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ENVIRONMENTAL JUSTICE: A CASE WITHOUT BLACK-AND-WHITE ANSWERS[1]

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ABSTRACT: Environmental injustice, environmental inequity, or environmental racism are terms utilized to describe the alleged disparate impact of potential or actual environmental hazards upon minority and low-income households. A methodology will be presented in this paper that provides a means of measuring any such relationship with greater accuracy and precision than the approaches used in earlier studies that supported assertions of environmental inequity. The greatest number of waste management facilities and the greatest percentage of minorities in the State reside in Lake County, Indiana. Distance correlations between waste management sites, minority residents, and household income found few indicators of either racial or class bias in the siting of such facilities. One case in eleven suggested class bias. However, the single case where racial bias might have been indicated also revealed that household income increased as one moved closer to the site. Persons living in proximity to this site enjoyed household incomes that easily afforded the mobility to leave the area had the residents so desired. In the case of such economic mobility, an assertion of racial bias cannot be supported. The results of this study cast doubt on the validity of earlier studies used to support assertions of environmental injustice, environmental inequity, or environmental racism.

KEYWORDS: Environmental justice, environmental racism, geographic information systems (GIS), waste facility siting.

INTRODUCTION

In October 1982, national attention was captured by a protest in Warren County, North Carolina, involving the siting of a landfill in rural Afton that would eventually accept over 32,000 cubic yards of soil contaminated by polychlorinated biphenyls (Geiser and Waneck, 1983; Bullard, 1990). At the time, Afton's population was one of the most economically depressed in North Carolina, and its population possessed the highest Black percentage (84%) in

[1] The opinions expressed or the conclusions reached within this manuscript are not necessarily those of the Indiana Department of Environmental Management.

that State (Bullard, 1990). This protest marked the genesis of a coalition formed to address an issue variously known as "environmental justice," "environmental equity," or "environmental racism" (Russell, 1989; Obmascik, 1992; Rees, 1992; Satchell, 1992). The coalition began to focus on the siting of such potentially hazardous facilities as landfills and waste incinerators in communities that were disproportionately or predominately non-white in ethnic character.

Since the early 1980s, the possible existence of a disproportionate impact of environmental hazards upon non-white minorities as well as the significance of potential racial or economic intent have been addressed (Bullard, 1986; Burke, 1993; Collin, 1992; Colquette and Robertson, 1991). President Clinton asked both the EPA and the Justice Department to develop "an aggressive investigation of the inequalities in exposure to environmental hazards" (Montague, 1993, p. 1), while Carol Browner, EPA Administrator, pledged to "weave environmental justice concerns throughout all aspects of EPA policy and decision-making" (Jones, 1992, p. 28). Bills have been introduced in Congress that, if passed, would seek to minimize the alleged disproportionate negative impacts of waste management upon the health and surrounding environment of minorities.

This study was designed to measure the degree to which both minority and low-income households were disproportionately exposed to the potential hazards of waste management facilities in Lake County, Indiana. A methodology was developed that provided a means of measuring these relationships with greater accuracy and precision than the approaches used in earlier studies.

SELECTED LITERATURE REVIEW

Earlier studies of possible environmental racism, defined here as that which "...encompasses any policy, practice or regulation intentional or not that adversely impacts disadvantaged individuals, groups or communities based on minority status" (U.S. Environmental Protection Agency, 1994, p. 19), grew directly out of the Warren County protest. A General Accounting Office (1983) study, based on 1980 census data for counties, examined four off-site hazardous waste landfills in the southeastern United States. Off-site landfills are neither part of nor adjoining an industrial facility producing the waste which is sent to such landfills. The study concluded that three (75%) of the four landfills were located in areas containing a majority Black population. The Black populations at all four sites had lower mean incomes than all races combined, and, for each of the four sites, more than 90% of the surrounding population with incomes below the poverty level were Black. In short, such off-site landfills tended to be sited in proximity to communities that were both economically depressed and predominantly Black.

Bullard (1983) used census tract and block statistics to examine solid waste sites throughout the city of Houston, Texas. His study concluded that six (75%) of the eight Houston incinerators were located in predominantly Black neigh-

borhoods. Bullard further concluded that all six (100%) of Houston's publicly-owned municipal landfill sites and five (83%) of the six privately-owned landfill sites were located in predominantly Black neighborhoods. He also noted that, while Blacks constituted approximately 28% of Houston's population, more than 75% of the city's solid waste sites were situated within Black neighborhoods (Bullard, 1984).

Bullard also addressed the question of economic status in waste facility siting. The Community Development Block Grant Program was created to channel Federal funds through the U.S. Department of Housing and Urban Development to communities "...based on poverty level, housing conditions, crowding, income, and general physical condition of these neighborhoods" (Bullard, 1984, p. 96). Bullard (1984) found that 93% of the publicly-owned solid waste sites in Houston were located within Community Development Block Grant target areas.

