# Not So Much: A Policy Brief on Recent Research on Environmental Justice in the Phoenix Area

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## Introduction

The study of environmental justice (EJ) is about 40 years old; during its history it has been dogged by controversy. Though few would deny that, on average, in the United States racial and ethnic minority groups are more impacted by human-caused pollutants than are dominant-group Whites, controversy surrounds why this is so. Some have argued "the deliberate targeting of people of color communities for toxic waste facilities and the official sanctioning of a life-threatening presence of poisons and pollutants in people of color communities" (Chavas 1993, p. 4). Others have argued simple correlation due to other factors that are disproportionately attributes of minority communities. For example, if poor people are more likely to live near pollution-generating facilities and minorities are disproportionately poor, then apparent racial disparities could be caused by economic disparities rather than any type of racism (other than, perhaps, systemic). In this vein, many scholars have argued that the EJ literature is theoretically and methodologically flawed (see, e.g., Anderton et al. 1994, Bowman 1997, Hamilton 1995, Liu 2001). Additionally, some have questioned the applicability of many of the early studies, which focused on African Americans in the southern U.S., to other minority groups and parts of the country, particularly newer areas that lack the divisive history of the South.

This policy brief presents results from two EJ studies performed on the Phoenix area (Campbell, Peck & Tschudi 2006, and Sobotta, Campbell & Owens 2007). Campbell and Peck are professors in the School of Public Affairs, and Sobotta and Owens are Ph.D. graduates of the School. Tschudi is a GIS research analyst at ASU's Decision Center for a Desert City.

Phoenix is a newer, rapidly growing city in the Southwest, and the African-American population is quite low (less than 5 percent); other minority groups are more salient. Unfortunately, as described in the following paragraphs, evidence from these studies indicates that environmental injustice based on race and ethnicity exists in Phoenix.

## The Location of Airport Noise

One methodological problem for the environmental justice literature is the question of "which came first," the environmentally harmful facility, or minority population groups. Current co-location of pollution and particular groups tells us little about the process that led to this outcome. Economists in particular believe that both goods and "bads" (or disamenities) that exist within a neighborhood are incorporated into housing prices. Thus, people will sort into neighborhoods based on how much they like or dislike their various attributes and also based on their own incomes. Under this assumption, if pollution-generating facilities were placed randomly in residential areas, the outcome years later would no longer be random; yet, the resulting outcome would be due to freedom of choice and market forces, not deliberate targeting of any particular group.

For careful analysis of environmental justice, it is important to be able to track whether the environmental disamenity was imposed on existing groups, or whether the groups moved into the disamenity's ambit after its location. Airplane noise from a major, municipal, commercial-service airport in the Phoenix area is a good case for EJ analysis because the location of the noise footprint from commercial aviation is determined through specific policy decisions. Further, when new noise contours were chosen in 1992, the decision-makers were presented with 32 noise reduction options that included information on ethnic groups that would be impacted by these varied choices.

Some might be surprised to think of aviation noise as a pollutant; it might seem like an overly dramatic simile rather than a fact. But, excess noise is injurious to humans: "Research indicates aviation noise can cause a variety of harms, including (but not limited to) communication interference, sleep disturbance, elevated levels of blood pressure and cholesterol, immune system deficiency, lower birth weight and higher frequency of premature birth, and hearing damage including to unborn babies (Holland, 1997)" (Sobotta, Campbell & Owens 1997, p. 129). In recognition of various dangers caused by noise, the World Health Organization (WHO), the U.S. Environmental Protection Agency (EPA), and the Federal Aviation Administration (FAA) all have limits for human noise exposure. The EPA's and WHO's limits are stricter than the FAA's.

Using a combination of 1992 airport noise contour data, 1990 U.S. Census data, Geographic Information System (GIS) methods, and multivariate regression analysis, research compared the population groups located within the noise area officially considered unhealthy (by the FAA) to those that could have been chosen to bear the noise instead. The U.S. Census provides detailed data regarding populations, including information on education levels, income levels, race

and ethnicity (and much more). However, due to privacy concerns, information is available in an aggregated form. For this study, data at the U.S. Census Block Group (CBG) level are used. "Noise footprints are generated using the Integrated Noise Model (INM), a computer model accepted by the Federal government as the means to determine official noise exposure" (Sobotta, Campbell & Owens 1997, p. 140). GIS methods allow matching of data that are geographically located, as here. Using GIS allows matching noise-footprint data with Census population-characteristic data. Then, in order to sort out the effects of the factors that could cause the noise-location decision, multivariate statistical techniques (regression analysis) were used.

In his study of environmental racism, Hamilton (1995) argues the following:

> Race should not be statistically significant, once one has controlled for…[economic costs] and the propensity for residents in an area to engage in collective action. In this model, the higher the probability that individuals will express their opposition to a firm's siting through the political process, the higher the perceived costs of location and thus the lower the chances the facility will be sited there (Hamilton 1995, pp. 110-111).

Therefore, in order to understand the effects of race or ethnicity, it is important to take into account income factors, and also factors that affect the ability and likelihood of groups engaging in collective action to try to prevent the imposition of environmental harms upon them.

