

Geography & Public Safety



A Quarterly Bulletin of Applied Geography for the Study of Crime & Public Safety

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A Message from the COPS Office Director

The Office of Community Oriented Policing Services is excited to bring you Volume 3 of *Geography and Public Safety*. In partnership with the National Institute of Justice, we will continue to develop this informative newsletter and publish it quarterly.

Within each issue, you will find illustrative examples of geographic information systems (GIS) in practice. The use of GIS can assist agencies in strategically applying their limited resources to make our streets safer and to enhance community policing efforts. We want to continue bringing you informative articles that contribute to our understanding of crime and public safety, articles that will include new concepts as well as those you have come to know. We will also continue providing technical tips, a synopsis of geography in the news, and listings of upcoming events.

We have planned a productive year ahead of us, identifying various topics that will be covered in future issues. In addition, each issue will focus on a theme, spotlight new and innovative research in the field of GIS, and include interviews with leading practitioners. We encourage you to use each issue to enhance public safety in your communities.

The theme for this issue is using GIS to address the full spectrum of public safety issues facing law enforcement. While mapping crime must remain a key focus, using the power of geographic analysis to enhance community policing and problem-solving strategies must also be pursued. In this new economy, in which we are all asked to do more with less, it is imperative that agencies make informed decisions by making the best use of available data. Just as GIS can be used to assess crime incidents, it can also be used to explore issues such as community participation, equitable distribution of police services, and procedural justice.

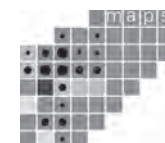
We want to thank the leadership of the National Institute of Justice for their partnership and support in this endeavor. Without their ideas and commitment, this publication would not have come to fruition. We will continue our partnership in developing future volumes of this newsletter.

I strongly encourage you to visit our website at www.cops.usdoj.gov and view previous issues. You can also register at www.cops.usdoj.gov/Default.asp?Item=2567 to be included on the subscribers list so you don't miss an issue. I also encourage you to reach out to our editorial staff to discuss your ideas and submissions to this publication.

Bernard Melekian
Director, Office of Community Oriented Policing Services
U.S. Department of Justice

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Full Spectrum Use of GIS by Law Enforcement: It's Not Just About Mapping Crime

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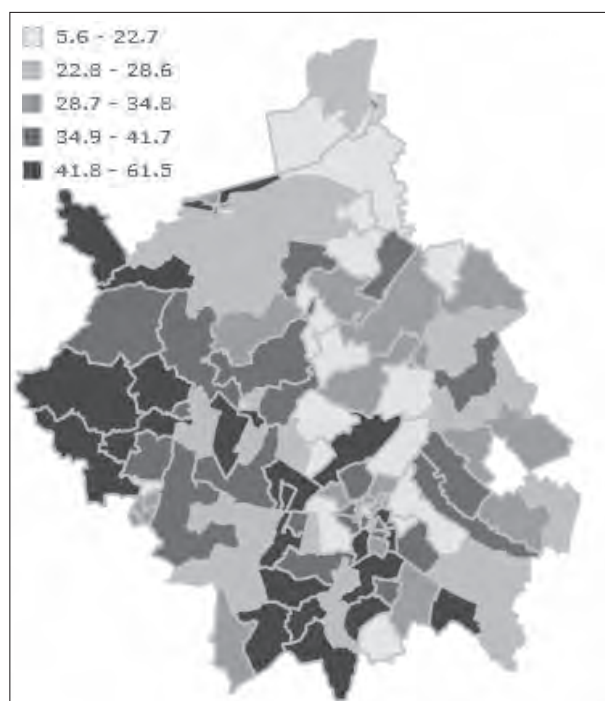
An increasing number of law enforcement agencies have benefited from crime mapping as geographic information systems (GIS)—the hardware, software, and personnel for mapping—have become more powerful, affordable, accessible, and user friendly. As valuable and important as mapping crime is, approximately 70% of demands for police services are for non-criminal matters. These non-crime-related services range from traffic control, to finding lost children or elderly residents suffering from Alzheimer's disease, to enhanced surveillance for protecting critical infrastructure in a post 9/11 era.

While GIS has been used effectively to accomplish tasks such as these, such non-traditional applications of GIS do not receive the same level of attention as efforts devoted to mapping crime. Particularly in these fiscally challenging times when police are being called upon to do more with less, departments should strive to use GIS analysis and tools to address,

assess, and enhance the full spectrum of police services and responsibilities.

Given the unique mission of the COPS Office, we are eager to promote the use of GIS to enhance not only the traditional enforcement responsibilities but also the three core components of community policing: problem-solving, partnerships, and organizational transformation. To do this, we encourage greater use of GIS to help assess and increase the effectiveness of efforts such as outreach, prevention, and neighborhood-based risk and capacity assessment, as well as the innovative use of GIS to assess and advance commitment to police accountability and legitimacy.

In this issue, featured articles address this full spectrum approach that not only combine traditional crime mapping and crime analysis techniques but also incorporate elements of community policing. The article "Engaging the Community: Operation Heat Wave," for instance, illustrates how Targeted Area Action



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Figure 1. Percentage of respondents who feel the police and other local services are successfully dealing with local concerns about anti-social behavior and crime issues

Grids (TAAG)—statistically identified distressed areas with high risk of crime—can be used to direct detectives conducting outreach to residents of these distressed areas to establish leads. The Urban Institute’s article “Measuring Potential Diffusion of Benefits and Crime Displacement Near Public Surveillance Systems” and the Shawnee (Kansas) Police Department’s article “Shawnee Viewer,” which provides an overview of its GIS tool for integrating and viewing data about locations, each illustrate how GIS can be used to address traditional law enforcement concerns and community policing strategies simultaneously.

For future issues of G&PS, readers are encouraged to submit examples, articles, and tech tips that reflect geographic approaches to the full-spectrum of public safety issues. For policing agencies, these efforts should encompass both traditional crime mapping as well as non-traditional applications of GIS related to community policing. In an effort to prime the pump, we offer a few examples below of what today would be considered non-traditional mapping supportive of community policing.

Example One: Mapping Citizen Perceptions and Levels of Satisfaction

Thematic mapping has been used, albeit sparingly, to assess and compare residents’ perception and levels of satisfaction with the police, of public safety issues, and about the community. Understanding how these dimensions vary by neighborhood allows police to assess impacts across the neighborhoods they serve and identify geographic areas where outreach and public relations efforts could be directed.

An illustrative example of this type of citizen perception mapping can be seen in Figure 1, which shows results from the United Kingdom’s Place Survey comparing wards across the county of Cambridgeshire. For this map, the indicator reflects the percent of respondents that agree “the police and other local services are successfully dealing with local concerns about anti-social behaviour and crime issues.”¹ Simple visualization of variations across wards in maps such as these may point to places where police and other local agencies may want to devote outreach. These maps may also be shared with community groups to serve as a foundation for discussions with those in communities that feel more disaffected.

