Clearinghouse
REVIEW

Journal of Poverty Law and Policy

September–October 2013
Volume 47, Numbers 5–6

PURSUING RACIAL JUSTICE IN THE 21ST CENTURY

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MAXIMIZING THE POWER

of Geographic Information Systems in Racial Justice

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Geographic information systems (GIS), consisting of maps and other formats, can be powerful for litigators and advocates to use to analyze and present empirical spatial information. Two earlier CLEARINGHOUSE REVIEW articles introduced GIS and its applications for antipoverty advocacy and litigation.[1] Here we continue to illustrate how advocates and litigators can use GIS to compile, synthesize, analyze, and visualize spatial evidence.

Discrimination often has a spatial dimension. Discrimination cases with a spatial inequality element typically involve governmental policies on land use, infrastructure, zoning, or enforcement, or all four.[2] We discuss mapping in such cases; accessing and combining public and other data; map construction and use; the research design to support specific claims; and ways to use GIS involving spatial data but not necessarily mapping. We discuss cases in which we were expert witnesses, expert consultants, or community advocates.[3]

When the Facts Do Not Speak for Themselves

Numerical data can be confusing and intimidating. Different people have different capacities for understanding data depending upon how they are presented. Maps and graphs allow patterns and relationships, not otherwise visible, to emerge. Maps are understood by the brain's right (nonverbal) hemisphere, which perceives the world holistically and connects directly to the emotional components of thought. Making new connections, maps and graphics can bring together disparate parts of the world. Shown a map of race, city boundaries, and zoning districts of his own hometown, a community leader in North Carolina said, "Oh, so that's what they're doing to us."[4]

Maps created through GIS are also effective in communicating data to judges and juries. Properly made, maps are very difficult to argue with by using "mere" words because a holistic argument is not amenable to being picked apart. The media also like maps and graphs. Maps used in the cases discussed below and others we have designed have been featured in the *New York Times*, the *Los Angeles Times*, the *International Herald Tribune*, local newspapers, and academic journals.[5]

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[1]Jason Reece & Eric Schultheis, *Poverty's Place: The Use of Geographic Information Systems in Poverty Advocacy*, 42 CLEARINGHOUSE REVIEW 430 (Jan.–Feb. 2009); Maya Roy & Jason Reece, *Poverty's Place Revisited: Mapping for Justice and Democratizing Data to Combat Poverty*, 44 CLEARINGHOUSE REVIEW 184 (July–Aug. 2010).

[2]Ben Marsh et al., Hidden Spatial Inequality and GIS (2009–10), http://bit.ly/12KGqum.

[3]For more information about our work, see Cedar Grove Institute for Sustainable Communities (n.d.), http://bit.ly/12OAb3K.

[4]Interview with Alfred Dixon, local businessman and community leader, in Southern Pines, N.C. (Nov. 2003).

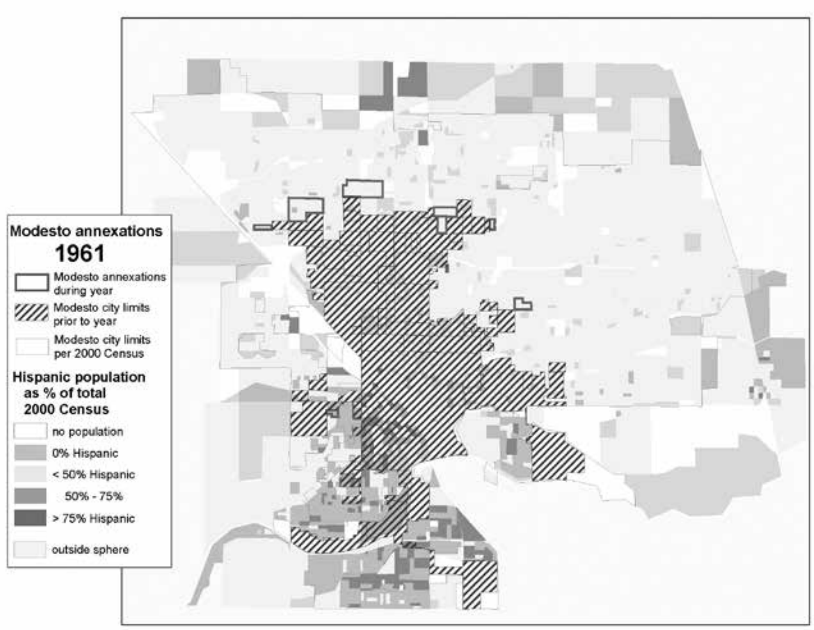
[5]James Dao, *Ohio Town's Water at Last Runs Past a Color Line*, NEW YORK TIMES, Feb. 17, 2004, at A1; Lee Romney, *Poor Neighborhoods Left Behind*, LOS ANGELES TIMES, at B1 (Sept. 18, 2005); Shaila Dewan, *Manicured Greens and Raw Sewage*, INTERNATIONAL HERALD TRIBUNE, June 15, 2005, at 204.

