Urban Nature for Well-being:
Design Recommendations for Psychological Benefits in Urban Public Spaces

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A thesis submitted in partial fulfillment of the
requirements for the degree of

Master of Urban Planning

University of Washington
2017

Committee:
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Program Authorized to Offer Degree:
Department of Urban Design and Planning

University of Washington

ABSTRACT

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Urban nature is an important contributor to human health and well-being in urban areas, and must be integrated into the public realm. Cities such as Seattle that are experiencing population booms are concentrating growth in urban areas and are becoming more dense. The increased density leads to a decrease in natural spaces, but also provides opportunity to design public spaces to be more efficient in terms of providing people with exposure to nature. This thesis shows the benefits of nature in cities, particularly the psychological benefits nature provides to urban residents. Recognizing and appreciating the social value of nature, this thesis aims to demonstrate ways in which nature can be cultivated in the city to harness the benefits to human psychological well-being and to recommend ways in which natural features can be incorporated into urban public space design to help facilitate this. A literature review of the current science behind the effects of nature on human health and well-being and effective public space design combined with three focusing on sensory qualities case studies of natural public spaces in Seattle to inform the final recommendations of this thesis. Examples of how these recommendations might be implemented are shown in the context of a site in Lake City, a neighborhood in Seattle experiencing increased densification. The lessons learned are intended to be transferable to other urban areas that are becoming denser, as ways to integrate nature into the public realm as these areas continue to develop. This thesis aims to provide a foundation for thinking more critically about the human relationship with nature in urban areas and how public space design can be used as a way of improving the psychological well-being of people in the urban environment.

ACKNOWLEDGEMENTS

I would first like to thank my thesis committee, Manish Chalana and Julie Johnson, for their valuable guidance and feedback throughout this process. I am also grateful to Nancy Rottle for her help with generating topic ideas and for suggesting important avenues of research. Thank you to Kathy Wolf, Kathleen Conner, and Debra Guenther for their insights into my case study sites.

Thank you to my parents for instilling in me an enthusiasm for the outdoors and ever-growing appreciation of nature. And thanks to all of my family for their constant support and love. Thank you Teo for our daily walks. Thank you to my friends near and far, roommates, and classmates for your friendship, guidance, and encouragement.

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Introduction

Background

For the first time in human history, the majority of the world's population is living in urban areas1. This global shift from rural to urban areas is a relatively new phenomenon; in 1950, only 30 percent of the world's population was urban, and by 2014 that number had jumped to 54 percent2. According to the latest projection by the United Nations, there will be an estimated 1.35 billion new urban residents by the year 20303. Cities are the confluences of intellectual collaboration, and the source of much of humanity's creative innovations, wealth generation, and economic growth4. Yet urban areas are also the sources of much of the world's pollution, diseases, and social injustices5. Rapid urbanization and development presents a great challenge to urban planning professionals to manage this growth in a way that ensures the health and well-being of urban residents. The time is ripe for reimagining our urban areas as places where humans can benefit from not only increased social interaction, but interaction with nearby urban nature as well.

In an attempt to manage population growth, many jurisdictions are implementing policy to curb sprawl into rural lands by concentrating growth in urban areas. These policies, such as Washington State's Growth Management Act, intentionally create an increase in urban population density. Urban density has many potential benefits, including the protection of critical environmental areas, efficient use of services and infrastructure, and improved quality of life. However, as urban areas become denser, the potential economic value of development often takes precedence over the

[1] (WHO, 2010)
[2] (United Nations, 2014)
[3] Ibid.
[4] (Bettencourt, 2010)
[5] (Harvey, 2009)

value of preserving natural spaces in cities. As a result, natural spaces in urban are becoming smaller and more fragmented. This poses a great threat to the ecological health of the landscape, and subsequently, human health and well-being. Urban nature provides important benefits to humans such as improving air and water quality, and plays a vital role in supporting ecosystems within and around cities. Too often in cities there is a disregard for the need for healthy urban nature, and as a result both humans and nature suffer.

Definitions of "nature" are as varied as they are contested. Nature can often be referred to as anything other than humans and human-manufactured things. Others consider nature to be anything and everything in existence, including humans and the built environment. Acknowledging the limits of distilling the concept of nature into a single definition of physical presence, for the purposes of this thesis **nature** is defined as any living outdoor flora and fauna, which includes vegetation as well as non-human living organisms such as fungi and urban wildlife. **Natural elements,** when mentioned in this thesis, are the individual living organisms themselves and the non-living natural resources of air, water, sunlight, rocks, and soil. Although natural elements can and do exist indoors, the focus of this research is on nature in **public spaces**, which are defined here as outdoor spaces that are physically accessible to the general public. **Urban nature** is defined as the presence of natural elements in an urban environment in the public realm. Examples of **urban nature typologies** include rain gardens, bioswales, rooftop gardens, community gardens, street trees, parklets, pocket parks, vertical gardens, and activated alleys. The presence of urban nature is often defined by terms such as "green" or "open" space. These terms are frequently used, but do not provide ample description of the complexity of urban nature typologies- natural features are not always green in color, nor are they always particularly open or spatially expansive. As an alternative, these types of spaces will be referred to as **natural spaces**: a space where the majority of

the site is covered with trees, grass, shrubs, and other living vegetation.

The built environment alone is not enough to sustain human life- we need nature to thrive. We rely on nature for fresh air to breathe, for the food we eat, the energy we consume to power our societies, and the water we drink. Research shows that humans are becoming increasingly disconnected from nature, and in part this disconnect is to blame for rising rates of obesity, anxiety, and depression in the industrialized world. This concern is seen most acutely in the densest urban areas. The denser the urban form is, the less space there is for nature, and the fewer opportunities there are for humans to interact with nature. However, if urban growth is planned and designed in a thoughtful way with ecosystem services and public health in mind, some of the negative externalities of cities such as psychological stressors can be mitigated and relieved[6].

For this to happen, there needs to be a greater understanding of the interconnectedness of humans and nature and an acknowledgement of the interdependence between human health and the health of the natural environment. In renowned conservationist Aldo Leopold's *Sand County Almanac,* he proposed a "land ethic" which describes a moral responsibility of humans to be stewards of the natural environment to ensure its health and longevity[7]. Although Leopold wrote about the land in the non-urban sense, this land ethic can and should be applied to the urban realm about nature in cities, by recognizing that the responsible stewardship of nature in our urban environments benefits nature and us. City planners and designers play a vital role in facilitating this sense of responsibility by incorporating ecological design into public spaces and green infrastructure to provide multiple functions that serve both people and the natural environment.

In industrialized societies today, our lives are increasingly technology-dependent and

[6] (Heerwagen, 2009)
[7] Leopold, Aldo. 1949. A Sand County Almanac, and Sketches Here and There. New York: Oxford University Press.

primarily take place indoors. Whether it is working at a computer in a climate-controlled building or at home watching television, much of the activities of modern people are housed within buildings. A study by the US Environmental Protection Agency showed that American adults spend an average of 90 percent of their time indoors[8]. Another study conducted by the Nature Conservancy found that only ten percent of American teenagers spend time outdoors each day[9]. Today, we simply aren't interacting with nature enough on a regular basis to realize the potentially powerful restorative benefits it has for us.

The past decade has seen a shift toward a greater concern about the implications of our technology dependency and disconnect with nature, both nationally and globally. The concern about human disconnect with nature coincides with public health concerns in the West surrounding increased rates of obesity, depression, and chronic diseases. According to some, these health concerns can at least partially be attributed to our increasingly sedentary lives indoors and away from nature. Popular books such as Richard Louv's *Last Child in the Woods* (2008), *Your Brain on Nature* (Selhub & Logan, 2012) and *The Nature Fix* (Williams, 2017) have helped to bring the conversation about human-nature disconnect and its health implications into the mainstream. The sudden rise in popularity of the Japanese practice of *shinrin-yoku,* or "forest bathing", where people go on structured forest walks with the aim of achieving improved health and well-being, is evidence of the public's growing interest in using nature as an antidote for psychological stress.

Some studies attribute the combination of increased technology use and lack of contact with nature to attention deficit disorders that have become common among adults and children alike.

[8] U.S. Environmental Protection Agency. 1989. Report to Congress on indoor air quality: Volume 2. EPA/400/1-89/001C. Washington, DC.
[9] (The Nature Conservancy, 2011)

Author Louv calls this "nature deficit disorder"[10]. Louv states that interaction with nature is critical for healthy physical and mental development, as it has been shown to improve mental cognition and alertness. Without regular interaction with nature, Louv argues, we are more prone to suffer from attention deficit and other psychological maladies.

A growing body of research is providing evidence for what we have intuitively known all along- that nature is critical for human health and well-being. Time in natural settings has been shown to reduce stress, support greater physical health and well-being, increase creativity, and improve attention and cognition. The effects of nature on our minds and bodies is a relatively new field of study, with some of the first studies conducted in the mid-20th century.

In the 1970's Roger Ulrich conducted a study on the effect of nature on the stress students experience with taking an exam. The study found that students who viewed scenes of nature could hold attention longer and showed less physiological signs of fear[11]. The study was one of the first to provide empirical evidence for the restorative power of nature. Another seminal study published by Ulrich in 1984 showed that in a hospital, patients assigned to rooms with windows looking out on natural scenes had shorter postoperative hospital stays, received fewer negative evaluative comments in nurses' notes, and took fewer potent analgesics than those with a view of a brick wall[12]. There are several psychological explanations as to why this was, but the main finding was that views of nature brought patients a sense of calm and awe, and this in turn helped to improve their physical and mental states.

Trees provide a myriad of health benefits to humans including shade from the sun, filtration of pollutants for cleaner air, and even aroma-therapeutic qualities. Trees are important for

[10] (Louv, 2011)
[11] (Ulrich, et. Al, 1991)
[12] (Ulrich, et. Al, 1984)

psychological health, helping to reduce stress and fatigue, and calm nerves[13]. A study conducted in London that found people living near trees took less anxiety medication than those who lived near fewer trees, regardless of economic status, income, age, and other confounding factors[14].

Scientists in Japan and Korea have taken the case for the positive health benefits from trees further, by creating designated trails in forests intended to improve the health of visitors. These trails promote the practice of *shinrin-yoku,* which has become a popular activity for people seeking respite from the stressors of urban life. *Shinrin-yoku* has been empirically shown to reduce stress levels in participants. In a study that took place in the Tokyo University Forest with nearly five hundred participants, the subjects showed significantly reduced hostility and depression scores, coupled with increased liveliness, after exposure to trees. After spending time in the forest, subjects had overall lower pulse rates and blood pressure, greater parasympathetic nerve activity, and lower concentrations of the stress hormone cortisol[15]. This study and others (Li 2010, Miyazaki 2011) about forest bathing provide evidence for the widely-held notion that time in nature is beneficial to human health and well-being.

Some, such as biologist E.O. Wilson who introduced the idea of *biophilia*, attribute the restorative power of nature to the fact that humans as a species evolved in nature. Biophilia is the hypothesis that humans possess an inherent affinity to the natural world[16]. Biophilia attempts to explain why people are drawn to views of nature, why we cultivate gardens, and have indoor plants. These behaviors are, according to this hypothesis, responses to our biophilic or "life-loving" brains[17]. The idea of biophilia also helps to explain why humans often consider environments that

[13] (Roe, et al. 2013)
[14] (Taylor et al. 2015)
[15] (Morita et al. 2007)
[16] (Wilson, 1984)
[17] (Kellert SR, 2005)

are devoid of natural elements to be barren and destitute. On the other hand, when one thinks of a rich and abundant environment, verdant scenes full of natural sensory experiences come to mind. We generally associate natural and thriving things as being positive, as a sign of health and vitality. It is no wonder then that gardens are often considered to be healing and relaxing, while a busy street bustling with cars and exhaust can be stressful and irritating.

Public spaces, which are in theory open to everyone to access, have great potential for facilitating positive human interactions with nature in cities. With increased densification in urban areas, public open space is becoming developed diminishing and becoming more disconnected. As the populations of urban areas become denser, the changes produced in the air, earth, water, and life within and around them can trigger environmental issues that affect the well-being of every city resident.

However, this densification and increasing urban populations also holds great potential for public spaces to be designed for efficiency, in that they might serve multiple functions, including providing access to nature. Implementation of urban natural spaces and weaving the ecology of the existing land into the urban fabric can provide opportunities for urban dwellers to have regular contact with nature. Through evidence-based research and design, public spaces, no matter how small, can function as spaces where humans can experience the positive psychological benefits of nature. For our own sanity that of others, we as planners, designers, and urban citizens, must be proactive in ensuring that living nature is a part of the current and future development of both public- and privately-owned spaces in urban areas.

The main concepts that form the basis for this research are:

1. **Increased urbanization is causing many cities to become denser**. Densification means more demand for development, and valuing development over the conservation of undeveloped spaces. Therefore, with increased development, our cities will accommodate fewer and smaller natural spaces.

2. **There is human health value in having nature in cities**. Humans need interaction with nature for social, physical, mental, and emotional well-being, particularly urban dwellers who are disconnected from nature.

3. **The design of spaces directly affects how they are perceived and how they are used by people**. There are specific design strategies that can be implemented to maximize the benefits of human interaction with nature in cities.

Research Question

How can small urban public spaces be designed to best support the potential psychological health benefits of human interaction with nature?

Audience

The intended audience for this thesis is anyone involved in the designing of public spaces, particularly those working in cities that are experiencing densification. The research is oriented toward cities that are becoming denser, where lack of green public space is a rising concern. This thesis is meant to advise urban designers, planners, landscape architects, professionals working for parks and recreation departments, and other individuals designing public spaces. I hope that my audience will take away a deeper understanding of the psychological health benefits of natural spaces

in cities, especially in dense urban areas. I want to convey the importance of designing spaces with health needs and desires in mind, understanding that to be effective, the design of public spaces must be rooted in the needs of the people using the spaces. This thesis is grounded in the belief in the inextricable interrelation of human and natural systems. Therefore, it suggests that the incorporation of natural elements into public space design must recognize both the importance of the health of these natural features and how this can positively benefit the health and well-being of the users of the space.

Deliverables

The deliverables of this research are a review of literature and case studies addressing psychological benefits of nature in urban settings from which I derive a set of design recommendations for creating natural public spaces in dense urban areas for human psychological health benefits. The design recommendations are illustrated through an application to public space typologies in the Lake City neighborhood in Seattle, as a means of showing how natural spaces might be implemented in an urban setting with the intention of positively impacting the psychological well-being of users of the space. The design recommendations draw from the evidence identified through the literature review, as well as findings from the case studies.

Although these recommendations are for a site in Seattle, the interventions proposed address common public space typologies and could inform other urban areas that are densifying. The suggested design implementation for Lake City is based on what would work for that place, taking in to account the climate and community context, but the set of design recommendations are broad enough that they could inform design in other dense urban areas in other US cities and around the world. The goal of these design recommendations is the thoughtful design of public spaces to

facilitate positive psychologically restorative benefits from human interactions with nature.

Methodology

Once the above conceptual foundation was established, a research strategy for a structured literature review was framed. The literature review is structured into four parts: public space; urban pressures; the value of urban nature; and the psychological health benefits of nature. The literature review provided evidence to support the research question. Sources consulted in the review included books and peer-reviewed articles from scholarly journals. To find these sources, I used the University of Washington Libraries website to search journal articles. From these articles, I consulted their works sited to find additional sources. The key search terms used to search for sources were: "urban nature", "nature", "green infrastructure", "public space", "human health", "psychological health", "well-being", "restoration", and "biophilia". Conclusions drawn from the literature review point toward the necessity for nature in cities to ensure human vitality, especially in cities that are becoming more populated and denser. Evidence shows the potential for natural elements to be incorporated into urban public spaces to provide benefits to human health and well-being.

Next, case studies were identified that illustrate the use of natural design interventions in urban public spaces to provide health benefits. Projects that mentioned human health and well-being as a goal of the project took precedence, especially if psychological benefits were specifically indicated. These case studies provide viable examples of design elements and strategies used to incorporate urban nature into public places to foster health and well-being in the people who visit these spaces.

I contacted professors at the University of Washington in the Landscape Architecture and

Environmental and Forest Sciences departments, as well as an employee at Seattle Parks and Recreation to get their suggestions of public spaces that they consider to provide psychological health benefits. Then, I wanted to see what projects nationwide were exemplary of good design for public health benefits, and to do this I consulted the following sources: the American Society of Landscape Architects website, Places Journal, the Landscape Architecture Foundation's Performance Series case studies, and the Landezine website. Again, the frame for looking for these projects were those that specifically referenced public health benefits, and psychological benefits when noted.

