

GREENWAYS AND CRIME ON NEARBY PROPERTIES:
AN INVESTIGATION OF REPORTED CRIMES
ALONG THREE GREENWAYS

by

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Table of Contents

Abstract	1
Introduction	1
Literature Review	3
Studies on the effect of a greenway on crime rates	3
Studies on the perceptions of crime or crime risks.....	6
Methods	12
Research design.....	12
Step 1: Selection of study areas and control areas	13
Socioeconomic comparisons across time periods	18
Step 2: Crime data	23
Step 3: Comparison of number and location of crime incidents	25
Limitations	37
Conclusion	37
References	39
Appendix	41

List of Tables

Table 1: Literature review summary	11
Table 2: Reported crime incidents before and after completion of greenways	25
Table 3: Proportion of crimes occurring on properties within 150 meters of greenway	26

List of Figures

Figure 1: Research design	12
Figure 2: Flow chart of research procedure	13
Figure 3: Study and control areas in Chapel Hill	15
Figure 4: Change in selected socioeconomic variables in areas of interest	20
Figure 5: The kernel estimation method for analyzing point density	25
Figure 6: Density of reported crimes prior to completion of Bolin Creek Trail Phase II	28
Figure 7: Density of reported crimes after completion of Bolin Creek Trail Phase II	29
Figure 8: Density of reported crimes prior to completion of Lower Booker Creek Trail	31
Figure 9: Density of reported crimes after completion of Lower Booker Creek Trail	32
Figure 10: Density of reported crimes prior to completion of Dry Creek Trail	34
Figure 10: Density of reported crimes after completion of Dry Creek Trail	35

Abstract

During greenway planning efforts, landowners along the proposed path often voice concerns about an increase in crime due to the expectation that a greenway provides criminals with refuge and sheltered access to targets. In response to this common public perception, this study investigates the question of whether the presence of a greenway increases the risk of crime occurring on the properties adjacent to the greenway. Three greenways in Chapel Hill, North Carolina were selected for the study. Through spatial analysis in a geographic information system, crime trends in the study areas for periods before and after each greenway installation were compared to trends for the same time periods in control areas with similar socioeconomic composition. Results indicated that two out of the three greenways appeared to have no influence on the rate or location of crime. In the third case, the density of crime in the vicinity of the greenway increased after the trail opened. The study concludes that the empirical data does not fully support the existence of a relationship between greenways and crime. Due to a limited number of cases included here, this study does not attempt to establish causality. Future studies involving more observations should be able to provide more reliable results.

Introduction

As communities across the United States seek to protect environmental quality and to enhance transportation alternatives and recreational appeal, more comprehensive land use plans and transportation plans now include a greenway plan as an element. Greenways, also known as linear parks, can be defined as 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” (Little, 1990, p.1). This definition captures a spectrum of greenway types, from urban corridors primarily for human recreation to rural corridors serving conservation purposes, which may or may not include a path or trail.

While early concepts of linear parks, such as Olmstead’s “Emerald Necklace” in Boston, were embraced for the purpose of maintaining human contact with nature, today’s greenway plans state a variety of purposes. Modern objectives include: supporting safe pedestrian and bicycle transportation by linking land uses via non-motorized corridors;

enhancing recreational opportunity by linking existing parks; preserving ecological systems through retention of natural linkages; reducing flood damage by preventing development in flood plains; and removing pollutants from the water and air by maintaining vegetated land cover (Mecklenburg County Park and Recreation Department, n.d.; Durham Trails and Greenways, 1988). Supporters of greenway development also argue that green spaces within urban areas improve mental health, promote social ties among neighbors, and can be safer than inner city, barren areas, if properly designed (American Planning Association, 2003).

In the U.S., implementation of the greenway plan almost always requires cooperation and support from a number of individuals or groups who own property along the proposed path of the project. In spite of the benefits mentioned above, a local government attempting to gain easements for a specific greenway project may encounter substantial resistance from the property owners, whose cooperation the government needs. The opposing groups usually believe that a greenway threatens their personal interests. A study conducted by the Rails-to-Trails Conservancy to document the extent of rail-trail opposition states that fears about a proposed trail are similar on every project and include concerns about loss of property value, increased liability, increased risk for crime, and loss of privacy (Doherty, 1998, p. 9). The loss of property value that is related to a greenway would be the result of perception of or actual existence of the other problems.

This study investigates the question of whether the presence of a greenway increases the risk of crime occurring on the properties adjacent to the greenway by looking at empirical evidence for three greenways in Chapel Hill, North Carolina. The findings, whether positive or negative, will add to the body of knowledge from which planners and the general public can seek education on the validity of the perceptions about greenways and crime. A review of the literature reveals only a few studies on the topic that use actual crime data; most of the reviewed studies have used surveys of property owners about their perceptions and their actual experiences. While perceptions of crime are at least as important as actual occurrences, the use of crime data here provides objective evidence to corroborate or contradict the general conclusions of previous studies, whether those studies focused on perception of crime or on observed crime. Another methodological contribution of this study is the use of a geographic information system (GIS) to visualize crime patterns and establish the spatial relationship of crimes to greenways. This research design also differs from most previous studies on the subject due to the inclusion of socioeconomically matched control areas. Because this study focuses on a small number

of greenways, it will investigate the association of greenways and crime, but will refrain from asserting a causal relationship.

The next section will review the scope, method, data, and results of similar studies. The methods, results, and limitations of this study will then be explained, followed by conclusions and directions for future research.

Literature Review

The research question grew out of an assumption (based on one instance of personal observation) that one of the reasons property owners along a proposed greenway are likely to oppose the construction is their belief that the greenway will increase their risk for crime. Numerous studies and histories of greenways indeed mention this type of obstacle for greenway planning and construction (Seattle Office for Planning, 1987; The Conservation Fund and Colorado State Parks State Trails Program, 1995; Feeney, 1997; Doherty, 1998; Tracy & Morris, 1998; Crewe, 2001). A review of the literature on crime and greenways reveals that studies on the fear of crime are as numerous as studies on actual crime occurrences on greenways. Because the goal of my study is to investigate actual crime trends on the chosen greenways, I will first describe studies that have addressed the question of whether properties near a greenway do experience more crime. I will conclude with the studies that cover the related subject of perception of crime risk. Some of the studies fit into both categories. Table 1, at the end of this section, summarizes the literature review.

Studies on the effect of a greenway on crime rate

Investigations into the relationship of greenways and crime rates vary in their methodology. A few studies look at police records, but more often the research relies on surveys of residents and/or trail managers and law enforcement professionals about their experiences with the greenway in question. Very few studies on the specific topic of greenways and crime have come from the academic realm, or from other parties whom one could expect to be unbiased.

One recent academic study, investigating the crime impact of a greenway in the Boston area, found that police calls were marginally more frequent for houses next to the greenway corridor than for houses farther away, but were considerably less frequent than the calls from houses next to commercial streets in the neighborhood (Crewe, 2001). A second objective of the study was to examine residents' perceptions of the greenway corridor as a safe place. Safety ratings for the greenway were higher than for the commercial streets for daylight hours, while somewhat lower than the ratings for the streets for evening hours. The specific areas of analysis were two 0.5-mile segments of the Boston South-west Corridor parkland, which had been established 15 years earlier. There had been concerns from citizens about crime during the planning of this facility. The design of the crime data portion of the study consisted of a comparison between police calls, during the 1996-1998 period, occurring within a certain buffer (based on number of households) of the greenway segment and those occurring within the general neighborhood of the segment. Crime occurring in a similarly determined buffer of a commercial street was used as an additional control for the experimental greenway buffer area. The findings revealed that both the greenway buffer and the commercial street buffer had a slightly higher number of calls per 100 households than did the neighborhood overall. Those living next to the greenway were somewhat more likely to make a police call than was the average neighborhood resident, but not as likely as those living near a busy commercial street. The study concluded that the greenway corridor had no significant impact on crime for the properties closest to it. The method for analyzing perception of safety involved telephone interviews of 111 residents who were evenly dispersed throughout the study areas and who represented the age and gender composition of the neighborhoods. To gauge respondents' standards of safety, the interviewers asked residents to compare their perception of safety on the greenway with that of two nearby commercial streets. The study area residents' perceptions of safety on the greenway segments varied greatly between daytime and nighttime usage, with a large majority in both neighborhoods stating that the greenway segment in question was "totally safe" during daylight hours. For nighttime hours, one segment received mixed ratings on safety, while the other segment was described as "not safe at all" by a large majority in that neighborhood. Although an overwhelming majority of the residents interviewed said they never use the greenway at night, the interviewees were not disturbed by the nearby presence of a dark, natural area at night. Evening usage of the greenway varied between the two neighborhood groups studied. The author concludes that differences in neighborhood population densities, greenway width, and expected

level of activity in the segments explained the difference in evening behaviors of the two groups.

An important difference between the method used in this study and that in my study will be in the control areas used. In order to eliminate the possibility that greenway effects are reaching the control properties, I compare the greenway properties to an area which is not as close to the greenway as were the control areas in this study, but which nevertheless is similar to the greenway area in socioeconomic characteristics. Furthermore, my study uses a pre-test/post-test design rather than the post-test only design used in this investigation.

In an earlier study, the Seattle Office of Planning analyzed the effect of the nine year-old Burke-Gilman Trail on property values, crime, and quality of life in adjacent neighborhoods (1987). The data was collected through telephone interviews of 110 residents near and adjacent to the trail, real estate agents who buy and sell homes near the trail, and police officers who patrol neighborhoods adjacent to the trail. The effect on property values was inconclusive using this method, but the experience of residents and police officers with crime in the adjacent neighborhoods revealed that the trail had little, if any, apparent effect on crime. According to the study, in eight years there was an average of two incidents per year (vandalism or break-ins) where a trail user may have been involved. Police officers interviewed believed that the trail does not impact vandalism and burglary rates because motor vehicles are prohibited on the trail and separation of the criminal from an escape vehicle acts as a deterrent for those types of crimes. None of the residents surveyed believed that conditions had worsened with the opening of the trail. A former trail opponent stated that the trail's impact had been much more positive than expected. Because the reports authors are part of a local government that supported trail construction, the impact of a bias in the study cannot be ruled out.

