Environmental Psychology and Urban Green Space:

Supporting Place- Based Conservation in Philadelphia, PA

Alicia Coleman

Spring 2014

Amy Hiller, MSW, PhD

Howard Neukrug, P.E., BCEE, Hon.D.WRE

ACKNOWLEDGEMENTS

I would like to express the deepest appreciation to the personnel that assisted in the development and execution of this project:

Dr. Amy Hillier and Howard Neukrug, whose direction support have proved invaluable for myself and the City of Philadelphia; Emily McCoy and Donna Shumpert of Andropogon Associates for their continuous assistance and bearing my learning curve with ArcGIS; and Dr. Yvette Bordeaux, Stanley Laskowski, Craig Calabria, Robert Flowers, Dan Garafolo, Julian Goresko, David Hollenberg, and Robert Lundgren for their insightful guidance and persevered stewardship within the University.

This also would not have been possible if not for the encouragement and influence of my dad, stepmom, and siblings this last year. The sum of this work is dedicated in memory of my mom; may the service, passion, and drive she shared never cease through time or space.

ABSTRACT

ENVIRONMENTAL PSYCHOLOGY AND URBAN GREEN SPACE:
SUPPORTING PLACE-BASED CONSERVATION IN PHILADELPHIA, PA

Alicia Coleman

Concentration: Environmental Policy

Readers:

Amy Hillier, University of Pennsylvania
Howard Neukrug, Philadelphia Water Department

Green space and stormwater infrastructure are of valued importance within the City of Philadelphia, but little research exists on understanding the unique contribution that green spaces can make in developing environmentally-conscious citizens. Using a multi-disciplinary approach, this project aims to explore theoretical components of environmental psychology and place attachment as related to the socioenvironmental benefits of urban green space. Two methods were used in 2013-2014 at one green space with stormwater management on the University of Pennsylvania campus: behavior mapping and a 200-person place attachment survey. An initial conclusion is that few participants have attachment to the space, but this does not inhibit perceptions of its quality and worth. The extensive use of the space indicates ample opportunity for environmental education on green stormwater infrastructure. Further research should be conducted to see if perceptual attachment leads to attitudinal correlates to environmental stewardship of place-centered conservation techniques, like green stormwater infrastructure.

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INTRODUCTION

Extensive literature confirms that green space can provide many environmental services in urban areas, including cleaner air and water, reduced stormwater, and energy savings. In addition, a range of social science disciplines (such as psychology, urban planning, public health, and geography) demonstrates a broad array of health and cultural services associated with the human experience of nature in cities. As an eclectic and integrative field of inquiry, environmental psychology expounds that the person is a social agent that seeks to create meaning from their built and natural environment. The concept of place, as present in the field of human geography, offers a framework for integrating environmental meanings into ecosystem management.

Sustainability of the natural environment is based on the premise that individuals and their communities consist of interacting social, economic, and environmental systems, a concept known as the "triple bottom line". Each system must be kept in balance in a community to adequately function on behalf of its inhabitants. With the presence of climate change, the resiliency of all stakeholders is of vital importance.

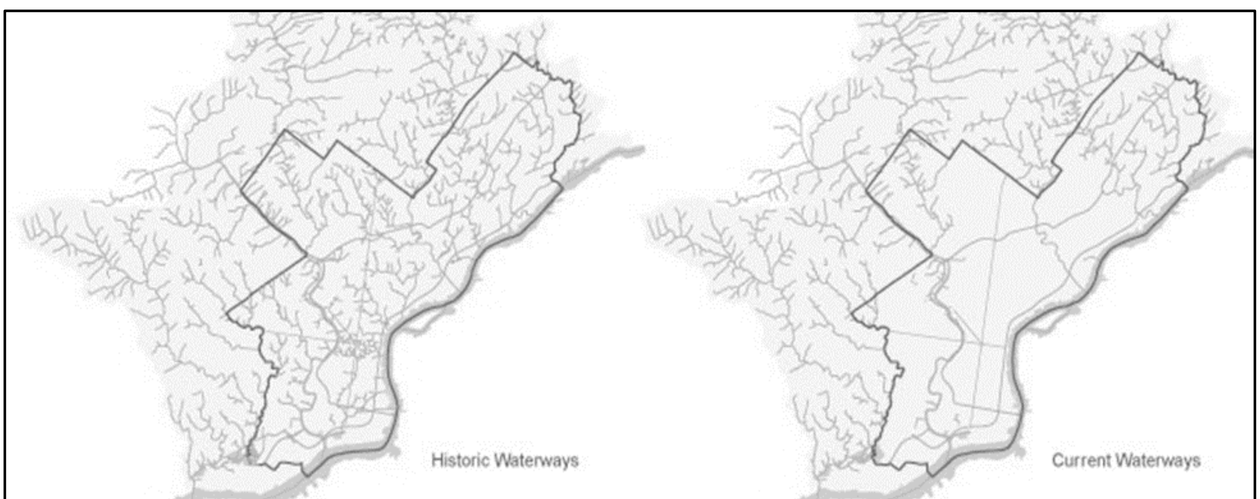
The following literature review will attempt to bridge the aforementioned disciplines into cohesive undertaking, emphasizing that green space and water management is pivotal in mediating Philadelphia's triple bottom line. An initial analysis of Philadelphia's triple bottom line approach to environmental sustainability will be outlined to provide context for further review. The subsequent sections will be considered through the lens of Philadelphia's anthropogenic degradation and current programs that have attempted to bind human-environmental mitigation. Then, residential perception of urban green space will be explored by the subjective, emotional, and symbolic meanings associated with natural places and the personal bonds or attachments people form with specific places or landscapes. Within this section, salient theoretical concepts of environmental psychology will be reviewed to determine how residents perceive green space.

1: HUMAN-ENVIRONMENTAL INTERACTION IN PHILADELPHIA

The City of Philadelphia has a long-standing impact on its natural environment, which greatly contributes to its current stance on sustainability measures. Ecologically, the City sits on a cusped fall line separating the Atlantic Coastal Plain and Piedmont ecoregions. The topography is primarily flat with poorly drained soil (Auch 2012). Prior to European settlement, the dendritic drainage patterns were quite prominent in Philadelphia, while fluvial erosion and deposition were the primary geomorphic processes. Historic landforms included dune fields, beaches, lagoons, embayments and barrier islands (Pennystone Project 2014). Generally, the climate was characterized by a humid subtropical climate zone with high seasonal temperatures and evenly distributed precipitation throughout the year (Encyclopaedia Britannica 2014).

The area's rich ecological worth was ideally suited locale for humans. The societal value held in Philadelphia spans hundreds of years, and includes Native American inhabitants, founding fathers, and industrial backdrops. The most noted historical accounts value the vision of William Penn, who foresaw a "Greene Country Towne" for what is now the City of Philadelphia (PWD 2009). These early settlers saw gently undulating terrain and arterial tributary streams to major water sources, the Delaware River to the East and the Schuylkill River to the West. The abundance of water made the area highly attractive, especially during the era of Industrial Revolution in the mid-19th century. Urban development and industrialization have been the most substantive human impacts on local ecology and topography. By the mid-19th century, a growing population had nearly decimated surrounding waterways by dumping industrial waste and human sewage into surrounding streams (PWD 2013).

The existing watersheds facilitated drainage of this waste, but in attempt to remediate the increasingly apparent degradation, a sewer system was developed. The building of sewers in preexisting stream beds was a novel idea and irresistibly appealing; the beds were already the lowest point of the land and adequately channeled in a downward gravitational flow (Levine 2010). About 200 miles of Philadelphian streams were subsumed like this, by engineering sewers into diverted streams, filling land over the pipes, and extending the grid without the additional expense of carving the naturally preexisting channels (Levine 2010). The erasing of surface stream systems has rapidly transformed hydrological conditions over time, leaving only 118 miles of flowing streams present today (Map 1) (PWD 2013). To tackle stormwater management and water quality



Map 1. Philadelphia Waterways: Historic and Current. PWD 2013.

issues in the newly developed area, major land purchasing initiatives along the Schuylkill River were promoted in 1855. This was aimed to prevent the land surrounding drinking water sources from being developed. An unforeseen problem, though, was that the Schuylkill headwaters do not begin in Philadelphia, and constituents from the upstream watershed continued to negatively impact the City. Additionally, this primal attempt at land preservation did not halt the outbreak of typhoid fever between 1860 and 1909, which (Levine 2011). As consequence, the bacteria- ridden water supply took the lives of 27,000 Philadelphians.

1.1 THE CITY OF PHILADELPHIA'S CURRENT "TRIPLE BOTTOM LINE"

Regulations to ensure cleaner water and general environmental stewardship were not put into place until the second half of the 19th century. Now, the political arena in both Philadelphia and the United States recognized the importance of protecting the natural environment for human health and vitality. Most recently, Philadelphia has undertaken an array of progressive initiatives aimed to combat the multifaceted human-environmental realm in a changing climate. The following will outline the prior and current strategies Philadelphia has undertaken to reshape the City's sustainability agenda, first with a broad timeline for contextual progression, then a more thorough analysis of dominant policies. Focus will concentrate on efforts benefiting green space, however the interconnected nature of urban sustainability must tie together supporting initiatives.

Timeline and Brief Descriptors of Philadelphia's Sustainability Programs

2007: The City of Philadelphia Sustainability working group released a *Local Action Plan for Climate Change*.

2008: In Mayor Michael Nutter's January 2008 inaugural address, he pledged to make Philadelphia the greenest city in America. Soon thereafter, the Mayor's Office of Sustainability was created.

2009: Mayor Nutter released *Greenworks Philadelphia*, a comprehensive supplement to the *Local Action Plan*, with additional goals to reduce GHG emissions, expand open space, and retrofit built infrastructure.

2009: The Philadelphia Water Department introduced *Green City, Clean Waters*, a 25-year plan to protect and enhance watersheds and the City's water supply by managing stormwater with green infrastructure.

2009: *Get Healthy Philly* is a municipal collaboration with the US Department of Health and Human Services to promote community-based prevention and wellness strategies to reduce obesity and tobacco use

2010: *GreenPlan Philadelphia* was implemented alongside *Greenworks* to specifically plan for open space

2010: *Green 2015* was introduced to unite city government and neighborhood residents in transforming 500 acres of empty or underused land in Philadelphia into parks or green space by 2015 (PPR 2011).

2011: The City introduced the Vacant Property Strategy to devise a plan on how both governmental and private owners would buy, sell, and maintain vacant land.

2011: The City reformed its existing zoning code, which is intended to ease diverse urban growth patterns and accommodate all development stakeholders

2012: Under the City Planning Commission, *Philadelphia 2035* was adopted to plan the present and future growth and development of the City.

Local Action Plan for Climate Change

The cornerstone of Philadelphia's *Local Action Plan* is a commitment to GHG reduction, the heart of global environmental mitigation. The outlining strategies aimed to reduce the city's greenhouse gas (GHG) emissions 11.6% by 2010. It was Philadelphia's specific commitment to achieve this goal through 28 target actions in five areas: Buildings, Transportation, Industry and Waste, Greening and Open Space, and Policy, Education and Outreach (City of Philadelphia 2007).

The Greening and Open Space section was quite vague compared to priorities directly influencing built infrastructure. Nonetheless, the two highlighted elements, including maintaining the City's previous tree canopy (15 percent) and reducing energy demand from greening and open space, were inclusive of the primary physical environmental issues faced in an urban setting. Another positive aspect of this agenda was the formulation of *GreenPlan Philadelphia*, which aimed to reverse the loss of and stabilize existent tree canopy (City of Philadelphia 2007).

The aforementioned mitigation protocol presents a comprehensive outline of GHG reduction. However, this strategy alone is insufficient; climate models predict that even if global emissions were halted now, that the earth's climate would continue to exhibit escalating signs of global warming for decades (IPCC 2013). Additionally, the plan neglected verbose conversation on green space, social vitality, and the water industry as a whole. The strategic development of these missing sectors was transposed into two inclusive plans that reflected the ideology of the *Local Plan- Greenworks Philadelphia* and *Green City, Clean Waters*.

Greenworks Philadelphia

As the most outward adaptation proposal for the City of Philadelphia, *Greenworks Philadelphia* seeks to reduce the social and biological vulnerability to climate change impacts. This plan considers sustainability through five lenses—Energy, Environment, Equity, Economy and Engagement (City of Philadelphia 2009). Since *Greenworks* was released, sustainability principles have been successfully integrated into a number of other complementary City plans that promote greening and open space. Philadelphia's ultimate goal is to integrate sustainability across city government sectors, a progressive scheme that has the potential to address climate change across governance. In its fourth year, metrics have shown that 95% of the 166 proposed initiatives are underway or complete (City of Philadelphia 2013).

However, the updated *Greenworks* plan has still neglected to address issues within the water sector and broader concepts of open space. Target 8, meeting federal standards for stormwater management, seemingly, sparked the birth of a revolutionary sustainability-driven water management scheme.

Green City, Clean Waters

The Philadelphia Water Department (PWD) established a vision to install and promote green stormwater infrastructure throughout the City alongside its progressive environmental policy agenda. The 25-year *Green City, Clean Waters* plan, is set to promote "grey infrastructure" (underground cisterns, piping, or associated management) to assist or mimic ecological water management (PWD 2013).

Since approximately 73% of historic waterways are piped in Philadelphia, the majority of existing sewage transport exists within a combined sewer system, where stormwater rainfall is combined with wastewater and discharged into the water bodies at a combined sewer outfall (CSO) prior to treatment (PWD 2013). This is troublesome with the quantity of impervious surface in the urban landscape: water bodies become polluted by contaminated runoff; stormwater volumes that exceed sewer capacity back-up and cause flooding; waterways, wetlands and encompassed biodiversity suffer from pollution; and tainted water quality can inhibit water-bound recreational opportunities (PWD 2013).

Of notable importance is PWD's program vision to "[create] a green legacy for future generations while incorporating a balance between ecology, economics, and equity," (PWD 2009). The multifaceted nature of urban green space would not be as successful in the City if not for the innovative strategies multisectoral approach that PWD has installed. Additionally, the plan mimics the goals of *Greenworks Philadelphia* and is supported by the US Environmental Protection Agency (EPA) and interagency collaboration

GreenPlan* and *Green 2015

Reflecting a goal put forth in the "Equity" section of *Greenworks Philadelphia*, the City has taken a holistic view of urban greening and green space with *Green 2015*. The predominant goal of the program is to convert 500 acres of empty or underused land in Philadelphia into parks or green space by 2015 (PennPraxis 2011). The priorities outlined in the *Green 2015* policy include new parks for neighborhoods that have little or no access to parks or green space (PennPraxis 2011). The report observes that even with the Fairmount Park system, Philadelphia still has more than 200,000 residents (about 1 in 8 residents) that do not live within a 10-minute walk of a public green space; "Leaving this many citizens without access to park space is like leaving the entire cities of Allentown and Erie combined without access to parks," (PennPraxis 2011). Besides effort to increase green space in Philadelphia, the plan is intended to create jobs, reduce crime, and restore natural and human health systems. Naturally, this program will aid stormwater management by diverting runoff into pervious surfaces, resisting flooding and the urban heat island effect.

Philadelphia2035

As the City's most current Comprehensive Plan, *Philadelphia2035* approaches physical development planning by analyzing present conditions and preparing for future projects and policies. Broad policy recommendations were noted in a collective Citywide Vision in 2011 and geographically- specific recommendations in 18 District Plans, which will be complete by 2017 (PCPC 2011). The ultimate goal is to provide adequate housing, transportation, health, and welfare facilities for Philadelphia residents, while taking the aforementioned programs into account.

The highlighted topic of open space is thoroughly analyzed in this report. Primary objectives focuses on trail connectivity and refurbishment, both on a regional and citywide level (PCPC 2011). An ultimate goal is to create a citywide master trail plan that helps to connect citywide parks to existing natural areas. The objective to expand access to neighborhood parks and recreation reiterates the desire to have Philadelphians within a ten-minute walk to park space. The subject of water quality is, again reemphasized for Philadelphia's major water bodies.

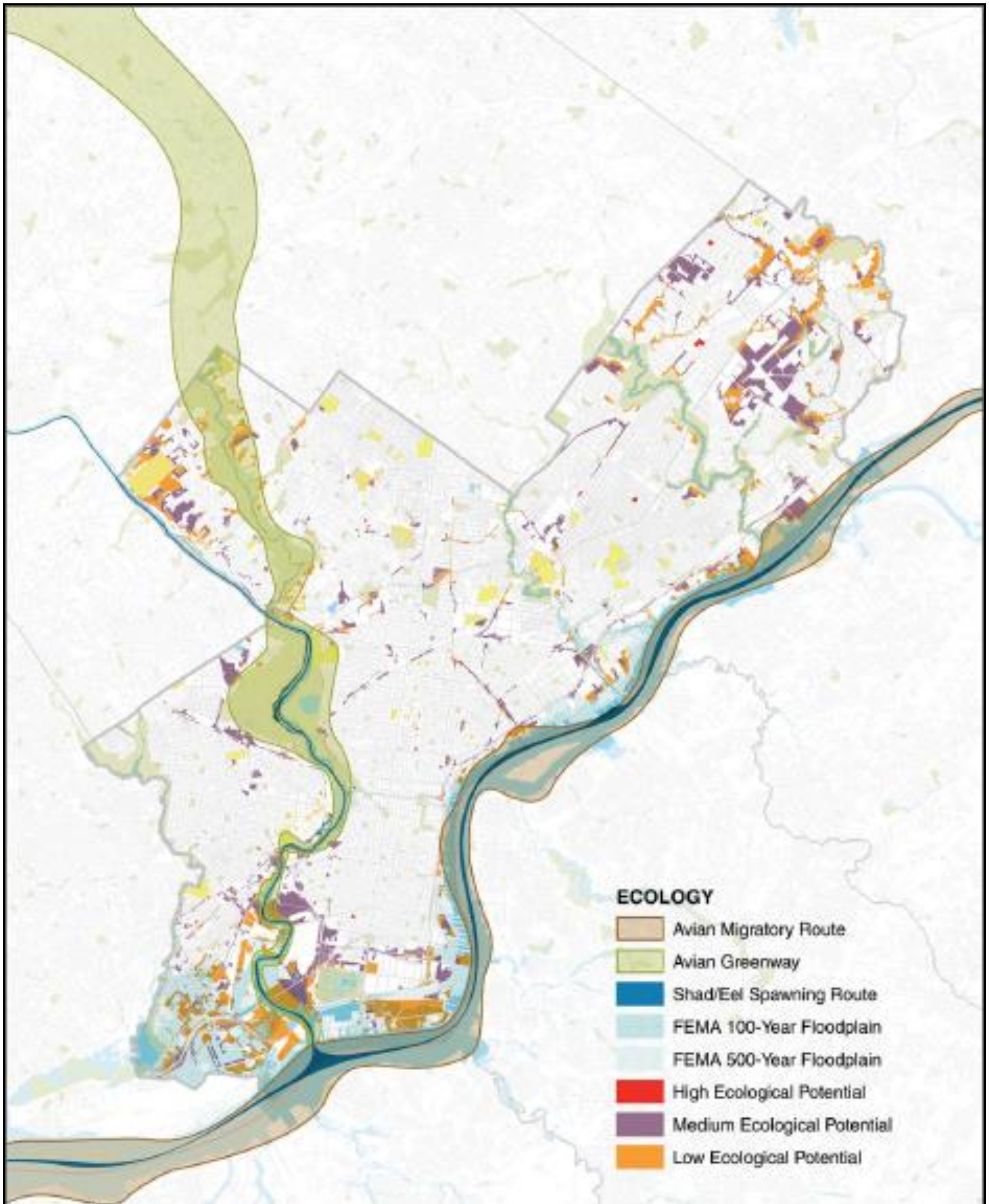
1.2 THE TRIPLE BOTTOM LINE BENEFITS OF URBAN GREEN SPACE

It is only through a cooperative political agenda that the abovementioned programs will be completed, and the City of Philadelphia appears to maintain an open line of communication. Urban green space was one of few constants in the programs, and its ability to mediate Philadelphia's triple bottom line cannot be ignored. Although touched upon in the description of major programs, the following will expand on the benefits of urban green space through the triadic scope of sustainability principles.

Natural Environment Systems

Ecology and Biodiversity

Because of the extensive urbanization in the upper Middle Atlantic Coastal Plain since the 19^{th} century, little ecological community research exists on historical trends in native flora and fauna (Pennystone Project 2014). Most recently, habitat fragmentation, loss and isolation seriously threaten the diversity that creates healthy, natural ecosystems. It is not surprising that the ecoregion ranks third in contemporary land cover change from 1973 to 2000 (Auch 2012). In spite of this, the City of Philadelphia offers an important harbor for remnant biodiversity. This is most apparent by the John Heinz National Wildlife Refuge at Tinicum that buffers Southwestern Philadelphia and freshwater tidal marsh within the Delaware Estuary. The refuge protects a variety of habitats, including the largest freshwater tidal marsh in Pennsylvania and migratory stopover environment for over 300 avian species (FWS 2013) (Map 2).



Map 2. Avian Migratory Route. Western Pennsylvania Conservancy 2007; Federal Emergency Management Administration 2005.

Although Heinz Refuge is the nation's largest urban wildlife refuge (Fisher 2013), contiguous green space networks within the City of Philadelphia can provide a buffer to increased land use and fragmentation, enabling natural populations of species and threatened habitat to survive. The ecological value of each green space will vary according to is physical qualities, usage type, and management regime. For example, a green space that is intended for heavy recreation, such as sporting events, will overly compact subsurface soil layers and minimize water infiltration. Regardless, new and upgraded parks, playgrounds, schoolyards, and community green space can host a wide variety of useful plants, birds, and small mammals. Green streets and trails can also create networks for migrating birds, pollinating bees, and breeze-borne seeds.

The integrated watershed approach that the Water Department has initiated with *Green City, Clean Waters* seeks to improve natural land-water symbiosis through green stormwater infrastructure. Using a range of techniques, vegetative-rich land plots intercept stormwater runoff, infiltrate a portion of it into the ground, evaporate a portion into the air, and sometimes release a portion slowly into the sewer system (PWD 2009). This process naturally restores a water cycle similar to that of pre-development conditions. The subsurface soil layer acts as a filter to toxins carried by runoff, and improves the water quality and flow for aquatic species. Above land, the vegetation can host many different fauna and avian species typical of an urban setting. Also, the green stormwater infrastructure will assist the physical restoration of stream channels and streamside lands to restore downstream habitat (PWD 2009).