From all the examples in Seattle suggested previously from experts and those found from around the country, I then narrowed down the selections to three examples, choosing those that fit the framework for the case studies. This framework consists of the following parameters: the project is in Seattle; it is a public space; it is urban; it is small; and it provides perceived psychological health benefits. Definitions and reasoning for each of these five parameters are below.

Seattle. The example project must be within Seattle city limits. This ensures that the project is viable, and perhaps partially replicable, in Seattle within the local constraints of government, climate, and public opinion.

Public. The example project must be a space that is publically accessible, whether it is publically or privately owned. The intent of this project is to inform public space design, and therefore it is important that the case examples are themselves public spaces.

Urban. The project must be in an urban setting, to show that elements of the design might be used in other urban settings. Since this project focuses on Seattle, the definition of "urban" for this framework came from what are Seattle's "Urban Centers", as recognized by Seattle's Comprehensive

plan, *Seattle 2035*[18]. All case studies are within urban center boundaries.

Small. These case studies are all areas less than 1 acre in size. This parameter draws from the conceptual framework of this research, which states that as cities become denser, areas for natural space diminishes. The intent here is to look at spaces that utilized a relatively small area to achieve the desired benefits.

Health Benefits. All the case studies are considered to specifically provide some form of psychological health benefits. Based upon the research gathered through the literature review, some common terms were extracted to indicate if a place is mentally restorative. These terms include: peaceful, sense of enclosure, awe-inspiring, serene, meditative, and calm. If any of these terms were used to describe the places considered for a case study, it was considered a potentially restorative space.

To discover how lessons from these case studies might inform public space design in Lake City, an assessment of public space typologies in the study area was made. The top three public space typologies identified were: streetscape, pocket park, and public park. These are the three most apparent public space typologies present in the one-block radius surrounding the central intersection of Lake City in Seattle: Lake City Way and 125th Street. Consequently, the three projects ultimately chosen as case studies are examples of each one of these public space typologies.

The three case studies selected are: The Swale on Yale, Waterfall Garden Park, and Summit Slope Park. These cases are all within the city of Seattle and were recommended by professors and/or planning professionals as urban public spaces that potentially provide psychological health

[18] http://www.seattle.gov/dpd/cs/groups/pan/@pan/documents/web_informational/p2580242.pdf

benefits using natural elements. It should be noted that Waterfall Garden Park is a privately-owned space that is open to the public. To explore the benefits provided by each of these places, I first searched online for descriptions provided by the designers and blogs about the spaces to see if there were mentioned any terms or elements of design that can potentially lead to mental restoration. The terms were drawn from findings of the literature review, and particularly the book *With Nature in Mind*, which identifies key elements of urban nature that can be mentally restorative. These search terms and keywords included: peaceful, sense of enclosure, awe-inspiring, serene, meditative, calm. I then consulted people involved in the design of the projects to see if they considered the space to be mentally restorative and why, and if this was a design consideration. Another source I consulted was online reviews of each space on Google Reviews, TripAdvisor, and Yelp. From these reviews, I drew out common terms used to describe the space and compared these with the original search terms.

I made visits to the three case study sites to observe how people were utilizing the space and to gather my own observations and impressions of the site. The method of observation was to visit the site midday on a weekday, to observe everyday visitors to the site, as opposed to people who might only visit on a weekend, or might be tourists. I sat in one spot where I had a vantage of the entire space, and observed activity for about one hour. Means of data collection included field notes, photographs, and sketches. These site visits were intended as a means of ground-truthing the information gathered online about the case study sites.

Combined with the literature review, the case studies inform the creation of a set of design recommendations for small public spaces. These suggestions strive to answer the initial research question: How can urban public spaces in cities that are densifying be designed to best capture the potential psychological health benefits of human interaction with nature? Finally, these design

recommendations will be applied to sites in Lake City in Seattle to show how these interventions might be implemented in a real-world context.

Literature Review

Introduction

To approach the design of public spaces, I needed to gather foundational knowledge of public space design theory, along with an understanding of the desired benefits I intend the design to have. I began by researching the positive health benefits of human contact with nature. These benefits can be experienced by anyone that has access to nature, and therefore an avenue for increasing access to nature in urban settings is to incorporate natural elements into urban public spaces. I focus on the psychological benefits afforded by nature, because these are arguably the most accessible to all- as opposed to something like walking on a trail, which might be a barrier to someone who is unable to walk. Studies have shown that psychological benefits from nature can come from simply viewing a natural scene or breathing in scents released by trees. If these benefits can be gained by simply viewing or being in and around nature, these natural spaces need not be large. Therefore, these natural design elements can be implemented in relatively small urban spaces such as pocket parks, green streets, and vertical gardens.

As urbanization increases, demand for development takes precedence over conserving open space in cities. As a result, public natural spaces become smaller and rarer. Public spaces are ideal opportunities to incorporate nature back into the city, but with fewer open spaces, opportunities for re-incorporating nature in the city decline as well. This has serious implications on public health. Throughout history, people have expressed a desire to interact with nature, citing feelings of awe, serenity, and general well-being in the presence of nature, but only in the last 30 years has science shown a direct connection between nature and human health. Researchers in the fields of psychology, public health, and others are adding to a growing collection of evidence showing that

nature is in fact beneficial to human health.

This review considers the implications of increased density in many cities, its impact on urban public spaces, the value of nature in cities, and the human health benefits of nature. There are many definitions for what is meant by health, but this review will refer to the World Health Organization's definition of health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity"[19]. Similarly, there are many different concepts and definitions of the term nature, but in the context of this review, nature is living outdoor vegetation and other non-human living organisms.

Public Space

Urban public spaces provide opportunity for the interconnection between the built and natural systems to be showcased, and they can be designed to support ecosystem health as well as human health. The term *public space* is assigned many different meanings depending on factors such as ownership, accessibility, and regulation. It can take on a more abstract meaning, as that given by Gehl Architects, which describes public spaces as "the life between buildings"[20]. According to the American Planning Association, a public space may be any space "within the public realm that helps promote social interaction and a sense of community"[21]. Public spaces can include plazas, town squares, parks, marketplaces, public commons and malls, public greens, piers, special areas within convention centers or grounds, sites within public buildings, lobbies, concourses, or public spaces within private buildings[22].

The benefits afforded by urban nature can only be gleaned if one has access to it. Many

[19] (WHO 1948)
[20] (Gehl 1987)
[21] (APA)
[22] (Ibid)

studies have revealed that the distribution of urban nature often disproportionately benefits predominantly white and more economically affluent communities[23]. This inequity in spatial access to urban nature is increasingly considered to be a social justice issue, and is a central concern of the environmental justice movement. Beyond spatial distribution, the physical design of urban natural areas can implicate the ease of access and the enjoyment of urban nature. People come in a variety of shapes, sizes and abilities, and therefore no design can be a universal solution. However, despite the inherent diversity among people, there are similarities in their needs and desires, and there are some elements of public space design that can be employed to address these. Furthermore, top-down policy can greatly influence access to urban nature not only in terms of distribution, but also by regulating who can use urban public spaces, and when and how those spaces can be used.

Extensive research has shown ways that public spaces can be most effectively designed to encourage the use of space and to maximize human enjoyment of the space. A seminal work in such research is William Whyte's *Social Life of Small Urban Spaces* which identifies key features of effective design of public spaces for human use. This study and others found that desirable public spaces afford various activities and experiences, such as walking, bicycling, sitting, relaxing, recreating, and socializing (Whyte 1980, Gehl 1987). Specific features of well-used public spaces include protection from unpleasant experiences, and areas that allow for observation. Whyte found that a key element of a successful public space where opportunities for seating- benches, ledge, moveable chairs, and steps can all provide hospitable places for people to sit, if made available for use and at the proper height for sitting comfortably. Environmental psychology experts Rachel and Stephen Kaplan also encourage the use of benches in public spaces to provide people the opportunity to stop and

[23] (Wolch et al. 2014)

observe their surroundings, creating a sense of "escape" from one's everyday life[24]. Whyte's observations of human behavior in public spaces echo this theory, reporting a preference for areas that provide alternative experiences to one's daily routine, such as enjoying a meal outside, stopping for an impromptu conversation, or finding space for solitude[25].

In terms of accessibility, Whyte discovered that the relation of a space to the street plays a major role in how many people visited a space, and should facilitate an effortless flow from the street to the space. As a result, he recommended that plazas be no more than 3 feet above or below street level. Another vital discovery made by Whyte was the elements that most attract people to a space. He found that the most important features were trees, water, sculptures, and food, and that the more of these features were in a space, the more people frequented the space26.

The Kaplans' research take human preference for natural features even further, by exploring how to design public with what they call "nearby nature", for the benefit and satisfaction of humans. Their research focuses on the psychological dimensions of having natural settings nearby for people to experience, and what aspects of these settings are most beneficial to human well-being. They primarily study the nature of "restorative" environments, which they attribute reducing mental fatigue. Mental restoration is related to positive psychological responses of increased alertness, attention, concentration, and emotions. Several studies have shown that nature can elicit these positive psychological responses, causing reductions in tension, anxiety, stress hormones, fatigue, and by boosting positive emotions and mood (e.g., Alcock et al., 2013; Barton & Pretty, 2010; Hartig et al. 1991; Hartig et al. 2003). Landscape architect Frederick Law Olmsted recognized the restorative powers of nature, and in his Report to the Congress of the State of California in 1865,

[24] (Kaplan, Kaplan & Ryan, 1998)
[25] (Whyte 1980)
[26] Ibid.

argued that viewing nature "employs the mind without fatigue and yet exercises it, tranquilizes it and yet enlivens it; and thus, through the influence of the mind over the body, gives the effect of refreshing rest and reinvigoration to the whole system"27.

Based on research into the relationship between being in nature and mental restoration, the Kaplans and Robert Ryan categorize the characteristics of restorative settings as follows: **being away**; **extent**; **fascination**; and **compatibility**[28]. **Being away** simply means removing one's self from the source of stress, whether physically or abstractly, for example, looking out a window at a scene that takes your mind off the stressful situation. The element of **extent** is related to a sense of expansiveness provided by a setting, making one feel as if they are in a different world. Well-designed places can give a sense of limitlessness, physically and conceptually. The Kaplans give the example of an exhibit in a zoo depicting a setting from another region of the world, and how that can make visitor feel transported to another place[29]. **Fascination** refers to being in a state of mind where one's attention is held by something that does not demand effort- looking at a flower, or watching the dancing flames of a fire, for example. Finally, **compatibility** is another factor to reducing psychological stress, in that it refers to a setting aligning with or being compatible to, human inclination. The Kaplans state that humans are drawn towards participating in activities that relate to the natural world such as bird watching, fishing, and gardening, and therefore places that afford the opportunity to do these activities are often attractive to people[30]. The empirical findings from this research on how nature is experienced for positive health outcomes is helpful for considering what design elements to include in spaces of nearby nature to aid in mental restoration.

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[27] (Ulrich et al., 1991)
[28] (Kaplan, Kaplan & Ryan, 1998)
[29] Ibid.
[30] (Kaplan et. al. 1998)

Urban Pressures

Although some cities in the US are depopulating, many, such as Seattle, are experiencing major growth booms, partially because of neighborhood revitalizations, as well as major businesses relocating their offices to these cities. This trend toward urbanization is referred to as the "back-to-the-city movement"[31]. This movement is not only happening in the US- for the first time in human history, most the world's population is living in urban areas[32]. The world's population is expected to increase dramatically in the next century. In a report by the United Nations Department of Economic and Social Affairs, Population Division (UNPD), by 2050 over 70% of the world's population is expected to reside in cities[33]. Urbanization poses a challenge to urban planning professionals to manage this growth. Growth management strategies require that growth be concentrated in areas particularly where urban infrastructure already exists. This approach puts pressure on such areas and increases population density.

If densification occurs without proper conservation and designation of urban natural spaces through policy and design choices, there can be negative ramifications on human health[34]. As urban areas become denser, the changes they produce in the air, earth, water, and life within and around them trigger environmental issues that affect the well-being of every city resident[35]. However, if well planned and managed, densification can provide potential advantages to human health such as reducing vehicle use in favor of active modes of transportation, cleaner air and water, increased social interaction, and more everyday interactions with nature.

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[31] (Hyra 2015)
[32] (WHO 2010)
[33] (UNPD 2012)
[34] (de Vries et al. 2003)
[35] (Spirn 1984)

Urban Nature

Before discussing the value of urban nature, the term *nature* must be addressed. The term is, as environmental historian William Cronon puts it, "a profoundly human construction"[36]. This is not meant to suggest that nature is abstract or unreal, but to highlight how descriptions and understandings of nature are all purely from a human perspective. As a product of living in the Anthropocene, many people consider the built environment to be separate from nature-- perhaps even the opposite of nature. We often use the word nature to describe phenomena in this world that is not human, nor created by humans. However, built environments are situated within and as part of the natural environment, and their very existence hinges upon this connection.

Humans rely on the natural world for the air we breathe, the water we drink, and the food we eat. When considering this, it seems contrary to separate the human from the natural world. For the purposes of this thesis, I draw from the Kaplans' and Ryan's description that nature "is not characterized by its distance from human settlement. Nor is a natural area necessarily one that is unaltered by human intervention"[37]. Urban nature is planted, planned, and landscaped by humans to fit into the urban form. In urban areas, nature takes the form of "a variety of outdoor settings that have substantial amounts of vegetation... That includes parks and open spaces, street trees, vacant lots, and backyard gardens"[38]. Natural spaces in urban areas are often referred to as "green" or "open" spaces, but urban nature can be a variety of colors, natural elements, and can be enclosed, particularly in a dense urban setting.

Cities are complex systems, involving the processes of nature and the health, social, and

[36] (Cronon 1995)
[37] (Kaplan, et al. 1998)
[38] Ibid.

economic concerns of humans, and must be designed with this in mind. As Anne Whiston Spirn writes in her book, *The Granite Garden*, "All the open spaces in the city- rooftops, plazas, parking lots, streets, highways, parks, and urban wilds- are part of an interlocking, multifaceted system"[39]. Humans have always found value in natural features, recognizing nature's aesthetic and utilitarian qualities. One theory on why this is, the biophilia hypothesis, describes a biologically based, inherent human need to affiliate with life and lifelike processes[40]. Because of this attraction, city dwellers through the ages have sought to have nature within reach. This is evidenced in cities throughout history in the form of garden plots, fountains, parks, rooftop gardens, and in the goals of urban movements such as the Garden City movement and New Urbanism. History shows that as cities grow larger and denser, as distance from the countryside and wilderness increases, the desire to "recapture" nature increases[41]. Perhaps it is a nostalgia for the idea of the purity of nature-- the fresh air, lack of pollutants, wild beauty-- that which at times seems like the opposite of life in an urban area.

From ancient Rome, to industrial-era London, to cities today, people have found ways to integrate the positive aspects of nature into city life. In nineteenth century America, as industry boomed and urban skies became increasingly polluted, an urban landscaping movement, led by Frederick Law Olmsted, endeavored to improve urban public health by bringing more nature into cities. The solution was grand city parks, intended to be the so-called "lungs of the city", providing residents with green open spaces where they could breathe clean air. Unfortunately, as cities continue to grow, open land becomes scarce, and city budgets often prioritize efforts other than park maintenance. The mid-20th century saw the decline of many city parks due to park budget cuts

[39] (Spirn 1984)
[40] (Kellert and Wilson, 1993)
[41] (Spirn 1984)

and shifting priorities, including the removal of Buffalo's Humboldt Parkway to build a freeway, and rampant crime in New York City's Bryant Park in the 1970's[42]. Many parks in cities today, to reduce maintenance costs, are heavily hardscaped with far fewer natural features than the Olmstedian parks of the past (Figure 2.1).

Figure 2.1 Lake City mini park is an example of a primarily hardscaped park with few natural features.

Urban nature can improve the health of residents in the city and offset some of the negative environmental externalities produced by cities such as air pollution, the heat island effect, and noise. Trees in cities remove some of the carbon monoxide and particulate matter emitted by vehicles. A study conducted in 1980 of the air filtering potential of different trees found that certain types of plants and the arrangements of plants have increased function for reducing air pollution[43]. For example, the study showed that tree species with dense branches, rough bark and large, hairy leaves are the most effective at reducing particulate matter in the air. Furthermore, certain types of planting arrangements are more effective than others in air pollution filtration. These include group planting, mixed species, layered plantings, and groundcovers as opposed to pavement[44].

