A GEOSPATIAL ASSESSMENT OF HURRICANE IMPACT ON BURGLARY IN LAWRENCE TOWNSHIP, NEW JERSEY

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ABSTRACT

This study addressed the under-researched area of the impact that hurricanes have on crime. Specifically, this study examined the relationship between two hurricanes, Hurricane Irene and Hurricane Sandy, and burglary rates in Lawrence Township, New Jersey. Data for this research was obtained from dispatch detail provided by Lawrence Township Police Department for all crimes in the area during the years of 2009-2012. This study focused solely on the crime of burglary (n=423) and the months surrounding each of the storms. Results showed an increase in burglaries after Hurricane Irene and a decrease in burglaries following Hurricane Sandy.

INTRODUCTION

New Jersey is a state that typically does not experience many hurricanes, but in 2011 and 2012 the state suffered devastating loss and damage due to Hurricane Irene and Hurricane Sandy. Hurricane Irene in August of 2011 caused the state over $1 billion in damage, 11 deaths and about 2 million power outages lasting about six days; and Hurricane Sandy in October of 2012 caused New Jersey $36.8 billion in damage, 37 deaths and 2.7 million power outages lasting about 11 days (Hurricane Irene, 2012; Dopp, 2012; Associated Press, 2012, November; Associated Press, 2012, August; Rexrode & Dobnik, 2012). Weather has been found to affect mood, memory, and even the criminality of a person (Keller et al, 2005; Denissen, Butalid, Penke & Van Aken, 2008; Cohen, 1990). Most previous studies have focused on normal weather occurrences such as the changing seasons or varying drops in atmospheric pressure, but only a select few have focused on extreme weather occurrences such as natural disasters. Natural disasters are defined as "any event or force of nature that has catastrophic consequences," (Natural disaster, 2013) and the most commonly occurring natural disasters are earthquakes, floods, forest fires, tornados and hurricanes.

Research into the social effects that natural disasters cause has found that either the public reacts with social chaos, such as rioting or mass panic (Erikson, 1994; Smith & McCarty, 1996; Siegel, 1999; Rossi, 1983), or the public responds to the disaster by coming together with hopes of rebuilding (Friesema, 1979; Drabek, 1975; Beckley, 2008). When mass chaos occurs after a disaster, it is common for crime to increase in the affected area. The most common crime committed after a disaster is looting which is documented as a post-disaster rise in burglaries (Beckley, 2008). Based on these findings, it is logical to study further the link between disasters and burglaries over other crimes.

Few prior studies have focused on the effect that hurricanes have on crime. Two relevant studies include Friesema et al (1979) and Lebeau (2002). Friesema et al (1979) found that assaults decreased for fourth months in Galveston Texas following a hurricane, while auto thefts increased beyond the normal rate and the increase lasted for over six months after the storm. In 2002, Lebeau found an increase in police calls in all categories (a minimum increase of 2 standard deviations above the daily mean) in North Carolina after Hurricane Hugo, and the volume of the calls shifted to different times of the day after the storm (possibly due to changed routine activities).

Even fewer studies have examined the direct impact hurricanes have had on burglary rates. In 2011, Leitner and Helbich conducted a study comparing the effects both Hurricane Rita and Hurricane Katrina had on Houston, Texas. The results showed that Hurricane Katrina did not affect crime, while Hurricane Rita led to a significant short-term increase in burglaries and auto thefts. The researchers determined that the reason Hurricane Rita affected crime when Hurricane Katrina did not was due to the fact that Hurricane Rita involved an evacuation order for the area while Hurricane Katrina did not. In support of this thesis, various studies have shown that Hurricane Katrina had a significant impact on crime in the state of Louisiana where it occurred and where mandatory evacuations were issued (Varano, Schafer, Cancino, Decker & Greene, 2010). These findings were further confirmed by Hagenauer, Helbich and Leitner's 2011 study that found burglaries increased up to three times the normal amount in Houston Texas following Hurricane Katrina; and Leitner and Guo's 2013 study that found a short-term increase in burglary in Louisiana following Hurricane Katrina that lasted about one month.

