GREENWAYS AND TRAIL USE: INFLUENCES OF THE NEIGHBORHOOD ENVIRONMENT

by

DASHAN CHERIE WILLIAMS

(Under the Direction of Katherine Melcher)

ABSTRACT

This thesis examines the use of three urban greenway trails in the southeastern U.S. to evaluate characteristics of greenway trails that may be associated with higher levels of trail use, especially among women. Some of the neighborhood characteristics associated with greater use such as connectivity, mixed land use and high population density are looked at in relationship to the use of greenway trails among women and users in general. The findings from these cases found that population density along with connectivity and mixed land use appear to have little to no relationship with use; women are using these trails more than men and overall use can still be higher even when all factors are not present.

INDEX WORDS: Greenways, trails, trail use, walking behavior, North Oconee River Greenway, Athens-Clarke County, landscape architecture
GREENWAYS AND TRAIL USE: INFLUENCES OF THE NEIGHBORHOOD ENVIRONMENT

by

DASHAN CHERIE WILLIAMS

B.S., California State University, Long Beach, 1997

A Thesis Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

MASTER OF LANDSCAPE ARCHITECTURE

ATHENS, GEORGIA

2013
GREENWAYS AND TRAIL USE: INFLUENCES OF THE NEIGHBORHOOD ENVIRONMENT

by

DASHAN CHERIE WILLIAMS

Major Professor: Katherine Melcher
Committee: David Spooner
               David Berle
               Melinda Cochran

Electronic Version Approved:

Maureen Grasso
Dean of the Graduate School
The University of Georgia
August 2013
DEDICATION

This thesis is dedicated to my Lord and Savior Jesus Christ, without whom, this line of study and thesis would not have been remotely possible. I also dedicate this to my mom and dad, Shanda Fernandez and Daniel Williams. Your prayers and support over the years and especially during this time back in graduate school have been the wind in my sail. I love you both.
ACKNOWLEDGEMENTS

I would like to thank Katherine Melcher, my advisor who’s calm and consistent direction helped navigate me through the trials of thesis writing. David Spooner, thank you for always being available to review my work and give me honest and critical feedback. Scott Slaney, thank you for exposing me to the profession of landscape architecture and believing in me. Your support over the years has been immeasurable. Kimberly Fleming, where do I even begin? Your prayers and countless hours of encouragement over the years have been a safe harbor for me to refuel and keep going. And where would I be without the love, friendship and support of the M’Ladies; Diane, Lindsay, Lisa, Shannon and Vera you ladies have been the wind beneath my wings.
TABLE OF CONTENTS

Page

ACKNOWLEDGEMENTS ................................................................. v
LIST OF TABLES ................................................................. viii
LIST OF FIGURES ................................................................. ix

CHAPTER

1 INTRODUCTION ................................................................. 1
   Purpose of Thesis ......................................................... 1
   Organization of Thesis .............................................. 5

2 PREVIOUS RESEARCH – GREENWAYS AND TRAILS ............... 7
   Greenways, Trails and Trail Users ................................ 7
   The Benefits of Greenways Trails ................................. 11

3 LITERATURE REVIEW .................................................. 16
   Factors Related to Trail Use ....................................... 16
   Who Uses Greenway Trails? ....................................... 22

4 METHODOLOGY ......................................................... 25
   North Oconee River Greenway .................................. 27
   Bicentennial Greenway Trail .................................... 28
   Swamp Rabbit Trail ................................................. 30
   User Data Collection – SOPARC ....................... 31
   Neighborhood Characteristic Data .......................... 38
   Land Use ................................................................. 39
5 OUTCOMES OF DATA COLLECTION AND LIMITATIONS ...... 41
  Results of SOPARC Data – General Use.......... 41
  Results of SOPARC Data – Use by Gender........ 44
  Neighborhood Characteristic Data.............. 48
  Population Density........................... 48
  Connectivity.................................. 49

6 ANALYSIS, RECOMMENDATIONS AND CONCLUSIONS ...... 54
  Analysis of Results............................ 54
  Limitations................................... 60
  Conclusion.................................... 61
  Recommendations for the Future............... 65

REFERENCES........................................ 68
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table Number</th>
<th>Table Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Trail Characteristics Comparison Chart</td>
<td>27</td>
</tr>
<tr>
<td>5.1</td>
<td>Total Trail Users for All Trails</td>
<td>42</td>
</tr>
<tr>
<td>5.2</td>
<td>Trail User Count by Time of Day</td>
<td>43</td>
</tr>
<tr>
<td>5.3</td>
<td>Trail Users by Time of Day and Points</td>
<td>43</td>
</tr>
<tr>
<td>5.4</td>
<td>Trail Users by Day of Week</td>
<td>44</td>
</tr>
<tr>
<td>5.5</td>
<td>Total Trail Users by Gender</td>
<td>45</td>
</tr>
<tr>
<td>5.6</td>
<td>Female Users by Time of Day and Point</td>
<td>45</td>
</tr>
<tr>
<td>5.7</td>
<td>Female Trail Users by Time of Day</td>
<td>46</td>
</tr>
<tr>
<td>5.8</td>
<td>Male Users by Time of Day</td>
<td>46</td>
</tr>
<tr>
<td>5.9</td>
<td>Male Users by Time of Day and Point</td>
<td>46</td>
</tr>
<tr>
<td>5.10</td>
<td>Female Users by Day of Week</td>
<td>47</td>
</tr>
<tr>
<td>5.11</td>
<td>Male Users by Day of Week</td>
<td>47</td>
</tr>
<tr>
<td>5.12</td>
<td>Female Users by Day of Week and Point</td>
<td>48</td>
</tr>
<tr>
<td>5.13</td>
<td>Male Users by Day of Week and Point</td>
<td>48</td>
</tr>
<tr>
<td>5.14</td>
<td>Population Density - 6 Observation Points</td>
<td>49</td>
</tr>
</tbody>
</table>
LIST OF FIGURES

Page

Figure 1.1: Burke-Gilman Trail............................... 4
Figure 1.2: Along the Bay Trail............................... 9
Figure 1.3: The Ridge Trail................................. 9
Figure 3.1: Connectivity and Urban Form.................. 20
Figure 4.1: North Oconee River Greenway Trail........... 28
Figure 4.2: Bicentennial Greenway Trail................... 29
Figure 4.3: Swamp Rabbit Trail.............................. 30
Figure 4.4: NORG Observation Points Photos.............. 32
Figure 4.5: NORG Observation Points Map.................. 33
Figure 4.6: SRT Observation Points Photos............... 34
Figure 4.7: SRT Observation Points Map.................... 34
Figure 4.8: BGT Observation Point A Photo................. 35
Figure 4.9: BGT Observation Point B Photo................. 35
Figure 4.10: BGT Observation Points Map.................. 36
Figure 5.1: NORG Population Densities, Point A.......... 51
Figure 5.2: NORG Population Densities, Point B.......... 51
Figure 5.3: BGT Population Densities, Point A.......... 52
Figure 5.4: BGT Population Densities, Point B.......... 52
Figure 5.5: SRT Population Densities, Point A.......... 53
Figure 5.6: SRT Population Densities, Point B.......... 53
CHAPTER 1

