# Planning for Small & Ordinary Natural Urban Spaces to Enhance Mental Health & Well-being: The Psychological Health Benefits from Contact with Nature

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## Abstract

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In the face of accelerating urbanization and rising incidence of chronic illness, nature in the urban setting is a vital contributor to quality of life. This project highlights the proven, positive effects of experiences with nature on psychological health and recommends integrating nature into small, ordinary urban spaces to create a network of natural areas that provide access to a healing environment. The modest scale of this proposed intervention offers a feasible and potentially economical opportunity to create an urban environment that supports psychological well-being. Small and publically accessible spaces provide an opportunity to increase experience with nature in the urban setting while supporting the health of individuals and communities. Incremental changes lead to significant progress over time. The project proposes a framework for evaluating the quality of small, natural urban spaces and provides recommendations for incorporating such spaces into planning efforts.

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## Acknowledgements

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# Chapter 1: Nature, Psychological Health, and Planning

## Part I: Introduction

In the spheres of public health, medicine, and urban planning, it is acknowledged that human health depends on healthy urban and natural environments (Dannenberg et al. 2011). This awareness grows out of a global experience of accelerating, large-scale environmental degradation. The health of communities is also in decline, as evidenced by an increasing incidence of chronic disease. The interplay between environmental and human health is critically important to successful and sustainable urban planning and development. This thesis focuses on the contributions of often overlooked natural urban spaces to psychological health.

This discussion about urban health starts with a recognition of the indivisible relationship between humans and the natural world. As interest in the connection between nature and psychological health to emerge four decades ago, evidence validating the impact of the natural environment on mental health was notably absent (Kaplan, R. and S. Kaplan 1989). A great deal of work has since confirmed the importance of nature on all aspects of human health, psychological well-being in particular (Frumkin 2001; de Vries et al. 2003; Groenewegen et al. 2006; Maller et al. 2008; Dannenberg et al. 2011; Ward Thompson and Aspinall 2011; Bratman, Hamilton, and Daily 2012; Wolf, Flora, and Housley 2012). Of particular importance to this project is how exposure to nature provides individuals with opportunities for cognitive restoration and stress reduction (Kaplan R. and S. Kaplan 2011; van den Berg, Koole, van der Wulp 2003; Health Council of The Netherlands 2004; Ong and Peterson 2011; Bratman et al.

2011; Wolf and Housley 2013). This project integrates these proven, positive effects of experiences with nature into a framework that can inform strategy for enhancing small, ordinary, and publically accessible urban spaces with nature. Access to nature in an urban environment is a critical feature of a healthy community and this element is absent from many current conversations within the community of urban planners. This is an undeniably complex but critical topic; a clear understanding of the connection between the natural world and psychological health has a great implication for sustainable urban planning.

## Part II: Scope

This project recommends integrating nature into small, common, and underused spaces to create a highly accessible constellation of restorative areas throughout the urban setting. This thesis hypothesizes that the highly organized and linear form of the urban built environment dictates a certain emotional range. This may have a cognitive dulling effect at both subconscious and conscious levels. In contrast, natural spaces provide a direct counterpoint to the structured and technologically driven daily experience of many urban dwellers. The greater variety of forms and patterns found in a natural setting may enrich the human experience by catalyzing inspiration, inviting creativity, and restoring mental fatigue.

Urbanization, densification, and the increasingly negative effects of the built environment on public health make this topic highly relevant. Land in urban settings is scarce and in high demand. Integration of nature into overlooked and publically accessible urban areas can maximize both the utility of space and the health benefits resulting from contact with nature.

The modest scale of this proposed intervention offers a financially feasible opportunity to modify an urban environment in order to enhance psychological well-being. Opportunities to develop new parks will be increasingly rare and expensive. A dispersed system of small natural urban spaces that exist as distinct from but complementary to a larger network of green spaces increases the frequency of natural urban experiences. A patchwork of natural areas throughout an urban setting disrupts the highly organized, predictable built form and increases the variety of experiences an individual may have. This physical reshaping can gradually improve underused urban spaces and overtime stimulate experiences that support psychological well-being and foster a positive sense of engagement with the urban setting.

Accessible, small, natural spaces interspersed throughout an urban environment provide an opportunity for local community members to participate in the shaping and stewardship of public space. Emotional bonds to a local place generate increased commitment to the surrounding community and enhance well-being (Altman and Low 1992). Local residents can effectively identify community needs, inform relevant design and strategy, and anchor implementation and maintenance. Locally driven solutions can enhance community pride, engender a sense of ownership, and foster an interest in care for public space.

Efforts that expand access to nature in publically accessible spaces may provide disproportionate benefits to low-income communities. Poor communities struggle with a larger burden of disease, including psychological illness, and may subsequently significant benefit from small-scale improvements to the physical environment, particularly those coupled to local

community engagement efforts (WHO 2014; Kuo et al. 1998; Ward Thompson et al. 2012). Supporting basic needs such as access to quality housing, food, and sanitary living conditions are a challenge for low-income populations. Urban planning efforts need to focus the creation of environments that promote psychological well-being and social cohesion (Marmot et al. 2008). Access to nature in an urban setting is one way to support mental health and may achieve positive results relatively quickly. Even a slight improvement to the mental health of a community would be a significant accomplishment.

## Part III: Structure

The project begins by underscoring nature as an important health resource in an urbanizing world (Chapter 2). In this context, the influence of the built environment on the psychological dimension of health and well-being emerges as an increasingly critical aspect of urban planning. To maximize the benefit contact with nature provides requires an understanding of human preference for both natural and built spaces (Chapter 3). Factors that influence preference are undeniably complex. Although the discussion of preference in this project is limited to an overview, various studies are highlighted to identify key qualities that drive preference for natural and urban spaces. These characteristics are distilled into a framework that can inform the evaluation of small, ordinary, and publically accessible natural spaces in the urban setting (Chapter 4). Following the exploration of environmental preference, theoretical models are outlined that describe the two specific psychological outcomes from exposure to nature: cognitive restoration and stress reduction (Chapter 5). In addition to emotional benefit, a growing body of research shows that individuals and communities prefer natural urban spaces.

This research on preference, coupled with a focus on the health benefits of natural urban spaces are the two principles that inform a set of practice recommendations that can be used by urban planners and policy makers (Chapter 6). The limits of this project and areas for further research are addressed (Chapter 7). This project concludes by discussing the value of considering small, ordinary, and publically accessible natural spaces in the planning of dense but healthy urban communities (Chapter 8).