Figure 2, which also reflects data from the United Kingdom’s Place Survey, shows the percentage of respondents who “perceive drug use or drug dealing to be a problem in their local community.”² Maps of citizen perception regarding levels of public disorder can provide an additional indicator of where problems may exist. These areas may confirm what official crime data captured, such as incident reports or arrests,

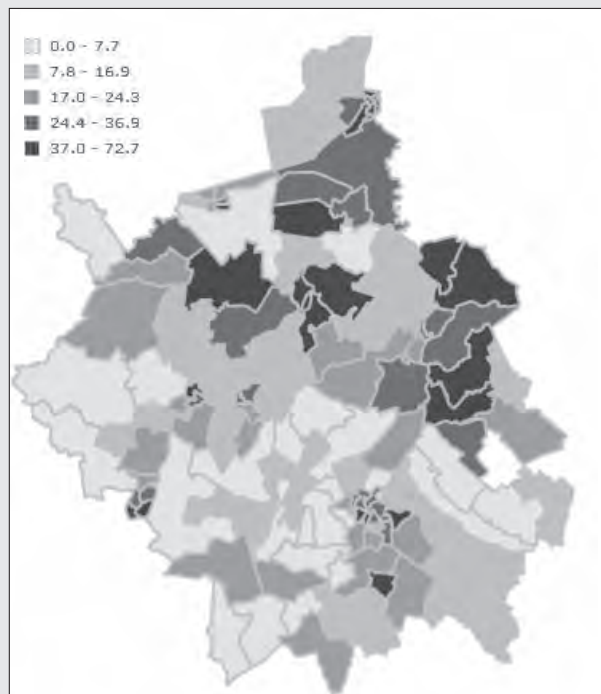
but they also may help identify areas where crime and disorder are under-reported.

Besides relying on survey data, other types of data that could be mapped to assess citizen perceptions of police include citizen-initiated complaints against police, either as raw numbers or normalized against a baseline of citizen contacts (e.g., number of complaints resulting from traffic stops divided by number of traffic stops times 1,000).

Example Two: Mapping Police Behavior

Rather than just mapping crime, police may also map locations where they interact with the public. Many departments map field contacts as well as the locations at which they provide services such as “well-being checks.” GIS also can be used to assess police activity and behavior. Maps can be used to assess distribution of activity across geographic units while also taking into account contextual data that may drive that behavior.

Included within its annual internal affairs reports, the Charlotte-Mecklenburg Police Department has used density mapping to



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Figure 2. Percentage of respondents who perceive drug use or drug dealing to be a problem in their local community



Figure 3. Charlotte-Mecklenburg Police Department's density of use of force relative to arrest hotspots

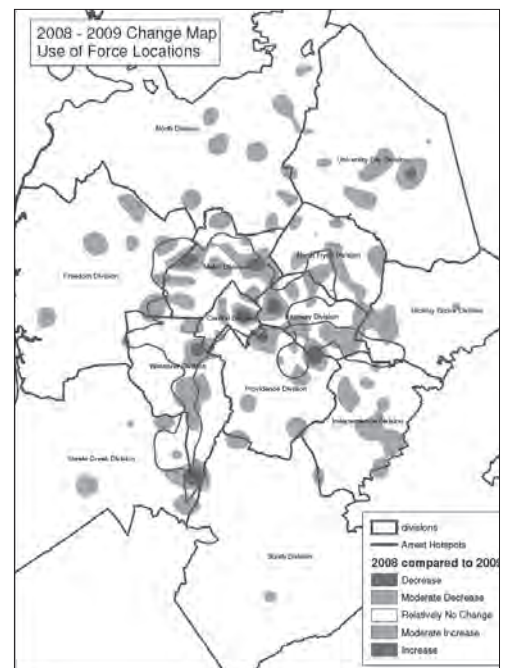


Figure 4. Charlotte-Mecklenburg Police Department's changes in density of use of force relative to arrest hotspots

assess the degree to which their deployments of force are geographically distributed and how the density of incidents involving force relates to crime hotspots.

As Figure 3 illustrates, there is considerable correspondence between the highest density locations for use of force in 2009 and areas representing arrest hot spots.³

The utility of such maps concerning community relations services is that the strong relationship between use of force and crime may allay some concerns about the unequal distribution of force across neighborhoods. Figure 4 shows further utility of this approach by comparing changes in use of force compared to the previous year.⁴ At the city level, the rate in which use of force was deployed in 2009 decreased to 1.5 use-of-force incidents per 100 arrests from 1.7 in 2008. However, when seen in a change map, local dynamics are revealed; increases and decreases at specific locations are clearly depicted. ■

Notes

- 1 Figures 1 and 2 are accessible on a webpage that allows for interactive query and mapping <http://map1.cambridgeshire.gov.uk/observe/Flash/Place%20Survey%202008/atlas.html>. Click the box labeled "Data" to change the indicator from the Place Survey to be thematically mapped.
- 2 *ibid.*
- 3 Figures 3 and 4 are reproduced from the Charlotte-Mecklenburg Police Department's 2009 Internal Affairs Report: www.charmeck.org/city/charlotte/CMPD/organization/PoliceChief/InternalAffairs/Documents/2009IARReport.pdf
- 4 *ibid.*

Integration of Centralized Intelligence with Geographic Information Systems: A Countywide Initiative

Captain Jeffrey S. Paul and Agent Thomas M. Joiner
Morris County (New Jersey) Prosecutor's Office

Under the cover of winter darkness, a sophisticated crew of disguised burglars used acetylene torches and power tools to enter commercial buildings and cut into automated teller machines (ATMs) throughout Morris County, New Jersey. Their efforts were highly organized, their movements appeared synchronal, and their overall proceeds exceeded \$100,000. One night in March, as this crew gained entry into their 15th building, they were greeted by a burglary task force, which was comprised of law enforcement officers from nine different agencies. In the months that followed, the suspects pled guilty to all 15 commercial burglaries and received 8 years in state prison for their crimes.

This scenario isn't a script from Hollywood; it is the result of an investigation that concluded in March of 2010 in Morris County. Through the centralization of intelligence and a strong partnership with municipal police departments, law enforcement resources are readily shared to reduce crime throughout the county.

Globalization of Crime

Morris County stands in a unique position to address the issues of narcotics, gangs, and drugs as a suburban problem rather than an urban epidemic. With the high density of road networks that intersect the county, traveling and commuting into Morris County from surrounding criminogenic urban areas has become easier. These state highways, interstates, and the abundance of secondary roads have exposed Morris County's residential communities to an aggregation of motivated offenders searching for potential targets with valuable rewards.

With the globalization of crime, criminals are no longer restricted to geographic boundaries. However, offenders still assume that police agencies don't share data. In the past, these assumptions would have been accurate, but with the proliferation of web-based intelligence-sharing databases, agencies can easily disseminate data and track offenders throughout various geographic areas.

Intelligence Crime Task Force

In 2007, Morris County Prosecutor Robert A. Bianchi, Esq., created the Morris County Prosecutor's Office Intelligence Crime Task Force (ICTF) to meet the newly adopted demands of the intelligence-led policing (ILP) model. The ICTF's function is to conduct targeted investigations that focus on the worst offenders, specifically those individuals actively engaged in crimes relating to gangs, drugs, weapons, and burglaries.

The ICTF investigative staff is fully integrated with specialized assistant prosecutors who actively engage with the detectives in daily investigations and operations. This partnership marries the ILP model, practiced by the investigative staff, with an aggressive prosecutorial model, managed by the legal staff. As an additional layer to this hybrid philosophy, the local police departments actively contribute and are enthralled in this process. Without the support and contributions of the 37 local municipal police departments, efforts to centralize intelligence would be highly unsuccessful.

The Morris County Prosecutor's Office ICTF, as well as the Morris County Sheriff's Office and the Morris County Park Police, focus their efforts on centralized resources. Centralization includes the collection, collaboration, and dissemination of resources in a more effective and efficient manner.

The ICTF resembles a regional or county fusion center, where the goal is to emulate a service agency for the municipal departments covering the 500 square miles of Morris County. In its basic form, the municipal departments provide data and intelligence from their respective jurisdictions to the ICTF. This data is compiled into a central database, analyzed, and distributed as actionable intelligence to the broader Morris County law enforcement community. After distributing these intelligence products, the law enforcement community evaluates the trends and investigates persons of interest, or people who are actively contributing to these crime trends. These investigations are further developed using geospatial intelligence.