INTRODUCTION

Purpose of Thesis

This work began with a desire to ensure that people living in urban areas have access to parks and trail systems in the communities where they live. Greenway trail systems have the potential to allow for this access due to their far-reaching linear form. This idea aroused my curiosity to understand, what causes people to use public spaces in their communities. The North Oconee River Greenway (NORG) in Athens, GA is an example of a trail system in a community that appears to have a low level of use. In fact, when engaging in casual conversation with people who live in the surrounding community, I find that many are unaware that the greenway even exists. A recent survey of residents near the NORG revealed that there is a perceived lack of safety on the trail and therefore a lower level of use (Feagan 2011). I believe an opportunity exists here to connect the surrounding college community to the river and trail systems and make that edge between the two a more active public space.
To embark on this study, I review the literature for two main ideas; 1. What are some of the factors related to trail use? 2. Who uses greenway trails? Greenway trails have been generally defined as linear open spaces established along either a natural corridor, ridgeline, along a railroad right-of-way converted to recreational use, a canal, a scenic road, or other route (Little 1990). Figure 1.1 gives an example of a greenway trail. In researching factors related to greenway trail use, I found that culture, social processes, trail characteristics and even neighborhood characteristics can have an influence on trail use. A community’s culture can influence whether a trail is used as a means of transportation to satisfy daily living needs or as a means of recreation to support an active lifestyle (Humphrey 2004). Trail characteristics include things such as pavement type and condition, type of use allowed (e.g. biking, hiking, walking or running), lighting, vegetation, views, aesthetics, facilities (e.g. parking, restrooms and seating). A study on high and low poverty communities found that in high poverty communities, the pavements were often in poor condition and factored into the frequency of use (Franzini et al. 2010). However when strong social networks existed that encouraged an active lifestyle, trail use was high even when pavement
conditions were poor. So, it would appear that social factors might have a greater relationship to trail use than even trail characteristics. The final factor reviewed was neighborhood characteristics. Neighborhood characteristics looks at things such as the connectivity of trails to surrounding areas, land use surrounding the trails, population densities, community demographics (e.g. gender, race, income, age, etc.). Several studies consistently referred to connectivity, land use and population density as strong influencers of walking behavior (Deitrick and Ellis 2004; Frank and Engelke 2005; Owen et al. 2007; Vernez Moudon et al. 2006). This study will focus on these three neighborhood characteristics to allow for a broad perspective of the environment that greenway trail users use.

Connectivity is defined as having continuous pedestrian infrastructure or sidewalks on the main roads or trails that lead to surrounding destinations; land-use refers to the existing use of buildings and structures (e.g. residential or commercial use); and population density is measured in people per square mile (PPSM) and is relative to the other trails in the study when low, medium or high use is considered.
The purpose of this study is to identify characteristics of greenway trails that may be associated with higher levels of trail use, especially among women as some research has shown that men tend to use greenway trails more than women (Wekerle, Safe City Committee of the City of, and Toronto 1992).

![Figure 1:1 Burke-Gilman Trail, Seattle, Washington (Little 1990)](image)

This thesis will look at neighborhood characteristics associated with greater use and evaluate their relationship to the use of greenway trails in general and among women.
The intent is to provide information that may assist planners and designers when assessing characteristics that can increase use of urban greenway trails.

Several research studies of specific greenways will be synthesized to identify the gender of those using urban greenway trails and identify neighborhood characteristics that may influence trail use. Three urban greenways trails in Athens, GA, Greensboro, NC and Greenville, SC will be studied to test the existing literature on what may positively influence greenway trail use among women and make recommendations, based on the findings. It should be noted that the observations and information gathered during this study were specific to the greenway trails being studied. This should be taken into consideration when applying this study and results to other settings.

Organization of Thesis

Chapter 2 will take a look at the differences between greenways and trails. It will then review the literature on how greenways have been defined and the various perspectives that greenways can be viewed from. The definition and perspective that will be used for this thesis will then be established, and it will finally discuss the many benefits of greenway trails.
Chapter 3 will review the literature on some of the factors, which may influence recreational trail use in urban settings. The literature review will be followed up with a discussion of the research problem and question. The chapter will conclude with an introduction to the case studies that will be established for this study.

Chapter 4 will discuss the methodologies used to study three selected greenway trails and the correlation between trail use by female users and population density.

Chapter 5 will describe the results of the case studies.

Chapter 6 will analyze the results of the SOPARC method; its implications on future design and discuss recommendations.
CHAPTER 2

PREVIOUS RESEARCH - GREENWAYS AND TRAILS

Greenways, Trails and Trail Users

The New Oxford American Dictionary defines a greenway as "a strip of undeveloped land near an urban area, set aside for recreational use or environmental protection" (Jewell and Abate 2001). The same Oxford Dictionary defines a trail as, "a beaten path through rough country such as a forest or moor." The two definitions suggest that each is located in completely different settings, the greenway near an urban setting and the trail in a country setting. However, it is important to note that greenways often include trails but they are not one in the same (Moore and Shafer 2001). Greenways can be corridors for vehicles and wildlife, scenic and historic routes as well as open space connectors. Charles Little introduced one of the most widely accepted definitions of greenways in the influential work, Greenways for America (Markeson 2007; Moore and Shafer 2001; Shafer, Scott, and Mixon 2000; Walmsley 1995). Little broadly defines greenways as follows:

1. A linear open space established along either a natural corridor, such as a riverfront, stream valley, or
ridgeline, or overland along a railroad right-of-way converted to recreational use, a canal, a scenic road, or other route, Figures 1.2 and 1.3.

2. Any natural or landscaped course for pedestrian or bicycle passage.

3. An open-space connector linking parks, nature reserves, cultural features, or historic sites with each other or with populated areas.

4. Locally, certain strips of linear parks designated as a parkway or greenbelt (Little 1990).

5. Little farther identified five major types of greenways: (a) urban riverside greenways, (b) recreational greenways, (c) ecologically significant natural corridors, (d) scenic and historic routes, and (e) comprehensive greenway systems or networks (Little 1990, p. 1).

Fabos (1995) suggested that greenways were "corridors of various widths, linked together in a network in much the same way as our networks of highways and railroads have been linked" (Moore and Shafer 2001, p. 4). Searns (1995) traced the history of greenways, arriving at a contemporary definition of greenways as resources that achieve multiple objectives, particularly in urban areas (Moore and Shafer 2001).
Along the Bay Trail, Pinole Point, San Francisco Bay Area acquire from developer to provide a crucial trail link (Little 1990).

The Ridge Trail in the San Francisco Bay Area traverses the region’s uplands (Little 1990).

According to Flink (1993), trail users can fall into one of six different types of user categories; pedestrian (e.g. walkers and hikers), non-motorized vehicular (e.g. bikers), non-motorized water (e.g. kayakers and canoeists),
pack and saddle animal (i.e. equestrians), motorized vehicular (e.g. snowmobilers and backcountry jeep users) and motorized water trail users (e.g. ski boats or motor boats). With so many types of trail users, it is important to distinguish among the various trail types that support their activities. Trails falls into one of four categories; land-based, water-based, single-user or multi-user (Flink 1993).

Depending on perspective, greenways and trails can take on various shapes and meanings. For example, Axelson et al. (1999) identified 13 different trail types based on the activities they supported and their settings. Moore and Shafer (2001) summarize the various perspectives of greenways and trails nicely in the Introduction to Special Issue Trails and Greenways: Opportunities for Planners Managers and Scholars. Planners, landscape ecologists and recreation professionals all define greenway resources relative to their particular framework and setting. Managers view trails as facilities to be maintained and managed. Communities view them as sources of various benefits such as aesthetics, fitness or traffic mitigation. Policymakers see them as opportunities to shape land use. To researchers they offer opportunities for applied study
and to users, trails and greenways are travel routes and settings for activities and experiences.

For the purpose of this thesis, when referencing greenways, the definition put forth by Charles Little, with the focus of recreational greenways was used because the greenways that were studied fit best into his definition. When referencing trails, the concept of multi-user trails for the use of pedestrian and non-motorized vehicular users was used because those are the types of trails that were studied.