## Part IV: Methodology

Interest for this project stemmed from discussions about the impact of the built and natural environments on mental health (Ulrich 1984; Spirn 1984; Kaplan R. and S. Kaplan 1989; Hartig, Mang, and Evans 1991; Frumkin 2001; Kuo and Sullivan 2001a, b; Maller et al 2006; Dannenberg et al. 2011; Bratman, Hamilton, and Daily 2012; Wolf, Flora, and Housley 2012). The scoping and topic selection process began with a review of a wide range of sources. Once the premise was selected, literature reviews, peer-reviewed articles, and books by key thought leaders were selected to highlight the best available evidence validating the psychological benefits to urban populations from contact with nature. The Web of Science Core Collection database was used to perform citation tracking for peer-reviewed articles. Seminal work on the effective design of highly used public space informed the focus on small, ordinary, urban spaces (Whyte 1980; Gehl 1987; Kaplan R., Kaplan S., and Ryan 1998). From the research, major findings were identified to inform guidelines and recommendations intended to help incorporate this concept of nature into planning practice.

## Part V: Terminology

The following terms used in this project are defined as follows:

- Directed attention: the process of suppressing distraction to maintain focus (Kaplan S. 1995; Berman, Jonides, and Kaplan 2008).
- Healthy community: one where the negative influences of the built environment on health are minimized through physical modifications that reduce health risk factors and focus on chronic disease prevention (CDC, 2013b).
- Mental fatigue: the exhaustion of directed attention (Kaplan R. and S. Kaplan 1989; Kaplan S. 1995).
- Mental health: "a state in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community" (CDC 2013a).
- Quality of life: "a broad multidimensional concept that usually includes subjective evaluations of both positive and negative aspects of life" (CDC 2011).
- Urban nature: areas with living elements under some degree of human management.
- Well-being: "the presence of positive emotions and moods (e.g., contentment, happiness), the absence of negative emotions (e.g., depression, anxiety), satisfaction with life, fulfillment and positive functioning" (CDC 2013c).

## Chapter 2: Nature, Health and the Urbanizing World

As of 2007, for the first time in human history, the majority of the world's population resided in urban areas (WHO 2010). By 2050, more than 70% of the world's projected 9.6 billion people are expected to live in urban areas (UNPD 2012). Urbanization pressures planning agencies to carefully manage the economic, social, and environmental health of increasingly complex communities. Urban development has the potential to both benefit and challenge human health. Despite relatively higher income, better sanitation, and increased access to nutrition and health services, urban living is also connected to an increased risk of chronic illness (Lederbogen et al. 2011). Cities are stressful and rife with significant socio-economic inequities. The social and environmental determinants of health in urban areas are dynamic and complex (WHO 2014). This project explores how one variable, access to natural urban spaces, can positively influence the human experience by supporting psychological health.

Increasing urban density has important ramifications for public space and urban nature. Recent estimates by the National Association of Realtors found that over 50% of American homeowners prefer more compact and complete communities (Leinberger and Alfonzo 2012). This preference for dense urban living is a notable shift from previous patterns of low-density suburban development that began at the turn of the 20$^{th}$ century (Chudacoff, Smith, and Baldwin 2010). The shift to the suburbs was fueled in part by a desire for a more tranquil environment that was closer to nature. Ironically, many suburban developments actually decreased access to nature. Low-density development patterns inhibited non-motorized mobility, forced commuting, and consumed vast amounts of natural space (van den Berg,

Hartig, and Staats 2007). It is clear that higher density developments are superior in many ways, however, these efforts may have a negative impact on health if densification occurs without protecting green space through policies, incentives, and regulations (de Vries et al. 2003).

As technology and employment confines more people indoors, communities have a greater need than ever before for contact with nature (Louv 2011). The percentage of time spent outdoors has diminished to such an extent that daily contact with nature is increasingly rare. Indoor experiences may account for as much as 90% of the average American's life (Bratman, Hamilton and Daily 2012). This is true all across the developed world (Pergams and Zaradic 2006; Grahn and Stigsdotter 2010).

An interest in the benefit of natural experiences has emerged as a way to balance negative health consequences from increasingly urban and technologically dominated lifestyles (Katcher and Beck 1987; Wilson 1984; Kellert and Wilson 1993; Frumkin and Fox 2011; Louv 2011; Stefanovic and Scharper 2012; Dannenberg et al. 2013). Advocacy for nature is no longer restricted to environmentalists. There is an increased interest in this topic across many academic, public, and non-governmental organizations (Dannenberg et al. 2011; Wolf, Flora, and Housley 2012). As urbanization and densification threaten natural urban spaces, this topic becomes increasingly relevant to planning.

Urbanization has been linked to the rise of chronic illness. Living in cities is a risk factor for many of the leading causes of morbidity and mortality such as heart disease, cancer, diabetes,

stroke, preventable injuries, and of particular interest to this discussion, a worsening of mental illness (CDC 2013a; Dannenberg et al. 2011). There is increased interest in how the built environment can support health (Forsyth, Slotterback, and Krizek 2010).

> Instead of searching for a single necessary exposure, health scientists had to disentangle the complex interplay of lifestyle, genetic, and environmental factors during the life course. Psychological and social aspects of health and illness, such as stress and social support, received increasing amounts of attention, and new concepts and methods became available for the study of nature experience and health (Hartig et al. 2011, 135).

The interrelation between the urban environment and chronic illness presents an enormous, multilayered challenge to public health and planning. This project focuses on one facet of this problem, individual and community psychological health, and specifically explores how the cultivation of small natural urban spaces can lead to improvements in this domain.

Worldwide, mental health and substance use disorders account for 13% of the global burden of disease (WHO 2013). Only 17% of adults in the U.S. enjoy optimal mental health (CDC 2013a). The factors that influence psychological health are many and varied. Access to natural experience is an important element of a psychologically healthy urban setting. Research supports that relatively modest experiences with a natural setting can enhance mental health (Kaplan 2001; van den Berg, Hartig, and Staats 2007). As national health costs rise, the effect of the urban environment on the potentiation and amelioration of chronic illness has emerged as an important public health topic (Forsyth, Slotterback, and Krizek 2010). Innovation has to be effective, efficient, and inexpensive. Integrating nature throughout the urban environment in

underused public spaces offers an opportunity to make modest and incremental improvement on the psychological health of urban communities. This is the premise of this project.

# Chapter 3: Preference for Natural and Urban Spaces

## Part I: Introduction

Effective integration of nature into small, ordinary and publically accessible areas is predicated on understanding general preferences for natural and urban spaces. This chapter describes innate preferences for both natural and human-made settings based on observational and experimental research. The organized and linear patterns that dominate the built environment create a predictable setting and restrict the array of psychological, physical, and social experiences that can occur in a space. Nature is a counterpoint to this. The successful development of small, natural urban spaces depends on an understanding of preference for both the natural and the urban.

