Chapter 9
A Methodology for Assessing Dynamic Fine Scale Built Environments and Crime: A Case Study of the Lower 9th Ward After Hurricane Katrina

Andrew Curtis, Jacqueline W. Curtis, S. Wright Kennedy, Amit Kulkarni, and Traci Auer

Abstract This chapter will present a method of data collection and analysis for fine scale environments experiencing change. The setting for this work is the Lower 9th Ward of New Orleans for the period 2010 and 2011. The approach described here utilizes a low cost mobile data collection strategy involving a spatial video, a built environment coding scheme, and fine scale spatial analysis using a spatial filter that creates a surface of abandonment/blight/returnee rates linked to individual crimes. This chapter will also address the need for longitudinal analysis beyond simply considering changes in crime events by framing crimes between two data collection periods. Although this chapter should be viewed as a methodological example, including the importance of primary data collection and spatial investigation at the street segment scale, one interesting result is that crimes in association with abandonment and blight only became statistically significant for the 2011 landscape. The chapter concludes with several examples of spatial video derived fine scale maps that can be used to advance current spatial crime theories.

A. Curtis, Ph.D. (✉) • J.W. Curtis, Ph.D.
GIS Health & Hazards Lab, Department of Geography, Kent State University, Kent, OH, USA
e-mail: acurti13@kent.edu; jmills30@kent.edu

S.W. Kennedy, M.A.
Department of History, Rice University, Houston, USA
e-mail: swk@rice.edu

A. Kulkarni
Department of Geography and Anthropology, Louisiana State University, Louisiana, USA
e-mail: akulka1@tigers.lsu.edu

T. Auer
Department of Economics, University of Southern California, Los Angeles, CA, USA
e-mail: tauer@usc.edu

M. Leitner (ed.), *Crime Modeling and Mapping Using Geospatial Technologies*, Geotechnologies and the Environment 8, DOI 10.1007/978-94-007-4997-9_9,

Keywords Hurricane Katrina • Lower 9th Ward • Spatial video • Disaster recovery and crime

9.1 Introduction

The link between ecological processes and crime is frequently made in both the academic and popular literature. Simply put, some spaces are perceived to be, or indeed are, associated with or encouraging of criminal activity. Unfortunately, data to capture these associations, especially at the finest of sub-neighborhood scales involving the interrelationship between buildings and streets, is hard to acquire. Attempts to make such fine scale comparisons often involve considerable effort (and expense) and as a result tend to be cross-sectional in nature. This is particularly problematic for landscapes of change; the two most obvious examples being foreclosed neighborhoods and post-disaster landscapes. This chapter will present a methodological approach that can be used to extract patterns in such dynamic conditions; including data collection, a method of coding and analysis, and the importance of temporal bracketing for this type of ecological analysis. The neighborhood chosen, the Lower 9th Ward in New Orleans, does not have particularly high crime levels, but was chosen as an excellent example of neighborhood extremes, where home owners (potential victims) reside next to broken and unsecured homes (potential crime spaces). In addition some streets are impassable while many blocks contain vegetation that is now at roof level. Within this extreme landscape, change is still occurring. New homes are constructed, both systematically and in isolation as "pioneers" within the sea of devastation and blight, while other buildings become progressively more distressed. The Lower 9th Ward presents the extremes of what might happen in an American neighborhood, and this chapter shows how this dynamism can be captured and linked to crime.

9.2 Fine Scale Built Environments and Crime

9.2.1 The Link Between Geography and Crime

Across several academic disciplines there has been a shift towards more ecological assessments of the built environment in association with different social outcomes, with arguably the most interesting work now involving the finest of geographic scales. This makes intuitive sense especially if the goal is to understand patterns and processes with a view to intervention. For example, play spaces may provide positive development opportunities *but what of their quality*, *including the perceived attributes of both the space itself and the path to that space from the residence*? Elevated levels of diabetes may present as hotspots on a map, *but what about the*

streets, living environment, and access to food opportunities for each patient within that area of elevated disease? And with regard to crime, *how will the configuration of individual buildings, the condition of those buildings, and the surrounding micro-environment either promote or hinder crime*? Answers to such fine scale questions with regard to crime can frame policy suggestions (Loukaitou-Sideris 1999) and lead to successful crime reduction interventions (Dalton et al. 2008; Peed et al. 2008) including location denial strategies (Taniguchi et al. 2011).

The link between geography and crime is well established in criminology (Brantingham and Brantingham 1995), following a larger trend in academia embracing an ecological approach to investigating the patterns and processes of social problems within the built environment, where the relationship is arguably both contextual and compositional; the landscape is both an indicator of activity and may also attract/repel people who participate in that activity (Shaw et al. 1929; Bursik and Grasmick 1993; Ackerman and Murray 2004). The classic example often used in criminology classrooms is the theory of broken windows (Wilson and Kelling 1982), whereby the visual presence of socially unacceptable elements on the landscape (such as graffiti) may indicate that an environment contains crime, while also signaling that the lack of social oversight allowing these visual cues to occur will not hinder future criminal activity (Wilson and Kelling 1982; Skogan 1990). In terms of the post-disaster landscape described in this chapter, vacant and abandoned properties provide hidden spaces (Ackerman and Murray 2004), while dumping and overgrown vegetation might indicate a lack of localized activity making such areas ideal for criminal participation (Wilson and Kelling 1982; Skogan 1986, 1990; Perkins et al. 1993). At the same time these visual cues obviously drive perception and fears (Skogan 1986; LaGrange et al. 1992; Perkins et al. 1992; Perkins and Taylor 1996) that in turn might impede the desire to change the neighborhood for the better (to recover), and may perpetuate or even further develop a landscape suitable for crime. A linked ecological concept is routine activity theory, that the presence of oversight and guardianship will have a deterring effect on crime (Reynald 2011). In this regard criminals will be less attracted to locations where there are obvious signs of inhabitation, which in terms of the post-disaster landscape include rebuilt/refurbished buildings and signs of ongoing occupancy.

Ecologically based theories explaining crime locations also generate discussion with regard to an appropriate spatial scale for research. Although the physical condition of a neighborhood may contain visible signs of disrepair, crime does not occur homogeneously throughout the area. Crime is more spatially localized, with particular buildings, block faces or street corners being important (see Sherman et al. 1989; Taylor 1997; Smith et al. 2000; Kinney et al. 2008). These fine-scale geographies can play different roles, though the concept most relevant to the discussion of post-disaster landscapes is of crime attractors (Brantingham and Brantingham 1995); a location where a specific need is met, whether that is the presence of a victim or concealment.

There are several crime-related examples where the importance of spatial specificity is obvious, such as the built environment around transportation hubs. For example in Loukaitou-Sideris's (1999) work in Los Angeles, micro-geographies

around bus stops were mapped identifying various negative visual cues (graffiti) or locations (such as alleyways) and then overlaid with crime locations. Street corners are important territories for gangs so Taniguchi et al. (2011) focused their research on crime counts around them. Both these papers are examples of how a small area is the only relevant space for analysis and any broader scale is problematic as it may either smooth out these patterns or mislead the reader towards conclusions of a more geographically extensive problem (Tita et al. 2005; Pitcher and Johnson 2011).[1] Therefore the units of geographically focused research should be based around theoretical places rather than convenient aggregations of data (Bernasco and Block 2011).