A frequently cited study on the effect of trails on safety is *Rail-trails and Safe Communities: The Experience on 372 Trails* (Tracy and Morris, 1998). This study investigated incidents occurring on rail-trails during 1995 and 1996. Methods of data collection included surveys of trail managers, letters from law enforcement agencies responding to specific questions, and telephone interviews with coordinators of voluntary and professional trail patrols. Overall, the study concludes that rail-trails are safe places. While surveys were sent to managers of all known open rail-trails (861), only 43 percent (372) of the trail managers responded. It is possible that managers of trails experiencing

problems would be less likely to respond, as they may feel the problems reflect poorly on their own job performance. Thus the sample of trails in the study may not be a good representation of actual trail experiences. The follow-up data collection addressing law enforcement agencies and patrol coordinators was directed only at those trails for which the researchers had received responses in the initial survey of managers. Crime on the trails in 1995 and 1996, based on the survey of managers, was compared to FBI Uniform Crime Report for 1995. Essentially this part of the study compares voluntary reports of trail managers to voluntary reports of law enforcement agencies across the nation. Some attempt was made to control for the type of environment; trails were categorized as urban, suburban, or rural and compared to a matching category in the FBI national data. In this study, crime rates on trails were much lower than crime rates in environments of similar urban, suburban, or rural character nationally. The use of voluntary reports only and the very rough match between the experimental areas and the control areas weakens the study's findings. Forty percent of the law enforcement agencies that were questioned via letter responded (12 agencies). The letters appear in an appendix. All of the letters deny that the trail in question has had a negative effect on crime. While some of the law enforcement professionals gave very brief narrative summaries of the numbers, others admitted that their incident reporting methods do not permit the extraction of data for the location in question, but they nevertheless provided support of trails based on general experience. Still others did not state whether their testimony is based on statistics or on general impression. None of the respondents included the actual crime data. Presumably they were not asked to do so.

The Rails to Trails Conservancy and National Park Service sponsored the study by Tracy and Morris, described above. Because the Conservancy and the Park Service both have considerable interest in the success of the trails, the study's objectivity is questionable. The study did not acknowledge the limitations mentioned above.

Studies on perceptions of crime or crime risks

It is possible that common expectations that greenways increase the risk for crime on nearby properties are based on two assumptions: (1) greenways are heavily vegetated and thus offer criminals not only access to targets but also refuge; and (2) greenways have few users and the user is of the transient, socially deviant variety. Most greenways probably do consist of some segments that are heavily vegetated, but other segments may

not be. Studies on the typical greenway user tend to describe a person who is well educated and who earns an above-average income (Furuseth and Altman, 1991; Lindsey, 1999). While socially deviant types could be expected to avoid the interviewers in these research projects, the studies do contradict the expectation that the greenway would have few socially responsible users.

Several studies explore the accuracy of the commonly held fears by investigating the attitudes of residents along trails that already exist (Minnesota Department of Natural Resources, 1980; National Park Service, 1992; Feeney, 1997). Surveys often include questions on property values, quality of life, and benefits in addition to questions about problems such as crime. The study by Crewe, described earlier, looked at residents' safety ratings of the greenway in addition to analyzing crime records (2001).

A 1980 study by Minnesota Department of Natural Resources took an interesting approach: attitudes of landowners along two proposed trails were compared with attitudes of landowners along two existing trails. The data was collected through interviews. The responses indicated that a majority of the responding landowners along the two proposed trails believed that a trail would increase vandalism and other crimes on their property, while a majority of responding landowners along the two existing trails agreed with the statement that trail users cause few problems. The total number of landowners that were interviewed along each trail was not provided in the report. The survey instruments for the proposed trail group and for the existing trail group were not identical, in part because of the status of the trails involved. However, the difference between the two instruments in the wording of the questions relating to crime perception weakens the comparison of responses between the two groups.

A study by the National Park Service, in cooperation with Pennsylvania State University, surveyed users and residents on three rail-trails in different regions of the U.S. (1992). The objectives were to explore the benefits of the trail for the surrounding communities, to examine effects on nearby property values, to determine what problems, if any, exist for trail neighbors, and to develop a profile of trail users. Methods included surveys and counts of users for a twelve-month period, mail surveys of a sample of landowners whose property bordered the trail or was within .25 miles of the trail (.5 miles in the most rural case), and telephone interviews with real estate agents. From the trail users, 1,705 usable surveys were obtained; from landowners, 663 were usable. Regarding problems with the trail, the majority of landowners stated that there was no increase in the number of

problems since the opening of the trail and that living near the trail was better than had been expected and also better than living near the unused railroad. The types of problems that a minority of property owners mentioned were unleashed or roaming pets, illegal motor vehicle use, and litter on or near the trail.

In 1995 a graduate student at the University of North Carolina at Chapel Hill investigated the perceptions and experiences of residents along three greenways in Cary, N.C. (Tedder, 1995). A survey was mailed to 145 households and 109 responses were received and used in the study (75%). Regarding the occurrence of problems associated with the greenways, the highest percentage of respondents reported no problems (36%). Those problems most frequently indicated in the responses were trespassing (27%), noise (24%), roaming pets (23%), and loss of privacy (21%). Of the more serious problems, nine percent indicated vandalism as a problem and two percent indicated burglary. The study concluded that greenways do not generate significant problems for adjacent residents, and that fears about greenways are unsubstantiated.

A 1997 study of the Mohawk-Hudson Hike-Bike Trail focused on the perceptions of landowners along the existing trail (Feeney, 1997). This trail had been constructed in the 1970s and early 1980s along an old canal towpath and railroad grades. For the study, data was collected through a survey of the landowners, which covered the following topics: satisfaction with the trail as a neighbor; perceptions of impacts on property values; perceptions of safety and possible problems; and perceptions of the benefits to the community. Results revealed that 75.9 percent of responding landowners (n=215) believed that the trail does not pose a risk to their family's safety. Majorities of the landowners also reported no problems with vandalism (68 percent) or with burglary (76 percent). The most commonly reported problem was litter (14 percent stated as major problem), but even in this category, the average response was that it was not a problem. In the study's conclusion the author acknowledged that impacts of a trail on the adjacent properties depend in part on circumstances, but also stated that the typical fears associated with proposed trails, such as increased crime, noise, loss of privacy, and decreased property values, are not supported by this study. The Schenectady County Department of Planning sponsored this study, however, and they may have an inherent bias on the subject due to the local government's probable involvement in the construction of the public trail.

Some studies have investigated fear of crime not in relation to greenways specifically, but in relation to certain physical attributes. An awareness of the attributes that contribute to such fear is important in understanding at least some of the reasons why many people continue to associate greenways with crime, in spite of the results of studies using empirical data and studies on the attitudes of landowners on existing greenways.

One study investigated a theoretical relationship between exterior site features (specifically prospect, refuge, and escape) and fear of crime (Nasar and Fisher, 1992). The authors combine the characteristics systematically to create a typology of places that are either “most safe,” “moderately safe,” or “most unsafe.” (High Prospect/Low Refuge is the most safe combination, while at the other extreme, Low Prospect/High Refuge creates the most unsafe type of place. Other combinations create moderately safe places.) Escape correlates with prospect. Two different methods were used to uncover fear of crime at a particular building site on a college campus: (1) an in-person survey, including a site map, conducted at various locations near the site, and (2) interviews with females after dark at the site in question. (The second part of the study focused on the perceptions of females because the earlier survey had revealed, not surprisingly, that women were more sensitive to the relationship between environmental characteristics and perception of safety.) Eight different locations at the site, representing a range of typologies, were rated for perceived safety. Results support the theory that areas with refuge for an offender and limited prospect for the victim contribute to fear of crime. Of interest is the fact that, while areas perceived as unsafe received consistent scores between the two study methods, the safer-seeming areas received significantly more favorable scores in the on-site method than in the site map method. Although the two methods did not collect perceptions from the same group of people, this finding suggests that an environment previously imagined to be only moderately safe may seem even safer when actually experienced.

Most likely the image of greenways that many citizens carry in their heads would fall into Nasar’s and Fisher’s Low Prospect/High Refuge category that describes the type of place perceived as least safe. Thus the fear of crime with respect to proposed greenways persists, even if empirical data from other greenway projects do not support the perception. In actuality many greenways likely include a variety of place types that fit different categories of Nasar and Fisher’s typology. One may feel safe in some areas of the greenway and at risk in others.

Although vegetation on greenways may provide the amount of refuge that corresponds to increased fear of crime, one study on the link between vegetation in an urban residential areas and *actual crime* in the area reveals a negative relationship (Kuo and Sullivan, 2001). In this study, the authors compared two years' worth of crime reports for 98 apartment buildings in a public housing development in Chicago, which had differing levels of vegetation. Their hypothesis was that vegetation that preserves visibility does not promote crime. The use of the public housing development provided built-in control for architectural style, building size, socioeconomic characteristics of the residents, and level of building and landscape maintenance. Also the housing authority's assignment procedure for residents in the complex was random, which theoretically eliminated a correlation between levels of vegetation and characteristics of residents. The 98 apartment buildings that were included in the study provided a range of vegetation levels, but where present, the vegetation consisted of grass and widely spaced, high-canopy trees. Results showed that the greener a building's surroundings are, the fewer crimes. (The relationship was consistent whether comparing vegetation levels to total crimes, property crimes, or violent crimes.) However, unlike this public housing campus, greenways usually include some areas with shrubbery and low-canopy trees. Thus studies of greenways and crime cannot necessarily be expected to show that greenways reduce crime.

