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Mapping Trends in Bike Theft on Furman Campus from 2001 to 2016

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Tindall Ouverson, Introduction to Geographic Information Systems (GIS), Fall 2016

Introduction

Theft is one of the most common types of crime on campus, bike theft being a prime example that often gets underreported (Fisher, 1995). A more recent report by the University of California Santa Barbara Police Department would indicate that among the thefts that occur on a college campus, bike theft is still the most prevalent (NLECTC, 2011). Furman is no exception. Here, the Furman University Police Department categorizes bike thefts as "bike larcenies" in their reporting system. However, most bike thefts on a college campus are not for monetary gain but as a means of transportation for opportunistic students. Though the goal of student bike thieves may be to get to class on time, the United States Department of Justice classifies them as "joyriders" (Johnson, Sidebottom, & Thorpe, 2008). Campus bike theft is a concern because it results in a monetary loss for students. We can assume the thefts are underreported and that most bikes do not have their correct market value, as 92% of the bikes reported stolen have a value of "$0.00" listed. For the remaining 8% of bikes with a value listed in the Furman campus crime database, the loss totals over $18,000 for the past fifteen years. If every bike had an average value of 100 dollars – which is a reasonable value given the wide variety of bikes on campus – that would be a loss of $93,400. Beyond an economic deficit, bike theft is both a problem in a social and environmental sense (Gamman, Thorpe, & Willcocks, 2004). Bicycles are an important form of alternative transportation, something Furman University recognizes in its plan to become carbon neutral by 2026. Bike theft can be considered as a deterrent to greater utilization of bikes as an alternative transportation method (Lierop, Grimsrud, & El-Geneidy, 2015)

It is likely that most of the bike thefts are concentrated in housing areas, especially freshman housing. While it is easy for the public to gain access to the campus, the installation of the Swamp Rabbit Trail behind Furman is also likely to have increased theft on campus.

Methods

The data was mapped and analyzed using ArcGIS 10.4.1. The bike theft data did not come with XY coordinates, but rather gave the location of the theft on campus. These locations are buildings, roads, and locations both on and off campus; however, only incidents that included a specific place were included. Incidents that had general locations like "South Housing Complex" or "Off Campus" were excluded. There were only 36 of these cases. To obtain XY data, Google Earth was used to get the coordinates of each location where a bike may have likely been stolen, determined by where bike racks were on campus. This was done with the aid of a campus map. There are limitations to this method, as the coordinate points are not the exact location of each theft. The data was then projected from WGS 1984 to the State Plane Coordinate System. As the dataset was comprised of individual points, the Integrate tool was used to snap together points within a certain radius (I chose 1 meter). The Collect Events tool then created a count value, where n = the number of thefts at each location, represented by a point. Then, the Spatial Autocorrelation tool was used to find the distance where spatial clustering was statistical significant. The chosen distance needed to be a logical fit in relation to how buildings are arranged on campus. With a distance band of 200m chosen, the Hot Spot Analysis (Getis-Ord Gi*) tool was used to determine if any of the theft locations were statistically significant hotspots (or cold spots) with 90, 95, and 99 percent confidence intervals. Then, the Kernel Density tool showed the density of bike thefts within a certain radius (200m). The analysis was done multiple times at several distance bands. For the second part, the data was divided into pre and post Swamp Rabbit Trail installation, then analyzed separately using the same tools as above. As the reporting system changed after August 29 of this year, only thefts from this date and before were counted in this research.

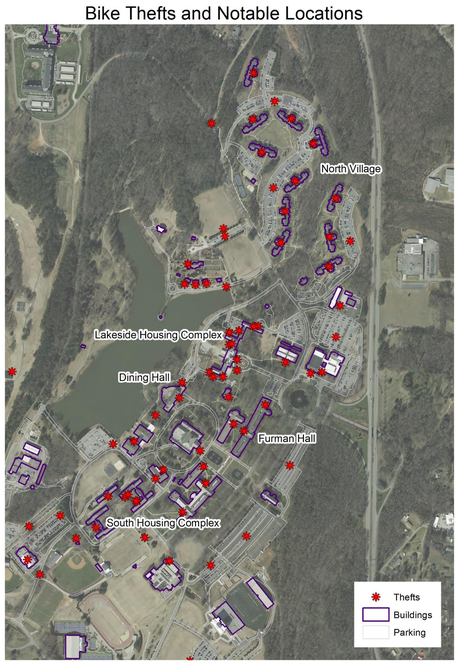

Figure 1: Locations of bike thefts, with parking and buildings. High-theft locations are labeled.

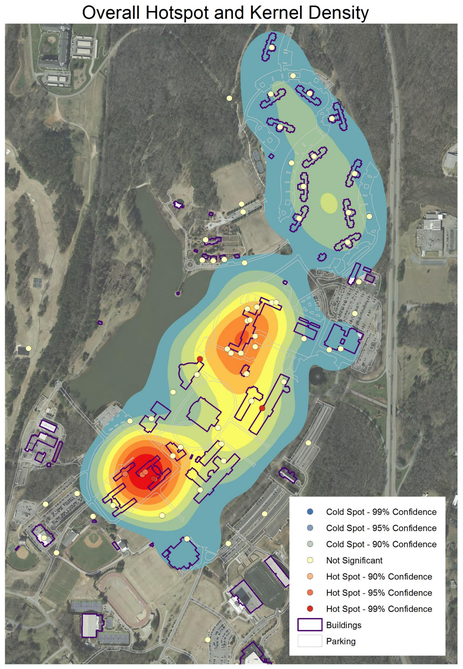

Figure 4: 2001-2016 hotspot analysis and kernel density for bike theft.