Urban Heat Island and Temperature

The widespread cluster of dry impervious surface in Philadelphia does not allow water to infiltrate into subsoil systems, which moderate temperature and moisture. Aptly named heat islands occur on the surface and in the atmospheres. Surface heat islands are most prevalent on sunny summer days, when the sun heat dries exposed surfaces, like roofs and pavement, to temperatures 50-90 º F hotter than the air, whilst shaded or moist open surfaces remain close to air temperature (EPA 2013). Atmospheric heat islands, in contrast, are due to the absorption and slow release of heat from urban infrastructure; the annual mean air temperature of a high-density city, like Philadelphia, can be 1.8-5.4 º F warmer than its surroundings (EPA 2013).

When general temperature fluxes are considered, annual average temperature in Pennsylvania increased by 0.5 º F in the last century (UCS 2008). Temperature is expected to rise at a faster rate driven by past and future heat-trapping gases. Winter temperatures may rise 8 º F above historic levels and summer temperatures are predicted to rise 11 º F under high-emission scenarios by the end of the century (UCS 2008). When the urban heat island effect adds to increases in temperature, the sake of built infrastructure and residential well-being are jeopardized.

Moisture, or evapotranspiration, and shade cover from an arboreal canopy in a green space lowers surrounding air temperature. Shaded surfaces may be 40-45 º F cooler than peak temperatures of unshaded area. Similarly, evapotranspiration, alone or in conjunction with shade cover, can reduce peak summer temperature by 2-9 º F (Akbari, et al 1997; Huang, et al 1990). Expanding the arboreal canopy within Philadelphia will help to regulate present and future temperature. All of the aforementioned programs have recognized the need for spans tree coverage. In addition to strategy goals, the interstate

Plant One Million campaign in 13 counties in southeastern Pennsylvania, New Jersey, and Delaware to plant one million trees has obliged a 30% tree canopy increase by 2025 (PHS 2014). As host organization, the Pennsylvania Horticultural Society intends to promote healthy tree growth that will create stronger canopy coverage to regulate temperature.

Water Quality and Flooding

When it rains, the water in Philadelphia infiltrates through pervious vegetative coverage or flows over impervious paved areas, carrying any acquired sediment or contaminants along with it before entering a waterway. As a whole, Pennsylvania's climate is becoming wetter (UCS 2008). The marked influx of precipitation events, between 5 and 20 percent, is shown on climate models as a continuing trend in both high- and low-emission futures. Seasonal rainfall is expected to increase in both spring and fall, and intensify statewide by 5 to 12 percent. Coupled with rising temperatures and altered stream flow patterns, municipal and ecosystemic water supplies could decrease during summer months (UCS 2008). Shifts in the magnitude and timing of precipitation events also lead to community hazards, such as erosion, sewage contamination, and flooding (UCS 2008).

These changes in precipitation not only pose threat to existing stormwater infrastructure and water treatment utilities, but also to neighborhoods that are ill-equipped to handle flood events. When strategically engineered, the permeability of green space can offset impervious surface runoff

The adaptive strategies of *Green City, Clean Waters*, including tree trenches, rain gardens, and green roofs; plus, the focus on alleviating combined sewer overflow will strengthen the city's resilience in times of increased flooding events. Stream restoration and water quality controls will improve Philadelphia's resilience during drought, particularly when water quality and supply are sacrificed. Additionally, the pertinence of the water sector will support adaptation planning for other environmental issues, like the urban heat island effect and energy efficiency.

Psychosocial Systems

Sociodemographics

According to the US Census Bureau (2014), the total population in Philadelphia is approximately 1.5 million people across 134.10 square miles. As of 2012, approximately 44 percent of the population is African American, 36 percent is Caucasian, 13 percent is Hispanic or Latino, and 6 percent is Asian (Census Bureau 2014). About 26 percent of residents live below the poverty line (Census Bureau 2014).

Philadelphia is strongly delineated by neighborhoods, so variation in community cohesion and use of public space is ever-present. Several studies in the poorest neighborhoods of Chicago have shown that nearby green space may contribute to social contact and a sense of unity between neighborhood members (Coley, et al 1997; Kuo, et al 1998). Other studies conducted in wealthier, existing "green" neighborhoods found that green space promoted a general sense of cohesion without need to stimulate new social bonds (Maas, et al 2008). Overall, urban green space can improve the social capital nexus by offering space for communication, interaction, and learning.

Another social issue in Philadelphia is crime and safety. Expansive literature explains on the relationship between crime prevention and environmental design (US Dept. of Justice 2009; Kuo & Sullivan 2001; Crowne 1991). Katyal (2002) suggested that crime can be prevented by manipulating the design and placement of many simple aesthetic factors, such bus stops, and park benches. This suggests that areas that typically experience high crime rates are unattractwive, poorly lit, and designed so that a passerby does not recognize suspicious behavior. When green space is aesthetically managed, it can communicate the message that it is cared for, thus promoting a sense of safety (Maas, et al 2008). The improved access, appearance, and opportunities in newly devised green space areas will make them more desirable destinations for the public.

Mental Health

Environmental stressors can be acute (e.g. pollution) or chronic (e.g. crowding or traffic) (Steg, et al 2013). Chronic exposure to these elements, as typical in an urban setting, elevate physiological defense mechanisms, such as adrenaline, cortisol, and blood pressure, as well as adverse psychological indicators, such as negative affect and annoyance (Steg, et al 2013). Urban greening has the ability to provide psychological restoration, or the reduction of stress and mental fatigue, that, in turn, can alleviate physiological stress (Kaplan & Kaplan 1989).

Research in mentally restorative environments has primarily been guided by two theoretical approaches: stress recovery theory (SRT) (Ulrich 1983; Ulrich, et al 1991) and attention restoration theory (Kaplan, 1995; Kaplan & Kaplan 1989). SRT is concerned with stress- reduction when an individual first encounters a perceptually demanding situation, while ART focuses on restoration from attentional fatigue following an engagement that is mentally strenuous. The two theories are quite compatible, but are generally regarded as complimentary perspectives (Hartig, et al 2003).

When taken together, one's mental health can be restored from urban green space when directed attention and stress is reduced. If the mentally strenuous occurrences typical of the city environment are eased by the calming appearance of greenscapes, one will be able to perform better on tasks that depend on directed-attention abilities (Berman, et al 2008). This analysis will be further explored in the next section.

Education

Urban environmental education is an inclusive technique to address the aforementioned socioenvironmental issues in a city. Specifically, environmental education builds on diverse approaches including natural history, youth and community development, environmental justice, human health, urban farming, and general environmental stewardship (Kudryavtsev & Krasny 2012). Verrett, et al (1990) of the EPA suggest that environmental education should be relevant to citizens of every cultural, ethnic, and socio-economic level, juxtaposing traditional education methods with innovative techniques that meet specific needs of the community.

Environmental education can be conveyed across various interfaces in Philadelphia, as the diverse ages, sociodemographic factors, community cohesion and geographic dispersion can indicate the receptivity of new information. Additionally, using urban green space as both an educational tool and host site of educational events is a prime opportunity to expand the environmental knowledge base of community residents.

Despite not being an avid part of the education curriculum in Philadelphia, interagency support is encouraging environmentalAn example of how Philadelphia is engaging young students is through the *Green Cities, Clean Waters* program. Recognizing the importance of engaging and training young people as stewards of valuable natural resources a partnership with the Philadelphia School District has led interactive, environmental education-centered stormwater management on-site of school grounds. Greenfield Elementary (PWD 2013a) of central Philadelphia, Penn Alexander Elementary in West Philadelphia (PWD 2013b), and George W. Nebinger Elementary in Bella Vista (Abate 2012, PWD 2012) are examples of recipients.

Another educational tool is the Urban Watershed Curriculum developed by the Fairmount Water Works Interpretive Center and PWD. Building on an ascending knowledge base, the curriculum is designed as a series of thematic units starting with the student's personal perspective and working towards community involvement. The learning experience provides students with the widest view of urban water delivery systems and helps them become active participants in 21st – century solutions to urban water issues. (Farimount Water Works Interpretive Center 2012)

Public Health

Heat Index

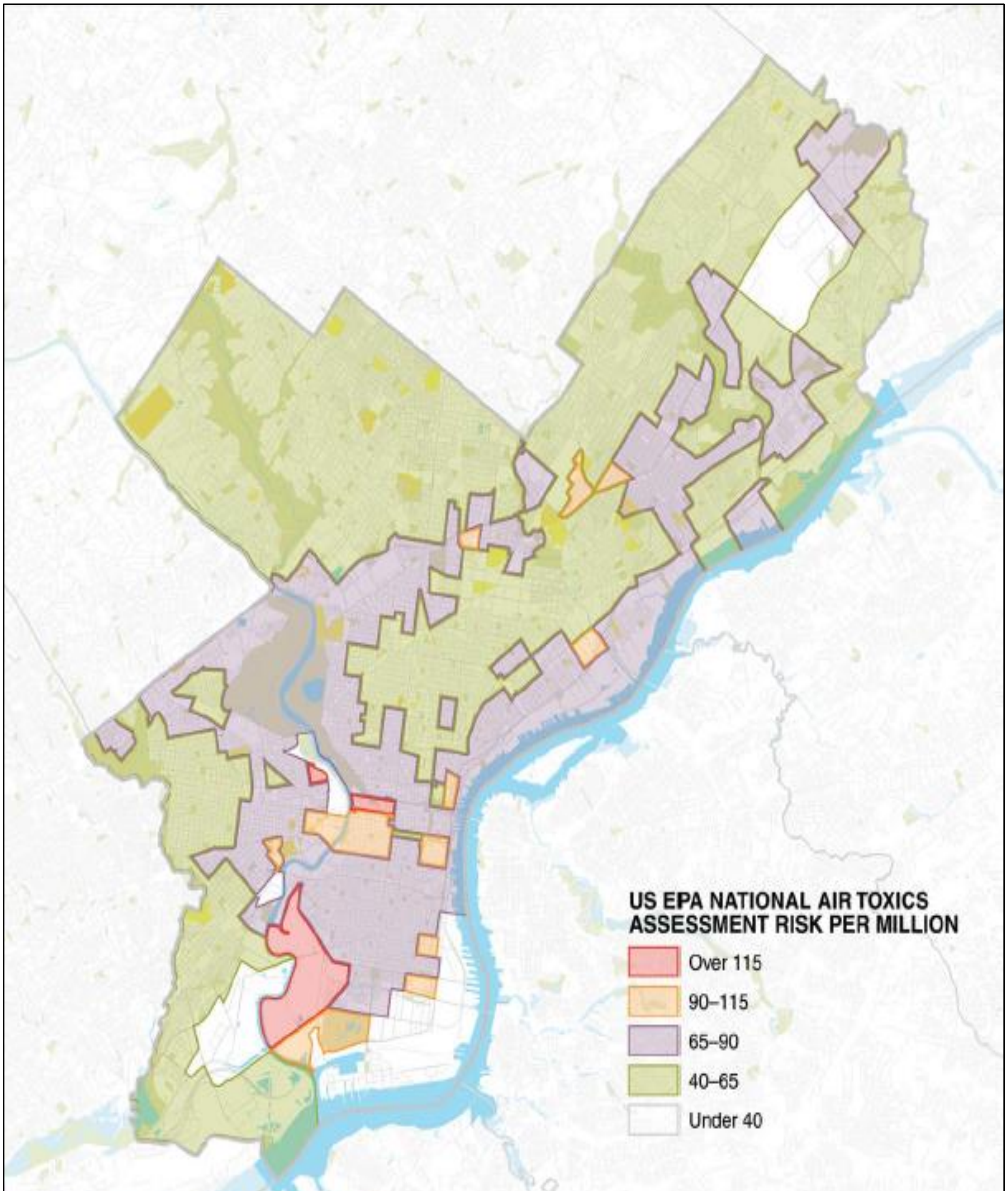
An annual environmental concern is the heat index, or the relative gauge of temperature perceived by the human body when actual temperature, wind, and humidity are considered (UCS 2008). Future changes to the average summer heat index could strongly affect the quality of life for residents of Pennsylvania, especially large urban areas like Philadelphia. Under the higher-emissions scenario, an average summer day could feel 13 º F warmer than actual temperatures in Eastern Pennsylvania (UCS 2008).

Heat waves have been a fixture of summers in Philadelphia, most notably the severe Summer of 1993 that resulted in 100 deaths (PWD 2009). Green space and larger green stormwater infrastructure projects reduce the severity of human heat index by creating shade, reducing the amount of heat-absorbing pavement and rooftops, and emitting water vapor. Together, these elements cool hot air and can reduce heat-stress-related fatalities in the City (PWD 2009).

Air Pollution

Increased energy demands typical of an urban setting generally result in greater air pollution emissions, and Philadelphia typically exceeds the federal air quality standards for both ozone (smog) and fine particulates (soot) (PWD 2009). Due to expected changes in climate, the number of days failing to meet the federal ozone standards is expected to quadruple later in the century (Frumhoff, et al 2007). Although now dated, Map 3 shows the type of air quality conditions Philadelphia residents were breathing every day.

The photosynthetic properties of trees and shrubbery in Philadelphia's urban green space and green stormwater infrastructure are natural mitigation tools to improve air quality. Pollutants, such as sulfur dioxide, ozone, and particulates, can be filtered by tree leaves through a plant's natural metabolic processes or washing off in the rain (PWD 2009). Carbon dioxide, emitted by GHGs, is also received through the stoma of leaf cells and converted into oxygen.



Map3. Air Toxins Report Source: U.S. Environmental Protection Agency 1999
http://www.epa.gov/ttn/atw/nata1999/

Physiological Health

Active recreation in green space would appear to be its most obvious use in an urban setting. It should be noted that the relationship between physical activity and green space is likely to be influenced by multiple factors, including attributes of the environment and the individual (Maheswaran 2010). Since the desire to exercise is intrinsically motivated, those that wish to be active will commute to a green area as necessary (Steg, et al 2013). Thus, the evidence for a positive link between nature and physical activity has been mixed and inconclusive (Maas, et al 2008); but, if a green living environment provides an incentive to be physically active, this could positively influence individual, and general, public health.

Philadelphia has vested interest in the connection between the natural environment and public health, as exemplified by the both *Greenworks* and *GreenPlan* initiatives. One target, specifically, was to provide park and recreation opportunities within 10 minutes of 75 percent of residents; now, the City has about 10,400 acres of open space (City of Philadelphia 2013). Not described in detail above, *Greenworks* also strategized to increase walkable access to healthful, local food. There are currently 314 markets, gardens, and farms within the City bounds.

Economic Systems

The final sphere of sustainability, most influential to decision making, is economics. Production and consumption take a considerable toll on natural resources, so concepts of sustainable development are closely linked to urban growth and development. These counterbalancing forces seemingly undermine the foundation to which economic growth is built upon, but adaptive practices, such as those described below, can remediate a balance to a state of near stasis. Less emphasis was placed on this section, as policy opportunities pertaining to green space was sparse in comparison. It is well recognized, however, that Philadelphia has created a competitive advantage in sustainable economics.

Monetary Incentives

The heart of human behavioral psychology and operant conditioning is founded on the notion that reinforcement will strengthen an individual's future behaviors when the rewarding stimulus is intrinsically valuable. Economists often emphasize that higher incentives increase thoughtful behaviors and improve performance (Gneezy, et al 2011). Monetary incentives for pro-environmental behaviors are conducive to the standard price effect, in which the incentivized behavior is more attractive (Gneezy, et al 2011).

For example, the new stormwater management fee is based on a parcel based-billing schedule, centered on gross land area (20%) and impervious cover (80%) (Crockett 2010). This billing not only enforces strong stormwater regulations, but incentivizes prosocial behaviors and compact development that implement best practices. If interested, residents may elect to gain technical assistance from PWD in the Rain Check program (PWD 2013c). Neighborhoods have been an offered opportunity in the Stormwater Credit program to use grants and loans in qualifying projects that retain the first one-inch of rainfall on greened properties (PWD 2013d). Grantees receive credits as long as: the management practices are upheld, the public and on-site runoff is managed, the property is within view other neighbors to project influence on their behavior, and are environmentally feasible (PWD 2013d).

Increased Property Value and Homeowner Benefit

As early as the 1850s, landscape architect Fredrick Law Olmsted justified the purchase of New York City's Central Park by noting that the rising of adjacent property would produce enough taxes to pay for the park; indeed, the park was responsible for an extra in $5.24 million in contemporary tax surplus (Crompton 2007). In Philadelphia, green stormwater infrastructure is expected to raise property values by 2-5 percent (PWD 2009). A study by the Trust for Public Land (2008) concluded that residential property within proximity of a park space adds $688 million across the city, which translates to $18 million in real estate taxes.

Additionally, a cost/ benefit analysis conducted in Southeast Philadelphia, which only had 1.8 percent tree cover in 2008, indicates that the mandated 30 percent canopy expansion will be over 1 million dollars (PA DCNR 2011). The tree cover offered by urban green space also works in tandem with other initiatives to help increase energy efficiency and reduce consumption. If planted strategically, tree canopy shade can block heat or prevent heat loss seasonally, thereby reducing energy requirements.

Workforce Development

Governments at all levels handle significant costs when dealing with the high poverty rate in Philadelphia. Green space creates entry-level job opportunities for those who may be otherwise unemployed or living in poverty (PWD 2009). These new jobs benefit the Philadelphian society by reducing poverty-related costs and reducing the prevailing poverty rate. In 2009, there about 250 residents employed in Green Jobs (PWD 2009).

An innovative local enterprise bridging social justice and environmental stewardship is the PowerCorps PHL program. Partnered with AmeriCorps, this City program focuses on youth workforce development and crime prevention priorities in entry-level green jobs. Crews are stationed within the Philadelphia Water Department and the Wissahickon, Cobbs Creek, and Pennypack Parks to plant 3,000 trees, revitalize 3,000 acres of public land, and educate almost 20,000 residents in watershed preservation (PowerCorpsPHL 2013). The nine-month term of service for enrolled workers also allows for post-service job placement support and skilled trade apprenticeship opportunities.

Recreation and Health

Urban green space provide tangible value to direct use recreation, such as team sports and bicycling or picnicking and reading. If urban green space or parks were unavailable, the value of these activities can still be computed by evaluating the cost of a similar recreation experience in the private marketplace. This concept of "willingness to pay" represents a savings to residents, which is not determined by income, rather a dollar amount that is comparable with prices within the private market system (Gneezy, et al 2011). Tallying the annual number of park visits and activities Philadelphians engage in, the Trust for Public Land's Center for Park Excellence estimated that the park and recreation system offers a direct use value of approximately $1.1 billion each year, or about $2 per resident per day (WRT 2010). When the cost of preventative health measures is considered, the use of urban parks and green space can also reduce the strain on public medical services.

Opportunity Cost

Opportunity costs, or the costs avoided by taking certain actions, are often overlooked when adhering to the broad context program analyses (WRT 2010). The example provided in *GreenPlan Philadelphia* is that a streamside landscape can often perform the same erosion-control function as a bulkhead, but unlike the bulkhead, the riparian landscape can slow water flow, reduce the risk of downstream flooding, host a healthy ecosystem, and be aesthetically pleasing (WRT 2010). The alleviated costs precludes floodwall construction, maintains environmental resilience, and provides a community amenity.

2: ENVIRONMENTAL ATTACHMENT AND PLACE-BASED CONSERVATION

As seen by policy improvements since the *Local Plan for Climate Change*, the focus on broader "triple bottom line" benefits from Philadelphia's green space aim to address environmental issues and inherent risk of inaction. This inclusive system encourages flexible, comprehensive designs for greened space, but does not always advocate for citizen ownership or stewardship for the natural environment. Falling in line with traditional natural resource management policies, the aforementioned method emphasizes the value of natural resources in terms of commodities offered therein (e.g. water quality, recreational opportunities) (Kyle, et al 2004). Even though green infrastructure and green space is being implemented in Philadelphia, there are barriers in successful implementation of such infrastructure. Less scientific—and political—attention is being paid, on the other hand, to that type of nature close to where people live and work, to small-scale green areas in cities, and to their benefits to urban dwellers (Chiesura 2004).

A new paradigm places greater emphasis to "understanding the subjective, emotional, and symbolic meanings associated with natural places and the personal bonds or attachments people form with specific places or landscapes" (Williams and Vaske 2003). Coined as place-based conservation, this approach emphasizes that localized places can be more than geographic settings with delineated physical and textural characteristics; they are fluid, malleable, and dynamic contexts of social interaction and memory (Stokowski 2002). This is valued for its ability to provide insight on the divergent meanings various stakeholders ascribe to natural settings, as well as to (Kyle, et al 2004).

Of interest, residential perception and attachment to the natural environment can be evaluated to measure if a "connectedness to nature" can lead to pro-ecological behaviors (Mayer and Frantz 2004). Awareness and appreciation of the natural environment and the perception of 'place' is a long-standing dimension of sustainable urban design (Carmona et al. 2010). There is a limited but growing body of literature on the roles, functions, attitudes, and constraints to green space implementation and natural resource management in the United States (Pincetl and Gearin 2005; Johnson, et al 2008). Because issues of environmental sustainability largely concern the choices and action people take, new evaluations of environmental psychology can bridge the gap between policy motives and residential awareness of open space initiatives.

One way to gauge the environmental mindset of urban residents is by assessing the emotional attachment they have to existing natural settings within the city they consider home, albeit temporary or permanent. Such concepts of home and community imply an enduring and deeply emotional relationship to a place and people, often exemplified from frequent use of a particular place or how a particular place has come to symbolize something important to an individual's identity (Williams, et al 2008). Ryan (2005) has identified three research gaps in understanding attachment to urban natural areas:

1. Effects of environmental experience: Current research has not dealt with the effects of environmental experience, such as user expertise or user intent; thus, the terms has been defined as recreational use, which is clearly underestimating the attachment that could take place in these settings.

2. Effects of place: It is important to understand how the physical attributes of a place affect attachment, especially for city planners and decision makers. The connection between physical characteristics of a place and people's attachment needs to be established within the setting of urban natural areas to ensure their importance is recognized and maintained respectfully.

3. Impact of attachment on attitudes toward planning and management: The identification of environmental attitudes and consciousness is needed to more sensitively manage areas or known information on developing an attachment for urban green space affects individual environmental action, predominantly the stewardship of local natural areas.