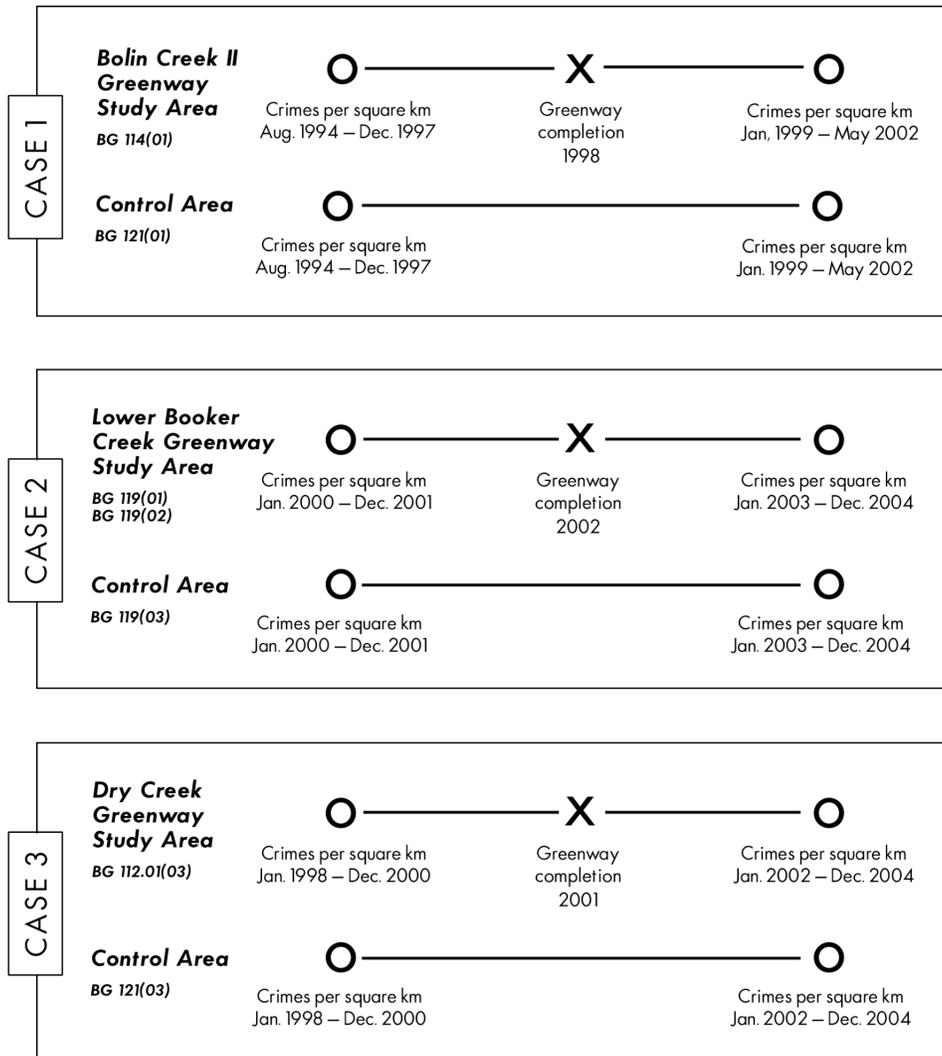
Table 1: Literature Review Summary					
	TOPIC		DATA		FINDINGS
	Crime Occurrences	Perception of Safety	Crime Records	Surveys or Interviews	
Minnesota DNR, 1980 – two existing trails vs. two proposed trails		✓		✓	Landowners along the existing trails are much less likely than landowners along the proposed trails to believe that the trail does or will present a crime risk.
Seattle Office of Planning, 1987 – one existing trail	✓	✓		✓	Over a span of eight years, an average of 2 incidents per year (vandalism or burglary) along the 12-mile trail may have involved a trail user. The majority of residents state that the trail adds to their quality of life.
Nasar & Fisher, 1992 – fear of crime in different types of exterior settings		✓		✓	Areas with high “refuge” and low “prospect” characteristics instill the most fear when compared to areas with other combinations of these attributes.
NPS, 1992 – three existing rail-trails		✓		✓	A majority of landowners stated that there was no increase in the number of problems since the opening of the trail.
Tedder, 1995 – three existing trails		✓		✓	The highest percentage of respondents reported no problems (36%). Those problems most frequently indicated in the responses were trespassing, noise, roaming pets, and loss of privacy, although none was mentioned by more than 27% of respondents.
Feeney, 1997 – one existing trail		✓		✓	Over three quarters of landowners along the 35-mile Mohawk-Hudson Trail believe that the trail does not pose a risk for their family member’ safety. A wide majority also reports no problems with property crimes.
Tracy & Morris, 1998 – 372 existing rail-trails	✓		✓	✓	Based on the voluntary reports from trail managers and from the FBI’s UCR database, crime rates on trails were much lower than rates in other general environments of similar urban, suburban, or rural character.
Crewe, 2001 – two segments on an existing greenway	✓	✓	✓	✓	Those living next to the greenway were somewhat more likely to make a police call than was the average neighborhood resident, but not as likely as those living near a commercial street. A large majority of residents in both neighborhoods perceive the greenway as being “totally safe” during the day. Perceptions about evening safety on the greenway were mixed for one segment and were stated as “not safe at all” for the other segment. Respondents were not disturbed to be living near the greenway.
Kuo & Sullivan, 2001 – 98 existing apartment buildings	✓		✓		The more vegetation surrounding the apartment building the fewer crimes reported for the building. Vegetation consisted of trees with high canopies and grass.

Methods

Research Design

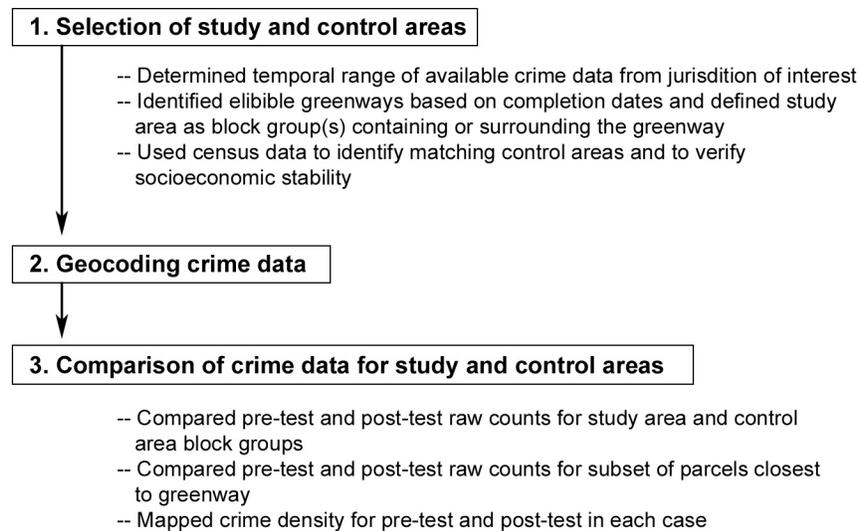
In this study, change in crime events over time on properties adjacent to three greenways was compared with change in crime events over time on properties in three matched control areas with similar socioeconomic characteristics. The study compares change in two different ways: through a quantitative comparison of crime rates and through inspection of the intensity of point data using kernel density analysis in a GIS. Figure 1 illustrates the research design.

Figure 1: Research design



The flow chart in Figure 2 illustrates the process followed in conducting the study.

Figure 2: Flow chart of research procedure



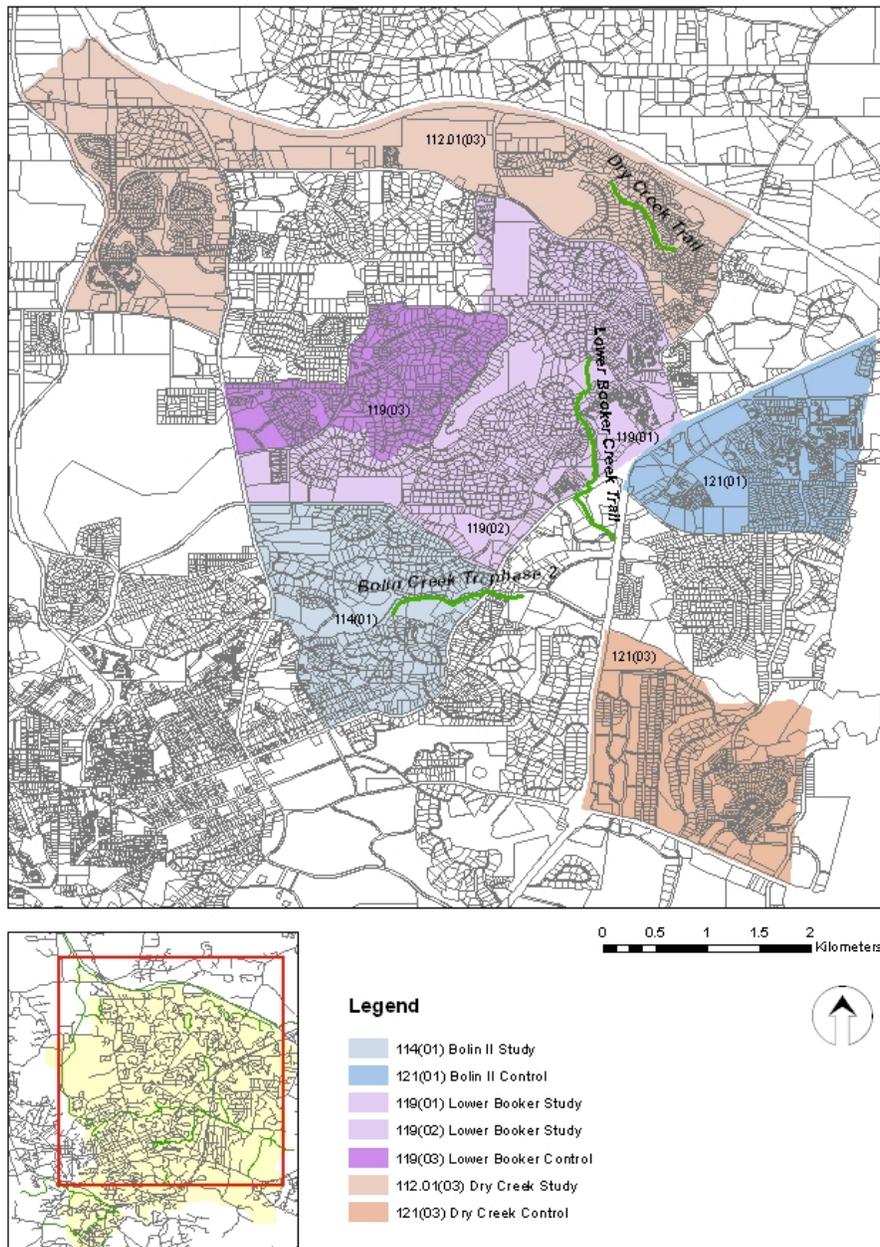
Step 1: Selection of Study Areas and Control Areas

Due to the author's access to the necessary GIS data for the Chapel Hill area, the Town of Chapel Hill was selected as the police jurisdiction of interest¹. The choice of specific greenways in Chapel Hill was limited by the range of years for which the police department could provide crime records with addresses. The data covered late July 22, 1994 through December 31, 2004. Three greenways in Chapel Hill were completed in years that allowed study of before and after time periods of at least two years in duration. These were: Bolin Creek Trail Phase II, completed in 1998; Lower Booker Creek Trail, completed in 2002; and Dry Creek Trail, completed in 2001.

¹ Originally I intended to compare the crime impacts of a greenway in an area of relatively low crime rates with the impacts of a greenway in an area with relatively high crime rates. Chapel Hill would be the location of the low-crime greenway case. The first greenway chosen to be the high-crime case (in Charlotte, N.C.) had to be ruled out because I discovered that the greenway of interest had been completed too recently (2004) to be able to analyze greenway effects. I then determined that a greenway in Durham, N.C., completed in 2000, provided a case of differing socioeconomic characteristics on each side of the greenway. However, the Durham Police Department advised against using their crime data for time periods prior to 2000 because of data quality issues. Therefore, in the interest of timely completion of the study, it was decided that all cases would be in Chapel Hill. This adaptation made greater use of the data already requested from the Chapel Hill Police Department.

Because of the need to control for other neighborhood changes that may affect crime rates and locations, socioeconomic stability of the study areas, as well as the control areas, were assessed through the use of U.S. Census data from 1990 and 2000. The geographic level at which the chosen indicators were available dictated that the study areas and control areas be Census block groups. The block group data for both 1990 and 2000 were based on the Census 2000 boundaries. Median household income, from the 2000 Census, was the primary variable used to identify matching control areas for each greenway study area. Block groups that contained other greenways were eliminated as candidates for control areas. Other variables, in addition to median household income, were used to assess socioeconomic change in the study and control areas between pre-greenway and post-greenway time periods. These were median value of owner-occupied units, median gross rent, owner-occupancy rates, and vacancy rates. Refer to the appendix for the relevant 1990 and 2000 Census data for all study areas and control areas, as well as for the Town of Chapel Hill. The assumption is that the crime rate in an area would vary inversely with each of these variables, except for the vacancy rate. In order to isolate the effect of the greenway on crime rates and locations within the study and control areas, socioeconomic status of each area should show relative stability across the time periods of interest. Figure 3 below shows the location of all study areas, control areas, and greenways of interest.