However, data are not readily available for these small spaces. In the previously mentioned Taniguchi study, census aggregations were manipulated using Thiessen polygons to create more appropriate geographies representative of street-corner areas of influence. In another census based manipulation, Bernasco and Block (2011) used mattress style configuration of blocks to investigate crime attractors and spillover effects for street robberies in Chicago between 1996 and 1998. If primary data are collected then it usually involves labor intensive surveys and assessments of the local environment, that can be vulnerable to fieldworker error.[2] For example Reynald (2011) used house-to-house surveys to assess both visual signs of guardianship and actual resident reaction to strangers in the street. Although data collected in this way provide valuable insight, in this case identifying the "direct active" role of guardianship in limiting crime for fine scale spaces, it is not surprising that this effort is usually only applied to one area for one time period.

9.3 Longitudinal Crime Analyses

9.3.1 The Lack of Available Data

An analysis for one time period is problematic for different reasons. It is acknowledged that crimes cluster in space and time as it is likely that the same combination of environment and activity make a target attractive to repeated crimes, especially with initial success (Felson 2006; Braga et al. 2011). If these environmental conditions persist over time, then clusters will be both spatially and temporally stable at that same location or in close proximity where a successful experience makes nearby victims more susceptible in future time periods (Townsley et al. 2003; Pitcher and Johnson 2011). However, fine scale spaces are also dynamic and the characteristic

[1] There are other methodological advantages of working with fine-scale geographies, such as a street segment, as coding errors are minimized (Brantingham et al. 2009).

[2] For other examples see Taylor et al. (1985), Perkins et al. (1992, 1993), Perkins and Taylor (1996), Loukaitou-Sideris (1999), Sampson and Raudenbush (1999), and Loukaitou-Sideris et al. (2002).

of a building, or adding or subtracting light, or the removal of a trash pile from the street can effect immediate change in patterns resulting in shifting crime geographies. Unfortunately, the number of studies that include fine-scale analysis for multiple time periods is sparse (see Weisburd et al. 2004; Braga et al. 2010; Groff et al. 2010), and even more so for those that include environmental primary data (Taylor 2001), such as monitoring physical change or capturing residents' shifting perception of impacts to crime (Robinson et al. 2003).

One reason for this paucity in primary data driven research is the logistical challenges it poses, especially for multiple time periods (Sampson et al. 1997). However, recent developments in individual mobile assessment tools, volunteered geographic information, and as will be discussed in this chapter, mobile mapping techniques, have opened the way for more dynamic street-level analyses allowing researchers to unshackle themselves from secondary data especially census enumerations at inappropriate scales (Immergluck and Smith 2006).

9.3.2 Fine Scale Dynamic Landscapes

One of the more visually recognized outcomes of the economic downturn in the United States since 2008 has been the rise in foreclosed neighborhoods (Bess 2008; Dalton et al. 2008). Even before these events, criminologists had realized that there might be a link between such dynamic landscapes and crime (Immergluck and Smith 2006). Prior to the foreclosure crisis, vacant and abandoned structures were primarily viewed as the loss of capital from neighborhoods experiencing economic downturn, usually in the inner cities (Accordino and Johnson 2000), but now residential foreclosures associated with global economic shifts have emerged as a factor in vacancy and abandonment; and what was once a concern in poor, inner-city neighborhoods, now extends to suburbs, middle class neighborhoods and satellite cities (Wilson and Paulsen 2008). Although it is often suggested that the resulting decline of buildings, streets and neighborhoods may be linked to fine-scale spatial and temporal patterns of crime (Rogers and Winter 2009), the lack of available data makes robust analyses problematic (Schuetz et al. 2008). Post-disaster landscapes offer similar dynamic street and building environments where an externality and not internal neighborhood social process have changed the normal pattern of living. Just as with foreclosed neighborhoods, but often rendered in even more extreme terms, the neighborhoods of New Orleans after Hurricane Katrina have left open spaces, abandoned buildings, trash (debris), and severely reduced social cohesion and service infrastructure. It is not hard to imagine how landscapes harbor or encourage crime if the same patterns and processes associated with "Broken Windows" or "Routine Activity Theory" (Cohen and Felson 1979) is relevant irrespective of genesis. After all, abandoned buildings and vegetation overgrowth provide concealment for criminal activities, a situation reinforced by reduced city services (policing routes) and fewer occupied homes providing oversight. A further component in the post-disaster landscape is a novel mix of attractors including

crime-susceptible spaces and victims. Victims may live next to abandoned homes or vegetative tracts that provide the mix of both concealment and opportunity, or they can live in isolation, where the unique setting of an absence of community might result in severe stress and domestic violence. In addition, "pioneer" homes, those buildings that remain isolated in blocks of overgrown vegetation, meet the lack of supervision criteria identified by Felson (2006). These landscapes suggest a hybrid "holistic" theory including both ecological theories might be appropriate (Reynald and Elffers 2009; Reynald 2011).

Given such a potentially interesting mix of factors it is a shame so much post-disaster crime research usually focuses on the immediate aftermath of the event, including looting, fraud or violent crime, or the movements of crimes by those who have been displaced (Decker et al. 2007; Frailing and Harper 2007, 2010; Cromwell et al. 1995; Tierney et al. 2006; LeBeau 2002; Davila et al. 2005; Brezina and Kaufman 2008; Varano et al. 2010). Research on the post disaster recovery phase frequently involves stresses and coping mechanisms, such as substance use, or crime resulting from psychopathology and domestic violence (Weisler et al.2006; Adams and Adams 1984; Foa et al. 2006; Fothergill 1996, 1999; Morrow and Enarson 1996; Enarson 1999). Even here the research landscape tends to be short in duration, often within a year of the disaster, not the 5 and 6 years later after the event as is the setting for this chapter. As a result, there is little written on the relationship of long term recovery and crime as seen through the lens of a lack of collective efficacy and routine activity.

If it is possible to remove oneself from the emotional aspects of these landscapes, and the suffering that created them, an opportunity is presented to observe fine scale ecological processes on social outcomes. For example, it is well accepted that there is a bidirectional observation between landscape and crime – it is both reflective of local social processes while also being affective of social events. Translating this to the Lower 9th Ward (though obviously without the typical causative pathway), blighted and abandoned buildings, trash or graffiti are indicative of the lack of local social cohesive bonds (returnees) while also providing potential crime locations. Whereas normally these physical aspects occur through a process of social degradation and loss of control, in the Lower 9thWard they were imposed through an exogenous process; buildings lie abandoned and decaying because of flood waters, and graffiti initially covered this landscape because of search and rescue teams. The one post-disaster feature more commonly associated with a lack of typical social cohesion is dumping, though in this case performed by outsiders seeing opportunity for a free way to dispose of trash.[3] The lack of social cohesion that "allows" such negative visual evidence is based on a lack of ability to return and rebuild, and not disinterest in the neighborhood.

[3] A New York Times magazine article "Jungleland: the Lower Ninth Ward in New Orleans gives new meaning to 'urban growth'" by Nathaniel Rich describes in a general sense many of the visual vegetative, returnee and blight problems faced by the neighborhood (see http://www.nytimes.com/2012/03/25/magazine/the-lower-ninth-ward-new-orleans.html?_r=1&ref=magazine).

