

Class, race, and the disposal of urban waste: Locations of landfills, incinerators, and sewage treatment plants

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Abstract:

This study compared the socioeconomic status, racial composition, and ethnic composition of 49 randomly selected U.S. cities with those of the census tracts containing the solid waste disposal facilities and sewage treatment plants for those cities. Contrary to the environmental racism and classism hypotheses, residents of tracts with landfills or incinerators had higher incomes and were less likely to be minority group members than residents of the cities that generated the refuse—although they did have somewhat lower education levels. There were few differences between the population characteristics of the cities and the census tracts that contained their sewage treatment plants. Possible explanations for these findings are discussed.

Keywords: Pollution | Environmental racism | Socioeconomic status | Class | Race

Article:

In the last decade, researchers and activists have added concerns about environmental racism and classism (United Church of Christ 1987; Bullard 1994) to the long catalog of troubles (Hurst 1995) visited upon minorities and the poor. Studies showing that the minority and poor neighborhoods suffered most from air pollution appeared as early as the 1970s (Mohai and Bryant 1992). By the 1990s, disturbing research reports about the siting of hazardous waste facilities (U.S. General Accounting Office 1983; United Church of Christ 1987; Bullard 1994), vocal protests against environmental degradation in minority and poor neighborhoods (Bullard 1994; Austin and Schill 1994), and tensions between a growing environmental justice movement and mainstream environmental organizations (Chavis 1992; Sierra Club 1993) had established environmental racism and classism as topics of popular discussion and official attention (Anderton et al. 1994; Clinton 1994).

Despite this growing concern, research about the effects of social class, race, and ethnicity on exposure to environmental hazards remains in the formative stage (Anderton et al., 1994). Important questions about which types of environmental pollution are linked to class, race, and ethnicity, how other variables affect these relationships, and appropriate research methodologies for studying these questions remain largely unexplored. This research note contributes to the resolution of these problems in two ways. First, it investigates how the locations of two rarely studied types of facilities—the landfills and sewage treatment plants that dispose of municipal waste—are linked to race, ethnicity, and class. Second, it illustrates a research design little used in previous research, comparing the characteristics of cities that generate urban waste with the census tracts that receive it.

STUDIES OF RACE, ETHNICITY, CLASS, AND ENVIRONMENTAL HAZARDS

A number of studies linking the class, race, and ethnicity of neighborhoods to environmental degradation have appeared, but their coverage has been far from comprehensive. Mohai and Bryant's (1992) review of research from the 1970s through the early 1990s showed that the majority of studies (13 of 21) focused on air pollution, limited their research to one or a few urban areas (15 of 21), and correlated the percentage of minority or poor citizens in census tract or zip code areas with the extent of pollution or the existence of hazardous or environmentally undesirable facilities in these areas. Sixteen of 20 studies that examined income showed that lower income areas experienced more environmental hazards, and 15 of 16 that used race as an independent variable showed that minority citizens were more subject to these outcomes.

A second review of air pollution studies (Sexton et al. 1993) also concluded that poor and minority citizens breathed dirtier air, and studies not included in these reviews (Kruvant 1975; Gould 1986; Earickson and Billick 1988), as well as subsequent research (Brajer and Hall 1992; Mohai and Bryant 1992; Schwartz and Levin 1992; Wernette and Nieves 1992; Adeola 1994; Goldman and Fitton 1994; Pollock and Vittes 1995), have generally shown that the poor and minorities suffer more from various types of environmental degradation—although not without exception (Napton and Day 1992; Zimmerman 1993; Anderton et al. 1994; Glickman 1994).

Several studies have examined the exposure of minorities and less privileged citizens to hazardous waste (Gould 1986; Mohai and Bryant 1992; Zimmerman 1993; Anderton et al. 1994; Goldman and Fitton 1994; Pollock and Vittes 1995), but we found only two that concerned ordinary solid waste, both covering only a single city. Berry (1977) found that in Chicago a higher volume of solid waste was generated in Black and poor neighborhoods (followed closely, however, by the most affluent neighborhoods), but he did not investigate the location of solid waste disposal facilities. Bullard (1983) similarly found that landfills and incinerators in the Houston area were concentrated in African American neighborhoods. We could find no study that examined the location of sewage treatment plants in relation to class, race, and ethnicity.