Figure 3: Study areas and control areas in Chapel Hill



As the map shows, portions of the Bolin Creek Trail Phase II and the Lower Booker Creek Trail extend beyond the boundaries of the selected study areas. In each case, those portions of the trail share a right-of-way with a street or parking lot. Because the impact of the trail on crime in those segments would be indistinguishable from the impact of a street or parking lot, the addition of another block group to each study area would merely increase the geographic area of analysis without providing additional insight for the research question. Therefore the study areas were limited to the block groups shown.

BOLIN CREEK PHASE II STUDY AND CONTROL AREAS

The Bolin Creek Trail Phase II is a paved greenway contained within Census 2000 block group 01 in tract 114, hereafter referred to as BG 114(01). This area is predominantly residential, with some commercial establishments bordering the greenway as it nears its intersection with E. Franklin Street. Along most of the greenway, wooded areas separate the greenway from the developed portion of the parcels. An exception is a large, flat parcel containing an apartment complex at the west end of the greenway where it meets the Phase I section. Based on 1999 median household income, block group 01 in tract 121 was chosen as the control area for the Bolin Creek study area. The median household income in BG 121(01), reported in the 2000 Census, was \$49,213, compared to \$52,986 for the Bolin Creek Trail Phase II study area². The control area is largely residential, but also contains an elementary school and an American Legion property, as well as commercial properties along Highway 15-501 North. Like the Bolin Creek area, the residential uses consist of both single family and multi-family uses.

Bolin Creek Trail Phase II

² Block group 03 in tract 119 had the closest median household income (\$53,750), relative to the Bolin Creek study area [BG 114(01)], but this value was also most similar to the Lower Booker Creek study areas' [BG 119 (01) and (02)] median household incomes. BG 119(03) was assigned as a control area for Lower Booker Creek because Bolin Creek and its second best match on median household income were closer in value than Lower Booker Creek and its second best match.

LOWER BOOKER CREEK STUDY AND CONTROL AREAS

The Lower Booker Creek Trail is a 0.26-kilometer, paved greenway that follows the creek for part of its length. The creek serves as part of the boundary between block groups 01 and 02 in tract 119. Therefore, as is evident in the map above, this study area is rather large. The majority of the land area contains single-family residences, although apartment complexes, an elementary school, a middle school, a library, a lake, and a park also exist in these two block groups. The area includes business establishments along E. Franklin Street. The greenway itself borders only residential and commercial uses. The control area selected for comparison to the Lower Booker Creek study area was block group 03 of the same tract (119). It contains mostly single-family residences, but a few multi-family uses also exist. A church is the only institutional use and, unlike the study area, there are no commercial uses. The median household incomes in 1999 for BG 119(01) and BG 119(02) in the study area were \$54,727 and \$54,625 respectively. The median household income in 1999 for the control area was \$53,750.

Lower Booker Creek Trail



DRY CREEK STUDY AND CONTROL AREAS

The Dry Creek Trail is an unpaved, 0.23-kilometer greenway totally contained within block group 03 of Census tract 112.01. Unfortunately for the purposes of this study, this block group is very large and sprawling, while the greenway itself borders only a few properties in the eastern part of the block group. Thus some

Dry Creek Trail



areas quite far from the greenway are included in the greenway study area. The block group contains single-family residences, multi-family residences, a retirement complex, a high school, and some office uses. However, only single-family residences border the greenway itself. Unlike the Bolin Creek Trail and Lower Booker Trail, Dry Creek Trail is not paved. The control area chosen for BG 112.01(03) was BG 121(3). At the time of the 2000 Census, this area included single-family residences and multi-family residences. Shortly after 2000, a mixed-use development was built, which, besides single-family and multi-family residences, includes an elementary school, retail uses, and office uses. The median household incomes in 1999 for the Dry Creek study area and control area were \$40,833 and \$40,700 respectively.



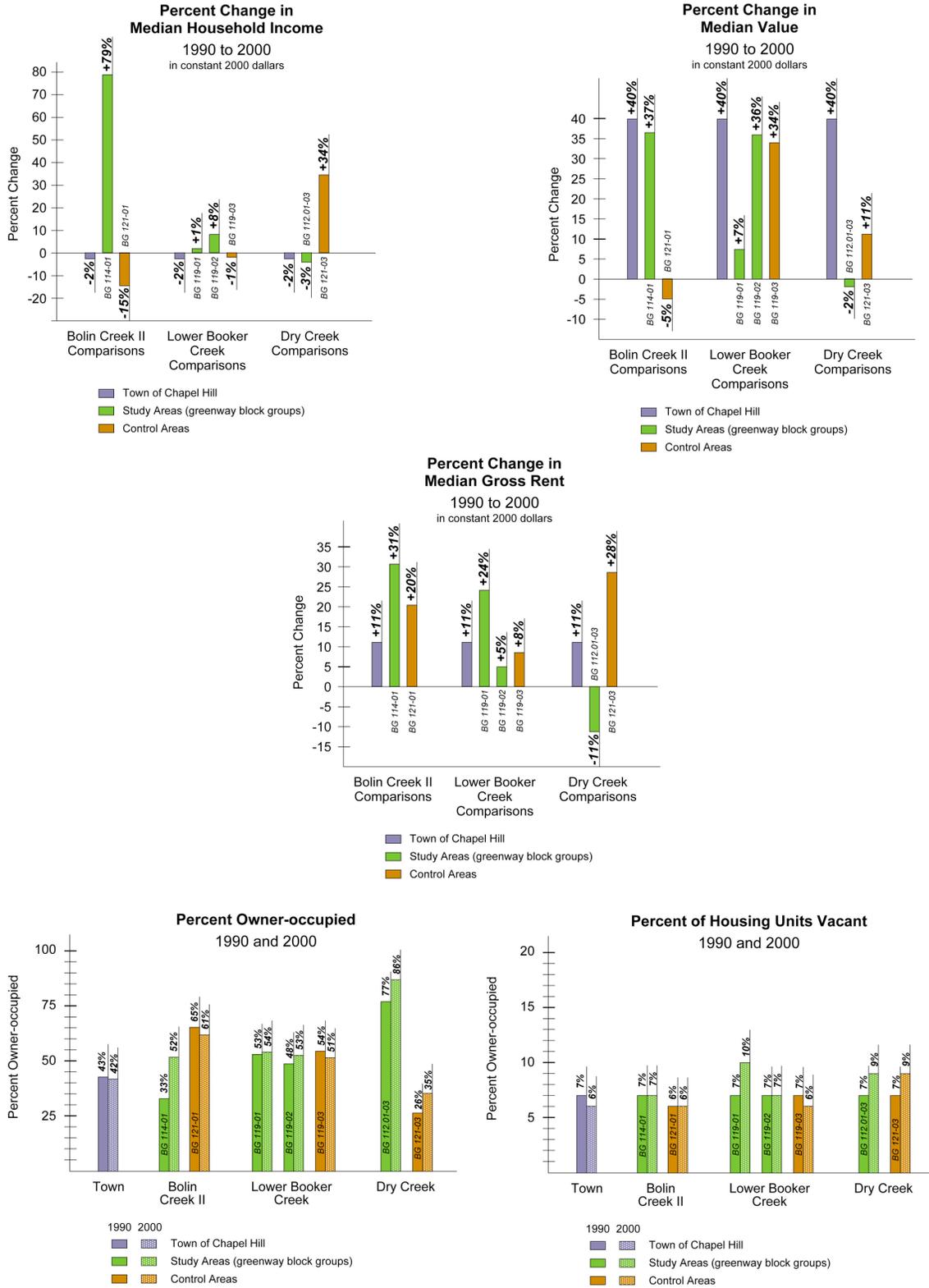
Socioeconomic comparisons across time periods

Although the time period spanned by the crime data used in this study is mid-1994 through the end of 2004, the only method for assessing socioeconomic change in the areas of interest was through comparison of 1990 Census data and 2000 Census data. Lower Booker Creek Trail and Dry Creek Trail were completed shortly after 2000. Thus the pre-greenway socioeconomic conditions of the areas in these cases were best represented in the 2000 Census data rather than in the 1990 data. The post-greenway socioeconomic conditions of the relevant areas were essentially unknown in these cases. However, if the areas appeared stable during the ten years between 1990 and 2000, we assumed that they were also stable during the four years after 2000.

The amount of change was measured as a percent of change in median household income, median value of owner-occupied units, and median gross rent. Actual differences in rates of tenure and vacancy were additional indicators of change or stability. Figure 4 below illustrates the levels of socioeconomic change in each area. As mentioned above,

all Census figures used in calculating percent increases are shown in Table 1 in the appendix. Monetary values for 1990 were adjusted to control for inflation before comparing with the values for 2000. Comparison of the percent change in each area with the percent change for the town overall was the means for assessing the relative stability of each area.

Figure 4: Change in selected socioeconomic variables in areas of interest, 1990 to 2000.



Data sources: U.S. Census 1990 and U.S. Census 2000

SOCIOECONOMIC CHANGE IN BOLIN CREEK STUDY AND CONTROL AREAS

Of all the matched pairs of block groups in this study, the study area and control area selected for the Bolin Creek Trail Phase II case were the most problematic with regard to control of the socioeconomic variables expected to impact crime. The chosen indicators for stability show mixed results.

The data show that the Bolin Creek Trail Phase II study area experienced an unusually large increase in median household income between 1990 and 2000, compared to the town overall and to the control area. Thus, although the study area and control area had similar values for median household income in 2000, the study area had a much lower median household income in 1990 than did the control area (\$26,683 versus \$58,025, in constant 1999 dollars). The large increase in median household income for the Bolin Creek study area may have been the result of an increase in the percentage of units in the area that were owner-occupied. Median value of owner-occupied units in this area increased by almost the same percentage as median value of owner-occupied units in the town overall. However, median gross rent in the Bolin Creek study area showed a greater than expected increase between 1990 and 2000, relative to median gross rent in the town overall. Vacancy status was stable in the Bolin Creek study area. Looking at all five indicators of stability, one may conclude that the type people living in this particular study area changed substantially during the ten-year period but that the investment in properties was relatively stable. Because this study area is very close to the campus of UNC-Chapel Hill, it is probable that a greater proportion of residents in this block group in 1990 were students, which resulted in a low median household income, compared to the town overall. In fact, Census data from 1990 and 2000 show that the percentage of residents living in non-institutional group quarters (which includes off campus dormitories) was 14.7 percent in 1990, compared to 5.4 percent in 2000. Although the reported income of university students naturally would be low, the socioeconomic background of college students may not have been substantially different from the additional homeowners living in the area in 2000. An additional caveat is that, because the greenway was completed in 1998 and the period in which the crime data was analyzed ranges only from mid-1994 through 2002, actual socioeconomic changes occurring in the 7 ½ -year time period may have been somewhat less substantial than the change that the Census showed over a ten-year period. To summarize, the stability of the Bolin Creek Trail study area is difficult to determine. However, because of the

explanations above, the greenway was nevertheless included in the study. Observed changes in crime rates and locations must be cautiously interpreted.