This study focuses on the under-researched area of the way in which hurricanes affect burglary. This relationship was analyzed using police data from Lawrence Township, New Jersey over a four-year period with a focus on two major hurricanes that affected the state, Hurricane Irene in 2011 and Hurricane Sandy in 2012. Appling the findings from the relevant previous research to the current study, I hypothesized that both Hurricane Sandy and Hurricane Irene would affect burglary rates in Lawrence Township, NJ, and, because Hurricane Irene involved a voluntary evacuation order in the Township, that it would have a more significant impact on burglaries (Clark, 2011; Ratcliffe, 2011).

METHODOLOGY

The data used for this study were obtained from the dispatch detail tables provided by Lawrence Township Police Department (LTPD) in Lawrence Township, Mercer County, New Jersey. The data encompassed response data for all crimes over the four-year period of 2009-2012. Due to the narrow focus of this study, only the data concerning burglaries were analyzed (n=432). The data consisted of 17 variables including: the XY coordinates of each observation; call number; zone; create and closed date and time; minutes; hours; year; month; quarter; day; hour; am/pm; and crime type. An analysis of this data for the 2009-2012 time period showed that the average response for a burglary call for Lawrence County lasted 193 minutes. In addition, most calls occurred in 2011 (138 calls), during the afternoon hours (242 calls), in the month of September (46), in police zone C (134) and on a Monday (78 calls).

MEASURES

Burglary Frequency. Burglary frequency was measured by the number of occurrences that took place in each month for each of the four years (2009-2012).

Hurricanes. Both Hurricane Irene and Hurricane Sandy were studied for comparison purposes. The hurricanes were represented in the data by the dates that each occurred in the state of New Jersey. Data was analyzed for the months directly preceding and following each of the two storms.
Programs Used: Two programs were used in this study: the data was analyzed in SAS 9.3; and all maps were rendered from the data in ArcMap10.

PROCEDURE

Topologically Integrated Geographic Encoding and Referencing (TIGER) line shapefiles of Mercer County, New Jersey and Lawrence Township, New Jersey were utilized in this study (http://www.census.gov/cgi-bin/geo/shapefiles2010/main). These files included the county subdivisions, all roads and lines, and blocks of Mercer County. Once all census files were uploaded to ArcMap, shapefiles for Lawrence Township were isolated and clipped in the program (this was completed by using the clip tool in the ArcMap Toolbox under the extract menu) to create a comprehensive map of only Lawrence Township, NJ. The resulting map was projected to utilize a projected coordinate system, and the LTPD data was added as XY data to the map, creating a pin map of all of the burglary events from LTPD.

After the Lawrence Township map was rendered, the analysis of the data began by creating a time series data set in SAS. This procedure involved sorting the data by month and utilizing the proc freq function to create a table consisting of the number of crimes that occurred in each month for each of the four years. The resulting output from this function was merged into the original data set creating a new frequency variable for the number of crimes per month that was renamed and labeled each month with its associated calendar number ranging 1-12. This data set was used to create a Gplot. The original SAS Gplot was uploaded to excel to produce a clearer frequency graph which is depicted below in Figure 1.

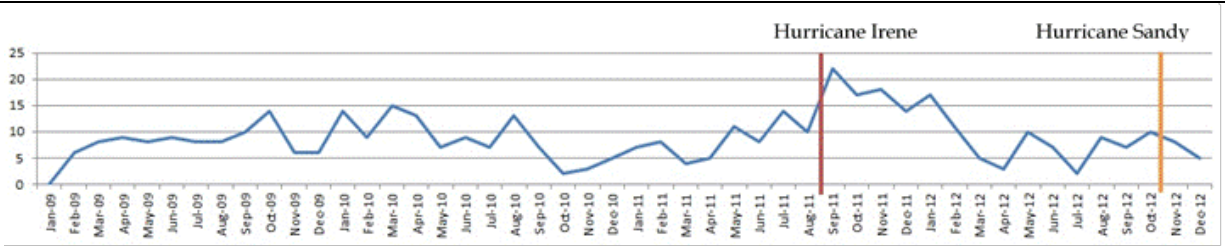

Figure 1.
Frequency of burglaries in Lawrence Township, New Jersey per month over the period of January 2009- December 2012
Note: Hurricane Irene is represented by the red line; Hurricane Sandy is represented by the orange line. The average number of burglaries per month= 9.