The Benefits of Greenway Trails

Greenway trails have long been a part of the urban environment and the human experience and over time have evolved to meet the needs of people. More than just parks and amenities, greenways today are an adaptation to the pressures of urbanization that helps mitigate the loss of natural landscape as a result of growing urbanization (Searns 1995). Greenway trails provide many benefits to people and communities. Studies have associated benefits such as health, economic, environmental and social to the presence of greenways in communities.

The positive impacts of having access to nature and recreation opportunities on physical and psychological health have been well documented. Greenway trails are an
excellent way to connect people to nature and recreational opportunities. Many recreational trails allow for activities such as sitting, walking, bicycling, jogging, running, rollerblading, skateboarding, horse riding and other activities. Greenway trails provide greater accessibility to more residents than traditional parks because of their linear form and length, (Markeson 2007), and therefore, allow for greater access to nature and the benefits that nature provides.

The sedentary lifestyle and unhealthy American diet have produced an epidemic of obesity in this country. According to the Center for Disease Control and Prevention (CDC), the obesity rate in America was 27% in 1999; almost double that of the 15% obesity rate in 1980. A comprehensive report prepared in 1996, by the U.S. Surgeon General found that those who engage in regular physical activities reduced their risk of premature death; reduced risk of coronary heart disease, hypertension, colon cancer, and non-insulin-dependent diabetes; improved maintenance of muscle strength, joint structure, and joint function; weight loss and favorable redistribution of body fat; improved physical functioning in persons suffering from poor health; and healthier cardiovascular, respiratory, and endocrine systems (Centers for Disease et al. 1996).
Providing opportunities for people to walk is important to help reduce obesity and improve people’s health. When people have nowhere to walk, they gain weight. Obesity is more likely in unwalkable neighborhoods, but goes down when measures of walkability go up: dense housing, well-connected streets, and mixed land uses reduce the probability that residents will be obese (Goldberg et al. 2007).

Studies have also found that simply having access to nature can also have beneficial effects on health both physically and psychologically. Roger Ulrich, in his classic 1984 study, manipulated the views of convalescent patients so that, from their rooms, half of them could see views of trees and half of them saw views of a brick wall. Those with a view of trees recovered faster than those with the brick wall view (Ulrich et al. 1991). According to the Ulrich study, the ones with views of trees also had fewer complications during surgical procedures and request fewer medications.

Environmental psychologists Rachel and Stephen Kaplan attributed nature’s restorative abilities to a termed they coined as, “soft fascination”. They theorized that natural scenes are almost effortlessly able to capture people’s attention and lull them into a sort of hypnotic state where
negative thoughts and emotions are overtaken by a positive sense of well-being (Kaplan 1995; Abrams 2013). A 2010 study looked at the effects of having parks in the vicinity of people’s homes and whether having this amenity acted as a buffer against stress. They found that while having the presence of green space was not enough to make people forget about stressful life events it did support the notion that green space can provide a buffer against the negative health impacts of stressful life events (Van Den Berg et al. 2010).

The Trust for Public Land did a report on the need for parks in our communities. They found that, in addition to the health benefits associated with trails and access to nature, there are also economic, environmental and social benefits of trails (Sherer 2003). Economically, parks help to increase property values, revitalize communities by attracting and retaining businesses and residents and help to increase tourism. Environmentally, parks help with pollution abatement, cooling and controlling stormwater runoff. Socially, parks help to reduce crime, create opportunities for recreation and help to create stable neighborhoods with strong communities.

The differences between greenways and trails and the benefits of greenways, parks and open space were just
discussed. Greenways can take on various forms and functions however they will not always have trails associated with them. Trails can also take on various forms and can cross water or land for a myriad of transportation uses. The numerous benefits associated with greenway trails make them a highly important area for further study specifically in the area of use. Therefore, the next chapter will continue to explore the idea of greenway trail use and the neighborhood characteristics associated with that use by discussing the methodologies used to answer the thesis question, “Are greenways with connectivity, mixed land-use and high population density used more frequently in general and by women?”
CHAPTER 3

LITERATURE REVIEW

Factors Related to Trail Use

One of the best places to look for examples of characteristics of the built environment that influence trail use or walking behavior is a street of the preindustrial era. City streets of the preindustrial era had to allow for the mobility of pedestrians. Activity patterns had to be fine grained, density of dwellings had to be relatively high, and everything had to be connected by a continuous pedestrian path network (Southworth 2005). A recent review of the literature shows that these qualities still relate to walking behavior today. Environments that are associated with more walking tend to be densely populated, have a continuous flow of connectivity via pedestrian pathways that directly connect to desirable locations and land use that employs a mix of residential and retail (Deitrick and Ellis 2004; Frank, Engelke, and Schmid 2003; Frank and Engelke 2005; Owen et al. 2007; Vernez Moudon et al. 2006).

There are numerous factors that relate to trail use. Neighborhood and trail characteristics, perceptions of
safety, as well as individual and social motivators are all factors that are related to an individuals' use of trails.

Trail characteristics such as pavement type and condition, lighting, view sheds, surrounding vegetation, overall aesthetics, cleanliness and the availability of amenities such as seating, phones, restrooms and parking can all factor into an individual’s use of trail systems (Humphrey 2004; Reynolds et al. 2007; Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities: An ITE Proposed Recommended Practice 2008; Geoffrey et al.).

Trail use can also be related to an individual’s motivation. Individuals who believe that physical activity is important to their overall well-being and physical health or an individual with a strong social network that supports and encourages physical activity will be more likely to engage in physical activity on trails. A comparison study was done between two low and high poverty neighborhoods and it showed that the physical conditions of walking paths do have an influence upon walking habits however, even in the face of poor physical path conditions, a strong social network appeared to outweigh the poor physical conditions of the paths (Franzini et al. 2010).
There are also neighborhood characteristics such as the demographics of the community surrounding the trial, trail infrastructure; populations and land use that can impact a trails use.

This study will focus on three of the neighborhood characteristics that relate to trail use; connectivity, population densities and land-use surroundings selected trails. Two concepts widely used in discussions of the neighborhood environment, and its influence upon various types of travel behavior such as walking, are connectivity and proximity (i.e. mixed land-use and population density).

Connectivity refers to the number and directness of transportation linkages between destinations (Frank and Engelke 2005). Connectivity and the degree to which destinations can be reached in a direct, rather than an indirect pathway, have been shown to be predictive of walking behavior (Frank, Engelke, and Schmid 2003). An example of this can be seen in Figure 3.1. A more direct route results in a shorter distance traveled and could be considered more walkable.

Fitzhugh, Bassett, and Evans (2010) conducted a study, on two neighborhoods with high-density populations, mixed land use and resident proximity to nonresidential destinations. What was missing from these neighborhoods
was connectivity to those nonresidential destinations. There were no sidewalks. A greenway trail was installed, in one of the neighborhoods, which connected to retail and school destinations. Pre and post installation observations were done on the intervention neighborhood. They found that safe pedestrian infrastructure did increase outdoor physical activity.

Even though the literature shows that connectivity is a factor that may influence walking behavior, the literature also suggests that connectivity alone will not lead to this behavior but connectivity and proximity (high population densities as well as mixed land use) are necessary (Deitrick and Ellis 2004; Frank and Engelke 2005; Owen et al. 2007; Vernez Moudon et al. 2006) for walking behavior to occur.
Proximity as a concept is normally operationalized in two ways: in terms of density and in terms of mixture of uses (Frank and Engelke 2005). Density deals with the concentration of people, dwelling units, households or structures in an area. When relating density to travel, the idea is fairly simple, the higher the density, the higher the proximity. Mixture of uses refers to the spatial placement of residential, industrial and commercial buildings. When these locations are mixed, the opportunity
for a variety of commercial and industrial locations to be in close proximity to places of resident are greater.