METHOD

The cases for this analysis were the solid waste and sanitary sewer "waste streams" generated by a sample of U.S. cities with populations of more than 100,000.¹ For each waste stream, we compared characteristics of the waste generators (the population of the city) with those of the waste recipients (the population of the census tracts in which the landfill, incinerator, or sewage treatment plant that received the waste or sewage was located). We used census tract data to represent the demographic characteristics of waste recipients in preference to the zip codes used in some other studies (e.g., United Church of Christ 1987). Census tracts are typically smaller, more uniform in population size, and designed to correspond to existing neighborhoods (Anderton et al. 1994).

We hypothesized that recipients of waste streams would be of lower socioeconomic status and include a higher proportion of minorities than the generators of waste streams. It is possible to conceptualize and measure class and race equity in exposure to pollution and environmentally undesirable facilities in various ways (Zimmerman 1993), but the most common approach has been to examine the correlation between the class or racial composition of geographic areas (generally zip codes or census tracts) and the presence of waste disposal facilities or levels of pollution within them; that is, most studies have investigated the extent to which minorities or lower socioeconomic status residents lived in less healthy or desirable environments than other citizens. Our study, by contrast, compared the characteristics of waste generators and recipients, focusing attention on whether the more privileged dumped their wastes on the less privileged.²

We analyzed our data first for all waste streams combined, and then separately for solid waste and sewage waste streams. Because several well known studies (U.S. General Accounting Office 1983; Bullard 1994) have focused on the South, we also examined results for waste streams in the South separately, following the list of Southern states used by Bullard (1994).

We selected 50 U.S. cities of more than 100,000 in population for our study by drawing a systematic sample from a list of all such cities, giving every city an equal probability of selection. We determined the census tract locations of the landfills, incinerators, and sewage treatment plants that received the cities' waste streams by a mail survey sent to their city planning departments, supplemented by telephone interviews. Several rounds of mail follow-up questionnaires and phone interviews yielded complete information for 49 of the 50 cities we initially selected for our sample. In phone interviews, a few planning departments could not immediately identify the facilities that their cities used. In these instances, we used telephone interviews with city public works departments to obtain addresses for the facilities and telephone interviews with the planning departments to obtain the census tract numbers. Planning departments were sometimes unable to provide census tract numbers for facilities outside their city's boundaries. We gathered this information through phone interviews with the planning departments that served the jurisdictions where the facilities were located.

Three waste streams terminated in tracts with no residents. These and two others that ended in tracts with fewer than 30 residents were eliminated from the analysis. We created three

"synthetic tracts" by combining information from adjacent tracts that contained a single waste disposal facility. Three facilities received waste from two different cities; because the waste stream was the unit of analysis and there were six distinct waste streams involved, we included all six. Eleven cities reported sending waste to both a landfill or incinerator and a sewage treatment plant in the same tract. We treated these as separate waste streams because the tracts involved were receiving two types of waste.³ There were eight cases in which cities piped sewage to two plants in the same tract and one in which one city used two landfills in the same tract. Because we were unable to measure the volume of waste streams and the facilities may have been smaller ones, we treated each of these situations as a single waste stream. These procedures resulted in a total of 152 waste streams for analysis, 69 for solid waste and 83 for sewage. Sixty-six were in Southern states.

We gathered information from the 1990 census about the demographic characteristics listed in Table 1 for both the cities that generated the waste streams and the tracts that received them. Census reports for two tracts contained some missing data, and two tracts had no owner-occupied housing, resulting in missing data for the median and mean values of owner-occupied housing.