[42] (Schuyler, 2015)
[43] (Smith & Staskawicz 1977)
[44] (Spirn, 1984)

The best public spaces are designed to be enjoyed year-round--moderating heat in the summer and providing shelter from the cold in chillier months. Natural elements can help turn as spaces into temperate microclimates, thus making them more welcoming places for people to visit. Trees and other plants provide shade from the hot sun and can act as barriers from cool winds. Vertical plantings on walls can reduce reflective sunlight glare and help to absorb radiant heat. Waterfalls and other water features create a cooling effect by emitting mist into the air[45]. Furthermore, the sight and sound of water is known to have a calming effect on people.

Health Benefits of Nature

Aside from depending on nature for our basic needs, evidence has shown that humans also need nature for psychological, emotional and spiritual reasons (Wilson, 1984; Katcher and Beck, 1987; Roszak et al., 1995; Frumkin, 2001; Wilson, 2001). A growing collection of empirical, theoretical, and anecdotal evidence shows how nature has the power to have a positive influence on the body, including reduced blood pressure, lower cholesterol, stress-reduction, and a more positive outlook on life (Moore, 1981; Kaplan and Kaplan, 1989; Hartig et al., 1991; Ulrich et al., 1991a; Ulrich et al., 1991b; Kaplan, 1992a; Rohde and Kendle, 1994). Several studies have shown that exposure to nature helps with stress reduction and cognitive function (Kaplan R. and S. Kaplan 2011; van den Berg, Koole, van der Wulp 2003; Wolf and Housley 2013). Access to nature is also linked to longevity (Takano et al., 2002), and self-reported health (de Vries et al., 2003). Urban environments with natural elements are more likely to make people feel psychologically well[46]. In one study, the amount of time people spent in a natural urban space and how often they visited were

[45] Ibid.
[46] (Hernandez 2005)

both positively related to reported mental restoration[47]. Additionally, the more an individual was stressed prior to the green space visit, the greater the degree of stress recovery[48].

A landmark study in the connection between exposure to nature and psychological health illustrated that views of nature can have significant effect on how people feel. Conducted on patients being treated in hospitals, some patients' rooms had a view of a natural setting, while others looked out at a brick wall. By measuring an array of physiological measures- heart rate, skin conductance, muscle tension, and pulse transit time-- researchers found that recovery was faster and more complete when subjects were exposed to the natural landscapes rather than the wall[49]. Similar research conducted in prison environments suggests that cell window views of nature are associated with a lower frequency of stress symptoms in inmates, including digestive illnesses and headaches, and with fewer sick calls overall by prisoners[50].

Research by Rachel and Stephen Kaplan on access to nature in the workplace showed that exposure to nature is related to lower levels of perceived job stress and higher levels of job satisfaction[51]. Workers with a view of trees and flowers from their desks felt that their jobs were less stressful and they were more satisfied with their jobs than others who could only see built environments from their window. In addition, employees with views of nature reported fewer illnesses and headaches[52].

Studies conducted in inner-cities found that people living in "greener" surroundings (areas of relatively more vegetation than not) reported lower levels fear, fewer incivilities, and less

[47] (Korpela et. al. 2008)
[48] Ibid.
[49] (Ulrich et al., 1991b)
[50] (Moore, 1981)
[51] (Kaplan and Kaplan, 1989)
[52] Ibid.

aggressive and violent behavior. These studies found that residents of buildings with greater levels of surrounding vegetation reported fewer crimes, both property crimes and violent crimes[53]. Some psychologists attribute the linkage between vegetation and reduced crime to the ability of nature to help to mitigate mental fatigue. Several studies by the Kaplans have shown nature as a mechanism for alleviating mental fatigue. In a study conducted in 1987, Stephen Kaplan proposes three symptoms of mental fatigue: irritability, inattentiveness, and decreased control of impulses. If left unchecked, he states, there is a high propensity for mental fatigue to lead to "outbursts of anger and potentially… violence"[54]. Numerous studies indicate that interaction with nature helps to relieve symptoms of mental fatigue. Contact with nature in a variety of forms- wilderness, prairies, parks, views of natural landscapes, indoor plants- are all shown to positively contribute to recovery from mental fatigue and improve cognitive functioning (e.g., Canin, 1991; Cimprich, 1993; Hartig, Mang, & Evans, 1991; R. Kaplan, 1984; Lohr, Pearson-Mimms, & Goodwin, 1996; Miles, Sullivan, & Kuo, 1998; Ovitt, 1996; Tennessen & Cimprich, 1995)[55].

The exact connection between nature and crime prevention are not conclusive, but it can be inferred from these studies that by reducing irritability, impulsivity, and low cognitive function--all known precursors to violent behavior--green spaces might help to prevent violent crime. Another possible factor may be that these spaces encourage people to stay outdoors, therefore increasing informal surveillance of outdoor spaces, and therefore lowering the chances of crime[56]. This theory echoes Jane Jacobs' "eyes on the street" mentality that places are safer and have stronger community ties when people are literally looking out for their neighbors[57]. Both Jacobs and Whyte believed that

[53] (Kuo et. al. 2001)
[54] (Kaplan 1987)
[55] (As cited in Kuo et. al. 2001)
[56] Ibd.
[57] (Jacobs, 1961)

the primary thing that attracts people to a space is other people. This may seem contradictory when designing spaces for restoration, which one might think of as needing to be encouraging of solitude and seclusion, but it is an important observation for planners and designers to keep in mind. Spaces still need to feel welcoming, and the sight of other people enjoying a space is a key motivation for people to enter a space[58].

Studies have shown that the presence of vegetation encourages people to visit and stay in public places[59]. In one study, it was found that use of common outdoor areas in inner-cities was most concentrated in spaces that had trees and grass[60]. A series of studies conducted in inner-cities showed that outdoor spaces with trees were consistently more used by youth, adults and mixed-age groups alike than other spaces without trees. The studies also found a positive correlation between the number of trees in a space and the number of people using that space simultaneously (Coley, Kuo, & Sullivan, 1997; Kuo, Sullivan, Coley, & Brunson, 1998; W. C. Sullivan, Kuo, & DePooter, 2001). These studies provided evidence showing that trees and grass help to create spaces that bring neighbors together and support social interaction[61].

Conclusion

By recognizing and appreciating the value and health utilities of nature, urban planners and designers can effectively cultivate nature in the city to harness the benefits to human health and well-being. The above information is evidence of the need for nature in cities to ensure human vitality, especially in cities that are becoming more populated and more dense. Densification can compound urban stressors such as air pollution and noise, but it also has the potential for creating places that

[58] (Whyte, 1980)
[59] (Sullivan et. al. 2004)
[60] (Coley, Kuo, Sullivan, 1997)
[61] (Sullivan et. al. 2004)

are more walkable, diverse, and lively. Urban nature can enhance the urban experience by facilitating mental restoration, helping to relieve common ailments in industrialized society caused by tension, anxiety, stress, and fatigue.

In terms of designing spaces for psychological well-being, some key elements from the literature emerged. There are the physical elements noted by The Kaplans and Ryan

By incorporating the information of studies by environmental psychologists, urban ecologist, sociologists, and public health specialists, our densifying cities can be places that are not just livable but beneficial to human psychological health and well-being.

Case Studies

Introduction

These case studies illustrate the use of natural elements in urban public spaces to provide health benefits to users of the space. The three case studies selected represent the following typologies: Streetscape; Pocket Park; and Community Garden. These three public space typologies were selected based on the conceptual framework previously stated of public spaces present in urban areas that are densely populated. The case studies were selected using the parameters previously mentioned in the methodology, which were developed to find cases that best fit the objective of this project. The selection parameters are: the site is within Seattle city limits; it is a publically accessible space; the site is situated in an urban center62; it is less than 1 acre in size; and is a potentially psychologically restorative space.

The following case studies were recommended by professors and/or planning professionals as public spaces that potentially provide psychological health benefits using natural elements. To explore the benefits provided by each of these places, I compiled key terms informed by the literature review as to what makes a space conducive to psychological well-being to use as indicators of whether users of the space felt it was mentally restorative. These terms included: sense of enclosure; pleasant; quiet; peaceful; respite; and places to sit. I then searched online for descriptions of the projects provided by the designers and/or blogs about the spaces to see if there were mentioned any terms or elements of design that can potentially lead to mental restoration. Next, I searched for these terms in online reviews of each space on Google Reviews, TripAdvisor, and Yelp.

[62] As designated by Seattle's comprehensive plan: http://www.seattle.gov/dpd/cs/groups/pan/@pan/documents/web_informational/p2580242.pdf

I then visited the sites to observe in-person how people were utilizing the space and to gather my own observations and impressions of the site.

To evaluate the spaces in terms of potential psychological health benefits, a **sensory framework** was developed based on how the site is experiences through the five senses. Humans interact with environments through their senses, and therefore if one is to receive benefits from being in a place, it is going to be through some combination of sensory experiences. Nature is rich in sensory experiences, from the textures, patterns, scents and colors of plants, to sounds of wildlife, wind, and water. As Stephen Kellert observes in his book *Birthright*, even in today's technologically-enhanced and information-rich world, the natural world is still the most sensory stimulating environment that humans ever encounter[63].

Combined with the literature review, the case studies inform the creation of a set of design recommendations for small natural public spaces. These recommendations strive to answer the initial research question: How can urban public spaces in cities that are densifying be designed to best capture the potential psychological health benefits of human interaction with nature?

[63] (Kellert, 2012)

Sensory Framework

Natural elements engage people in sensory experiences. They can offer a combination of these experiences—for example, birds can provide visual engagement as well as auditory engagement. These sensory experiences are key to the overall experience someone has in a space. If there are pleasant sensory experiences afforded by a space, people will be more apt to want to visit and stay in a space. Regarding psychological benefits provided by a space, the consideration of sensory experiences provided by natural elements can be used in tandem with the characteristics of mentally restorative settings as identified by the Kaplans and Ryan. The four key characteristics that they identified as potentially providing mental restoration are both physical and conceptual characteristics, and can be created and supported by natural elements (Figure 3.1).

The characteristic of **being away** is imparted by a space that gives one a sense of being physically or conceptually removed from the source of fatigue. Natural elements can be used to achieve this by creating spaces that make people feel like they are away by providing people with sensory experiences that may be different from their source of fatigue. Visually, vegetation can be used to block views of built environment, traffic, construction, or other scenes that might be mentally taxing for people to view. Sounds of nature can also mentally transport people from the sounds of the built environment. Scents are also a powerful way to invoke a sense of being away, and natural elements, especially flowers, can provide this experience.

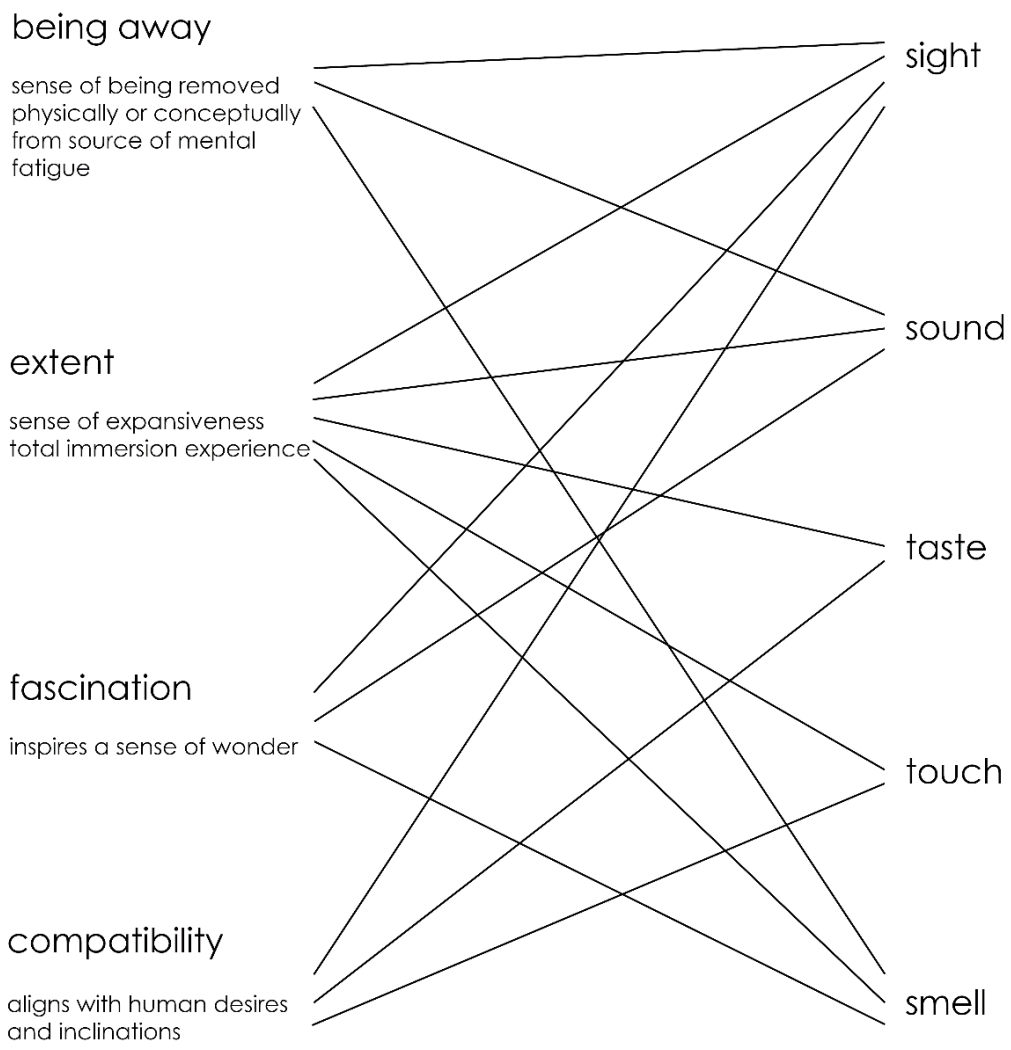


Figure 3.1 Characteristics of restorative settings can be supported by sensory experience.

Extent, or a sense of expansiveness, can be created by engaging all the senses. If one sees, hears, tastes, touches, and smells things that are outside of the setting that causes stress and fatigue, this can give a sense of being immersed in a totally different setting that is more restorative.

A sense of **fascination** can come from sensory engagement that holds one's attention in a

way that does not require much mental effort. The Kaplans and Ryan describe fascination as something that inspires thinking, doing, and wondering. Fascination can be stimulated by natural elements that provide interesting stimuli for the senses- birdwatching, gardening, or watching a waterfall, for example. Thinking and wondering can be inspired by sounds, scents, and visual engagement, while "doing" is generally associated with the sensation of touch.

Compatibility, the level at which a setting is in alignment with human needs and desires, can also be supported by natural features. The Kaplans and Ryan identify gardening, observing wildlife, and predation (hunting, fishing) as some of the most common human inclinations. Nature provides the opportunity for these activities. However, in an urban environment, the activities of gardening and watching wildlife are the most accessible. These activities engage the senses of sight, smell, taste, and touch.

Sight

"To sit in the shade on a fine day, and look upon verdure, is the most perfect refreshment."
—Jane Austen[64]

Research such as Roger Ulrich's hospital study and the Kaplans' studies into mental restoration from nature provide evidence for the positive benefits derived from viewing nature. A possible explanation as to why looking at nature is mentally restorative is that natural patterns are congruent with patterns in our own visual processing. More specifically, the fractal patterns found in nature matches the fractal structure of our eyes65. Fractals, patterns that are repeated at differing scales, are found everywhere in nature, from seeds to tree trunks (Figure 3.3). According to the Kaplans, a restorative environment is one that allows the eyes to focus on something that does not

[64] (From her book, *Mansfield* Park*)*
[65] (Spehar & Taylor, 2013)

require any special physical or mental effort. Nature's fractals provide these easy-to-process scenes which can trigger the release of natural opiates in the brain66. Beyond looking at trees and other plants, watching movement in nature- a waterfall, bees flying around, or the movement of wind through leaves can have a calm effect on the mind. Therefore, to encourage movement in a space, elements that allow for movement such as a water feature or colorful flowers to attract birds and pollinators, should be included in a space. According to the biophilia, we are also comforted by observing nature because it reminds us of our place in and connection to the natural world.

Figure 3.2 Observing other living things provides healthy distraction and can remind us of our connection to the natural world.

Figure 3.3 Fractals, patterns repeated at differing scales, are found everywhere in nature.