In 1987, the United Church of Christ's Commission for Racial Justice released the first comprehensive study on a national level that focused on the relationship of race and economic class to the spatial distribution of hazardous waste sites. These sites included commercial hazardous waste facilities and uncontrolled toxic waste sites. The study used census data merged with zip code boundaries to define the term "communities." This study (United Church of Christ, 1987, p. xii, xiv) drew several major conclusions, including:

1. Representing a consistent national pattern, race proved to be the most influential variable, among those tested, in association with the location of commercial hazardous waste facilities.
2. Communities with the greatest number of commercial hazardous waste facilities had the highest composition of minority residents.
3. In communities with two or more hazardous waste facilities or one or more of the nation's five largest landfills, the average minority percentage of the population was more than three times that of the communities without such facilities (38% versus 12%).
4. Race was the most significant variable in determining communities with commercial hazardous waste facilities from those without; race was followed by the value of owner-occupied housing.
5. Three out of every five Black and Hispanic Americans lived in communities with uncontrolled toxic waste sites.
6. Approximately 50 percent of all Asians/Pacific Islanders and American Indians lived in communities with uncontrolled toxic waste sites.

In the most notable study completed since the United Church of Christ's study, Mohai and Bryant (1992) examined the siting of commercial hazardous waste facilities in a three-county area surrounding Detroit, Michigan. Their research employed concentric circles placed at intervals of 1 mile and 1.5 miles around each of the sixteen commercial hazardous waste facilities in the study area. Information on race and household income was obtained through person-

Table 1. Population, income, and racial composition of Indiana and Lake County in 1989.

	Indiana	Lake County	Percent Distribution by Race (State/County)	Lake County's Rank by Percent
Total Population	5,544,159	475,594	n/a	2nd
White	5,022,596	334,459	90.6/70.3	92nd
Black	428,722	116,572	7.8/24.5	1st
American Indian, Eskimo, or Aleut	14,494	1,097	0.3/0.2	4th
Asian or Pacific Islander	36,595	2,345	0.7/ 0.5	5th
Other Race	40,752	21,121	0.7/ 4.4	1st
Total Minority	521,563	141,135	9.4/29.7	1st
Median Household Income	$28,797	$30,439	n/a	21st

al interviews. Their methodology allowed Mohai and Bryant to "pinpoint" to the nearest 0.1 mile the location of randomly selected households surrounding each community's waste management facility. Their placement was more exact than those in previous studies of "community" or "neighborhood" that were based on census tracts, zip code boundaries, or entire counties.

Mohai and Bryant (1992) concluded that of those people living more than 1.5 miles from a commercial hazardous waste facility, 18% were minorities, and 10% were below the poverty line. For those residents living between 1 mile and 1.5 miles from a commercial hazardous waste facility, 39% were minorities, and 18% were below the poverty line. Of those who resided within 1 mile of a commercial hazardous waste facility, 48% were minorities, and 29% were below the poverty line. Mohai and Bryant concluded that both the percentages of average minority and below poverty line populations increased when approaching the hazardous waste facilities. Their findings mirrored the pre-study indicators that, while Michigan, the three-county area, and Detroit have minority percentages of 16%, 21%, and 76%, respectively, 16 (76%) of Michigan's 21 commercial hazardous waste facilities are located within the three-county area, and 8 (38%) are located within Detroit proper. Mohai and Bryant concluded that race and location were independent of income based on a multiple linear regression analysis and, further, that race was a better predictor than income of the location of a commercial hazardous waste facility.

Mohai and Bryant measured the distance to the facility to the nearest 0.1 mile and found that the relationship between the location of sites and income was no longer statistically significant.

MATERIALS AND METHODS

This study was limited to the State of Indiana, where several suitable study sites existed for measuring the degree to which both minority and low-income households might be exposed to the potential hazards of waste management facilities. A review of the census data and the locations of waste management facilities showed that Lake County would be the most suitable area to study.

Lake County is located in the extreme northwestern corner of Indiana; it has the highest concentration of heavy industrial plants and waste management facilities; and the highest non-white minority percentage of any county in the State (Table 1) is located here. Specifically, the percentage of Blacks within Lake County (24.5%) is more than three times the percentage of Blacks in the State as a whole (7.8%). These factors suggest (as in Mohai and Bryant, 1992) that environmental racism might well occur in Lake County.

Census data were obtained from several 1990 Census Summary Tape Files, merged with 1990 Tiger/Line data, and subsequently entered into a geographic information system (GIS). Census data, obtained at the block group level, provided information on the variables studied. For purposes of accuracy and precision, the location of the waste management facilities were confirmed through site inspection. The thirteen waste management sites included in this study are listed in Table 2.