## Part II: Preference for Natural Spaces

Theoretical and experimental work has demonstrated a widespread preference for the natural environment (Ulrich 1983; Kaplan R. and S. Kaplan 1989; Kaplan, R. and S. Kaplan 2011; Park et al. 2008; Staats, Kieviet, and Hartig 2003; Grahn and Stigsdotter 2010). Emotional preference for nature developed from an early human need to assess and to understand the environment in order to survive. The biophilia hypothesis posits that humans formed a preference for semi-open natural spaces with extended sight lines overlooking water, which were spaces that supported meeting the basic needs of finding food and avoiding danger (Orians and Heerwagen 1992; Kellert and Wilson 1993). In addition to survival, an ability to find relaxing environments was equally adaptive as it allowed for recovery from stress and fatigue (Ulrich 1993; Kaplan R.

and S. Kaplan 1989; Heerwagen and Orians 1993; Kellert and Wilson 1993; Frumkin 2001; van den Berg et al. 2003; Hartig and Staats 2006).

Until recently, humans have had an intimate connection to the natural environment (Frumkin 2001; Pretty 2002). The biophilia hypothesis theorizes an emotional connection to other living things, a connection deeply rooted in biological evolution. This theory claims that the relationship between humans and all other living beings is profound:

> The brain evolved in a biocentric world, not a machine-regulated world. It would therefore be quite extraordinary to find that all learning rules related to that world have been erased in a few thousand years, even in the tiny minority of peoples who have existed for more than one or two generations in wholly urban environments (Kellert and Wilson 1993, 32).

Rachel and Stephen Kaplan initiated some of the earliest efforts to systematically assess the psychological impact of contact with nature (Kaplan S. and R. Kaplan 1978; Kaplan R. and S. Kaplan 1989). The Kaplans sought to understand what benefits nature brings, to whom, and under what circumstances. This work outlined a universal human preference for a natural environment. The Kaplans created general conceptual categories of environmental preference and revealed a connection between preference and need.

Various qualities and physical characteristics of natural environments have been shown to influence preference (Kaplan R. and S. Kaplan 1989; Kaplan S. 1995; Orians and Heerwagen 1992). People are highly sensitive to spatial composition, which likely developed out of a need

to evaluate the environment as a matter of survival (Wilson 1984; Ulrich 1986, 1993; Heerwagen and Orians 1993). Environmental assessment, which is one element of preference, begins with a rapid evaluation of whether the space is hospitable or dangerous (Ulrich 1983; Kaplan R. and S. Kaplan 1989; Kaplan R., S. Kaplan, and Ryan 1998; Heerwagen and Orians 1993).

A setting where one can discern a sense of order and which has a certain degree of complexity enriches a preference for that setting (Kaplan R. and S. Kaplan 1989). People generally prefer partially open and natural spaces, delineated by physical cues such as trees, vegetation, and pathways, which inform the individual about how to access the space. Definition created by natural features and moderately uniform surfaces support access and facilitate orientation (Korpela and Hartig 1996; de Vries et al. 2003; Groenewegen et al. 2006; Grahn and Stigsdotter 2010). Semi-open spaces generate interest by encouraging exploration and stimulating curiosity (Kaplan R. and S. Kaplan 1989).

The natural setting provides an important counterpoint to the restrictive built form. The linear and determined physicality of street networks, the architectural form of buildings, and the vertical thrust of utility infrastructure subconsciously drive a desire to find and experience natural settings.

**Figure 1:** Natural environments are more conducive to restoration than their urban counterparts. Various qualities common to natural settings enhance preference for such spaces. Semi-open open areas and physical cues such as paths support orientation and assessment of the types of experiences a person may have. Partially obscured foregrounds and moderately complex compositions catalyze a sense of wonder about the setting and invite exploration. These qualities offer interesting alternatives to the restrictive forms of the urban environment. (Images taken by the author)

**Figure 2:** The high degree of organization common to the urban form offers limited choice of experience or opportunities for respite. (Images taken by the author)

## Part III: Preference for Public Spaces

Research on human behavior in urban settings has identified preference for public space and can guide strategy for creating highly utilized, small and ordinary natural urban spaces. The work of both Whyte and Gehl found that human activity in public spaces serves as a proxy for the desirability of the space (Whyte 1980; Gehl 1987). Observational studies on the use public

space identified certain qualities that effectively invite use and meet people's need to relax, recreate, and socialize. At the most fundamental level, desirable public areas are those where the spaces between buildings enable human activities and social life. These spaces enrich the human experience by supporting a variety of activities and directly counteract the restrictive, singular patterns of use common to many urban spaces.

**Figure 3:** Urban spaces often fail to plan for diverse uses. Urban spaces that restrict a variety of uses are not preferred, as evidenced by low activity (left). Public areas that lack space for sitting and relaxing or with facilities that only support a narrow range of activities fail to invite diverse use (right). (Images taken by the author)

Specific features of well-designed and subsequently well-used public spaces include human-oriented design, features that enable a variety of uses while providing protection from unpleasant experiences, and areas that allow for observation. Analyses of people's behavior in public spaces illustrate widespread preference for areas that provide an alternate experience to the daily routine, such as enjoying a meal outdoors, meeting with friends, stopping for an impromptu conversation, or finding space for solitude (Whyte 1980). Desirable public spaces also allow for various activities and experiences, such as walking, bicycling, sitting, relaxing, recreating, and socializing (Gehl 1987). Public spaces with these qualities are energized by

human use, which in turn fosters spontaneous experiences and disrupts the highly organized and predictable patterns of behavior in the built environment. Figure 4 illustrates both effectively and poorly designed public spaces.

**Figure 4:** Preferred urban spaces support activities such as walking, biking, and relaxing, are scaled in such a way as to create a comfortable environment to spend time in, and have features that support a range of uses for a variety of users (left column). Diverse spaces to observe others, socialize, relax, recreate, and enjoy pleasant weather have a strong influence on preference. Less desirable public spaces create an uncomfortable environment, due to inappropriate scale, lack of features limits activities such as sitting, socializing, or playing. Overly determined form only allows a limited variety of activities (right column). (Images taken by the author)

Gehl Architect's *15 Public Space Quality Criteria* (Figure 5) provide a framework for evaluating and ranking public spaces. The criteria identify key elements that contribute to preference for and use of urban areas (Gemzøe 2013). The criteria are divided into four domains: delight, comfort, place, and protection. Delight refers to spaces that feel appropriately scaled for human use, allow for positive sensory experiences with physical surroundings, enable a pleasant experience with the climate, and which are large enough to support desired activities but intimate enough for participants to be at ease. Comfort describes places that enable a variety of activities for all users, such as a range of spaces to sit, walk, stand, play, and socialize. Place refers to the unique character of a space and how well the space integrates into the larger network of public space. Protection is the ability of the space to provide shelter from unpleasant sensory experiences such as noise, traffic, accidents, and crime.