[66] (Valtchanov, 2013)

Sound

"The faint whisper of rain and running water was still there and it had the same tender note of solitude and perfection" – Tove Jansson[67]

Nature sounds can be highly soothing to our brains. In general, people tend to feel most disturbed by motorized sounds like traffic and construction, while most nature-produced sounds help to put our minds at ease[68]. Sounds of nature such as waves crashing and birds singing are frequently used in meditation, known to induce a sense of calm. Neuroscientist Daniel J. Levithin found that three sounds in nature tend to be particularly psychologically salubrious, and those are the sounds of wind, water, and birds[69].

Birdsong Studies are inconclusive on the scientific reasons why birdsongs have a positive psychological impact on people, but it could be that they are a non-threatening auricular sign of life, which helps put one's mind at ease, or that the birdsong helps to distract people from other, more unpleasant sounds. Whatever the reason, most people seem to find the sound of songbirds to be mentally refreshing and restorative[70].

Water The sound of moving water helps to calm the mind. The sound of a babbling or trickling water has a soothing effect, as evidenced by the implementation of delicate water features in Japanese gardens and other meditation gardens. On the other hand, large water features such as fountains and waterfalls which elicit rushing and crashing sounds can be effective in masking other undesirable sounds, and by lulling our minds into a meditative state. In Seoul, the Cheonggyecheon stream (Figure 3) was daylighted to produce a new soundscape to drown out the sounds of traffic.

Wind Similar to rushing water, the sound of wind can have a relaxing effect on our brains. For

[67] From Jansson's book *Moominvalley in November*
[68] (Marcus & Barnes, 1998)
[69] (Williams, 2017)
[70] (Marcus & Barnes, 1998)

wind to make a sound, it must pass through something. Wind passing through trees, particularly pine trees can create a rushing sound that most people find soothing.

Figure 3.4 Cheonggyecheon Stream. Water is a healing element experienced by many senses.

Figure 3.5 The sound of most birds is considered by many to be a joyful, calming sound.

Touch

Haptic perception, recognizing objects through the sense of touch, is an important way of how humans interpret their surroundings. Our skin is the largest sensory organ, with which we perceive changes in temperature. We perceive cool air in a space as "refreshing" and "rejuvenating" based on how the air is sensed by our skin. This tactile sense factors greatly into feelings of mental restoration- as we are likely to feel restored in such places that we find refreshing and rejuvenating. Natural features can play an important role in mitigating the temperature of a space so that it is more comfortable for people to be in. Cooling features such as tree canopies that cast shade and waterfalls that emit mist can make spaces feel refreshing and mentally restorative. These are especially helpful features in urban environments, creating a sense of an "oasis" from the stagnant built environment. Putting plantings at the level of people can encourage people in the space to interact with the plants by touching them. Vertical gardens and plantings in or next to benches are ways to make plants accessible to visitors of a space and to offer tactile engagement by. It is important that these plants are safe for people to touch- thornless, and not known to cause allergic reactions. Plants that look smooth or soft might encourage people to touch them.

Figure 3.6 Trees and other vegetation can help to regulate temperatures, providing respite from a hot day (left).

Figure 3.7 Soft, non-irritating plants can invite interaction (right)

Taste

Taste is not only essential to our survival—signaling what is safe or unsafe to eat— it has been proven to positively affect our moods. The sense of taste can be engaged in public spaces by providing edible plants. Planting edible trees that are fruit and nut bearing is one way to provide a source of food in a public space that does not require much space or maintenance. Putting a community garden in a space is another way to facilitate the cultivation and tasting of edible plants. Food gardens are also a way to encourage social interaction, and physical activity, both of which can lead to improved psychological health and well-being[71].

Figure 3.8 Nature provides us with the food we need to survive.

Smell

The nose is a direct portal to the brain, and therefore our sense of smell is highly linked to psychological response. Some scientists believe that of all the senses, smell is most closely connected with our memory. This olfactory memory is critical to the survival and evolution of the human

[71] (Middle et al. 2014)

species, helping early humans to locate food and water. In urban environments, we no longer rely on sense of smell for survival, yet it is still important to our perception of our surroundings, and therefore for our psychological well-being. Certain scents are more generally pleasing and restorative to us than others. We have long known that smells can influence our moods and even heal us from ailments, and recent research into the effects of aromatherapy confirms this intuition[72]. Aromatherapy is known for its positive psychological effects, and worldwide it is the most popular alternative treatment for anxiety[73]. Tree aerosols are a powerful source of aromatherapeutic scents in nature. Aerosols such as "pinoylvin" in pine trees and the terpinoids in cypress trees have been proven to act as mild sedatives, and stimulating respiration, which relaxes the mind[74]. The phytonicides found in certain trees are reported to reduce stress hormones, and are an important aspect of the forest bathing experience.

Figure 3.9 Fragrant herbs such as pineapple sage offer olifactory experiences in a space.

[72] (Lee et al. 2011)
[73] Ibid
[74] (Williams 2017)

CASE STUDY

Swale on Yale

TYPE	Streetscape
LOCATION	South Lake Union 400 block of Yale Ave N
HOURS	N/A
SIZE	270 feet long
DESIGNER	KPG, Inc.; Berger Partnership; Runberg Architecture Group PLLC
MANAGER	Seattle Public Utilities
PARTNERS	Department of Planning and Development, Seattle Department of Transportation, Vulcan Inc.

Figure 3.10 The Swale on Yale in Seattle. Source: Google Maps

CONTEXT The Swale on Yale is multi-functional stormwater infrastructure project, and is an example of successful green infrastructure in a dense urban area. It provides water filtration treatment for stormwater runoff travelling towards Lake Union. Once fully completed, the project is estimated to treat an average of 190 million gallons of stormwater every year. The swales, planted with native grasses are designed to slow the flow of stormwater and remove pollutants before it flows into the lake[75].

[75] Seattle Public Utilities. http://www.seattle.gov/util/EnvironmentConservation/Projects/SwaleonYale/Background/index.htm

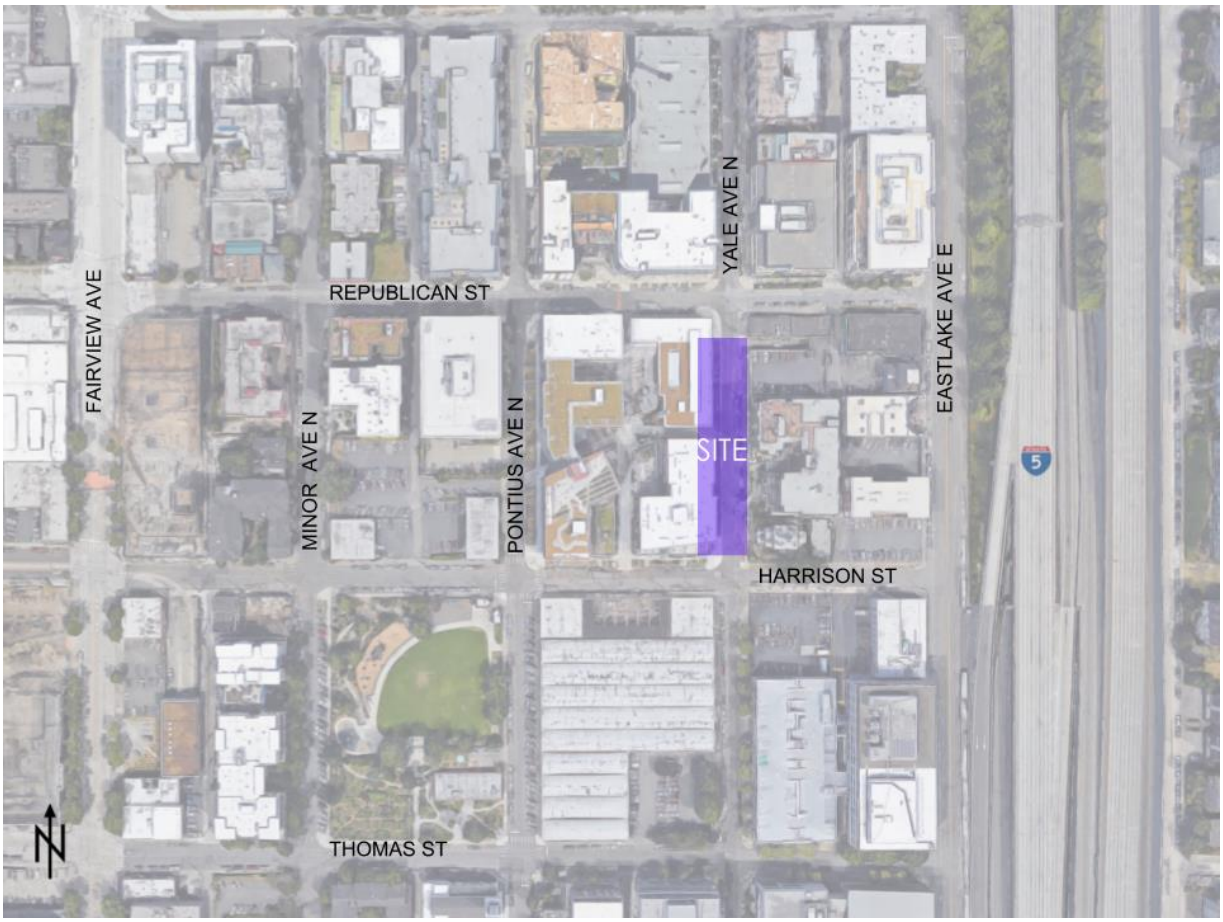


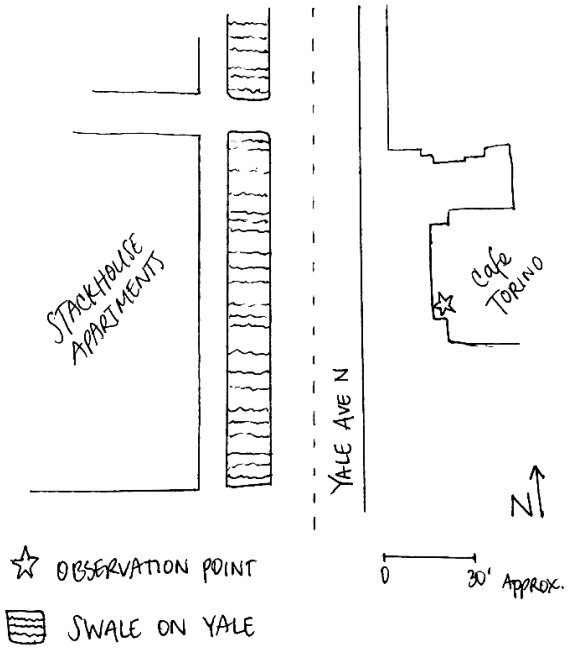
Figure 3.11 The Swale on Yale is located in South Lake Union.

ELEMENTS Bioswales slow and filter the flow of water. Benches along the edges of the installation provide seating. Interpretive signage informs passersby of the natural processes occurring in the site. Native, drought-tolerant plants.

PLANTS Carman's rush (*Juncus patens*), Bunny Blue Sedge (*Carex laxiculmis),* Gold Fountains Sedge (*Carex dolichostachya),* Variegated Japanese sedge (*Carex morrowii*), California Blue Rush (*Juncus patens*).

BENEFITS Creates a buffer for pedestrians between the street and sidewalk, and provides the amenity of green space in an increasingly dense urban neighborhood. Connects people visually and psychologically with natural processes.

Figure 3.12 Site map of the Swale on Yale



ACTIVITY

Date: Tuesday, May 2nd

Time: 3:45-4:45pm

Weather: Overcast, sunbreaks. About 65°F

Approximately 60 people pass by the site on foot. The majority are alone, with a dog, or in pairs. Most don't appear to be looking directly at the Swale. One man stops to sit on a rock, facing the Swale, stays for about 20 minutes, looking at the plantings, watching the other people pass by. A woman sits on one of the benches facing the Swale, smoking a cigarette.

SENSORY EXPERIENCE

Sight Grasses with varying shades of green. Movement of the grasses in the breeze. On a rainy day, there is water moving through the Swale.

Touch Visitors can bend down and touch the grasses, especially if sitting on one of the benches.

Sound The sound of cars passing by, people chatting as they walk by, some indirect construction noise.

Taste No discernable tastes or opportunities for taste.

Smell The smell of wet pavement. Getting close, the swampy smell of water captured in the Swale.

Figure 3.13 The bioswale exposes natural processes for passersby to observe

Figure 3.14 Vegetation create a buffer between the street and sidewalk

Figure 3.15 Benches offer opportunities to sit and observe

Figure 3.16 The vibrant grasses in the bioswales move in the wind, providing visual interest to the largely static built environment

LESSONS

- Green infrastructure can serve the function of being a public green space
- Natural elements of flowing water and native grasses enhance the pedestrian experience
- Benches along the Swale offer opportunities for people to sit and observe natural processes occurring in the space.

CASE STUDY

Waterfall Garden Park

TYPE	Pocket Park
LOCATION	Pioneer Square 219 2nd Ave S
HOURS	8am-3:45pm, daily (winter)
SIZE	0.12 acre (60 x 80 feet)
DESIGNER	Masao Kinoshita of Sasaki, Dawson & DeMay
MANAGER	Annie E. Casey Foundation

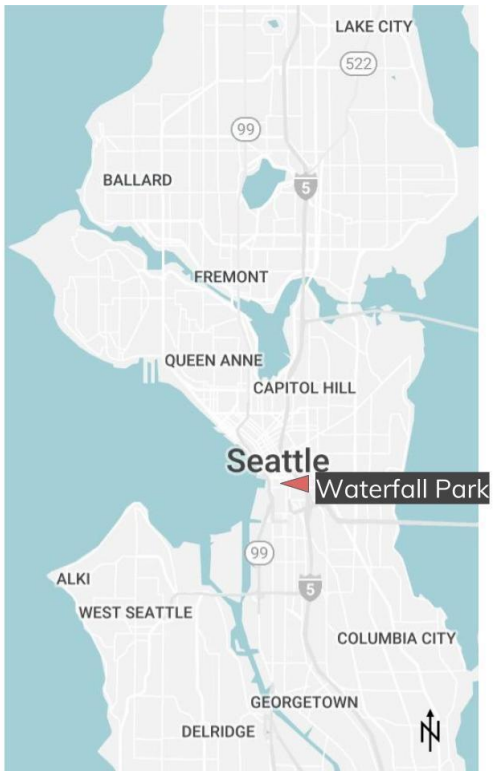


Figure 3.17 Location of Waterfall Garden Park within Seattle. Source: Google Maps

CONTEXT This privately-owned public space was completed in 1978 to commemorate the site where the United Parcel Service (UPS) was founded. It is in the Pioneer Square neighborhood in downtown Seattle, within the Pioneer Square Historic District. It was designed by landscape architect Masao Kinoshita, known for designing the similar Greenacre Park in New York City. Providing a refuge for visitors from the busy surrounding area, it is considered to be "Seattle's Paley Park"[76].

[76] "Seattle's Pioneer Square Waterfall Garden". Kobayashi, Koichi (August 12, 2004), translated by Mio Uo & Travis Doty. Visiting Japanese Gardens.