Environmental psychology expounds on this multifaceted interface. As both a specialty merging social psychology and environmental awareness, the discipline focuses on the large-scale, "molar-physical" environment (Williams 1995). It supports place-based conservation by identifying key psychological dimensions occurring in built and natural urban environments. Recognizing that this analysis is not generalizable for every resident in Philadelphia, the subset literature is meant to discuss recent theoretical and empirical approaches that explain conditions underlying perceptual and attachment barriers to green infrastructure practices.

2.2 The Perceptual Dimensions of Natural Environmental Places

The ability to perceive involves gathering, organizing, and making sense of an environment through sensory or tactile stimulations. These sensory stimuli are usually perceived as an interconnected whole, and can only be separated by deliberate action (i.e. closing one's eyes) or by selective attention (Carmona et al. 2010). When there are many stimuli, of which most are meaningless to the individual, it becomes necessary to exclude them from cognitive process (McHarg 1969).

Perception concerns more than just seeing or sensing; it refers to the more complex processing or understanding of stimuli. Ittelson (1978) identifies four types or scopes of perception to a place, describing each as operating simultaneously: cognition, affection, interpretation, and evaluation. These are described within the broad context of physical and psychosocial attributes of environmental psychology and place attachment theory as relevant for urban green space.

Physical Environment

Evaluation

Defined by Ittleson (1978), evaluation refers to the values and preferences which determine 'good' or 'bad' elements in the environment. When considering the preference-potential found in urban green space, initial work by Wilson (1984) proposed the biophilia hypothesis, in which human have an evolutionary genetic- attachment to terrestrial landscapes.

Aesthetic appreciation and preference for space derives from its spatial and visual qualities (Carmona, et al 2010). Personal appreciation of urban green space is a product of perception and cognition, which is reflective of individual taste and culturally-learnt preferences. Nasar (1998) found individuals evaluate an environment in a broader set of criteria, whose attributes of “likeable” environments translate into generalized preferences: 1. Naturalness- prevalence of natural over built environments; 2. Upkeep/civilities- environments that appear to be cared for; 3. Open, defined space- the blending of defined open space with panoramic appeal; 4. Historical significance- environments that provoke favorable associations; 5. Order- existing organized coherence, legibility, and clarity within an environment.

In this context, visual preference and appreciation for green landscape space is of utmost importance. McHarg (1969) provides the most fundamental approach to scenic landscapes worthy of social and environmental cohesion, in which urban areas just form one part of a wider functioning ecosystem, where the biotic environment neighbors the human-made environment. The Coventry-Solihull-Warwickshire Sub-Regional Planning Group (1971) found that major factors that “create a landscape and influence an individual’s appreciation of it, or figure in their intuitive assessment of its worth” were landform (characteristics of shape and slope), land use (residential, water, etc.), and land features (divided into ‘natural’ and ‘man-made’).

An overlapping sociopsychological debate in quantifying images of nature and aesthetic landscape preferences is whether urban residents stand above natural systems (the anthropocentric view), or whether they feel part of or even subservient to nature (the ecocentric view) (Zweers 2000). A possible explanation is the ecological aesthetic, which states that knowledge about the ecological functions of a landscape will lead to partiality for it and make knowledge an important motive of preference (Steg, et al 2013). In other words, the personal intrinsic value each person holds about a natural system stems from a deeper understanding of intact ecosystem functions (Gobster 1999).

Cognition and Space

Cognitive processes can be described as innate mental processes of memory and attention, which enable one to make sense of his or her physical surroundings (Ittleson 1978). When speaking of urban green space, the ease by which cumulative information is processed is known as perceptual fluency, with a central assumption that natural environments are processed more fluently than cluttered built features (Joye 2007; Joye & Van den Berg 2011). The paradox of sensory overload, as described by McHarg (1969) results in an anomie or sort, where responses of omission, filtering, or channeling lead one removed from their present environment into their own thoughts.

Perceptually fluent processing of natural stimuli, as that in green space, can be attributed to the way the visual brain is structured; the sense of spatial cognition is more attuned to the way visual information is composed in natural scenes than in the human built environment (Joye 2007; Steg et al. 2013). The greater attention-restoring potential of natural environments, thus, may be explained by the fact that fluent stimuli require less cognitive resource demand than disfluent ones, which leaves more room for attentional restoration.

Psychosocial

Affection

The intuitive feelings that influence perception of an environment are characterized as environmental affection (Ittleson 1978). The benefaction of meaning from a space creates a cognitive place of attached, reinforced associations. An emotional bond between the person and a place is an important part of the human experience and what they consider meaningful enough for emotional attachment to occur.

Tuan (1977) suggested that emotions link all human experiences, especially experiences as encountered in the physical world. Emotionally-driven motivations are said to be central components of human-environmental relations, for the goals sought in the everyday world and feelings about these places are bound to influence cognitive behavior (Gold 1980). Feelings of security and comfort are also included among the constituent elements of affection (Guiliani 2003).

Place attachment can connote the affective bond people have with places, which is typically operationalized as a combination of place identity and place dependence (Farnum, et al 2005). Place identity is the connection between the self and a particular setting that consists of a collection of memories, interpretations, ideas, and related feelings about the physical environment. Place dependence refers to the emotional bonding to a site that decreases the perceived suitability to sites of similar intent (Milligan 1998). It is the connections based specifically on activities that take place in a particular setting (Farnum, et al 2005).

Otherwise noted, this perceived association involves a conscious or subconscious preference of how well a setting compares to others, given a range of alternatives. Place dependence differs from other forms of attachment because it can be viewed as a negative extent that limits achievement of a valued outcome. For example, the sum of options may be negative, but the chosen option may be the best choice among bad alternatives (Jorgensen and Stedman 2001). Also, the strength of dependence may be based on functional goals rather than on affective evaluations, thus, it is an important concept in resource specificity.

Interpretation

Ittleson (1978) defines environmental interpretation as the functional meaning or association derived from past memories and projected to present experiences. As noted, a primary interest of environmental psychology and urban design considers how humans interact with both the physical and built environments. Understanding this relationship is an essential component of planning and management (Carmona et al. 2010), where infrastructure is the cornerstone of anthropogenic landscapes. The form and configuration of architectural space influences the human experience and subsequent behavior (Franz & Weiner 2008; Carmona et al 2010). Joedicke (1985) has suggested that the basic quality of spaciousness is an important component of an experience, and this is especially prevalent when environmental behaviors in green space are concerned. It is likely that people change the environment just as it influences and changes them, so, the built environment is both a medium for and the outcome of social processes (Carmona et al 2010).

Social Bonds and Community

Low and Altman (1992) have defined the social dimension of place attachment as such: “places are repositories and contexts within which interpersonal, community and cultural relationships occur, and it is to those social relationships to which people are attached.” Guest and Lee (1983) found that social involvement with friends and kin is one of the most consistent and significant sources of place attachment. The benefits of green space mediating social bonds was previously described, but also applicable to this section.

The term “community” can result from the creation or enhancement of a shared geographical place by neighboring individuals. In the interactional perspective, a community occurs, “when the latent bond of common interest in the place- the shared investment in the common field of existential experience- draws people together and enables them to express common sentiments through joint action,” (Wilkinson 1991). The central feature distinguishing a community from other social action fields is the generalizable place-oriented action that can facilitate interpersonal bonding (Theodori and Kyle 2013).

Attitudes

Investigation of place attachment as an attitude in environmental psychology can provide a general framework in which to categorize human environmental interaction. The illustration of an attitudinal approach in spatial settings suggests place as an attitude object (Jorgensen and Stedman 2001). Fishbein and Ajzen (1975) define an attitude as a response to an exogenous object, where, for purposes of this study, the green space setting (place) is considered the attitude object. Stedman (2002, 2003) introduced this concept to capture attitude-like dimensions of place cognitions that were not encompassed by existing constructs; as an attitude, place satisfaction represents a general judgment of setting quality, leading to a divergence of place attachment and satisfaction (Farnum, et al 2005).

Gray (1985) proposed a model for attitudes toward the environment; outlined here, will reflect the possible set of attitudes that may promote or inhibit place attachment to an urban green space: 1. General environmental concern: the pressing need to act in unified concert on behalf of the environment; 2. Primitive beliefs: there is no interdependency of all life, and whatever happens, science will create a technology to solve any problem; 3. Cost/benefit: the long-term and short-term aspect of the magnitude of any personal or societal threat; 4. Locus of responsibility and control: such as, what difference can one individual make; and 5. Derived beliefs: on the extent and impact that conservation, pollution, and population size can have in nature.

Summary

This literature review demonstrates that place attachments, place identity, sense of community, and social capital are all critical parts of person-environment transactions that foster community development in all of its physical, social, political, and economic aspects. Consequently, the intrinsic attributes of place described above can provide a greater understanding of how community spaces, like green space, can motivate residents and community stakeholders to preserve, protect, or improve their natural environment. This approach capitalizes a people-centered approach aimed to uncover the needs of the public and create meaningful destinations for visitors.

With these ideas to bear, a study was conducted on a large green space and stormwater management site on the University of Pennsylvania campus, Shoemaker Green (Figure 1). The objectives and goals of this research are as followed: (1) to explore the relationship between intrinsic place attachment and environmental experience at a site with green stormwater infrastructure; (2) to identify the impact of attachment on sustainable stewardship attitudes; (3) to investigate the value of environmental infrastructure as provider of social services; (4) to address possible gaps in environmental education from the University of Pennsylvania about this site, as related to sustainable development; (5) to provide valuable information on the needs of a community's environmental stewardship efforts.

3: METHOD

3.1 Study Setting and Description

Shoemaker Green was converted from the University's tennis courts in 2012. The green space is located immediately east of South 33rd Street between Walnut and Spruce Streets on the University of Pennsylvania campus. Park. Simultaneously serving as the entrance of the University's eastward expansion within Philadelphia, Shoemaker is surrounded by the University's most iconic and historic athletic facilities- the Palestra and Franklin Field.

The University of Pennsylvania holds a strong institutional presence within the City. As one of the nine original Colonial Colleges, the University now is now one of the top research institutes in the country and hosts about 25,000 students on 96 contiguous acres, with 12 million square feet of buildings (UPenn 2014).

Figure 1. Shoemaker Green

In 2007, the University of Pennsylvania President Amy Gutman signed the American College and University President's Climate Commitment (ACUPCC). This pledge committed the University to develop mitigation plans for long-term GHG reduction. Penn has been supporting a Climate Action Plan since 2009, with aims to enhance institutional leadership in environmental sustainability and responsible use of resources (Penn GCP 2009). The primary foci of the plan is energy reduction and resource management but special attention is paid to the physical environment.

Before the advent of the Climate Action Plan, the University has boasted a high standard of the sustainable built environment on campus. Of the many recommendations within its mission, the Climate Action Plan is dedicated to develop and implement sustainable protocols and practices in site planning, open-space design, and landscape maintenance (Penn GCP 2009). With robust life-cycle analyses on all projects in mind, the University strives to guide capital project decisions by the need of the campus' assets and landscape portfolio over time (Penn GCP 2009).

In accordance with the Sustainable Sites Initiative (SITES), under local landscape architect firm Andropogon, LLC, Shoemaker Green was modelled for sustainable campus design, and improves campus stormwater management by integrating a rain garden, porous pavers, and a subsurface rainwater cistern to irrigate the lawn and vegetation. Shoemaker also only contains native flora, high efficiency lighting, and an integrated waste management system. In line with the Climate Action Plan and the City of Philadelphia's overall sustainability trends, the motive for converting Shoemaker Green was to minimize runoff and flooding, improve on-site water quality, reduce the effect of the urban heat island effect, restoring biomass on site, increasing local biodiversity, and improving aesthetic environment for the community. Shoemaker Green was recently rated 2 out of 3 for SITES.

It was found that on overarching goal of the space was to look like a manicured woodland that functions in a sustainable manner (Flowers 2014). In accordance with the University's landscape plan, Shoemaker was designed with the continued aesthetic elements that are used on campus, including brick and granite (Hollenberg and Lundren 2014). College campus are typically disjointed in landscape architecture form, preventing a visual continuity across space. Shoemaker is said to have the DNA of the University's historic College Green, while meeting the needs of that area of campus.

The arterial pathways through the space link an east-west pedestrian connection from the central academic and residential campus to the University's central recreation at Penn The primary walkways were expected to be used by commuters and unimodal forms of recreation, like running. The arch from Smith Walk to David Rittenhouse Labs was intentionally more expansive than other walk ways on site because it is an emergency vehicle route (Flowers 2014). There is ample seating areas on site, including stone walls, park benches, and portable café seating. It was noted that the arrangement of the permanent seating fixtures were deigned to be shaded by the established tree canopy during the hottest times of day. The preexisting World War II memorial is a symbolic feature of the space, while simultaneously providing a pleasant shift in scenery from South 33rd Street.

The most noted wildlife seen on Shoemaker are typical of urban settings, though the neighborhood Red-tailed hawk has been sighted frequently (Flowers 2014). The only pest recorded nearby has been the Canada Goose (*Branta canadensis*) in Penn Park, but they are not expected to migrate uphill into Shoemaker Green (Flowers 2014). 33rd Street.

The lawn area is ideal grounds for passive recreating, but it is purposefully sloped to reduce high-intensity sporting events (Garofalo and Goresko 2014). Under the lawn, at the epicenter of the space, is a 20,000 gallon stormwater cistern. The subsurface soils are engineered to handle pressure by buffered sandy loams that drain well (Hollernberg and Lundgren 2014). From risk of soil compaction, which would impede the amount of rainfall infiltrated, the staff will utilize air spade shattering annually to aerate the soil (Flowers 2014). The cistern is also closed for the winter season, as to prevent any residual ice-melt salt from entering the water system.

General maintenance of the space varies by season. The staff is well-informed of the sustainable protocol needed on-site; as example, they are cognizant of not spreading winter ice-melt over the porous pavers and are trained in native plant upkeep (Flowers 2014). The daily maintenance routine includes litter removal, which has been negligible, emptying trash and recycle cans, and preserving an, overall, clean aesthetic presentation (Flowers 2014). Landscape maintenance is usually conducted in less energy-intensive manners (i.e., using power tools) unless it proves impractical for the specific task (Flowers 2014). The only fertilizers used on Shoemaker and around campus are made of compost tea, which is high in nutrients and live microbes that facilitate plan health (Flowers 2014). All maintenance staff members have been informed of the SITES pilot, and it was noted that most are quite enthusiastic about the initiative (Flowers 2014).

Visitors can opt to “rent” the space for most forms of gatherings. The lawn or surrounding pavers have been promoted as ideal grounds for public crowds (Flowers 2014). Alcohol is prohibited, but arrangements can be made for prepared food or barbeque grills (Flowers 2014). There is a fixed price for events if sponsors are unaffiliated with the University; the price includes support staff, electrical components, barricades, tent set-up and break down, and an indirect fee to mark sprinklers (Flowers 2014). If affiliated with the University, holding an event at Shoemaker is free of charge. There have been no accounts of deliberate vandalism in the space, though the amount of skateboarding near the seating wall was verbalized as a concern (Flowers 2014). In accordance with the University's policing schedule, the safety at Shoemaker Green is consistent with other parts of campus.

3.2 Materials and Analysis

The components of this research were conducted using social behavior mapping and intercept surveys. All recordings were collected from June 2013 through April 2014. Since the site is on campus property, both protocol were approved by the University of Pennsylvania's Institutional Review Board.

Behavior Mapping

Social behavioral mapping, or behavior mapping, is a form of systematic, unobtrusive observation research that tracks individual behavior in relation to features of the physical environment (Cosco, Moore and Islam 2010; Moore and Cosco 2010). The behavior mapping protocol was based on The Systematic Observation of Play and Recreation in Communities (SOPARC), an observation tool designed to estimate the number and characteristics of people using parks created by McKenzie, et al (2006).

For this research, the goal was to monitor the site throughout the year at various days and times of day to determine how natural and built elements influence the usage of the site. A place-centered approach was used, where all activity occurring on Shoemaker

Green was recorded, as opposed to an individual- centered approach, where few people are targeted and followed across space.

The observation schedule in SOPARC is one-hour intervals (morning, lunch, afternoon, evening), typically, every day for one week (McKenzie & Cohen 2006). Unlike SOPARC, a more random approach was used for Shoemaker to account for seasonality and changes in the academic year. This protocol used sixteen observation rounds over the 2013-2014 year, the non-participant observer assessed visitors in their natural context. Four sessions were designated per season, with each session consisting of one two-hour observation interval (note: the first and last sessions were three hours to log a total of 34 observation hours). The sessions were randomly chosen by three week days and one weekend day each season, with hours varying from mid-morning to early evening. A computer aided drawing (CAD) paper-based map was used to “point count” each visitor and their activity, then transposed into ArcGIS 10.1 software for vector and spatial analysis. Additionally, a variety of other environmental factors pertaining to each observation day were recorded, including temperature, sunlight, noise, etc.

SOPARC delineates key target areas that represent all standard target locations likely to be used by a site visitor. Using that method, Shoemaker Green was broken down into ten target areas, as seen in Figure 2. Sample zones were created by the main features (lawn, rain garden, memorial, DRL, athletics buildings) and walkways (seating areas in front of canopy, near DRL and Smith Walk).

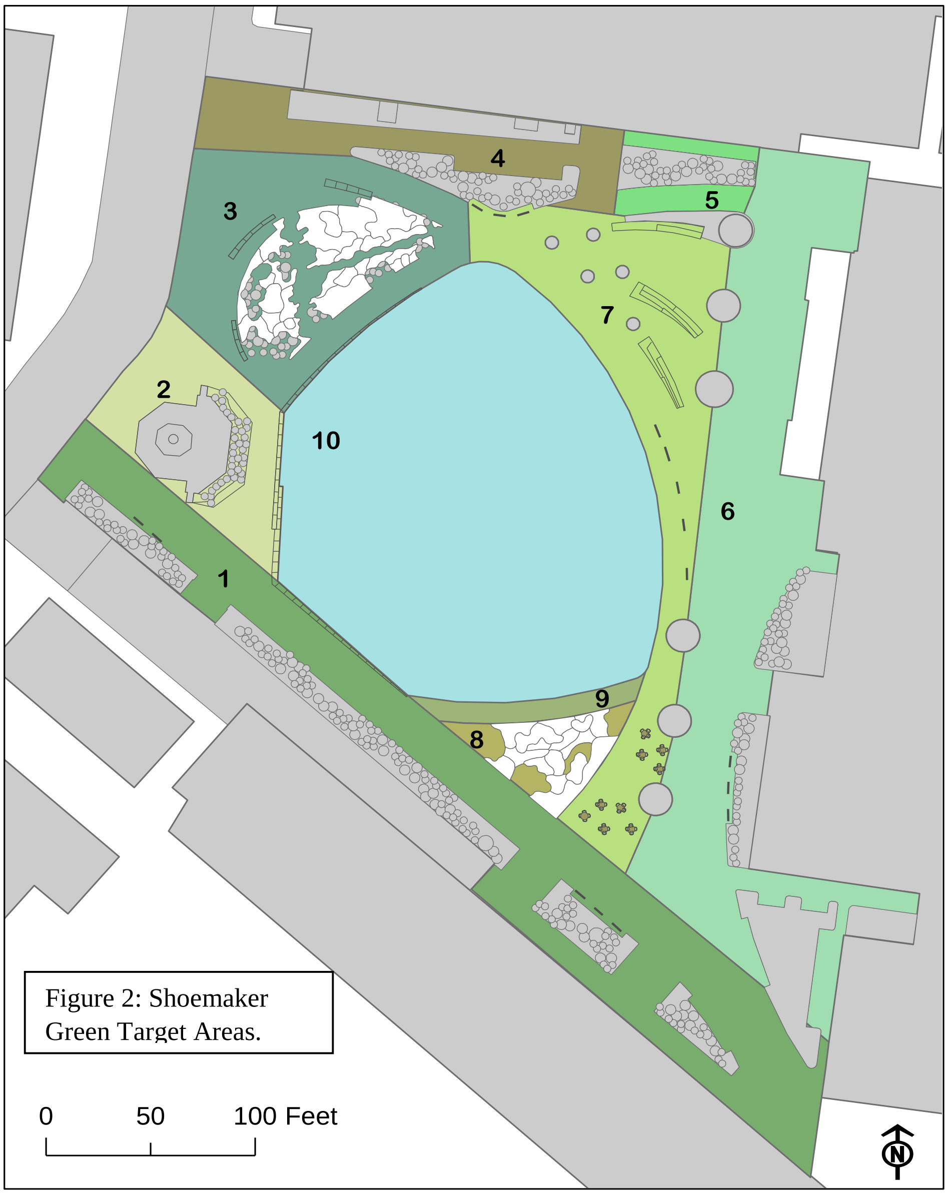


Figure 2: Shoemaker Green Target Areas.

ArcGIS 10.1 was used as a visual and analytical tool to show the distribution of visitor behavior. The site's base maps were retrieved from the supporting landscape architecture firm Andropogon Associates but additional vector and raster graphics were produced to analyze trends in total site use and activity by season. The gender of each individual was notated during data collection, but this study is more concerned with seasonal variations, not gender-based extrapolations.

The results of the 2013-2014 social behavior mapping will first be analyzed as annual sums, then by season. Primary site use was transferred into ArcGIS 10.1 as observation points, then clustered by kernel density (12 square foot radius, 1.5 cell size). Conceptually, kernel density fits smoothly curved surface is fitted over each "visitor" point. The surface value is highest at the location of the point and diminishes with increasing distance (ESRI 2011), so the greater number of points in an area, the higher the value. Where there were not enough observed points to make meaningful density maps, the Focal Statistics tool was used to "plump" the raster cells for ease of visual reference. Vigintile classification, or 20 quantiles, was used to display broad changes in density, and Zonal Statistics were used to make descriptive statistical inferences of the sample areas (Note- when a non-integer occurred, the value was rounded down to account for a whole person). The values of density mapping are not intended to be interpreted literally, rather, as indicators of person-dispersion within each sample zone.

Additional analysis explored the site visitor proximity to stormwater management features and viewshed of various "observer points" on site, both of which will be further detailed in the next section. These two operations were conducted to get a sense of what someone may see and feel while using the site, and in turn perceive, based on built and natural environmental factors.

In attempt to quantify the qualitative built and natural environmental features at Shoemaker Green, a ranked grid of such aspects was developed. The goal was to determine the impact of the physical environment on the various types of experiences people have on-site. As a hypothetical scenario, the viewshed, or line of site that identifies the cells in an input raster that can be seen from one or more observation points or lines, of people relaxing in various seating areas to "see" these features as a person would on site.

