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2016 Environ. Res. Lett. 11 031001

Environmental Research Letters

PERSPECTIVE

A perspective on the historical analysis of race and treatment storage and disposal facilities in the United States

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Keywords: hazardous waste, environmental justice, GIS methodology

Abstract

Studies of environmental injustice have been intensely scrutinized by social science researchers since the publication of the United Church of Christ's Commission for Racial Justice report entitled *Toxic Wastes and Race in the United States* in 1987. Importantly, there has been an emphasis on analysing longitudinal data to answer the question 'which came first, people or pollution?' In addition, determining where environmental hazards are located and how demographics around those hazards are estimated has become central to any empirical enquiry on the topic. This new letter by Mohai and Saha (2015 *Environ. Res. Lett.* **10** 115008) adds to our emerging understanding of environmental justice by analysing the distribution of Treatment, Storage and Disposal Facilities across the United States to determine why they are concentrated in non-white and low income neighbourhoods. The researchers clearly demonstrate how longitudinal analysis and advances in geographic information system methodology can help address meaningful social questions about environmental inequality that are central to environmental policy and practice.

Perspective

Decades of environmental justice research points to the fact that in the United States hazardous waste is disproportionately located in non-white and low income neighbourhoods (Taylor 2014: 33–46 & 69–97). Interpreting this empirical generalization, however, continues to prove problematic and two competing explanations of the relationship between race, ethnicity, poverty and hazardous waste have emerged (Taylor 2014: 3, Mohai and Saha 2015a: 2). The first hypothesis, known as the 'disparate siting hypothesis' suggests that facilities that process hazardous waste are likely to be discriminately sited in low income and non-white neighbourhoods (Mohai and Saha 2015a: 2). The second hypothesis proposes that the relationship is the result of 'post-siting demographic change' and due to structured choice (Stretesky and Hogan 1998: 272, Mohai and Saha 2015b: 3). That is, some people have the economic and social capital to 'vote with their feet' and choose residences, schools and jobs that are distant from undesirable land uses after they are sited (Bullard 1990: 6). New longitudinal research in this volume of *Environmental Research Letters* by Mohai and Saha (2015a) examines waste treatment, disposal and storage facilities (TSDFs) sited across the entire United States between the years of 1966 and 1995 to help determine whether ' (1) there has been a pattern, at the time of siting, of placing hazardous waste sites, polluting industrial facilities, and other locally unwanted land uses (LULUs) disproportionately in low-income and people of colour communities, or (2) demographic changes after siting have led to disproportionately high concentrations of low-income and people of colour around hazardous sites' (p 1).

Mohai and Saha's study is significant as it provides empirical verification in an environmental justice setting by demonstrating how geographic information system (GIS) methodology can influence research findings—especially concerning interpretations of the relationship between hazardous waste and race. Results demonstrate that the 'unit hazard' approach is an inappropriate methodology because of the random error generated when estimating demographics around hazardous waste. That is, the unit hazard

approach examines the variability of waste between units such as census blocks, census tracts, cities, towns, counties or states that can contain environmental hazards. However, hazards such as TSDFs do not often fall in the centre of a unit (such as a census tract) and are likely to be located anywhere within the unit, including near a border (Chakraborty *et al* 2011, Taylor 2014: 41, Mohai and Saha 2015a: 16). Because of this situation, the results produced by unit-hazard models are likely to contain significant random error when it comes to demographic estimates around hazards, a situation that is shown to decrease associations between variables (Fleiss and Shrout 1977: 1188–9). Indeed, when relying on the unit hazard approach, Mohai and Saha (figure 1 and table 1) find weak or non-existent relationships between the location of TSDFs and non-white populations that can only be classified as symptomatic of random error conditions when presented in combination with their more precise GIS methodology. As a result, the study's findings question previous research that uses unit hazard methodology to make policy recommendations about the origins of environmental injustice in the United States. The implications of Mohai and Saha's work for policy and enforcement are immense (see Konisky 2015: 5–8). For instance, consider that the United States Environmental Protection Agency reports they are actively 'developing solutions to benefit overburdened communities' but that these communities must be located and identified (http://www.epa.gov/enforcement/enforcement-basic-information).

Mohai and Saha attenuate the problem of random error by using a 'distance-based' approach, which does not assume that all residents in a census tract or block with a TSDF are more proximate to that TSDF than residents in adjacent census tracts or blocks. Distance-based approaches used by Mohai and Saha are advantageous as they pinpoint the exact location of hazards and then estimate demographics around each site based on 'areal apportionment.' Apportionment constructs circles around each TSDF and estimates the demographics of each circle based on the area of standard units (e.g., census tracts) within the circle. As a result, previous relationships between demographic variables and hazardous waste that were hidden by fluctuations around the true location of the TSDFs in the unit hazard models suddenly become apparent. In Mohai and Saha's study this methodology reveals strong evidence of (1) disparate siting and (2) post-siting demographic changes. Drawing upon concepts in urban social geography (Rex 1968, Knox and Pinch 2010), the longitudinal nature of Mohai and Saha's work allow them to suggest that neighbourhoods undergoing significant transition were most likely to be the target of TSDFs siting in the future. The recognition by Mohai and Saha that areas that undergo heavy transition face changing (and sometimes harmful) land use patterns that are tied up in concepts of social inequality and can be explained by examining the 'path of least resistance' (see also Schelly and Stretesky 2009). That is, corporations may look for areas where permit applications can be easily obtained and/or potential resistance by community members and civil society organizations is minimal (Bullard 1993).