This data set was uploaded into ArchMap10 as XY data which created a pin-map of all of the burglary events in Lawrence Township that occurred between the years of 2009-2012. Both the data and the map were projected within the program to create a more realistic map. The data were added to the new map and divided using the SQL function to create individual files for each storm. For Hurricane Irene, which occurred in New Jersey on August 28th, 2011, the month of September was isolated for each of the four years to analyze if there was any noticeable difference during the year of 2011 when the storm took place. Hurricane Sandy occurred in New Jersey on October 29th, 2012; therefore, the month of November was isolated for each of the four years to see how, if at all, the storm impacted burglaries in the township in 2012. For both storms, the month directly following the storm was studied due to the findings in Leitner and Guo's 2013 research that found a burglary spike after a hurricane lasting one month.

After new files were created for the months following each storm, the data for each file were projected and then spatially joined to the projected Lawrence Township, NJ block file that was retrieved from the Census website. Following the data join, choropleth maps were created for the total number of burglaries in the month following each of the storms (Hurricane Irene was represented by the month of September and Hurricane sandy, October) for each of the four years represented in the data. The resulting maps included four choropleth maps for each storm.

RESULTS

Figure 2 illustrates the impact that Hurricane Irene had on burglaries in the month directly following the storm. The month of September 2011 had the highest amount of burglaries (22 burglaries) that Lawrence Township, NJ had experienced in any other month over the four- year period analyzed (average number of burglaries for September between 2009-2012 was 11.5 burglaries).

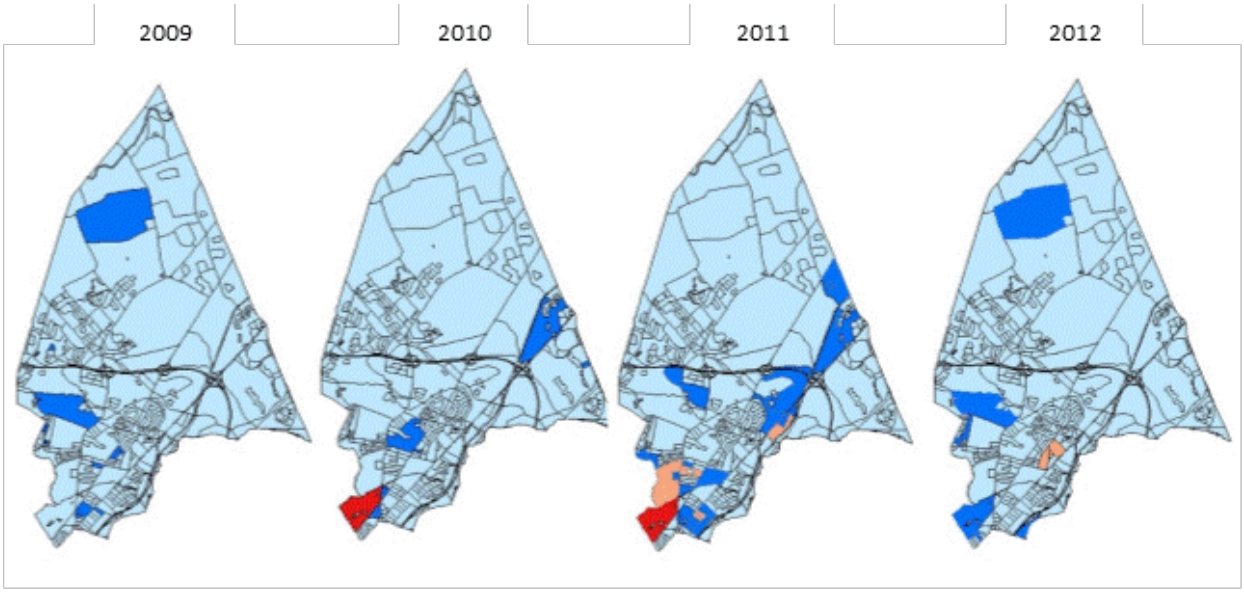

Figure 2.

Choropleth Images illustrating the effects of Hurricane Irene (occurred in NJ on August 28th 2011). Pictured is the month of September for 2009-2012.

Another interesting finding in the data is that following Hurricane Irene in August of 2011 not only did the month of September experience a spike in burglaries, but also the following months of October, November, December, January and February experienced the highest number of burglaries of the four-year period. As seen in Table 1, October 2011 experienced 17 burglaries while the four-year average for October was 11 burglaries; November 2011 experienced 18 burglaries while the four-year average was 9; December 2011 experienced 14 burglaries while the four-year average was 8; January 2012 experienced 17 burglaries while the four-year average was 11; February 2012 experienced 11 burglaries while the four-year average was 9. After February 2012, burglary rates returned to normal. This suggests Hurricane Irene led to a possible six-month spike in burglaries.