Early research on pedestrian travel emphasized the importance of retail to create an inviting pedestrian environment (Owens 1993; Rapoport 1987; Whyte William 1988). Planning theorists hypothesize that mixed land uses may encourage pedestrian activity (Frank, Engelke, and Schmid 2003; Lindsey et al. 2006). Some studies have shown that direct connectivity to nonresidential locations in conjunction with mixed land use may in fact increase trail use (Frank, Engelke, and Schmid 2003; Urbanism 2001). According to Southworth (2005), a walkable neighborhood or city is one were places that serve daily needs can be reached on foot within 10-20 minutes or up to \( \frac{1}{2} \) mile. In fact, it appears that distance to destinations is the single factor that most affects whether or not people decide to walk or to take the car, and is more of a determinant than weather, physical difficulty, safety or fear of crime (Funahashi, Architecture, and Research 1985; Handy 1996; Komanoff and Roelofs 1993; Smith and Butcher 1994). The types of places that fall within the category of nonresidential locations include such uses as shops, cafes, banks, laundries, grocery stores, day care centers,
fitness centers, elementary schools, libraries, and parks (Southworth 2005).

Who Uses Greenway Trails?

According to several studies, the most frequent users of trails are white, males and have upper income and education levels (Furuseth and Altman 1991; Lindsey et al. 2006; Shafer, Lee, and Turner 2000; Lindsey 1999). Research from the City of Toronto indicates that in North America, women often feel at risk in public parks (Luymes and Tamminga 1995). Consequently, men make up the vast majority of solo users of urban parks and greenways, particularly in isolated areas and in low-use time periods (Wekerle, Safe City Committee of the City of, and Toronto 1992). One might assume that users of trails would reflect the demographics of those living closest to the trail however; this does not appear to affect use. Reed et al. (2011) conducted a 3-year study to understand the correlation between user demographics and physical activity on a newly constructed 2-mile abandoned rail line that was converted into a trail. Their findings were that white male adults were the highest users of the trail even though they were not the majority of the two census tract groups abutting the trail. Carr et al. (1993) pointed out that this fact means that for many women (and for other groups
such as aging people and those with disabilities) public
open space is not open at all. Perceptions of safety can
also relate to trail use especially among women, children,
seniors and the disabled (Luymes and Tamminga 1995).
Places can be perceived to be unsafe by these groups
e specially when they are unused. According to Whyte (1980)
in his 1980 study, The Social Life of Small Urban Spaces,
what attracts people most, it would appear, are other
people. However even more than people attracting people,
spaces that have higher ratios of women tend to be used
more (Whyte 1980).

A later study done by Mozingo (1989), which also
looked at how public spaces are used, looked more
specifically at how men and women use these spaces.
Mozingo found that Whyte’s study appeared to address only a
small part of a range of valid and successful forms of open
space. While Whyte’s study suggests open spaces should
connect to the surrounding streets and create opportunities
for stranger interaction, Mozingo found the opposite to be
prefer open spaces that emphasize a filtering or mitigation
of negative factors, psychological familiarity and comfort,
places to socialize with friends, and spatial control.”
“...Spaces that are directed away from the street could be
particularly successful for women. By their less public and less connected nature, these spaces help women more easily maintain their vital psychological boundaries.”

For the purpose of this study, a successful greenway trail was defined as a trail with higher numbers of users.
CHAPTER 4

METHODOLOGY

William Whyte’s study of public spaces suggests that a higher use of public spaces might drive more use (Whyte 1980). In terms of neighborhood characteristics, we have also discussed that connectivity, mixed land-use and population density together can influence greater use. To test these theories, these three neighborhood characteristics will be studied in conjunction with who is using greenway trails. Three greenway trails were selected for observation to answer the question, “Are greenways with connectivity, mixed land-use and high population density used more frequently by people in general and by women?” The three greenways selected were: North Oconee River Greenway (NORG) in Athens GA; The Greenville Hospital System Swamp Rabbit Trail (SRT) in Greenville, SC and the Bicentennial Greenway Trail (BGT) in Greensboro, NC.

Each trail was selected for specific similarities and differences. The similarities were their proximity to river corridors, climate, pavement type, trail use allowed and proximity to urban areas. The differences were their perceived level of use, city population, trail length and
perceived neighborhood characteristics (connectivity, land-
use and population density). It seemed that the BGT and
SRT had a high level of connectivity because both the BGT
and SRT were planned with the purpose of connecting the
trails to specific points. The SRT specifically planned
that their 17.5-mile trail would run from Greenville
Hospital in Travelers Rest, SC to downtown Greenville, SC.
The BGT also formally planned for the trails 20-mile
connection to run from downtown Greensboro to the City of
High Point. Both trails have a reputation for high use so
I made an assumption that they also had denser populations
and higher mixed land use surround the trails, than the
NORG. The population of the city and trail length for each
trail was not intentionally chosen but were simply default
characteristics after similarities and differences were
selected (Table 4.1).

In addition, two points were selected on each trail
for observations. Point A on each trail represents a point
on the trail surrounded by more homogenous residential land
uses. Point B on each trail represents more of an urban
part of the trail that is surrounded by a higher number of
mixed land uses. The NORG is the main focus of this
observation as it has the lowest perceived level of use.
This lack of use may be due to low-proximity and lack of connectivity. The other two trails however, the SRT and BGT have a reputation of being well used. I propose that these trails may have higher population densities, mixed land-use and connectivity than the NORG, which is reflected in their trail use.

### North Oconee River Greenway

The NORG in Athens, Georgia has a trail system that runs along the North Oconee River for approximately 3.4 miles (Figure 4.1). The trail currently extends from N. Thomas Street and Williams Street near the University of Georgia campus to The Sandy Creek Nature Center. The trail is multi-purpose and is used for pedestrian walking, running, hiking and biking.

<table>
<thead>
<tr>
<th>Trail, Location</th>
<th>2010 Population</th>
<th>Trail Length</th>
<th>Pavement Type</th>
<th>Near River</th>
<th>Perceived Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORG, Athens, GA</td>
<td>116,084</td>
<td>3.4 Miles</td>
<td>Concrete</td>
<td>Yes</td>
<td>Low</td>
</tr>
<tr>
<td>BGT, Greensboro, NC</td>
<td>273,425</td>
<td>20 Miles</td>
<td>Concrete</td>
<td>Yes</td>
<td>Med</td>
</tr>
<tr>
<td>SRT, Greenville, SC</td>
<td>60,379</td>
<td>17.5 Miles</td>
<td>Concrete</td>
<td>Yes</td>
<td>High</td>
</tr>
</tbody>
</table>
Bicentennial Greenway Trail

The BGT is a multi-use paved trail that is really a combination of three greenway segments, now made into one: the Lake Brandt, Bicentennial Greenways and the Battleground Rail-Trail (Figure 4.2). It is an almost 20 mile greenway trail that connects the City of High Point to the City of Greensboro.
Figure 4.2 Bicentennial Greenway Trail, Greensboro, North Carolina (Conservancy 2012)
Swamp Rabbit Trail

The SRT is a 17.5-mile multi-use paved trail system that runs along the Reedy River connecting Travelers Rest with the City of Greenville (Figure 4.3). It is a part of a larger master plan of trails that were designed for Greenville County in 2008.

Figure 4.3 Swamp Rabbit Trail, Greenville, South Carolina (Conservancy 2012)
This study will observe the trails at consistent points and time intervals to identify the gender of users and it will identify the neighborhood characteristics (connectivity, land-use and population density) within \( \frac{1}{2} \) mile of the observation points. A modified version of the System for Observing Play and Active Recreation in Communities (SOPARC) is the methodology that will be used to collect user data. Once the data has been collected for all three trails, comparing use data among the trails will identify greenway use.

