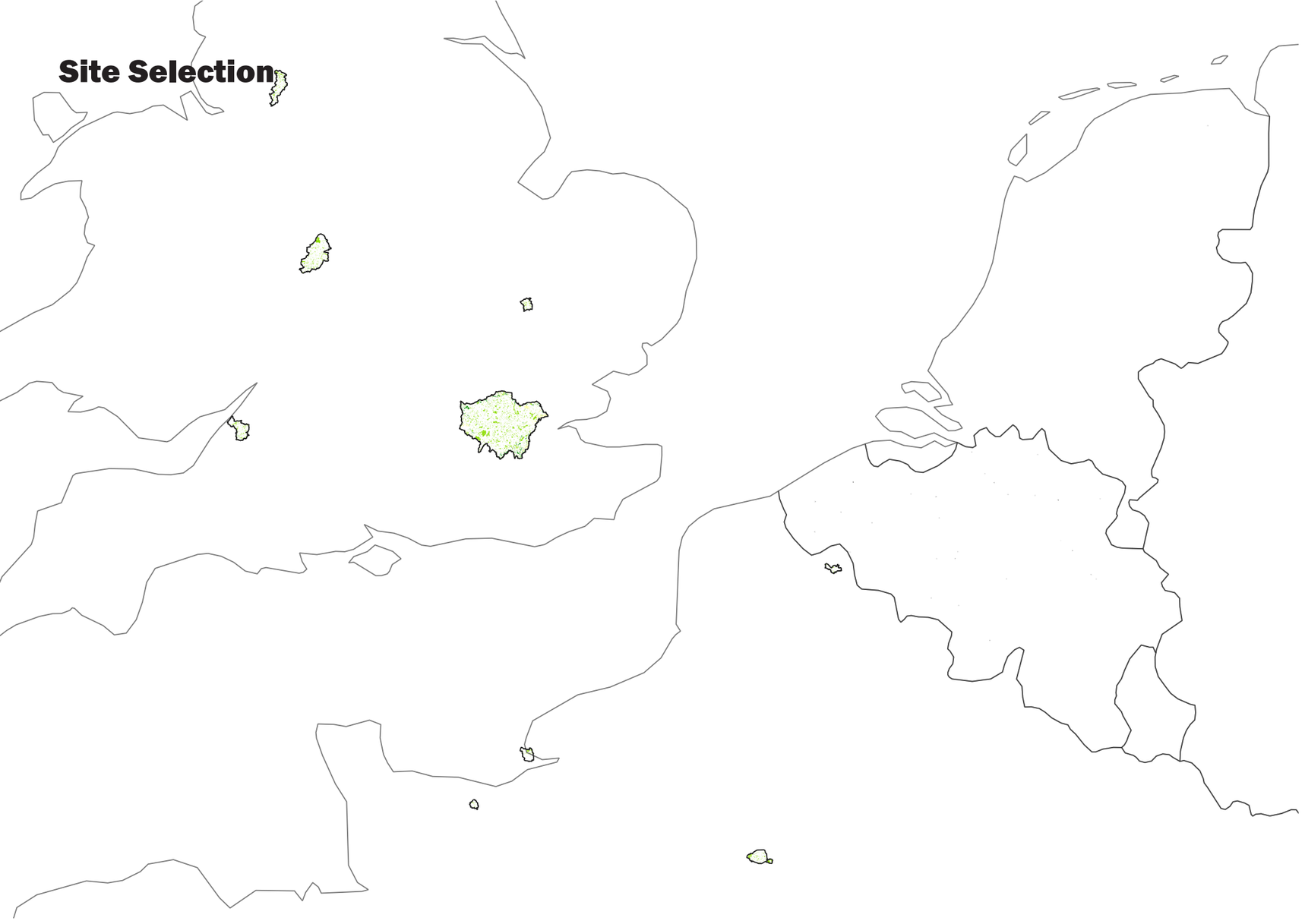
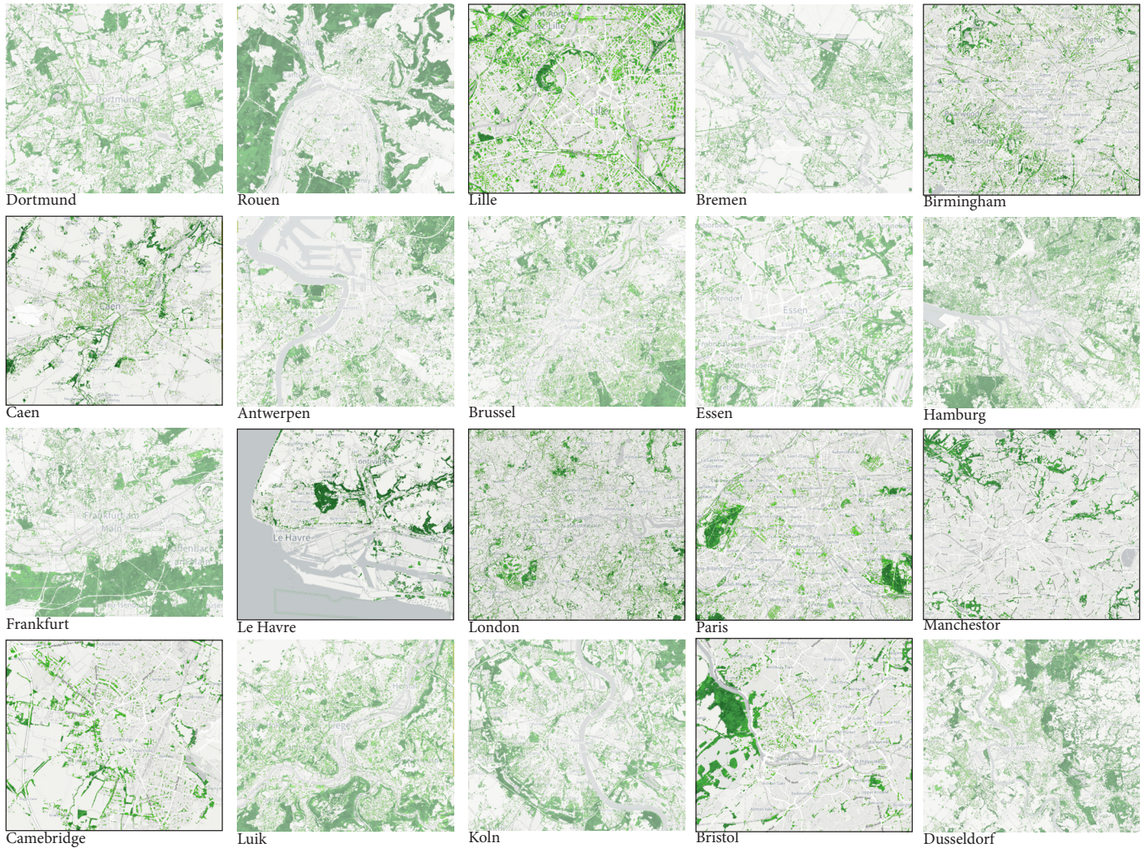
APPENDIX