The inflation-adjusted median household income in the Bolin Creek control area decreased from 1990 to 2000, as did the median for the town overall (by 15% and 2% respectively). While the change in this area on that indicator did not vary as greatly from the change for the town as the study area does, the control area's decrease in median value of owner-occupied units was a marked difference from the large increases for the study area and town. Median gross rent, owner-occupancy rate, and vacancy rate appeared relatively stable for the control area. Thus, as with the study area in this case, temporal stability is difficult to assess. However, because Chapel Hill is relatively small in geographic size, and because several block groups had to be eliminated as control candidates due to the presence of other greenways, BG 121(01) remained the control area for the Bolin Creek Trail study area.

SOCIOECONOMIC CHANGE IN LOWER BOOKER CREEK STUDY AND CONTROL AREAS

The median household income in the block groups selected for the Lower Booker Creek Trail case varied similarly with that of the town overall between 1990 and 2000. The block group showing the greatest variance from the town's increase was BG 119(02), which makes up half of the Lower Booker study area. Median household income increased by eight percent compared to the decrease of two percent for the town. The other half of the study area, BG 119(01), varied the most from the town norm on change in median value of owner-occupied units (an increase of seven percent compared to the town's 40 percent increase) and on change in median gross rent (13 percentage points higher than the town's percent increase). This block group also showed a greater increase in the vacancy rate between 1990 and 2000. Owner-occupancy was stable in all areas selected for in this case. Because at least half of the study area was relatively stable on each indicator, compared to the town overall, the Bolin Creek Trail remained in the study. The control area in this case was relatively stable across all five indicators between 1990 and 2000.

SOCIOECONOMIC CHANGE IN DRY CREEK STUDY AND CONTROL AREAS

Percent change in median household income for the study area between 1990 and 2000 was quite close to the percent change for the town overall (three percent decrease and two

percent decrease respectively, after adjusting for inflation). Changes in other indicators were not as similar. Median value of owner-occupied units decreased slightly in the study area (by two percent) while increasing by 40 percent in the town overall. Median gross rent decreased in the study area as much as it increased in the town (by eleven percent). The control area showed much more change in median household income than did the town (increasing by 34 percent versus the decrease of two percent for the town). Although median value of owner-occupied units increased in both the control area and the town, the former showed only an eleven percent increase versus the town's 40 percent increase. The control area's change in median gross rent was greater than the change that the town overall experienced on this variable (28 percent increase versus eleven percent increase). Owner occupancy rates and vacancy rates in the Dry Creek study and control areas changed more than the town's rates, but were not substantially different. The owner-occupancy rate increased a modest nine percentage points in both the study and control area, versus the town's decrease of only one percentage point. Change in the vacancy rate in the study and control areas was negligible between 1990 and 2000, as it also was for the town overall. Because the median household income in the Dry Creek study area showed almost the same negligible amount of change that the town overall showed, the study area was considered socioeconomically stable enough to be included in the study. Based on the chosen indicators, the control area was less stable, relative to the town, than would be desired ideally. However, given the small supply of control block group candidates in the police jurisdiction, BG 121(03) remained the in the study as the best control for BG 112.01(03).

Step 2: Crime Data

The Chapel Hill Police Department provided street addresses for all incidents of homicide, forcible rape, robbery, aggravated assault, burglary, larceny, motor vehicle theft, vandalism and drug arrests, from mid-July of 1994 through December of 2004. Earlier data were not available in electronic form. The total number of incidents was 35,230.

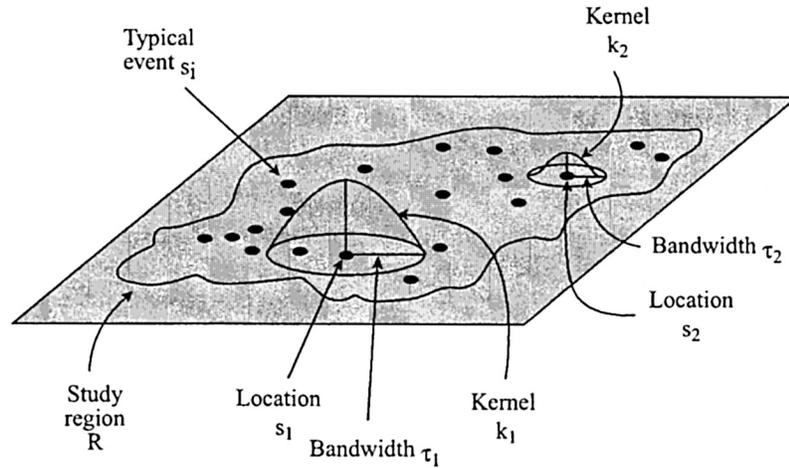
In preparation for geocoding, the addresses were standardized using ESRI's ArcToolbox address standardization script. To improve the geocoding match rate, data for city and state were added for each incident, after confirming with the police department that all

incidents were in Chapel Hill. The US Streets centerline shapefile, from ESRI, was the reference data for geocoding. To avoid basing conclusions on inaccurate spatial assignments of the crime data, incidents having tied address matches during the automated geocoding process were left unmatched. Sixty-seven percent of the crime incidents were successfully matched with addresses in the street reference file.

Change in the number of reported crimes per square kilometer was compared between study areas and control areas. Additionally the proportions of crimes in the study areas occurring on parcels having their centers within 150 meters of the greenway were compared for the before and after time periods. Finally, kernel density analysis provided results for the locations of crime clusters, or “hotspots.”

The kernel analysis comparison method allows a more meaningful visual inspection of point data in cases where many points are overlapping and therefore are difficult to interpret if simply “eyeballing” point distribution. Large amounts of point data on a map can be merely confusing. Furthermore, simple visual interpretation of the map is inadequate because the human mind is conditioned to find meaning and identify patterns and clusters, even when the data represented may be purely random (Anselin, Cohen, Cook, Gorr & Tita, 2000). In kernel estimation, a smooth estimate of the intensity of point data is derived by moving a circular window over the data. Figure 3 illustrates how kernel estimation works. The resulting map shows not the points themselves but varying levels of intensity. The radius, or “bandwidth,” of the circular window ideally should be based on the actual distance between points in the sample (Anselin et al, 2000). Specifically, the bandwidth should be one half of the average distance between all points (Fontaine and Smith, forthcoming). In this study, an appropriate bandwidth was determined separately for each case by using one half of the average distance between all crime points located in each greenway study area, rather than all crime points in the entire jurisdiction. The resulting smaller bandwidths provided kernel density maps that showed a greater sensitivity to clustering than maps created from using the bandwidth based on one half of the average distance between all crime points in the entire jurisdiction. For each case, the density level categories were defined by natural breaks (jenks) in the pre-test analysis and these same breaks were applied to the categories in the matching post-test map.

Figure 5: The kernel estimation method for analyzing point density



Source: Adapted by Anselin et al. (2000), from Bailey and Gatrell (1995).

Step 3: Comparison of number and location of crime incidents

Findings were mixed across the three cases, with two of the study areas faring worse than their control areas on change in crimes per square kilometer. Table 2 shows the results of raw counts. The number of crimes should not be compared across cases, as the time periods are different for each case. The Bolin Creek case was the only one in which the study area compared favorably to the control area. In the Lower Booker Creek case, the study area experienced a decrease in crime after the greenway was completed, but the control area saw an even greater decrease. Crimes per square kilometer in the Dry Creek study area increased after the trail opened, while the control area showed a reduction in crimes per square kilometer.

Table 2: Reported crime incidents before and after completion of greenways						
	STUDY AREAS			CONTROL AREAS		
	Period 1	Period 2	%Δ	Period 1	Period 2	%Δ
Bolin II	218	244		221	277	
per sq km	80	90	+11.9	95	119	+25.3
Lower Booker	381	344		108	78	
per sq km	75	68	-9.7	60	44	-27.8
Dry	183	337		95	80	
per sq km	30	56	+84.2	36	30	-15.8

Because the study areas are much bigger than the group of properties that actually touch each greenway, the change in the proportion of crimes occurring on parcels within 150 meters of the greenway was also examined. Table 3 summarizes these calculations. This method of analysis presented a different picture; the Bolin Creek case was the only one in which the properties near the greenway contain a higher proportion of the study area's crimes after the greenway was completed, implying a possible negative impact from the greenway's presence.

	BEFORE			AFTER		
	In Block Group	In Buffer Parcels	Proportion in Buffer	In Block Group	In Buffer Parcels	Proportion in Buffer
Bolin II	218	15	6.9%	244	32	13.1%
Lower Booker	381	344	12.3%	344	78	9.6%
Dry	183	10	5.5%	337	13	3.9%

CRIME CHANGE IN BOLIN CREEK STUDY AND CONTROL AREAS

In the Bolin Creek study area, there were 80 incidents per square kilometer reported during a 3.5-year period before Bolin Creek Greenway Phase II was completed (August, 1994 through December, 1997). In the 3.5-year period after the greenway opening, 90 crimes per square kilometer were reported, an increase of 12 percent (January 1999 through May 2002). However, during these same time periods, incidents per square kilometer in the Bolin control area increased even more, from 221 to 277, or 25 percent. Based on the analysis of socioeconomic data from 1990 and 2000, one might expect the number of crimes in the Bolin study area to decrease between period one and period two, as all of the selected socioeconomic variables showed positive change for this area (refer to Figure 4). Although the control area had a similar median household income to the study area in 2000, the negative change seen in some of the socioeconomic indicators in this area between 1990 and 2000 would be expected to correlate with an increase in crime, which indeed is evident between the periods examined. Considering the crime data and socioeconomic indicators together, a possible conclusion is that socioeconomic improvement in the Bolin Creek study area counteracted a portion of the greenway's possible negative impact, which prevented the increasing crime rate in the study area from matching that in the control area. Examination of the proportion of crime occurring on the parcels closer to the greenway showed that in fact a higher proportion of the crime

occurred on the nearby parcels after the greenway was completed. This evidence supports but does not prove that the greenway influenced crime on nearby properties.

The kernel density analysis allowed us to visually examine clustering of the point data. Figures 5 and 6 show the density levels geographically in the pre-greenway and post-greenway time periods for the Bolin Creek II case. Darker areas on the map indicate a higher than expected intensity, relative to the average point distance in the study area.