9.4 A New Method for Fine-Scale Data Collection

9.4.1 The Spatial Video

In order to collect data at the street scale for a changing landscape of this type, a cost effective surveying system is needed. The spatial video approach described in this chapter has been successfully used by the authors in a variety of situations to collect building-scale data that can be combined in ecological analyses. These applications have included post-disaster neighborhood recovery, damage assessment, and linking crimes to different built environment features (Curtis et al. 2007; Mills et al. 2008; Curtis et al. 2010a, b; Mills et al. 2010; Curtis and Mills 2011).

Although video has previously been used for the assessment of the built environment especially with regard to visual cues of decline (Sampson and Raudenbush 1999), the spatial video used here is different in that location information linked to the image allows for viewing within a GIS, that in turn improves the ability to perform a spatial analysis of the image content. The spatial video consists of two (or more) cameras mounted to the side of a vehicle on window clamps. The only requirement for the camera type is that an audio input socket is available as a global positioning system (GPS) encodes vehicle location as sounds on one of the audio tracks. The GPS receiver is attached to a roof mounted aerial. The entire setup: two cameras, window mounts, GPS receiver and aerial, all easily fit into a small back pack. The vehicle drives along a neighborhood street at no more than 15 mph. Once finished, the tapes are digitized and processed using a GIS extension that creates an XML file associated with the video format mpg. Using the same software (GeoVideo by Red Hen Systems), the path of the vehicle is displayed onscreen in the GIS as a cursor moving along a path of points. In an inset window the video plays allowing the user to match images to the exact position on the map. Although environmental conditions can vary the precision along the route, it is still relatively easy to match the video image with a building outline in a GIS once the GPS path has been overlaid on high resolution aerial photography. Various other tools are available within this GIS extension, such as extracting video segments, or single images, that remain linked to the path allowing the user to return to any image's original location on the map. This chapter illustrates this primary data collection approach and extends the work of Curtis and Mills (2011) who had previously analyzed crime in another post-Katrina neighborhood. This earlier paper focused on a smaller neighborhood, Holy Cross, that had received less hurricane damage and more closely resembles typical urban decline in the United States. The neighborhood being analyzed in this chapter is larger and more extreme in all senses. The Lower 9th Ward is a post-disaster urban wilderness within which pockets of recovery are occurring.

9.5 Research Methods and Findings

9.5.1 Data Collection and Coding

Two spatial video trips were performed in August 2010 and 2011 to cover the majority of the Lower 9th Ward (approximately one block north of Clairborne Ave and above) in New Orleans. Once the video had been collected and processed, all buildings on the routes were heads-up digitized in ArcMap 10 using a combination of the available online imagery option with that GIS, and building locations seen on the video itself. This process was aided by a previous layer of buildings digitized for the Lower 9th Ward in the months following Hurricane Katrina using imagery acquired from the Louisiana State University Katrina Clearinghouse (Mills et al. 2008). In addition, a layer of parcels (owned property boundaries) was also overlaid on the available imagery.

Each building was coded using the same recovery score previously employed by the authors in the Holy Cross neighborhood of New Orleans to monitor recovery and crime (Curtis et al. 2010a, b; Curtis and Mills 2011). Buildings that were not occupied scored 1, that were cleared to the ground scored 2, that were being rebuilt scored 3, and were occupied scored 4. Those scoring 1 also received a second score of 2 if the property was sound but empty, 5 if it was boarded up, and 10 if it showed multiple aspects of severe blight including being unsecured, damaged, and with vegetation overgrowth. For the purposes of this chapter scores of 5 and 10 were combined to identify locations of "severe" abandonment that could present opportunities for crime and would indicate a lack of social oversight. The coding scheme has evolved from several years of recovery work in New Orleans and has proven to be suitable in terms of consistency in coding between different people, capturing important aspects of the recovering landscape, and allowing for easy GIS manipulation. Although originally designed as a recovery metric, the categories are consistent with Reynald's (2011) approach to capture local area guardianship especially occupancy (and visible occupancy).

In Fig. 9.1 three images illustrate this coding system with example scores of 1.10 (A), meaning the building scored a 1 and a second score of 10, a score 4 and 1.10 neighboring each other (B) and a 4 and 1.5 also as neighbors (C). One difference between the coding employed here and in previous papers is that no "clearing" (code 2), was used during 2010 as so much of the Lower 9th Ward had returned to open land. However, "2" was utilized in 2011 as this would capture properties that had been bulldozed since 2010. The video was progressed to each property for both years, with the code being added into the attribute table of the digitized building. During the encoding process, images of interest with respect to the purpose of this chapter were extracted from the video.

Fig. 9.1 Three examples of the recovery coding score; $A = 1.10$, $B = 4$ and 1.10, $C = 1.5$ and 4 (Source: Spatial video collected by S. Wright Kennedy August 2010)

9.5.2 Spatial Filter Analysis

After coding, the latitude and longitude center of each building was calculated and used as input into a spatial filter analysis more commonly used in epidemiology studies. The software employed, DMAP (Rushton and Lolonis 1996), calculates a user specified grid over the study area. A rate is calculated at a user specified distance (called a filter) around each node. These filters usually overlap to create a smoothed rate surface. In keeping with the justification for performing fine scale analyses of changing landscapes described at the beginning of this chapter, that social oversight and blight might act as ecological determinants on different types of crime, rates were generated for reoccupied homes and blighted buildings. Therefore, for every node, the rate of blight (scores of 5 or 10 as the numerator, and all buildings as the denominator) and occupied home (scores of 4 as the numerator) were calculated. Rate surfaces were generated for both years (2010 and 2011), remembering that both the numerators and denominators changed between these time periods. Further rates were calculated for the same variables and the same time periods where the denominator was the number of parcels. The difference in using these two denominators is that the first captures the visual built environment while the second is a more standardized measure of *what was* the built environment space (capturing cleared but now overgrown parcels). The results reported in this chapter are for the finest scale (a 0.025 mile filter) capturing the immediate neighbor effect on the landscape, though more coarse filters were also calculated (0.05 miles). Previous work of the authors has analyzed recovery at multiple scales (different filter sizes) in order to eliminate the potential for analysis bias based on any one bandwidth. A minimum denominator was established of five buildings so as not to capture isolated houses, but also having a threshold low enough not to miss the small clusters of pioneer returnees in the neighborhood.

The final rate surface is presented as a series of nodes overlaid onto the Lower 9th Ward map. The locations of crimes[4] proximate to the spatial video path were added to the GIS along with crime type and date. Only crimes for the period July 2010 to September 2011 were included in the analysis. Each crime location[5] was linked in the GIS to the closest spatial filter node. In this way for each crime the neighborhood (here defined as the same street, series of buildings or possibly block) rate of blight and occupied homes could be determined. From the total list of crimes,

[4] Crimes were extracted from the Metro New Orleans Crime Map (http://www.nola.com/crime/nolasearchresults.ssf) which repurposes crime data from a variety of sources including the New Orleans Police Department.

[5] Crimes were reported by block segment, which even with digitizing using the associated map as guide, still leaves a degree of uncertainty as to exactly where the event took place. For several crimes it was easy to determine the location on the sparsely populated landscape, though for the purpose of maps presented in this chapter, the vagueness is preserved for ethical reasons. However, other studies are confident at working with just the aggregation of the street segment or block face which then limits errors associated with geocoding accuracy (see Weisburd et al. 2004; Braga et al. 2011).

Table 9.1 Summary of coding for 2010 and 2011

	2005	2010	2011	Parcels
All buildings	3508	904	1010	4290
Blighted		397 (43.9 %)	307 (30.4 %)	
Returned		365 (40.4 %)	463 (45.8 %)	

A summary of all buildings within the Lower 9th Ward

four were chosen to illustrate either the importance of occupied homes (domestic violence and burglary) or with little oversight often characterized by blight or open space (incivility or auto[6]).