After the center or source point of the waste management site was determined, a circle with a one-kilometer radius was drawn to determine which block groups either overlapped or were completely encompassed by the circle (Figure 1). The racial, ethnic, and income data for each of these block groups were stored in a data base. Additional circles were then drawn with two- and three-kilometer radii. Previously sampled, overlapping block groups were excluded from the new block groups identified by the wider radii (Figure 2). Their omission eliminated the possibility of counting any racial, ethnic, or income data twice. This process was repeated for each of the thirteen waste management sites under study.

After selecting those block groups qualifying for further study, the minority percentage of the population was determined within each block group. First, the number of people in the following four categories was determined: Blacks; Native Americans, Eskimos, or Aleuts; Asian or Pacific Islanders; and Other Race. Each sum was then divided by the total population within the block group and multiplied by one hundred to obtain a percentage. The respective minority percentages were added to the data base for each block group.

The median and not the mean household income was calculated using census data. Use of median household income was maintained throughout the project to minimize the possibility of skewing due to outlying data.

Table 2. Waste management facilities in Lake County, Indiana.

Site	Location	Status
Gary Landfill	Gary	Operating
J & D Landfill	Cedar Lake	Closed in 1983
American Fly Ash Company/ Gary Development	Gary	Closed in 1987
Munster Landfill	Munster	Operating
Feddeler Landfill	Lowell	Operating
Griffith Landfill	Griffith	Closed in 1993
Rhone-Poulenc Hazardous Waste Incinerator	Hammond	Operating
John B. Nicosia Municipal Incinerator	East Chicago	Closed in 1993
Lake Sandy Jo Landfill	Gary	Closed; Superfund NPL site since September 1983
MIDCO I	Gary	Closed; Superfund NPL site since September 1983
Ninth Avenue Dump	Gary	Closed; Superfund NPL site since September 1983
American Chemical Services	Griffith	Operating; Superfund NPL site since September 1984
MIDCO II	Gary	Closed; Superfund NPL site since September 1986

These data were analyzed using Pearson product-moment correlation analysis to determine whether or not significant correlations existed between (1) distance from the waste management site and minority percentage and (2) distance from the waste management site and median household income. A second analysis was carried out using multiple linear regression analysis to identify which variable, minority percentage or median household income, was the better predictor of distance from the site of each waste management facility. All determinations were made at the 95% confidence level.

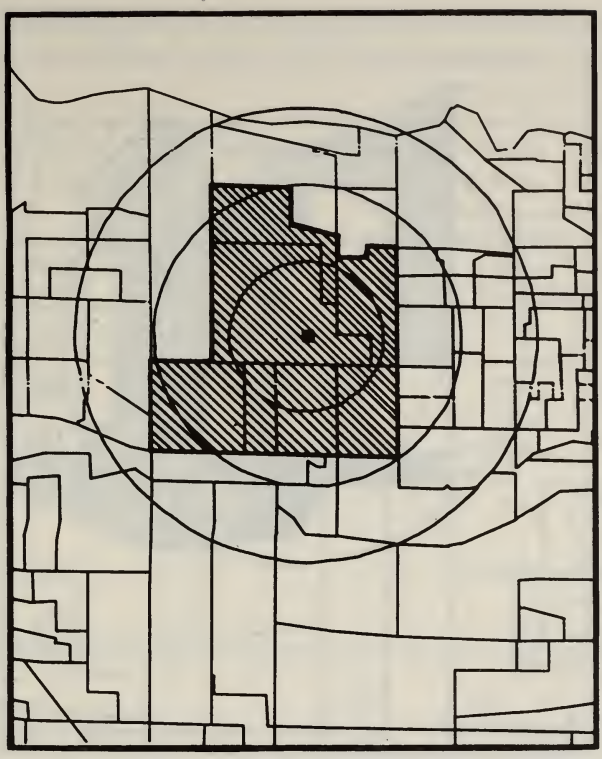

Figure 1. Block groups selected in the 1-kilometer ring surrounding the Gary Landfill.

RESULTS AND DISCUSSION

The Feddeler Landfill in Lowell and the closed J & D Landfill in Cedar Lake each had an extremely limited number of surrounding block groups and, therefore, did not provide sufficient data to successfully complete either a correlation or multiple linear regression analysis. The available census data (Table 3) revealed that both towns possess a greater than 98 percent white population (U.S. Bureau of the Census, 1993).

Correlation coefficients between distance from the waste management site and (1) the percentage of minority residents and (2) the median household income were calculated for the remaining eleven sites. Three significant correlations were found (Table 4).

Two significant correlations were found for the Munster Landfill site. First, a negative correlation between distance from the waste management site and minority percentage was significant ($P = 0.001$; $r = -0.69$). Thus, minority percentage increases as the waste management site is approached. This correlation supports the hypothesis that minority percentage should increase when moving toward the Munster Landfill.