We hypothesized that census tracts that received waste streams would contain higher percentages of African American, Hispanic, and Native American residents than the cities where the waste originated. We also examined the percentages of Asian and foreign-born residents, which have received little attention in previous research. Education is an important component of socioeconomic status and may provide resources to resist unwanted facilities; therefore, we hypothesized that the tracts that received waste would have higher percentages of less educated residents. To allow examination of possible effects of the percentages of residents at the extremes of education, we examined not only the percentages of city and tract residents who had not finished high school and who had college degrees, but also the percentages with less than a ninth grade education and with graduate degrees. We followed the same logic in testing the hypotheses that waste recipient tracts would be characterized by lower incomes and higher percentages of poverty than waste generating cities, tabulating several measures of each. Because home ownership is associated with socioeconomic status and may indicate greater neighborhood stability and political involvement, we also included the percentage of housing units that were owner-occupied. The median and mean values of owner-occupied units and median and mean rents were included both because they index socioeconomic status and because waste disposal facilities may adversely affect property values.

TABLE 1. Mean race, ethnic, and socioeconomic characteristics of waste stream generators and recipients, 1990

	All waste streams				Landfills/incinerator				Sewage treatments plants				All waste streams in South			
Charat eristics	Gene rator	Reci pient	<i>t</i>	<i>p</i>	Gene rator	Reci pient	<i>t</i>	<i>p</i>	Gene rator	Reci pient	<i>t</i>	<i>p</i>	Origi nator	Reci pient	<i>t</i>	<i>p</i>

	s	s			s	s			s	s			s	s		
% African American	20.5	15.4	3.17	.00	21.3	13.1	4.14	.00	19.8	17.3	1.04	.15	29.4	27.9	.48	.31
% Native American	0.7	1.9	-1.56	.06	0.7	3.2	-1.54	.06	0.7	0.8	-.55	.29	0.6	1.0	-1.95	0.3
% Asian ^a	2.6	2.4	0.61	.27	3.1	2.8	.53	.30	2.2	2.1	.33	.37	1.6	1.6	2.05	.02
% Hispanic	8.8	9.8	-0.98	.16	10.3	9.4	.63	.27	7.6	10.1	.04	4.3	4.9	-65	.26	
% foreign-born	7.3	6.7	1.64	.05	8.8	7.2	2.56	0.01	6.1	6.2	-.34	.37	4.8	4.2	1.26	.11
% < 9 years education	8.7	9.9	-1.63	.05	9.3	10.2	-.84	.20	8.3	9.6	-1.46	.07	8.6	10.0	-1.38	.09
% < high school graduate	23.1	25.9	-.214	.02	24.4	26.5	-1.20	.12	22.2	25.3	1.80	.04	24.0	27.7	-1.84	0.04
% with college degree	22.3	17.7	3.99	.00	22.1	17.8	2.47	.01	22.5	17.6	3.13	.00	22.1	17.7	2.28	.01
% with graduate degree	7.8	5.7	4.57	.00	7.8	6.1	2.30	0.01	7.8	5.3	4.18	.00	7.3	5.6	2.26	0.01
% households < \$5,000 income	7.1	7.2	-.23	.41	7.1	6.3	.99	.16	7.1	8.0	-.87	.19	8.1	10.3	-1.54	.06
% households < \$10,000 income	16.6	15.6	0.88	.19	16.8	15.1	.97	.17	16.5	16.0	.28	.39	17.3	20.0	-1.22	.11
% households > \$74,999 income	7.9	9.6	-1.93	.03	8.2	12.3	-2.54	.01	7.6	7.4	0.19	.43	7.6	8.3	-5.2	.30
% households > \$99,999 income	3.7	4.1	-.75	.23	3.8	5.4	-1.52	.07	3.6	3.0	1.04	.15	3.6	3.1	.56	.29