Standardization of Codes

Before implementing the use of geographic information systems (GIS) countywide, one of the most fundamental reform efforts Prosecutor Bianchi addressed was the need to standardize the incident codes (CAD/RMS) in an effort to comply with the analytic demands of the ILP model. By standardizing these codes, data is efficiently and uniformly collected in a central database that is accessible to every department countywide.

To maximize the productivity of this database, a considerable amount of time was spent collectively with the municipal chiefs evaluating and standardizing the data, so real-time analytics can be applied to investigative operations. These changes were made prospectively, and the definitions are based on a common understanding of specific call and crime types (incident codes) within every police department. For instance, incident codes were categorized into commonly accepted groups to measure and forecast crime trends more easily and accurately. More specifically, instead of measuring overall burglary incidents, the standardized codes divide burglary into three types: residential, commercial, and motor vehicle.

These incident codes are captured into a database and geocoded at the parcel level in Esri ArcGIS 10.0 as a separate crime layer. Data from this layer is complemented with additional layers including parole releases; residential, employment, and leisure activity spaces of chronic offenders; prior incidents; and weekly transactions from pawn shops throughout Morris County and surrounding counties.

Operational Analysis

Prosecutor Bianchi's strategic goal is to reduce overall crime countywide without requiring additional resources. To achieve this, the standardized crime data is analyzed, and problematic areas are identified. After classifying an area as high risk or problematic, agencies are deployed to these areas to suppress the emerging crime problem, placing particular concern on eliminating the problem rather than diffusing or displacing it.

The use of GIS has simplified the process of determining which areas are identified. For instance, monthly or bi-monthly burglary reports are distributed and include descriptive maps of overall patterns and emerging trends; hot spot analysis; crime forecast models such as Risk Terrain Modeling or Journey to Crime Analysis; profiles of arrested individuals, including target selection locations and Modus Operandi; temporal trends; and monthly comparisons of incidents. These reports are generated based on the aforementioned standardized data and intelligence submitted by the municipal departments.

Feature *in the next issue of*

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Geography & Public Safety

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The forecasts, which adopt the techniques of Risk Terrain Modeling, utilize past criminal events, as well as variables that are correlated with burglary incidents, to create risk scores for small geographic areas throughout Morris County. These risk values, or high-risk scores, represent areas that are geographically and statistically similar to areas that have been victimized in the past. For the analysis, five significant variables are used to create and forecast high-risk areas: (1) past burglaries, (2) the residential location of individuals arrested for theft or burglary between 2009 and 2011, (3) the proximity to major highways, (4) the geographic concentration of males between the ages of 16 and 24, and (5) the location of apartment complexes and hotels. By operationalizing the spatial influences throughout the county, agencies allocate resources to these identified areas in a proactive manner.

Tactical Analysis

Once specific crime patterns are identified, short-term operations are coordinated to apprehend the targeted offenders. One specific technique used to aid an investigation is geographic profiling. Together with ArcGIS, geographic profiling gives the ICTF the ability to use heuristic algorithms to delineate specific regions that have higher probabilities of containing an offender's residence, place of employment, or leisure space. From these probabilities, we prioritize these areas and develop a list of likely suspects based on the GIS data that falls within our search radius.

Rather than use a calibrated distance decay function, the Morris County Prosecutor's Office combines the truncated negative exponential distance decay function with a weighted land usage variable. This land usage variable is an ordinal level variable consisting of different classifications. By examining the last known address of prior offenders, the land use classifications are assigned a value based on the frequency or prior likelihood that they contained an offender's residence. These weighted values are factored into the geographic profiling calculation to produce more accurate results; this modified calculation takes into account the road networks, lakes and ponds, and diverse land use. These estimates, combined with the additional data, have led to successful results, as stated previously with the apprehension of the "ATM Bandits" in March of 2010.

Conclusion

While the obvious benefit of centralization is the significant reduction of crime, an added benefit is that the reduction of crime comes at no additional cost to any police agency. Instead of spending money to reduce crime, agencies share data and resources and periodically allocate officers to areas that have been identified as emerging or problematic. Inter-agency officer allocation is strictly voluntary and on an as-needed basis. By lending an officer to another jurisdiction for a shift, the necessary manpower is met and intelligence is shared more readily.

This proactive approach has led to successful results in Morris County. Since 2007, the total crime index in the county has decreased by 11%, violent crime by 21%, and property crime by 7%. These results support the shift from quantitative result to qualitative results. Under Prosecutor Bianchi's initiative, there have been roughly 1,000 more years of state prison sentences handed out with fewer cases having been filed. These numbers represent the problematic or chronic offenders who are receiving longer state prison sentences, and yet those most problematic offenders in need of social services continue to receive rehabilitation efforts. Qualifying low-risk offenders are admitted into the new Mental Health Diversionary Program, which Prosecutor Bianchi also implemented.

With shrinking budgets and a constant demand for services, the law enforcement community must find a way to provide citizens with services in the most cost-efficient and effective manner. By centralizing intelligence, using proactive measures, and adopting an analytical presence, agencies can target prolific offenders to reduce crime in the community. With the assistance of geographic information systems and the centralization of intelligence, the spatial boundaries of police departments become limitless and the demands of the taxpayers are fulfilled. ■

Engaging the Community: Operation Heat Wave

Deputy Chief Brigitte Gassaway
Property Crimes Division, Dallas Police Department

Sergeant Steven Armon
Crime Analysis Unit, Dallas Police Department

Dana Perez
Planning Unit, Dallas Police Department

Operation Heat Wave is a summer crime reduction initiative launched by the Dallas Police Department with the intent of reducing overall citywide crime by focusing specifically on residential and business burglaries, other thefts, and motor vehicle burglaries. The initiative builds upon the coordinated efforts that occurred last year during the summer crime initiative, Operation Triangle. This year there is a two-pronged approach that, first, allocates resources where they would have the most effect in preventing offenses and, second, attempts to engage the community in crime-fighting efforts through the use of door-to-door contacts soliciting actionable intelligence.

The initiative is coordinated by Deputy Chief Brigitte Gassaway, commander of the Property Crimes Division. The initiative first targeted

one Targeted Area Action Grids (TAAG) area in each of the seven patrol divisions. Beginning April 18, 2011, the Dallas Police Department has expanded to ten TAAGs to address crime in the two categories identified above.

TAAG areas are geographic hot spots within the city where conditions are favorable for crime to occur. Twenty-seven areas have been identified and represent approximately 7% of the city, or about 26 square miles, and have about 30% of the total Part I crimes. The model uses a multivariate method that improves the forecasting effectiveness of geographic information systems (GIS) compared to conventional or retrospective mapping methods because it looks at more than just crime. The variables or indicators themselves do not create crime; they simply point to locations where, if the conditions are right, the likelihood of victimization and criminal behavior increases. The TAAG areas produced will assist in strategic decision making and tactical action by showing where conditions are favorable for crime to occur in the future.