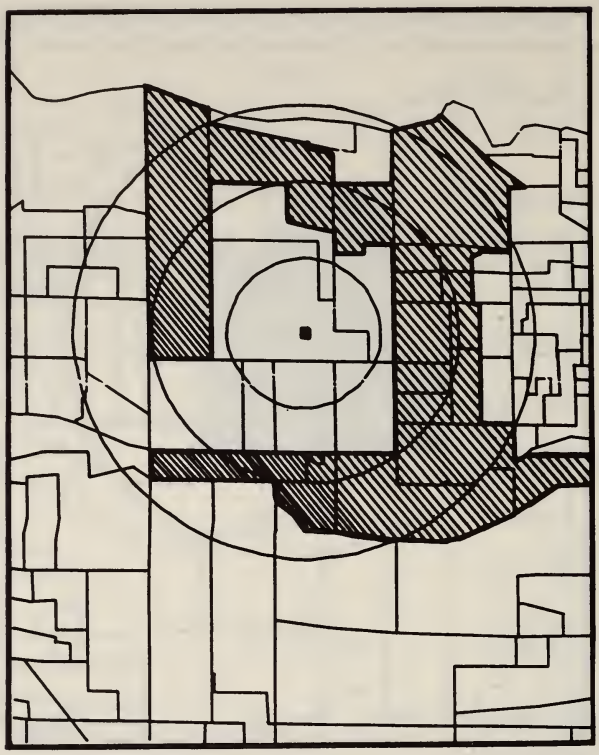

Figure 2. Block groups selected in the 2-kilometer ring surrounding the Gary Landfill.

The second significant correlation suggests a relationship between distance from the waste management site and median household income ($P = 0.005$; $r = -0.62$). The median household income increased as the waste management site was approached. This correlation contradicts the hypothesis that median household income should increase when moving away from the Munster Landfill and has important implications when considered together with the other significant correlation found for this site (see above).

Minority households in Munster increase in number when moving toward the center of the waste management site. The Asian/Pacific Islander category is the largest minority group, comprising 3.3% of the total population and accounting for 76.8% of the total minority population in Munster (Table 3).

The median household income ($48,006.00) reported for White households in Munster is slightly lower than the median household income ($48,483.00) of Munster as a whole (Table 5). Table 6 lists, by concentric rings around the Munster Landfill, the number of Asian/Pacific Islander households that fall into the Census Bureau's delineated household income ranges. A high number of households located around the waste management site have median incomes greater than $100,000 per year. The number of households increases

Table 3. Distribution by percent race and percent total minority of the total population in 1989 for selected towns with waste management facilities in Lake County, Indiana.

	White	Black	Amer. Indian Eskimo, or Aleut	Asian or Pacific Islander	Other Race	Total Minority	Total Population
Cedar Lake	98.3	0.0	0.8	0.3	0.5	1.7	8,885
East Chicago	38.2	33.6	0.3	0.1	27.8	61.8	33,892
Gary	16.3	80.6	0.2	0.1	2.8	83.7	116,646
Griffith	95.1	2.5	0.1	0.8	1.5	4.9	17,916
Hammond	84.9	9.0	0.4	0.3	5.3	15.0	84,236
Lowell	99.1	0.0	0.0	0.1	0.8	0.9	6,423
Munster	95.7	0.4	0.0	3.3	0.6	4.3	19,949

dramatically when moving closer to the site. Visual inspection of the site revealed both a substantial number of new homes being built and the presence of several housing developments surrounding the Munster Landfill. That 76.8% of the minority population in Munster is Asian/Pacific Islander may explain a significant portion, if not all, of the difference in median household income between Munster residents as a whole and those that are Asian/Pacific Islander. The high median household income for the Asian/Pacific Islander population suggests that the significant negative correlation between distance from the waste management site and minority percentage is less meaningful (if not meaningless) than it would have been if income increased as distance from the waste management site increased. Hence, for this particular case, claims of environmental injustice, environmental inequity, or environmental racism may lack merit.

Although superficially Munster appears to support a case of environmental racism (since minority population increases with greater proximity to the Munster Landfill), one must also consider the apparent presence of social and economic mobility among a large portion of the minority population. Before claims of environmental racism, or even inequity, are leveled, the minority population's ability to move away from a potential environmental hazard must be examined. At this particular site, a large portion of the minority population is clearly able to exercise social and economic mobility but has chosen to reside in proximity to the potential environmental hazard. The categorization of a person or household as a minority may not in every case reflect an unwillingness to reside near a potential environmental hazard; nor may it indicate a

Table 4. Pearson product-moment correlations for waste management facilities and demographic characteristics for Lake County, Indiana.