Both built and natural features on site were converted to raster using a cell size of 0.25. These rankings were based on visual dominance in the space and ascending value of natural environmental importance. They were given the following ranked values: 1 = tall, built components (buildings, memorial [interior circle and exterior skirt], lighting; 2= mildly obstructive built components (wall seating, South 33rd, sidewalk, memorial (interior); 3= small constructions (curbing, café seating, benches, bike racks, rockwall); planting areas were valued by their species diversity (4-10), then given 2 extra points for their respected importance; 4= lawn; 5= lawn, and 6= tree canopy (NOTE: A value to the pavement was not determined, as the initial methodology used provided inaccurate results. Also, it should be noted that this procedure is not applicable during every season, given the large quantity of perennial and deciduous plantings on site. This ranking protocol was subjective to the author's discretion, so interpretable results could vary.)

The new grid was reclassified into five categories, with "5" being the lowest value of environmental stimulation and "1" being the highest value (Figure 22). An elevation layer was created using contour lines and elevation points, then added to reclassified built features to create a grid that considered the elevation with visual barriers (Figure 23). The viewshed operation was used on eight “seated” observer points (OFFSETA=4) in the center seating spot in each area. The AZIMUTH1 and AZIMUTH2 attributes were added as the 180 degree “viewsheds” someone can see when facing forward.

Two concepts grounding behavior mapping include Gibson’s concept of affordances (1977) and Barker’s notion of behavior settings (1968). Affordances are defined as the relational features of an environment, to which its intrinsic characteristic promote or impede the abilities of the visitor. Behavior settings, on the other hand, are regular patterns of behavior specified by time and place; they are also dependent on the physical characteristics of the place and levy the prescribed social roles expected to occur in that place (Barker 1968). With that in mind, due care was given to not assuming false inferences on visitor behavior, as an affordance or opportunity within the space does not necessarily signify preference for certain areas.

Survey

A paper-based survey was completed by 200 participants in 2014. Participants were intercepted by the author at various locations within the site’s confines. All participants received a short briefing on the purpose of the study prior to responding. Participant privacy was upheld by maintaining a buffer of comfortable distance while surveys were scored.

The scale of the survey was based on a collection of prominent place-related research (Tuan 1977; Low and Altman 1992; Farnum, et al 2005; Kyle, et al 2004;

Williams, et al 2008). Given the importance of place for this study, as well as the primary intentions for usage of the space, it was decided that the survey would focus on the dimensions of place identity and dependence and feelings of involvement and satisfaction.

Participants were asked: (1) how often they visit the site; (2) if they are associated with the university; (3) how they utilize the space; (4) if they are aware of the sustainable landscape practices on site; and ratings of (5) how they identify with the site; (6) how the social interaction mediated on the site influence innate sense of place, particularly in relatedness to a natural environment; (7) if the site is facilitating their needs; (8) their emotional attachment to the site; (9) perceived quality of the site and their experience; and (10) additional thoughts or comments. Excluding the final section, the survey is approximately half multiple choice and half ratings; the final section is an optional, open ended question. This survey does not include unique personal identifiers (sociodemographic information, household salary, etc) as part of the study; obtaining this information appeared to violate the ethical boundaries of individual attachment to green space in an institutional setting.

Descriptive and inferential statistics were used to analyze the survey data using R software. The characteristic dimensions of place attachment were compared to the independent variables of how often the site is frequented. Using a two-factor analysis of variance (ANOVA) procedure, the total sum of squares was extracted to show the sum of all squared differences from each mean. If interactions were insignificant ($p > .05$), the group means do not differ, and it can be accepted that the mean value for the dependent variable (attachment category) is the same regardless of the independent variable (frequency to the site).

4: RESULTS AND ANALYSIS

4.1 Behavior Mapping

Total

As indicated by Figure 1, Smith Walk was the most highly utilized walkway. This was not expected, given its continuation to Penn Park, additional sports facilities, and South Street. The arterial walkway in Area 9 had the greatest mean of all sample areas, approximately 2 people per 12 square feet. This route offers a convenient bypass from Smith Walk to any of the eastern gymnasiums, so this may be have been a result of design and opportunity. The eastern wall of David Rittenhouse Laboratories (hereafter, DRL) was the least utilized area of the space, but, the southern directional of the density values may indicate that people were commuting to or from the Palestra's side access point. The very low

AREA	MIN	MAX		MEAN		STD	
1	0	0.68	8.11	0.10	1.19	0.14	1.64
2	0	0.21	2.51	0.06	0.68	0.05	0.60
3	0	0.23	2.77	0.05	0.60	0.05	0.59
4	0	0.16	1.97	0.04	0.47	0.04	0.46
5	0	0.05	0.63	0.01	0.11	0.01	0.14
6	0	0.18	2.17	0.04	0.42	0.04	0.48
7	0	0.29	3.44	0.05	0.55	0.04	0.49
8	0	0.25	2.97	0.03	0.31	0.05	0.54
9	0	0.30	3.61	0.22	2.67	0.04	0.53
10	0	0.18	2.13	0.01	0.09	0.02	0.20

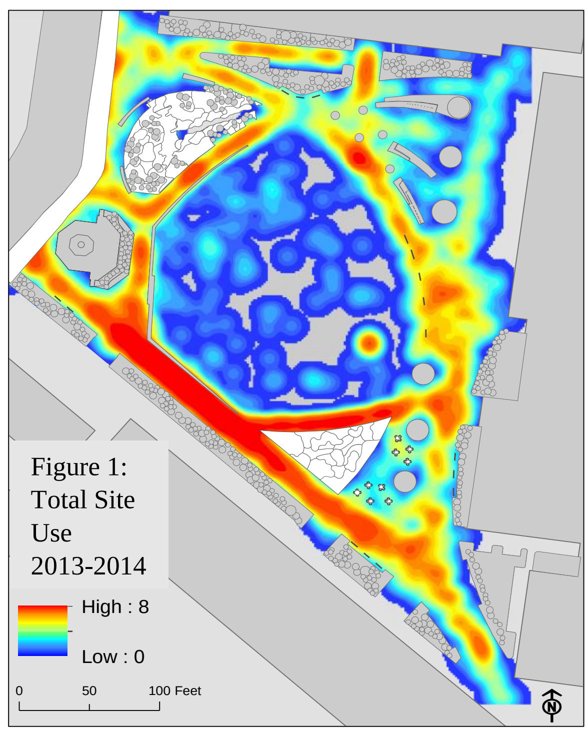


Figure 1: Total Site Use 2013-2014

point count on the lawn should be noted as well. As a central component to the space, the lawn was expected to host a variety of activity, yet it had one of the lowest

maximum and mean values.

Walking

Again, Zone 9 reared the greatest mean area for commuters to walk (Figure 2); its high of two people per twelve square foot search radius is significant compared other areas. Not surprisingly, Smith Walk was the greatest maximum walking concentration. Consistent walking activity resumed around the rest of the space. Presumably, some residual point counts from Zone 9 trickled into Zone 7, boosting its maximum to about three people. But, its high density in front of the wall seating and tree trenches, nearby adjacent steps towards the Palestra, is also notable. The lawn, Zone 10, did experience sporadic walking rates throughout the year but nothing significant enough to yield a high mean or maximum. Although extending the bounds of the sample area zones, the walking

AREA	MIN	MAX		MEAN		STD	
1	0	0.53	6.38	0.08	0.94	0.11	1.27
2	0	0.15	1.83	0.04	0.50	0.04	0.47
3	0	0.16	1.88	0.04	0.45	0.04	0.47
4	0	0.13	1.55	0.03	0.37	0.03	0.38
5	0	0.07	0.81	0.01	0.11	0.01	0.15
6	0	0.14	1.65	0.03	0.31	0.03	0.35
7	0	0.25	2.97	0.04	0.42	0.04	0.43
8	0	0.22	2.60	0.02	0.27	0.04	0.52
9	0	0.26	3.14	0.19	2.24	0.04	0.51
10	0	0.12	1.47	0.00	0.04	0.01	0.12

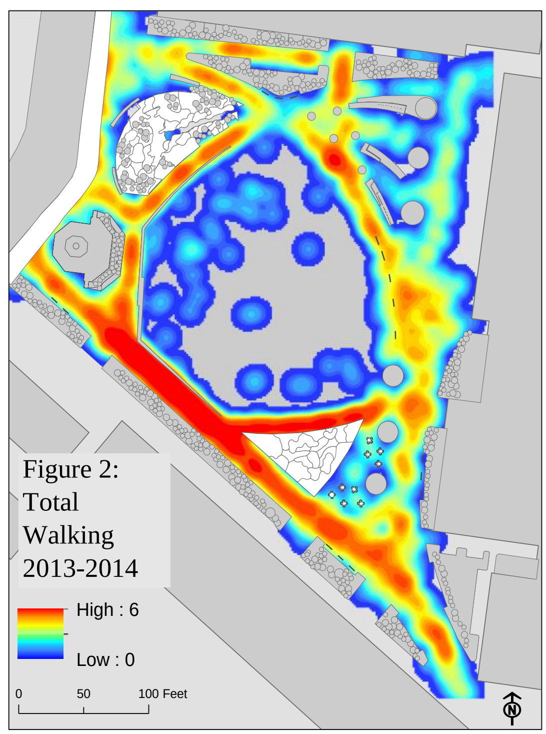


Figure 2: Total Walking 2013-2014

path outside DRL's southern entry is quite distinct. The walking path along the outskirts of the seating arch is also interesting; this trend could further posit the opportunity versus preference notion, to which the openness of the space behind the seating is more appealing, even though it is canvassed with a built structural backdrop, and the narrower walking strip in front of the benches is less comfortable, even though it is neighbored by the green lawn. This form of analysis is inconclusive for this study, as the independent relationships of people walking near the benches and people sitting there was not specifically notated, but further inquiry in such approach would be interesting. Overall, the frequency of walking within Shoemaker Green has undoubtedly contributed the greatest to the total site usage.

Summer 2013 Walking

Zone 1 and Zone 7 showed the greatest maximum values for walking in Summer 2013 (Figure 3). It appears as though the majority of walkers from Zone 7 are in front of Hutchinson Gymnasium or the Squash Courts. There was less walking activity in Zones 5 and 9 possibly sue to the negligible observation periods during the academic semester. This assumption may be true for the limited observations noted near the Palestra in Zone 7. The dense cluster of observations in front of the lawn and tree trenches was not noted as anything meaningful, but is in interesting proximity to the tree trenches, wall seating, lawn and stairs leading to the Palestra.

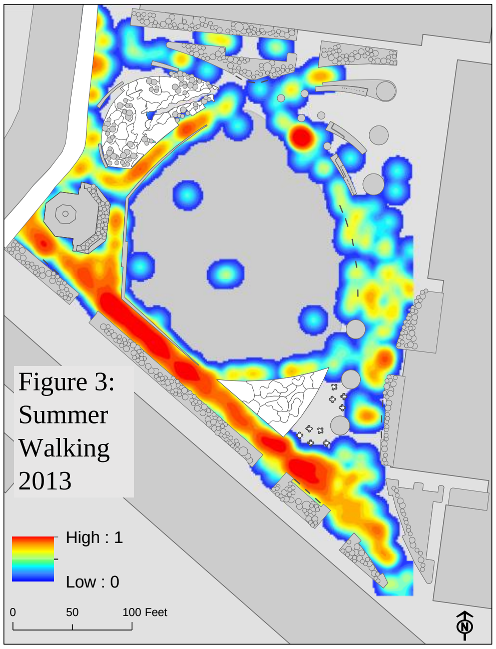


Figure 3: Summer Walking 2013

Fall 2013 Walking

The most visually apparent differences between Summer and Fall walking trends are the increased density in Zone 9 and the walking rate in front of DRL (Figure 4). Again, with the onset of the Fall term, this was not surprising. The distribution of walkers in Zone 1 (Smith Walk) was less dispersed compared to the previous season; this may be attributed to more groups of people walking or increased activity to or from the variety of offerings within the Weiss Pavilion at Franklin Field. It is interesting to note the presence of the café seating and its effect on walking behavior; in the Summer, no observations were recorded within the area of the seating, but more walkers were observed in this area during the Fall.

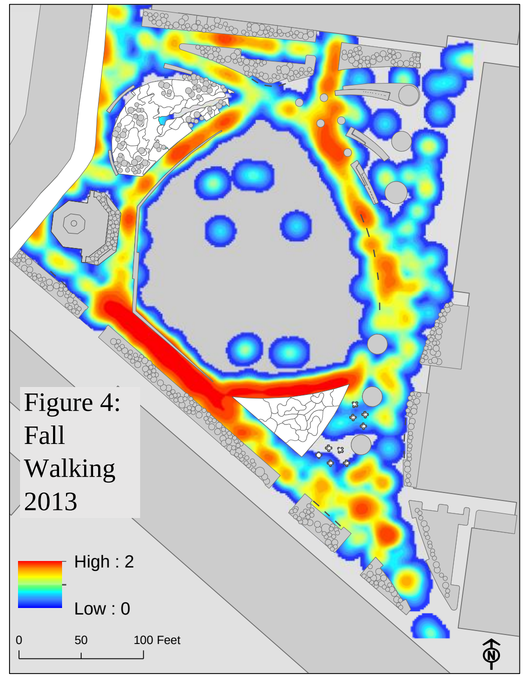


Figure 4: Fall Walking 2013

Winter 2014 Walking

The descriptive statistics for Winter walking observations (Figure 5) were not as noteworthy as the previous seasons', so analysis will be based on visual inquiry. The absence of the café seating only subtly increases walking behavior within that area. The walking trend along Zone 1 (Smith Walk) shows no apparent shift, but the density of users traversing to Penn Park has, seemingly, increased. Also, there is an apparent increase in walking along Zone 6 (the Palestra), as well as the previously unutilized Zone

5. The walking path outside of DRL’s side door appears to be a constant through the semester seasons.

Spring 2014 Walking

Again, Spring walking behavior (Figure 6) did produce many statistically significant results. Zone 1 and Zone 9 were the most utilized areas, though Zone 9 had a relatively higher mean (0.59 compared to 0.22). Visual inquiry suggests that there is a higher walking rate within the empty café seating area and the memorial. The density of people walking from the side of the Palestra had decreased in the Spring, but the use of the adjoining stairs had increased. Again, as compared to the previous seasons, walking behavior on the lawn is minimal.

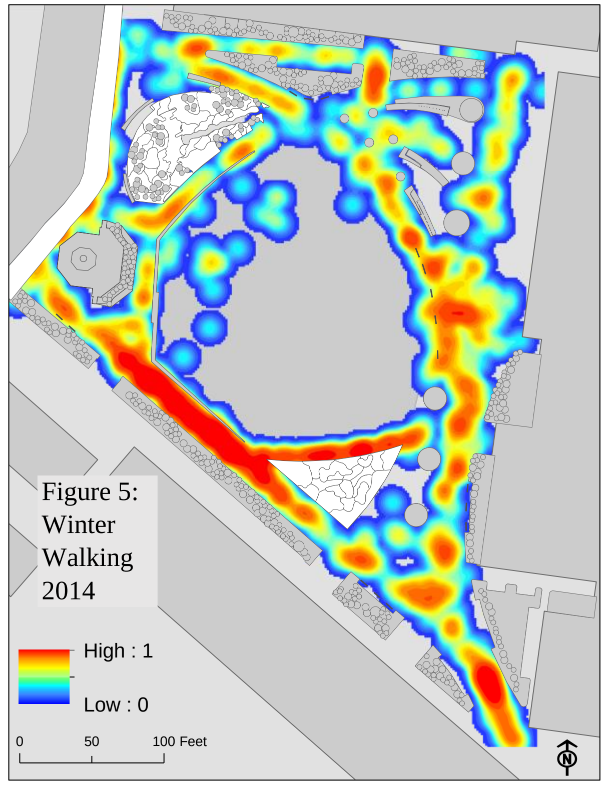


Figure 5: Winter Walking 2014

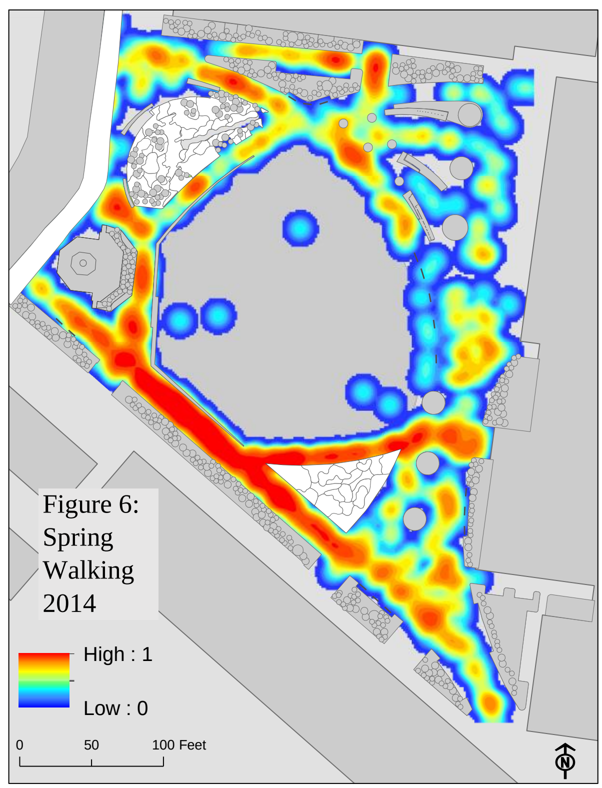


Figure 6: Spring Walking 2014

Recreation

Because of the limited number of people recreating on Shoemaker Green, the kernel density search radius was expanded to double the original (24 square feet, versus 12 square feet). This expansion was intended to provide a more distinct visual coherence of trends, rather than limiting the density "mounds" by such few points. Also, all forms of recreation were included in the kernel density analysis (running, biking, skateboarding, playing Frisbee, etc). An additional figure was provided for each season to note running and biking patterns, as these two activities contributed the most to the kernel density outcomes.

Total

Given the convenient thoroughfare of Smith Walk to Penn Park and South 33rd Street, it was expected that this zone would be most widely utilized for recreating. Although the statistics are insignificant, the zone of second- greatest recreation use is the area near the rain garden. Intuitively, this would not appear to be the easiest entry or exit point for those running or biking. There is also heavier density near the seating areas, which is interesting because of its structural delineation. The overall trend of people recreating on site is almost in a delineated tendency; short of the few outliers near the Palestra of on the lawn, the observations conclude that people generally follow similar paths along Shoemaker Green. The limited use of the lawn as a recreational area should also be noted (Figure 8).

AREA	MIN	MAX		MEAN		STD	
1	0	0.060	1.43	0	0.26	0.014	0.34
2	0	0.022	0.53	0	0.07	0.004	0.08
3	0	0.016	0.39	0	0.08	0.003	0.08
4	0	0.013	0.31	0	0.06	0.003	0.07
5	0	0.000	0.01	0	0.00	0.000	0.00
6	0	0.013	0.31	0.002599	0.06	0.003	0.07
7	0	0.014	0.34	0.002591	0.06	0.003	0.07
8	0	0.017	0.41	0.003585	0.09	0.003	0.08
9	0	0.030	0.73	0.009419	0.23	0.005	0.11
10	0	0.033	0.80	0.001267	0.03	0.003	0.07

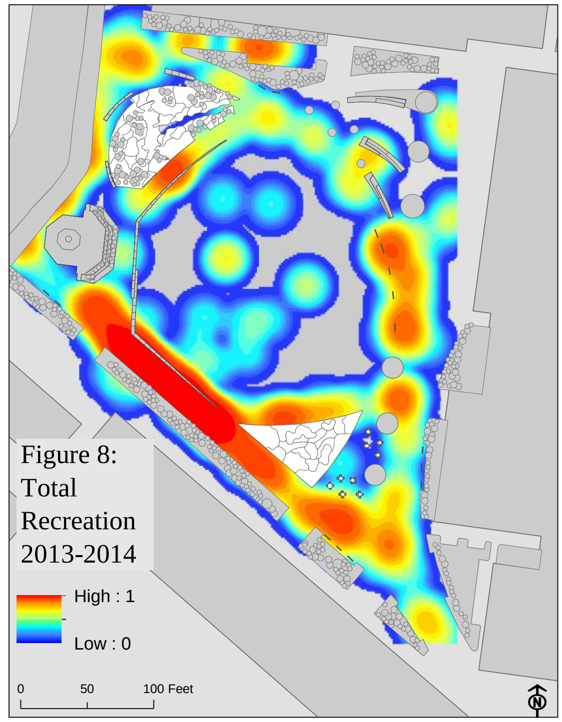


Figure 8: Total Recreation 2013-2014

Seasonal Recreation

None of the Zones exhibited statistically significant results. The greatest use of the lawn occurred during the Summer observations, so it can be inferred that users were not deterred from active recreating during warmer weather. Also, the area around the rain garden, possibly with people using South 33rd Street as entry or exit, is showing higher traffic than other areas of the site. The biking and running map (Figure 10) shows, again, Zone 1 (Smith Walk) as being the most employed area for recreation. It was interesting to see a biker traverse across the lawn, and to see others cut in-and- out of the seating area. The running patterns may be typical; if a group of people are running together, they were observed to run in horizontal or linear formation.

Fall observation brought similar conclusions, however the bike rack near DRL shower a greater emergence of bikers than in Summer. On one observation day, a group of young adults were seen trick-biking around both the wall seating and the benches, which accounts for the density of bikers near both seating areas. It was interesting to see someone using the lawn to play Frisbee in the Winter season, but the few mild days would accommodate such activity.