Table 1. Table of burglary frequencies per month per year in Lawrence Township NJ during 2009-2012 (n=423).

	January	February	March	April	May	June	July	August	September	October	November	December
2009	4	6	8	9	8	9	8	8	10	14	6	6
2010	14	9	15	13	7	9	7	13	7	2	3	5
2011	7	8	4	5	11	8	14	10	22	17	18	14
2012	17	11	5	3	10	7	2	9	7	10	8	5

Note: Highlighted values correspond to the months affected by each storm. Irene is represented in yellow and Sandy in green.

The maps rendered for Hurricane Sandy show quite a different result. Figure 3 shows that burglaries

decreased during November 2012 (8 burglaries), the month following the storm. The average number of burglaries for November between 2009-2012 was 9, and the month prior to the Hurricane Sandy had 10 burglaries.

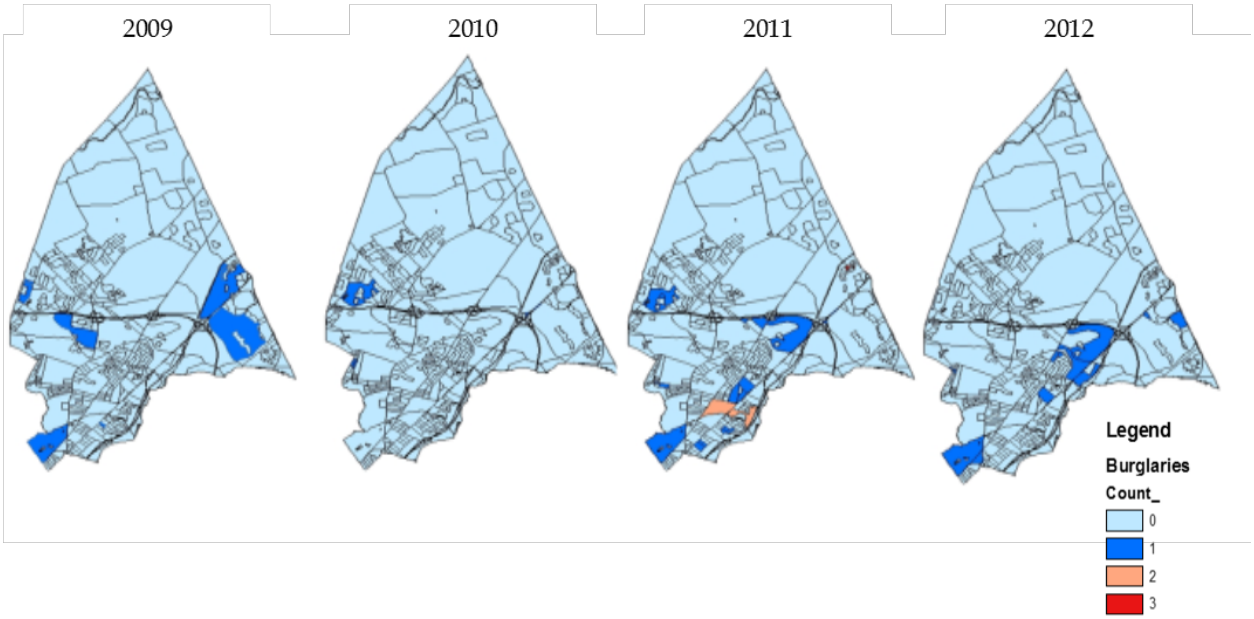

Figure 3.

Choropleth Images illustrating the effects of Hurricane Sandy (occurred in NJ on October 29th 2012). Pictured is the month of November for 2009-2012.

DISCUSSION

In conclusion, an analysis of Lawrence Township Police dispatch for burglary over the years of 2009-2012 showed that there was a positive relationship between Hurricane Irene and burglary in Lawrence Township, and a possible negative relationship between Hurricane Sandy and Hurricane Irene. The month following Hurricane Irene produced 22 burglaries which is about 13 burglaries above the monthly average of nine burglaries[1]. This increase in burglary is supported by all of the previous hurricane research that found short-term spikes in burglaries, and it closely aligns with the findings of Leitner and Guo's 2013 study, that found a month- long increase in burglary in Louisiana following hurricane Katrina (Varano et. al., 2010; Leitner & Guo, 2013; Leitner& Helbich , 2011; Hagenauer, Helbich & Leitner, 2011).