**Figure 5:** Adaptation of a conceptual model of the *15 Public Space Quality Criteria*. (Content courtesy of Gehl Architects. Image taken by the author)

# Chapter 4: An Integrated Framework for Preferred Natural and Public Spaces

## Part I: Introduction

This chapter integrates the findings on preference into a framework for evaluating small, natural urban areas. Incorporating nature into ordinary spaces found within the determined, built environment is one approach to maximizing the benefit of publically accessible areas for urban residents. These spaces physically disrupt the highly structured urban form and, in doing so, create refuge. In addition to being an economical use of land, nature in everyday urban spaces promotes restorative and stimulating experiences.

Too many public and natural urban spaces suffer from underuse or neglect. Many cities have public space that are so large that they actually discourage use (Whyte 1980). The scale of such spaces effectively deters engagement; non-existent or uncomfortable spaces for sitting, relaxing, or socializing also discourage use. Neglected natural spaces in cities are prime locations for illicit activity, crime, and refuse. Small and ordinary spaces frequently provide minimal utility and value to individuals and communities. There are many small and often-overlooked spaces are ideal locations for enhancing the urban environment through the introduction of natural elements. Nature in small and ordinary areas that incorporate the desirable qualities of both natural and urban spaces can create well-used, restorative areas scattered throughout the urban setting. Such spaces maximize the use of land and the health benefits publically accessible spaces can provide.


**Figure 6:** Successful small, natural urban spaces have a balance of order and composition that invites engagement, stimulates interest, and allows for a variety of experiences. The ideal small, natural urban space offers a positive alternative to the highly organized and often underwhelming built environment. (Upper left image courtesy of www.migrationresearch.org; other images taken by the author)

Dispersed small, natural spaces throughout an urban environment with certain qualities and compositions allow for positive and stimulating experiences by increasing the variety and spontaneity of activities that can occur in the space. Small, natural spaces are intimate enough to allow for a person to enjoy an individual experience such as taking a walk, reading a book, or relaxing in a comfortable area. They are large enough to accommodate several people engaged in various activities, such as an outdoor lunch or a private conversation. Spaces with moderately complex compositions, defined by natural and human-made features, create

interesting environments that entice people in to spend time exploring. Natural elements that partially obscure the foreground imbue the space with a mysterious quality, stimulating curiosity and encouraging engagement in the space (Kaplan R. and S. Kaplan, 2011). Ease of accessibility enables regular use, allowing many people to have frequent, rejuvenating experiences. The combination of accessibility and complexity facilitates spontaneous experiences, such as discovering a beautiful flower, watching wildlife, or coming across an acquaintance.

**Figure 7:** Small, ordinary natural urban areas that vary in size and composition enable a range of experiences and provide a break from daily stressors. Partially obscured foregrounds and soft, varied light patterns influence preference and invite engagement. (Lower right image courtesy of christopherleo.com; other images taken by the author)

## Part II: A Framework for Small, Ordinary Natural Spaces

Previous sections have identified key qualities of desirable natural urban space. This section introduces criteria for development of these spaces that can serve as a guide to planners and policy makers. These guidelines are distilled from the previous discussion on preference and

enumerate the desirable qualities of these spaces. These guidelines are called the *Criteria for Nature in Small, Ordinary Public Spaces* (Figure 9).

The *Criteria for Nature in Small, Ordinary Public Spaces* builds on the *15 Public Space Quality Criteria* framework and also consists of four dimensions: delight, comfort, choice, and place (Figure 8). Delight emphasizes natural and planned design features that employ varied composition to create both open and protected spaces that generate a sense of depth and intrigue. Comfort describes places that are easily accessed, scaled appropriately for human use, create a pleasing connection to natural elements, provide physical features that support desired activities, and protect from unpleasant experiences. Choice describes the ability of the space to support a range of uses. Place refers to the degree to which the space allows a person to experience relief from daily activities, as well as its local identity and integration into the larger network of natural urban areas that span the entire community.

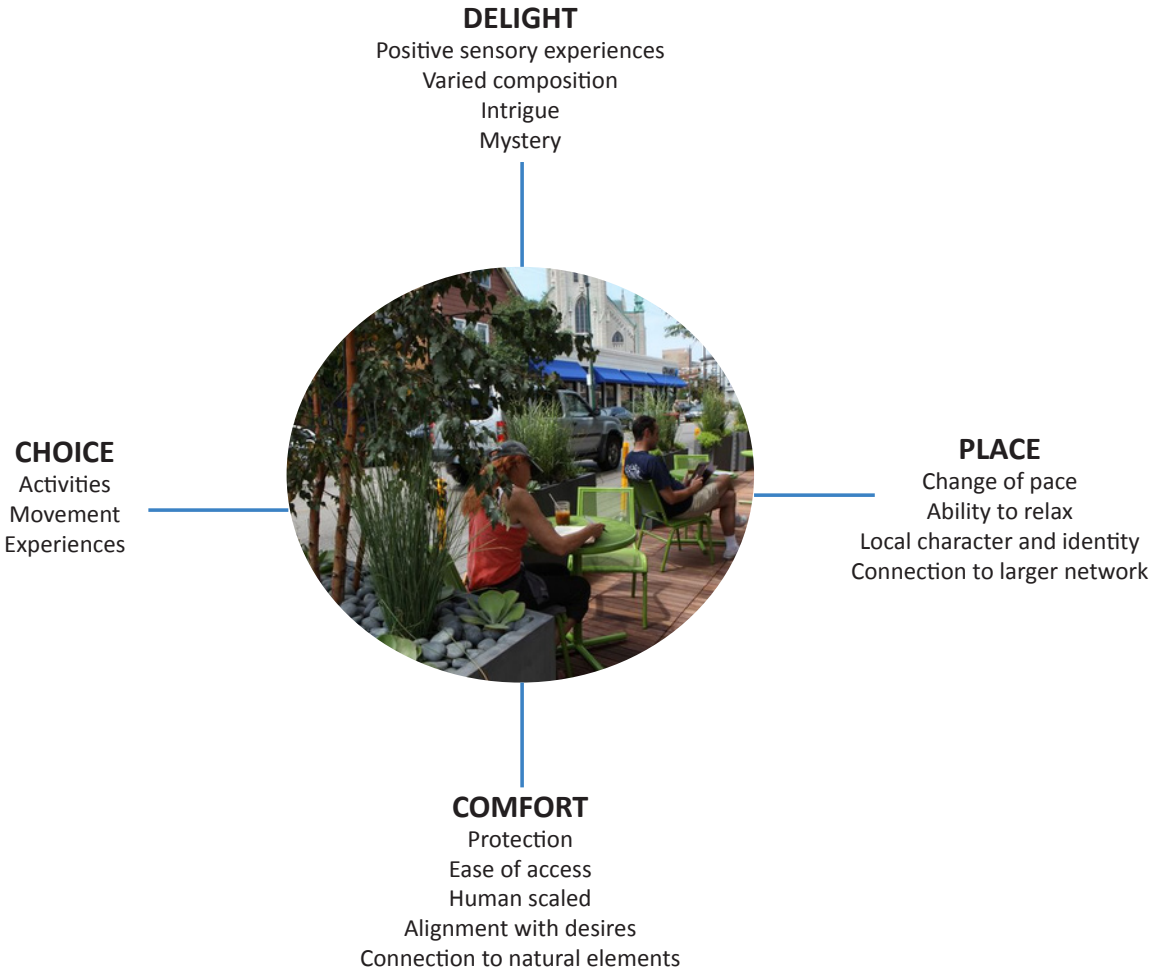


**Figure 8:** A conceptual model of the *Criteria for Nature in Small, Ordinary Public Spaces* that provides an integrated framework for evaluating small, commonly used natural urban spaces. (Criteria created by the author. Image courtesy of christopherleo.com)