**User Data Collection - SOPARC**

Two points on each of the 3 trails were observed for the gender of users. When selecting the points for observation, an assumption was made about the areas immediately surrounding the observation points that were based on visual observations. For each trail, observation point A was selected for its perceived proximity to residential areas and observation point B was selected based on its perceived proximity to more commercial areas.

One collector was stationed at each of the observation points during consistent days and times to tally male and female users with a digital counter. The activity that was counted as use included, sedentary activities such as
standing, sitting, walking and vigorous activities such as biking or jogging.

For the NORG, point A is located near Martin Luther King Boulevard and College Avenue; point B is located near the corner of S. Poplar Street and Oak Street (Figure 4.4 and 4.5).

![NORG Observation Points](image)

Figure 4.4 NORG Observation Points, A on the left and point B on the right.

Point A for the SRT is located near the corner of Main Street and Grandview Road and point B is located near Main Street and Camperdown Way in downtown Greenville (Figure 4.6 and 4.7). The points for the BGT are located near Jamestown Park for point A (Figure 4.8) and near Old Battleground Road for point B (Figure 4.9). Figure 4.10 gives a map view of the BGT observation points.

SOPARC calls for multiple collectors to collect during the morning, afternoon and evening to ensure a good range
of sample times. Typically, with multiple collectors, synchronized collections would be done. This study was limited to one data collector for each site so a modification was necessary. A range of times for morning, afternoon and evening was established for efficiency in reaching each of the points.

Figure 4.5 NORG Observation Points Map, observation points A and B
Figure 4.6 SRT Observation Points Photos, A on the left and point B on the right.

Figure 4.7 SRT Observation Points Map.
Figure 4.8 BGT Observation Point A Photo.

Figure 4.9 BGT Observation Point B Photo.
Figure 4.10 BGT Observation Points Map.

For each of the points, 8 a.m. to 11:30 a.m. was established as the morning range, 12:00 p.m. to 2:30 p.m. was set for the afternoon range and 3:00 p.m. to 5:00 p.m. was set for the evening collection times.
To allow for consistency, collection times were done at 10 a.m. and 11 a.m. for the morning range, 12:45 p.m. and 2 p.m. for the afternoon range and 3:00 p.m. and 4:30 p.m. for the evening range.

SOPARC was designed to obtain direct information on community park use, including relevant concurrent characteristics of parks and their users (McKenzie and Cohen 2006). The original SOPARC design was intended to take a snapshot in time of activity in a park setting. The observer does a scan by visually sweeping the established area once from left to right, then recording what they saw. Since the data collected for this thesis was for a trail, where there tends to be constant movement, and not a park, where users tend to remain for a period of time, a modification was adapted so that the scans would not yield zero data. The modification included doing visual scans every 2-minutes, beginning at the appropriate start time, for 15-minutes intervals. During each scan, a digital counter was use to tally the number of men and women present during the scan. That data was then recorded on to a prepared chart.

SOPARC also calls for collection of data during weekend and weekday times. Data was collected on Sunday and Monday for each trail in order to capture weekend and
weekday use patterns. Data for the BGT was collected on Sunday, January 20 and Monday, January 21, 2013, the SRT was collected on Sunday, January 27 and Monday, January 28, 2013 and the NORG was collected on Sunday, February 3 and Monday, February 4, 2013. All of the observations took place during the winter months of January and February. The outside temperatures ranged from 35 degrees F to 60 degrees F. Every attempt was made to ensure that points were observed on fairly clear days and during consistent times. One of the collection days was on a national holiday and during the presidential inauguration so it is possible that data from that day may have been out of the normal range of activities.

**Neighborhood Characteristic Data**

Once user data was collected for this study, demographic data on population density was also collected and analyzed for correlation to use. 2010 Census data from the U.S. Census Bureau was collected for population density within ½ mile of the trail observation points and analyzed in geographic information systems (GIS).

Direct connectivity to nonresidential locations appears to be a major driver of walking behavior therefore; existence of these locations within ½ mile of the trail observation points will be identified through aerial
images. According to Vernez Moudon et al. (2006), popular walking destinations for those who walked for recreation, were grocery stores, non-fast food restaurants, drug stores, convenience stores, banks, coffee shops and post offices. Moudon et al. found that “thresholds for attractive walking environments included approximately two or more agglomerations of grocery stores, non-fast food restaurants and retail stores, but no more than four individual grocery stores within 1 km of the respondents' homes.” These locations were used as acceptable nonresidential locations. Two or more of these acceptable locations within ½ mile of the collection point qualified as a yes that point is connected to nonresidential locations. Neighborhood characteristics were gathered from the U.S. Census Bureau and analyzed using Geographic Information System (GIS).

**Land Use**

Two observation points were selected for each trail, point A to represent a residential setting and point B to represent mixed land use. Since it is understood that the properties surrounding points A are residential, the retail establishments for points B will be the only places itemized. Some of the retail establishments observed near the NORG, point B include: Mama’s Boy Restaurant, Dairy
Queen, Church’s Chicken, Tire Depot, a body shop, several office buildings and UGA’s campus.

The establishments surrounding the SRT, point B include Spill the Beans Coffee Shop, Hampton Inn, Subway Sandwich, The Lazy Goat Restaurant, Peace Performing Arts Center, Spa At West End, Mellow Mushroom Restaurant, The Velo Fellow Bar, The Overlook Grill, Mary's Restaurant, High Cotton Restaurant and Numerous Office Buildings.

Establishments near the BGT’s point B include Cooke Vending and Snax Grocery, A Finishing Touch Nail Salon, Southern Foods Restaurant, Choice Community Credit Union, Optimus Urgent Care, Southeastern Eye Center, RiteAid, Sorella Day Spa, Ann Crittenden Hallmark, Kyoto Fantasy Express Restaurant, Lincoln Green Fitness Center Pool and Guilford Courthouse National Military Park.
Chapter 5

OUTCOMES OF DATA COLLECTION AND LIMITATIONS

This chapter will detail trail user counts identified by the SOPARC data collection methodology. Population density within ½ mile of the collection points was calculated. Connectivity within ½ of all observation points was defined and identified, and the land use mix surrounding each of the 6 observation points was itemized.

Results of SOPARC Data – General Use

Total trail users counts from the SOPARC method counted all users (men, women, children, seniors etc) doing any type of activity on the trail (walking, sitting, standing, running, biking etc.) during the selected morning, afternoon and evening timeframes both during the week and the weekend. Results from the NORG revealed a sample user population of 40 users total. The BGT had 159 users and the SRT had a total of 90 users (Table 5.1).

When looking at total trail use by point, a different picture emerges. Points A for each trail represents a more residential setting while the B points for each trail represent settings with mixed land use. Most of the use for the NORG occurs on point A, throughout the day while the BGT and SRT experience their heaviest use on point B.
throughout the day. Point A on the NORG had 33 total users while point B had 7 users. Point A for BGT had 40 users while point B had 119. The SRT had a total of 29 users for point A and 61 users for point B.

Table 5.1: Total Trail Users for All Trails

<table>
<thead>
<tr>
<th>SOPARC - Total User Count</th>
<th>Point A</th>
<th>Point B</th>
<th>Total Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORG</td>
<td>33</td>
<td>7</td>
<td>40</td>
</tr>
<tr>
<td>BGT</td>
<td>40</td>
<td>119</td>
<td>159</td>
</tr>
<tr>
<td>SRT</td>
<td>61</td>
<td>29</td>
<td>90</td>
</tr>
</tbody>
</table>

Total user count by time of day was also observed. During the morning hour range, 8 a.m. to 11:30 a.m., the NORG still had far fewer users, 4, than the BGT, 38, and the SRT 22. The afternoon range, 12:00 p.m. to 2:30 p.m. and evening range, 3:00 p.m. to 5:00 p.m., counts remained consistent with BGT having the highest use in the afternoon of 59 users and in the evenings, 62 users, SRT coming in next with 27 users in the afternoon and 41 users in the evening and the NORG with the least users at 17 in the afternoon and 19 in the evening (Table 5.2).