Presentation: Simplicity, Repetition, and Graphic Scale

The power of maps lies in their legibility, which relies upon clarity in design as well as in presentation. Reducing visual clutter reduces brain clutter so that a viewer can focus on what really matters. Creating maps in support of plaintiffs in *Committee Concerning Community Improvement v. City of Modesto*, we used GIS to analyze and illustrate municipal exclusion and its effects (i.e., the lack of municipal services) in Hispanic neighborhoods that were urban in all but legal standing.[6] We mapped, among others, annexation, city limits, sewer service, storm water drainage, sidewalks, and streetlights. Residents themselves identified neighborhood boundaries, and we used census files to obtain city limits, population density, race, and ethnicity. Census Bureau data are best used at block level for precision when examining neighborhood conditions. To show the political and the quality-of-life impact of exclusionary practices, we used city and county data to analyze parcel density (average lot size), age of housing, tax values, and access to municipal services.

Note: A color version of figs. 1–10 is available at http://povertylaw.org/clearinghouse/joyner-graphics.

Figure 1. The effect of annexation: Modesto city limits and Hispanic residents, 1961.



Source: U.S. Census 2000; Modesto annexation boundary files from City of Modesto. © 2004 by Cedar Grove Institute for Sustainable Communities.

All of the data used in the Modesto case were downloaded from public sources. Soon after we were brought into the case, the county took its GIS files for public works—sewer, water, streetlights—off its website. While attorneys can obtain such data (albeit with frequent delays), suppression is a serious concern for community advocates.

Historically, Modesto created predominantly Hispanic islands through preferential annexation of non-Hispanic white neighborhoods and open land.[7] By doing so, the city excluded more than 25,000 urban residents. For decades, these urban neighborhoods have lacked sewer services, storm water drainage facilities, streetlights, sidewalks, street-side garbage pickup, and municipal police protection. To show the effect of annexation on the racial and ethnic composition of the city, we constructed a time series of maps showing the city's boundaries year-by-year from 1961 (fig. 1) to 2004 (fig. 2). As the sequence is shown, the point is made forty-four times: Modesto annexed predominantly white areas and excluded predominantly Hispanic areas. The series is shown quickly, as in a flipbook. Audiences consistently report that this presentation is effective and memorable.[8]

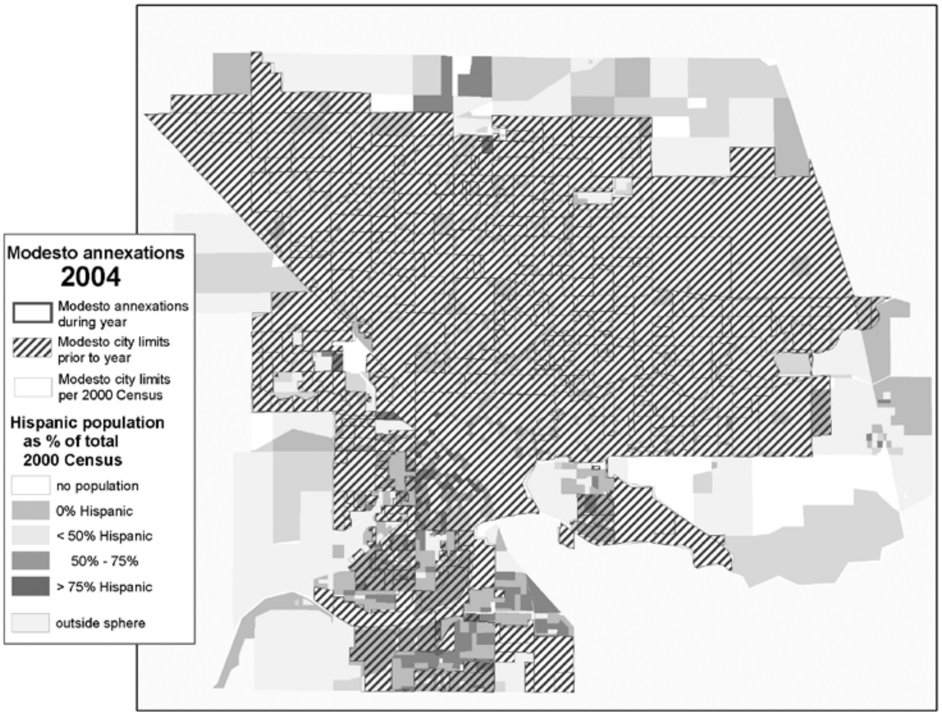
The color scale for maps such as this is chosen carefully. Because the "percent Hispanic" statistic represents only one category, the data are shown as a progressive intensity of a single color (light to dark), rather than, for example, a rainbow of colors (red, yellow, blue). This replicates how the brain perceives a few-to-many continuum.

[6]*Committee Concerning Community Improvement v. City of Modesto*, Case No. CV-F-04-6121 LJO DLB, 2007 U.S. Dist. LEXIS 94328 (E.D. Cal. Dec. 11, 2007); see Ben Marsh et al., *Institutionalization of Racial Inequality in Local Political Geographies*, 31 Urban Geography 691 (2010), http://bit.ly/15Gu5Wg.