Solid Waste Site	Minority Percentage		Median Household Income	
	r	*P*	*r*	*P*
Gary Landfill	-0.10	0.474	0.33	0.017*
Rhone-Poulenc Hazardous Waste Incinerator	-0.06	0.644	0.03	0.842
MIDCO I	0.14	0.378	-0.08	0.598
9th Avenue Dump	0.07	0.707	-0.14	0.408
MIDCO II	0.17	0.521	0.25	0.358
American Chemical Service	0.32	0.165	0.32	0.170
Griffith Landfill	0.35	0.118	0.33	0.146
American Fly Ash/ Gary Development	0.11	0.566	0.07	0.722
Munster Landfill	-0.69	0.001*	-0.62	0.005*
Lake Sandy Jo Landfill	-0.01	0.923	-0.18	0.155
Nicosia Incinerator	0.05	0.775	-0.16	0.343
Feddeler Landfill	n/a		n/a	
J & D Landfill	n/a		n/a	

* = significant correlations.

lack of social or economic mobility for that particular minority. Further, the conclusion of the United Church of Christ's study (1987, p. *xiv*) that "approximately 50 percent of all Asian/Pacific Islanders and American Indians lived in communities with uncontrolled toxic waste sites" may not be as meaningful if circumstances such as those found in Munster are discovered at other locations in the United States.

A third significant correlation was found between distance from the Gary Landfill and median household income ($P = 0.017$; $r = 0.33$). The greater the distance from the center of the Gary Landfill, the greater the median household

Table 5. Median household income by town and race in 1989 for selected towns with waste management facilities in Lake County, Indiana.

	Total	White	Black
Cedar Lake	$27,144	$26,987	n/a
East Chicago	$19,391	$23,359	n/a
Gary	$19,390	$21,291	$18,763
Griffith	$36,562	$36,736	n/a
Hammond	$26,883	$27,653	$17,670
Lowell	$35,998	$35,969	n/a
Munster	$48,483	$48,006	n/a

income. This correlation supports the hypothesis that low-income households are disproportionately exposed to the potential hazards of waste management facilities.

No significant correlation between distance from a waste management site and minority percentage was found for the Gary Landfill or for any of the other five waste management sites in Gary (Table 4). According to census data (U.S. Bureau of the Census, 1993), the city of Gary has a minority percentage of 83.7%; therefore, one might argue that any distance measurement for Gary, when compared to minority percentage, would not render a correlation due to the frequency and distribution of minorities throughout the city as a whole. Perhaps, minorities are somewhat evenly distributed throughout Gary. If so, a consistent number of minorities would be present at any distance from the center of a waste management facility within the city. From this, one could argue that the number of waste management facilities within Gary supports Bullard's findings for Houston (Bullard, 1984) — that minorities are disproportionately exposed to environmental hazards due to their sheer predominance (Blacks, in the case of Gary).

With this strong pre-study indicator of a disproportionate exposure of the minority community to the potential environmental hazard represented by the Gary Landfill in mind, Bullard's (1983, 1984) methodology will be examined more closely. As the results of our research indicated that no significant correlation existed between increasing minority percentage and proximity to the Gary Landfill, the site was re-examined using Bullard's methodology. Data from the 1990 census (U.S. Bureau of the Census, 1993) was acquired for Tract 103 (Figure 4), the census tract in which the Gary Landfill is sited. These data indicated a total minority percentage of 93.8%; for Gary as a whole, the total

Table 6. Asian/Pacific Islander median household income in 1989 by concentric ring about the Munster Landfill in Lake County, Indiana.

Income Range	First Ring	Second Ring	Third Ring
$15,000-$24,999	0	0	5
$25,000-$34,999	0	6	10
$35,000-$49,999	7	0	4
$50,000-$74,999	12	33	4
$75,000-$99,999	12	9	7
> $100,000	74	37	6

minority percentage was 83.7%; and for Lake County as a whole, the total minority percentage was 29.7%. For the Black population, Tract 103 had a percentage of 87.8%; whereas, in Lake County, Blacks comprised 24.5% of the total population. These figures, derived using Bullard's methodology, strongly suggest that minorities in general and Blacks in particular are disproportionately exposed to any hazards represented by the Gary Landfill. However, Tract 103 includes areas more than 3 kilometers away from the Gary Landfill (Figure 4). Immediately to the south of and contiguous with Tract 103 are Block Groups 261, 263, and 264 of Census Tract 411 and Block Group 262 of Census Tract 412 (Figure 5). With the exception of a small corner of Block Group 261, these block groups are all located within 2 kilometers of the Gary Landfill, and, without exception, they are all completely within 3 kilometers of that waste management facility. These four block groups have a Black population of no more than 0.6%. The virtual absence of a Black population in close proximity to the Gary Landfill suggests (just as the Munster findings did for the results of the United Church of Christ's study (1987)) that any findings of a disproportionate exposure of minorities to waste management facilities found using the methodology employed by Bullard (1983, 1984) may not be meaningful.