Although when each trail is analyzed for use by time of day for each point, the NORG has its highest use on point A during the afternoon and evening hours. The BGT and SRT have their highest use in the evening (Table 5.3).
Table 5.2: Trail User Count by Time of Day

<table>
<thead>
<tr>
<th>SOPARC – Total User Count by Time of Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORG</td>
</tr>
<tr>
<td>Morning</td>
</tr>
<tr>
<td>Afternoon</td>
</tr>
<tr>
<td>Evening</td>
</tr>
</tbody>
</table>

Table 5.3: Trail Users by Time of Day and Points

<table>
<thead>
<tr>
<th>SOPARC – User Count by Points and Time of Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORG Point A</td>
</tr>
<tr>
<td>Morning</td>
</tr>
<tr>
<td>Afternoon</td>
</tr>
<tr>
<td>Evening</td>
</tr>
</tbody>
</table>

While it was important to observe total use patterns and use by time of day, it was also important to observe use by time of week. Weekend and weekday use was also observed. Overall, weekend use on all three trails was higher than weekday use with the NORG having 25 users on the weekend and 15 during the week, BGT having 113 on the weekend and 46 during the weekday and SRT having 62 users on the weekend and 28 during the week. When these same days are analyzed by points within each trail, the trend continues with the weekend for each point having the highest use however, again, the NORG has more activity on point A whether it is a weekend or a weekday and the BGT and SRT see more use on point B (Table 5.4).
Table 5.4: Trail Users by Day of Week

<table>
<thead>
<tr>
<th>SOPARC — Total User Count by Day of Week</th>
<th>NORG Point A</th>
<th>NORG Point B</th>
<th>BGT Point A</th>
<th>BGT Point B</th>
<th>SRT Point A</th>
<th>SRT Point B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekday</td>
<td>13</td>
<td>2</td>
<td>11</td>
<td>35</td>
<td>11</td>
<td>17</td>
</tr>
<tr>
<td>Weekend</td>
<td>20</td>
<td>5</td>
<td>29</td>
<td>84</td>
<td>18</td>
<td>44</td>
</tr>
</tbody>
</table>

Results of SOPARC Data — Use by Gender

Across the board, women use these three trails more than men with the exception of the SRT, which had almost equal use of the trail by men and women. The sample size for the NORG shows 24 female and 16 male users, the BGT 87 female and 72 male users and the SRT, 44 female and 46 male users (Table 5.5).

Observations of female use by time of day showed that the evening hours had the highest use, followed closely by the afternoon. The NORG showed a total of 12 female users in the evening, 10 in the afternoon and 2 in the morning. The BGT had a higher count of 37 in the evenings, 27 in the afternoon and just slightly fewer in the mornings at 23. The SRT had a total of 23 female users in the evening, 9 in the afternoon and 12 in the morning (Table 5.6). As for female use by point and time of day, female users showed greater use in the more residential area, point A on the NORG and the mixed land use areas, point B of the BGT and SRT.
Table 5.5: Total Trail Users by Gender

<table>
<thead>
<tr>
<th>SOPARC - User Count by Gender</th>
<th>NORG</th>
<th>BGT</th>
<th>SRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>24</td>
<td>87</td>
<td>44</td>
</tr>
<tr>
<td>Male</td>
<td>16</td>
<td>72</td>
<td>46</td>
</tr>
</tbody>
</table>

Table 5.6: Female Users by Time of Day and Point

<table>
<thead>
<tr>
<th>SOPARC - Total Female Users by Time of Day and Point</th>
<th>NORG A</th>
<th>NORG B</th>
<th>BGT A</th>
<th>BGT B</th>
<th>SRT A</th>
<th>SRT B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morning</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>21</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Afternoon</td>
<td>9</td>
<td>1</td>
<td>8</td>
<td>19</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Evening</td>
<td>11</td>
<td>1</td>
<td>8</td>
<td>29</td>
<td>8</td>
<td>15</td>
</tr>
</tbody>
</table>

When comparing gender use for time of day, it appears that the preferred time of day for use is fairly consistent between men and women. Men appear to prefer using the trails during the evening and afternoon hours. The only exception seems to be the BGT, where men used the trail more during the afternoon hours than the evening hours, which was reverse for females on the same trail (Table 5.7). The NORG showed 7 male users in the evening, 7 in the afternoon and 2 in the morning. The BGT had 25 male evening users, 32 afternoon users and 15 morning users. The SRT show 18 male users in the evening, 18 in the afternoon and 10 in the morning (Table 5.8). The results by observation point reveal the same use pattern as with female users. The NORG, point A, which is more residential, has more use by male users in the evening and
afternoon hours and point B, on the BGT and SRT, which has mixed land use, has more use (Table 5.9).

Table 5.7: Female Users by Time of Day

<table>
<thead>
<tr>
<th>SOPARC - Total Female Users by Time of Day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Morning</td>
</tr>
<tr>
<td>Afternoon</td>
</tr>
<tr>
<td>Evening</td>
</tr>
</tbody>
</table>

Table 5.8: Male Users by Time of Day

<table>
<thead>
<tr>
<th>SOPARC - Total Male Users by Time of Day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Morning</td>
</tr>
<tr>
<td>Afternoon</td>
</tr>
<tr>
<td>Evening</td>
</tr>
</tbody>
</table>

Trail use by gender during the weekday or the weekend showed a fairly significant gap between weekend and weekday use. Use between both male and female users was much higher on the weekends than during the week. The NORG shows 15 female users on the weekend and 9 female users on a weekday. The BGT shows 55 female users on the weekend
and 32 during the week and the SRT shows 28 female users on the weekend and 16 during the week (Table 5.10). Male users on the NORG showed 10 on the weekend and 6 during the week, 58 male users on the BGT on the weekend and 14 male users during the week and the SRT showed 34 male users on the weekend and 12 during the week (Table 5.11).

Table 5.10: Female Users by Day of Week

<table>
<thead>
<tr>
<th>SOPARC - Total Female Users by Day of Week</th>
<th>NORG</th>
<th>BGT</th>
<th>SRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekday</td>
<td>9</td>
<td>32</td>
<td>16</td>
</tr>
<tr>
<td>Weekend</td>
<td>15</td>
<td>55</td>
<td>28</td>
</tr>
</tbody>
</table>

Table 5.11: Male Users by Day of Week

<table>
<thead>
<tr>
<th>SOPARC - Total Male Users by Day of Week</th>
<th>NORG</th>
<th>BGT</th>
<th>SRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekday</td>
<td>6</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>Weekend</td>
<td>10</td>
<td>58</td>
<td>34</td>
</tr>
</tbody>
</table>

When use according to gender is viewed by observation point, we see that point A has the highest use on the weekend for the NORG and point B has the highest use on the weekend for the BGT and SRT (Table 5.12 and 5.13).