Figure 6: Density of reported crimes prior to completion of the Bolin Creek Trail Phase II (dedicated in 1998)

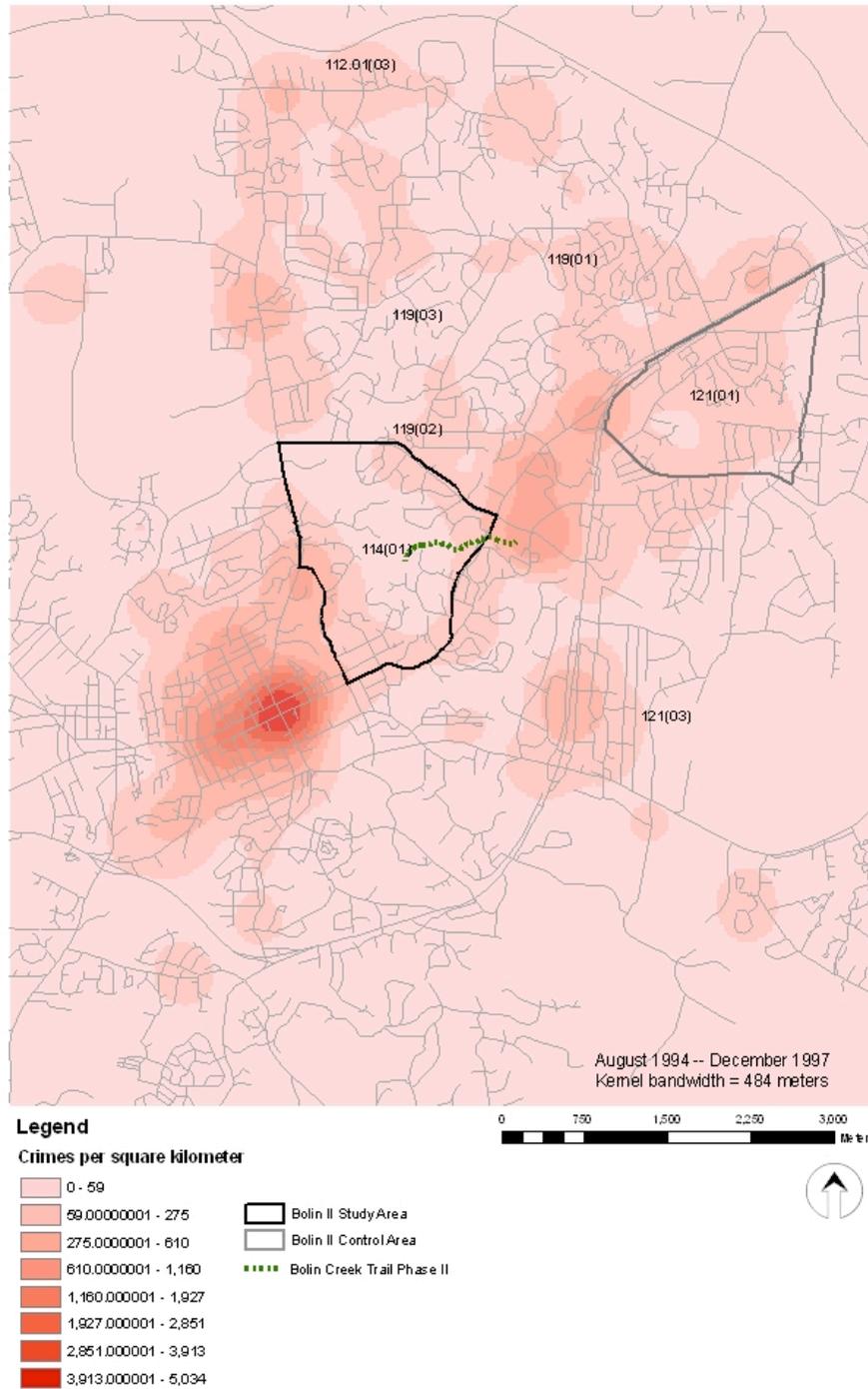
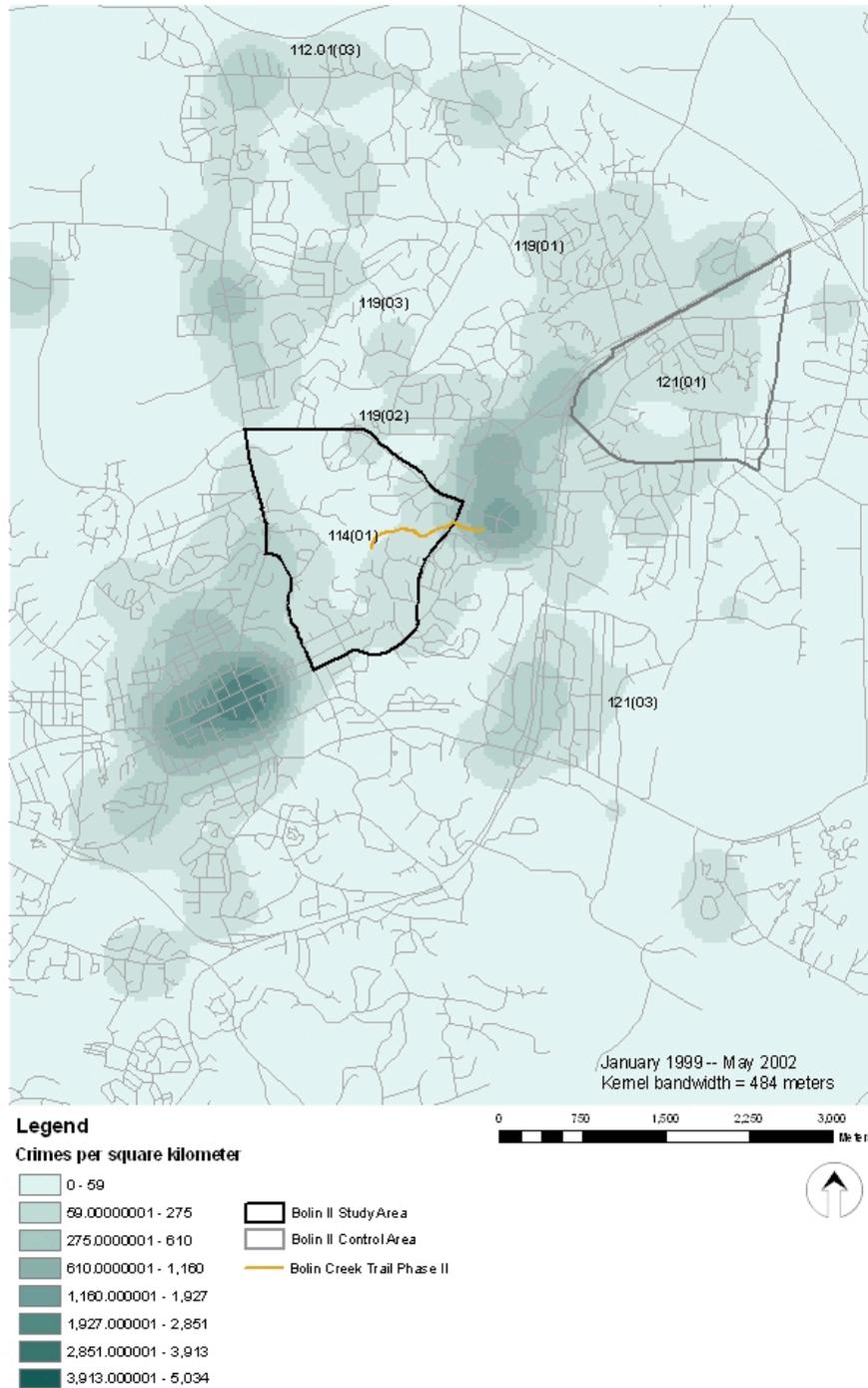


Figure 7: Density of reported crimes after completion of Bolin Creek Trail Phase II (dedicated in 1998)



The density analysis showed that the clustering pattern in the study area changed more than the pattern in the control area. Specifically, the area immediately south of Phase II of the Bolin Creek Trail increased in intensity of crime incidents.

CRIME CHANGE IN LOWER BOOKER CREEK STUDY AND CONTROL AREAS

In the two-year period prior to completion of the Lower Booker Creek Trail (January, 2000 through December, 2001), there were 75 incidents of crime per square kilometer. (Refer to Table 2 on page 25.) Following completion of the trail, there were 68 incidents per square kilometer in a two-year period (January 2003 through December 2004), which was a ten percent decrease. However, the control area experienced a 27 percent decrease during this same period, from 60 crimes per square kilometer to 44 crimes per square kilometer. Thus, although the Lower Booker Creek Trail did not increase the crime rate in the surrounding area, crime may have fallen more had the trail not been present. However, the examination of incidents occurring on the parcels within 150 meters of the trail does not support that conclusion. The proportion of incidents in the study area that this trail buffer captured decreased from 12 percent to 10 percent after the trail was completed (see Table 3), indicating that the crime rate for the buffer decreased even more than for the overall study area. The socioeconomic status of both the study area and the control area had been relatively stable between 1990 and 2000. Although the pre-test and post-test periods both follow the most recent census, the amount of socioeconomic change in the study area and control area between periods is unlikely to have been great enough to impact crime either positively or negatively.

The kernel density analysis shows graphically how the study area and control area compared both before and after the trail was completed. See Figures 7 and 8 below.

Figure 8: Density of reported crimes prior to completion of the Lower Booker Creek Trail (dedicated in 2002).