[7]Throughout this article, white refers to non-Hispanic whites.

[8]The series was also used in *Sanchez v. City of Modesto*, a voting rights case (51 Cal. Rptr. 3d 821 (Cal. Ct. App. 2006)).

Figure 2. The effect of annexation: city limits and Hispanic residents, 2004.

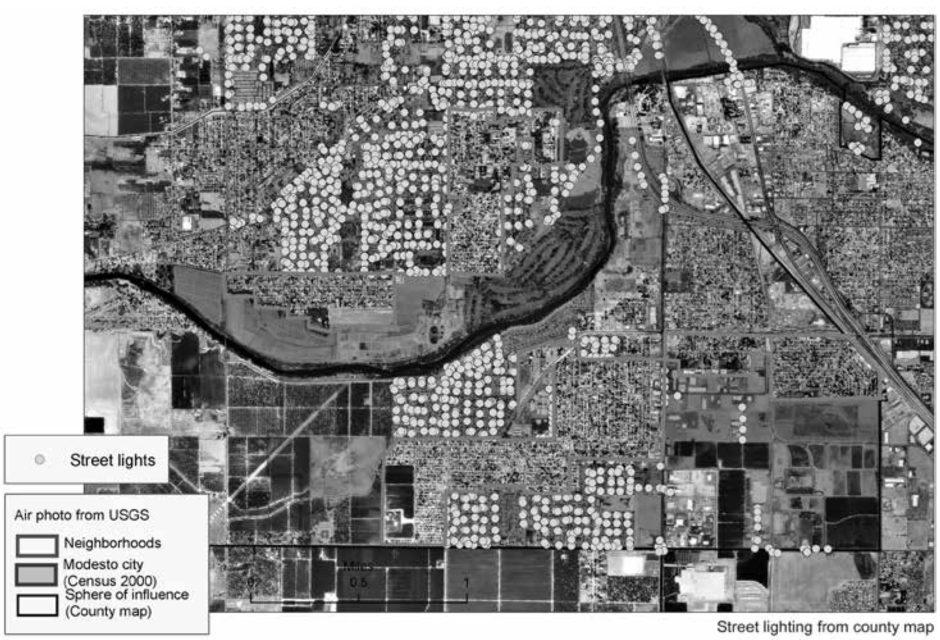


Source: U.S. Census 2000; Modesto annexation boundary files from City of Modesto. © 2004 by Cedar Grove Institute for Sustainable Communities.

Figure 2 shows Modesto at the time *Committee Concerning Community Improvement v. City of Modesto* was filed.

Figure 3 is designed to show a quality-of-life and personal-safety issue resulting from the city's annexation policies: lack of streetlights. To approximate the effect of living in these neighborhoods at night, we used a black-and-white U.S. Geological Survey satellite photo as the background and showed the streetlights as yellow circles. The result illustrates the density of the neighborhoods lacking streetlights—intuitively comparable to visually experiencing the divided city at night.

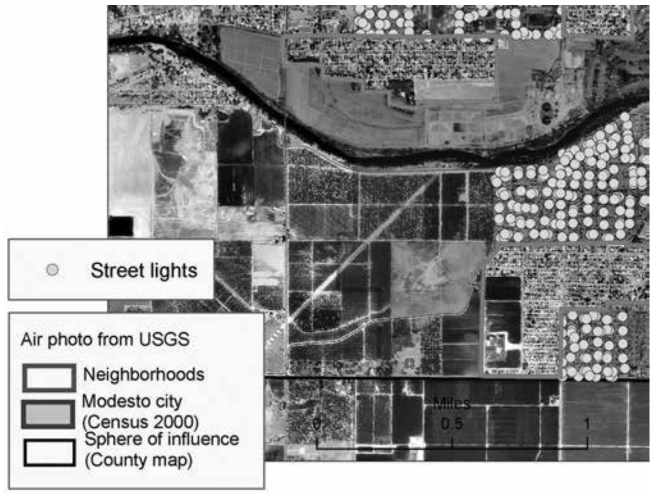
Figure 3. Access to streetlights and municipal exclusion.



Source: Digital orthophoto quad from U.S. Geological Survey; city limits from City of Modesto; sphere of influence from Stanislaus County; streetlight locations from City of Modesto; boundaries of plaintiff neighborhoods from plaintiffs' attorneys. © 2004 by Cedar Grove Institute for Sustainable Communities.

The role of scale in the maps can be seen by comparing figure 3 with figure 4, which is a zoom of figure 3. The breadth of figure 3 better illustrates the extent of the exclusion across southwestern Modesto, while the scale and focus of figure 4 better illustrate the size and density of the excluded neighborhoods.

Figure 4. Access to streetlights and municipal exclusion.



Source: Digital orthophoto quad from U.S. Geological Survey; city limits from City of Modesto; sphere of influence from Stanislaus County; streetlight locations from City of Modesto; boundaries of plaintiff neighborhoods from plaintiffs' attorneys. © 2004 by Cedar Grove Institute for Sustainable Communities.