Table 5.12: Female Users by Day of Week and Point

<table>
<thead>
<tr>
<th>SOPARC - Total Female Users by Day of Week and Point</th>
<th>NORG A</th>
<th>NORG B</th>
<th>BGT A</th>
<th>BGT B</th>
<th>SRT A</th>
<th>SRT B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation Points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekday</td>
<td>9</td>
<td>0</td>
<td>7</td>
<td>25</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Weekend</td>
<td>13</td>
<td>2</td>
<td>11</td>
<td>44</td>
<td>9</td>
<td>19</td>
</tr>
</tbody>
</table>
Table 5.13: Male Users by Day of Week and Point

<table>
<thead>
<tr>
<th>Observation Points</th>
<th>NORG A</th>
<th>NORG B</th>
<th>BGT A</th>
<th>BGT B</th>
<th>SRT A</th>
<th>SRT B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekday</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>10</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Weekend</td>
<td>7</td>
<td>3</td>
<td>18</td>
<td>40</td>
<td>9</td>
<td>25</td>
</tr>
</tbody>
</table>

Neighborhood Characteristic Data

2010 Census data for three neighborhood characteristics was analyzed for comparison between the trails.

Population Density

Population density for all three trails was provided by the 2010 census and analyzed using GIS. The census data contained counts for occupied housing in the county. Occupied housing counts were identified within a ½ mile buffer zone of the six observation points. The area (A) for the ½ mile buffer zone radius (r) was calculated using the formula the area of a circle, \( A = \pi r^2 \). If the diameter is exactly 1 mile, then the radius is exactly 0.5 miles. Using \( A = \pi r^2 \), we find that the area is exactly 0.25(\pi) square miles. This is approximately 0.7854 square miles. Next, people per square mile (PPSM) were calculated using the occupied housing counts from GIS and then divided by the area.

Occupied housing within ½ miles of the observation points showed that when compared to each other, the NORG
has the highest density, SRT has the next highest and the BGT has the lowest density. The NORG has a density of 6,094 people per square mile (PPSM) for point A (Figure 5.1) and 7,466 PPSM for point B (Figure 5.2). The SRT has 4,793 PPSM for point A (Figure 5.3) and 5,043 PPSM for point B (Figure 5.4) and the BGT have 4,382 PPSM for point A (Figure 5.5) and 3,939 PPSM for point B (Figure 5.6), (Table 5.14).

Table 5.14: Population Density for all 6 Observation Points

<table>
<thead>
<tr>
<th>Population Density (PPSM)</th>
<th>NORG A</th>
<th>NORG B</th>
<th>SRT A</th>
<th>SRT B</th>
<th>BGT A</th>
<th>BGT B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population Density (PPSM)</td>
<td>6,094</td>
<td>7,466</td>
<td>4,793</td>
<td>5,043</td>
<td>4,382</td>
<td>3,939</td>
</tr>
</tbody>
</table>

**Connectivity**

Connectivity is defined as having continuous pedestrian infrastructure or sidewalks on the main roads or trails that lead to surrounding destinations within ½ miles of the trail observation points. For the sake of simplicity, the observation points for this study are either defined as having connectivity or not having connectivity. According to this definition, all six observation points have connectivity.
Figure 5.1 NORG Population Densities, Point A

Figure 5.2 NORG Population Densities, Point B
Figure 5.3 BGT Population Densities, Point A

Figure 5.4 BGT Population Densities, Point B
Figure 5.5 SRT Population Densities, Point A

Figure 5.6 SRT Population Densities, Point B
Chapter 6

ANALYSIS, RECOMMENDATIONS AND CONCLUSIONS

Analysis of Results

The overall use for all 3 trails was slightly different that expected based on perceptions of use with the BGT having the highest number of users instead of the SRT, the SRT having the second highest number of users instead of the BGT and the NORG having the least amount of users as expected. Use is highest during the afternoon and evening hours for all 3 trails however, when use by time of day is analyzed by observation point, the NORG has the highest use in the afternoons and evening for point A, the SRT and BGT also have higher use in the afternoons and evening but for point B. The main question being asked for this thesis is, “Are greenways with connectivity, mixed land-use and high population density used more frequently in general and by women?” There are three interesting findings in these results: 1. There appears to be an inverse relationship between population density and use. 2. Overall, female users frequented the trails more than male users. 3. When time of day and day of the week are looked at for use among men and women at each of the
observation points, women were the highest users on the NORG point A during the evenings and weekends.

Population density along with connectivity and mixed land uses appears to have little influence on use. In fact, there seems to be an inverse relationship between population density and use, the higher density locations had less trail use. The NORG, point B, has the highest population density at 7,466 PPSM, mixed land use and connectivity, which places it in a category of high use according to the literature (Deitrick and Ellis 2004; Frank and Engelke 2005; Owen et al. 2007; Vernez Moudon et al. 2006), yet it has the lowest overall use of 7 people when compared to the other 2 trails. On the other hand, the BGT, point B does have mixed land use and connectivity however, it has the lowest population density of 3,939 PPSM and the highest use at 119 users. Technically, both observation points have all 3 factors present and theoretically should have relatively high use. The BGT does fit the mold of what the literature says it should have in terms of use, relatively speaking. However, the NORG is significantly lower in use by 112 users. This could be due to negative perceptions of safety of the NORG or lack of exposure or knowledge that the trail even exists. Both BGT observation points are located near large
parks, one being a national park and a very large golf course. Their proximity to these large parks allows for a greater opportunity for exposure to users of the parks who may not have been specifically looking for the trail. The NORG on the other hand, is located in a highly populated area with a mixture of business types surround it, however the observation point of the trail itself is somewhat hidden behind Mama's Boy restaurant and appears to take a fairly quick turn into a vegetated area that looses visibility quickly, which could also speak to a perceived lack of safety.

Point A at both the NORG and SRT have high population densities, relatively speaking and connectivity however they do not have mixed land use. Yet use at these points is significantly higher than their corresponding B points. Higher use due to mixed land use implies that trails in these settings are being used as a means of transportation and not simply recreation. Since the NORG point B is located near a main street that has connectivity to the University of Georgia (UGA) campus, users may opt for the main streets that allow for a more direct route to campus than the trail. It could also be that since both of these points are located in residential locations that perhaps these points are more highly used because they are
conveniently located near there users residence. The SRT point B also had alternate routes on the trail that could be taken by users so it is possible that some users were not counted due to their use of other parts of the trail that were not being observed.

The other interesting finding from these results is that, overall, female users frequented the trails more than male users with the exception of the SRT which had 2 more men than women using the trail. For the NORG and BGT, most of that use takes place during the afternoon and evening hours. The day light during the evening hours was still fairly bright so there was not yet a need for outdoor lighting. The SRT also shows a higher preference for use in the evening but shows a slightly higher preference for morning use over the afternoon. Male users on the other hand preferred afternoon and evening use on all 3 trails. Male and female users alike prefer weekend use to weekday use for all 3 trails. Unlike a number of studies that have shown males as the largest frequenters of greenway trails, these results show a different picture. Women use these trails more than men. While the results of use by women appear to agree with Whyte’s study of public spaces being used more by women when there are higher ratios of women present, it does not agree with other studies overall.
regarding use by men vs. women. The San Francisco Bay area study on public spaces talked about women preferring spaces that emphasize filtering or mitigation of negative factors and/or psychological familiarity meaning a range of physical settings to allow for choices and comfort (Mozingo 1989). Mozingo concluded her survey of men and women by speculating that men seem to prefer “front yard” experiences where they can watch people and socialize less, while women seem to prefer “backyard” experiences where they can socialize more, watch people less and not feel as if they are on display. Whyte’s model for public spaces advocated for a connection with the street, which is the opposite of filtering or mitigating for negative factors. Looking at each observation point in light of the preferences suggested by Mozingo, all six points have some form of filtering or mitigation from traffic either through heavily vegetated borders, clusters of buildings or bridges. Perhaps this setting does translate to a safer feel, allowing women to use the trails at a higher rate than expected. In addition to the mitigation or filtering of negative factors, the SRT point B allows for a wide range of physical settings. It has several trails and paths that can be used, various seating areas with fixed and movable chairs on varying levels and places to either
gather socially with friends or to engage in recreational activities such as walking, rollerblading or biking.