9.6 Results

9.6.1 Changes in the Lower 9th Ward Between 2010 and 2011

A total of 6 hours of driving time video were captured for the Lower 9th Ward for 2010 and 2011. The digitizing and coding of the spatial video took one person approximately 20 h for 2010, and then 10 h for 2011, a shorter period as the majority of the buildings only had to be populated with new scores. Table 9.1 presents an overview of the total buildings, both blighted and occupied (called "return") extracted for both years. The total number of buildings digitized in the Lower 9th Ward immediately after Hurricane Katrina is also provided for comparison. There are no blighted or returned numbers for 2005 as the entire neighborhood was under water.

What is evident from Table 9.1 is that, although slow, progress between 2010 and 2011 has been made with regard to clearing old blighted property (a drop of 90 buildings) and with more homes being occupied (an increase of over 90). It is also poignant to see that the number of occupied homes in 2011 is still less than 20% of the buildings in the neighborhood from before Katrina.

Visual clues on the landscape

> A body was discovered in a burned car Monday afternoon in the Lower 9th Ward. The car -- a white Dodge Charger with a Memphis, Tenn., license plate -- was driven into towering bushes on Law Street between Flood and Choctaw streets. Much of the vegetation in the area has grown more than 12 ft high. "We call the city often," said Richelle Jackson, who could not see the Dodge Charger from the porch of her elevated home a stone's throw from where the car and body were found . "But they don't care". She and Sylvester and Molly O'Neal, who rebuilt in the Lower 9th Ward after their home was destroyed by floodwaters from broken levees during Hurricane Katrina, said this is the second burned car within

[6] For this analysis, crimes were collapsed into convenient categories thought to be of similar types with regards to their relationship with the landscape. In this way "incivility" combines simple drug arrests, simple arson and vandalism; "auto" combines car theft and theft from a car.

Fig. 9.2 Example images extracted from the spatial video showing crime-associated aspects of the landscape (Source: Spatial video collected by S. Wright Kennedy August 2010)

> weeks to appear in their neighborhood. The cars were located within a block of each other. The Charger was less than half a block from the O'Neal home, that has a manicured lawn adorned with lots of roses. But they could not see it from their porch either because of the neglect of public and private property around their home.
>
> *Burned body discovered in Lower 9th Ward neighborhood of New Orleans* by Leslie Williams, The Times-Picayune, Monday August 29, 2011

During the coding of all the buildings on the spatial video routes, various images were extracted and maps generated to illustrate landscape features relevant to the general theoretical discussions described earlier in this chapter. Figure 9.2 displays six of these images. Both A and B are typical of the Katrina-devastated buildings that are still found throughout the Lower 9th Ward. Many of these are damaged, sometimes in danger of collapse, and often overgrown with vegetation. In addition,

many are "unsecured" meaning doors and windows are open. As with the opening quote of this section, it is not surprising to find that crimes and evidence of crimes are continually linked in the media to these spaces in post-Katrina New Orleans. Similarly, many old lots are overgrown with vegetation to the point of being impenetrable, presenting further opportunity for activities beyond normal neighborhood oversight. B and C also display aspects of neighborhood decline more commonly associated with crime in non-disaster landscapes; graffiti and trash (dumping).

Although there is evidence of graffiti on several structures in the Lower 9th Ward, it is not as widespread as one might have thought given the number of abandoned properties. Of more concern is the illegal dumping, which ranges from vehicles (burned out joy rides), to multiple piles of tires and black bags of trash left by the road side. One poignant homemade sign on a street with both blighted and occupied homes states "this is a neighborhood not a dump". A further visual clue to a lack of normal social activity is the many abandoned churches and stores, locations that would have previously played an important role in the social fabric of the community. In addition, many roads are in a terrible condition, even to the point of being impassable, with D showing a bollard placed in the middle of the road to indicate a severe pot-hole. These roads limit access throughout the neighborhood, especially at night. Finally, E and F display aspects of gang activity in the neighborhood, both being memorials to someone who has died. In the first a t-shirt has been nailed to a telegraph pole, while in the second an "RIP" message is spray painted on the sidewalk. These originated from different locations within the neighborhood.

9.6.2 Results of the Spatial Filter Analysis

Once all the buildings had been digitized, eight different spatial filter maps were constructed; for the years 2010 and 2011, for blight and return, and with both buildings and parcels as denominators. Figure 9.3 displays the locations of the four crime categories overlaid on all nodes meeting a minimum of five buildings in the filter threshold. The mix of blighted and occupied homes is so interwoven that the node surface output for each rate surface in 2010 and 2011 is almost identical (only 2010 is shown here). The one difference is in the top left of the map for 2010 where a high rate of rebuilt homes can be seen. Each node is buffered by 41 m (approximately 0.025 miles) and these are merged to show the geographical extent covered by the filters in the rate calculation. In addition, a further buffer extends this area by 59 m to show all crimes that are within at least 100 m of a rate node. It is interesting to note that only ten crimes fall outside of the buffered areas, but of these, four are "incivility" and three are "domestic". One interpretation might be that the minimum of five homes in the denominator does not capture isolated "pioneering" homes where a high stress burden may lead to domestic violence. The map for 2011 is similar to 2010 with only a few subtle shifts in coverage, though the number of crimes outside of the buffer area now falls to six. It is important to note that this also captures an important aspect of a dynamic landscape, that reliance

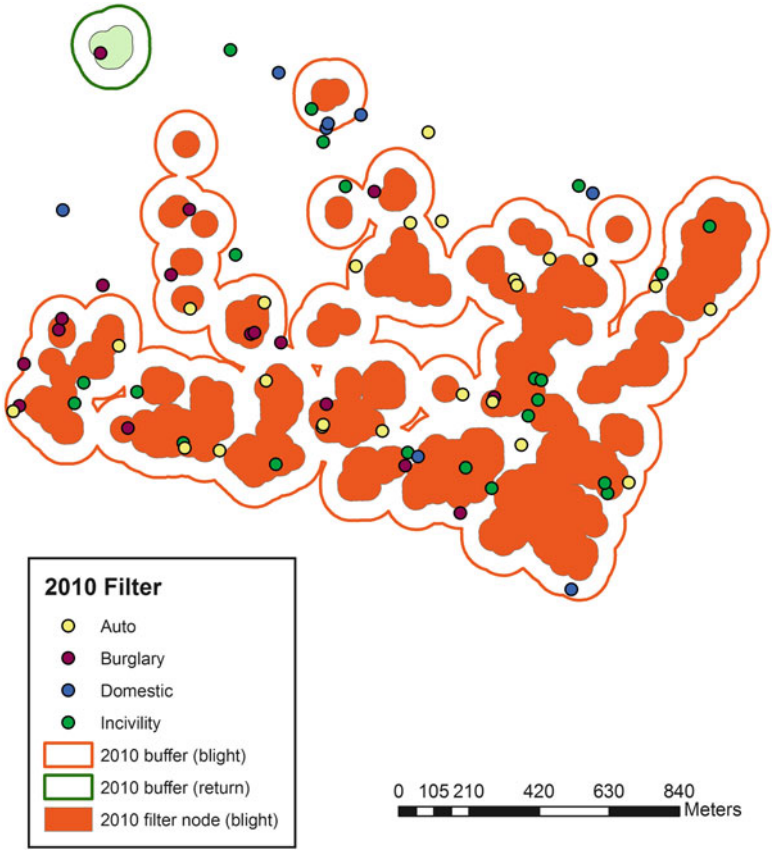

Fig. 9.3 The spatial filter map for 2010 showing the location of all buffered nodes and crimes by type

on cross-sectional data has limitations and the two bounded ecological landscapes presented here at least capture aspects of that change.