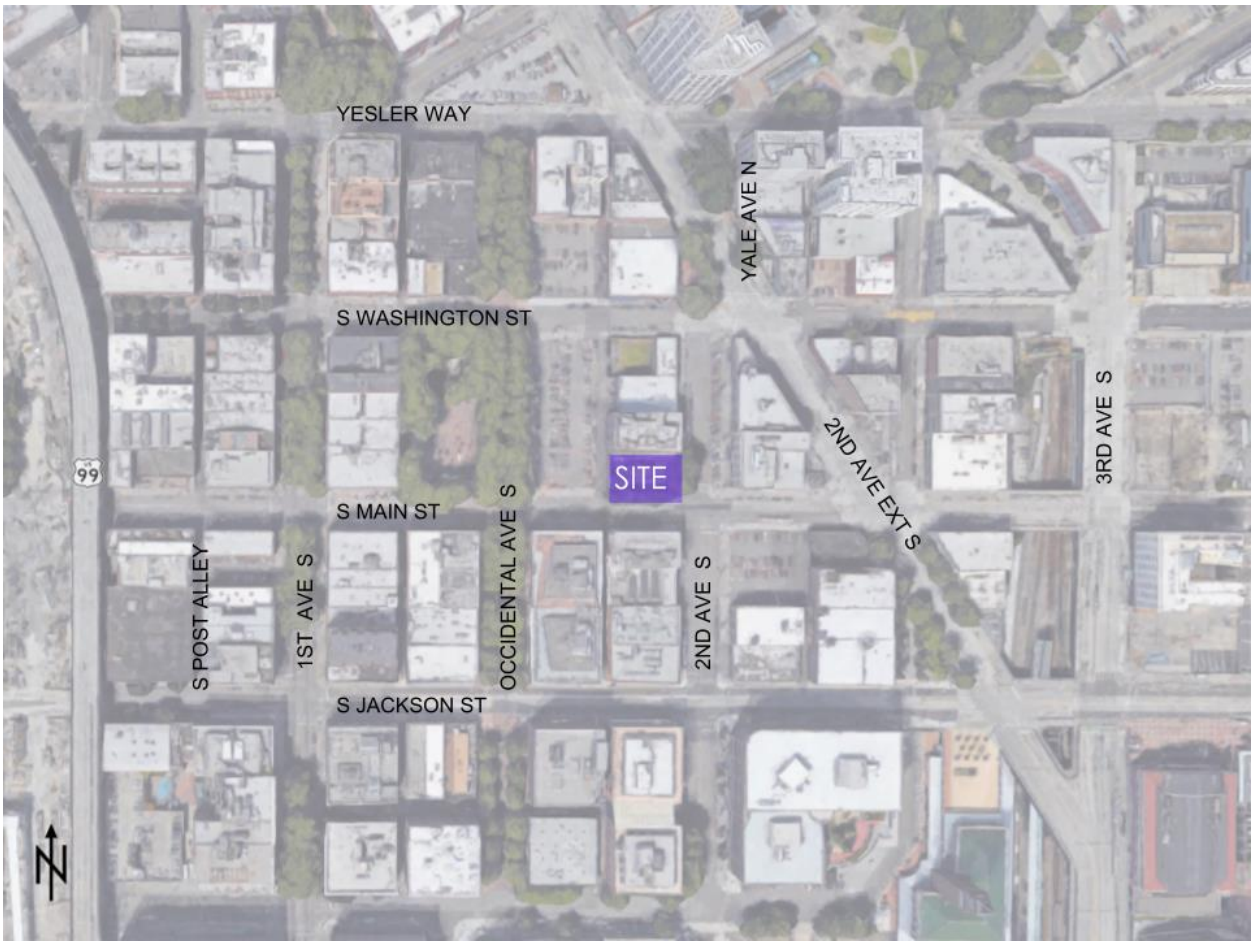


Figure 3.18 Waterfall Garden Park is in the Pioneer Square neighborhood

ELEMENTS The main feature of the park is a 22 foot tall constructed waterfall[77]. There are two levels of seating spaces around the perimeter with benches and many moveable tables and chairs. It is filled with natural features including the waterfall, canals, pools, tall trees, granite boulders, and many planters with flowering plants.

PLANTS Japanese maple (*Acer palmatum*), Hinoki cypress (*Chamaecyparis obtusa*), American Witchhazel (*Hamamelis virginiana*), American Snowbell (*Styrax americanus*), Littleleaf Linden (*Tilia*

[77] "Waterfall Garden". The Cultural Landscape Foundation. http://tclf.org/landscapes/waterfall-garden.

cordata), Cyclamen, Pansy *(Viola tricolor*), Rhododendron, Ferns, Devil's Club (*Oplopanax horridus),* Camellia, Hellebore, Oregon grape *(Mahonia aquifolium).* The garden has many trees and shrubs that provide shade and sense of enclosure. Flowering plants bring color to the space and pleasant scents.

BENEFITS Provides a space abundant in natural features that gives a sense of enclosure and serenity. Terms used to describe the park by visitors to the space include: "contemplative refuge", "secluded oasis", "hidden escape", "lovely quiet small park". Many users spoke to a sense of relaxation in the space[78]:

"A neat place to get away from the street, relax and collect thoughts. I liked just sitting and **listening to the water**"

"It is an **oasis in the middle of a busy city** where you can sit at the tables, chairs, and benches, and just relax and recharge"

"It is **shady and peaceful,** with lots of places to sit"

"A **restful and charming** park, complete with waterfall, tables and shade"

"The noise of the water, the **sense of enclosure**, and the **smell of the plants** are so beautiful and calming".

"Once you enter the gate, there is a **sense of tranquility**"

"The waterfall **creates a feeling of being in a forest** rather than a major city. Trees and shrubs contribute to that ambiance and large concrete planters feature seasonal flowers"

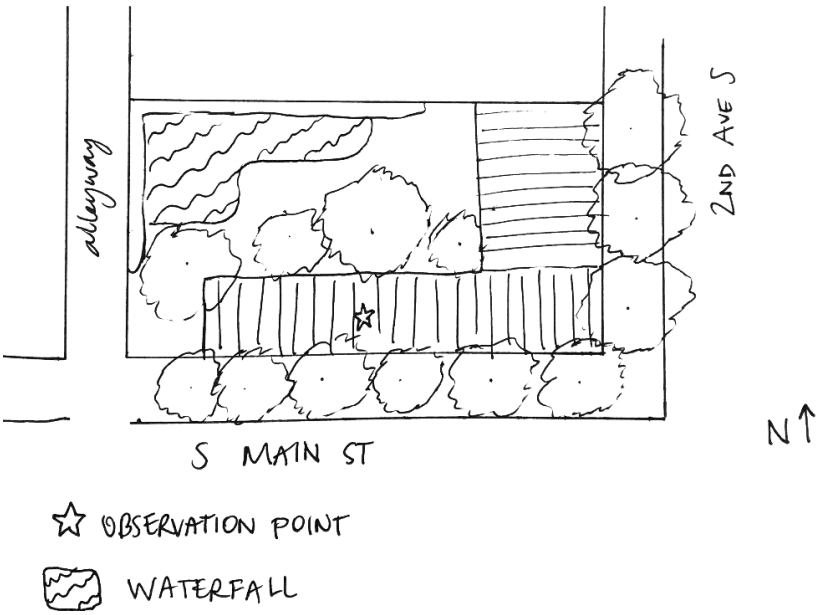


Figure 3.19 Site map of Waterfall Garden Park

[78] Yelp and TripAdvisor reviews. https://www.yelp.com/biz/waterfall-garden-seattle. https://www.tripadvisor.com/Attraction_Review-g60878-d561311-Reviews-Waterfall_Garden_Park-Seattle_Washington.html

Figure 3.20 Waterfall and colorful plantings in the park are sources of fascination

Figure 3.21 Layered plantings and a tree canopy provide visitors with a sense of enclosure and escape

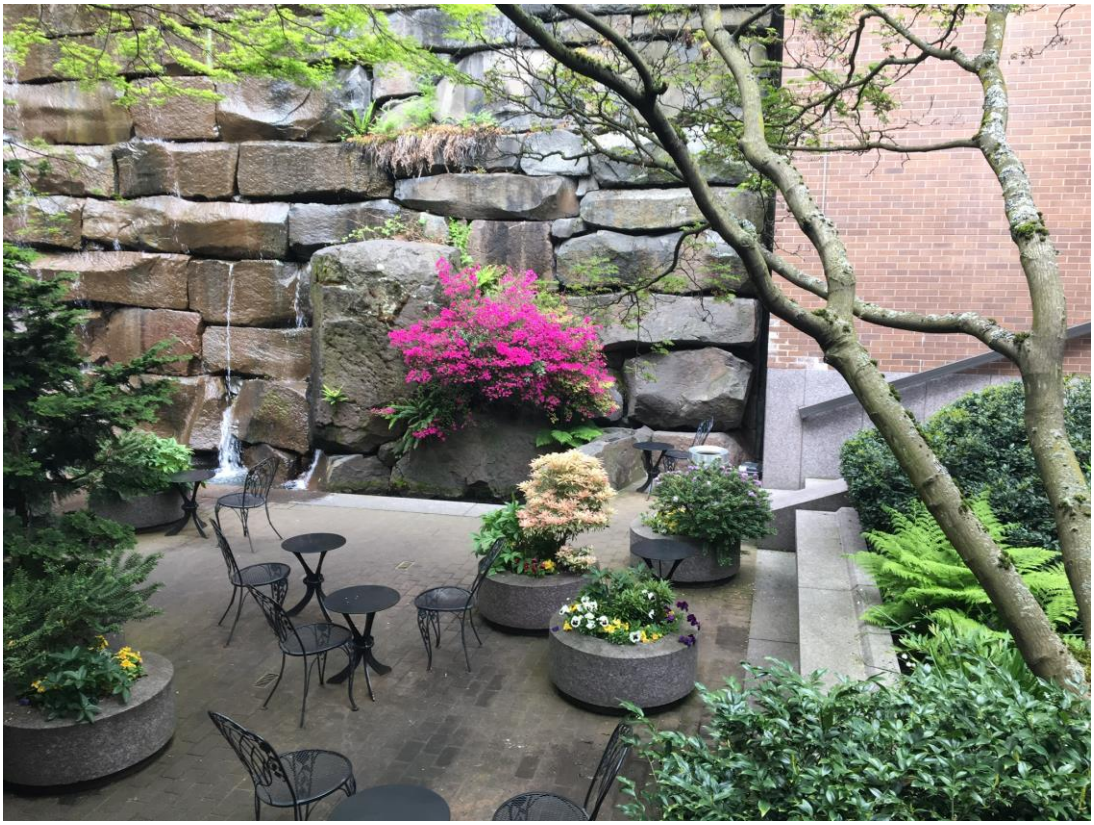


Figure 3.22 Many moveable tables and chairs offer flexible seating for people to stop and stay in the park

Figure 3.23 The park is home to several water features with moving water

ACTIVITY

Date: Tuesday, May 2nd

Time: 1:00-2:30pm

Weather: Sunbreaks, about 60°F

Approximately 59 people visited the site from 1pm-2pm. According to the security guard on duty, the most popular time for visiting the site is usually between 11:30am-2pm on weekdays, when many people who live or work nearby come to eat their lunch. Many people visiting the site came in and walked to the waterfall. They would then take photos, or just take a moment to stare up at it. Several people used the park as a shortcut, walking diagonally through the park from one entrance to the other, perhaps taking the more "scenic" route as opposed to staying on the sidewalk and walking the perimeter of the park. Some people stop and stay at a bench or one of the table and chairs. They eat, read, and write. One woman washed her dishes in one of the water features before the security asks her to refrain from doing so.

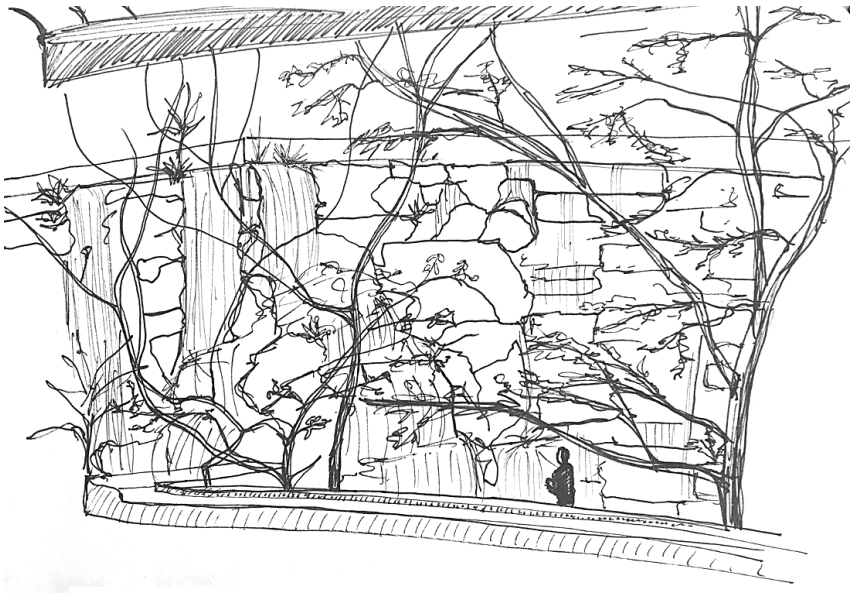


Figure 3.24 Sketch of a man observing the waterfall in the park

SENSORY EXPERIENCE

Sight The view of the waterfall is mesmerizing. There is a feeling of captivation from viewing the force with which the water crashes onto the rocks. The trees and plants are vibrant shades of green, many plants are flowering- colorful azaleas, cyclamen, camellias, and petunias. The occasional bird perches near or at the top of the waterfall.

Touch Visitors are free to run their hands through any of the water features- all are within reach and without barriers to impede contact. Plants are abundant and within reach. The benches lining the park are made of smooth granite. The walls of the waterfall are also made of granite and can be felt. The mist-filled air given off by the waterfall has a cooling effect on the skin.

Sound The waterfall is the dominant sound in the park. The constantly cascading water drowns out the sound of cars passing by on the streets adjacent, and is almost loud enough to mask the sound of a passing siren. There is a man talking to himself at the table closest to me, but the sound of the water makes his voice inaudible.

Taste There are no apparent opportunities for taste provided by the park.

Smell The air has a very fresh scent, a combination of the cool mist coming off the water and the abundance of green plants. The only unpleasant smell is from people smoking near the entrance.

LESSONS

- The sound of rushing water is a calming feature, both inspiring fascination and muffling unpleasant sounds from the surrounding area
- Abundant plantings add to a sense of escape from the urban setting
- Flowering plants provide aesthetic and olfactory appeal to visitors
- Providing ample seating and tables is key to encouraging people to stop and stay in a space

CASE STUDY

Summit Slope Park

TYPE	Public park
LOCATION	Capitol Hill 200 Summit Ave E
SIZE	0.4 acre
HOURS	4am-11:30pm
DESIGNER	Mithun
MANAGER	Seattle Parks and Recreation
PARTNERS	Department of Neighborhoods, P-Patch Community Gardening Program; Unpaving Paradise community organization

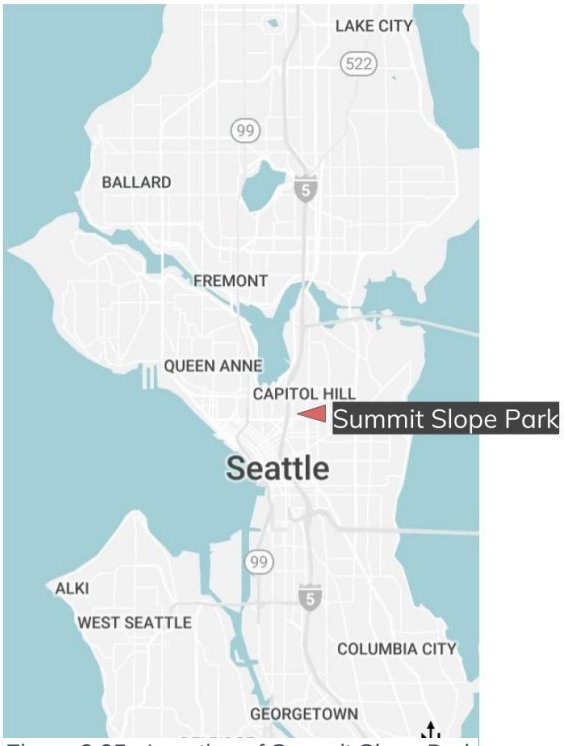


Figure 3.25 Location of Summit Slope Park within Seattle. Source: Google Maps

CONTEXT Prior to becoming a park, this site was a parking lot for three decades. In 2000, Seattle Parks and Recreation acquired the site and made it into the city park and P-Patch community garden that it is today[79]. The park was designed by Mithun, and is maintained through a partnership between Seattle Parks and Recreation, Seattle Department of Neighborhoods, and the Unpaving Paradise P-Patch organization. It received a Design Excellence Award in 2011 by The Seattle Design Commission, which noted: "The park is a clear example of how simple design and detailing can become a backdrop to the neighborhood, enhance our experience of the city and create a well-used and loved space for the community"[80].

[79] Seattle Parks and Recreation.

[80] City of Seattle Design Commission.