Site Selection



What are the conditions in nearby cities regarding tree coverage, mental health, and living environment, and which city would make a strong candidate for the application of this urban forest framework?

Tree Cover Canopy Comparison (within 500km of Delft)



Green Structure Comparison

To determine a suitable case study for this thesis. the green structure of cities within a 500km radius of Delft was compared. To do this, the Copernicus Tree Height dataset was consulted. This provided a clear visual overview of urban tree cover which revealed significant variations between cities. Paris, along with a view other cities, like London and Cambridge showed notably sparse tree canopy coverage.

From these initial selected cities, nine cities with relatively low green presence were selected for a more detailed and further analysis. Using GIS tools, I examined factors such as forested area, urban green surface, green space distribution and population density. For this, the datasets Tree Height and Land Use Data from Copernicus were used to calculate the data and numbers in the table below. However, it should be noted that some numbers might not be correct due to the calculations of the author or due to the possibility that the interpretation of 'forest' from Copernicus might differ then that of the author.

For Paris, the estimated forest coverage (Copernicus, 2018) would be only 1,36% according to the land use data. While this number should be interpreted with caution, it aligns with the broader conclusion that the city lacks both quantity and equitable distribution of green space. This makes Paris a highly relevant test case for exploring spatial strategies that integrate restorative forest typologies into the urban fabric.