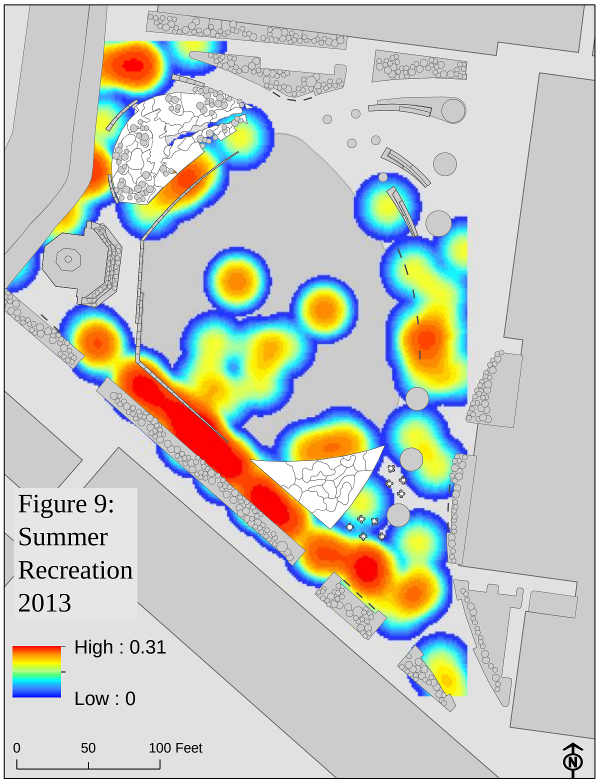


Figure 9: Summer Recreation 2013

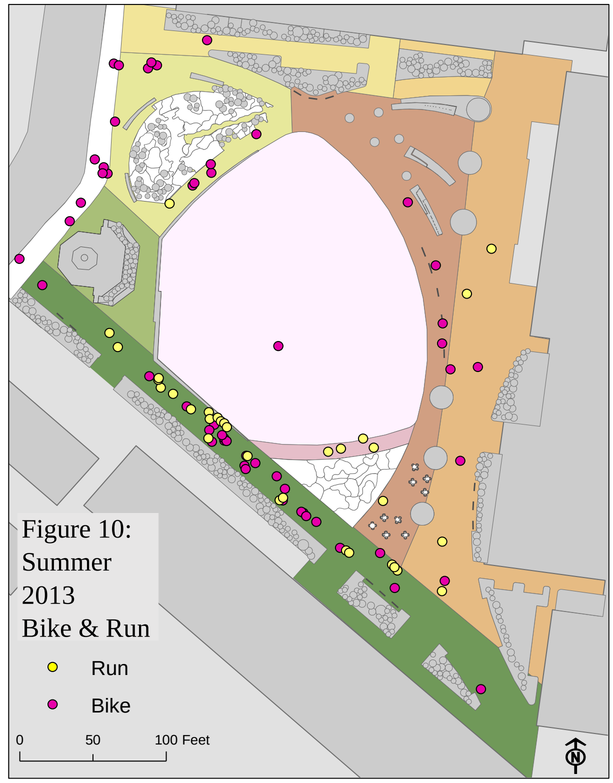


Figure 10: Summer 2013 Bike & Run

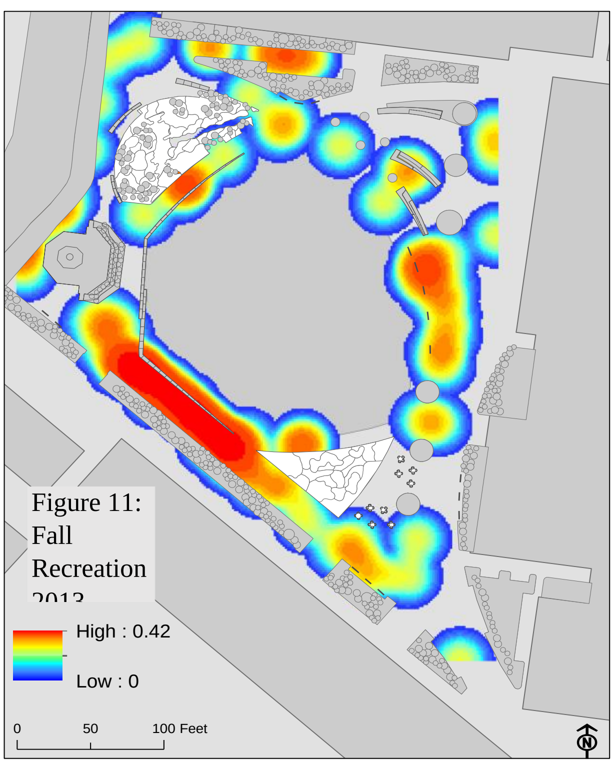


Figure 11: Fall Recreation 2013

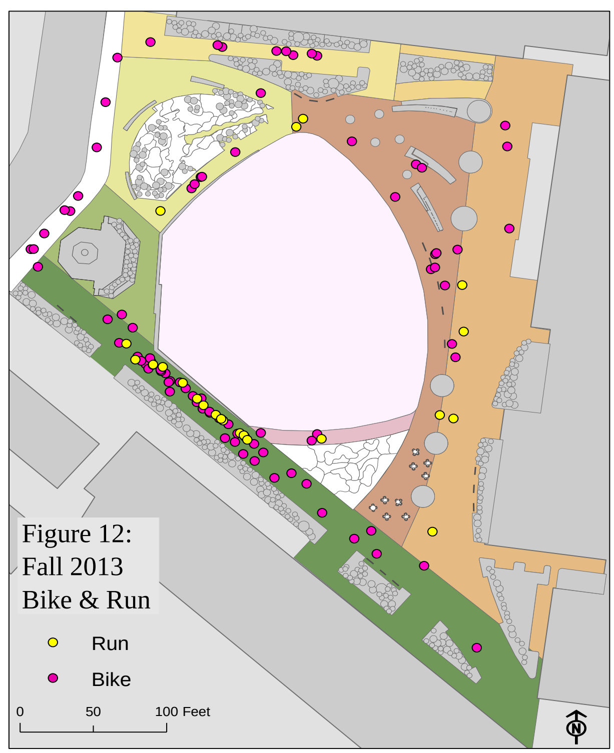


Figure 12: Fall 2013 Bike & Run

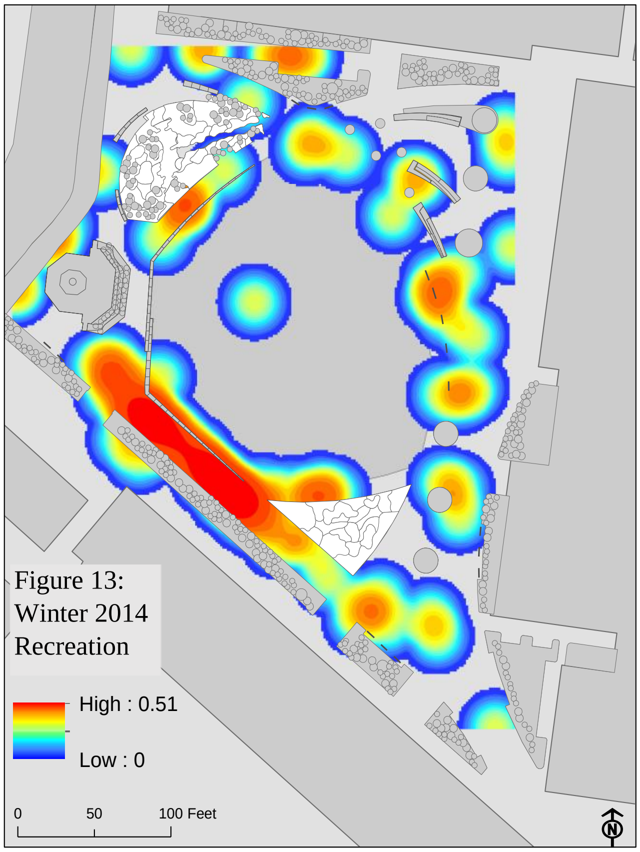


Figure 13: Winter 2014 Recreation

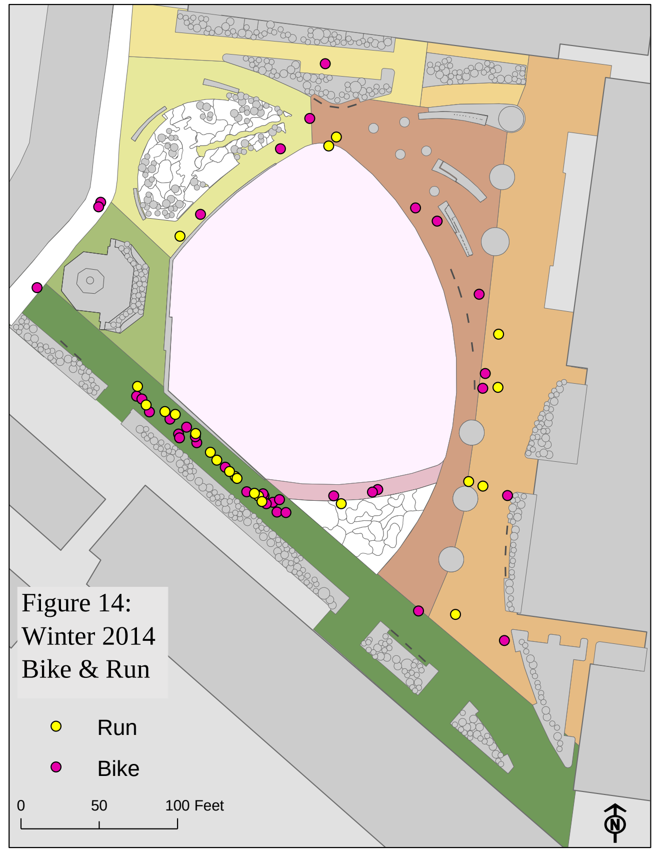


Figure 14: Winter 2014 Bike & Run

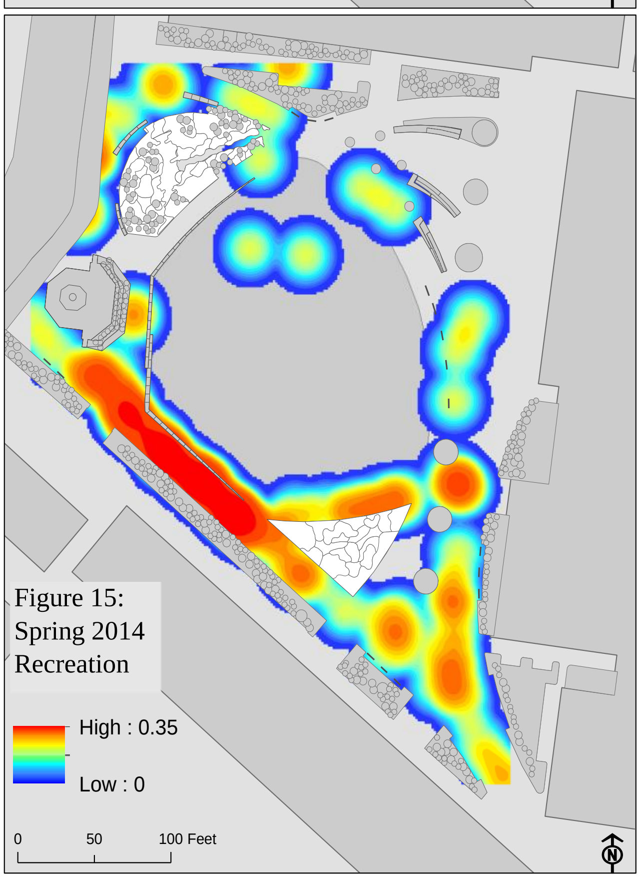


Figure 15: Spring 2014 Recreation

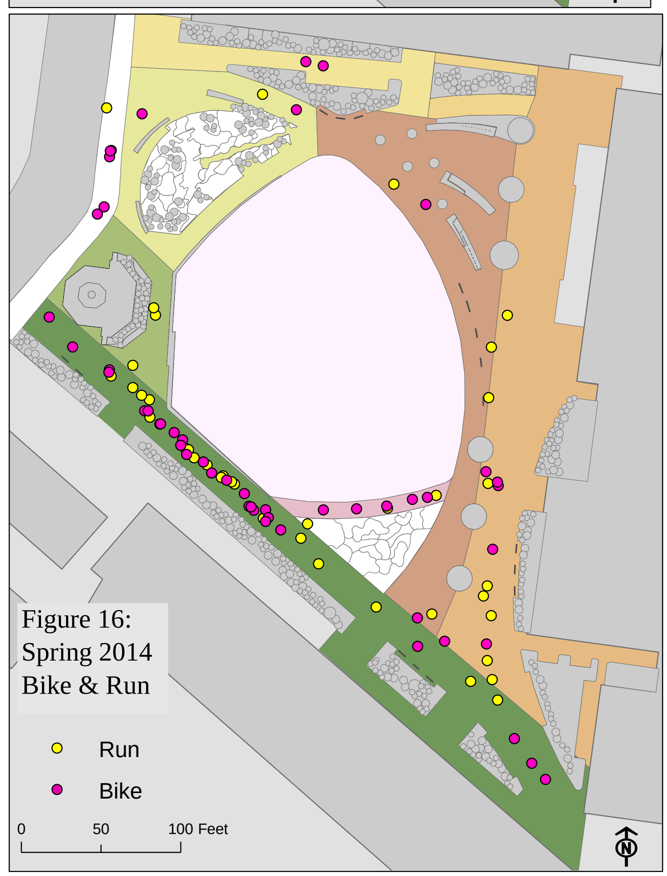


Figure 16: Spring 2014 Bike & Run

Site Use Compared to Stormwater Infrastructure Proximity

With such extensive use of Shoemaker Green, overall, it was decided to analyze the 75th quartile, or top- 25%, of selected visitors to the stomwater infrastructure features. The idea was to see how close the range of observations come to each visually- distinct BMP, with underlying presumption that if a visitor knows nothing about stormwater management, they could direct attention to these. Motive behind this analysis was also to see where opportunities exist to enhance on-site environmental education, based on typical interactions with natural features within the space.

To obtain these results, a 10-foot vector was buffered around the site's tree trenches and rain garden (Figure 17), then clipped and converted to raster. Each season's observations were reclassified into quartiles, and then masked by the top 25% in each sample zone. Since there were not many people socializing or relaxing, those were converted to single raster cells. Zonal Mean was then evoked, with each reclassified people-grouping as a zone and the buffer as the input value, to show the average distance from the stormwater feature from each sample zone. Note that the tree trenches on the northern part of South 33rd Street's sidewalk were excluded here, in part because they fell outside of the site's confines and

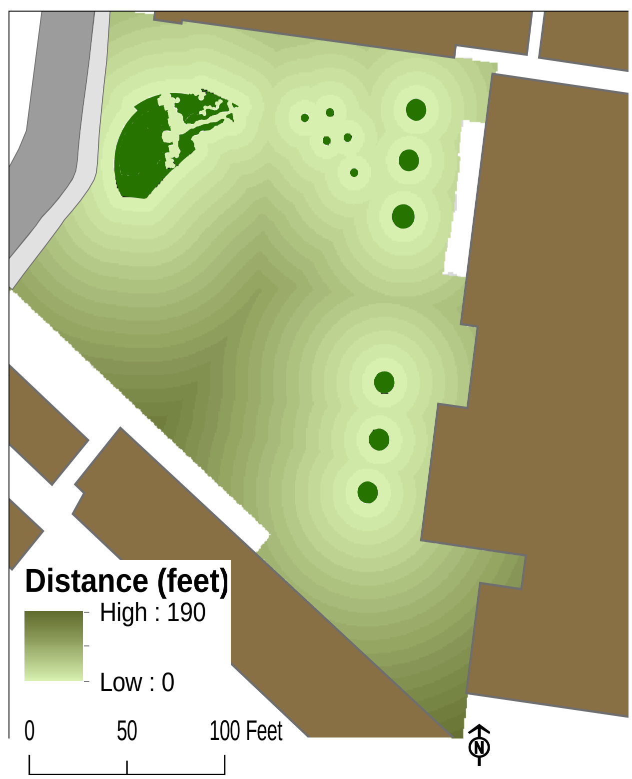


Figure 17: Distance from Stormwater Features

appeared to be part of the streetscape than the green space's landscape.

Total Use

The total use of the site from environmental features was, overall, evenly distributed across seasons and in line with visual expectations (Figure 18). Since the lawn area was densely clustered during summer observations, its 42 foot contrast to the 79.5- foot counterpart in the winter is not squarely comparable but interesting to note. The arterial walking path just below the lawn has a drastically different mean walking distance in the Winter than the other seasons; its 20 foot dissimilarity could lead one to believe that people were observed using the space are the furthest edges of the Zone, or merely, more people were seen exiting the Zone. The rain garden (Zone 3) was shown to have people walking closer to the garden in the Winter than other seasons (about a 4-foot distance compared to approximately 12 feet). The seating area (Zone 6) was noted to have a shorter mean distance from stormwater features in the Spring.

The eastern-most portion of DRL (Zone 5) was only significant in the Summer, with a relatively close distance of 13 feet. The furthest sample area from DRL (Zone 4) showed the greatest, but rather trivial, distance during the Summer, when the side door into the building was not used as much.

Walking

The 75^{th} quartile of walkers by season is very similar to the map of Total Site Use, since the primary observation was people walking (Figure 19). The corresponding map values are virtually identical, short of Winter walking near the rain garden (Zone 3); this mean is comparable to the other seasons in the same Zone. Also, Zone 5 emerged on this scale in both Summer and Fall, with similar results (14 and 18 foot distance). Various colors were used to distinguish each Zone's top quartile.

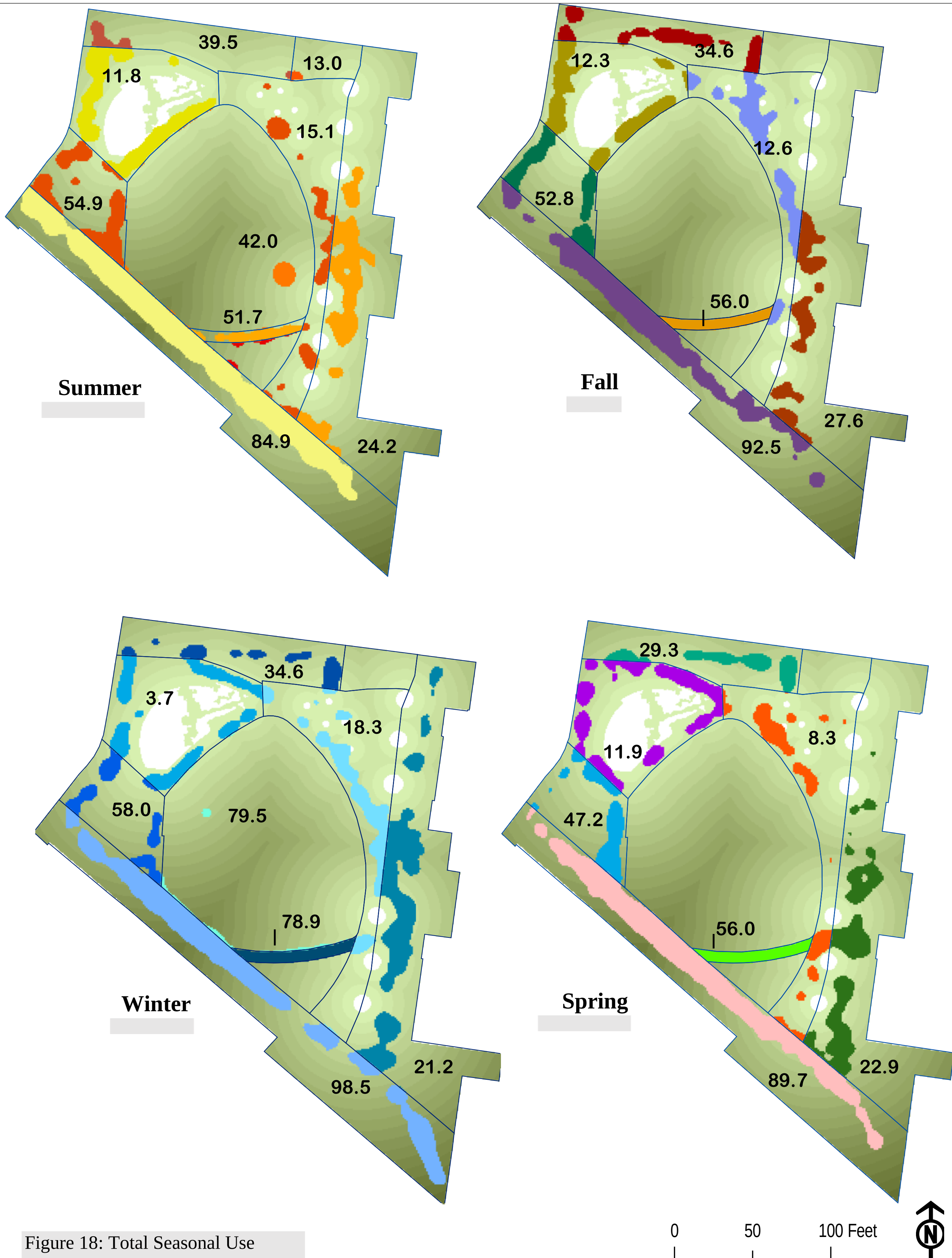


Figure 18: Total Seasonal Use Distance from Stormwater Features

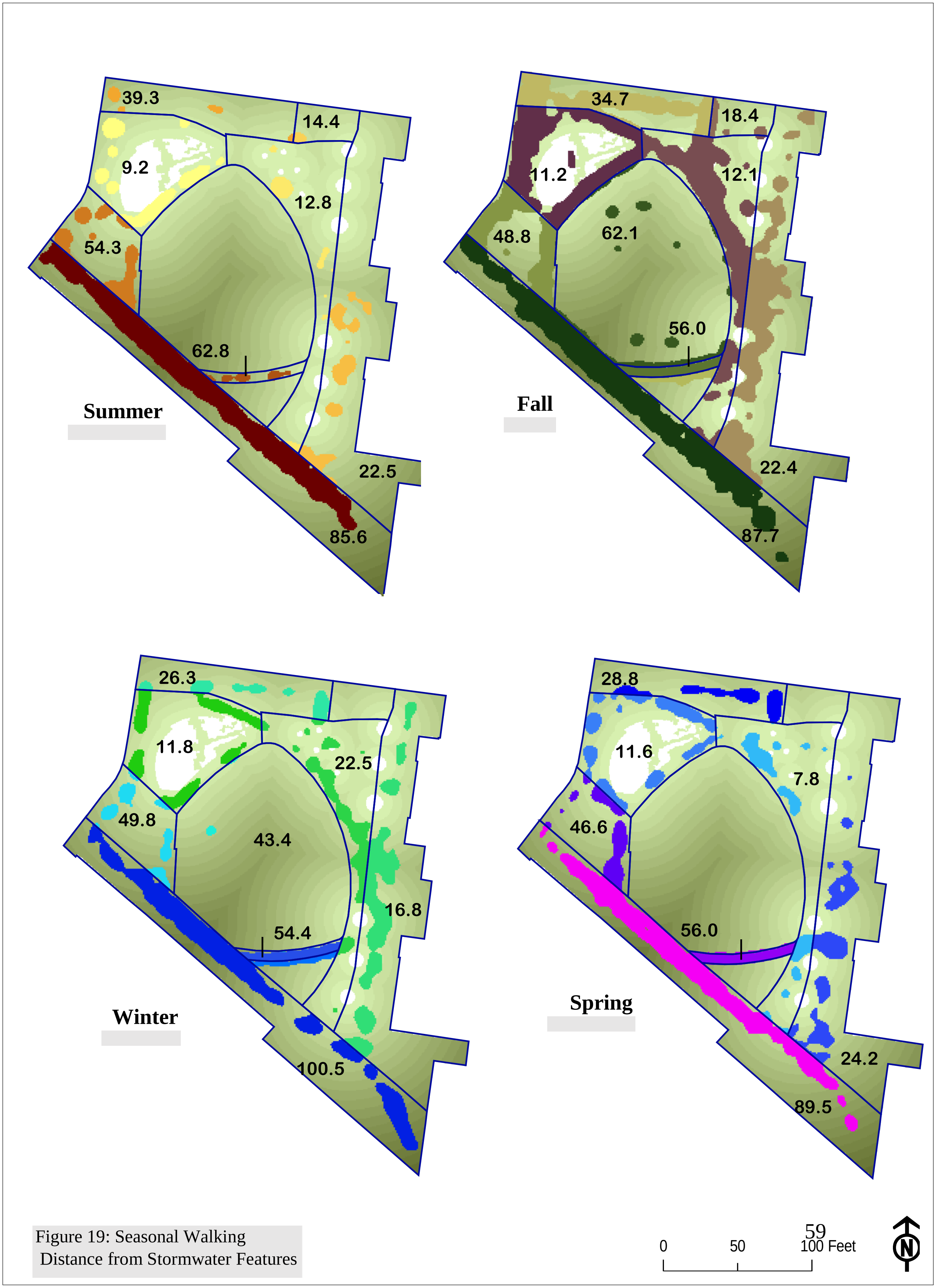


Figure 19: Seasonal Walking Distance from Stormwater Features

Recreation

The seasonal trends across recreating visitors were also relatively stable within the sample zones (Figure 20). Fall and Winter exhibited the most diverse variations; both seasons had an approximately 20-foot rise in distance from stormwater features in Zone 9 than the other seasons. These two seasons also had a greater amount of visitors that recreated near the rain garden than Summer or Fall.