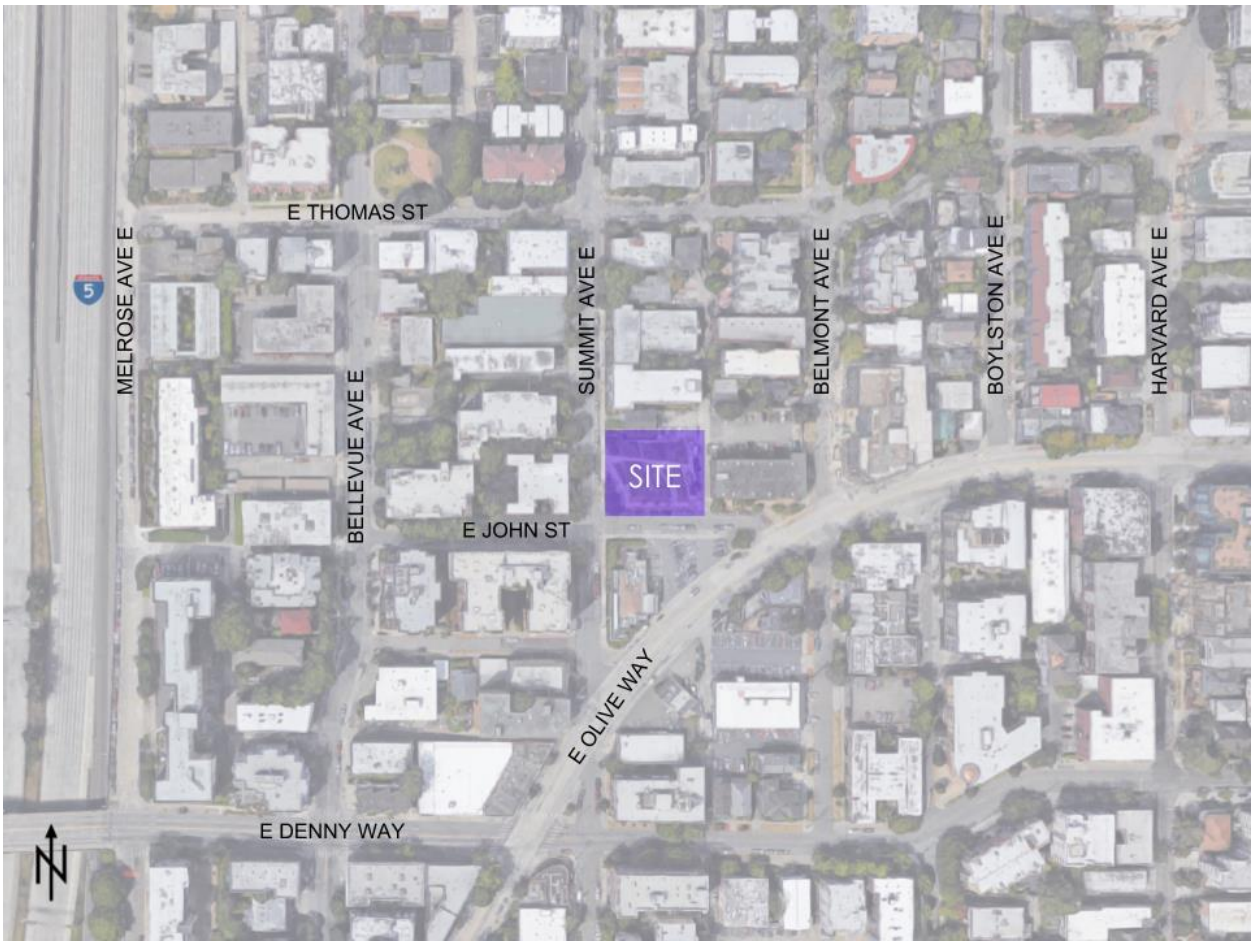


Figure 3.26 Summit Slope Park is located on Capitol Hill

ELEMENTS Twenty-four P-Patch plots for gardening, two lawn terraces and seating, plantings to attract pollinators, a community table, barbecue, skate dot (manual ledge), raingarden.

BENEFITS The active P-Patch provides a bounty of fresh food to its users and aesthetically-pleasing vegetation for park visitors. Online reviews from park users on indicate relaxing and rejuvenating qualities of the park:

"Great park for reading a book or **relaxing**"

"It's **refreshing** to walk through in summer when those gardens are bursting with vegetables and colorful plants."

"A **nice calm spot** with a beautiful garden. Some benches in the shade, and room to lay out in the sun."

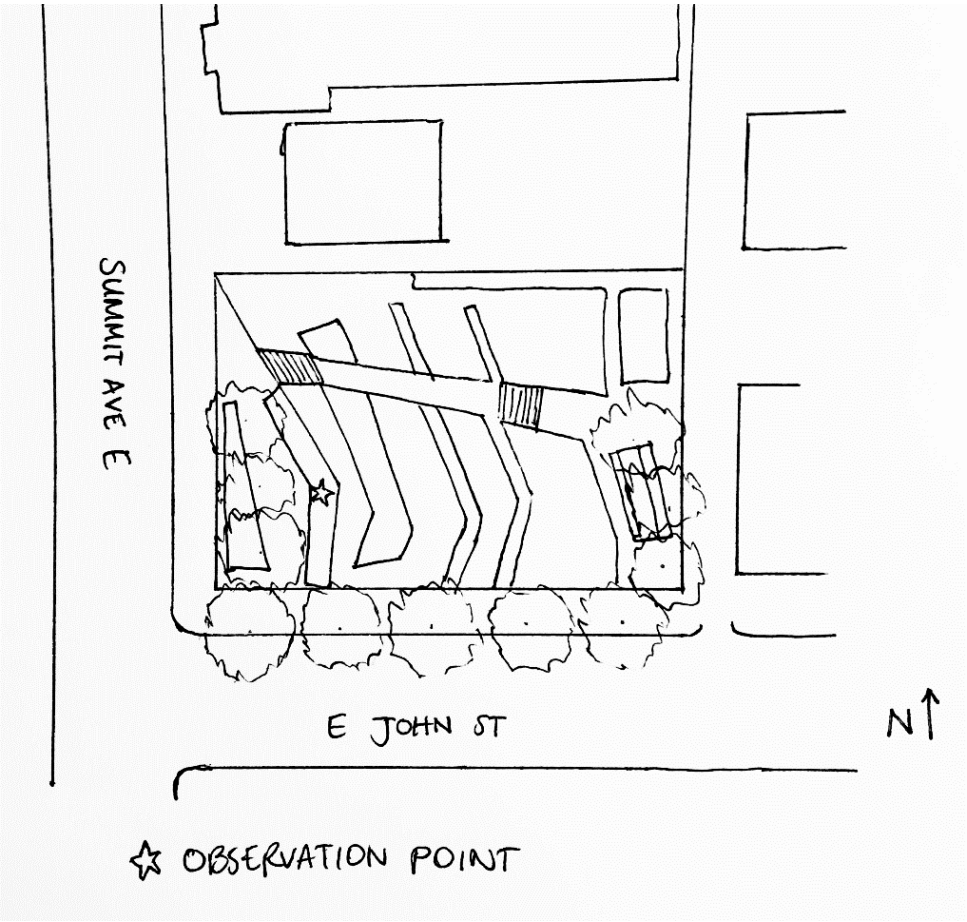


Figure 3.27 Site map of Summit Slope Park

ACTIVITY

Date: Friday, April 21st

Time: 12:30-1:30pm

Weather: Sunny, clear skies

There are three men and one woman working in the P-Patch, chatting with each other. A maintenance man from Seattle Parks and Recreation weed-whacks the grass. A man and a woman sit on the steps overlooking the P-Patch, eating their lunch.

Date: Tuesday, May 2nd

Time: 4:45-5:45pm

Weather: Cloudy, light rain at times

A group of 4 people hanging out around the communal table. They have backpacks, and could be transient. They are chatting and eating at the table. Meanwhile, several people come to the park walking their dogs, staying for around five minutes before leaving.

SENSORY EXPERIENCE

Sight There are few sight barriers within the park, with most of the vegetation under 3 feet high, no obstructing built structures, and the only trees are on the edges. Inside the park there are plenty of plants to look at, and an ever-changing variety of edible plants in the p-patch plots. In the early spring, there were many colorful flowers. Hummingbirds and butterflies are visiting the flowers. The park is situated near busy pedestrian streets of Olive and Summit, which makes the park a good place to sit and people-watch.

Touch The park is open, without much tree canopy and shade from neighboring buildings, so there is plenty of sunlight. It felt warm on sunny days, and would be a place to go and sit in the sun to warm up. The lack of shelter also makes it open to rainfall, so this could deter some people from visiting on rainy days.

Sound You can hear some traffic from busy Olive Way nearby, but it is not distracting because there is a buffer of buildings between the street and the park. There are sounds of people chatting in the park. Some birds can be heard in nearby trees. Weed whacker from the maintenance crew on a Friday, mid-day lasts around 20 minutes.

Taste There are many edible plants in the community garden. However, signs indicate that

the food is not to be eaten by the public. Taste appears to only be an opportunity for those that have a plot in the P-Patch.

Smell There is the smell of rain on the pavement and wet soil on a rainy day. Sitting on the benches on the West side there is the smell of recently-cut grass. Walking in the middle of the park in Spring through the P-Patch one can smell the scent of various flowers blooming.

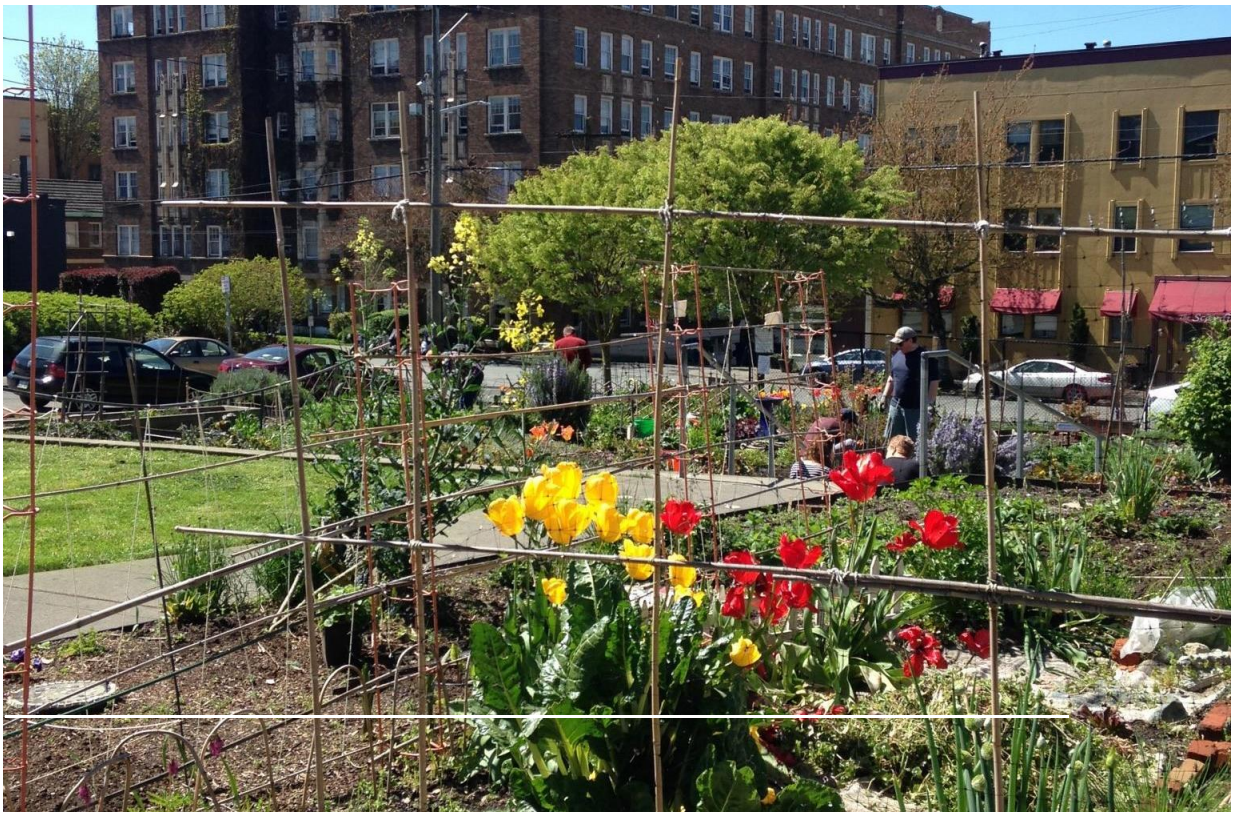


Figure 3.28 Flowering and edible plants create an immersive experience through the senses.

Figure 3.29 People gardening in the P-Patch

Figure 3.30 A communal picnic table encourages people to gather and provides a vantage point to the rest of the park.

Figure 3.31 The park offers a green haven in the middle of the built environment

Figure 3.32 View from the SW entrance to the park

LESSONS

- Simple design with flexible areas encourage use by a variety of users.
- Providing places to gather with seating and communal tables fosters a sense of community
- Incorporating food cultivation in a space increases chances for interpersonal interactions

LESSONS

Through looking at the design plans and intentions of the case study sites, combined with public opinion, and my own observations on site, some common trends emerged. The following outlines key aspects from the case studies sites that can lead to mental restoration, through the lens of the sensory framework:

To make a space more mentally restorative through sight:

More: plants, organic materials, color, movement

Less: synthetic materials, rigidity of forms

Key elements: water features, variety of plantings, colorful plants and flowers, plants that attract birds and pollinators, organic materials for paths, benches, and other structures, winding paths.

To make a space more mentally restorative through sound:

More: nature sounds

Less: vehicle noise, construction, other motorized sounds

Key elements: birdsong, water features, wind (through trees)

To make a space more mentally restorative through touch:

More: cooling features, plants to touch, smooth natural materials

Less: hard and abrasive surfaces, direct sunlight, thorny or allergy-inducing plants

Key elements: Vertical plantings, plantings at human-level, soft and leafy plants, tree canopy, water

To make a space more mentally restorative through taste:

More: opportunities to taste

Less: inedible plants, pesticides and other chemicals

Key elements: edible plants, especially those that are easily accessible (enjoyed on-site) such as berries, fruit and nut bearing trees

To make a space more mentally restorative through scent:

More: plants with pleasant and aromatherapeutic scents, plants that filter pollutants

Less: vehicle exhaust, cigarette smoke, other fumes

Key elements: Natural buffers to block exhaust from vehicles, trees, aroma-rich plantings such as: coniferous trees (pine, cypress), herbs, fragrant flowers

Combining the above aspects with the findings from the literature review, the following are combined lessons learned to consider when designing natural urban spaces that have the potential to provide public psychological health benefits. To create a space that has potential to provide mental restoration, the following lessons to consider are:

1. Providing places for people to sit. If people cannot sit, it is difficult to relax in a space.

2. A diversity and abundance of plants is pleasing to people in a multi-sensory way, especially if the plants produce flowers, have scents, or are edible.

3. The sound and sight of running water is calming to people and can create a sense of being away, a feeling of extent, and inspire fascination.

4. Trees are an important feature in providing people with shade and sense of enclosure.

5. Elements such as benches and chairs encourage gathering, and generally, having more people in a space attracts other people.

Design Recommendations

These design recommendations are based on the Sensory Framework developed and are informed by both the empirical evidence gathered through the literature review and the lessons learned from the case studies.

1. Start with small, incremental changes in the current context.

Starting where you are with what you have, by beginning with what is already present on the site, there is greater chance that the design will be successful and appropriate to the site. This includes:

- Acknowledging and incorporating any existing natural features (historically and present-day) where possible and appropriate
- Implementing small interventions that are feasible
- Connecting to existing greenways, parks, street trees, and other natural elements in the surrounding area to create a cohesive network of natural spaces

2. Incorporate natural elements that stimulate the senses.

One of the reasons that exposure to nature has been proven beneficial to humans is that it engages and enlivens our senses. The following are suggestions of how natural elements can be incorporated into a space to engage all five senses:

SIGHT

- Make the space visually appealing by using **organic lines and shapes** rather than rigid and straight in the design.
- Incorporate **colorful plantings** into the space.

- Use an **abundance and diversity of plantings** to create a scene that is lush, vibrant, and biodiverse.

- Plant **flowering plants** that will attract pollinators and provide visual interest.

SOUND

- Attract songbirds to the space by incorporating **trees and native plants** that will draw them to the space.

- Incorporate **water features** that will make the sound of rushing or running water.

TOUCH

- Make surfaces from **natural materials** with smooth texture.

- **Plentiful plantings**, especially those near places to sit will encourage people to interact with the plants.

- If there is a wall or other vertical surface, train plants to grow up on trellises as a **vertical garden** to encourage people to feel the vegetation.

TASTE

- **Edible plants** and in garden beds can provide people with something to eat.

- Incorporating **fruit and nut bearing trees** and provides people food and a sense of abundance.

SMELL

- Include plants that have **aromatherapeutic resins**, including hinoki cypress trees, cedar trees, and culinary herbs such as lavender, thyme, and rosemary.

- **Fragrant flowering plants** with fragrance are enjoyed by most people.