To create grids, the crime analysis team collects data from the event- and place-based indicators. There are 6,838 grids used within the city proper, measuring 1,320 feet by 1,320 feet. Using the Esri ArcView GIS program, the analyst overlays a continuous one-sixteenth square mile grid on the city, and the grids are then spatially joined with the data. This results in five separate layers with counts per grid. A composite map

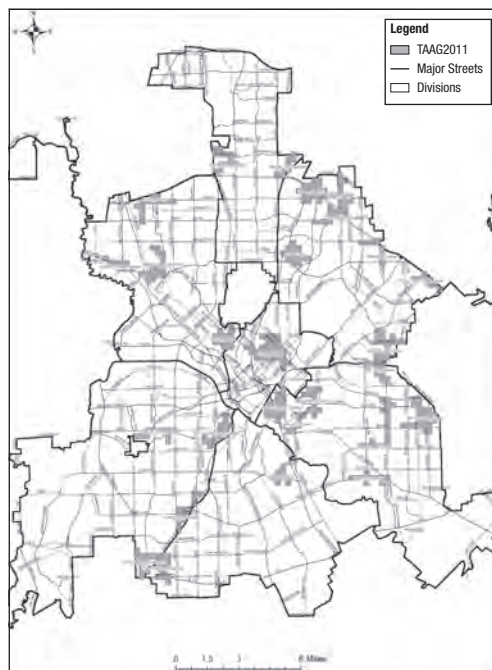


Figure 1. 2011 TAAG areas map prepared by the Crime Analysis Unit

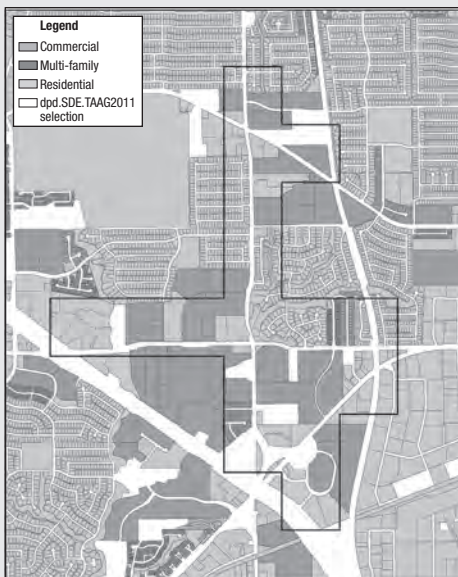


Figure 2. TAAG area identified in the Forest Audelia section of Dallas

with aggregated grid counts is produced by merging the multiple indicators together. The map is displayed in a choropleth, using standard deviational classifications and one-quarter standard deviation for the interval size. Figures 2 and 3 demonstrate the types of maps that are used first to identify the TAAG area and then to divide the sections into areas that a squad can canvass in either a 4-hour period on a weekday or during an 8-hour period on a Saturday.

The following are the indicators that were used to identify problematic areas in the map:

Event-Based Indicators

- Arrests: Drug, prostitution, and weapons
- Calls: Shootings, cuttings, drug house, prostitution, random gunfire, prowler, suspicious person, panhandler, in-progress calls; to include major disturbances and other calls that mention guns, drugs, fighting and gangs



Figure 3. TAAG area identified in the Forest Audelia section of Dallas with mapped community resources

- Offenses:
 - » Part 1 Violent Crime—murder, rape, aggravated assault, and robbery
 - » Part 1 Property Crime—burglary, BMV, other theft, UUMV...
*not including shoplifting

Place-Based Indicators

- Gang members' home addresses
- Arrestees: burglary, robbery, and BMV home addresses
- Parolee home addresses

What makes this crime-fighting technique unique is the community engagement aspect where all detectives within the department are required to wear their uniforms and go out into the community to meet the public in these distressed areas. Each detective goes into the field at least 32 to 40 hours during the summer. There are generally 150 detectives and administrative personnel canvassing during each operation. Each team

of detectives is assigned to a sergeant and is responsible for canvassing a number of doors. The detectives go door to door in the identified areas to try to obtain information on no-lead offenses and other intelligence information that could be shared throughout the city.

The belief is that engaging the citizens during this brief contact will have a positive impact on community relations regardless of the amount of actionable intelligence that is developed. Detectives also provide information on Operation ID; the Lock, Take & Hide program; iWatch Dallas; and other crime prevention strategies. Detectives encourage the citizens to attend crime watch meetings and provide information regarding an upcoming crime watch meeting in their neighborhood. During the months of June, July, and August, the number of interviews with the citizens increased.

Dallas Police Chief David O. Brown's philosophy regarding increased community engagement is being implemented as officers connect with citizens to determine information about criminal activity and perception of crime in their neighborhood. The department believes engaging citizens will be a key strategy in holding the line on crime. ■

Measuring Potential Diffusion of Benefits and Crime Displacement Near Public Surveillance Systems

Samantha S. Lowry and Nancy G. La Vigne
The Urban Institute

Law enforcement agencies across the country are investing in public surveillance systems to assist with crime prevention and police investigations. However, critics question whether cameras simply displace crime to neighboring areas that are not under surveillance and, counter to those critics, theory posits that crime reductions due to cameras may extend beyond their viewing area—known as a “diffusion of benefits.”

This article describes The Urban Institute’s evaluation of the use of public surveillance cameras in three cities—Baltimore, Maryland; Chicago, Illinois; and Washington, D.C.¹, with a specific focus on how geographic information systems (GIS) and spatial analyses were used to measure potential diffusion and displacement effects in the areas adjacent to the camera loca-

tions. The area highlighted below, Humboldt Park, Chicago, had significant reductions in crime following camera installation and, therefore, was a good candidate for investigating potential diffusion and displacement effects.

The spatial techniques employed to explore the degree to which camera impacts extended beyond the cameras’ viewsheds and into the surrounding areas were (1) the production of density maps of crime concentrations and calculation of Mean Center before and after camera implementation, (2) the use of the weighted displacement quotient (WDQ), and (3) the use of difference-in-differences (DiD) analyses, which enable the determination of whether changes found in the previously mentioned techniques were statistically significant.

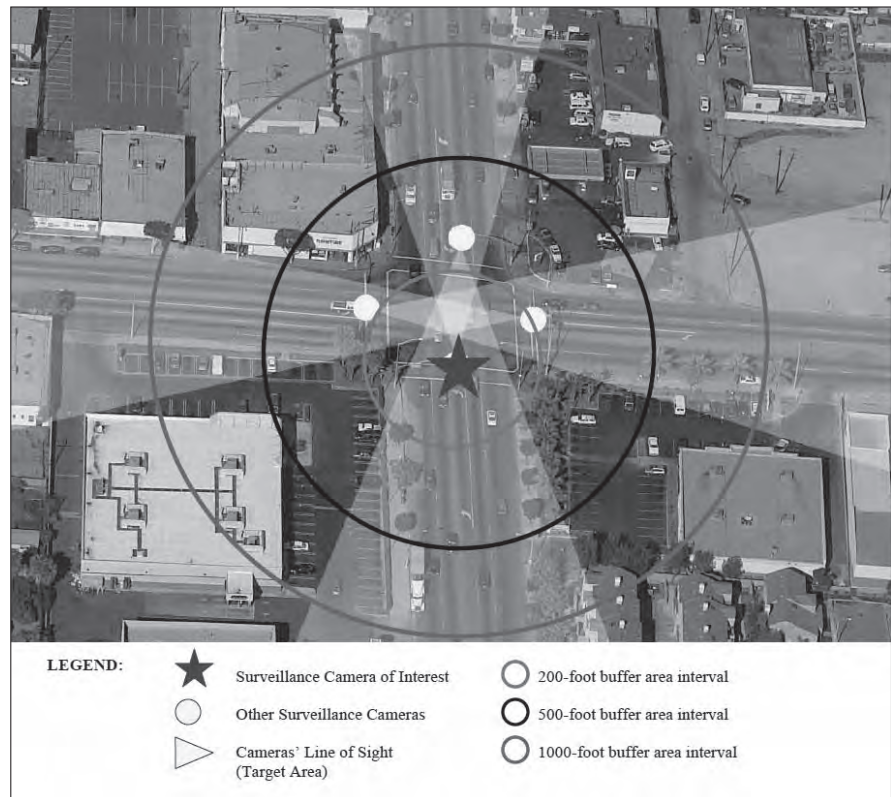


Figure 1. Camera viewshed and buffer development

Development of Diffusion and Displacement Zones

To provide spatial context for the density maps and more rigorous WDQ and DiD analyses described later, three specific geographic zones for potential diffusion and displacement following the introduction of surveillance cameras were established surrounding the camera sites. The immediate vicinity of each of the camera areas was defined as extending within 200 feet of the physical location of the cameras. Then 500- and 1000-foot buffers were designated around each camera target area using two concentric circles around the 200-foot buffer to look for diffusion and displacement effects, respectively (refer to the two outer rings in Figure 1).