In addition to the large spike in burglaries in the month directly after Hurricane Irene, the following five months also produced burglaries above the monthly average suggesting the storm led to a possible six-month increase in burglaries in Lawrence Township, New Jersey (see Table 1, values highlighted in yellow). A six-month increase in criminal activity as a result of a storm has been found before much like

[1] One burglary was highlighted on Lawrence Township's local website in addition a popular New Jersey news websites. Both stories can be found here:
http://lawrenceville.patch.com/groups/police-and-fire/p/10000-worth-of-property-stolen-from-lawrence-twp-fami4ce4bccc64
http://www.nj.com/mercer/index.ssf/2011/09/evacuated_family_comes_home_to.html

Friesema et al's (1979) study that found that auto thefts increased beyond the normal rate for over six months after a hurricane in Galveston Texas.

The analysis of the dispatch data surrounding Hurricane Sandy showed very different results; burglaries in the month following the storm actually decreased below the normal average (see Figure 3). Friesema et al. (1979) and Drabek (1973) found that after some extreme disasters community cohesion occurs where the community comes together to help repair all of the damage; this could explain the drop in burglary following Hurricane Sandy which produced much more serious damage to the State of New Jersey than did Hurricane Irene (Hurricane Sandy caused $36.8 billion in damage, while Hurricane Irene caused $1 billion in damage). Another possible explanation for these findings is that the town of Lawrence experienced evacuations during Hurricane Irene, while there were no evacuation orders in place for the town during Hurricane Sandy. This is similar to Leitner and Helbich's 2011 study that looked into the effects both Hurricane Rita and Hurricane Katrina had on Houston, Texas; they found Hurricane Katrina did not affect crime while Hurricane Rita did impact burglaries and auto thefts in the area. The authors found empirical evidence this effect was due to the fact that Houston had evacuations during Hurricane Rita and not during Hurricane Katrina, and, when families leave their homes during an evacuation order, their property becomes an easier target for burglars; a similar effect could have taken place in Lawrence Township during Hurricane Irene and Hurricane Sandy.

LIMITATIONS

This study did have some limitations such as the size of the area studied that included only one township and about 432 burglaries; a larger area of study, such as the entire state of New Jersey, could show a more accurate effect that the storms may have had on burglaries in the state as a whole. Another limitation was that only one crime was analyzed in this study; it is possible Hurricane Sandy and Hurricane Irene affected other crimes such as domestic violence rates or auto thefts that have been found to increase after disasters in previous studies. Finally, the researcher in this study was also limited in the amount of information specific to the town that was studied in reference to the exact damage the town sustained in each storm, how long the power outages or evacuation orders lasted in the area, and how many citizens actually evacuated their homes.

FUTURE RESEARCH

More research is needed to establish that there is, in fact, a connection between hurricanes and increased burglary rates on the East Coast. Future studies should look at a larger area containing a larger number of burglaries to analyze which will make the results more generalizable. In addition, future studies could look at other crimes, such as domestic violence, auto theft, car accidents and assaults that have all been found to either increase or decrease after disasters. Researchers could also investigate the length of power outages and if there is any relationship between the amount of time the power is down and crimes such as burglary and auto accidents which could be affected by failing security systems and traffic lights respectively. If it is possible for future researchers to collect data detailing the exact number of people who evacuate their homes and how many of those individual's homes are targeted for criminal activity, they could then further support or refute the theory that evacuations lead to more crime after disasters.

CONCLUSION

This study sought to examine the relationship between two hurricanes (Hurricane Irene in August of 2011 and Hurricane Sandy in October of 2012) and burglary rates in Lawrence Township, New Jersey; it found an increase in burglaries after Hurricane Irene and a decrease in burglaries following Hurricane Sandy. This study further supports the previous research of Leitner and Helbich (2011) that found an increase in burglaries following a storm that involved evacuations in an area and no effect after a storm that did not involve evacuations. In the case of this study, Hurricane Irene involved evacuations in Lawrence Township and was followed by a short-term spike in burglaries, while Hurricane Sandy did not involve evacuations and was followed by a decrease in burglaries. Further research is needed in the area to accurately determine if hurricanes do in fact impact rates of burglary in all areas, and also, if evacuations are a necessary factor in that impact.

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