TESTS	Lille	Caen	Paris	Le Havre	London	Cambridge	Bimingham	Manchestor	Bristol
Inhabitants	1.085.200	110.624	2.145.906	166.058	8.866.180	146.995	1.157.603	568.996	472.500
Size (km2)	142,39	25,7	105,4	46,86	1572	40,7	267,77	116,00	110,24
Forest area (km2)	0,06	0,35	-	0,21	55,23	0,67	1,52	1,92	3,33
Perentage forest	0,04%	1,36%	-	0,45%	3,51%	1,65%	0,57%	1,65%	3,02%
Urban green area (km2)	2,73	1,77	17,88	6,17	165,34	5,04	28,44	15,17	14,1
Percentage urban green	1,91%	6,89%	16,95%	13,17%	10,52%	12,39%	10,63%	13,06%	12,78%
Percentage urban green + forest	1,95%	8,25%	16,95%	13,62%	14,03%	14,04%	11,20%	14,71%	15,80%
Air quality (AQI)	31	24	43	28	28	26	36	34	35

Percentage urban green outside of center	10,26%

Questions	(IT) Palermo	(EL) Athens	(TR) Istanbul	(AL) Tirana	(IT) Naples
People satisfied with living in their city	10	9	8	7	6
People satisfied with public spaces in the city	7	10	3	5	9
People satifsied with the quality of air in the city		6		5	
People satisfied with the noise level in their city	9	7	8	6	3
People satisfied with the cleanliness in the city	10	5			6
Life satisfaction		10			
Place satisfaction		10			
How do you feel in your day-to-day life? (Country)	10				
Have you had any emotional or psychosocical problems? (Country)		5			
Totaal	**46**	**62**	**19**	**23**	**24**

Questions	(SRB) Belgrade	(IT) Rome	(MK) Skopje
People satisfied with living in their city	5	4	3
People satisfied with public spaces in the city		1	4
People satifsied with the quality of air in the city	2	3	10
People satisfied with the noise level in their city		1	5
People satisfied with the cleanliness in the city	1	9	7
Life satisfaction		8	
Place satisfaction		4	
How do you feel in your day-to-day life? (Country)			
Have you had any emotional or psychosocical problems? (Country)			
Totaal	**8**	**30**	**29**

Questions	(MLT) Valetta	(GR) Heraklion	(ROU) Burcharest	(POL) Kraków	Paris
People satisfied with living in their city					
People satisfied with public spaces in the city	8	6	2		
People satifsied with the quality of air in the city			9	8	7
People satisfied with the noise level in their city			10		2
People satisfied with the cleanliness in the city			2		3
Life satisfaction			7		3
Place satisfaction			6		3
How do you feel in your day-to-day life? (Country)					3
Have you had any emotional or psychosocical problems? (Country)					
Totaal	**8**	**6**	**36**	**8**	**21**

(IT) Turin	(CZE) Ostrava	(BG) Sofia
6	1	
		4
		4
		2
		5
	8	
6	**9**	**15**

Questions	(BEL) Brussels	(FR) Marseille	(LV) Riga	(ESP) Madrid	(HU) Budapest
People satisfied with living in their city					
People satisfied with public spaces in the city					
People satifsied with the quality of air in the city					
People satisfied with the noise level in their city					
People satisfied with the cleanliness in the city			8		
Life satisfaction	5			4	1
Place satisfaction					3
How do you feel in your day-to-day life? (Country)	1	3	6	5	5
Have you had any emotional or psychosocical problems? (Country)				6	
Totaal	**6**	**11**	**14**	**9**	**17**

(HU) Miskolc	(ME) Podgorica	(TUR) Istanbul	(PT) Lisbon
2	1		
		9	6
		7	8
5			3
			4
7	**1**	**16**	**21**

As a second step in this Analysis, the experience of quality of life and mental well-being in different European cities was explored and analyzed. This involved systematically reviewing the following resources:

- Quality of Life in European Cities 2023 (Eurobarometer)

- Mental Health and Urban Living (Mental Health Report FL530)

- Livability and Subjective Well-Being Across European Cities (Okulicz-Kozaryn & Valente, 2019)

From these sources, relevant aspects were extracted, such as satisfaction with city life, public space, noise level, air quality and cleanliness. To synthesize this information, a scoring system was developed; the lowest-ranked city per indication received the highest score (10 point), the next lowest received 9 points, and so on. This resulted in a cumulative score per city across all documents.