Density Mapping and Shifts in the Spatial Mean

The first set of spatial techniques employed to identify diffusion and displacement, density mapping, and the generation of spatial means is the most visually persuasive yet the least analytically rigorous. Kernel density maps, which aggregate and smooth out crime to depict concentrations, were generated in the areas covered by and surrounding the cameras.

These maps were generated for all aggregated crime at two points in time—one year before and one year after camera installation. For this analysis, the buffer zones surrounding the camera areas are used as boundaries to examine where the crime shifts but do not restrict the movement of the data within and outside them. The mean center of crime, which depicts the location where, on average, crime incidents occurred, was then calculated within a half mile of each camera target area for the same two points in time. Examining the expansion or reduction in the most dense (darkest) crime areas between pre- and post-installation maps indicates an increase or decrease in crime, while examining shifts in the mean center pre- and post-camera installation provides a visual depiction of the movement of crime over time (potential displacement).

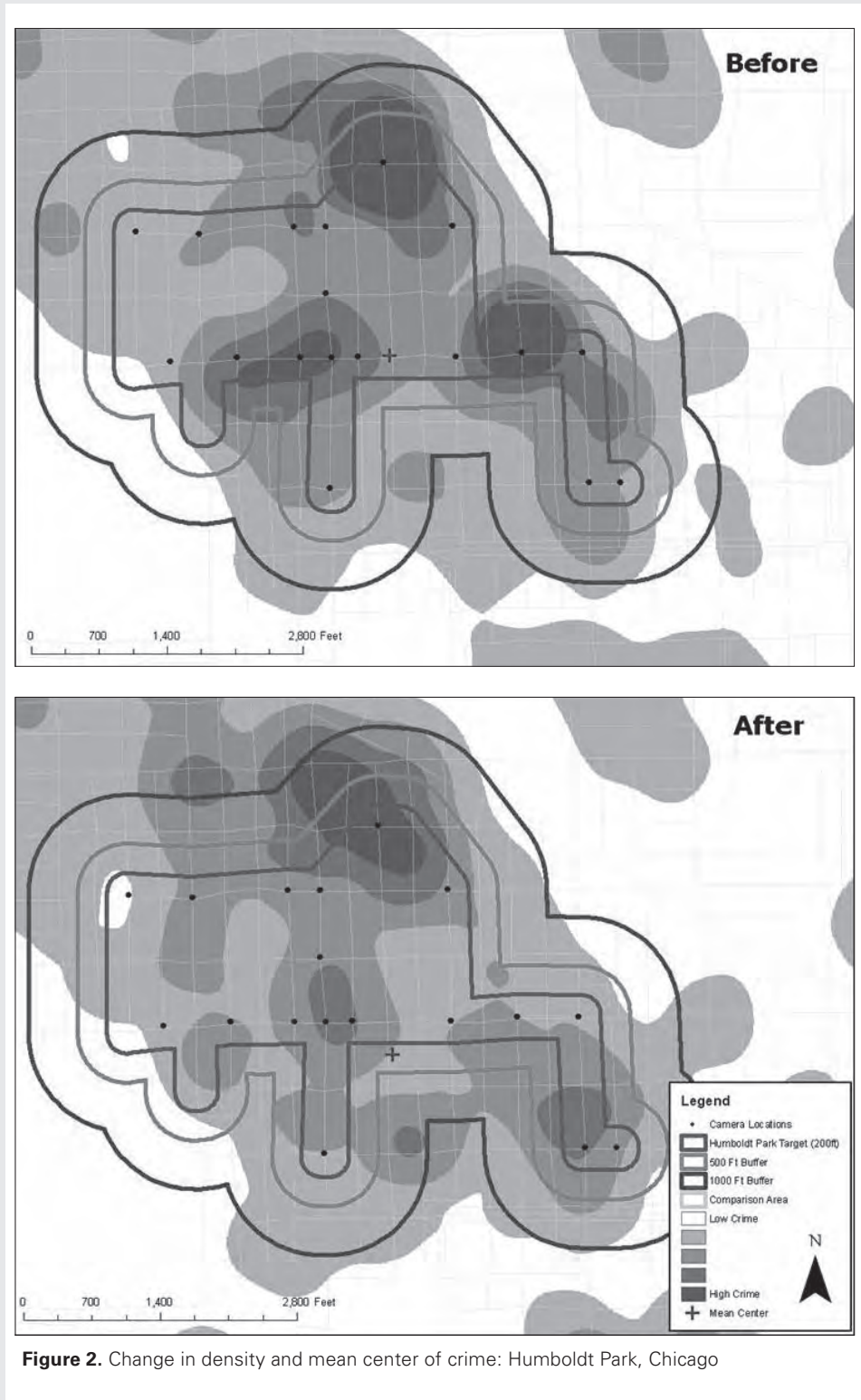


Figure 2. Change in density and mean center of crime: Humboldt Park, Chicago

As shown in Figure 2, on page 11, the darker regions, which indicate the highest crime areas in Humboldt Park, Chicago, diminished and new hot spots were not revealed, while the lower crime areas became more expansive.

The two hot spots along the southern portion of the camera area nearly dissolved, and only a single hot spot remained on the northern side. The mean center, shown as a cross in Figure 2, also supported the finding that crime was not moving beyond the camera area, with the center moving less than a single city block.

These findings suggest that although crime was diminishing in the camera areas, it was not geographically shifting. In other words, the cameras were not displacing crime; rather, the reduction was real.

Weighted Displacement Quotient

Another means of examining potential diffusion and displacement following surveillance camera installation is through calculation of the WDQ, which measures changes in crime occurring in the target area (A), displacement or diffusion zone (B), and comparison area (C) using two points in time (pre- and post-implementation).² The displacement and diffusion zones employed in this analysis were created using the 500- and 1000-foot buffers described above. Given that the WDQ, as it was originally intended, accounts for only a single displacement or diffusion zone, we calculated two separate WDQs—one for the 500-foot buffer and another for the 1000-foot buffer—over the same period. The WDQ formula is provided below:

$$WDQ = \frac{B_{t1}/C_{t1} - B_{t0}/C_{t0}}{A_{t1}/C_{t1} - A_{t0}/C_{t0}}$$

A_{t0} and A_{t1} are crime levels in the target area at times 0 and 1; B_{t0} and B_{t1} are crime levels in the diffusion or displacement zone at times 0 and 1; and C_{t0} and C_{t1} are crime levels in the control area at times 0 and 1.

The quotient is broken into two parts:

1. The *displacement measure*, the numerator, determines the change in crime in the displacement area relative to the change in crime in the control area over the same period.
2. The *success measure*, the denominator, determines the success of the intervention, or the reduction in crime in the target area relative to the control area over the same period.

A negative success measure confirms that there was in fact a decrease in crime in the target area and, therefore, displacement or diffusion effects may be occurring and further interpretation of the WDQ is needed. A positive value shows that crime increased in the target area, and the WDQ should not be interpreted because displacement of crime would not theoretically be expected if crime did not decrease in the target area.

There are two general steps involved with interpretation of the overall WDQ value: determining if the value is positive or negative and whether it is greater or less than 1/-1. A positive WDQ indicates a diffusion of benefits to the specified displacement or diffusion area (B), which in this case is either the 500- or 1000-foot zone, suggesting that crime has also declined in the buffer area as a result of the intervention. A negative result would suggest displacement of crime, with crime in the specified zone increasing over the same period. Values between 0 and 1/-1 indicate that the effect in the buffer zone is less than the effect that occurred in the target area. Values greater

than 1 or less than -1 indicate that the effects on crime—positive and negative, respectively—in the buffer were greater than the effects in the target area.