# Chapter 5: Theoretical Frameworks for Cognitive Restoration and Stress Reduction Through Contact with Nature

## Part I: Cognitive Restoration Through Contact with Nature

This chapter outlines theoretical frameworks for the psychophysiological benefit of nature on cognitive restoration and stress reduction. Various experimental studies have assessed the impact of natural and urban environments on mental fatigue (Kaplan R. and S. Kaplan 1989; Hartig, Mang, and Evans 1991; Hartig et al. 1996; Kuo et al. 1998; van den Berg et al. 2003; Berman, Jonides, and Kaplan 2008). Other studies have evaluated the way in which exposure to natural and urban environments effects stress by monitoring physiological responses, changes in mood, and performance (Ulrich 1984; Ulrich et al. 1991; Hartig 1993; Hartig et al. 2003; Grahn and Stigsdotter 2010). Two principle theories are discussed, Attention Restoration Theory (Kaplan R. and S. Kaplan 1989) and Stress Reduction Theory (Ulrich 1983). Both are widely used to understand how a natural setting restores cognitive fatigue and relieves stress (Hartig et al. 1996; Berto 2005; Bratman, Hamilton, and Daily 2012). The theories are interrelated and share the premise that attention and stress levels change with response to contact with natural environments. Attention Restoration Theory (ART) focuses on how natural environments influence cognition and how exposure to nature serves to rejuvenate attentional capacity. Stress Reduction Theory (SRT) emphasizes the importance of responses to stress from an evolutionary perspective and underlines the impact of landscapes on mood and emotions (Ulrich 1983). The following analysis of existing research explores the positive health implications of experiences with nature. Beneficial natural experiences, even if of relatively

limited scale and duration, inform the need for wider exposure to nature through the development of small, everyday spaces as a universal public health benefit.

From their research on preference for natural environments, the Kaplans developed ART, which posits certain characteristics of natural settings help restore cognitive fatigue (Kaplan and Kaplan 1989). ART identifies two types of attention, directed and involuntary. Directed attention is the process of suppressing distraction to maintain focus (Kaplan S. 1995; Berman, Jonides, and Kaplan 2008). Over time, directed attention is depleted, leading to mental fatigue. ART posits that settings that trigger involuntary attention allow directed attention to replenish. The theory claims exposure to nature has powerful and measurable restorative effects on directed attention through conscious and unconscious responses to natural landscapes (Kaplan R. and S. Kaplan 2011; Kaplan S. 1995).

Mental fatigue decreases the ability to attend to various tasks. At the most fundamental level, a reduced ability to focus hinders performance, which has numerous down-stream behavioral and social consequences described in more detail in later sections. Involuntary attention, in contrast, occurs with very little or no conscious effort in response to exciting or interesting stimuli in the environment. ART posits that contact with natural settings activates involuntary attention, particularly those environments that elicit a sense of mystery or fascination. The activation of involuntary attention effectively turns off mentally fatiguing directed attention (Kaplan R. and S. Kaplan 1989; Ong and Peterson 2011; Ward Thompson and Aspinall 2011). This switch from directed to involuntary attention interrupts directed attention and restores

mental fatigue. The restorative effects of nature are aided by elements that gently engage involuntary attention and in the process allow directed attention to recover.

**Figure 9:** Natural settings are particularly effective at activating involuntary attention. Qualities in the composition that elicit a sense of fascination invite a person to engage in the space. (Images taken by the author)

ART identifies four environmental qualities that contribute to restorative natural settings (Kaplan S. 1995). The first quality relates to characteristics in a setting that create a sense of being in an entirely different place. Even small natural spaces can prompt this reaction, such as paths through a garden, a view of nature through a window, or a miniaturized representation of nature such as *bonsai*. Spaces that provide a new perspective create an opportunity for disengaging from normal experience. Settings with such qualities can catalyze shifts in attitudes, which can in turn support changes in thoughts. Incremental and small positive

changes in experiences and thought patterns can improve quality of life. In highly fatiguing environments, even a modest positive shift in experience can bring about notable and measurable improvement in psychological health. Natural settings that elicit a sense of wonder or fascination activate involuntary attention and allow the mind to wander, creating psychological space for introspection and reflection. Settings that generate a sense of fascination are particularly effective for restoring directed attention (Kaplan R. and S. Kaplan 1989; Kaplan S. 1995).

To test ART and evaluate the restorative influence of direct and indirect contact with nature, Kaplan and Kaplan conducted various studies ranging from multi-day wilderness experiences, to residential surveys, to controlled experiments where participants viewed pictures of natural settings (Kaplan R. and S. Kaplan 1989; Kaplan R. 2001; Kaplan R. and S. Kaplan 2011). The wilderness studies collected data from youth and adult participants using self-reported evaluation over an eight-year period (Kaplan R. and S. Kaplan 1989). The studies found the prolonged and intimate connection with nature had measurable influence on cognitive restoration. Nature in the urban setting was also shown to positively influence restoration (Kaplan R. and S. Kaplan 1989; Kaplan R. 2001; Kaplan R. and S. Kaplan 2011). Studies using surveys of 188 residents conducted in a low- to middle-income community demonstrated exposure to nature influences well-being by restoring mental fatigue (Kaplan R. 2001). In an effort to further test ART, Berman, Jonides, and Kaplan's studies of university students found exposure to nature aids the recovery of fatigued directed attention (2008). The studies evaluated how walking in nature and viewing pictures of nature effected attention and mood as

measured by standardized attention tools (backwards digit-span Attention Network Task) and mood assessment tools (Positive and Negative Affect Schedule). Both studies documented measurable improvements in mood and attention following exposure to nature. Numerous studies using comparative models, self-reporting, and physiological measurements have continued to support the premise of ART, particularly the greater restorative potential of natural versus human-made settings (Kuo and Sullivan 2001a, b; Kellert and Wilson 1993; Kaplan S. 1995; Hartig et al. 1996; Health Council of The Netherlands 2004; Berto 2005; Park et al. 2008; Kaplan 2011; Bratman, Hamilton, and Daily 2012). Longitudinal assessments of self-reported health and well-being have also demonstrated that natural environments provide greater restorative effects than their urban counterparts (Health Council of Netherlands 2004; van den Berg, Hartig, Staats 2007; Ward Thompson and Aspinall 2011). These findings are particularly important in the context of urban environments that are replete with stimuli that force engagement of directed attention and drive fatigue (Berman, Jonides, and Kaplan 2008).