Using GIS, we geocoded the location (latitude and longitude) of streetlights from data supplied by the city. We then layered that information on census data on the race, ethnicity, and number of residents. Thus we found that the more than 20,000 Latino residents living in the excluded islands were 160 percent as likely to live more than 300 feet from a streetlight as non-Latino residents.

Measurement Scale and Context

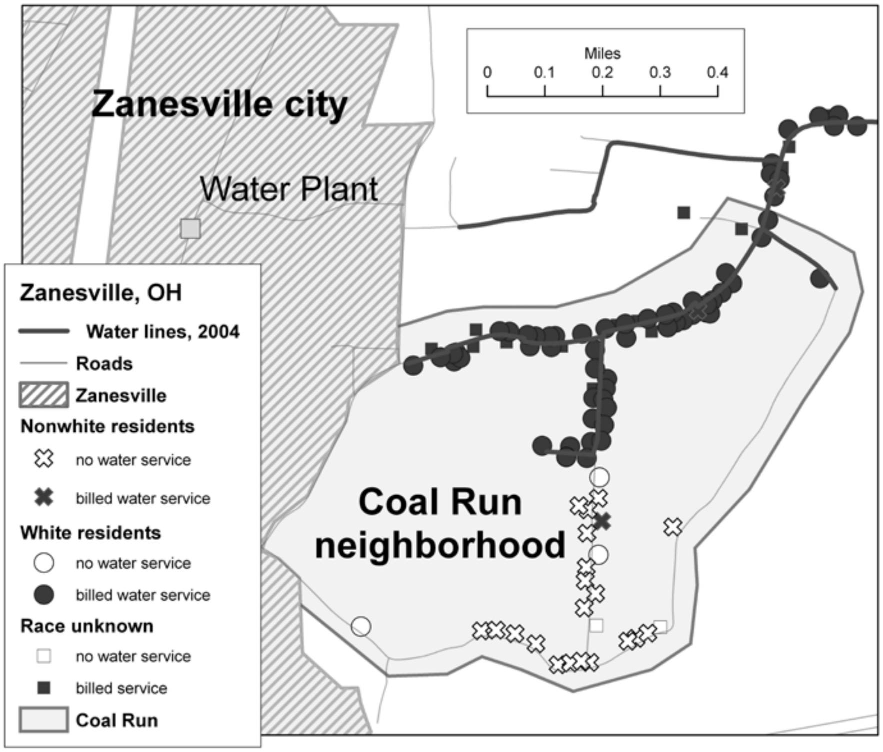
While race and access to public infrastructure were also at issue in *Kennedy v. City of Zanesville*, census data were not illuminating.[9] When public water lines were first installed in Zanesville in 1954, the predominantly African American Coal Run neighborhood was excluded while white residents bordering Coal Run were served. When public water lines were installed in Coal Run in 1954, the water line stopped at the last white home, although the water under the entire Coal Run area was contaminated from acid mine drainage. Over the next fifty years, the public water lines were extended well beyond Coal Run, but not to Coal Run.

Because the houses in the neighborhood were distributed across several census blocks, all of which were majority-white, U.S. Census Bureau data did not illustrate our case. We had to create an alternative analytic design to support the fair-housing case. To link water access to race, our legal team ascertained the race of householders through a door-to-door survey and used county data to locate water lines, sites of billed water service, house footprints, streets, and municipal boundaries.

For the jury, early in the 2008 trial, figure 5 was built layer by layer, showing first the streets, then water lines, houses, and race, adding each factor one step at a time.

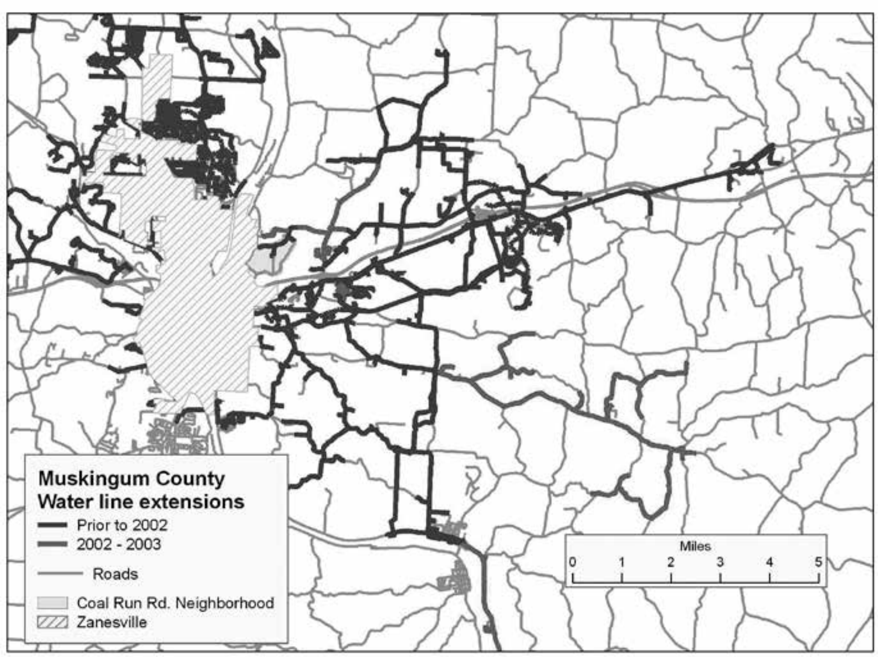
[9]*Kennedy v. City of Zanesville*, 505 F. Supp. 2d 456 (S.D. Ohio 2007); see also Reed Colfax, *Denied Water Service Because of Race, African Americans Win $10.85 Million Jury Verdict*, 43 Clearinghouse Review 398 (Nov.–Dec. 2009).