When time of day and day of the week are looked at for use among men and women at each of the observation points, women were the highest users on the NORG point A during the evenings and weekends. Point A, which does not have mixed land use, should indicate that this portion of the trail would show less walking behavior or physical activity than the corresponding B point. This result stands out because according to the literature, this portion of the trail does not have all of the factors necessary for walking or physical activity to occur. My observation of the NORG point A in comparison to the NORG point B were that point A has a significantly larger vegetated buffer between the surrounding streets and the trail perhaps allowing for the negative factor of traffic to be filtered out or mitigated by the surrounding vegetation. Since this point is located in a highly residential and densely populated area, I would speculate that a number of the female users are from the surrounding neighborhoods and perhaps feel a sense of familiarity in using a public space so close to home. Mozingo's study found that both physical and psychological safety is important to women. Women did not just perceive lack of safety as having undesirables present but also in
the degree of spatial control they felt, the maintenance of territoriality, lack of crowding and degree of group control. Again, my observation of the surrounding vegetation seemed to create a more enclosed space that could give the sense of more spatial control over the surrounding space.

Limitations

Some of the limitations of this study were that users were not surveyed or interviewed for information such as their proximity to trails, their purpose for using the trail, if the trail was a means of active transport, their perceptions of safety or social processes, which can affect physical activity. The collection of data was also limited to user gender and activity at specific points on the trail, which did not track for user destinations, frequency of use or cultural differences. The sample size for this study was limited to the users during limited days of the week, times of day, time of year and seasons. A larger sample may collect data during consistent times of day and night over the course of months or even years to give a clearer picture of the use of each trail.

These findings have revealed some key information. Population density along with connectivity and mixed land use appear to have little to no influence on use. The data
also shows that women are using these trails more than men. Finally, when the two points on the NORG are compared with each other, the point having the only some of the factors believed to influence walking behavior, has the highest use in general and among women. The next chapter will discuss the implications for these findings and make recommendations for future trail design.

Conclusion

A desire to ensure that people living in urban areas have access to parks and trail systems in the communities where they live is how this work began. Greenway trails can help to accomplish this due to their far-reaching linear form that gives them the ability to reach more people and communities. Greenway trails provide a wide range of benefits in our lives and environment including recreation, mitigation of the harmful affects of urbanization, means of transportation, wildlife corridors and many other benefits.

There are many perspectives that can be considered when discussing greenway trails, that being the perspective of the researcher, the ecologist, the manager the user and others. Our focus has been from the perspective of the user and what influences that use. Research made it clear that access to trails by those in the community was not so
much the issue as who is using the trails. The literature on greenway trails showed that men tend to use trails at a much higher rate than women. Even when the demographics surrounding the trail were studied and showed more women than men living near the trail, use by men was still higher, but why? Several factors arose from the literature as factors that may influence use. Three factors in particular, connectivity, mixed land-use and high population density arose many times in tandem implying that when all three factors are present they could be indicative of walking behavior (Deitrick and Ellis 2004; Frank and Engelke 2005; Owen et al. 2007; Vernez Moudon et al. 2006).

The data revealed three interesting finds:

1. Men are not the highest users of trails for these three greenways, women are.
2. There is an inverse relationship between high population density and trail use.
3. The trail with the highest population density and lowest amount of mixed land use had higher use than the corresponding point on the same trail with higher mixed land use.

These results clearly show that elements of the neighborhood environment vs. trail environment cannot be the only factors considered when evaluating use of
greenway trails. In fact, a study of the San Francisco area that looked at factors that influence non-motorized transportation concluded that although well-connected streets, small city blocks, mixed land uses, and close proximity to retail activities were shown to induce non-motorized transport, various exogenous factors, such as topography, darkness and rainfall had far stronger influences (Cervero and Duncan 2003). When considering use by women, it is also important to account for safety, both perceived and physical as well as filtering or mitigation of negative factors and the range of physical settings that allow for choices (Luymes and Tamminga 1995; Mozingo 1989).

I would speculate that incorporating other factors such as cultural and social processes, safety, nature and the built environment into the research of greenway trail use would give more accurate information on what people want in a public spaces and what causes them to use them or not. Design frustrations and wasted resources would be greatly reduced for landscape architects, planners, researchers and developers of public spaces if they had detailed information from a more holistic approach to design. Finally, it would add to an already growing body of
information, knowledge and industry practices towards building more useable public greenway trails.

The data collection for this research was limited to one observer, so the benefit of verifying the data that was collected, with a second observer was not available. This research was also limited in time and days available and the scope of research was limited to three factors of the neighborhood environment. There are many other factors that influence trail use such as perceptions of safety, cultural differences, social processes and aesthetics that were not considered in answering this thesis question.

In looking toward the future, research could be done in a number of areas. Trail users could be surveyed for information such as distance travelled, how often they use the trail, their purpose for use and their perceptions of safety. Perhaps the perception of safety survey along with an analysis of the vegetation and lighting surrounding the trails could give a better picture of current use trends and reasons behind them. Collecting other demographic data such as race, age and type of activity will allow researchers to better address social and cultural processes that may influence use. There appeared to be a number of seniors on the Bicentennial Trail. Perhaps it was due the proximity of the trail to senior facilities or maybe
certain neighborhood characteristics that are more appealing to seniors. Research could also be done on senior use and connectivity. In other words, is there higher use by seniors when there are more alternate connecting points to trails? There are a number of ways to contribute to the ongoing discussion of greenway trail use and increase the opportunities for people and communities to engage with each other in the public spaces where they live.

**Recommendations for Future**

The findings indicated that there are many factors at work when considering greenway trail use and what influences use. However, when looking at the data that was discovered through this study, there are a couple specific design recommendations that I would make for the NORG.

The NORG has the lowest use yet the highest population density when compared to the BGT and SRT. Based on my observations, the BGT and SRT both have high exposure to potential users. Both observation points for the BGT are near large parks and golf courses so the exposure is high. Likewise, the SRT runs directly through downtown Greenville, is near a spectacular rock waterfall and is surrounded by several eateries, making it highly visible. Planners for the NORG may consider the same when planning
for future trails. The idea is to connect the existing trail to active parts of the city to allow for higher exposure. Planning a multi-use trail that passes through downtown Athens could be an option. The trail could be in the form of a pedestrian bridge overpass or protected bike and/or walking trail that safely blends in with the existing streets and sidewalks of Broad Street or Lumpkin Street.

The NORG point A has higher use than the NORG point B, which contradicts the literature on mixed land-use and use. Observation points B for both the SRT and BGT have higher use than their corresponding point A. Both trails have very different spatial arrangements of land use so it is difficult to make the connection that mixed land use in a particular arrangement would make a difference in use for the NORG. The SRT has a much denser arrangement of retail, commercial and residential establishments while the BGT has a much looser pattern of arrangement. Yet they both still have highly used trails. The NORG has a denser pattern of arrangement, similar to the SRT however, the types of establishments surrounding the NORG point B fall more into the category of automotive repair shops, car washes and business offices than the more desirable sit down eateries and the aesthetically pleasing surroundings of the rock
waterfall and highly designed and landscaped paths. Allowing establishments such as small restaurants and retail clothing shops could change the face of the area and the use of the trail.

Ultimately, it will be necessary to engage the community surrounding the NORG point B and find out what they want. The common item that both the SRT and BGT had was in their planning process. Both had a high level of community and city involvement. They both had overarching plans of what the trails would connect to. The SRT also engaged the communities surrounding the trails by distributing surveys to understand what the community wanted in a trail. To best understand the NORG point B and how to make that segment of the trail more appealing to users, will require the input of the community surrounding that portion of the trail and an overarching vision of what the trail will connect to.
References


Wekerle, Gerda R., Toronto Safe City Committee of the City of, and Toronto. 1992. A Working guide for planning and designing safer urban environments. Toronto: For copies please contact Safe City Committee, City of Toronto Planning and Development Dept.