WDQ results indicated that crime decreased in the target area compared to the control area, with some crime reduction benefit extending to both 500- and 1000-foot buffers in the first 12 months but with no signs of displacement.

Difference-in-Differences

While the results from the above methods are promising, they lack statistical tests for significant change and, therefore, can be employed only to suggest whether diffusion and displacement may be occurring rather than to conclude so definitively. Thus we employed DiD analysis, which compares net change in crime in the target area using a control area to subtract other changes occurring in a similar location over the same evaluation period.

Employing this method in the target area, we determined that crime dropped by approximately 13% per month on average in the Chicago's Humboldt Park following camera installation. Given this statistically significant reduction in the camera area, we further investigated for diffusion and displacement using the same technique. This resulted in similar findings to the other spatial analyses presented above but with a higher degree of rigor—crime displacement was not evident within the 500- and 1000-foot zones.

It is prudent, therefore, to conclude that while cameras had an impact on crime in their intended spheres of influence, no evidence of displacement to nearby areas

was detected. In addition, more rigorous analyses also yielded no evidence of a diffusion of benefits to areas beyond the camera viewsheds, contrary to the spatial results.

Conclusion

Overall, the spatial techniques described in this article provided a well-rounded picture of the movement of crime in the vicinity of surveillance cameras. The density maps and mean center techniques provided a depiction of how the concentrations changed and shifted in and around the camera areas and whether hot spots were truly dissolved or if they merely moved to a new location several blocks away.



WDQ provided additional rigor through the introduction of comparison areas, enabling us to determine proportional change for each zone. This technique addressed whether there were diffusion or displacement effects, but it lacked a statistical significance measure. DiD was the most scientifically rigorous of the methods used and, while not a spatial statistic, nonetheless employed spatially designated areas for analysis purposes and generated a statistic to back up the findings of no displacement. Together, these methods offer persuasive evidence that the crime reduction impact of cameras was not countered by a displacement of crime to other areas. However, the degree to which cameras result in a diffusion of benefits remains an open question, with conflicting findings and the more rigorous test yielding no definitive signs of benefits beyond the camera viewsheds. ■

Notes

- 1 La Vigne, Nancy G., Samantha S. Lowry, Joshua A. Markman, and Allison M. Dwyer. 2011. *Evaluating the Use of Public Surveillance Cameras for Crime Control and Prevention*. Washington, D.C.: U.S. Department of Justice, Office of Community Oriented Policing Services.
- 2 Bowers, Kate J., and S. D. Johnson. 2003. "Measuring the Geographical Displacement and Diffusion of Benefit Effects of Crime Prevention Activity." *Journal of Quantitative Criminology* 19:275–301.

Shawnee Viewer: Streamlining Police Databases

Susan C. Smith
 Crime Analyst, Shawnee (Kansas) Police Department

In Shawnee, Kansas, the police department knew they had a number of disparate databases, many in different formats. For an officer to find information about any given address, he would need to run it in several different databases (e.g., CAD, RMS, Traffic, Court, and Offender). Often valuable information would be missed concerning a particular address because officers did not know all of the different databases available to them. In essence, requiring officers to know each database, to log-in to each, and to know how to query in each was time consuming, inefficient, and burdensome.

Shawnee Viewer is an easy and fast way to find information the city has on an address. As the user types the address, options for a matching address appear in a list below (see Figure 1). Once the user selects the address of interest, the program searches the Shawnee Viewer database for any associated records and displays the data in a form (see Figure 2). The base information includes parcel ownership, land use, value, legal descrip-

tion, ward/precinct, building permits, special assessments, parcel ownership change, special use permits, service request, and business license. The address can also be viewed on a map, or the user can select another address viewable on the map (see Figure 3).

Although Shawnee Viewer was originally created as a tool for planning and building permit staff, the Shawnee Police Department quickly recognized how it could be used to merge and streamline the address-based databases it maintained. The department worked with the geographic information systems (GIS) division to incorporate most of the available police databases into the program. However, the police department did not want this data available to all employees in the city, so the GIS division created a second tab that only police employees can access. This police tab includes information such as warrants, protection orders, no contact orders, registered offenders, suspects, field interview cards, CAD events, police reports, and house arrests.