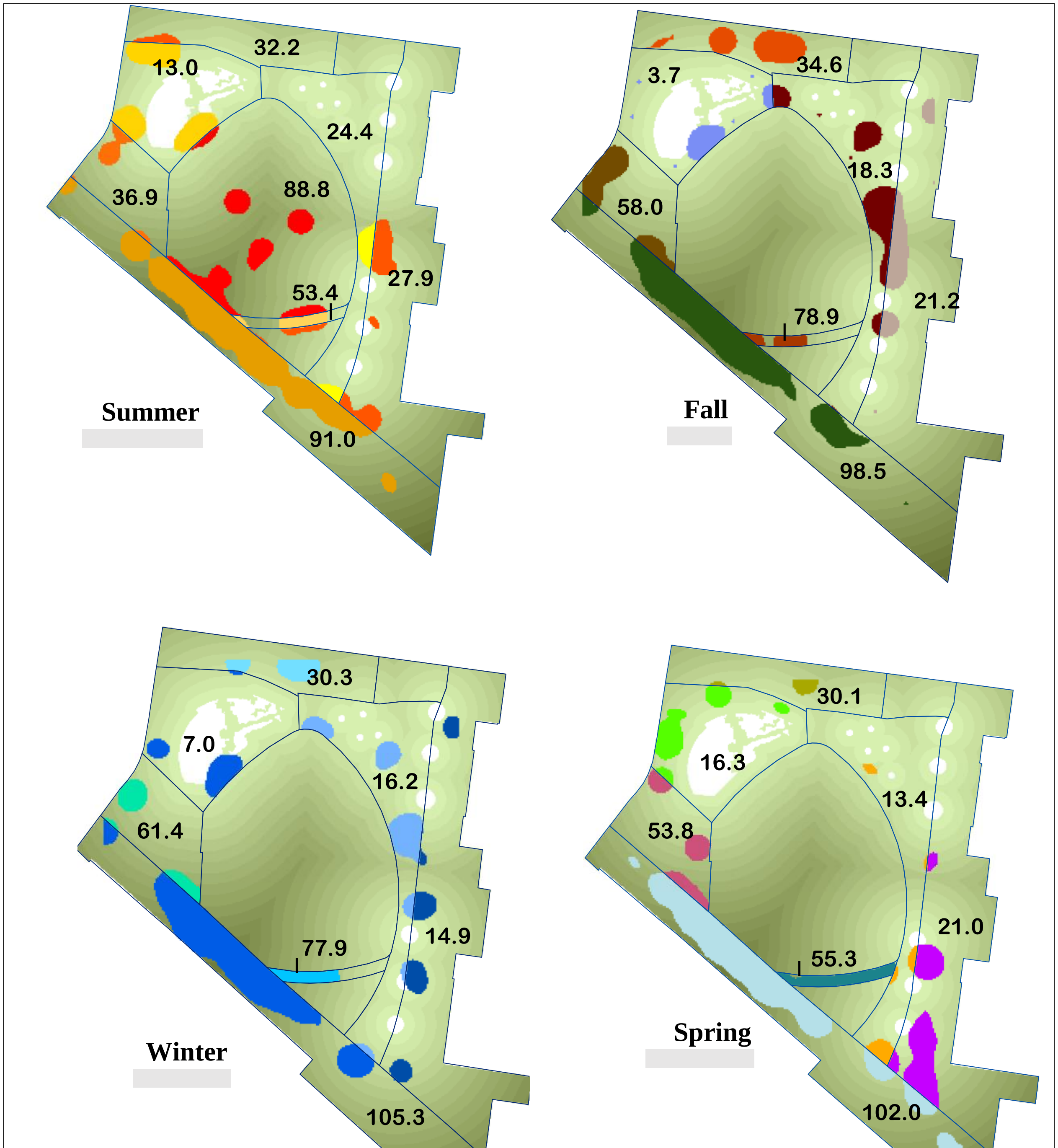
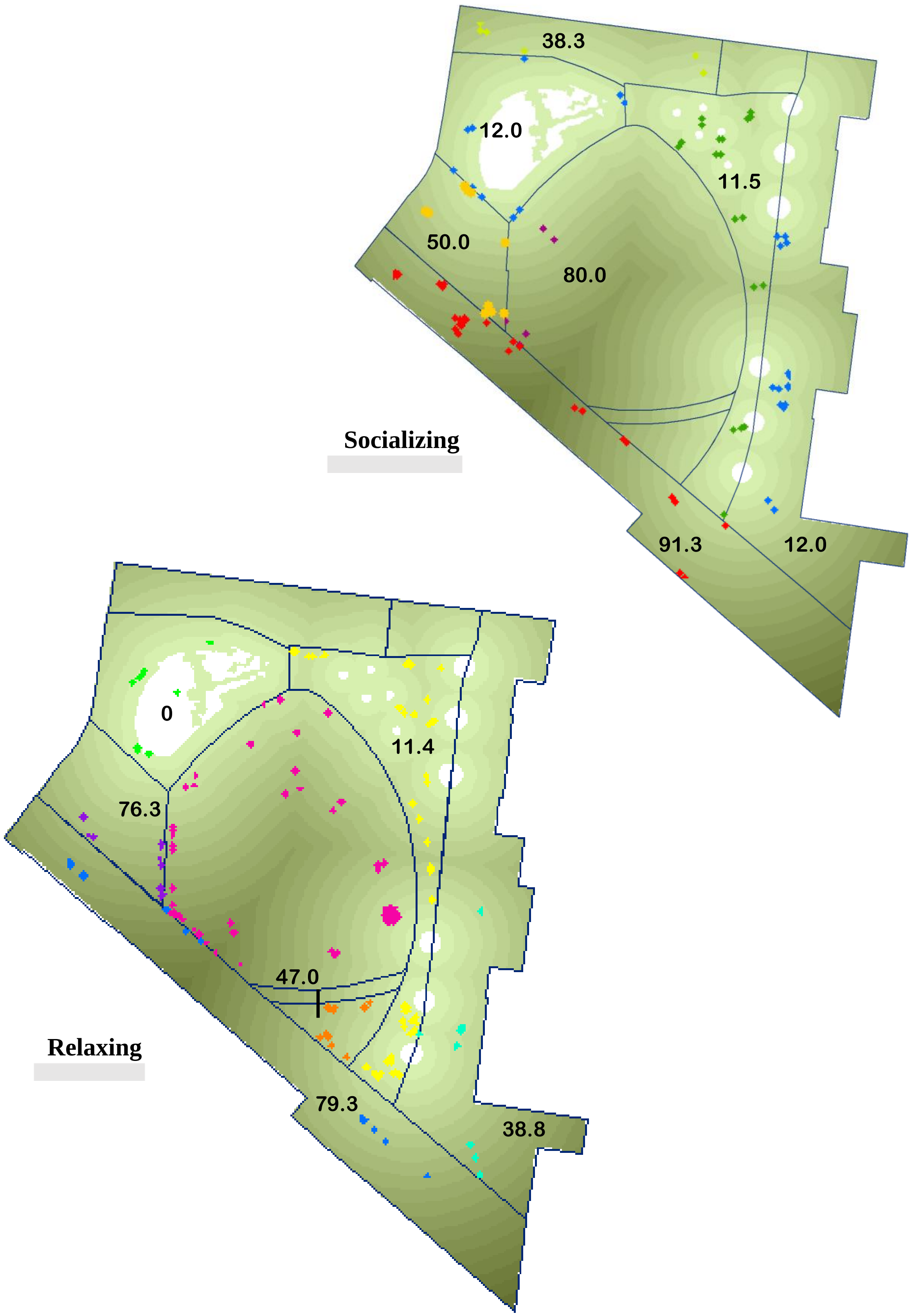


Figure 20: Recreational Distance from Stormwater Features

Socializing and Relaxing

There were too few observations of people socializing or relaxing this year of observations, so those points were converted to single raster cells to determine their proximity to stormwater infrastructure features. Those socializing near the seating area and athletics building (Zones 6 and 7) chose to stand quite close to these BMPs, with an average 12 foot distance. Results are similar near the rain garden (Zone 3). Conversely, more visitors chose to socialize further away from these features. When the Raster Count was evaluated, it showed that the greatest amount of visitors chose to socialize on Smith Walk (Zone 1, the furthest proximity), then the memorial (Zone 2) (Figure 21).

When analyzing those relaxing, it should be noted that all of the visitors chose to do so on the seating provided on site; thus, their initial proximity from stormwater infrastructure was predetermined. The mean approximations are a product of chosen location to relax, as well as apparent opportunity to sit comfortably. It appears as though the most visitors chose to relax in the seating area (Zone 6) or the lawn (Zone 10), which would be the most “naturally restorative” places to sit on site. Special notice should paid to the visitor that chose to eat their lunch in the center of the rain garden; of all places to sit, this visitor determined their destination to be within confines of emerging Spring foliage.



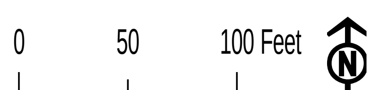


Figure 21: Socializing/ Relaxing Distance from Stormwater Features

Built vs. Natural Features on Shoemaker Green

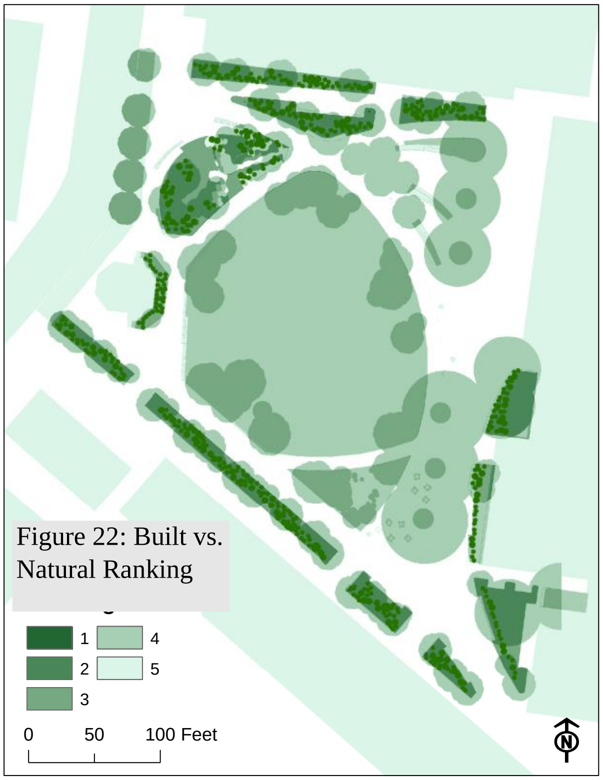


Figure 22: Built vs. Natural Ranking

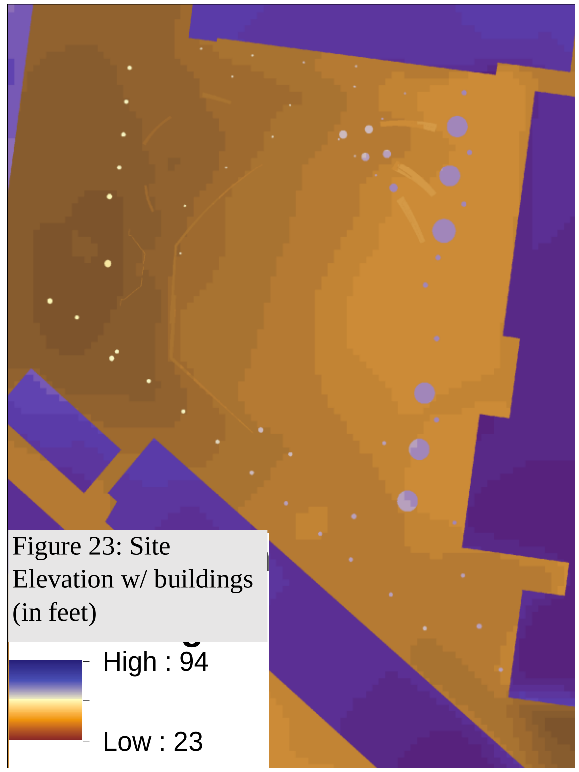


Figure 23: Site Elevation w/ buildings (in feet)

As result, all of the viewshed had a mean and majority value of about 4 (Figure 24 & 25, remaining in Appendix). This suggests that most people relaxing on site should experience the psychological benefits from the green space, given the dominantly fluid sphere of nature in the space. It would have been interesting to survey visitors sitting at these spots and determine what they are perceiving about the environment, compared to the notions suggested by these maps.

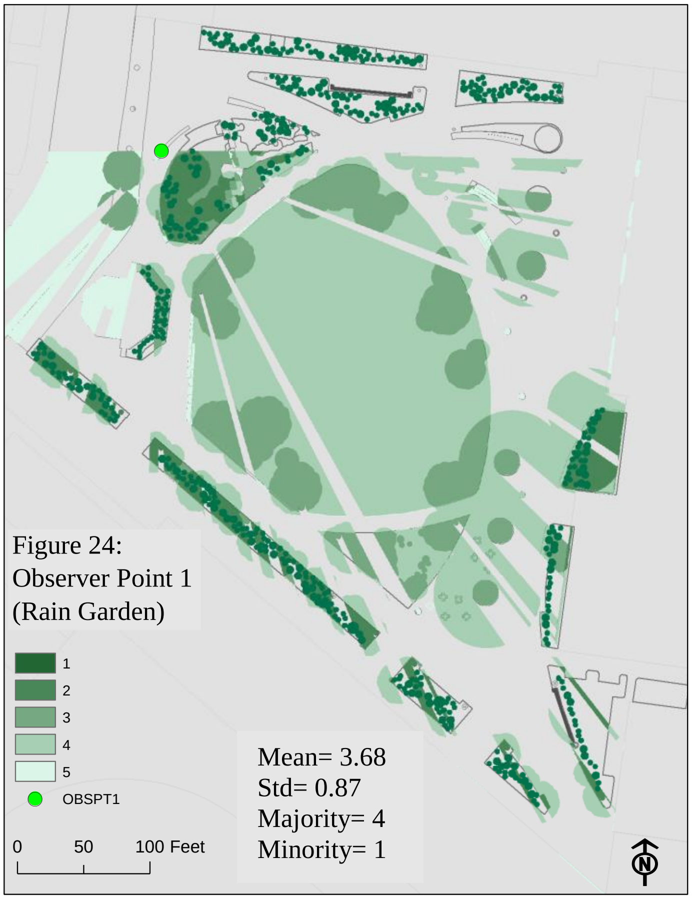


Figure 24: Observer Point 1 (Rain Garden)

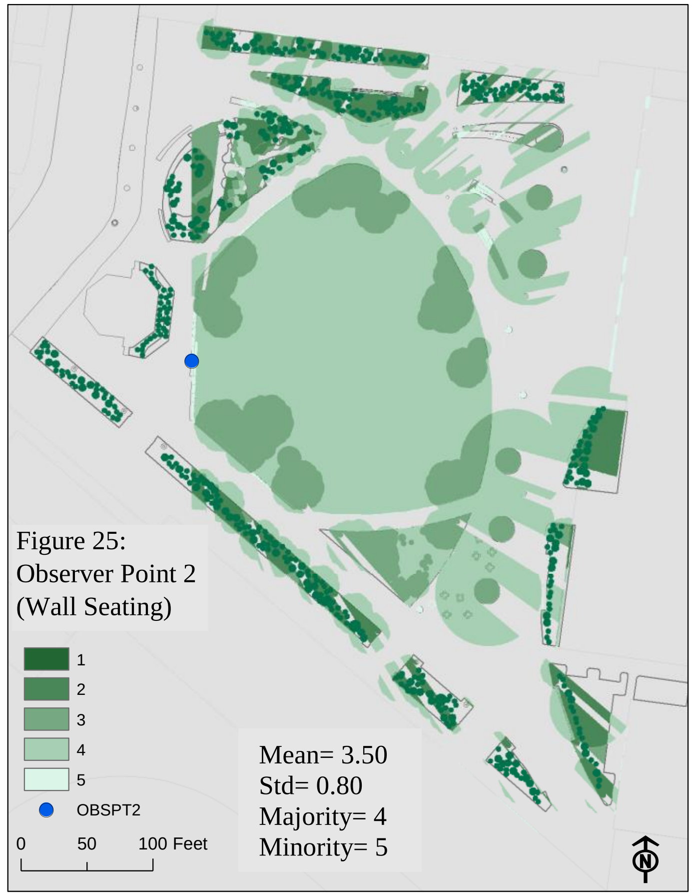


Figure 25: Observer Point 2 (Wall Seating)

4.2 Survey

To compare if the means of the various place attachment categories differ, ANOVA was used to test the difference in variance due to differences between observations within a group or differences between groups. The tables of the results are found in the Appendix, but the following will outline gathered inferences.

Survey Results

Overall, 172 University members and 28 community members participated in the survey. A community member was defined as anyone not belonging to the University of Pennsylvania, Drexel University, or another Philadelphian college. A frequency table of initial categorical variables was constructed to obtain a visual sense of how often the participants visited the site, what their community association was, and baseline knowledge of stormwater management. The most impactful finding is the amount of participants that did not know about the space's stormwater management regime and still thought it was important (86% unknowing compared to 93% considering it important). This can infer that the participants: 1) had previous knowledge of stormwater management and didn't know Shoemaker Green hosted such practices; or b) were unaware of the environmental infrastructure and used context clues to determine their importance. The uneven distribution of University-association participants compares to community may be reason for this, as the University's sustainability programs have permeated through campus life in various ways and degrees. It should also be noted that most of the University members surveyed frequented the site more than 20 times in a month; this would suggest that these participants were members of athletics teams, used the Weiss Education commons often, and/ or had classes in DRL.

Table 1: Frequency Table of Participants and SWM knowledge		**Are you aware of on-site stormwater management?**		**Do you think these are important?**	
Association	**Visits/Month**	**Yes**	**No**	**Yes**	**No**
Community Member	**1-5**	**0**	**21**	**15**	**6**
	6-10	**0**	**5**	**4**	**1**
	11-15	**0**	**2**	**2**	**0**

		16-20	**0**	**0**	**0**	**0**
		20+	**0**	**0**	**0**	**0**
University Member		**1-5**	**3**	**17**	**20**	**0**
		6-10	**9**	**23**	**29**	**3**
		11-15	**0**	**17**	**17**	**0**
		16-20	**13**	**23**	**39**	**3**
		20+	**3**	**58**	**61**	**0**

ANOVA

The ANOVA tests were subcategorized independent variables by the frequency of site visit, knowledge of stormwater management practices, and whether participants considered these important. The place attachment questions (dependent variables) were merged together by category. The means of each new column were calculated and used during testing. Only results with greater than 95% confidence (0.05 significance) are reported.

Significant confidence was found within the Relationships category (>0.001) for those visiting the site 1-5 times per month. This is interesting considering the questions asked; even though they frequent the site minimally, the participants still considered the social relationships they engage in at Shoemaker Green to be very important. Additionally, their elevated feelings of safety may be reflective of the widespread police presence on campus. This category was also significant for those visiting 16 to 20 times per month and 20 plus times per month.

Those that visited the site 11-15 times per month had the highest level of emotional attachment to Shoemaker Green. This is a good sign for the future of the space, considering the questions asked posited if the site was important to them and if they would be willing to invest time or money into bettering the space. Similar results were found for the next category. Those that visited the site 11 to 15 and 20 plus times per month had the greatest level of significance when their needs were assessed. This is also an important factor to consider moving forward, considering the questions ask if the space facilitated the needs of the participants over other green spaces compared to or more so than similar sites.

This series of questions reflected on the individual assessment of aesthetic and natural qualities of Shoemaker Green, including physical appearance, landscape quality, relation to nature, and overall experience. Interestingly, the groups of people that visited 1 to 5, 11 to 15, and 20 plus times per month showed the greatest level of significance.

None of the participants were found to identify with Shoemaker Green, which may be indicative to the type of questions that were asked. During the intergroup comparison, those that visited the both site 6 to 10, 11-15 and 20 plus times per month did show significance with those that scored highly on the relationship category; this group of visitors also displayed a strong association with those that ranked a high emotional attachment to the site.