While restoration is not limited only to natural settings, natural settings have an abundance of qualities that are highly restorative (van den Berg, Hartig, and Staats 2007). Natural and built environments may have varying degrees of restorative qualities. For example, some natural environments are considered dangerous and therefore are non-restorative, whereas some highly structured urban environments have qualities that are restorative.

## Part II: Stress Reduction Through Contact with Nature

In addition to supporting cognitive restoration, contact with nature also provides physiological and emotional benefits by reducing stress (Ulrich 1983; Honeyman 1992; Kaplan S. 1995; Grahn and Stigsdotter 2003; van den Berg, Hartig, and Staats 2007; Bratman, Hamilton, and Daily 2012; Ward Thompson et al. 2012; de Vries et al. 2013; Wolf and Housley 2013). SRT emerged as an alternative to ART to explain how exposure to nature can reduce stress (Ulrich 1983). SRT posits that viewing or being in nature generates automatic physiological and psychological responses that reduce stress. Stress is correlated with negative emotions and short-term changes in physiological processes as a result of increased autonomic stimulation. It is possible to have physiological and psychological responses to stress even when a person feels accustomed to the stressors of city life (Ulrich 1993; Lederbogen et al. 2011).

Humanity's connection to nature described in the biophilia hypothesis provides the foundation for SRT (Ulrich 1983; Kellert and Wilson 1993; Hartig et al. 2003). Within this theoretical framework, natural settings that have a focal point and features such as vegetation and water aid recovery from stress (Kellert and Wilson 1993). SRT claims the restorative or stress reducing outcomes from experiences with nature must result from more than fascination or involuntary attention (Ulrich 1993). According to SRT, a person's emotional response to an environment and the resulting impact on cognitive processes may occur without conscious awareness. Exploratory studies sought to test SRT by evaluating changes in stress related to viewing slides of urban and natural environments (Ulrich 1981). Measurements using alpha amplitude, heart rate, and emotional states found participants who viewed natural scenes had greater positive

responses and lower negative feelings than participants who viewed urban scenes. Participants exposed to urban scenes also reported increased aggravation, anxiety, and melancholy. Comparative studies with mildly stressed students also found viewing slides of natural scenes result in improved mood and decreased fear levels. To further validate SRT, Ulrich et al. measured self-rated emotional states and physiological stress through heart rate, skin conductance, muscle tension, and systolic blood pressure in 120 subjects who viewed a stressful movie followed by six scenes and sounds of highly urban to natural settings (1991). The study found significantly faster rates of recovery from stress when participants were exposed to the natural settings. These findings demonstrate that exposure to nature that is indirect, direct, short, or of long duration can produce measurable positive physiological and emotional responses (Ulrich et al. 1991; Hartig et al. 2003).

Additional studies have further demonstrated that contact with nature produces healing physiological and emotional changes that aid in stress recovery (Honeyman 1992; Heerwagen and Orians 1993; Hartig et al. 2003; Park et al. 2008; Bratman, Hamilton, and Daily 2012). Studies that have measured physiological responses to stress via salivary cortisol levels, diastolic blood pressure, and pulse have reported significantly reduced levels of stress among participants walking in forest settings compared to those in urban settings (Park et al. 2008). More recently, Lederbogen et al (2011) used functional magnetic resonance imaging (fMRI) to postulate that urban settings may overload neural processes that handle stress. Overall findings indicate everyday nature experiences have, at a minimum, psychologically and physiologically restorative impacts.

## Part III: Practical Applications of Cognitive Restoration and Stress Reduction

The psychological benefit of exposure to nature is a valuable part of the human experience and an important aspect of urban policy and planning decisions. Modifications to the built environment that enhance and expand opportunities for contact with nature result in trickle-down behavioral and social benefits. Nature, if effectively integrated into everyday spaces, can simultaneously enrich the urban form and support well-being.

Incremental, positive transformation can occur by introducing nature into areas between built spaces. Nature in small and ordinary settings counterbalances the rigidity that dominates the built form and creates a more manageable urban setting by increasing space for respite, self-reflection, and positive social interactions. Everyday natural experiences have psychologically and physiologically beneficial effects on behavior and mood. Even modest interventions can enhance the urban setting (Figure 11).

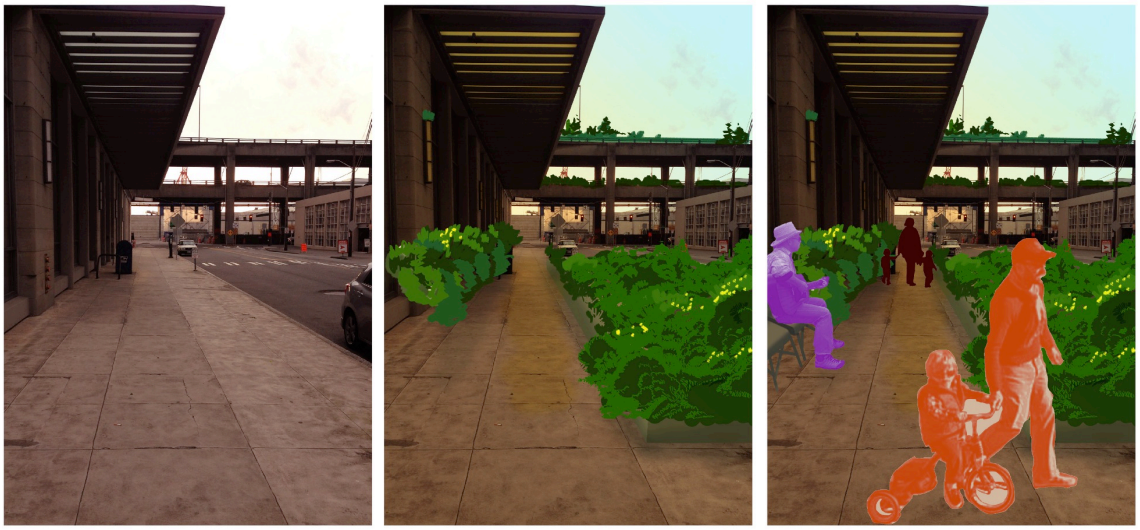

**Figure 10:** The underused space (left) is designed to accommodate a limited range of activities and lacks human-made and natural qualities that invite engagement.