9 income																
Median househ old income (\$)	28,377	32,198	-3.69	.00	28,395	34,305	-3.32	.00	28,362	30,470	-1.80	0.04	27,118	28,144	-.64	.26
Mean househ old income (\$)	36,055	38,349	-1.68	0.05	36,240	41,473	-2.19	0.02	35,903	35,789	.08	.47	35,592	34,467	.50	.31
% familie s in poverty	11.6	11.0	.63	.27	12.0	9.8	1.54	0.06	11.4	12.0	-.40	.35	12.5	14.6	-1.10	.14
% persons in poverty	15.2	14.0	1.09	.14	15.7	13.0	1.67	.05	14.8	14.8	.01	.50	15.9	18.2	-1.15	.13
% persons < 50% poverty level	7.1	7.2	-0.3	.49	7.9	6.0	1.45	0.08	7.0	8.1	-.98	.16	7.9	10.4	-1.59	.06
% persons < 125% poverty level	19.8	18.5	1.04	.15	20.4	17.0	1.78	0.04	19.3	19.7	-.21	.42	20.7	23.1	-1.14	.13
% of housing units owner- occupie d	51.3	59.9	-4.31	.00	49.8	63.4	-4.47	.00	52.6	57.0	-1.75	.04	52.0	49.9	.71	.24
Median value of owner- occupie d units (\$)	90,400	98,403	-1.99	.02	97,473	114,160	-2.37	.01	84,861	86,064	-.27	.40	73,285	78,285	-.91	.18
Mean value of owner- occupie d units (\$)	107,783	107,384	.09	.46	114,919	123,702	-1.15	.13	102,194	94,605	1.42	.08	92,399	86,971	.84	.20
Median contrac t rent (\$)	337	390	-1.10	.14	391	410	-.97	.17	366	373	-.55	.29	343	340	.17	.43
Mean	390	402	-	.1	405	423	-	.1	379	385	-	.3	351	356	-	.3

contract rent (\$)			1.05	5			.94	8			.50	0			.27	9
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Note. Significance tests are one-tailed ^a includes Pacific Islanders.

RESULTS AND DISCUSSION

Table 1 reports the means for waste originators and recipients and the significance of the difference between them for each of our measures. The leftmost two columns of figures include both waste streams that terminate at landfills or incinerators and those bound for sewage treatment plants. Eleven of 24 differences are statistically significant, but seven are in the reverse of the predicted direction, including all the significant relationships for percentages of minority residents, income levels, and housing. The percentage of African Americans in the destination tracts is actually five percent lower than in the originating cities. Also unexpected is the fact that none of the tests for measures of poverty are significant. Surprisingly, the four associations for education are in the opposite direction from the significant relationships for income. All four of the former are in predicted direction and significant, although the differences are substantively modest.

The overall results apparently reflect primarily the differences between the characteristics of originators and recipients of solid waste streams, which appear in the second two columns. There are eleven significant relationships *for* landfills and incinerators, but nine are in the opposite direction from our hypotheses—including, again, all the differences for minority group membership, income, and housing, as well as two significant differences among the poverty measures. The percentage of Blacks in tracts containing landfills and incinerators is a striking 8% lower than the percentage in the cities that generate the waste. Once again, only the relationships for education are in the predicted direction.

The third two columns of Table 1 show significant differences between originators and recipients of sewage for only six variables, including two in the reverse of the expected direction. Hispanics are slightly more likely to live in tracts that receive waste than in the cities that generate it, but differences for other racial groups are not significant. Our hypothesis about differences in educational levels again receives some support, but the differences are once more substantively modest.

Finally, results in the rightmost two columns are incongruent with the hypothesis that environmental racism and classism are more pronounced in the South. The smaller n means that fewer of the differences that do exist are statistically significant, but there are few substantively noteworthy differences. The most important ones involve the tendency for residents of tracts that receive waste streams to be less educated than residents of the originating cities, replicating the pattern from the national data. African Americans are again slightly less well represented in destination tracts than in originating cities, but the difference is not statistically significant.

SUMMARY AND IMPLICATIONS

Our results provide little support for the hypotheses that cities direct their solid waste and sewage to landfills, incinerators, and sewage treatment plants in census tracts with higher proportions of minority and low-socioeconomic status residents than are found in the cities themselves. Solid waste recipient tract residents are actually more affluent and less apt to be minorities than the residents of the jurisdictions that generate the trash, and there are few differences between the affluence and minority status of originators and recipients of sewage. Waste stream recipients are, as we hypothesized, somewhat less educated than waste generators, but, standing alone, this result is not enough to support the general proposition that waste flows from more privileged populations to less privileged. It may imply, however, that well educated people have greater resources for avoiding receiving waste. These may include greater political involvement, more knowledge of impending threats, and better understanding of the political process.