As each crime was spatially linked to the closest node, the rates attached to that node could be extracted to form a summary of the average percentage of blighted or returned homes at the node closest to each crime in that category (Table 9.2).

Although the numbers of crimes is too low by category to perform a difference of proportions t test, the overall pattern is still interesting in terms of what it suggests. As an example, there is little variation across all four crime categories using buildings as denominator in 2010 in the blight calculation. The biggest differences occur when the rate calculation uses parcels instead of all buildings as the denominator as this would capture smaller groupings of homes. Although there is relatively little difference between all four crime types and the blight rate during 2010, both auto and incivility have markedly higher average blight rates in 2011. Interestingly, the reverse is true for proximity to occupied homes, with little difference between

Table 9.2 Average blight and return rates for each crime type for 2010 and 2011

Denominator	2010 Blight Building	2010 Blight Parcel	2010 Return Building	2010 Return Parcel	2011 Blight Building	2011 Blight Parcel	2011 Return Building	2011 Return Parcel
Auto (25)	43.1	8.7	38.1	15	30.4	50.8	50.8	9.1
Burglary (17)	33.3	9.5	51.6	14.4	20	7.7	63.5	64
Domestic (8)	40	9.4	50	16	40	5.7	50	50
Incivility (22)	44.8	14	43.7	16.7	27.6	46.6	46.6	9.7
Auto and Incivility	43.95	11.35	40.9	15.85	29	48.7*	48.7	9.4

Where * means $p = 0.01$ and the number in parenthesis is the total for that crime type

all four crime types in 2010, but now a markedly lower rate for auto and incivility in 2011. One possible interpretation of these findings is that when considering the entire landscape (the pre-Katrina footprint and not just the remaining buildings), auto crimes and incivility crimes are more linked to a lack of activity, while the reverse is true for crimes of the home such as domestic disturbances and burglaries. By combining auto and incivility together based on these results (and a belief that this ecological finding makes sense), a difference of proportions *t* test was used to determine that the average percentage of blighted homes (using parcels as the denominator), was the only statistically significant difference from the background population. In other words, the rate of blighted properties around these crimes was higher than the percentage of blighted properties spread across the neighborhood. What is interesting from this finding is that the relationship only holds for 2011. Why? Is it possible that in the slow move to normalcy with the removal of blighted properties and a returning population, a tipping point has been reached whereby a devastated landscape begins to function more similarly to other urban landscapes?

9.7 Discussions

9.7.1 The Purpose of the Chapter

This chapter has presented a methodological approach to collecting fine scale built environment data that can be used to investigate street level patterns of crime. The particular focus was on a more extreme landscape than has previously been analyzed, in this case the Lower 9th Ward of New Orleans after Hurricane Katrina. Although the results presented here are interesting, the take-home message of this chapter is that a technology and technique exists to facilitate more fine-scale built

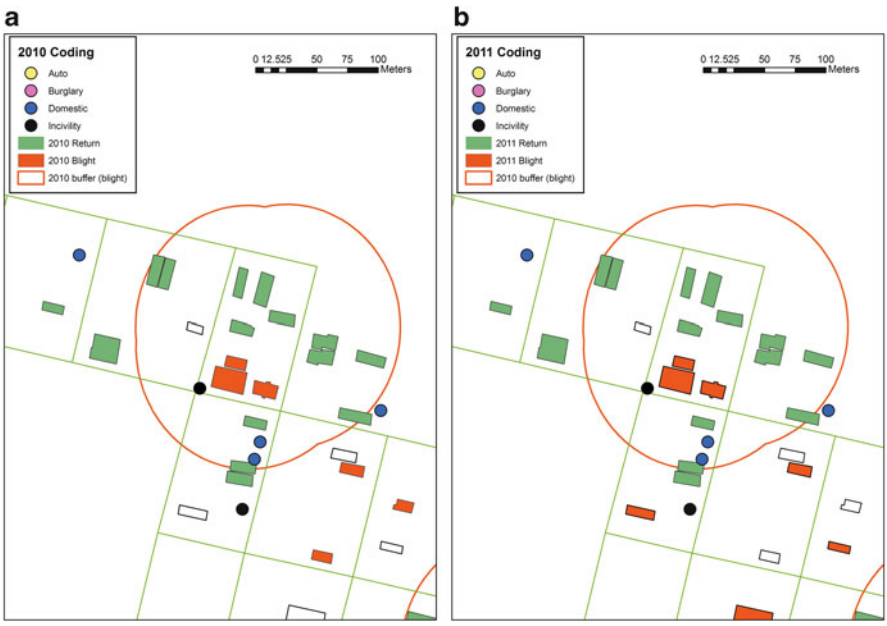

Fig. 9.4 (**a**) and (**b**) A relatively isolated recovery area of the Lower 9th Ward with a high number of domestic violence arrests

environment research suitable for many dynamic environments. Not only can the spatial video be used to capture the variables described here, it also provides an archival source that can be returned to for different investigations, or to follow new lines of inquiry that might emerge. This would be difficult from "walking" survey responses alone, as even if a photograph was taken, these are more likely to be seen in spatial isolation, whereas the video allows for more spatial context. As previously mentioned, images and maps have been generated from the spatial video source to illustrate different fine-scale discussions common in the crime literature, and this chapter will end with a series of block scale maps generated after the analysis had been completed.

9.7.2 Returning to the Spatial Video for Visual Evidence

Relatively little has been written about the space-time evolution of crimes, yet time is considered implicit in most theories (Pitcher and Johnson 2011). While the spatial video approach utilized here can be used to advance general theories, there are specific temporal questions that arise in a post-disaster landscape. For example, Fig. 9.4 a, b map the highest fine-scale concentration of domestic disturbances in the Lower 9th Ward. By comparing the area between 2010 and 2011 we can suggest

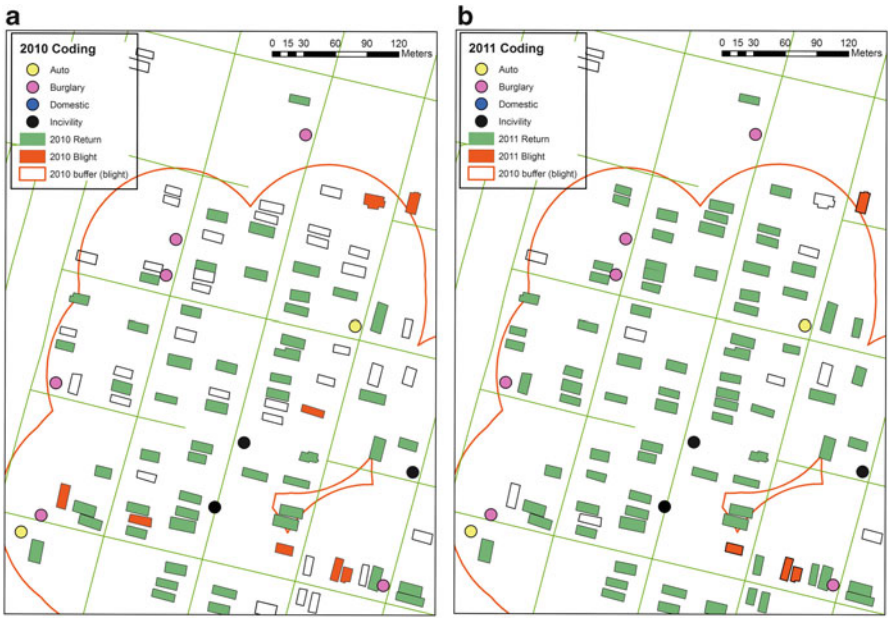

Fig. 9.5 (**a**) and (**b**) The recovery growth pole generated by "Make it Right"