Integration of natural elements (center) enhance the character of the space and can create an area that supports cognitive restoration and stress reduction. Nature in small, ordinary spaces provides space for respite and creates opportunities for a variety of experiences and activities (right). (Illustrations by Chris McNally)

Research building on the previous discussion on cognitive restoration and stress reduction has established clear connections with much more complex behaviors and emotional states (Kaplan R. and S. Kaplan 1989; Hartig 1993; Hartig, Mang, and Evans 1991; Hartig et al. 1996; Ulrich 1984; Ulrich et al. 1991; Kuo and Sullivan 2001a, b; Hartig et al. 2003; Leyden 2003; Health Council of the Netherlands 2004; Grahn and Stigsdotter 2010; Ong and Peterson 2011; Roe and Aspinall 2011; Bratman, Hamilton, and Daily 2012; Wolf, Flora, and Housley 2012; Wolf and Housley 2013). This section focuses on three significant indicators of quality of life: productivity, emotional health, and social cohesion.

The negative influence of mental fatigue on concentration has significant implications for personal development by supporting the ability to manage and accomplish goals (Roe and Aspinall 2011). An urban environment that provides an opportunity to replenish fatigued attention through contact with nature supports productivity by improving focus (Kaplan R. and S. Kaplan 2011). Experiences in outdoor open green spaces improve attention among children (Faber Taylor and Kuo 2011). Students in schools with views of natural settings have consistently better performance and behavior (Tennessen and Cimprich 1995; Matsuoka, 2010). Providing children in urban settings with opportunities to play in outdoor open, green spaces provides valuable restorative and attention-enhancing benefits contributing to reductions in the severity of ADHD symptoms (Faber Taylor and Kuo 2011). Providing a natural

view from a workplace predicts increased job satisfaction, improved focus, and decreased workplace error (Kaplan R. 2001). Exposure to nature during recovery from illness may support recuperation and reengagement in normal life activities. In a study of participants recovering from cancer, those who engaged in restorative nature-based activities returned to work, were more likely to work fulltime, often started new activities, and reported quality of life improvements over the study period (Cimprich 1993). Nature in small and ordinary public spaces would provide incremental benefit to urban communities by enabling frequent restorative experiences that could positively effect concentration and productivity.

Cognitive restoration and stress reduction impact mood and emotional health in a variety of ways. Mental fatigue leads to irritability, impulsivity, and unnecessary risk taking (Kaplan R. and S. Kaplan 1989). These emotional states and behaviors can reduce the likelihood of helping others and increase the likelihood of aggressive behavior (Kaplan S. 1995; Kuo and Sullivan 2001a, b). An urban environment that provides frequent opportunity for cognitive restoration, even if modest, could address these liabilities. Simple improvements to the built environment, such as exposure to trees and green space, contribute to a range of positive social and behavioral outcomes that include greater social cohesion, a sense of safety, a decrease in violence and impulsivity, and an increase in self-discipline (Kweon, Sullivan, and Wiley 1998; Kuo et al. 1998; Kuo and Sullivan 2001a, b; Faber Taylor, Kuo, and Sullivan 2002; Hartig et al. 2003). These findings underline the importance of contact with natural settings on the emotional health of a community.

Settings that enable attention restoration may also support social interaction (Hartig et al. 2003). Socially responsible behavior often requires putting the needs of the group before the needs of an individual (Kaplan R. and S. Kaplan 1989). Studies of people in highly distractive environments found it less likely that individuals would help others in need. These studies also noted an increase in aggressive behavior and documented decreased receptivity to socially important cues (Kaplan R. and S. Kaplan 1989). Natural urban spaces provide a partial solution. Safe green spaces encourage direct interaction among neighbors and have been shown to improve social connection and a sense of community (Sullivan, Kuo, and DePooter 2004).

# Chapter 6: Recommendations

The subtle but profound impacts of nature on psychological well-being will become increasingly important aspects of planning for dense urban areas. Integration of nature into small and ordinary public spaces provides a cost-effective and feasible approach to increasing opportunities for contact with nature and enabling psychological restoration for urban populations. Several recommendations for urban planning agencies have emerged from this investigation.

## Recommendation I

**Integrate an awareness of the psychological benefit of exposure to nature into planning policies.**

Consideration of the positive psychological impact from frequent experience with nature in small, publically accessible space enhances neighborhood, municipal, and regional planning efforts. Including the positive impacts on mental health from frequent experiences with nature can strengthen plans that address the natural environment, habitat, green infrastructure, open and public space. Policy goals could be expanded to develop integrated networks of nature in small public spaces in order to ensure widespread and frequent access to nature for mental restoration and stress reduction.

## Recommendation II

**Utilize the *Criteria for Nature in Small, Ordinary Public Spaces* to evaluate interventions.**

The criteria can serve as a tool to assess spaces for targeted for intervention. An evaluation framework based on the conceptual model of the criteria presented in Chapter 4 provides a systematic approach to document specific environmental qualities to identify areas for improvement (Figure 11). The presence of natural and human made features in a setting can be described according to how closely they align with the four dimensions of delight, comfort, choice, and place. The evaluation is qualitative and guides the transformation of spaces to maximize impact.