Figure 5. Access to water and race.



Source: Muskingum County, Ohio, GIS. Plaintiffs described their household racial composition. Cedar Grove Institute for Sustainable Communities and Relman, Dane and Colfax, PLLC, surveyed households to identify racial composition. © 2008 by Cedar Grove Institute for Sustainable Communities.

Figure 6. Coal Run and water: the importance of context.



Source: Muskingum County, Ohio, GIS. © 2008 by Cedar Grove Institute for Sustainable Communities.

Then figure 6 showed in context how far beyond the Coal Run neighborhood public water lines had been extended. As Reed Colfax wrote, "[t]he maps of these data were more powerful than any oral description of the evidence of discrimination…. These maps, which were presented to the jury virtually every day of the trial, served as a constant pictorial reminder of the racial divide in water service in Muskingum County."[10]

[10]Colfax, *supra* note 9, at 400.

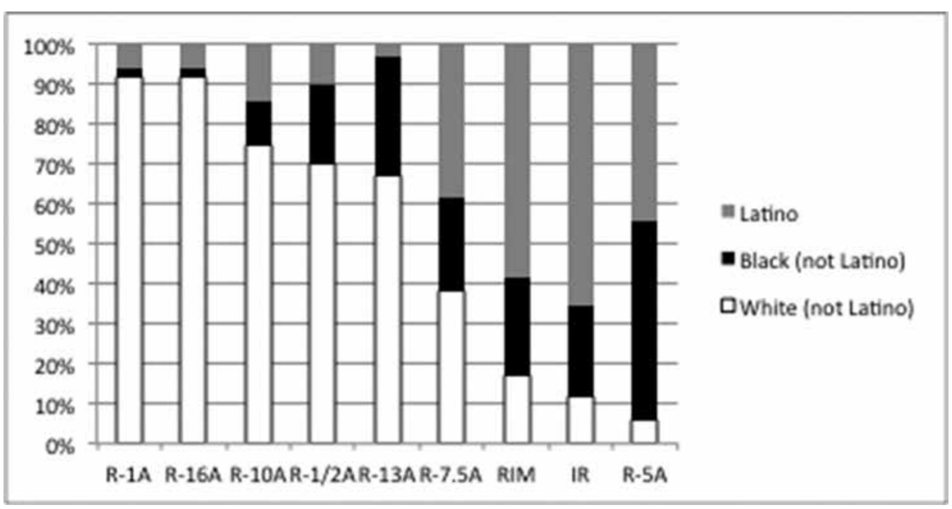
Poorly designed GIS weakened the defense's case, which used census block data and water lines built after the case was filed in an attempt to suggest that the African American neighborhoods had water during this period (a point not in contention). The defense also showed another census block in the county as having African American residents and water. Using census data, we ascertained that this was the site of a nursing home. Around 10 percent of the residents of the nursing home were African American. The defense's maps distorted the facts and weakened the credibility of the defense expert.

GIS and Statistics: Maps, Text, Tables, and Graphs

Beyond mapping, GIS is a method of analyzing and illustrating racial disparities with spatial statistics. These statistics can be simple or complex. The statistical methods range from "doing percentages" (as one friend of ours once explained to another) to complex spatial regression analyses of the impact of multiple possible influences. But, as in mapping, clarity is vital. Advocates should seek the least complex terms for all arguments.

GIS can be used to analyze spatial relationships with or without mapping. In *Miller v. City of Dallas*, residents of a Dallas neighborhood in the residential zone R-5A (far right column in fig. 7) claimed that the city provided municipal services in a racially and ethnically discriminatory way. The municipal services at issue included flood protection, repairing of streets, drainage services, and zoning protection from industrial nuisances.[11] To determine if there were racial differences in the residence of different zoning districts in Dallas, we layered the zoning boundaries over census block-level data, allowing us to identify blocks within each zone and then compile demographic characteristics of each zone. Figure 7 shows the percentages of white (non-Latino), African American, and Latino residents of seven residential zones and two industrial zones. Reviewing the percentages showed that zone R-5A was a vestige of racial zoning. Zone R-5A essentially meant that white people did not live in that area, and that zoning guided municipal neglect. GIS analysis confirmed that the link between zone R-5A and race of residents continued into the current era.