a temporal explanation behind this spatial pattern. Over this period there has been no further rebuilding, and while two of the blighted properties have been cleared, two others have become blighted. By returning to the video, it is evident that a home being rebuilt in 2010 was subsequently abandoned. The question this map raises is, does the relative isolation of these occupied homes, and the ongoing presence of blighted buildings (in combination with severe local vegetation overgrowth) provide the kind of increasing stressful environment that leads to domestic violence?

Previous work has considered the length of residential tenancy to crime (e.g., Kubrin 2003). For example Taniguchi et al. (2011) linked street corners with high percentages of people who had lived there for less than 5 years, with violent and property crime (see also Xie and McDowall 2008). This is also supportive of the idea that neighbor-to-neighbor surveillance is a product of how long residents know each other (Freudenburg 1986). For some post disaster neighborhoods in New Orleans not only has there been a significant reduction in overall population levels, but there has also been an influx of individuals from outside the area. Alternatively, new developments such as "Make It Right", a nonprofit that is relentlessly building new homes from one corner of the neighborhood outwards, are being built systematically to develop "community". Areas of new construction could be investigated in terms of place-based routine activities (Sherman et al. 1989) as this section of the neighborhood, at least during the day, contains both builders and disaster tourists. Figure 9.5a, b show the increase in occupied homes around "Make It Right", and the decrease in blighted homes. Of the ten crimes, five are burglaries; the impressive new

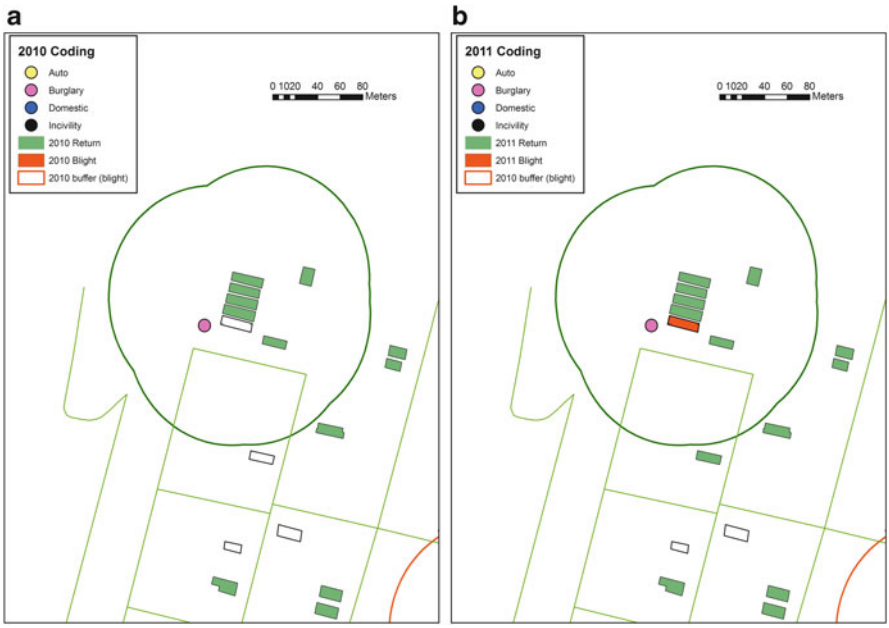

Fig. 9.6 (**a**) and (**b**) An example of "pioneer" returnees who are surrounded by open land

homes and easy access to a main road (North Claiborne) provide a possible crime attractor space. Further questions to consider could be, has this "constructed" community led to a degree of neighbor oversight one wouldn't normally expect given the length of residential tenancy?

A further aspect of post-disaster neighbor oversight is illustrated in Fig. 9.6a, b where the majority of homes are occupied, though still in relative isolation and providing an example of a pioneering mentality. However one home that was being rebuilt in 2010 has since been abandoned and moved into the blighted category. This provides an excellent example of how temporal framing captures more of the story than any cross sectional analysis. Interestingly, in this landscape of relative isolation, a burglary has still occurred.

Another common theme in fine scale crime research is the effect of spatial dependency. For example, Bernasco and Block (2011) found that robbery related crime attractors "radiate" out risk to neighboring census blocks. Similar questions could be posed here, for example, is the presence of blighted buildings in proximate blocks more likely to cause crime? One difference between studies in post-disaster landscapes such as the Lower 9th Ward is that crime is probably not a zero sum game, in other words, crime is attracted into the neighborhood from outside whereas other spillover studies suggest a set amount of crime only shifts geographically. A further difference is with the scale of movement. Although Bernasco and Block (2011) comment on the importance of neighboring blocks in terms of spillover

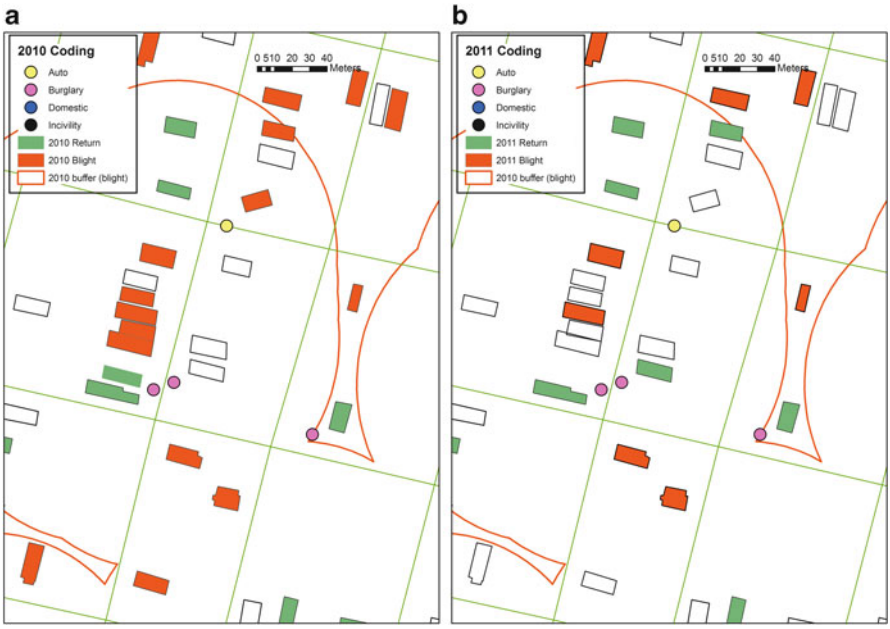

Fig. 9.7 (**a**) and (**b**) An example of the slow removal of disaster caused blight in the Lower 9th Ward

effects as the "… geographical range of humans is limited" (p 51), this might not hold for the Lower 9th Ward as it could be argued that the impediment of distance is lessened in post disaster landscapes. Obviously, this needs further investigation. On a similar note, one specific spillover effect to these crimes may occur along pathways, especially for the Lower 9th Ward where routes must be taken to crime attractors, both in terms of arriving at the neighborhood, and then to a final destination point such as that described in the newspaper quote regarding the dumping of a body. Again, linking spatial dependency to maps generated from the spatial video runs, Fig. 9.7a, b illustrate the vulnerability of occupied homes in a blighted and then cleared landscape. Three burglaries occur in blocks where only three homes are occupied. The rest of the immediate area is comprised of blighted buildings, some of which have been cleared by 2011. Is this an example of the attractiveness of the blighted properties increasing the risk for the occupied homes?