Similar findings (using a methodology closely comparable to the one used here) were obtained by Glickman (1994) in Allegheny County, Pennsylvania. Concentric rings with radii of one-half, one, and two miles were drawn around facilities listed in the Toxic Release Inventory and facilities storing "extremely hazardous substances" in Allegheny County. While Bullard's study (1983, 1984), the General Accounting Office study (1983), and the United Church of Christ's study (1987) identified a disproportionate exposure of minorities to the potential hazards, Glickman's more finely focused work found that "nonwhites and poor people actually bear proportionately slightly *less* of the risk than they would if equity existed" (Glickman, 1994, p. 5; emphasis in the original).

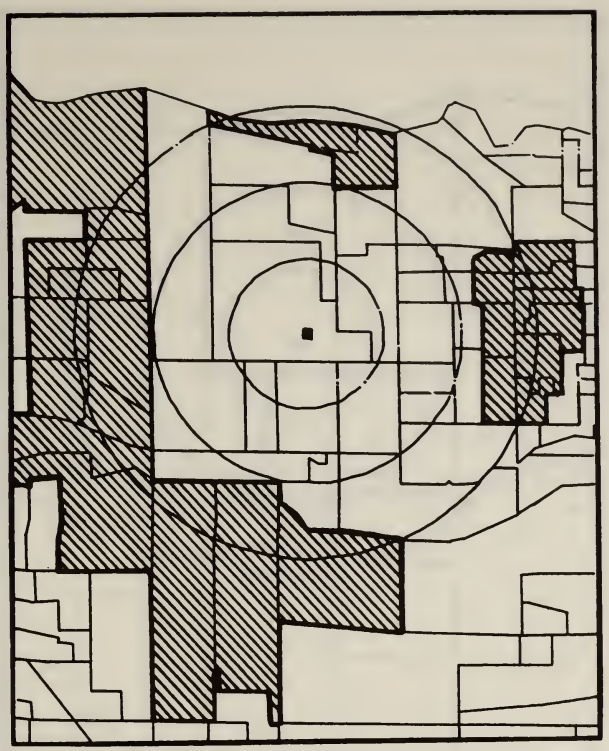

Figure 3. Block groups selected in the 3-kilometer ring surrounding the Gary Landfill.

The methodology employed in this study as well as in Glickman's has demonstrated a measurable advantage over previous work through alleviating two methodological problems. The United Church of Christ's study (1987) asserted its conclusions within the context of communities defined by zip code boundaries, a definition that is considerably more expansive than that of block groups, the preferable and more narrowly defined unit of analysis used in this research. Such a broad definition renders the conclusion that "three out of every five Black and Hispanic Americans lived in communities with uncontrolled toxic waste sites" (United Church of Christ, 1987) less meaningful than it might otherwise be. Bullard mixed block group data with census tract data, which clouded his results. He failed to specify exactly what was meant by terms such as "neighborhood" and "predominantly" when he concluded that six (75%) of eight waste incinerators were located within predominantly Black neighborhoods (1983, 1984).

The studies by the United Church of Christ (1987) and Bullard (1983, 1984) each draw a conclusion regarding the populations exposed to potential environmental hazards within certain fixed political boundaries. They relate the quantity of potential hazards to the corresponding socio-economic charac-

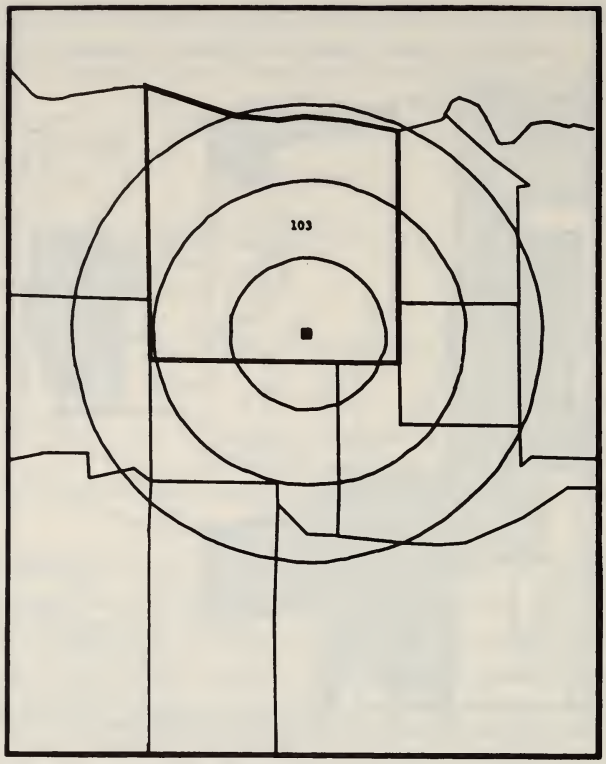

Figure 4. Census Tract 103 showing the location of the Gary Landfill.