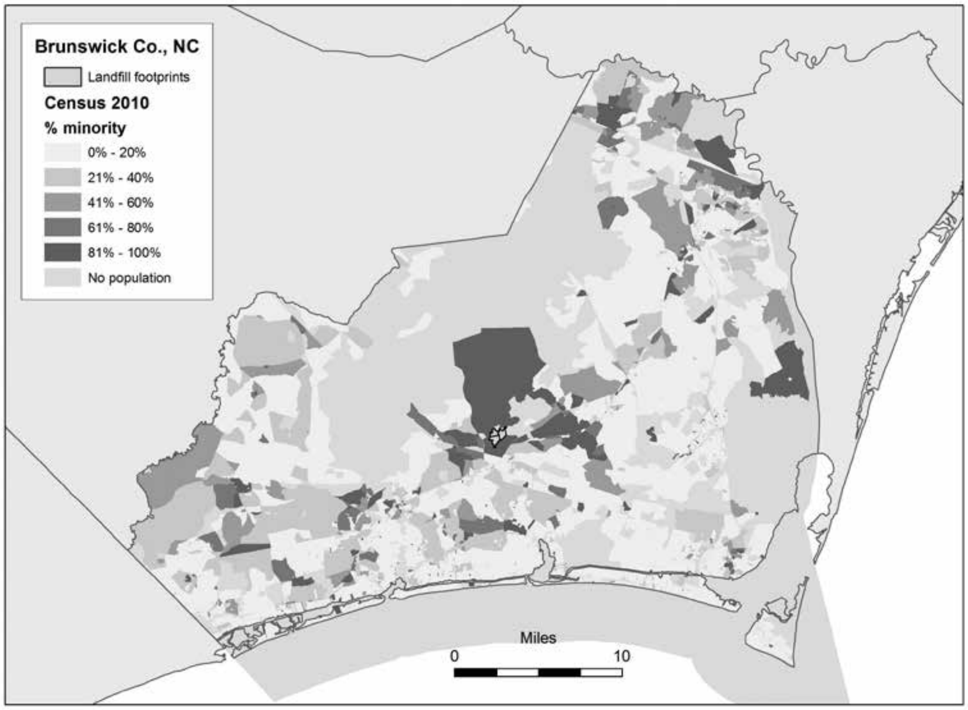
Figure 7. Zoning and race or ethnicity in Dallas, Texas.



Source: Zoning boundaries from City of Dallas GIS; U.S. Census 2000 block boundaries; U.S. Census 2000 race and ethnicity data at the block level. © 2008 by Cedar Grove Institute for Sustainable Communities.

[11] *Miller v. City of Dallas*, Civil Action No. 3:98-CV-2955-D, 2002 U.S. Dist. LEXIS 2341 (N.D. Tex. Feb. 14, 2002).

Figure 8. Location of landfill in relation to African American residents of Brunswick County, North Carolina.



Source: U.S. Census 2010; landfill parcels from Brunswick County online GIS records. © 2012 by Cedar Grove Institute for Sustainable Communities.

We employed mapping (e.g., fig. 8), statistics, and graphs in an environmental justice struggle over a landfill in a majority African American community in coastal North Carolina.[12]

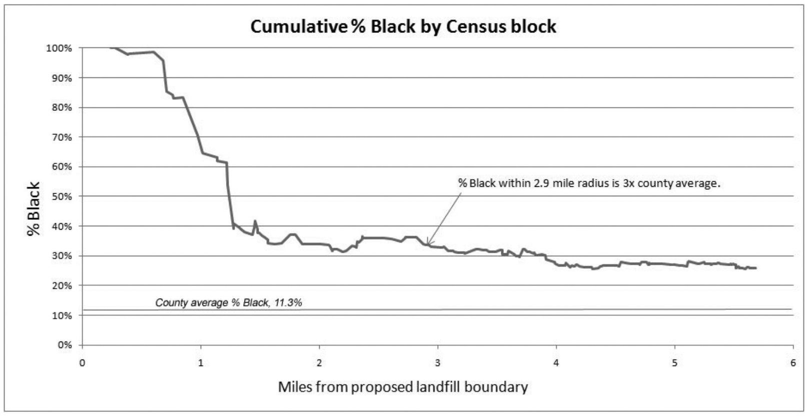
Figure 8 shows the proposed landfill in relation to the demography of the county and illustrates that the site lies in the middle of the county's largest majority African American population.

To illustrate pattern and practice, we showed that other locally unwanted land uses and parcels zoned industrial were disproportionately located in African American neighborhoods. We constructed maps to show the distribution of locally unwanted land uses and industrial zones to areas where African American residents lived. We mapped 119 locally unwanted land uses from federal, state, and county databases. We found:

- Census blocks located closest to the proposed landfill were nearly 100 percent African American. For the population within census blocks less than two-thirds of a mile from the landfill site, 98 percent of the population were African American, and 2 percent Hispanic.
- As far as 2.9 miles from the site, the affected population was still three times as likely to be African American as the county average.
- A person living within one-eighth mile of any of the 119 locally unwanted land uses was twice as likely to be African American as the average resident of the county. To show that this effect held across a continuum, we used line graphs. Figure 9 illustrates the African American percentage of the population living at given distances of the proposed landfill. Such a graph illustrates the extremity of the relationship between race and proximity to the landfill site; the relationship lessens as the distance increases. The African American percentage for the county as a whole (dotted line) puts data in context.