3. Incorporate plants into street infrastructure to create multifunctional green infrastructure. Instead of hardscaped ditches and drains, use plants and natural processes to facilitate the function. Green infrastructure should not only function as a means of filtering stormwater, but also to improve the human experience of the space. This can be achieved by:

   - Providing adequate walking space for pedestrians
   - Benches for people to sit and observe natural processes
   - Interpretive signage to engage people in understanding the natural process

Examples Of Recommendations

Figure 4.1 Vertical gardens allow for increased visibility of nature and encourage tactile engagement.

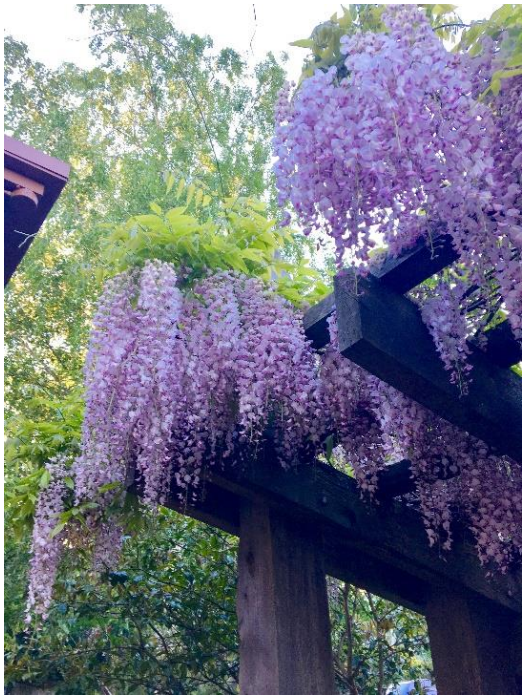


Figure 4.2 Climbing plants such as wisteria make use of vertical growing area in small spaces and can inspire fascination.

Figure 4.3 Community gardens provide respite from the built environment and places to cultivate food.

Figure 4.4 Benches allow users to sit and observe nature.

Figure 4.5 Seating below trees provides a sense of escape and respite from the sun.

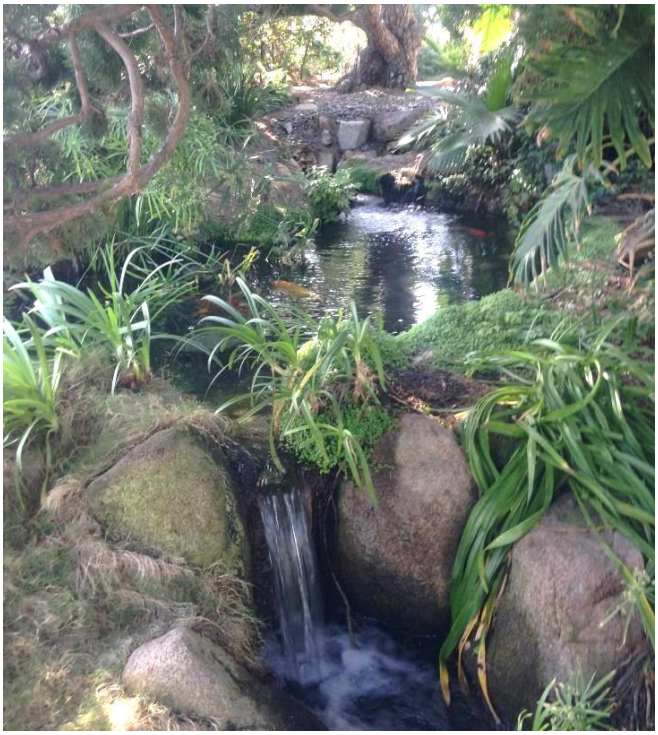


Figure 4.6 Water features create pleasant sounds and meditative movement.

Figure 4.7 A diversity of plant species and colors creates visual interest, engaging the viewer.

Figure 4.8 Green infrastructure can serve multiple functions

Implementation

Context

Seattle is currently one of the fastest-growing big cities in the country (Figure 5.1). It tops the list of major metropolitan areas becoming more dense (Figure 5.2). To manage this growth, Seattle's Comprehensive Plan aims to concentrate population growth into designated urban centers and villages (Figure 5.3). Lake City is one of these urban villages, and like other urban center in Seattle, rapid population increase is leading to a development boom in the neighborhood to accommodate Hub Urban Village (HUV) growth targets set by the City of Seattle's Comprehensive Plan. Lake City is in Northeast Seattle, located between Interstate 5 and Lake Washington, and is bordered by NE 85th Street to the south, and NE 145th Street to the north.

Figure 5.1 Seattle is one of the fastest-growing cities in the nation

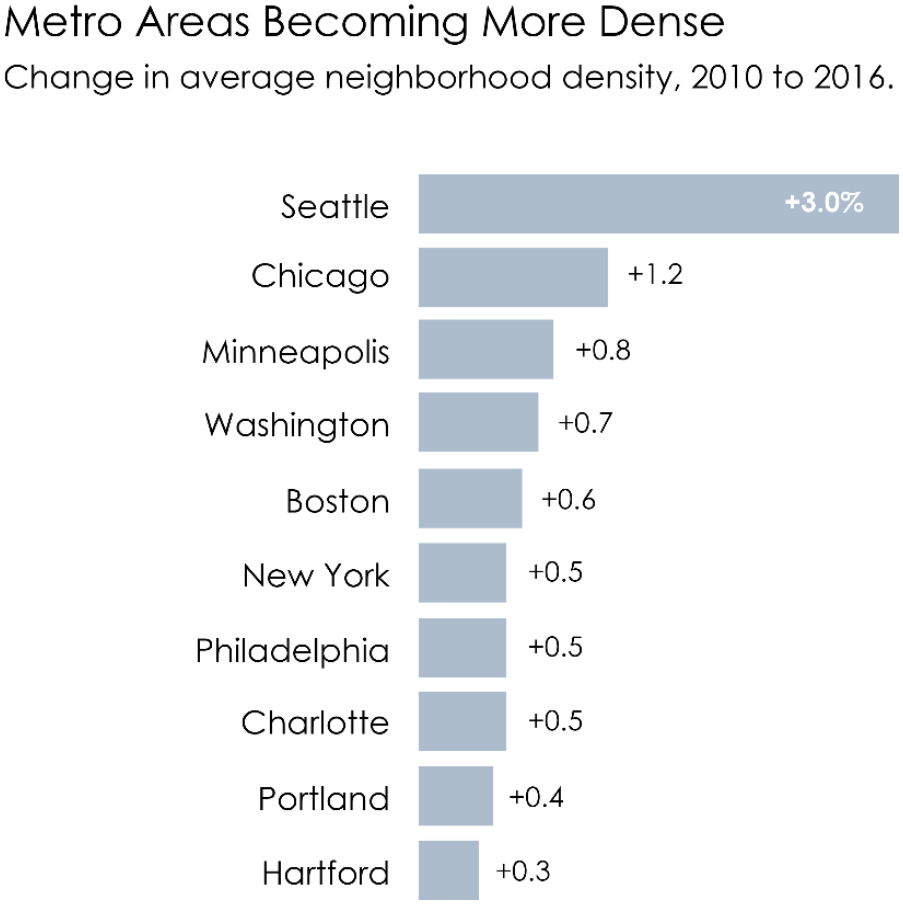


Figure 5.2 Seattle tops the list of major U.S. cities becoming more dense. 2016.

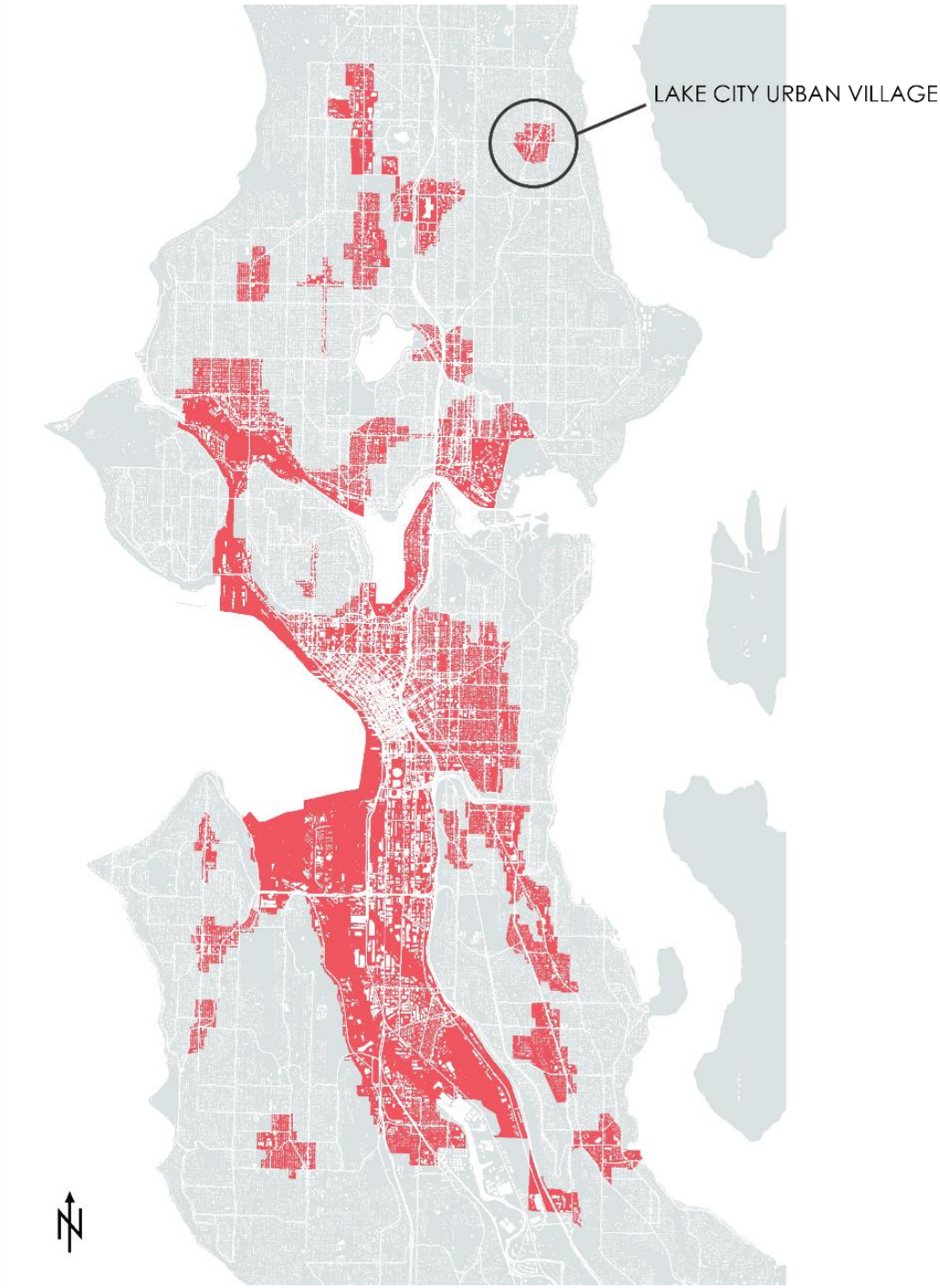


Figure 5.3 Seattle's Urban Villages. Source: City of Seattle GIS Database

Before this area became known as Lake City, it was home to the Coast Salish people who enjoyed the fertile land adjacent to the waters of what is now known as Thornton Creek and Lake Washington for thousands of years. The land was taken from the Salish people with the Treaty of Point Elliott in 1854, and settlement by European immigrants began in the area[81]. In 1887, a railroad was built to carry timber along what is roughly the route of what is today known as Lake City Way. Since the late 1800's, the area has seen many phases of economic ebbs and flows. The establishment of Lake City Way as the main highway and thoroughfare to Everett and the Eastside spurred development along the highway in the early 20th century, but the later additions of Aurora and I-5 as more direct alternatives took travelers away and business in Lake City slumped in the latter part of the century. As part of urban renewal efforts in the 1970's, a stretch of what is considered the center of Lake City- the intersection of Lake City Way and NE 125th Street- was revitalized through the addition of sidewalks, street tree plantings, and public art installations[82].

Today, Lake City is a diverse neighborhood, both ethnically and socioeconomically (Figure 5.4). Walking along the central stretch of Lake City Way, one will encounter many small businesses run by immigrant business owners- everything from a Filipino bakery to a Middle Eastern market. Evidence of gentrification is seen in the changing facades and stark heights of new development going in (Figure 5.5).

[81] (Wilma 2001)
[82] Ibid.

Median Household Income by Census Tract, 2013

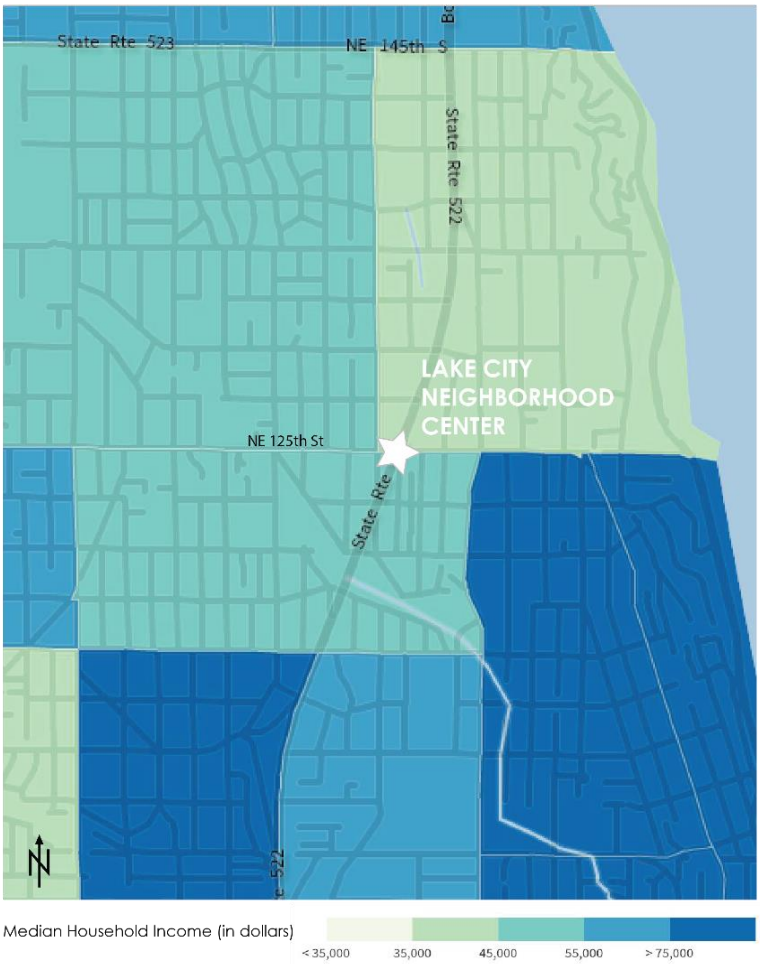


Figure 5.4 Differences in household income around Lake City. Source: census.gov

Table 5.1 Lake City HUV growth targets.

Lake City Urban Village Growth Target information		
	Households	Jobs
2004	1,920	1,510
2024 target	+900	+650
% of target*	58%	no data

*as of April 9, 2014

Table 5.2 New and proposed development near Lake City Way and NE 125th St.

Site Address	Project type	Status	Number of residential units
3500 NE 125TH ST	Eleven 3-story buildings containing 44 residential units	Dec. 5, 2015: Design Review Early Design Guidance	43
12350 33RD AVE NE	23-unit residential building with one 483 sq. ft. live-work unit	June 25, 2013: Permits issued.	23
12706 33RD AVE NE	7-story, 159 unit apartment building with 5 live/work units.	April 1, 2015: Land Use Application	159
12320 32ND AVE NE	Six-story structure containing 46 units and 53 small efficiency dwelling units (for a total of 99 residential units) and 3 Live/Work Units	Oct. 15, 2015: Land Use Application	99
12311 32ND AVE NE	7-story building containing 9 live-work units with 144 residential units above.	March 31, 2009: Permits issued.	144
12705 30TH AVE NE	6-story, 70 unit apartment building with a 6,600 sq. ft. childcare center located on the first level.	Feb. 22, 2017: Permits issued.	70
3025 NE 130TH ST	7-story, 117-unit apartment building	Jan. 9, 2017: Permits issued.	117
3021 NE 130TH ST	3-story, 5 unit townhouse	Jan. 17, 2017: Permits issued.	5
3117 NE 133RD ST	one, 3-story, four unit townhouse structure (4 units total)	Permits issued.	4
		TOTAL NEW RESIDENTIAL UNITS:	664

In the past year, 664 new residential units have been built or have permit approval (Table 5.2). Population growth and new development can often lead to the negative effects associated with gentrification, such as rising cost of living and displacement of long-time residents, but the City of

Seattle is attempting to mitigate these externalities in Lake City. In 2016, Mayor Ed Murray, along with the City's Office of Planning and Community Development (OPCD), launched an "a new integrated planning effort" for Lake City, entitled "A Shared Vision for Lake City"[83]. This new initiative aims to combine the efforts of all city departments, who in the past worked independently in communities, into a more collaborative approach to meeting neighborhoods' needs.