Why, then, do our findings contrast so sharply with those of much previous research? One possibility is problems with the research itself. However, our sampling procedure and near-perfect response rate precluded sampling bias, and our respondents had both easy access to the information requested and the expertise to collect it. We talked by phone with respondents in almost half the cities and detected no hint of concerns about revealing environmental racism, and we guaranteed the cities' confidentiality. There has been some speculation that studies that use census tracts less often show associations between minority and socioeconomic status and environmental hazards than those that use larger units (Anderton 1994). However, there have not been enough studies to establish such a pattern clearly, and census tracts appear to be the more appropriate units (see above). It is also possible that the racial and class compositions of the recipient tracts were different at the times the landfills, incinerators, and sewage treatment plants were located there, though it is hard to imagine that more privileged citizens would seek out living quarters near these facilities, raising the status of the recipient tracts over time.

A second possibility is that decisions about the siting of solid waste landfills and incinerators and sewage treatment plants involve different dynamics than siting of some other environmentally undesirable facilities. In general, ordinary solid waste and sewage are disposed of near their point of origin, because it is uneconomical to transport them far. Therefore, almost all communities must find nearby sites, and disputes over facility location usually pit residents who oppose the facility against local government. This is quite a different situation from the one that prevails in the siting of radioactive or hazardous waste disposal facilities. There, federal or state government or powerful corporations face off against residents of a few locales, sometimes chosen in part specifically because their residents are expected to be unable to mount effective resistance. Although landfills, trash incinerators, and sewage treatment plants are rarely seen as the most desirable of neighbors, they are familiar nuisances, which clearly have to be somewhere in the area. They are therefore unlikely to stir up the kind of prohibitive resistance that prosperous, politically empowered neighborhoods are apt to mount against nuclear waste dumps or grossly polluting industries.

A third explanation is that the siting of landfills, incinerators, and sewage treatment plants used by cities is strongly influenced by variables that outweigh any tendency to locate such facilities in less privileged or minority neighborhoods. In the case of landfills, changing technology, tighter regulation, and growing reliance on large facilities with extensive land requirements may have led to the replacement of city dumps like those described in Bullard's (1983) Houston study—often located in poor and minority neighborhoods—with landfills in suburbs or exurban areas, which tend to be Whiter and more affluent than cities. The lower population density of such areas means that our findings do not necessarily imply that landfills are commonly sited immediately within affluent, White neighborhoods. However, the unpleasant side effects of landfills—odors, convergence of garbage trucks, and blowing refuse—are not limited to immediately adjacent land, and the findings provide no plausible support for the common image of the landfill sited in the midst of a poverty-stricken minority neighborhood. Sewage treatment plants, on the other hand, must be sited on the shores of rivers and lakes, which contain both affluent and poverty neighborhoods. Hence, there is no particular reason to expect these tracts to be Whiter or wealthier than the cities that their facilities serve. In both cases, factors unrelated to socioeconomic or minority status may simply be more decisive than race and ethnicity or socioeconomic factors.

It is possible that a much more elaborate study, with extensive controls for variables such as accessibility, land availability and prices, hydrology, soil type, and so forth, would reveal that—when all other things are equal—waste disposal sites do gravitate to poor and minority neighborhoods. Not only would such a study be so expensive as to test the limits of feasibility, it is unnecessary to test the environmental racism and classism hypotheses. As developed to date, the literature about environmental racism and classism has seen race, ethnicity, and class as powerful predictors that overwhelm other factors in siting decisions and are readily apparent in zero-order analysis. It has not viewed them as minor *factors* detectable only after the introduction of elaborate controls. In other words, the argument in the environmental racism literature has been that minorities and poor people are usually the big "losers" in siting decisions; it has not been that they would not be such big "winners" if only their race and class were considered.