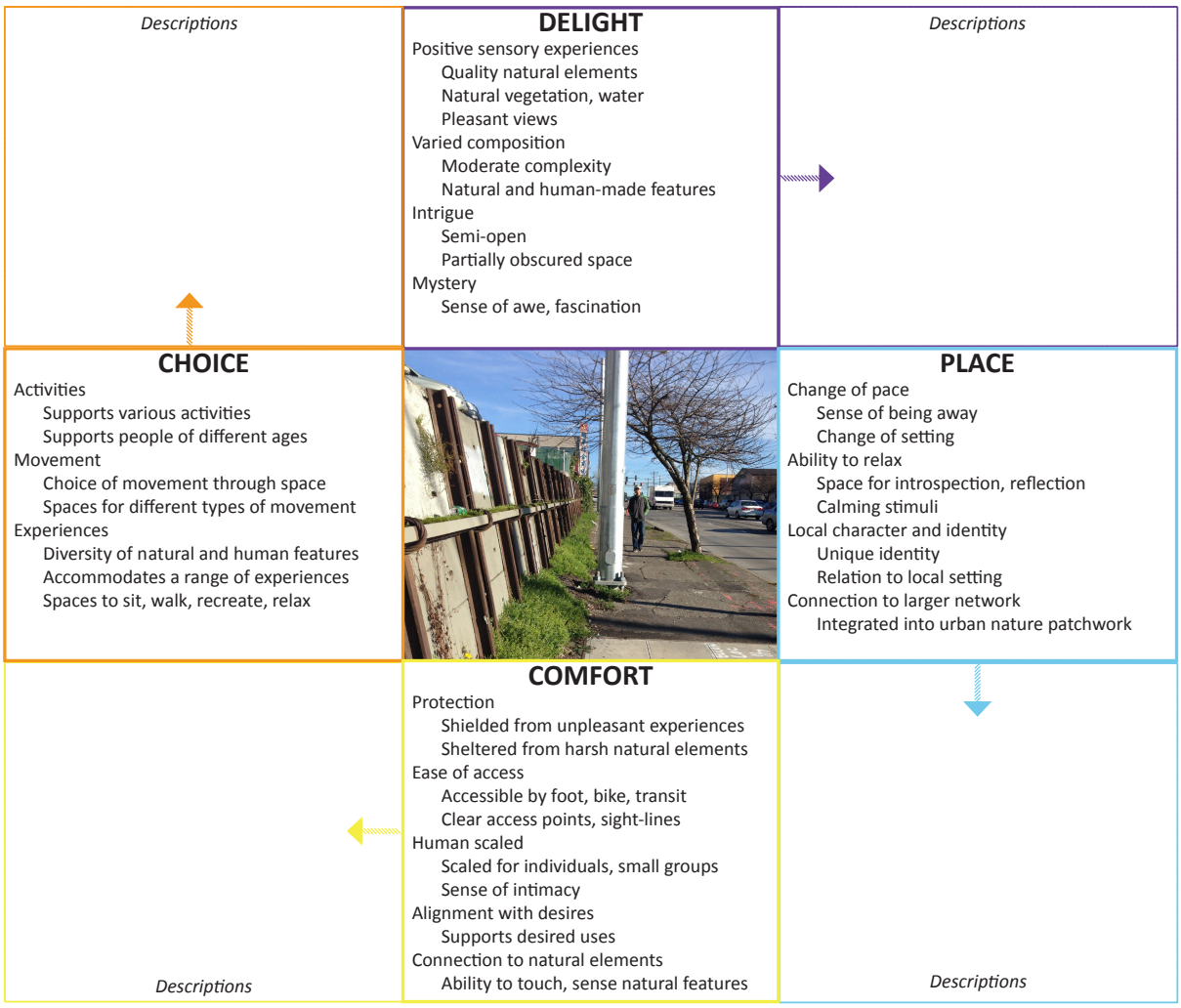


**Figure 11:** An example application of the *Criteria for Nature in Small, Ordinary Public Spaces* evaluation framework that assesses an everyday space targeted for intervention. Detailed descriptions provide a qualitative assessment of how existing conditions align with the four

dimensions of the criteria. This approach to evaluation of ordinary or distressed spaces helps identify improvements to create successful small, natural spaces. (Image taken by the author)

## Recommendation III

**Initiate a pilot program to develop small natural urban spaces.**

Collaborative pilot programs offer a variety of benefits. They create simplified procedural models and allow for incremental implementation. Gradual changes can be financially feasible. Cooperation between residents, community organizations, and public agencies offers a way to share resources, engage local communities and expedite implementation. Small-scaled pilot projects can be tested and easily refined, allowing for ongoing assessment, modification, and adaptation. The disproportionate burden of illness experienced by poor populations necessitates supporting health through planning for communities in most need. Prioritizing communities with low access to nature allows pilot programs to incrementally improve the health most vulnerable urban residents.

## Chapter 7: Further Research

This project has addressed the valuable psychological benefit that nature provides urban residents and has suggested an approach to providing access to small and ordinary urban natural spaces. Although the proposed intervention is conceptually straightforward, implementation will require awareness of the dynamic interplay between urbanization, land use, mental health, quality of life, and social behavior.

This project has discussed the widespread preferences for natural and public spaces. Socio-cultural differences were beyond the scope of this project but represent an essential dimension of preference. In addition, the creation of small, natural urban spaces requires neighborhood involvement in order to adequately garner and maintain community support. Factors that influence both individual and community connection to place are multi-faceted. A detailed assessment of these issues, although essential for the effective development of small and ordinary natural urban spaces, is beyond the scope of this project. This project acknowledges that the recommendation to develop a pilot program to integrate nature into everyday, publically accessible spaces requires detailed guidelines. The collaborative approach to improving public spaces developed by the New York City Department of Transportation may provide a useful precedent for outlining program goals, participant responsibilities, financial commitments, and procedures (NYC Plaza Program 2013).

This project has established the importance of contact with nature on psychological well-being and the need to include this benefit in urban planning efforts. As a follow up to this discussion,

an inventory and assessment of existing initiatives focused on integrating nature into the urban setting would provide a foundation for developing an implementation plan. These spaces could be evaluated through the use of the *Criteria for Nature in Small, Ordinary Public Spaces*.

Quantifying the economic value of the natural environment is complex and challenged by lack of consensus (Baycan Levent and Nijkamp 2005). Baycan Levent and Nijkamp acknowledge the range of valuations methods of urban green spaces and propose a classification system that incorporates qualitative and quantitative measures, including: ecological, economic, social, planning, and multidimensional values (2005). Their work also presents a set of criteria and indicators in an attempt to define and outline the uses of urban green spaces that address: amount and quality; biodiversity and conservation; environmental quality; uses; public involvement; finances; and planning and management. A research review of the benefits of open and recreational spaces in the U.S. uses direct economic impacts of property value and revenue from use to quantify value (Ewing and Shoup 2010). This report acknowledges indirect economic impacts such as ecological services and mental health benefits, while beyond the scope of the study, warrant more attention. Similarly, a recent study of the economic value of Seattle Parks and Recreation system uses a quantitative approach to assess value as determined by: property value, tourism, direct use, health, community cohesion, clean water, and clean air. The study notes the challenge of addressing all potential valuation approaches, particularly the economic value of mental health benefits resulting from contact with nature (Harnik et al. 2011). These efforts illustrate the difficulty of quantifying the value of urban

natural spaces. Despite the challenges, translating the value of small-scale urban naturalization into economic terms is critical for successful implementation and deserves more study.

# Chapter 8: Conclusion

This thesis advocates an approach to planning that recognizes the subtle but important psychological benefit provided by contact with nature. In the face of increasing urbanization and a rising incidence of chronic illness, nature in the urban setting is a vital component of quality of life. As cities become increasingly dense, efficient use of space becomes more critical for community well-being. Exposure to nature supports psychological health through cognitive restoration and stress reduction. Integrating nature into small and often overlooked spaces can enhance productivity, emotional health of communities, and social cohesion. This project argues that developing nature in small and ordinary urban spaces is an important and potentially economical approach to improving the quality of life. This discussion provides recommendations to encourage the psychological benefits of natural experiences occupy a more prominent role in urban planning policy and practices. The new *Criteria for Nature in Small, Ordinary Public Spaces* framework offers an approach to evaluating and developing small, natural, and publically accessible spaces (See Chapter 5 and Figure 11). Small and common spaces provide the opportunity to create an urban network of healing natural areas.

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