Paris consistently appeared among the lowest – scoring cities, particularly with regards to mental health outcomes, perceived quality of public space and general life satisfaction. With a total of 21 points, Paris ranked near the bottom of the selection. Combining this information with the spatial analysis of green space, this reinforces the conclusion that Paris represents a highly relevant and urgent context for testing the restorative urban forest typologies.

Tree Species in Paris

1. *General Information*

tree	english name	height and spread
Platanus	plane	10-15, 12-20
Aesculus	horse chestnut	8-12, 8-12
Tilia	linden	10-15, 10-15
Acer	maple	6-12, 6-10
Styphnolobium	japanese pagoda tree	6-12, 6-10
Prunus	prunus	5-10, 5-8
Fraxinus	ash	8-15, 10-15
Quercus	oak	8-15, 10-15
Pinus	pine	8-12, 6-10
Celtis	hackberry	6-10, 6-10
Pyrus	pear	5-10, 5-8
Carpinus	hornbeam	6-10, 6-10
Corylus	hazel	4-8, 4-6
Populus	poplar	6-12, 6-10
Malus	apple	4-8, 4-6
Ulmus	elm	6-12, 6-12
Robinia	black locust	6-10, 6-8
Taxus	yew	3-6, 2-3
Gleditsia	honey locust	8-12, 8-10
Betula	birch	6-12, 6-10

tree	spatial qualties	environmental qualities
Platanus	dense cannopy	cool area, filters air pollution, preservations of habitats
Aesculus	symmetrical canopy, prominent form	provides shade, supports pollinators, sensitive to drought
Tilia	broad canopy, calming appearance	supports pollinators, tolerates urban conditions
Acer	ornamental tree, controlled shape	autumn interest, supports insects
Styphnolobium	airy structure, light-filtering canopy	nitrogen-fixing, urban stress tolerant
Prunus	compact form, seasonal accent	early bloom provides nectar, low shade
Fraxinus	large, open crown	fast-growing, good CO2 absorber
Quercus	large canopy, deep shade	supports biodiversity, long lifespan
Pinus	conical shape, filtered shade	evergreen, absorbs pollutants
Celtis	irregular branching, medium canopy	adaptable, drought resistant
Pyrus	round crown, human scale	urban tolerant, low maintenance
Carpinus	tidy, compact form, ideal for hedges	good urban tolerance, supports wildlife
Corylus	shrub-like, multi-stemmed	supports pollinators and birds
Populus	tall, narrow crown	fast-growing, wind and air filter
Malus	small tree, accessible height	supports pollinators, seasonal interest
Ulmus	wide branching, arching form	shade, wind protection
Robinia	light canopy, upright form	nitrogen fixer, urban stress tolerant
Taxus	low, compact form	evergreen, filters air
Gleditsia	open canopy, light shade	urban tolerant, supports insects
Betula	light crown, vertical trunks	fast growing, pioneer tree

color and texture	sensorial qualities
rough texture, large lobbed leaves	urban noise reduction, lot of shade
dark green glossy leaves	flower clusters, large leaves, shade
heart shaped leaves	fragrant flowers, soft rustling leaves
smooth bark, seasonal color change	vivid autumn colours, smooth bark
	elegant leaves, seasonal white flowers
colored spring flowers	showy flowers
dark green leaves, coarse	coarse leaves, rustling sound in wind
rough bark, acorns	rugged bark, acorns, majestic presence
needles,	pine scent -> associated with forest
rough bark	rough bark, small berries
glossy leaves, white blossems	blossoms in spring, glossy leaves
smooth bark, winged fruits	fine foliage, winged fruits
heart shaped leaves, small flowers and nuts	nuts, catkins, soft leaves
white bark	fluttering leaves, sound in wind
white to pink flowers	flowers, small fruits, fragrance
dark green leaves	dense leaves, textured bark
	fragrant white flowers, thorny branches
needles, red berries	dense needles, dark form
feather like leaves	fine textured foliage, filtered light
white bark, peeling bark	white bark, fluttering leaves