teristics of the populations within those fixed boundaries. However, the studies did not necessarily determine the socio-economic characteristics of the population directly surrounding and/or most likely to be exposed to the potential hazards. The mere fact that a community or zip code area is, for example, 30% minority cannot support a conclusion that the minority households are clustered around or disproportionately exposed to the potential hazard. The minority population may be dispersed within the community or even clustered a considerable distance away from the waste management site, yet still be situated within the same zip code area or census tract. More importantly, the potential environmental hazard may be bordering on another community or zip code area that remains unaccounted for by the methods used by either the United Church of Christ or Bullard.

As for the remaining nine sites examined in this study, no clear reason exists for why no significant correlations were found. Of the eleven sites whose data permitted correlation analysis, no significant correlations were found between distance from the waste management site and minority percentage (with the single exception of the Munster Landfill). This finding undermines the contention that minority households are disproportionately exposed to the

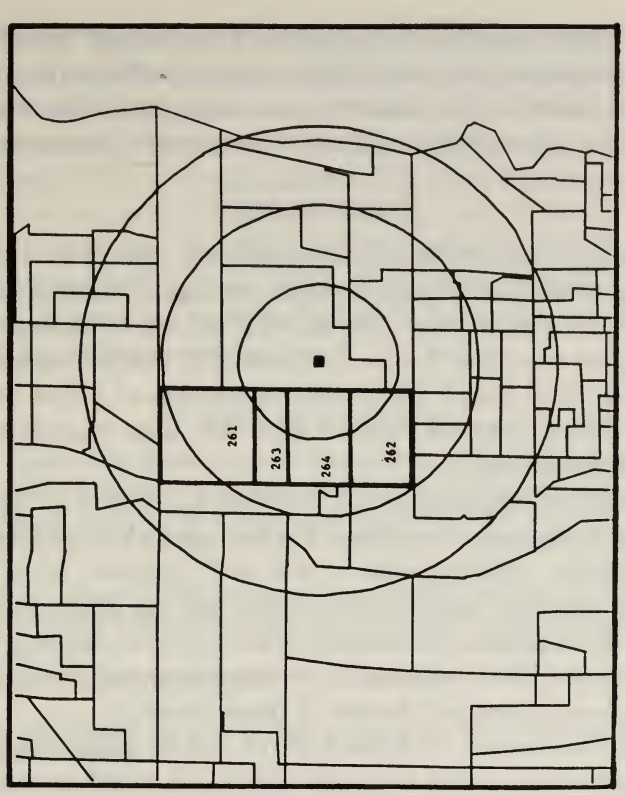

Figure 5. Census Block Groups 261, 262, 263, and 264 showing the location of the Gary Landfill.

potential hazards of waste management facilities. Of the same eleven sites, no significant correlations were found between distance from the waste management site and median household income (with the exception of the Munster and Gary Landfills). This finding, along with the negative correlation between distance from the waste management site and median household income found at the Munster Landfill, undermines the contention that low-income households are disproportionately exposed to the potential hazards of waste management facilities. One might argue that some other variable, such as age, level of education, or percentage of owner-occupied homes, may be significant predictors of distance from each site, but the argument that minority percentage or median household income are such predictors is difficult to support with these results.

For those sites without significant correlations between distance from the waste management site and either minority percentage or median household income, the data for the latter two variables are somewhat evenly distributed around the relevant waste management facilities. The data do not increase or decrease in a consistent pattern when moving away from the waste manage-

ment sites. A better question for researchers to consider would be one that assesses individual persons potentially or actually affected by or exposed to environmental hazards rather than one that seeks a prediction of distance from a site based upon one or more racial or socio-economic characteristics.

CONCLUSIONS

The reported research failed to find significant support for a claim of environmental racism or environmental inequity in Lake County, Indiana. Ten out of eleven cases did not support a racial bias. Ten out of eleven cases did not provide evidence of a class bias as determined by median household income. In fact, the Munster Landfill site refuted suggestions of a class bias through a negative correlation between distance from the waste management site and median household income.

Although the census block group is clearly superior to the census tract or zip code area as the unit of analysis. Further research should be performed, wherever possible, utilizing data at the still narrower block level. This approach may minimize problems associated with the existence of any peculiarly shaped block groups. The random house-to-house sampling employed by Mohai and Bryant (1992), although time-consuming and financially demanding, should become a standard feature of future research.

Environmental racism, as defined above, can be claimed when an intentional or unintentional action adversely affects the health or environment of minorities. However, as in the case of Munster, if those residing around a waste management facility have a high level of economic mobility that would allow them to move away if they so desired, it becomes an egregious task to apply the term "environmental racism" to such a case, even when consideration is given to the "unintentional" element within the definition.