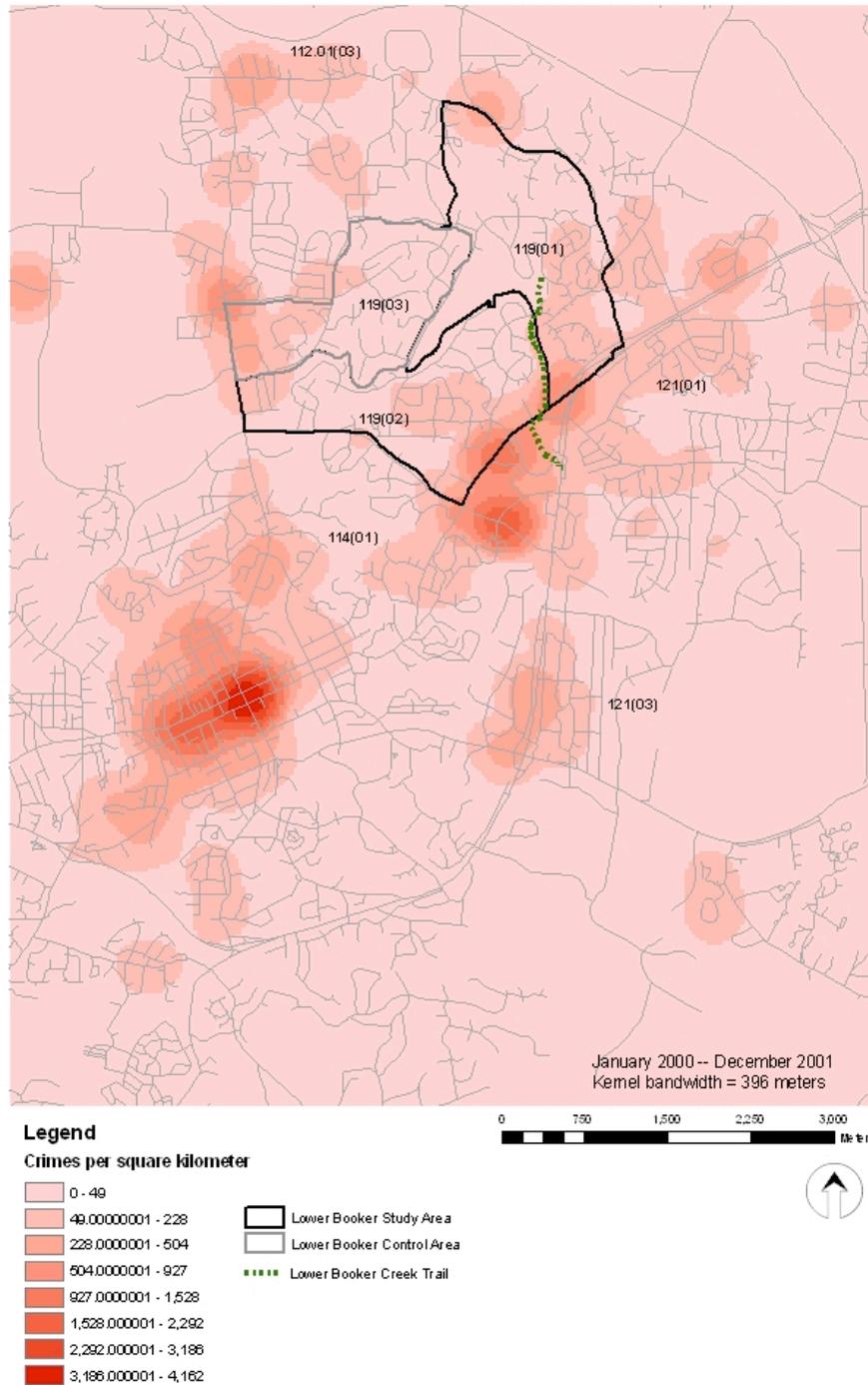
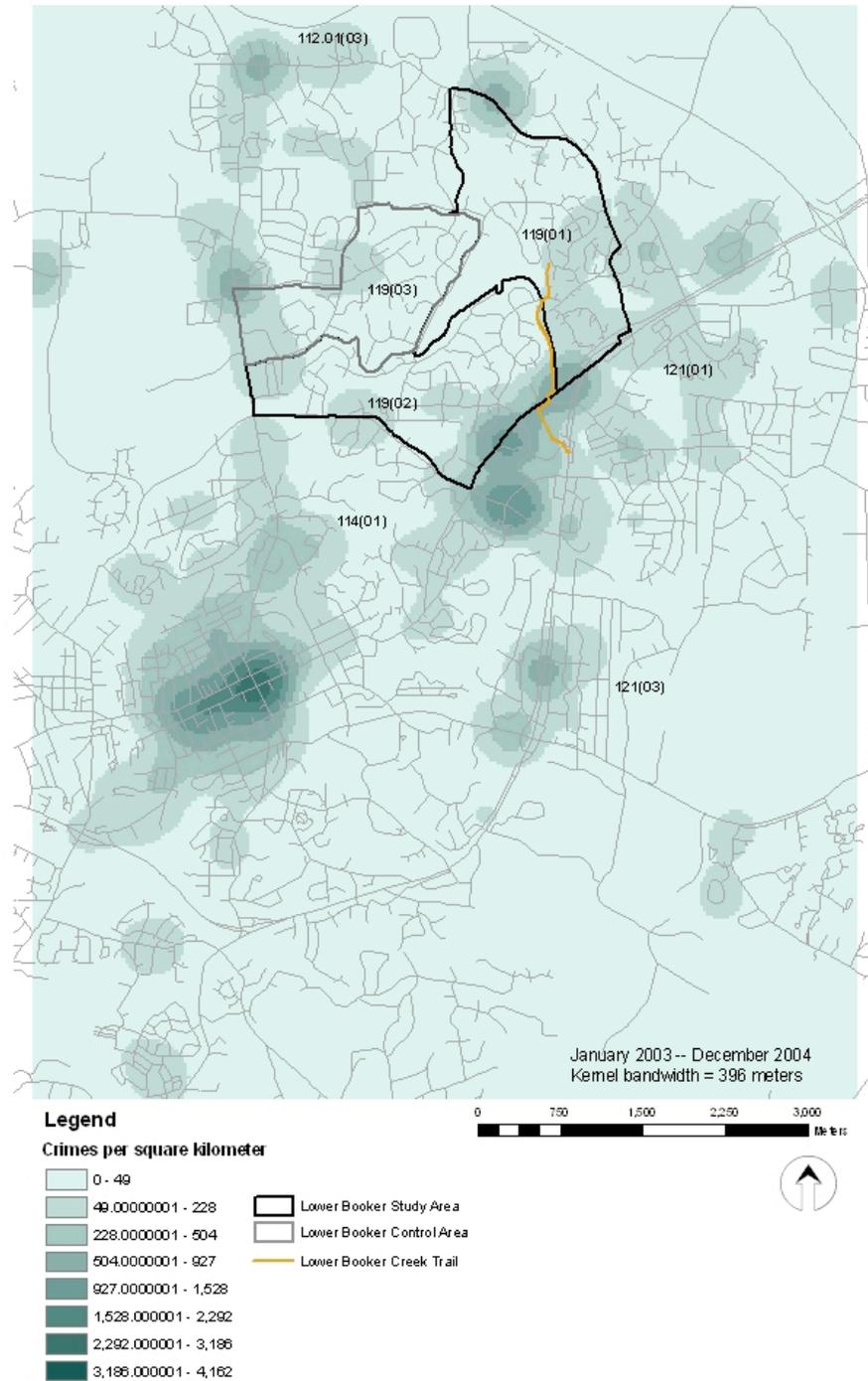


Figure 9: Density of reported crimes after completion of the Lower Booker Creek Trail (dedicated in 2002).



The maps show that the pattern of crimes in the study area did not change substantially after the trail was installed. A shift in a moderate level of crime density occurred in part of block group 02 that is at least 800 meters from the greenway. In the control area, crime density decreased in the section near Airport Road. Crime of moderate density level also shifted somewhat within the residential part of the control area.

CRIME CHANGE IN DRY CREEK STUDY AND CONTROL AREAS

In a three-year period prior to completion of the Dry Creek Trail (January, 1998 through December, 2000), the study area experienced 30 crimes per square kilometer. (Refer to Table 2 on page 25). After the completion of the greenway, the rate was 56 crimes per square kilometer for the period from January, 2002 through December, 2004. This was an 84 percent increase. By contrast, the control area showed a decrease of 16 percent for the same time periods, from 36 crimes per square kilometer to 30 crimes per square kilometer. However the large increase in the crime rate in the study area was not due to increases near the Dry Creek Trail. Table 3, on page 26, shows that the proportion of crimes in the study area occurring on the parcels in a 150 meter greenway buffer decreased from 5.5 percent to 3.9 percent between the time periods analyzed.

The kernel density analysis also showed that the crimes per square kilometer remained unchanged in the vicinity of the greenway after the Dry Creek Trail was completed. See Figures 9 and 10 below.

Figure 10: Density of reported crimes prior to completion of the Dry Creek Trail (completed in 2001).

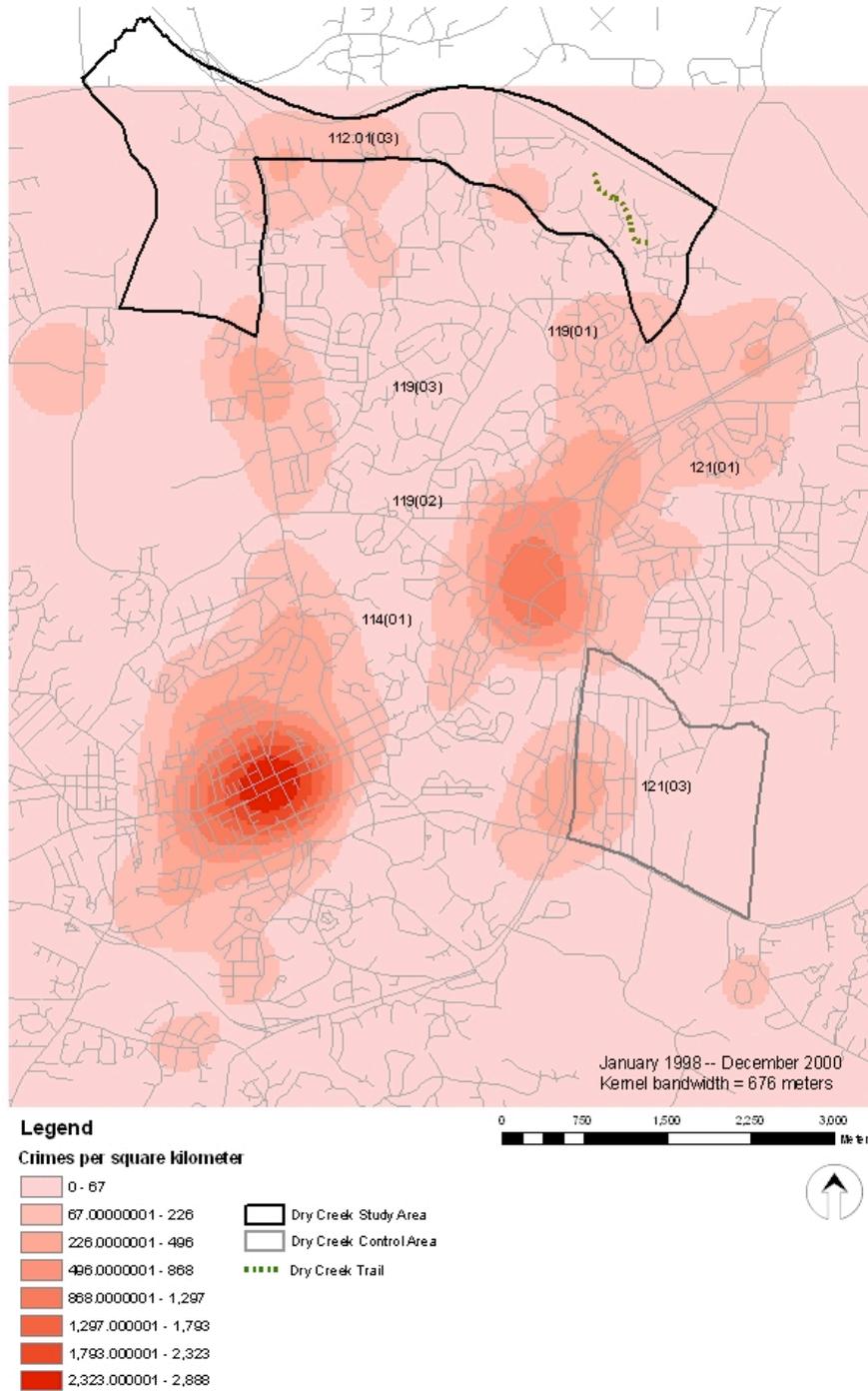
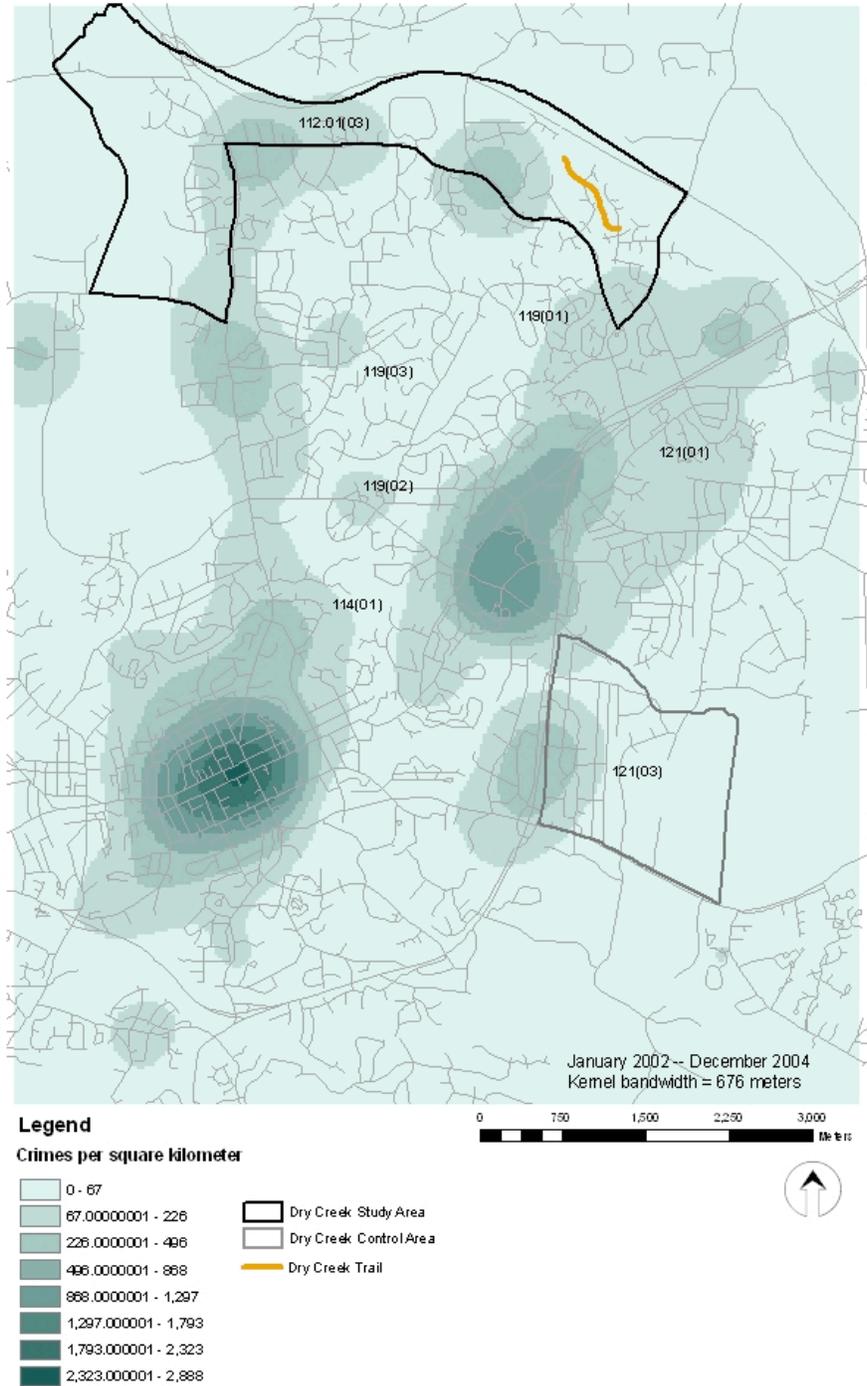