Figure 5.5 New and proposed development near Lake City Way and NE 125th Street.

[83] ("A Shared Vision for Lake City", 2016)

Framework

Recognizing the current and future residential development in Lake City, and the need to ensure the future livability of the area, the City of Seattle developed the Lake City Urban Design Framework in 2016. Within this framework, the Seattle's OPCD recommended zoning changes to the Lake City Urban Village to encourage dense population growth and create a more walkable commercial core (Figure 5.6).

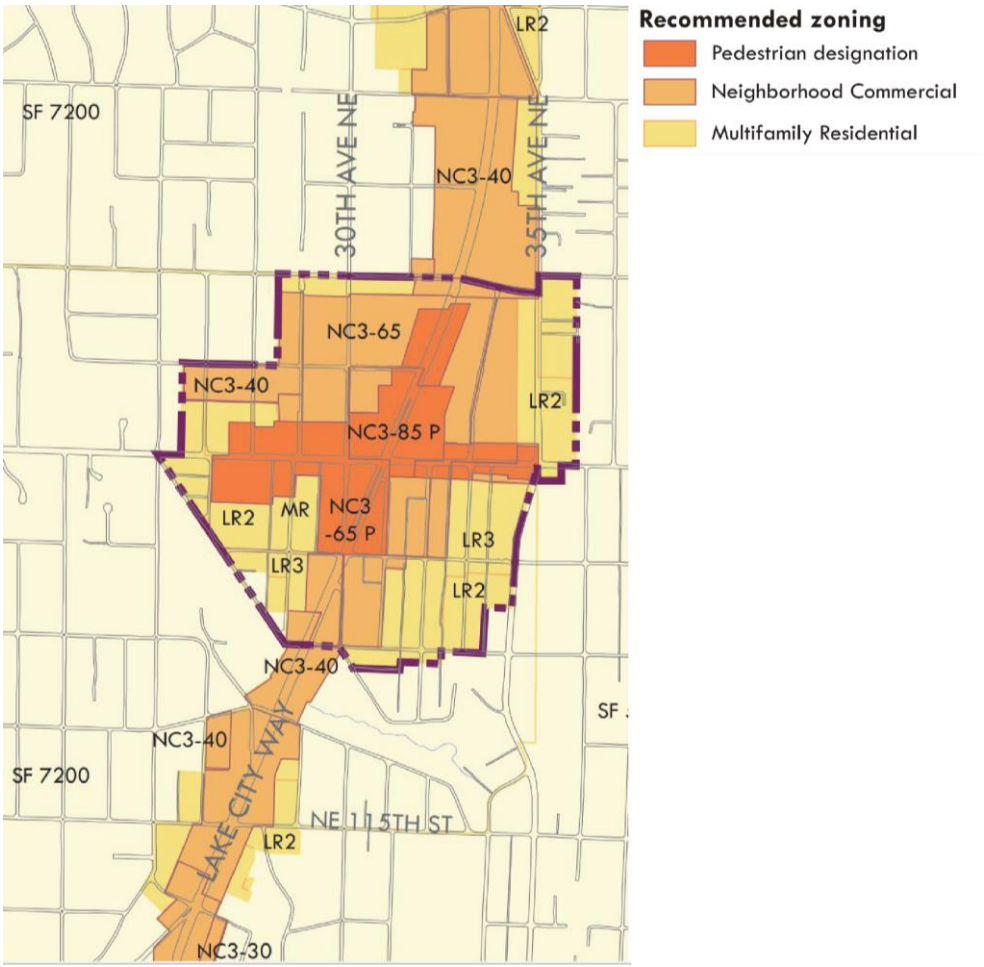


Figure 5.6 New zoning recommendations for Lake City. Source: seattle.gov

With the emphasis on a more pedestrian-friendly retail core comes the need for pedestrian

amenities and opportunity to enhance the pedestrian experience. Currently, Lake City is not particularly pedestrian friendly, especially around the neighborhood core. One recommendation that is stated in the Urban Design Framework is to develop more pocket parks and courtyards that are accessible by pedestrians to create a sense of comfort and shared public space in the urban core. Through community outreach efforts, the creators of the Framework received input from community members, and many of them expressed a desire for linear parks, a more connected green network, and more public plazas to enhance the public realm[84].

Existing Conditions

The Lake City Urban Village, relative to surrounding areas outside the boundary, has a dearth of tree canopy and green spaces (Figure 5.7). Zooming in to the center of the neighborhood, you see that. Even though there is a park (the Lake City Mini Park) in the neighborhood core, the park is primarily hardscaping (Figure 5.8). Although there is a lack of public natural spaces currently in the Lake City Urban Village, there is also opportunity for introducing urban nature into existing public spaces. By using the Sensory Framework as a guide, the public spaces in Lake City's core could be reimagined as spaces of thriving vegetation that can support mental restoration for those who visit them.

[84] (Lake City Urban Design Framework, 2016)

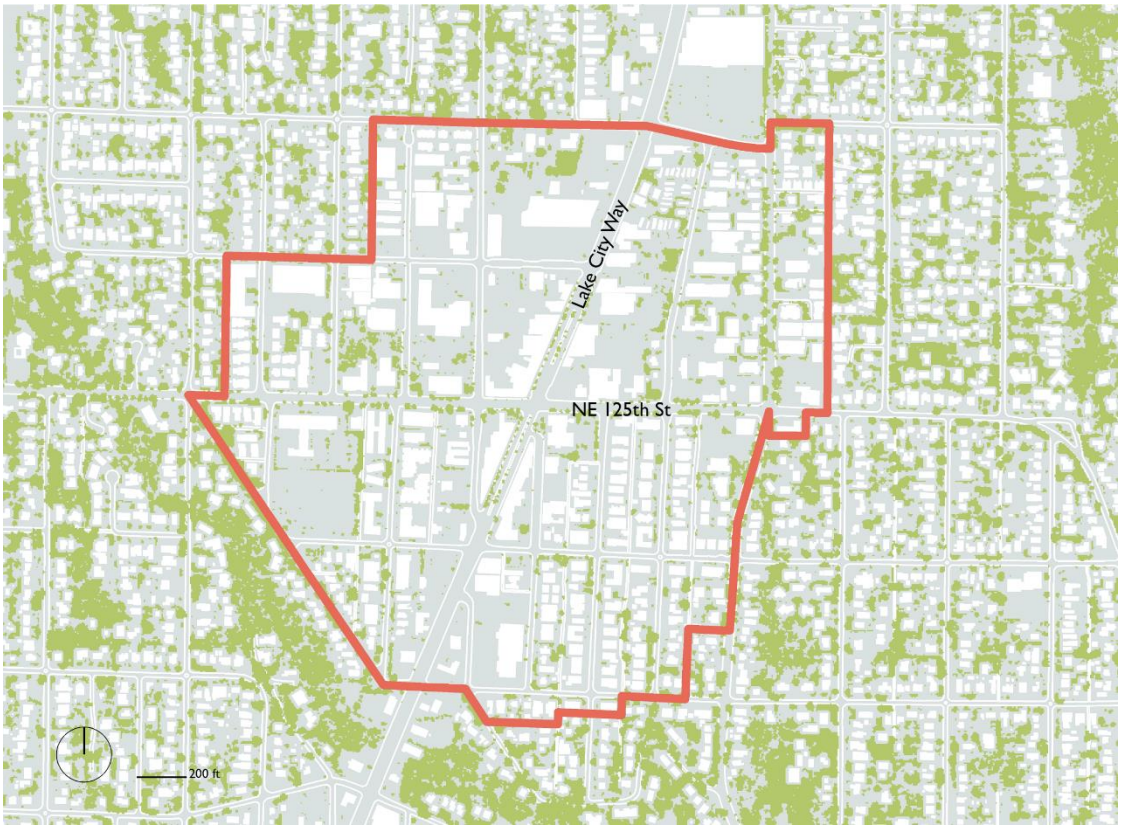


Figure 5.7 A lack of green spaces within the Lake City Urban Village.

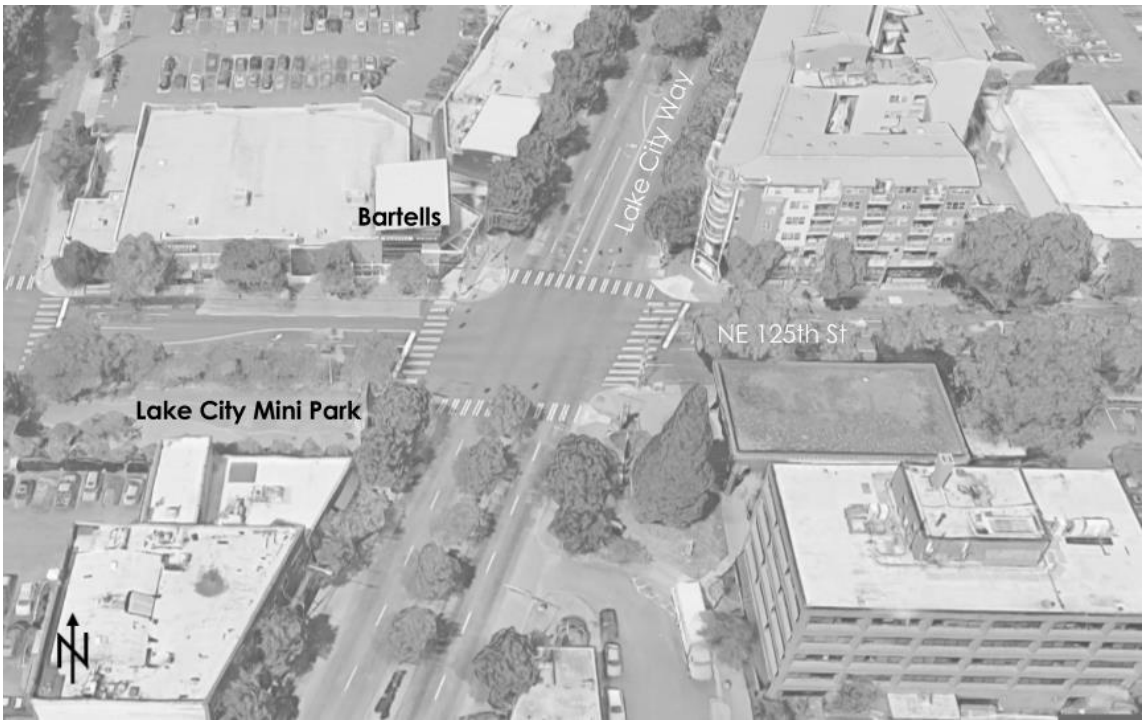
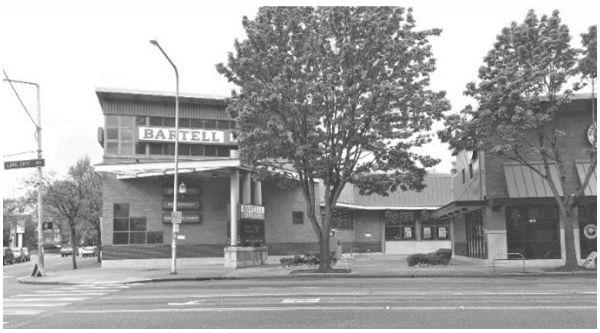


Figure 5.8 The intersection of Lake City Way and NE 125th Street.

What the intersection of Lake City Way and NE 125th Street might look like after implementing natural public spaces that are based on the Sensory Framework:

Figure 5.9 The intersection of Lake City Way and NE 125th Street reimagined with natural interventions.

The northwest corner of the intersection:



CURRENTLY

AFTER with the inclusion of the following features:

-**Water feature** with **benches**

-Climbing **flowering plants** and **fruit trees**

-**Bioswale** along Lake City Way

The Lake City Mini Park on the southwest corner of the intersection:

 CURRENTLY

AFTER with the inclusion of the following features:

- Community garden with beds of **edible plants**
- Plantings of **flowers to attract birds and pollinators**
- **Vertical green wall** with **bench**

Reflection

This thesis provides recommendations for ways in which nature can be incorporated into urban areas to support psychological health benefits. The recommendations are evidence-based ideas for designing spaces with specific natural features that could provide urban dwellers with respite from psychological stressors. This thesis does not, however, claim that simply adding more select natural features to urban public spaces will lead to improved psychological health for the people who use the space. Psychological health and well-being are complex and highly personal conditions, and as such, cannot be comprehensively addressed through simply changing the setting that a person is in. The research cited in this thesis provides evidence to suggest that setting, and especially settings rich with natural features, can aid in improving psychological health and well-being by reducing stress, anxiety, and depression, but it is certainly not a solution in and of itself.

If we as planners and designers hope to improve the health and well-being of the people living in the communities that we are planning and designing, it is imperative that we always consider these issues holistically. Psychological health issues require a complex and holistic approach. Modifying and improving our public spaces to support psychological benefits to people is just one piece of a larger, integrated puzzle. To address issues of psychological health, we must also provide and support policy that prioritizes people getting the health services they need, as well as prioritizes greater environmental health and healthier lifestyles.

The examples for implementation provided in this thesis are meant to show, at a conceptual level, what design recommendations might look like if applied to a real site. They illustrate what public spaces could look like if re-designed with the psychological benefits of nature in mind. These examples draw from the literature and the case studies, using natural elements suggested by the text

as well as features observed in the case study sites. Elements were chosen that could potentially work in the site based on these case study sites in Seattle, which are typologically similar to the site in Lake City. This is not intended to suggest that simply adding these design elements and natural features to a space will guarantee that the space will bring psychological benefits to the users. For these spaces to be successful in that regard, there are several important things to consider when planning and designing public natural spaces:

- The spaces should always be designed with the intention to serve everyone in the community equitably.
- The design of a space should reflect the needs and desires of the residents of the community that it is in--this includes current residents, transient residents, and future residents.
- Every site is unique, and needs to be treated as such--there is no one-size-fits-all design solution for public spaces.
- Knowledge of the natural ecology of a place is essential to appropriately choosing which natural features and vegetation to incorporate into the site and where.
- Native plants that attract beneficial insects, birds, and other pollinators should always take precedence over non-native vegetation.

There is much potential for urban spaces of nearby nature to have powerful effects on the psychological well-being of urban resident. Although much is known about the positive impacts of urban nature on human physical health, there is still relatively little research on the psychological benefits of human interaction with nature the urban context. Much of the current research focuses on urban natural spaces in the more traditional sense of designated parks and open spaces. Further research on the impacts of nature in an outdoor urban setting could lead to a greater awareness of

the need for nature in urban environments. Planners and designers have the opportunity to consider the findings of evidence-based research on the important connection between nature and human psychological health when creating urban public spaces.

By considering the design of a space through a sensory framework with human experience with nature at the heart of the design, the resulting spaces could have more of a positive impact on the mental restoration of visitors to the space. Using natural elements that provide the widest diversity of sensory engagement could potentially have the greatest positive impact on because it provides people with an immersive experience. However, not every space needs to incorporate opportunities to engage all of the senses. As evidence suggests, even a street tree outside one's window can provide some mental restoration. With thoughtful consideration to how humans engage with their environment, and using current research about how humans benefit from interacting with nature, urban planners and designers have great potential to create positive impacts on human health through urban natural space design.

RESOURCES

Trees

City Fruit - Best Trees for Western Washington https://www.cityfruit.org/sites/default/files/file-uploads/bestfruitvarieties.pdf

Native Plants

Washington Native Plant Society (WNPS)
http://www.wnps.org

Ladybird Johnson Wildflower Center
http://www.wildflower.org/plants

Habitats

Xerxes Society - Guide to Providing Habitat for Pollinators
http://www.xerces.org/wp-content/uploads/2009/05/pollinator_friendly_parks_21ed_xerces_society.pdf

National Audubon Society - Native Plant Database for Attracting Birds
http://www.audubon.org/plantsforbirds

The Pollinator Pathway
http://www.pollinatorpathway.com

Community Gardens

Seattle P-Patch Program
http://www.seattle.gov/neighborhoods/programs-and-services/p-patch-community-gardening

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