9.7.3 The Next Steps

In terms of future research, questions can be asked as to what constitutes an appropriate space around such potential crime attractors. For example Taniguchi et al. (2011) pose the question, how far from the street intersection does the influence

of the gang set space extend? Similarly here, how far does the influence of a blighted building or an overgrown parcel extend? Spatial interdependency is widely acknowledged (Hipp 2007) but how does it influence crime in neighborhoods such as the Lower 9th Ward?

Finally, the spatial video is an archived data source that can be used for exciting new approaches to fine scale crime research. For example, it is possible to explore the type of neighborhood watchfulness view shed from a home's windows as suggested by Newman (described in Reynald 2011) by turning the types of maps displayed in this chapter into three dimensional street scenes. Similarly, aspects of dumping, and the transition from public to private space (or in this case, overgrown lot to private space) can also be mapped in three dimensions. As Pitcher and Johnson (2011) comment, GIS (and we extend this to geospatial technologies including field collection) now make fine scale, primary data driven, multiple time period research possible.

The rationale for conducting this type of work is double-edged in terms of reducing crime *and* improving neighborhood recovery. Paraphrasing Taniguchi et al. (2011:351), crimes concentrate in relatively few locations and so by understanding the place based characteristics of these spaces intervention strategies can be developed. Traditional examples of such location denial approaches include gang injunctions, though in the Lower 9th Ward it could simply be blight removal and grass cutting. To this end it will be interesting to see how crime patterns will change as a result of Mayor Mitch Landrieu's blight eradication strategy for New Orleans launched at the end of 2011.

9.8 Conclusion

A common thread for many recent place-based research papers is that fine scale environments are not only important theoretically in terms of the role these streets or buildings have on criminal action, but also in terms of accurate spaces for GIS based analysis. Broad area census aggregations do not capture these processes. Although crime pattern analysis can be conducted on events alone, linking these to other environmental variables has previously been difficult. Efforts that have attempted to capture detailed social and built environment information are expensive and time consuming, and therefore are either cross sectional or for a limited number of time periods. This chapter has produced further support for a geospatial approach that addresses these data issues. For example, a modified version of the methods used by Reynald (2011), such as a variant of the Block Environmental Inventory, and even counting pedestrians or other visible signs of activity in or around buildings and open areas to collect residential guardianship could be collected using the spatial video for multiple time periods. This allows for longitudinal fine-scale environmental data to be collected, and as such opens many new research avenues that had previously been relegated to discussion alone.

References

Accordino J, Johnson GT (2000) Addressing the vacant and abandoned property problem. J Urban Aff 22(3):301–315

Ackerman WV, Murray AT (2004) Assessing spatial patterns of crime in Lima, Ohio. Cities 21(5):423–437

Adams PR, Adams GR (1984) Mount Saint Helen's ashfall: evidence for a disaster stress reaction. Am Psychol 39(3):252–260

Bernasco W, Block R (2011) Robberies in Chicago: a block-level analysis of the Influence of crime generators, crime attractors, and offender anchor points. J Res Crime Delinq 48(1):33–57

Bess M (2008) Assessing the impact of home foreclosures in Charlotte neighborhoods. Geogr Pub Saf 1(3):2–5

Braga AA, Papachristos AV, Hureau DM (2010) The concentration and stability of gun violence at micro places in Boston, 1980–2008. J Quant Criminol 26(1):33–53

Braga AA, Hureau DM, Papachristos AV (2011) The relevance of micro places to citywide robbery trends: **a** longitudinal analysis of robbery incidents at street corners and block faces in Boston. J Res Crime Delinq 48(1):7–32

Brantingham PL, Brantingham PJ (1995) Criminality of place: crime generators and crime attractors. Eur J Crim Policy Res 3:5–26

Brantingham PL, Brantingham PJ, Vajihollahi M, Wuschke K (2009) Crime analysis at multiple scales of aggregation: a topological approach. In: Weisburd D, Bernasco W, Bruinsma GJN (eds) Putting crime in its place. Springer, New York

Brezina T, Kaufman JM (2008) What really happened in New Orleans? Estimating the threat of violence during the Hurricane Katrina disaster. Justice Q 25(4):701–722

Bursik RJ Jr, Grasmick HG (1993) Neighborhoods and crime. Lexington Books, New York

Cohen LE, Felson M (1979) Social change and crime rate trends: a routine activity approach. Am Sociol Rev 44:588–608

Cromwell P, Dunham R, Akers R, Lanza-Kaduce L (1995) Routine activities and social control in the aftermath of a natural catastrophe. Eur J Crim Policy Res 3(3):56–69

Curtis A, Mills JW (2011) Crime in urban post-disaster environments: a methodological framework from New Orleans. Urban Geogr 32(4):488–510

Curtis A, Mills JW, Kennedy B, Fotheringham S, McCarthy T (2007) Understanding the geography of post-traumatic stress: an academic justification for using a spatial video acquisition system in the response to Hurricane Katrina. J Conting Crisis Manag 15(4):208–219

Curtis A, Mills JW, McCarthy T, Fotheringham AS, Fagan W (2010a) Space and time changes in neighborhood recovery after a disaster using a Spatial Video Acquisition System. In: Showalter P, Lu Y (eds) Geospatial techniques in urban hazard and disaster analysis. Springer, Berlin

Curtis A, Duval-Diop D, Novak J (2010b) Identifying spatial patterns of recovery and abandonment in the Holy Cross neighborhood of New Orleans. Cartogr Geogr Inf Sci 37(1):45–56

Dalton E, Gradeck R, Mercaldo A (2008) Using maps of home foreclosures to understand national and local problems. Geogr Public Saf 1(3):5–8

Davila M, Marquart JW, Mullings JL (2005) Beyond mother nature: contractor fraud in the wake of natural disasters. Deviant Behav 26:271–293

Decker SH, Varano SP, Greene JR (2007) Routine crime in exceptional times: the impact of the 2002 Winter Olympics on citizen demand for police services. J Crim Justice 35:89–101

Enarson E (1999) Violence against women in disasters: a study of domestic violence programs in the United States and Canada. Violence Against Women 5(7):742–768

Felson M (2006) Crime and nature. Sage, Thousand Oaks

Foa EB, Stein DJ, McFarlane AC (2006) Symptomatology and psychopathology of mental health problems after disaster. J Clin Psychiatry 67(Suppl 2):15–25

Fothergill A (1996) Gender, risk, and disaster. Int J Mass Emerg Disaster 14:33–56

Fothergill A (1999) An exploratory study of woman battering in the Grand Forks flood disaster. Int J Mass Emerg Disaster 17:79–98