Figure 11: Density of reported crimes after completion of the Dry Creek Trail (completed in 2001).



The study area block group in this case is very large and captures areas as far as four kilometers away from the greenway. Crime intensity increased in two parts of the study area after the trail was completed, but the Dry Creek Trail is too far from each to have improved the access to those locations for criminals. The crime density increase in the western portion of the block group was in the area of a shopping center and multi-family complex; the other increase was in the vicinity of the high school. The control area in this case showed almost no change in the pattern of crime density.

When the experience along one greenway differs from others, environmental factors may be important in explaining the difference in crime rates. As some of the literature on perception of crime risk points out, aspects such as low prospect and high refuge indicate danger in the minds of many because these aspects are understood to represent opportunity for the criminal (Nasar and Fisher, 1992). The number of formal access points on the greenway could also facilitate or hinder criminal activity, with more frequent access points providing the potential personal crime victim with more escape routes and also increasing the would-be criminal's fear of interruption from entering users. The types and number of users may influence the trail's impact as well. If the greenway has too few users or becomes a hangout for socially deviant types, it could invite crime. However, these environmental characteristics do not appear to be involved in difference in the results for Bolin Creek versus Lower Booker and Dry Creek. The trails are close to the same length, and each of the trails has two or three formal access points. Bolin Creek Trail and Lower Booker Creek Trail are very similar in qualities of refuge and prospect, in the author's opinion. The author also observed approximately the same type and number of users on these two greenways on one visit. The Bolin Creek Trail's distance from adjacent buildings, and its low elevation relative to those buildings may provide some privacy for criminals, but, at the same time, the steep slopes and wider wooded buffers make these properties less accessible from the greenway than are the properties in the other cases. Thus the environmental characteristics of the Bolin Creek Trail Phase II do not explain why this greenway could have impacted crime risks differently than the other trails in the study.

Limitations

The interpretation of results is limited by a number of factors. First of all, the crime data analyzed in this study were reported crimes only. Some proportion of crimes is never reported and the location of the unreported crimes may or may not be random. Secondly, the study includes only three cases and therefore does not allow statistical analysis or assertions of causality. Third, the study areas and control areas were much larger than the area that could be affected by the greenway in each case, due to unavailability of the most relevant data at the Census block level. Although the crime data could be analyzed at the smaller scale, the socioeconomic status of areas smaller than the block group was impossible to determine. The use of relatively large block groups as study areas in a geographically small police jurisdiction limited the set from which I could select matched control areas. Also related to the use of Census data was the fact that the most recent socioeconomic information was from 2000, which in some cases aligned better with the pre-test period, leaving no socioeconomic information for the post-test period. In those cases, any stability or instability that was evident between 1990 and 2000 was assumed to remain beyond 2000.

Conclusion

This study uses empirical data to investigate the question of whether the presence of a greenway increases the risk of crime for properties near the greenway. Common public perception is that it does, and thus concern about crime frequently exists among landowners when a greenway is proposed in their area. While this study of three trails does not answer the question with finality, the evidence here can contribute to an awareness of actual experiences that should inform the dialogue between planners and property owners regarding their concerns about proposed greenways.

The results are largely reassuring for concerned residents. Two of the greenways, Lower Booker Trail and Dry Creek Trail, had no impact on crime levels in the immediate area, a finding which contradicts the common expectation. On the other hand, the data indicated that, in the area near the Bolin Creek Trail Phase II, the crime level increased after the trail opened. The increase occurred in spite of the fact that, based on U.S. Census data, the study area showed positive socioeconomic change, if any. The evidence of this case

supports the general perception that greenways increase the risk of crime for adjacent properties, but this case by itself does not prove a causal relationship.

The greenway development plans of many cities and counties indicate that greenways are expected to serve numerous public objectives, such as increasing transportation options and recreational opportunities, preserving ecological linkages and reducing flood damage by preventing development, and removing pollutants from the water and air. Nearby residents understandably are concerned that these objectives will be met at their own expense. However, the results of this study suggest greenways may not be not as much of a threat to property owners as expected. Given these results and the results of other studies, a decision by a local government to sacrifice the beneficial functions of greenways due to a fear of crime would not be well-supported by the research thus far.

As more and more law enforcement agencies take advantage of geographic information systems, crime data will become more easily accessible. While some studies have examined a large number of trails using survey data, future research should be able to use actual crime data from a sample of trails that is large enough to allow statistical analysis. The temporal aspect of the analysis can be retained in future studies as well, as archives of usable data continue to accumulate. Also, because perception of crime risks persists in spite of the evidence of many studies, another direction for research would be determining the qualities of refuge, prospect, and escape that people typically assume in their visualization of proposed greenways. Methods of communicating the greenway proposal could then address the assumptions at the outset. The accumulation of objective literature on the subject of crime and greenways is only the first step in the effort to base local government decisions on the most appropriate issues. The assumptions employed by all involved parties must be recognized and addressed in order to promote well-informed consensus.

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Appendix

Selected socioeconomic variables for 1990 and 2000

	Median HH Income		Median Value		Median Gross Rent		Housing Units		Occupied		Vacant		Owner-occupied		Renter-occupied	
	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000
Town of Chapel Hill	\$20,277	\$29,140	\$117,488	\$217,200	\$473	\$690	14,743	19,084	13,885	17,932	1,058	1,152	5,885	7,387	7,800	10,265
Adjusted for Inflation (in 2000 \$)*	\$29,900		\$155,084													
Ballin Creek Study																
BG 114(01)	\$22,487	\$52,986	\$178,200	\$317,900	\$440	\$759	820	918	783	854	57	62	248	448	515	408
Adjusted for Inflation (in 2000 \$)	\$29,880		\$232,718													
Ballin Creek Control																
BG 121(01)	\$43,958	\$49,213	\$125,800	\$158,200	\$302	\$794	681	943	642	868	39	55	418	529	225	349
Adjusted for Inflation (in 2000 \$)	\$59,025		\$188,058													
Lower Boaker Creek Study																
BG 119(01)	\$41,324	\$54,727	\$180,200	\$228,700	\$528	\$863	1,027	1,095	958	980	71	105	512	528	445	454
Adjusted for Inflation (in 2000 \$)	\$54,548		\$211,596													
BG 119(02)	\$39,485	\$54,625	\$165,388	\$297,400	\$324	\$728	900	1,107	808	1,028	84	81	397	528	438	498
Adjusted for Inflation (in 2000 \$)	\$50,800		\$218,310													
Lower Boaker Creek Control																
BG 119(03)	\$41,324	\$53,750	\$180,200	\$282,800	\$528	\$749	552	784	514	721	38	43	275	368	239	353
Adjusted for Inflation (in 2000 \$)	\$54,548		\$211,596													
Dry Creek Study																
BG 112,01(03)	\$31,840	\$40,800	\$112,100	\$144,400	\$408	\$481	746	823	680	748	53	77	530	640	180	108
Adjusted for Inflation (in 2000 \$)	\$42,029		\$147,972													
Dry Creek Control																
BG 121(03)	\$20,000	\$40,700	\$141,400	\$208,200	\$487	\$825	843	798	784	728	39	68	200	252	381	478
Adjusted for Inflation (in 2000 \$)	\$30,360		\$188,948													

SOURCE: U.S. Census 1990 and 2000

* Based on inflation rate of 1.32 from the U.S. Bureau of Labor and Statistics!