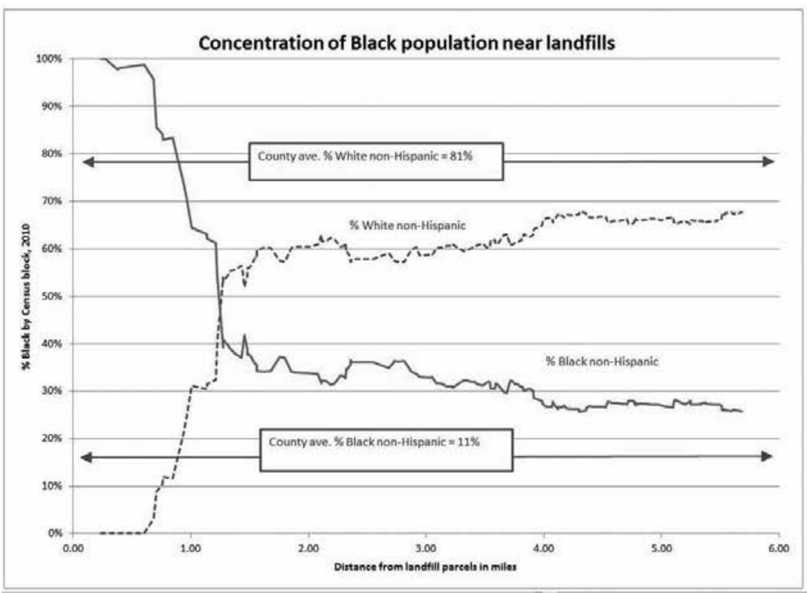
[12]This work was in support of an ongoing effort by the Royal Oaks Concerned Citizens Association to prevent the expansion of a landfill into a largely African American neighborhood (Ashley White, *Brunswick County Board Decides Not to Expand Landfill*, News 14 Carolina (March 30, 2012), http://bit.ly/1cr8Sq1).

Figure 9. Concentration of population near proposed landfill by African American percentages.



Source: U.S. Census 2010; landfill parcels from Brunswick County online GIS records. © 2011 by Cedar Grove Institute for Sustainable Communities.

Figure 10. Concentration of population near proposed landfill by race.



Source: U.S. Census 2010; landfill parcels from Brunswick County online GIS records. © 2011 by Cedar Grove Institute for Sustainable Communities.

Figure 9 does not, however, illustrate disparate effect because the information in this graph does not, by itself, establish that African American residents are treated differently from similarly situated nonminority individuals. To illustrate disparate effect, one must add data on the concentration of the other class (in this case, whites): add a line to the graph, as in figure 10. Note that the graph was originally shown in color using red and blue but can be shown equally well in black-and-white as a solid line and a dotted line.[13]

Disparate effect can also be demonstrated statistically by using appropriate statistical tests.[14] Statistical tests determine whether apparent differences are significant, that is, with a very low probability of being due to random variation.

Using census block data and data identifying the landfill location, we identified the number of African Americans and whites living within a given distance (i.e., one-half mile) of a locally unwanted land use. Statistical tests can determine if African Americans are significantly more likely than whites to live proximate to the landfill, thereby adding verifiable credibility to assertions of differences.[15] In this case, the probability of obtaining this result due to random variation is less than one in a thousand.

Using this information, we were able to show that the chosen site furthered a systemic disproportionate effect of environmental hazards on the county's African American residents. The county planning board voted to deny the landfill's permit.[16]

[13]This is particularly helpful for the color-blind, who make up 7 percent of the male U.S. population (Sight and Hearing Association, Colorblindness (Feb. 2004), http://bit.ly/17THf3Y).

[14]There are many statistical tests for different data forms and distributions. Two examples of commonly used statistical tests are the t-test and the odds ratio (Statwing Documentation, Statistical Significance (T-Test) (2012), http://bit.ly/14CVxBS; Michigan Center for Public Health Preparedness, Odds Ratio (2010), http://bit.ly/18MPH6e).

[15]Meridel J. Bulle-Vu, *Statistical Intent: A Post-Sandoval Litigation Strategy for Title VI "Impact" Cases*, 17 Georgetown Journal on Poverty Law and Policy, 461 (2010).

[16]Jason Gonzales, *Landfill Setback Costly for Brunswick County*, StarNewsOnline, May 5, 2012, http://bit.ly/15C84s4.

This example demonstrates the power of GIS to distill huge amounts of data into concise numerical or graphic descriptions. The example also identifies a challenge to this type of analysis: the validity of the results depends on the accuracy of each element. Because the final statistics are affected by the location of each of the 119 facilities, the entire analysis must be recalculated each time any locations are edited.

Complex Mapping Projects

GIS can process map patterns that are more complex than manual methods can handle, and they can produce mapping products that reveal patterns that are otherwise essentially unknowable. In another case, we employed all of the GIS techniques discussed here in a case against a city that has restricted placement of a type of group housing for people with certain disabilities.[17] Through amendments to its zoning ordinances, the city specified that no housing of this type could be placed proximate to certain other facilities (e.g., schools, parks, stores selling alcohol, or other housing of the same type).