In summary:

- Those that visited the site 1- 5 times per month: Value the relationships had on site and have a high perceived quality of the space
- Those that visited the site 6-10 times per month: Both identify with the space and value their relationships on-site
- Those that visited the site 11-15 times per month: Had the most statistically significant responses, in that they are emotionally attached to the space, felts as though Shoemaker Green suited their needs, ranked a high perceived quality of the space, and identify with the space in the intergroup comparison.
- Those that visited the site 16 to 20 times per month: Value the relationships had on site, and also identify in the intergroup comparison.
- Those that visited the site 20 plus times per month: Had statistically significant relationships on site, saw the site as suiting their needs, and highly ranked the perceptual qualities of the site.

However, the sum of squares in all of the independent categories are still quite low and never surpassed a 4 (neutral). Even though the ANOVA test has identified areas of significance among and within these variables, it is highly emphasized that the general level of attachment to Shoemaker Green is very low. The greatest mean (5.71) was found in the question asking if participants felt safe at the site; this is reassuring considering the policing regiment around campus as well as the documented police on site during behavior mapping. The standard deviation of the means were quite high, which, optimistically, could mean that some participants do have higher attachment than what is noted.

5: LIMITATIONS

There are a number of limitations to this study. Shoemaker Green can potentially reflect the institutional presence of the University and not necessarily the community of West Philadelphia. Therefore, it should be mentioned that this space may not be representative of similar green spaces in Philadelphia, but, rather, a sub-dimension of Philadelphia's socioecological environment.

For the behavior mapping collection, a more stringent observation protocol could have been used. The method to collect data was considered for randomized findings under typical or sporadic conditions. Following an observation regiment, similar to that advised in SOPARC (McKenzie and Cohen 2006) may have led to different results. Conclusions for seasonal differences could stem from a variety of reasons, including sunlight shading from the overhead tree canopy, the diversion of visitors sitting in at the café tables, or merely the different uses of the space by season. That being said, the data collection method may be reliable, but was not proven for validity. Similarly, there was only one observer collecting the data, due to a variety of constraints. Although due attention was given during the observation periods, potential for error is always present. Thus, inter-rater reliability would have made the observations increasingly valid. SOPARC is a validated measure but because of the changes made, one cannot assume that this instrument was reliable and valid.

As a consensus, the survey could have been more straight forward with questions that participants would be accustomed to taking. Also, some questions could have been reconstructed to evaluate additional factors of green space perception or general knowledge of stormwater management practices in the City or on campus. Total reliance on the intercept method may have also limited results, since the most involved students that could have held attachments to the site were not present for surveying or; a social learning experiment or variations of focus groups may have proven more advantageous. Additionally, if the survey was distributed at designated points, as opposed to the sporadic dispersal method used, supplementary spatial inferences could have been made (e.g, someone near South 33rd Street may have a different environmental experience than someone situated near the trees, given the varying amounts of physical and natural stimulus present).

6: DISCUSSION & RECOMMENDATIONS

William Whyte (1980) said, "It is difficult to design a space that will not attract people. What is remarkable is how often that has been accomplished." Such statement is applicable to Shoemaker Green. The space had been widely utilized throughout the 2013-2014 year, but has been observed to be more of a bypass rather than a destination. The lack of attachment or personal investment of the site may be indicative to its constructive purpose, however Shoemaker Green has the potential to be more than a commutable green space. Its on-site ecological functions are worthy to expand the natural environmental knowledge of the University's members, and its natural aesthetics offer many of the psychological benefits discussed in the literature review.

The following recommendations are based on amateur expertise, but well-founded on the considerations of this study.

- **Increase knowledge of stormwater management through on-site signage**. Since the University has a stringent policy for educational signage, decals for both interior windows and existing way-finding signs can mediate environmental education about Shoemaker Green. The Weiss Education Commons, the second-floor study adjunct of the Weiss facility, overlooks the northern proximity of Shoemaker Green and, if properly designed, could tastefully convey the environmental purpose of the site's stormwater management regime. A simple layered graphic, like the one showed below, with supporting text is a visual median for education that can be seen by the innumerable students that use the Weiss Education Commons throughout the semester.

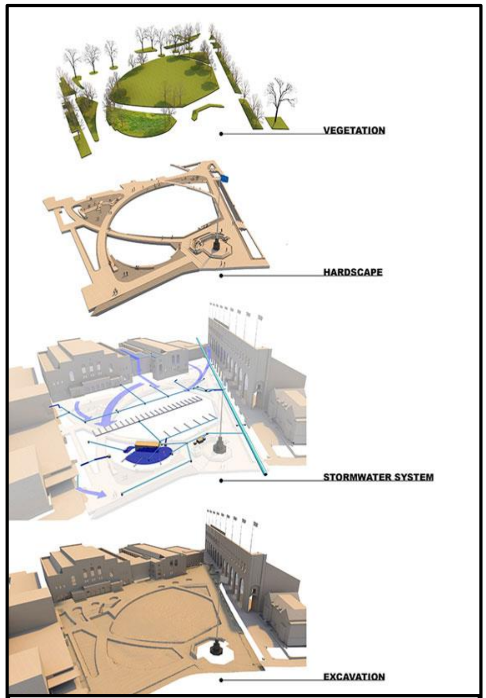


Figure 26. Layered Shoemaker Green. Holmes 2013.

- Additionally, the way finding signs within Shoemaker Green as well as those throughout campus would be an ideal opportunity to augment information on the University's sustainability practices. Again, a decal pinpointing the exact location of stormwater management practices on campus would highlight the importance of these spaces to visitors making their way through campus. The current signage on site (Figure*) does not illustrate the environmental importance of Shoemaker Green; given the apparent disconnect the space's visitors have to the natural environment, providing a visual breach for education would allow adequate knowledge expansion.

Also, there is one Discover Penn sign on Shoemaker Green. Discover Penn is the campus-wide cell phone tour that provides recordings of each designated place of interest. Of the eighteen Discover Penn locations, there were 1,279 total calls between June 2013 and April 2014 but only 25 of those calls (roughly 2%) were from Shoemaker Green with only 45% of the message listened to (Berkowitz 2014). Given this information and the documented paths that are most utilized on site, the aforementioned map (Figure *) indicates suggested spots to offer additional Discover Penn signs.

Figure 27. Current Discover Penn Signs & Suggestions for Shoemaker Green

- **Include Shoemaker Green as part of campus promotions for the University.** As noted in the behavior mapping, one group of the University's admittance tours was seen crossing South 33rd Street towards Shoemaker Green, then diverting the space to continue walking near the Southeastern attractions on campus. A brief statement or physical introduction to the space during tours of this nature, such as the Penn Previews or Preceptorials, would allow new or potential students to start building a connection to the green practices on campus and see Shoemaker Green as a space worthy of appreciation. Additionally, any pre-admittance promotional material displayed over the internet or distributed during information sessions can include a brief statement or graphic on Shoemaker Green and the various sustainable practices the University is undertaking.
- **Increase both academic and non-academic events on-site.** It has been noted that non-academically-based events, such as a cinema showing via mobile screen projection, and academic events, such as an astronomy night lecture and demonstration, have taken place since the reconstruction of Shoemaker Green. It would be beneficial if these two events were to continue and advertised more expansively. In addition to these, other events that enhance awareness of the space and development of environmentally-conscious students would be opportune educational situations. Events catered to all schools, including picnics or fundraisers, would enhance the communal bond of students while using this site for its constructed purpose. Another event or program, run through Penn's Sustainability network or EcoReps program, could be a day or series of programs aimed to educate participants on the sustainable practices on campus
- **Use Shoemaker for Restorative Environmental Experiences**

Physical stress and mental fatigue from academic life is an inevitable part of the college experience. The recent spate of student suicides in the University, especially, indicate the growing need to address these personal mental health concerns within the student body. As previously discussed, time spent in a natural environment engenders a calming and restorative effect that leads to improvement in mental clarity, attention span and mood elevation. A mental health task force has been created on campus to address such concerns, but further engagement to initiate mentally-restorative events could help student stress levels and future mental-health related issues on campus. Shoemaker Green is an ideal space to hold such events, given its vast lawn size and seating arrangement.

CONCLUSION

It is strongly believed that developing more sustainable cities is not just about improving the abiotic and biotic aspects of urban life, it is also about the social aspects of city life, that is—among others—about people's satisfaction, experiences and perceptions of the quality of their everyday environments (Chiesura 2004). The complex structure of ecological and social systems is intertwined and indivisible, as exhibited by the breadth of literature research that was conducted. The scale of anthropogenic change to the natural environment will be further exacerbated by climate change, and further investigation is needed to understand the dynamic in temporal and spatial relationships in socioecological processes.

This cross-disciplinary analysis attempted to better understand the nature of people's relationships to place and to develop a more holistic view of how such relationships influence our experiences of place and the success of community conservation initiatives, like Shoemaker Green. Place- based conservation is more of a process than a product. It allows for the convergence of social, scientific, planning, and geographic theories to shed light in thinking globally but planning locally. Recognizing the prominence of the physical environment on human well-being and perception of natural systems, this approach aims to bring a sense of ownership back towards urban ecological systems and to create meaningful natural places. A sense of bondedness, or feelings of being a part of one's neighborhood, and a sense of rootedness to the community are key to ongoing stewardship efforts at green spaces like Shoemaker Green. Here, emotional bonds within the institution and larger community are products not only of individual, internal processes but also external, social processes.

Despite their immaterial nature, these services provide clear benefits to people, whose loss can have serious socioeconomic, psychological, and ecological consequences. Shoemaker Green offers an urban commodity where visitors can divagate from the routine of everyday life and engage in activities outside the psychical barriers of the city. This has the potential to, or is currently occurring, in green spaces across the City of Philadelphia. People can view natural areas through the lens of their own different experiences, which, in turn, creates attachments to different qualities of these places. It is essential that park planners and managers incorporate these diverse viewpoints when making management decisions within institutional and non-institutional communities.

Valuation and assessment of these intangible services and benefits is of utmost importance to justify and legitimize strategies for urban sustainability. Both the City of Philadelphia and the University of Pennsylvania are in motion of creating a sustainable environment for human and ecological systems. However, when implementing these measures for resource management, such as green space, valuing and assessing their intangible services and benefits for human health and wellbeing must not be discounted. Beginning from the appraisal of the needs, perceptions, and beliefs of the individuals composing this very society, urban utilities and policy makers can further create natural places that have meaning its residents. Theory on place attachments and meaning, explored largely in environmental and community psychology, can help us to understand how particular preferences, perceptions, and emotional connections to place relate to community social cohesion, organized participation, and community development, all of which will continue to influence the success of sustainable development. The natural environment adds an additional dimension to the inherent system of social operations within a city, where a place is a social analogue to the ecosystem.

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APPENDIX

Season	Date	Day of Week	Observation Time	Special Circumstance	Weather Conditions
Summer	7/12/2013	Friday	2-5:00 pm	Football meeting (marked) > 20 min, approx 150 in attendence	Sun
Summer	7/25/2013	Thursday	10am- 12:30 pm	very hot/ humid	Sun
Summer	9/13/2013	Friday	1-3:00 pm	Engineering 'Welcome Back Picnic' (marked), approx. 200 in attendence	Sun
Summer	9/21/2013	Saturday	3:30-6:00 pm	Team/ family tailgate party, approx 30 in attendence, 3:30-5 pm	Sun
Autumn	10/20/2013	Sunday	2-4:00 pm	_	1st hour: Sun/ Overcast; 2nd hour: Rain
Autumn	11/10/2013	Sunday	10am- 12:30 pm	_	Part Sun/ Windy
Autumn	11/22/2013	Friday	1-3:00pm	_	Overcast, Drizzle
Autumn	12/19/2013	Thursday	2-4:00 pm	_	Sun
Winter	1/29/2014	Wednesday	12-2:00 pm	1-3" snow cover across space	Sun
Winter	2/7/2014	Friday	3:30- 5:30 pm	sports signage (marked)	Sun
Winter	2/23/2014	Sunday	12:30-2:30 pm	Ivy League Fencing Round-Robins event	Sun
Winter	3/10/2014	Monday	1:30-3:30 pm	Spring Break	Part Sun
Spring	3/20/2014	Tuesday	3-5:00 pm	First day of Spring	Sun/ Windy
Spring	3/24/2014	Monday	5-7:00 pm	_	Sun
Spring	3/31/2014	Monday	2-4:00 pm	Softball game- Penn Park	Part Sun
Spring	4/5/2014	Saturday	11am-2:00 pm	Lacrosse Game, Holi Day celebrations nearby	Sun/Windy

Season	Date	Temperature (°F)	Sidewalk/ Access Points	Lighting	Trash/Recycling	Plantings	Seating	Auditory Annoyance
Summer	7/12/2013	80	unobstructed	Daylight	maintained	healthy	normal	typical social interaction
Summer	7/25/2013	90	unobstructed	Daylight	maintained	healthy	normal	typical social interaction
Summer	9/13/2013	75	unobstructed	Daylight	maintained	healthy	normal	busy and loud
Summer	9/21/2013	65	unobstructed	Daylight	maintained	healthy	normal	typical social interaction
Autumn	10/20/2013	60	unobstructed	Daylight	maintained	Autumn colors	normal	typical social interaction/ mild traffic
Autumn	11/10/2013	45	sports booths (marked)	Daylight	maintained	Autumn colors	normal	typical social interaction/ mild traffic
Autumn	11/22/2013	55	unobstructed	Daylight	maintained	Autumn colors	normal	typical social interaction/ mild traffic
Autumn	12/19/2013	30	unobstructed	Daylight	maintained	leafless/ dormant	café seating removed	typical social interaction/ mild traffic
Winter	1/29/2014	20	unobstructed, rocksalt	Daylight	maintained	leafless/ dormant	café seating removed	typical social interaction/ mild traffic
Winter	2/7/2014	26	unobstructed, rocksalt	Daylight	maintained	leafless/ dormant	café seating removed	typical social interaction/ mild traffic
Winter	2/23/2014	50	unobstructed, rocksalt	Daylight	maintained	leafless/ dormant	café seating removed	typical social interaction/ mild traffic
Winter	3/10/2014	55	unobstructed, rocksalt	Daylight	maintained	leafless/ dormant	café seating removed	typical social interaction/ mild traffic
Spring	3/20/2014	55	unobstructed, rocksalt	Daylight	maintained	leafless/ dormant	café seating removed	typical social interaction/ mild traffic
Spring	3/24/2014	45	unobstructed	Daylight	maintained	leafless/ dormant	café seating removed	typical social interaction/ mild traffic
Spring	3/31/2014	50	unobstructed	Daylight	maintained	some buds	café seating removed	2 visitors relaxing talking loudly
Spring	4/5/2014	60	unobstructed	Daylight	maintained	natives blooming	café seating removed	busy and loud

Season	Date	Evidence of Abuse	Olfactory Annoyance	Police Pressence	Traffic (motor-driven in)
Summer	7/12/2013	No	some may perceive Prairie Dropseed as an distasteful	_	_
Summer	7/25/2013	No	some may perceive Prairie Dropseed as an distasteful	Bike:1	_
Summer	9/13/2013	No	some may perceive Prairie Dropseed as an distasteful	_	1
Summer	9/21/2013	No	some may perceive Prairie Dropseed as an distasteful	Bike:1, Walk: 3	2
Autumn	10/20/2013	No	some may perceive Prairie Dropseed as an distasteful	Walk:3	_
Autumn	11/10/2013	No	No	Bike: 2, Walk 1	_
Autumn	11/22/2013	No	No	Walk:1	6
Autumn	12/19/2013	No	No	Bike: 3, Walk: 3	3
Winter	1/29/2014	No	No	Walk: 1	6
Winter	2/7/2014	No	No	Walk: 1	2
Winter	2/23/2014	No	No	_	_
Winter	3/10/2014	No	No	Bike: 1	_
Spring	3/20/2014	No	No	Bike: 1	2
Spring	3/24/2014	No	No	Bike: 1	2
Spring	3/31/2014	No	No	Bike: 4	1
Spring	4/5/2014	No	No	_	3

Highlight Observations	Summer	Fall	Winter	Spring
Walk	788	1201	1044	984
Recreate	99	109	115	99
Relax (includes sitting, eating, and reading)	118	20	8	26
Socialize	22	39	10	21
Cell-Phone	16	23	19	15
Frisbee	9	0	0	2
Walk Dog	4	0	4	5

Behavior Mapping

Zonal Statistics

Total

AREA	MIN	MAX		MEAN		STD	
1	0	0.68	8.11	0.10	1.19	0.14	1.64
2	0	0.21	2.51	0.06	0.68	0.05	0.60
3	0	0.23	2.77	0.05	0.60	0.05	0.59
4	0	0.16	1.97	0.04	0.47	0.04	0.46
5	0	0.05	0.63	0.01	0.11	0.01	0.14
6	0	0.18	2.17	0.04	0.42	0.04	0.48
7	0	0.29	3.44	0.05	0.55	0.04	0.49
8	0	0.25	2.97	0.03	0.31	0.05	0.54
9	0	0.30	3.61	0.22	2.67	0.04	0.53
10	0	0.18	2.13	0.01	0.09	0.02	0.20

Total Walk

AREA	MIN	MAX		MEAN		STD	
1	0	0.042	0.51	0.003	0.04	0.007	0.08
2	0	0.013	0.16	0.001	0.01	0.002	0.03
3	0	0.019	0.23	0.001	0.01	0.002	0.03
4	0	0.014	0.17	0.001	0.01	0.003	0.03
5	0	0.000	0.00	0.000	0.00	0.000	0.00
6	0	0.009	0.11	0.001	0.01	0.002	0.02
7	0	0.016	0.20	0.001	0.01	0.002	0.03
8	0	0.009	0.11	0.000	0.00	0.001	0.01
9	0	0.017	0.21	0.002	0.03	0.004	0.05
10	0	0.010	0.13	0.000	0.00	0.000	0.01

Summer Walk

AREA	MIN	MAX		MEAN		STD	
1	0	0.138	1.65	0.022	0.26	0.026	0.31
2	0	0.053	0.64	0.011	0.13	0.011	0.13
3	0	0.051	0.61	0.007	0.08	0.009	0.11
4	0	0.030	0.37	0.003	0.03	0.005	0.06
5	0	0.027	0.32	0.002	0.02	0.005	0.06
6	0	0.047	0.56	0.005	0.06	0.007	0.09
7	0	0.141	1.69	0.005	0.06	0.013	0.15
8	0	0.018	0.22	0.002	0.02	0.003	0.04
9	0	0.029	0.35	0.012	0.14	0.006	0.07
10	0	0.020	0.24	0.000	0.01	0.002	0.02

Fall Walk

AREA	MIN	MAX		MEAN		STD	
1	0	0.20	2.39	0.02	0.26	0.04	0.43
2	0	0.06	0.76	0.01	0.14	0.01	0.15
3	0	0.08	0.91	0.01	0.14	0.01	0.18
4	0	0.07	0.82	0.01	0.14	0.01	0.15
5	0	0.04	0.43	0.00	0.04	0.01	0.07
6	0	0.06	0.78	0.01	0.07	0.01	0.10
7	0	0.07	0.89	0.01	0.14	0.01	0.18
8	0	0.08	1.01	0.01	0.11	0.02	0.21
9	0.028	0.12	1.42	0.08	0.98	0.02	0.21
10	0	0.06	0.74	0.00	0.02	0.01	0.06

Winter Walk

AREA	MIN	MAX		MEAN		STD	
1	0	0.15	1.84	0.02	0.23	0.03	0.34
2	0	0.05	0.56	0.01	0.10	0.01	0.12
3	0	0.06	0.71	0.01	0.10	0.01	0.14
4	0	0.05	0.65	0.01	0.10	0.01	0.13
5	0	0.01	0.15	0.00	0.04	0.00	0.04
6	0	0.06	0.70	0.01	0.11	0.01	0.14
7	0	0.05	0.64	0.01	0.11	0.01	0.13
8	0	0.08	0.91	0.01	0.08	0.01	0.16
9	0.05	0.09	1.11	0.05	0.54	0.02	0.21
10	0	0.03	0.37	0.00	0.01	0.00	0.03

Spring Walk

AREA	MIN	MAX		MEAN		STD	
1	0	0.12	1.45	0.02	0.22	0.03	0.30
2	0	0.06	0.73	0.01	0.13	0.01	0.17
3	0	0.06	0.71	0.01	0.12	0.01	0.14
4	0	0.06	0.70	0.01	0.11	0.01	0.14
5	0	0.01	0.15	0.00	0.02	0.00	0.04
6	0	0.05	0.64	0.01	0.09	0.01	0.11
7	0	0.06	0.74	0.01	0.11	0.01	0.12
8	0	0.07	0.80	0.01	0.06	0.01	0.14
9	0.017	0.09	1.09	0.05	0.59	0.02	0.19
10	0	0.04	0.49	0.00	0.01	0.00	0.03

Total Recreation

AREA	MIN	MAX		MEAN		STD	
1	0	0.060	1.43	0	0.26	0.014	0.34
2	0	0.022	0.53	0	0.07	0.004	0.08
3	0	0.016	0.39	0	0.08	0.003	0.08
4	0	0.013	0.31	0	0.06	0.003	0.07
5	0	0.000	0.01	0	0.00	0.000	0.00
6	0	0.013	0.31	0.002599	0.06	0.003	0.07
7	0	0.014	0.34	0.002591	0.06	0.003	0.07
8	0	0.017	0.41	0.003585	0.09	0.003	0.08
9	0	0.030	0.73	0.009419	0.23	0.005	0.11
10	0	0.033	0.80	0.001267	0.03	0.003	0.07

Summer Recreation

AREA	MIN	MAX		MEAN		STD	
1	0	0.01	0.31	0	0.06	0.003	0.06
2	0	0	0.11	0	0.01	0.001	0.02
3	0	0.01	0.15	0	0.03	0.002	0.04
4	0	0.01	0.12	0	0.01	0.001	0.02
5	0	0	0	0	0	0	0
6	0	0.01	0.14	0.0009	0.02	0.001	0.02
7	0	0.01	0.16	0.0005	0.01	0.001	0.02
8	0	0	0.07	0.0008	0.02	0.001	0.02
9	0	0	0.10	0.0018	0.04	0.001	0.03
10	0	0.01	0.18	0.0005	0.01	0.001	0.02