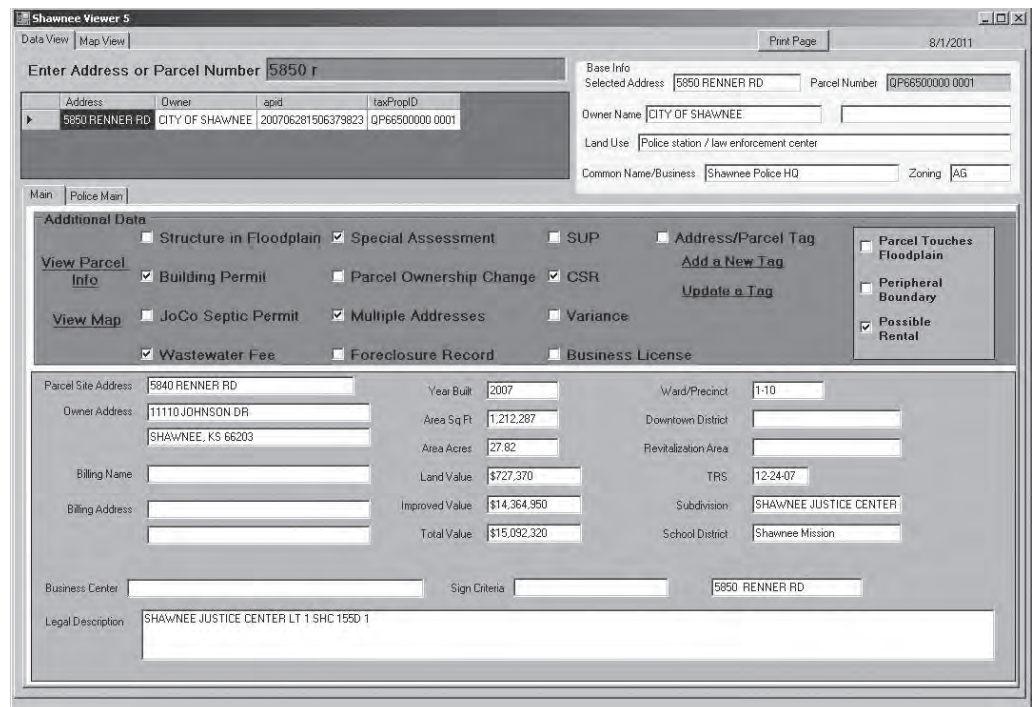


Figure 1. Selected address detail

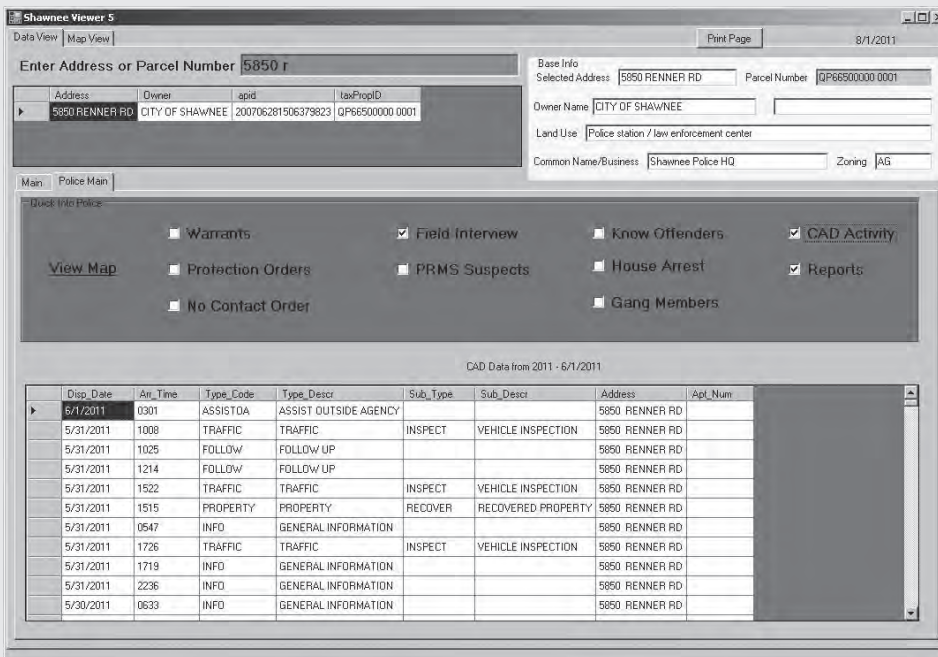


Figure 2. CAD data associated with selected address

Shawnee Viewer was created using Microsoft's Visual Studio and the Esri ArcReader and ArcGIS Publisher, so deploying the program, which is transferrable to other police departments nationwide, is free of charge. Shawnee Viewer is loaded on all PCs in the city, and SQL Server Express is the database.

In supporting the community policing philosophy of the Shawnee Police Department, its Crime Analyst Susan C. Smith felt officers, especially patrol officers, needed to have as much information as possible about any given address. Understanding that the GIS department had already undergone a massive integration of

disparate databases, all of which contained information about addresses in the city, and had created the Shawnee Viewer, Smith worked closely with GIS Analyst Doug Hemsath to use the information already contained in the Shawnee Viewer to integrate the police-only databases.

Having as much information as possible about the city's addresses helps to ensure officer and community safety. Information from Shawnee Viewer is used to better inform the officers who are serious about reducing crime and disorder, especially in going beyond incident-oriented 911 policing that had been done for decades. Rather than blindly responding to a given address, officers can quickly tap in the destination and obtain detailed information about that address without having to sign into and search a number of separate databases.

Shawnee Viewer also supports and emphasizes personal service to the public, as opposed to a bureaucratic response to an address. Providing information that a person is mentally unstable, disabled, hearing-impaired, or easily confused or disoriented to an officer prior to interacting with the resident leads to a more appropriate response and/or approach at the residence. It also helps to ensure that citizens (especially those with special circumstances like those described above) are treated like real people, not numbers, and shows the public that the police really do care about citizens' well-being.

Finally, use of Shawnee Viewer can lead to more positive contacts between the public and the police by having the officer be more knowledgeable about the people, conditions, situations, and environment in the community. It provides specific information for police-citizen contact and often information needed for criminal investigations and problem solving in the community. The police are able to use the information to map areas of concern, select criteria for further analysis, and make recommendations to officers for specific needs at a given address or group of addresses. This leads to better, more effective policing in the city, as well as a much better use of resources. ■

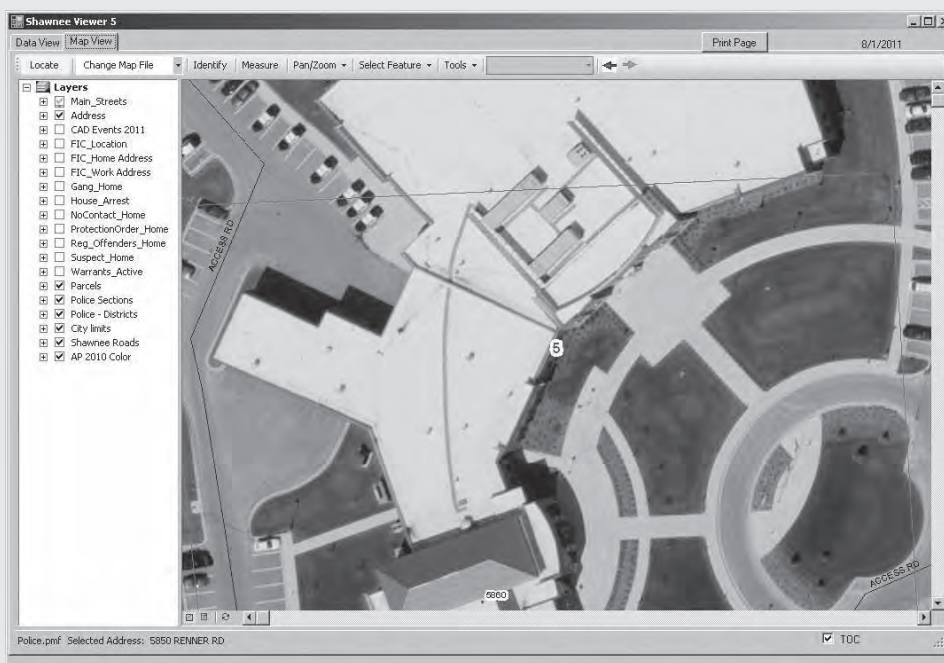


Figure 3. Map of selected address

Harnessing The Cloud—Part 1

Philip D. Mielke
City of Redlands (California)

Crime analysts and GIS professionals have a new set of free tools intended to create and share map products on the web. ArcGIS.com is devoted to cataloging and hosting users' data and is central to a group of new solutions. An analyst can post and share data in a variety of formats and make this data available for use in three hosted environments: ArcGIS Explorer Online, ArcGIS for Mobile, and Community Analyst. Each of these solutions has useful purposes for police departments. This article introduces uploading and cataloging data on ArcGIS Online and shows how to create an online map application that can be shared.

Cataloging Data for ArcGIS Online

ArcGIS Online is the center for hosting data and managing security for data sharing with other users and groups. Initially, users are required to create a free account with ArcGIS.com. Once this user account is created, a variety of features are available. Many basemaps like Bing aerial photography or USGS quadrants are on hand for quick deployment. The Esri Community Basemap incorporates data volunteered from many different sources. Cartographic representation of this basemap can be modified—e.g., users can set it to clear or

subdue levels of transparency to give context to the crime data that the user brings to the stage.

Esri keeps some functionality acquirable as premium services. How the user shares data (and what functionality is available) is dependent on the user's access to ArcGIS Server and the future availability ArcGIS Online premium services. Because many analysts do not have immediate access to install ArcGIS Server, and ArcGIS Server requires complex installation and operating instructions, this article focuses on two cloud-based resources for storing and symbolizing data.

Uploading Shapefiles for Online Maps

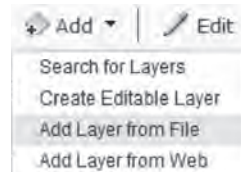
Users can upload shapefiles directly into a map on ArcGIS Online. This is the only free method immediately available for users to create maps with (1) ArcGIS Online for a public map, (2) ArcGIS Explorer for an online slideshow presentation, or (3) the ArcGIS Mobile application. The Esri Community Basemap places size limitations on shapefiles so that users can upload only zipped shapefiles that are under 1MB or under 1,000 shapes. This can still be an effective size for showing smaller subsets of crime data.

The following steps specify how to upload shapefiles in this manner:

Step 1. Create a user account with ArcGIS.com and log in.

Step 2. Click on the “Map” tab at the top.

Step 3. Click the dropdown button “Add > Add Layer from File.”

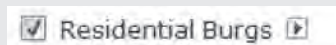


Step 4. Click “Chose File,” and select the zipped shapefile of an exported subset of the crime data.



Figure 1. ArcGIS Online allows quick creation of free online mapping applications.

Step 5. Click on the layer for the file of data just added to the table of contents, and click the check box next to, for example, “Residential Burgs.”



Step 6. Click on the added data layer, and select “Change Symbols.”