special	location
tree used with Hausmanization	major boulevards, plazas
flowers attract bees; conkers used in children's games	parks and wide boulevards
used in herbal teas, attracts bees	streets, parks, squares
Japanese varieties highly valued in design	formal parks, boulevards
blooms late summer, rare in Europe	urban squares, wide avenues
early blooming signals spring	parks, ornamental street edges
vulnerable to ash dieback disease	street trees, parks
hosts hundreds of species	urban parks and forests
pine scent has calming effect	wooded parks, edges of city
used in rewilding and resilience planting	mixed urban areas, edge zones
ornamental and edible varieties	street corners, plazas
responds well to pruning and shaping	formal avenues, garden borders
hazelnuts attract wildlife	forest edges, mixed plantings
used in windbreaks and fast reforestation	along rivers, large streets
edible apples, attractive to wildlife	parks, schoolyards, edible landscapes
used historically in city avenues	urban boulevards, plazas
high ecological value despite invasiveness	urban woodlands, pioneer plantings
toxic but medicinal, used in cancer drugs	formal hedges, cemetery plantings
lets light through in dense urban areas	plazas, narrow streets
white bark gives winter interest	parks, wild corners, edges

2. *Typology Suitability*

Tree	Healing	Social
Platanus	blocks noise, big canopy	large shade, good place to gather under
Aesculus	large leaves and shade.	large canopy and fragrant flowers.
Tilia	fragant flowers	large shade and nice scent
Acer	calming autumn colors	clear crown, allows visual connection in social spaces
Styphnolobium	light canopy	fragant flowers, dense folliage
Prunus	fragant flowers, beauty	blossems make it attractive in social spaces, focal point
Fraxinus	broad presence, moving canopy is calming	shade tree for gathering in parks
Quercus	strong presence	large canopy
Pinus	pine scent has therapeutic effects	
Celtis	irregular form and bark offer tactile qualities	used in urban rewilding, shade in streets
Pyrus	calming sight of flowers and fruits	fruit picking, flowers
Carpinus	dense foliage and strong trunk	broad canopy
Corylus	small nuts	harvestable nuts, shared memory
Populus	leaves can make a calming sound	focal point
Malus	fragence of blossems	fruit picking
Ulmus	strong presence	classic city tree, planted in rows
Robinia	soft foliage and filtered light	light shade tree in open areas
Taxus	healing meaning	used as low green walls or background
Gleditsia	filtered light creates soft play of light and shadow	interesting pods
Betula	rustling sound of birch leaves	soft presence and bark interest attract people

Tree	Refuge	Focus
Platanus	Blocks noise, reduces heat.	
Aesculus		bold foliage and symmetry can guide movement
Tilia	broad canopy creates sense of protection.	quiet rustling of the leaves
Acer		vibrant colors are stimulating
Styphnolobium	moderate shade and informal structure	light-filtering foliage gives rhythm and legibility
Prunus	offers seasonal refuge during flowering, human scale	
Fraxinus	large form.	strong vertical structure helps frame spaces
Quercus	dense thick canopy. Shelter from noise etc	
Pinus		simple calming form
Celtis	informal structure provides sense of retreat	dispersed form allows layered views
Pyrus	dense flowering creates temporary hideout	seasonal colour and bloom as accent
Carpinus	thick sturdy structure makes a good refuge	
Corylus	thicket-like form offers hiding and biodiversity	celtic tradition
Populus	tall, fast-growing sheltering element	silver popular sound
Malus	dense structure offers refuge and scent	flowers and fruit create focal seasonal event
Ulmus	dense canopy. Shelter for elements and noise	clear base and canopy create spatial clarity
Robinia	resilience and adaptivity	open structure allows compositional clarity
Taxus	low evergreen cover for secluded spots	symbolic sculptural use, framing views
Gleditsia	offers retreat with its delicate foliage	gentle guide tree along walkways
Betula	light but enveloping group planting	nice sound, and interesting shape to look at

This appendix presents an overview of the twenty tree species that informed the typology-based tree catalogue. The selection includes the species most commonly found in the Parisian urban landscape.

This part of the appendix contains of two parts:

1. General Information

Each species is described according to each botanical, spatial, ecological, sensory and functional qualities. This multi layered profile serves a the foundation for the typological placement and design application.

2. Typology Suitability

All species were assessed for their relevance to the four forest typologies. This assessment is based on both sensory and ecological characteristics, such as sound, scent, symbolic meaning, grown structure and adaptability. Many species appear in multiple categories with context-specific motivations.

Based on these tables, a curated selection of 'best fit' species was made per typology. This final selection can be found in the report in the Tree Catalogue, were the twenty trees are listed with their ability to evoke one or more of the specific restorative atmospheres of the four typologies.

Master Thesis - Lara Kamperman