Fall Recreation

AREA	MIN	MAX		MEAN		STD	
1	0	0.017	0.42	0	0.07	0.004	0.10
2	0	0.009	0.20	0	0.02	0.001	0.03
3	0	0.006	0.15	0	0.02	0.001	0.02
4	0	0.006	0.13	0	0.03	0.001	0.03
5	0	0	0	0	0	0	0
6	0	0.004	0.10	0.0005	0.01	0.001	0.02
7	0	0.007	0.16	0.0008	0.02	0.001	0.03
8	0	0.004	0.10	0.0006	0.01	0.001	0.02
9	0	0.010	0.24	0.0018	0.04	0.002	0.05
10	0	0.010	0.25	0.0003	0.01	0.001	0.02

Winter Recreation

AREA	MIN	MAX		MEAN		STD	
1	0	0.02	0.51	0.003	0.08	0.005	0.12
2	0	0.01	0.15	0.001	0.02	0.001	0.03
3	0	0.01	0.15	0.001	0.02	0.001	0.03
4	0	0	0.12	0.001	0.02	0.001	0.03
5	0	0	0.01	0	0	0	0
6	0	0.00	0.09	0.001	0.02	0.001	0.02
7	0	0.01	0.13	0.001	0.02	0.001	0.03
8	0	0.01	0.14	0.001	0.03	0.001	0.04
9	0	0.01	0.27	0.003	0.06	0.002	0.06
10	0	0.01	0.26	0	0.01	0.001	0.02

Spring Recreation

AREA	MIN	MAX		MEAN		STD	
1	0	0.014	0.35	0	0.07	0.004	0.08
2	0	0.006	0.14	0.0008	0.02	0.001	0.03
3	0	0.005	0.12	0.0007	0.02	0.001	0.02
4	0	0.003	0.07	0.0005	0.01	0.001	0.02
5	0	0	0	0	0	0	0
6	0	0.006	0.15	0.0009	0.02	0.001	0.03
7	0	0.004	0.10	0.0004	0.01	0.001	0.02
8	0	0.004	0.10	0.0011	0.03	0.001	0.03
9	0	0.007	0.17	0.0032	0.08	0.001	0.02

Summer Run

AREA	COUNT
1	22
2	0
3	1
6	4
7	1
9	4

Summer Bike

AREA	COUNT
1	22
2	2
3	15
4	1
6	4
7	4
10	1

Fall Run

AREA	COUNT
1	46
2	5
3	9
4	8
6	5
7	10
9	3

Fall Bike

AREA	COUNT
1	36
2	3
3	9
4	9
6	5
7	10
9	2

Winter Run

AREA	COUNT
1	12
3	1
6	5
7	1
10	1

Winter Bike

AREA	COUNT
1	19
2	2
3	3
4	1
6	3
7	3
9	3

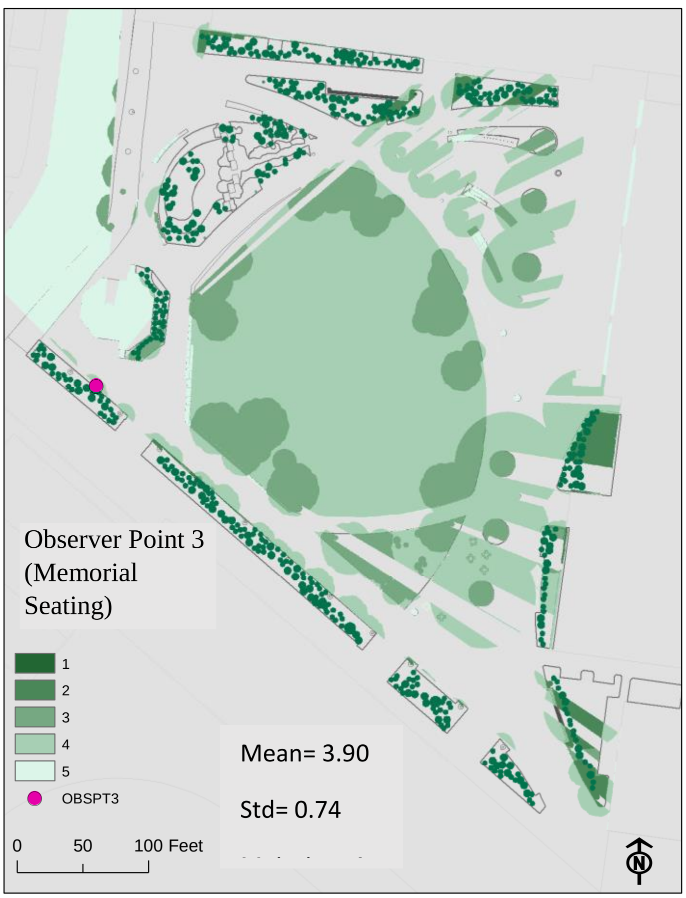
Spring Run

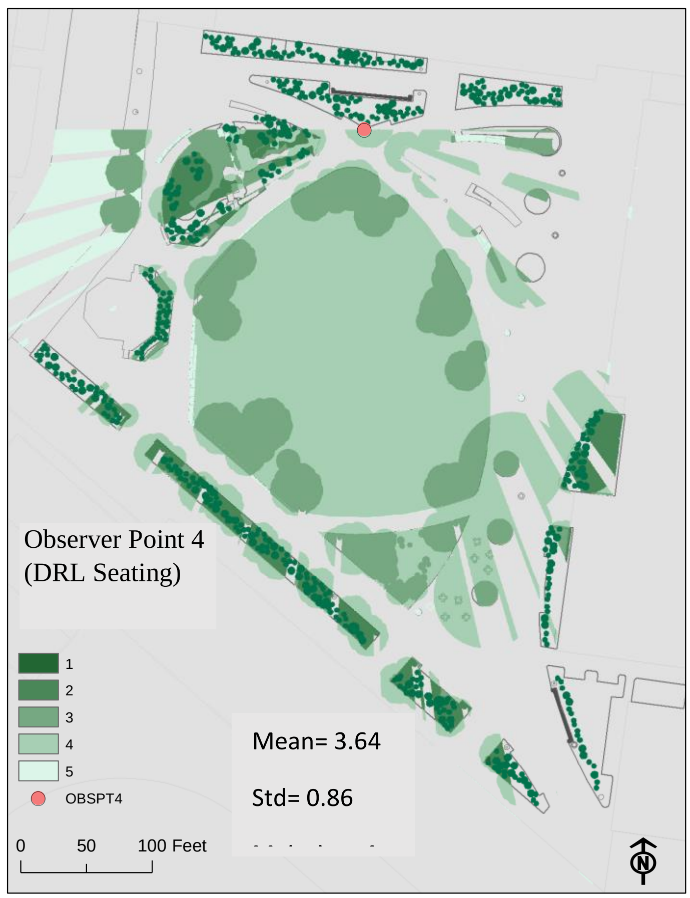
AREA	COUNT
1	18
2	2
3	2
6	7
7	4
9	2

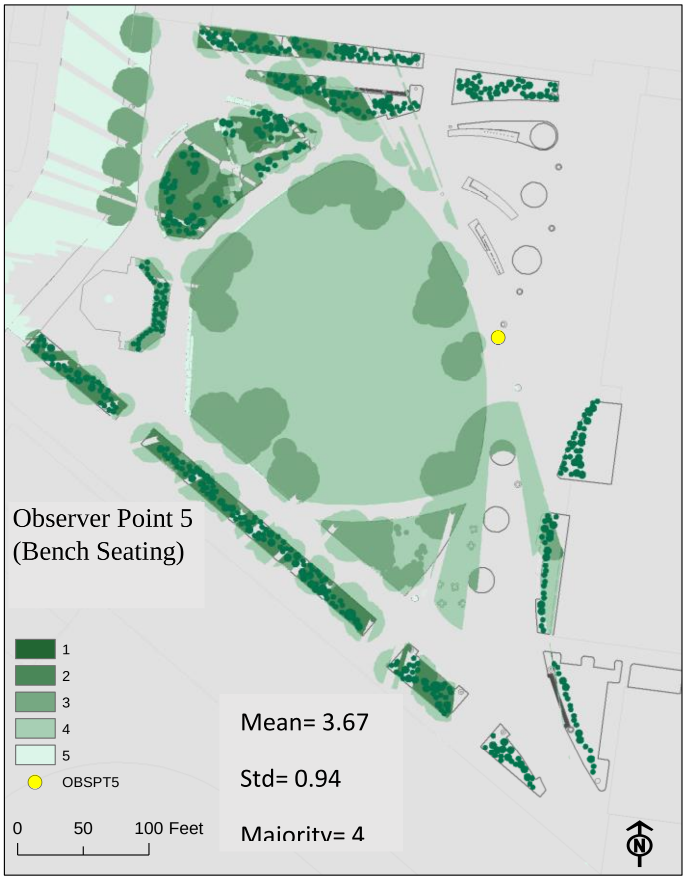
Spring Bike

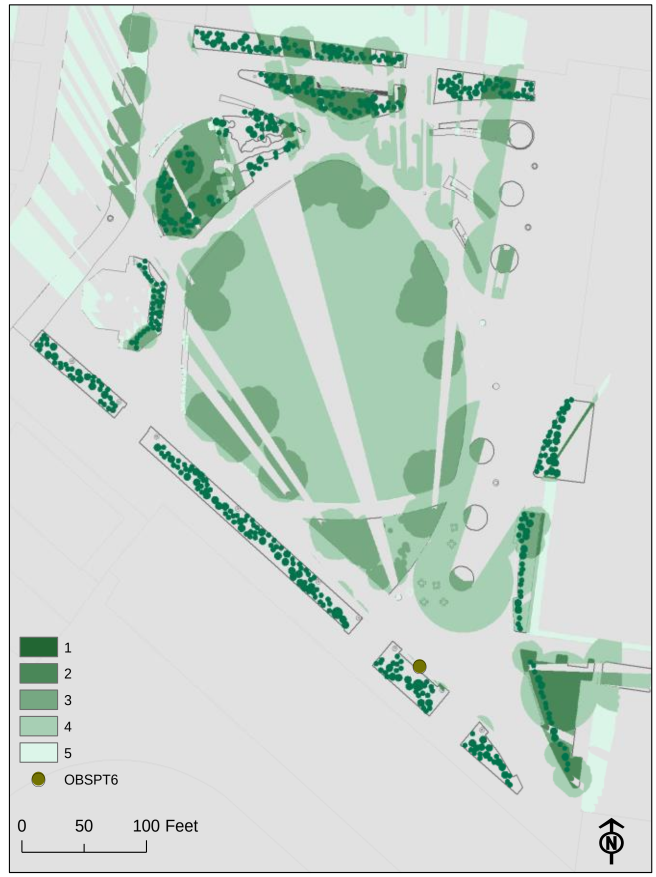
AREA	COUNT
1	25
2	2
3	4
4	2
6	5
7	2
9	5

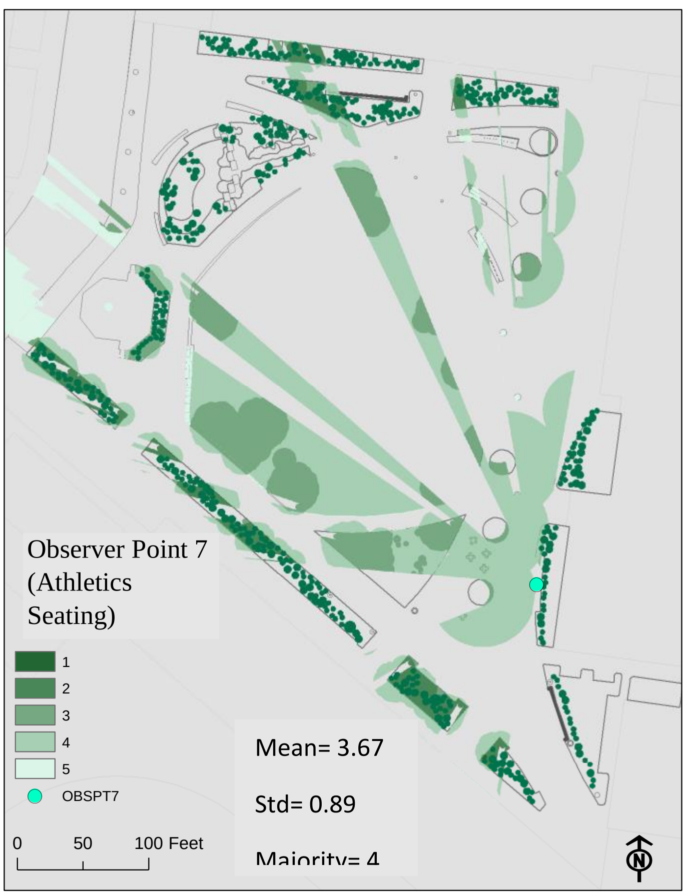
Remaining Viewshed Analysis

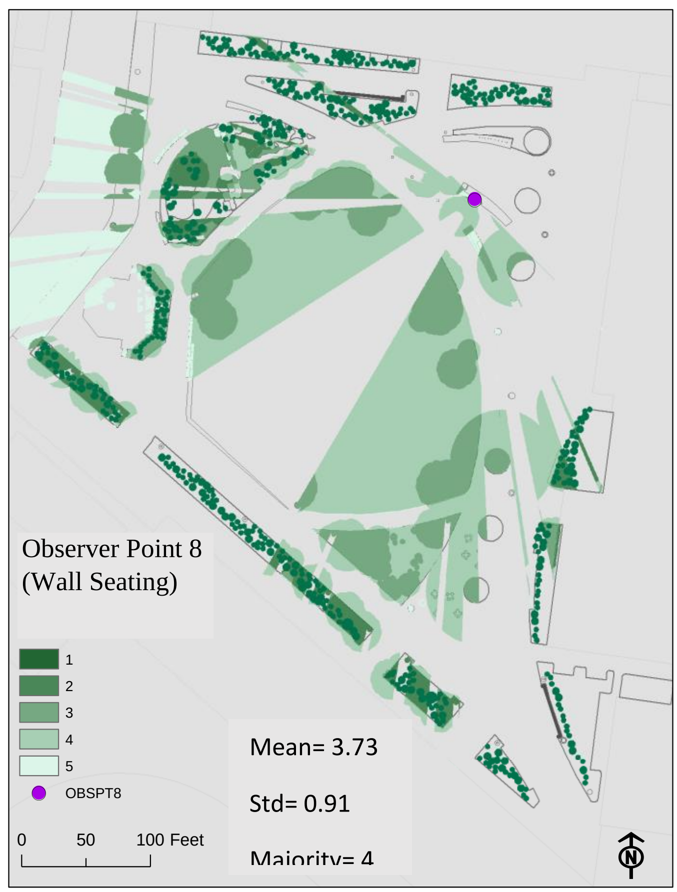





Observer Point 5
(Bench Seating)
1
2
3
4
5
OBSPT5
0
50
100 Feet
Mean= 3.67
Std= 0.94
Majority= 4


1
2
3
4
5
OBSPT6
0
50
100 Feet


Observer Point 7
(Athletics
Seating)
1
2
3
4
5
OBSPT7
0
50
100 Feet
Mean= 3.67
Std= 0.89
Majority= 4


Observer Point 8
(Wall Seating)
1
2
3
4
5
OBSPT8
0
50
100 Feet
Mean= 3.73
Std= 0.91
Majority= 4

Survey

1. How often do you visit this site in a month (circle one)?

A. 1-5 times B. 6-10 C. 11-15 D. 16-20 E. greater than 20

2. Are you associated with a university (student/ staff at UPenn, Drexel, etc) or unassociated community member?

A. university association B. unassociated community member

3. What is your use of this space (circle all applicable)?

A. Commute/ school-related B. Commute/ occupation-related C. Recreation (running, biking bypass) D. To be in a "natural" setting E. Relaxation

F. Studying, reading G. Eating a meal H. Other, please note ______________________

4. Are you aware that this site features sustainable landscape practices (i.e., stormwater management)?

A. Yes B. No

If so, which are you aware of?

Do you think these are important?

A. Yes B. No

The following statements refer to the degree to which you ***identify*** with the site.

Using the following scale please choose a number from 1 to 7 that best reflects your level of agreement with the following statements. Please mark each statement in the space provided.

Strongly Disagree			Neither Agree or Disagree			Strongly Agree
1	**2**	**3**	**4**	**5**	**6**	**7**

_____I identify strongly with Shoemaker Green

_____This green space is representative of who I am

_____This site is part of me

The following statements refer to the degree to which you have ***relationships*** with the people at this site (both colleagues, friends, Penn employees etc…)

Using the following scale please choose a number from 1 to 7 that best reflects your level of agreement with the following statements. Please mark each statement in the space provided.

Strongly Disagree			Neither Agree or Disagree			Strongly Agree
1	**2**	**3**	**4**	**5**	**6**	**7**

_____The other people in this site enhance my experience

_____The relationships I have in this site are important to me

_____I feel relaxed at this site.

_____I feel safe at this site.

_____Police patrol would elevate feelings of safety.

The following statements refer to the degree to which you feel that Shoemaker Green facilitates your ***needs*** (relaxation, socializing, etc…) better than other green spaces in Philadelphia.

Using the following scale please choose a number from 1 to 7 that best reflects your level of agreement with the following statements. Please mark each statement in the space provided.

Strongly Disagree			Neither Agree or Disagree			Strongly Agree
1	**2**	**3**	**4**	**5**	**6**	**7**

_____Shoemaker Green provides me with what I need, more so than other green spaces

_____This green space is the best place for me to fulfill my needs

_____I am committed to this site because it gives me what I need

_____This site is the best alternative for my goals and needs

The following statements refer to the degree to which you are ***emotionally attached*** to Shoemaker Green. **Think about feelings you may have when at the site.**

Using the following scale please choose a number from 1 to 7 that best reflects your level of agreement with the following statements. Please mark each statement in the space provided.

Strongly Disagree			**Neither Agree or Disagree**			**Strongly Agree**
1	**2**	**3**	**4**	**5**	**6**	**7**

_____I feel happy in this green space

______I have negative feelings for this site

______What happens in this place is important to me

______I am willing to invest my time or talent to make this place better

______I am willing to make financial sacrifices for the sake of this place

_____I feel excited in this green space

______I have no particular feeling for this place

The following questions relate to your view of the site's overall ***perceived quality*** based on a series of adjectives.

Please circle the number that best reflects your assessment of the aesthetic and natural qualities of Shoemaker Green.

Mediocre Appearance	**1**	**2**	**3**	**4**	**5**	**6**	**7**	Superior Appearance
Low Quality Landscape	**1**	**2**	**3**	**4**	**5**	**6**	**7**	High Quality Landscape
Low Relation to Nature	**1**	**2**	**3**	**4**	**5**	**6**	**7**	High Relation to Nature
Overall, Poor Experience	**1**	**2**	**3**	**4**	**5**	**6**	**7**	Excellent Experience

Additional thoughts, suggested improvements, or things you'd like to see at Shoemaker Green:

Analysis of Variance Tables

Response: Site1 (1-5)

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
identify	3	0.2051	0.06836	0.5181	0.67050	
relate	5	4.0114	0.80229	6.0809	3.977e-05	***
ematt	7	0.5630	0.08042	0.6096	0.74729	
need	4	0.2578	0.06444	0.4884	0.74420	
percep	4	1.4538	0.36346	2.7548	0.03038	*
identify:relate	15	3.4177	0.22785	1.7270	0.05207	.
identify:ematt	17	3.7785	0.22227	1.6847	0.05224	.
identify:percep	3	0.1219	0.04063	0.3080	0.81960	
relate:percep	1	0.3148	0.31475	2.3857	0.12471	
Residuals	140	18.4710	0.13194			

Response: Site2 (6-10)

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
identify	3	0.3023	0.10076	0.9079	0.43901	
relate	5	1.2240	0.24480	2.2057	0.05704	.
ematt	7	1.4404	0.20577	1.8540	0.08165	.
need	4	0.9185	0.22963	2.0690	0.08807	.
percep	4	0.8993	0.22482	2.0257	0.09407	.
identify:relate	15	5.8711	0.39141	3.5267	3.845e-05	***
identify:ematt	17	3.5444	0.20849	1.8786	0.02449	*
identify:percep	3	0.4174	0.13913	1.2536	0.29281	
relate:percep	1	0.0000	0.00000	0.0000	1.00000	
Residuals	140	15.5377	0.11098			

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Response: Site3 (11-15)

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
identify	3	0.0651	0.021706	0.4103	0.7458146	
relate	5	0.4102	0.082045	1.5510	0.1779503	
ematt	7	1.2007	0.171535	3.2428	0.0032135	**
need	4	0.9945	0.248622	4.7001	0.0013716	**
percep	4	0.7795	0.194887	3.6843	0.0069495	**
identify:relate	15	2.1947	0.146310	2.7660	0.0009109	***
identify:ematt	17	4.1447	0.243804	4.6090	1.315e-07	***
identify:percep	3	0.0000	0.000000	0.0000	1.0000000	
relate:percep	1	0.0000	0.000000	0.0000	1.0000000	
Residuals	140	7.4056	0.052897			

Response: Site4 (16-20)

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
identify	3	0.5376	0.17920	1.3833	0.2504496	
relate	5	3.4519	0.69038	5.3292	0.0001629	***
ematt	7	1.5188	0.21697	1.6748	0.1198758	
need	4	1.0941	0.27352	2.1114	0.0825480	.
percep	4	0.5747	0.14366	1.1090	0.3548067	
identify:relate	15	4.0154	0.26769	2.0664	0.0148643	*
identify:ematt	17	3.3268	0.19570	1.5106	0.0990309	.
identify:percep	3	0.5242	0.17474	1.3489	0.2610963	
relate:percep	1	0.0000	0.00000	0.0000	1.0000000	
Residuals	140	18.1365	0.12955			

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Response: Site5 (20 plus)

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
identify	3	0.8340	0.27800	2.5082	0.0613957	.
relate	5	3.7979	0.75958	6.8530	9.488e-06	***
ematt	7	1.4356	0.20508	1.8502	0.0823227	.
need	4	4.6402	1.16005	10.4661	1.905e-07	***
percep	4	3.2342	0.80855	7.2948	2.296e-05	***
identify:relate	15	6.8459	0.45639	4.1176	3.252e-06	***
identify:ematt	17	5.5393	0.32584	2.9398	0.0002483	***
identify:percep	3	0.2357	0.07857	0.7089	0.5482317	
relate:percep	1	0.3148	0.31475	2.8397	0.0941868	.
Residuals	140	15.5175	0.11084			