Step 7. Select one of Esri’s basic symbols, or reference a URL for a suitable icon image. Users can make and store their own PNGs in an online storage method,

such as Dropbox, or use predefined icons. For example, www.emsymbology.org/Police_CAD-RMS/RMS.html lists available icons. Simply right click the icon from the browser, select “Copy Image URL,” and paste it into the address bar.

Step 8. Control the way end users click and access shapefile data fields by selecting “Configure Pop-up.”

Step 9. Repeat for as many layers needed for the data product.

Step 10. Click “Save As.” Enter a title, searchable tags, summary, and the folder in which to save the data.

Step 11. Click “Share.” This enables sharing options for the online map created. Facebook and Twitter are options for police departments that have engaged their citizens with social networking, or a simple URL can be created for sharing in e-mails or on websites. The “Embed in Website” option allows the code to be copied and pasted into an existing website, and the “Make a Web Application” option is advisable only if the user has direct access to a web server and can configure XML and HTML.

Uploading Layer Packages

Users can upload layer packages to ArcGIS Online directly from the ArcGIS Desktop environment. ArcGIS Online allows 2GB of storage for this data, and there are many clues that Esri intends to offer premium hosting for these data services. Layer packages will soon be accessible for ArcGIS Online Maps, ArcGIS Explorer, and ArcGIS

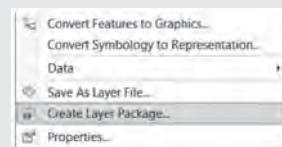
Mobile Maps. Currently, users can utilize this desktop environment for online storage and access. Once this data is added to the premium hosting service, users can add searchable information to each data profile.

The following steps specify how to upload layer packages in this manner:

Step 1. In ArcGIS 10.x, sign in to ArcGIS Online by clicking on “File > ArcGIS Online...”

Step 2. Symbolize the data intended for uploading. Vector data (points, lines, and polygons) or raster data (kernel densities or surface) can be uploaded. The layer file also requires a description saved under “General” under the layer properties. This is how the user and group users can search and identify information about the origin of that data.

Step 3. Right click on the layer to upload to ArcGIS.com. Select “Create Layer Package...”



Step 4. Select the layers to include, and “Upload Packages to My ArcGIS Online Account.”

Step 5. Click “Validate.” This will determine if the data has the required elements to be uploaded or if there is a problem with uploading this data. Error messages are generally intuitive to follow.

Step 6. Click “Share.” An additional “ArcGIS Online Package Details” dialogue will appear, and the user should ensure that the summary, description, credit information, searchable tag information, and permissions specifying which group users are able to see the data have been entered. Additionally, “Everyone” can be allowed access to search and view the data.

Layer packages are superior to shapefiles as a method for sharing data on ArcGIS Online. Layer packages store layer properties as set by the analyst. Symbology is stored, as well as label, scale level, and field distinctions. Layer packages can also be raster data sets, which are a necessity for analysts who produce kernel density hotspot analysis

products. Additionally, Modelbuilder has a geoprocessing task that allows automated methods of uploading and updating data.

ArcGIS Online Community

While logged into ArcGIS.com, searching for different tags and keywords brings up a list of existing and cataloged data already accessible. Larger entities have the enterprise resources available to leverage and share cataloged data through ArcGIS Server, so there is a trend toward finding country-wide (and country-scaled) data. U.S. Census, USGS, and USFS all provide many different and useful representations of their data. NOAA provides real-time weather data services, and different aerial photography services are easy to find for most regions of the United States. This catalog of regularly updated data is still in its early stages, but as GIS becomes more accessible so will agencies that find a value returned by sharing their data.

There is an obvious element of social networking borrowed from the current trend of Twitter and Facebook. Users develop and promote groups that have a particular focus on a region or a functional need. Data has searchable profile information with a contact tied to the other end that can ask more questions of that data. Comment sections on each data profile provide an easy means of communication, and group users have built-in security privileges to allow access to only certain data. ArcGIS Online is becoming a little more like an online social network for data and the agencies that provide that data. What will make it work? Accessibility to tools that are available only by putting your data in the cloud.

The next Tech Tips will take a look at three useful tools on Esri’s cloud. ArcGIS Explorer Online can produce online slideshows that are navigable, query-able, and perfect for CompStat-style meetings. ArcGIS Mobile can allow police and field staff the chance to view and edit crime data on an iPhone or iPad in the field. Finally, Community Analyst provides a complex assortment of demographics and community data. These three applications are made more valuable by enabling the user to use his or her own data for orientation and context. ■

Baltimore PD Uses Xora GPS To Enhance Officer Safety and Increase Community Policing

The Baltimore Police Department is responsible for a community of more than 641,000 citizens and an area of more than 92 square miles, which means that at any point 2,000 sworn officers can be dispersed throughout a large area. Baltimore PD has enlisted the services of Xora technology as a part of their new project called “Side Partner”—a program intended to increase the productivity of patrol officers when they are away from their cars by allowing them to use their smartphones to run warrants, check license plate numbers, etc. It allows officers to have the tools needed to work effectively, without being reliant on the technology typically located in their patrol cars. This allows officers to interact with citizens on the street and become more involved with the community.

Xora’s GPS Field Management System now allows dispatchers and command staff to know where each officer is located at all times. This increases officer safety by enabling dispatchers to map the location of an officer quickly if they are in need of help. Further, Xora’s technology also allows the administration to analyze the number of officers deployed to each sector and district over time, providing them with information about how to best assign officer deployment in the future to best address the needs of the community. ■

Peabody Police Detective Develops iPhone App To Enhance Police-Citizen Communication

Detective Peter Olson of the Peabody (Massachusetts) Police Department developed a new smartphone application called “My Police Department,” which allows local citizens to communicate with law enforcement through the push of a button. The application, which

is free to citizens, is a platform for citizens to report crime, send tips, and ask questions directly to the police agency in their area. Citizens are even able to take a picture and immediately upload it to the site, enabling officers to know the exact location of the incident through the phone’s GPS.

Citizens are often the eyes and ears of the street, and this application is a way to bridge the gap between the police force and the community they serve. The new application is a cost-effective way for law enforcement agencies to engage their community and utilize the information they provide in an efficient manner. Participating police departments will pay a yearly fee for the service based on the population of their jurisdiction. The typical price for a medium-sized city of 25,000–75,000 people is about \$600–\$700 per year. Twenty five communities have already signed up for the service, including a number of agencies in Massachusetts, as well as in Maine, Texas, California, Georgia, and Wisconsin. ■

Fusion Core Solution Now Available

Esri and Microsoft announced the launch of their new data-sharing tool that allows federal, state, local, and tribal agencies to collect, analyze, share, and track information effectively to help identify and prevent public safety threats. At the Esri Homeland Security GIS Summit held in San Diego, July 10–13, Microsoft announced the availability of Fusion Core Solutions (FCS). The tool is designed specifically to identify growing threats by organized crime, gangs, drug trafficking organizations, and potential terrorists.

The GIS function allows the spatial analysis of suspicious activity reports, crime data, and other information related to criminal threats and allows quicker dissemination of information to first responders. For more information about FCS, visit www.microsoft.com/fusion. ■



Crime Mapping Events

International Association of Crime Analysts & Massachusetts Association of Crime Analysts 2011 Training Conference

September 19–23, 2011
Hyannis, Massachusetts
www.iaca.net/conference.asp

National Institute of Justice Crime Mapping Research Conference

October 17–21, 2011
Miami, Florida
www.nij.gov/events/maps/welcome.htm

International Association of Chiefs of Police 118th Annual Conference and Exposition

October 22–26, 2011
Chicago, Illinois
www.theiacpconference.org/

Association of American Geographers Annual Meeting

February 24–28, 2012
New York, New York
www.aag.org

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