Frailing K, Harper DW (2007) Crime and hurricanes in New Orleans. In: Brunsma DL, Overfelt D, Picou S (eds) The sociology of Katrina. Rowman and Littlefield, Plymouth
Frailing K, Harper DW (2010) School kids and oil rigs: two more pieces of the post-Katrina puzzle in New Orleans. Am J Econ Sociol 69(2):717–735
Freudenburg WR (1986) The density of acquaintanceship: an overlooked variable in community research? Am J Sociol 92:27–63
Groff ER, Weisburd D, Yang SM (2010) Is it important to examine crime trends at a local "Micro" level?: a longitudinal analysis of street to street variability in crime trajectories. J Quant Criminol 26(1):7–32
Hipp JR (2007) Income inequality, race, and place: does the distribution of race and class within neighborhoods affect crime rates? Criminology 45:665–97
Immergluck D, Smith G (2006) The impact of single-family mortgage foreclosures on neighborhood crime. Hous Stud 21(6):851–866
Kinney JB, Brantingham PL, Wuschke K, Kirk MG, Brantingham PJ (2008) Crime attractors, generators and detractors: land use and urban crime opportunities. Built Environ 34(1):62–74
Kubrin CE (2003) Structural covariates of homicide rates: does type of homicide matter. J Res Crime Delinq 40:139–70
LaGrange RL, Ferraro KF, Supancic M (1992) Perceived risk and fear of crime: role of social and physical incivilities. J Res Crime Delinq 29(3):311–334
LeBeau JL (2002) The impact of a hurricane on routine activities and on calls for police service: Charlotte, North Carolina and Hurricane Hugo. Crime Prev Community Saf Int J 4(1):53–64
Loukaitou-Sideris A (1999) Hot spots of bus stop crime: the importance of environmental attributes. J Am Plan Assoc 65(4):395–411
Loukaitou-Sideris A, Liggett R, Iseki H (2002) The geography of transit crime. J Plan Educ Res 22(2):135–151
Mills JW, Curtis A, Pine J, Kennedy B, Jones F, Ramani R, Bausch D (2008) The clearinghouse concept: a model for geospatial data centralization and dissemination in a disaster. Disasters: J Stud Policy Manag 32(3):467–479
Mills JW, Curtis A, Kennedy B, Kennedy SW, Edwards J (2010) Geospatial video for field data collection. Appl Geogr 30(4):533–547
Morrow BH, Enarson E (1996) Hurricane Andrew through women's eyes: issues and recommendations. Int J Mass Emerg Disaster 14:5–22
Peed C, Wilson RE, Scalisi NJ (2008) Making smarter decisions: connecting crime analysis with city officials. The police chief (September). Available online: http://policechiefmagazine.org/magazine/index.cfm?fuseaction=display_arch&article_id=1603&issue_id=92008
Perkins DD, Taylor RB (1996) Ecological assessments of community disorder: their relationship to fear of crime and theoretical implications. Am J Community Psychol 24((1):63–107
Perkins DD, Meeks JW, Taylor RB (1992) The physical environment of street blocks and resident perceptions of crime and disorder: Implications for theory and measurement. J Environ Psychol 12(1):21–34
Perkins DD, Wandersman A, Rich RC, Taylor RB (1993) The physical environment of street crime. J Environ Psychol 13(1):29–49
Pitcher AB, Johnson SD (2011) Exploring theories of victimization using a mathematical model of burglary. J Res Crime Delinq 48(1):83–109
Reynald DM (2011) Factors associated with the guardianship of places: assessing the relative importance of the spatio-physical and sociodemographic contexts in generating opportunities for capable guardianship. J Res Crime Delinq 48(1):110–142
Reynald DM, Elffers H (2009) The future of Newman's defensible space theory: linking defensible space and the routine activities of place. Eur J Criminol 6:25–46
Robinson JB, Lawton BA, Taylor RB, Perkins DD (2003) Multilevel longitudinal impacts of incivilities: fear of crime, expected safety, and block satisfaction. J Quant Criminol 19(3):237–274
Rogers WH, Winter W (2009) The impact of foreclosures on neighboring housing sales. J Real Estate Res 31(4):455–479

Rushton G, Lolonis P (1996) Exploratory spatial analysis of birth defect rates in an urban population. Stat Med 15:717–726
Sampson RJ, Raudenbush SW (1999) Systematic social observation of public spaces: a new look at disorder in urban neighborhoods. Am J Sociol 105:603–651
Sampson RJ, Raudenbush SW, Earls F (1997) Neighborhoods and violent crime: a multi-level study of collective efficacy. Science 277(5328):918–924
Schuetz J, Been V, Ellen IG (2008) Neighborhood effects of concentrated mortgage foreclosures. J Hous Econ 17(4):306–319
Shaw CR, Zorbaugh F, McKay HD, Cottrell L (1929) Delinquency areas. University of Chicago Press, Chicago
Sherman L, Gartin PR, Buerger ME (1989) Hot spots of predatory crime: routine activities and the criminology of place. Criminology 27:27–55
Skogan W (1986) Fear of crime and neighborhood change. Crime Justice 8:203–229
Skogan W (1990) Disorder and decline: crime and the spiral of decay in American neighborhoods. University of California Press, Berkeley
Smith WR, Frazee SG, Davison EL (2000) Furthering the integration of routine activity and social disorganization theories: small units of analysis and the study of street robbery as a diffusion process. Criminology 38:489–524
Taniguchi TA, Ratcliffe JH, Taylor RB (2011) Gang set space, drug markets, and crime around drug corners in Camden. J Res Crime Delinq 48(3):327–363
Taylor RB (1997) Social order and disorder of street blocks and neighborhoods: ecology, microecology, and the systemic model of social disorganization. J Res Crime Delinq 34(1):113–155
Taylor RB (2001) Breaking away from broken windows: Baltimore neighborhoods and the nationwide fight against crime, grime, fear, and decline. Westview Press, Boulder
Taylor RB, Shumaker SA, Gottfredson SD (1985) Neighborhood-level links between physical features and local sentiments: deterioration, fear of crime, and confidence. J Archit Plan Res 2:261–275
Tierney K, Bevc C, Kuligowski E (2006) Metaphors matter: disaster myths, media frames, and their consequences in Hurricane Katrina. Ann Am Acad Polit Soc Sci 604:57–81
Tita GE, Cohen J, Engberg J (2005) An ecological study of the location of gang 'set space'. Soc Probl 52:272–99
Townsley M, Homel R, Chaseling J (2003) Infectious burglaries: a test of the near repeat hypothesis. Br J Criminol 43:615–33
Varano SP, Schafer JA, Cancino JM, Decker SH, Greene JR (2010) A tale of three cities: crime and displacement after Hurricane Katrina. J Crim Justice 38:42–50
Weisburd DL, Bushway S, Lum C, Yang SM (2004) Trajectories of crime at places: a longitudinal study of street segments in the city of Seattle. Criminology 42:283–321
Weisler RH, Barbee JG IV, Townsend MH (2006) Mental health and recovery in the Gulf Coast after Hurricanes Katrina and Rita. JAMA 296(5):585–588
Wilson JQ, Kelling GL (1982) Broken windows. Atl Mon 249(3):29–38
Wilson RE, Paulsen DJ (2008) Foreclosures and crime: a geographical perspective. Geogr Pub Saf 1(3):1–2
Xie M, McDowall D (2008) The effects of residential turnover on household victimization. Criminology 46:539–75