A final possible explanation of our unexpected findings is differences in research design. Most previous studies compared the demographic composition of neighborhoods where citizens breathed polluted air, drank polluted water, or received undesirable waste with that of the general population or less polluted areas. Our research compared the demographic characteristics of waste-receiving areas with those of waste-producing areas.

Each approach has strengths and weaknesses. Operationalizing environmental racism or classism as the extent to which minority or lower socioeconomic status citizens are more burdened than others by pollution or waste has intuitive appeal. However, researchers who use this approach may find that whether their results reveal environmental racism or classism depends on the areas chosen for comparison. In the present study, for example, comparing census tracts containing the

landfills that handle urban waste with all tracts nationwide might well have simply replicated our conclusions; that is, these tracts may be among the Whiter and more privileged simply because many are located in suburbs or exurbs rather than central cities or rural areas. Comparing the tracts that host the facilities with other tracts where the facilities might otherwise "reasonably" have been located might have produced a different result, but it is all but impossible to construct a list of such tracts from existing data. A similar dilemma has appeared in studies of air pollution (Harrison 1975; Gelobter 1992). When research is limited to urban areas, the benefits of air pollution controls are greater for poor neighborhoods—because the urban poor are concentrated in central city neighborhoods with poor air quality. But when the research covers the entire nation, the association disappears, probably because the rural poor suffer little from air pollution.

The approach used in the present study taps more directly a different aspect of environmental racism or classism, the extent to which privileged majority group citizens dump their waste on less privileged or minority citizens. This approach also has intuitive appeal, and in this study it proved easy to apply and yielded interesting—albeit unanticipated—findings. However, it too is not without flaws. Our data do not tell us which city residents or corporations generate the most solid waste and sewage, and it is possible that the more affluent and powerful city residents are responsible for more than their share. However, there are no readily available data to provide this information, and pinpointing exactly who generates waste is a knotty problem (Zimmerman 1993). Who, for example, are the generators of industrial waste—factory owners, managers, workers, customers, or some combination?

Viewed more generally, our results suggest the need for more attention to the specific conditions under which environmental racism and classism are most likely to appear and how methodological decisions can influence research results. Specifically, we believe that progress will come most quickly if researchers consider (a) whether the social class and racial characteristics in areas considered most burdened with pollution are being compared with those of the general population, those of waste generators, or those in areas that are otherwise similar to the waste receiving areas; (b) whether education and income have the same relationship to the experience of pollution; (c) factors that might counterbalance any tendency toward geographic concentration of specific types of pollution or location of undesirable facilities in poor or minority neighborhoods; and (d) how changing technologies, economic conditions, and government regulations might lead to changes in neighborhoods where pollution is concentrated. Careful attention to questions such as these can help advance from the discussion from blanket use of phrases like "environmental racism" toward careful specification of the conditions under which such outcomes appear.

Notes

¹Only solid waste streams from regular municipal solid waste collection were included. Landfills or incinerators for construction debris and hazardous wastes were included only if they also received municipal solid waste.

²If a census tract that contains a waste disposal facility is located partly or entirely or within the city that generates the waste, its residents are both waste recipients and generators. In this situation, our procedure, which used the mean for all city residents—including those in the recipient tract—may have made the difference between the means for the generating city and recipient tract smaller than it would have been if the recipient tract were excluded. We chose to include means for these tracts in the generating cities because omitting them would clearly have misrepresented the demographic composition of the generating cities. Fortunately, there were only two waste streams for which the population of a destination census tract was more than 10% of the population of the city in which the waste originated.

³Our decision to include both solid waste and sewage waste streams when both flowed from the same city to the same destination tract meant that the same city-tract pair could be included twice in the combined analyses in Columns 1 and 4 of the table. Although this procedure could be criticized as double-counting some city-tract pairs, we concluded that the alternative—removal of some waste streams from the analysis—raised even more serious issues. In any event, when we removed one of each of the duplicate city-tract pairs from the combined analyses, the results differed only in fine detail from those reported here.

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