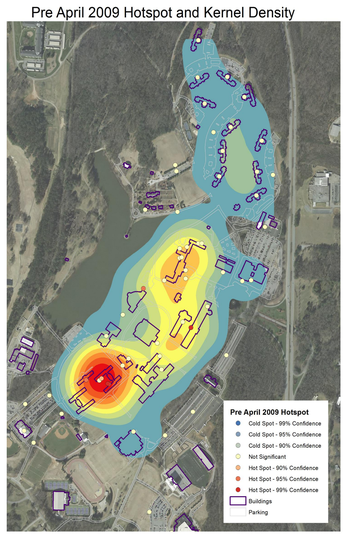

Figure 2: Hotspot analysis and kernel density pre-April 2009 for bike theft.

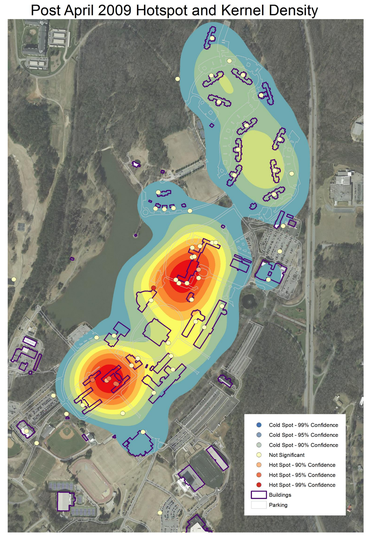

Figure 3: Hotspot analysis and kernel density post-April 2009 for bike theft.

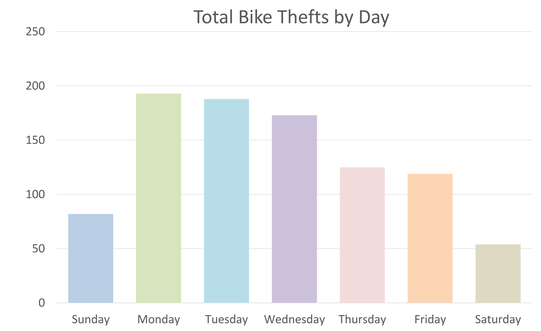

Figure 5: Histogram of thefts by day.

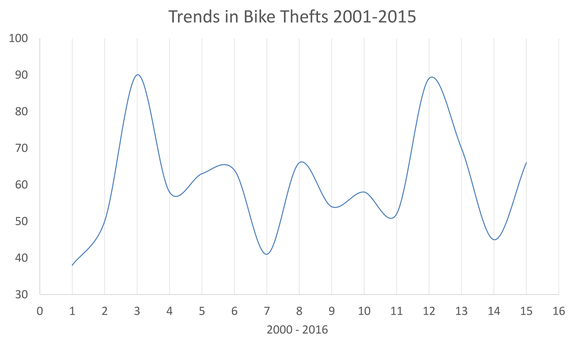

Figure 6: Smooth line graph showing theft trends for the past 14 years (2016 not included).

Results

For this analysis, 200m was determined to be a usable distance band from the incremental spatial autocorrelation results. The z scores reported were not significant, but this distance was appropriate for how buildings are clustered on campus. A 200m radius covers one cluster of buildings without including another cluster. From the hotspot analysis, the most significant locations for bike theft are around the South Housing Complex, though the data set and Collect Events indicates that the Dining Hall had the highest count of thefts reported. Before the Swamp Rabbit Trail was paved behind Furman University in April 2009, Furman Hall was the most significant hotspot while South Housing had a highest number of thefts per 200m square area. After the Swamp Rabbit Trail was paved, the Dining Hall became the most significant hotspot for theft and South Housing buildings became slightly more significant hotspots. The number of thefts per 200 square meter area increased for Lakeside Housing and North Village.

Discussion

Because residences and academic buildings are grouped close together, a 200m is an appropriate neighborhood for analysis. Bikes at Furman are more likely to be stolen from buildings and because this is a residential campus, these thefts are most common in places that students frequent. The important thing for students to remember is to register their bikes, keep the receipt for proof of purchase, and record the bike's serial number. Bikes do not easily get returned to their rightful owners without proof of ownership. It may be especially important for incoming freshman classes to receive this information, as the majority of thefts occurred near South Housing. This may be due to lack of experience, and possibly the housing complex's proximity to the Swamp Rabbit Trail as hotspots in South Housing did become more significant post April 2009. To prevent potential theft, the Furman University Police Department recommends that students secure their bikes with a U-lock, as this is the most secure option. While this is anecdotal, officers have related cases of community members using bolt cutters to remove lock cables from students' bikes.

In the future, it would be useful to investigate how lighting on campus influences bike thefts. The relationship between these theft and lighting is complicated and often counterintuitive, though a more extensive system of streetlights produces a feeling of safety (Atkins, Husain, & Storey, 1991).

References

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Data Sources

Figure 1, Figure 2, Figure 3, Figure 4: 1) Parking and Building polygons modified by author from an existing shapefile accessed through the \\fushare\gisdata server 2) Basemap provided by an ORTHO2016 of Greenville County, accessed through \\fushare\gisdata server.

Furman University Police Department database record for campus crime

All maps developed using Environmental Systems Research Institute (ESRI) ArcDesktop, 10.4.3.

Acknowledgements

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