In Munster, the homes surrounding the landfill were constructed after the landfill had been sited and had started operation. Therefore, any adverse effects associated with the site were "intentional," but intentional on the part of those so exposed to the potential hazard. Although no attempt was made to determine property or home values in Munster, a widely shared perception of a potential environmental hazard might possibly have resulted in the benefit of reduced property purchase costs in proximity to the Munster Landfill. Such a trade off has been observed in other parts of the United States (*e.g.*, Bailey, 1994). Reduced property values could also result in the attraction of persons with limited incomes well after a potential environmental hazard had been located (*e.g.*, Been, 1994), and, as the general tendency for minority households to exhibit lower median household incomes exists in the United States, the attempt to locate such a potential hazard away from minority or low-income populations could soon be frustrated. In the case of Gary, historical research by Hurley (1992) suggests that the presence of the employment opportunities created by the waste management facilities can override considerations of the potential environmental hazards accompanying the wastes. In any of these cases, with-

out a finely focused assessment of what groups are exposed to a potential environmental hazard and a longitudinal tracking of how the composition of those groups changed over time, assertions of racial or class bias in the siting of waste management facilities are not especially enlightening.

What is argued for is a reexamination of the operationalization of environmental justice, incorporating not only race or ethnicity but other elements such as the level of economic mobility and the pursuit of economic choice. Otherwise, the risk taken is a loss of meaning and significance for the term environmental justice. This research, especially in the case of Munster, indicates the need for such a reexamination.

LITERATURE CITED

Bailey, J. 1994. A wealthy suburb airs its complaint: Flies in the "hood." Wall Street J., 11 July, A1, A7.

Been, V. 1994. Unpopular neighbors: Are dumps and landfills sited equitably? Resources 115: 16-19.

Bullard, R.D. 1983. Solid waste sites and the Black Houston community. Soc. Inq. 53: 273-288.

_____. 1984. Endangered environs: The price of unplanned growth in boomtown Houston. California Soc. 7: 85-101.

_____. 1986. The politics of pollution: Implication for the Black community. Phylon 47: 71-78.

_____. 1990. Dumping in Dixie: Race, class, and environmental quality. Westview Press, Boulder, Colorado, 165 pp.

Burke, L.M. 1993. Race and environmental equity: A geographic analysis in Los Angeles. Geo. Info. Sys. 3: 44-50.

Collin, R.W. 1992. Environmental equity: A law and planning approach to environmental racism. Virginia Environ. Law J. 11: 495-546.

Colquette, K.M. and E.A.H. Robertson. 1991. Environmental racism: The causes, consequences, and commendations. Tulane Environ. Law J. 5: 153-207.

Geiser, K. and G. Waneck. 1983. PCBs and Warren County. Sci. for the People 15: 13-17.

Glickman, T.S. 1994. Measuring environmental equity with geographical information systems. Resources 116: 2-6.

Hurley, A. 1992. Challenging corporate polluters: Race, class, and environmental politics in Gary, Indiana, since 1945. Indiana Mag. Hist. 88: 273-302.

Jones, S.C. 1992. EPA targets "environmental racism." Nat. Law J., 9 August, B28.

Mohai, P. and B. Bryant. 1992. Environmental racism: Reviewing the evidence. *In:* B. Bryant and P. Mohai (Eds.), *Race and the Incidence of Environmental Hazards: A Time for Discourse*, pp. 163-176, Westview Press, Boulder, Colorado, 251 pp.

Montague, P. 1993. Rachel's hazardous waste news #366: Environmental justice in Georgia. Environ. Res. Found., 2 December, 1.

Obmascik, M. 1992. Environmental racism theory misses some toxic realities. Denver Post, 8 February, B1.

Rees, M. 1992. Black and green: The birth of eco-racism. New Repub. 206: 15-16.

Russell, D. 1989. Environmental racism: Minority communities and their battle against toxics. Amicus J. 11: 22-32.

Satchell, M. 1992. A whiff of discrimination? U.S. News and World Rep. 112: 34-35.

United Church of Christ, Commission for Racial Justice. 1987. Toxic wastes and race in the United States: A national report on the racial and socio-economic characteristics of communities with hazardous waste sites. United Church of Christ, New York, New York, 69 pp.

U.S. Bureau of the Census. 1993. Census of population, social and economic characteristics, Indiana, 1990. Government Printing Off., Washington, D.C.

U.S. Environmental Protection Agency. 1994. Environmental justice initiatives. Environ. Protection Agency, Washington, D.C., EPA 200-R-93-001, 20 pp.

U.S. General Accounting Office. 1983. Siting of hazardous waste landfills and their correlation with racial and economic status of surrounding communities. General Accounting Office, Washington, D.C., GAO/RCED-83-168, 13 pp.