The amount of land not affected by this regulation (i.e., available for group housing) is a critical fact, but it is far from obvious from ready observations. To show the potential magnitude of such restriction, we used GIS to map all examples of restriction buffers for each type of facility and then to encircle the sites with the exclusion buffers using various possible setbacks mentioned by city documents and personnel. Mapping the more restrictive buffer showed that such a buffer would eliminate all parcels where such housing for the disabled could be built. Mapping another, less restrictive buffer showed that only a few parcels would not be restricted and that housing for people with disabilities would have been possible on only a tiny percentage of the available acreage. The magnitude of the restrictions in this case was unknowable until mapped. The systematic impact of the restriction upon the city's disabled residents and providers of housing for the disabled was invisible without GIS.

■ ■ ■

Discrimination is often fundamentally about space—who lives where relative to political power, housing, infrastructure, or noxious facilities, or who is not permitted to live in particular areas. GIS analysis and graphics enable attorneys and other advocates to combine patterns into new syntheses and illustrate relationships that cannot be seen on the ground or from the underlying numerical data. Spatial thinking makes for rapid awareness that is resistant to linear counterargument. GIS tools potentially supply evidence not otherwise available and enhances communication. Because of the potential complexity of spatial data, advocates must exercise care to avoid producing figures that are confusing, misleading, or ineffective. Producing effective maps relies on having correct data at the appropriate scale and translating such data into text, maps, and graphics that are simple and powerful.

Authors' Acknowledgment

As always, we would like to thank Ben Marsh for his invaluable assistance with this article.

[17]Because the case referred to here is ongoing, the city is not identified.

The Geography of Justice

Founded in 2003, the Kirwan Institute for the Study of Race and Ethnicity is an applied multidisciplinary research center to support access to opportunity and justice. How does an institution understand the different factors driving inequity in society? Supported by scholars in law, planning, sociology, and geography, the Kirwan Institute quickly began using space as an organizing frame to conceptualize and understand inequality. Over time we developed opportunity mapping and an opportunity communities model, a comprehensive community development model for understanding our society's geography of opportunity as an essential step in dealing with systemic racial and ethnic inequalities.

For the past ten years, I have led the institute's use of mapping and geographic information systems (GIS) as a social justice tool to empower our partners and identify access to opportunity for all communities. We have had the pleasure of working with communities and partners in more than half of the states and developing stakeholder relationships that have let our mapping work inform court decisions, policy design, programming, and investments. The following are reflections on what we have learned from a decade of mapping to support social justice.

Geography and Justice Are Intertwined. The evidence of the relationship between place and space in understanding inequality continues to grow. Some of the most compelling research is from public health.[1] Place and community-based stressors affect not only the likelihood of successful social and economic outcomes but also individual and family health. We now understand that communities of concentrated poverty, isolated from economic opportunity, are communities of prolonged and extreme stress that can lead to destructive physiological changes. This public health research will—and should—bolster justice for vulnerable people and communities.

Mapping Communicates and Engages. Simplicity and intuitive design are critical to communicating with maps.[2] Effective mapping projects have a clear purpose, use maps designed as communication tools, and seek to engage those exploring data. A map is only good when it is understood.

Technology Marches Forward. Mapping continues to grow because of its utility for a variety of applications and because of technological advancements. A decade ago we spent much of our resources developing data. The development of volumes of accessible spatial data has enabled us to explore information never dreamed of a decade ago. New interactive mapping tools can enable any GIS user to design interactive mapping websites. Wireless technology enables us to crowd-source data and collect community-based information. Changes in technology enable us to pursue extensive participatory mapping activities, supplementing the "hard data" with community perceptions of assets, opportunities, and barriers to opportunity. We must continue to stay in tune with new technologies that allow innovative support for justice and community empowerment.

Mapping Is an "Iterative Space." As our work has evolved, we have come to appreciate that community-based mapping initiatives can be just as valuable as the maps or analysis produced. Mapping projects create "iterative space," a conceptual space where people from diverse backgrounds, disciplines, and areas of expertise can come together to think critically about problems. This working space can produce "soft benefits," such as relationship building among stakeholders.

Mapping Can Change Policies and Lives. We have seen the benefits of using mapping for relationship building. Relationships can transform policy making. Public policy practitioners, philanthropists, and other stakeholders have used our equity-driven framework to design policy, inform investments, and remedy barriers to opportunity for marginalized communities. Our long-term mapping goal should not be limited to stopping a disparate policy impact or getting a short-term advocacy victory. Our ultimate goal should be the institutional incorporation of our methods and equity frameworks.

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[1]Mike Wenger, Health Policy Institute, Joint Center for Political and Economic Studies, Place Matters: Ensuring Opportunities for Good Health for All: A Summary of Place Matters' Community Health Equity Reports (Sept. 2012), http://bit.ly/1e64idw.

[2]See Ann Moss Joyner & Allan M. Parnell, *Maximizing the Power of Geographic Information Systems in Racial Justice*, in this issue.

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