Mohai and Saha's study prompt additional questions about environmental injustice that cannot be answered in just one study. For instance, study raises significant questions about the definition and operationalization of hazardous waste and neighbourhoods (see Williams 1999, Downey 2005). First, Mohai and Saha study 319 commercial TSDFs. However, hazardous waste is released into communities in many different forms and from many different sources. Specifically, the US Environmental Protection Agency's *Enforcement and Compliance History Online* (or *ECHO*) database (http://echo.epa.gov/) lists over 400 000 active 'hazardous waste' facilities across the United States. These hazardous waste facilities include, but are not limited to many of the TSDFs in Mohai and Saha's study. Moreover, of these hazardous waste facilities, thousands are listed as potentially 'non-compliant' and operate in a potentially harmful fashion in their communities. The *ECHO* database also suggests that hundreds of hazardous waste facilities ($N = 416$) have faced formal enforcement actions by the federal government within the last five years, and at least some of these violations (i.e., those that are not merely paper and reporting violations) are likely to present a substantial threat to human health. As a result, the bulk of hazardous waste, and perhaps the most serious threats to communities, is possibly left out of Mohai and Saha's analysis. This omission is not likely to change any conclusions about environmental injustice in the United States and, if anything, points to the need for more research employing their rigorous methodology. Thus, the implication of Mohai and Saha's study for communities of colour is to highlight the potential and overwhelming extent of this social problem (see also Bullard 1996).

Second, Mohai and Saha bring up an important issue with respect to the demographics of hazardous waste. That is, the distance-based methodologies are sometimes noted as superior to unit based methodologies (Chakraborty and Maantay 2011). However, the 'path of least resistance' arguments advanced by Mohai and Saha (see also Mohai and Saha 2007) leave open for interpretation the issue of neighbourhood processes that shape environmental justice. Specifically, the units typically studied by environmental justice researchers are artificial constructs. This applies to census blocks, census tracts and concentric circles. An alternative would be to examine meaningful social units such as neighbourhoods as targets of waste and spaces of resistance (Williams 1999). As Mohai and Saha recognize, such questions are important as they ask how might environmental justice movements organize and resist TSDFs? More broadly, then, this research calls

for more investigation into the role of neighbourhood social and political processes in areas of transition. Unfortunately, studying artificial constructs make it more difficult to examine such issues. Nevertheless, until a more comprehensive indicator of hazardous waste and better concept of neighbourhoods are developed, Mohai and Saha's have set the standard for national level environmental justice analysis. Their work should be considered as important reading for environmental justice scholars and policy-makers.

Finally, it should be noted that Mohai and Saha point out that they are not the first environmental justice researchers to identify ways to improve environmental justice studies through better GIS methodology. Nevertheless, Mohai and Saha are the first to use this particular GIS methodology to identify the demographics of TSDFs over time and across the entire United States. As a result, they provide a unique and interesting quantitative history of environmental justice and TSDFs that helps answer the important question, 'which came first, people or pollution?'

References

Bullard R 1993 Anatomy of environmental racism and the environmental justice movement *Confronting Environmental Racism* ed R Bullard (Cambridge, MA: South End) pp 15–39

Bullard R 1996 Environmental justice: it's more than waste facility siting *Social Science Quarterly* **77** 493–9 (www.jstor.org/stable/42863495)

Bullard R 1990 *Dumping in Dixie* (Boulder, CO: Westview)

Chakraborty J and Maantay J A 2011 Proximity analysis for exposure assessment in environmental health justice research *Geospatial Analysis of Environmental Health* ed J A Maantay and S McLafferty (Dordrecht, Netherlands: Springer) pp 111–38

Chakraborty J, Maantay J A and Brender J 2011 Disproportionate proximity to environmental health hazards: methods, models, and measurement *Am. J. Public Health* **101** S27–36

Downey L 2005 Assessing environmental inequality: how the conclusions we draw vary according to the definitions we employ *Sociological Spectrum* **25** 349–69

Fleiss J and Shrout P 1977 The effects of measurement errors on some multivariate procedures *Am. J. Public Health* **67** 1188–91

Knox P and Pinch S 2010 *Urban Social Geography* (Oxon, England: Routledge)

Konisky D 2015 Introduction *Failed Promises* ed D Konisky (Cambridge, MA: MIT) pp 1–28

Mohai P and Saha R 2007 Racial inequality in the distribution of hazardous waste: a national-level reassessment *Social Problems* **54** 343–70

Mohai P and Saha R 2015a Which came first, people or pollution? Assessing the disparate siting and post-siting demographic change hypotheses of environmental injustice *Environ. Res. Lett.* **10** 115008

Mohai P and Saha R 2015b Which came first, people or pollution? A review of theory and evidence from longitudinal environmental justice studies *Environ. Res. Lett.* **10** 125011

Rex J 1968 The sociology of a zone of transition *Readings in Urban Sociology* ed R Pahl (Oxford, England: Pergamon) pp 211–31

Schelly D and Stretesky P B 2009 An analysis of the 'path of least resistance' argument in three environmental justice success cases *Society and Natural Resources* **22** 369–80

Stretesky P and Hogan M 1998 Environmental justice: an analysis of superfund sites in Florida *Social Problems* **45** 268–87

Taylor D E 2014 *Toxic Communities: Environmental Racism, Industrial Pollution, and Residential Mobility* (New York: NYU)

Williams R W 1999 The contested terrain of environmental justice research: community as unit of analysis *Social Sci. J.* **36** 313–28