*"... In order to understand the effects of race or ethnicity [on environmental justice], it is important to take into account income factors, and also factors that affect the ability and likelihood of groups engaging in collective action to try to prevent the imposition of environmental harms upon them."*

In "Aviation Noise and Environmental Justice: The Barrio Barrier," the following variables were used to control for race and ethnicity: the percentage of households in the CBG that were headed by a non-White person, and the percentage of households that were headed by an Hispanic person (households headed by non-Hispanic Whites were the "omitted," or reference group). Variables to control for income and for collective action/political factors were the percentage of adults in the area who did not graduate from high school and the percent of adults who had a bachelor's degree or higher (the percent of those who were high schools graduates but had not completed a bachelor's degree served as the reference group); the percentage of households that had income at or below the poverty line and the percentage of households with incomes greater than or equal to $50,000; the percentage of heads of household that were single with children, and the percentage of the CBG population that was non-English speaking. If income is the determining factor, then CBGs with more poor households should be more likely to be impacted by the chosen 1992 aviation noise contours. If the ability and likelihood to engage in political action matter, then those who have not graduated from high school, those who are not English speaking, and those who are single heads-of-household with children should be more likely to be impacted by the aviation noise. The hypothesis behind including single heads of households with children is that they may have much less time to engage in collective action. If race and ethnicity do not matter, after controlling for the income and political-action variables, then the estimated effects of the non-White and Hispanic variables should be small and not statistically significant.

Using both those CBGs that overlapped the INM noise contours and the comparison CBGs that could have been chosen instead, the sample size was 401 CBGs, 27 of which received officially unhealthy levels of aviation noise. Because the dependent variable is limited (many zeros and a few non-zero values), ordinary least squares (OLS) regression analysis was not suitable. To check for robustness, both Tobit and logit regressions were performed. In both analyses, the percent of the CBG's heads of households that were Hispanic was by far the most important predictor of a CBG overlapping with the chosen 1992 aviation noise contours. The coefficients for the variables measuring Hispanic heads of households were much larger than any other in the analyses, and they were also statistically significant at $p<0.01$ (one-tailed). The percent of households in the CBG that were poor was the second most important predictor.

In a situation where the specific placement of a pollutant (aviation noise) was chosen from 32 different options, a situation for which we can be sure that the 1990 population was present before the 1992 contours were chosen, in a newer, fast-growing city of the Southwestern sunbelt, this study provides strong evidence of environmental injustice for those of Hispanic ethnicity.

For a more detailed presentation of this study, please see Sobotta, Campbell & Owens (2007).

## The Location of Toxic Release Inventory Facilities

In the case of aviation noise, a specific organization made a choice that resulted in environmental injustice for some specific residents. Some of the EJ literature looks at single polluting facilities, but others look at several different polluting facilities for which location decisions may be made by many different people. Common facilities of study are Transport Storage and Disposal Facilities (TSDFs) and Toxic

Release Inventory Facilities (TRIFs). TSDFs often handle hazardous waste. TRIFs are facilities (usually, though not only, businesses) that emit chemicals known by the U.S. EPA to be toxins in sufficient levels that they are required by Federal law to report these emissions. One recent study examines the factors associated with TRIFs' locations in Phoenix (Campbell, Peck & Tschudi, 2006).

As noted earlier, a common problem in any EJ research concerns the timing of disamenity location — be it noise, waste or pollution — and the timing of populations' moves. To overcome this analytic challenge, this study collected information on the years in which TRIFs moved into their current location. As a result, we know which came first and can align population characteristics before TRIF location with the subsequent action of a new TRIF location.

Also in response to prior studies' shortcomings, the analytic model is complete and cannot be charged with having omitted variable bias. That is, in one of the most comprehensive models of TRIF location behavior to date, this work examines the following factors that might contribute to a TRIF's location decision: discrimination, economic and legal/compensation costs, political and collective action. Specifically, the analysis considers the neighborhood characteristics (based on Census Block Group or Tract aggregates) and racial and ethnic composition, under the hypothesis that non-majority White groups are treated differently from the majority. Specific variables measure the percent of the population that is African American, Hispanic, Asian, and American Indian (with the percentage White being the omitted category). Next, as microeconomic theory implies, the costs of production must be considered; and here the analysis examines land value and use variables as well as potential law suit costs that would compensate those harmed by these facilities. Of course, places with higher population density, housing values and resident incomes suggest greater potential costs of location to TRIFs.

*"... Carefully controlling for factors that should affect standard firm economic costs, and carefully controlling for factors that should affect political costs...there is evidence that race or ethnicity increases the likelihood of TRIF location, then this provides strong evidence that environmental discrimination exists..."*

The primary political variable is that of the distance from a TRIF to its closest political boundary. This variable is included to test the hypothesis that by locating on a boundary between two cities rather than in the middle of a city, a strategic firm could disenfranchise roughly half of affected residents. Regarding collective action, the model controls for the proportion of the population that voted for president in the most recent election, the proportion of residences that are owned (as opposed to rented), the proportion of the adult population with a high school degree, and the proportion of the population with incomes under 150 percent of the federal poverty threshold. In addition, because the inability to speak the dominant language in an area is expected to decrease effective political action to stave off unwanted development in one's neighborhood, the analysis includes the percent of those in an area whose primary language is Spanish and who speak English poorly or not at all. Additional important political action variables concern age: because older adults are more likely to engage in political action and children do not vote, the model controls for the proportion of the population that is between ages 55 and 74 and also the proportion of the population that is less than 16. Next, because homogeneity increases the likelihood of successful collective action outcomes, the analysis includes squared terms of race, ethnicity and language variables. Doing so allows for the effect of variables to "flip," with their impact positive at some levels, but converting to negative at other levels.

In addition to the variables that allow testing for the effects of discrimination, economic and legal costs, and political and collective action, the model also controls for the presence of other TRIFs, under the assumption that if such a facility is already located somewhere, then that location is suitable in unmeasurable ways as well. Finally, because the units of analysis are CBGs in 1990 and 2000 but tracts in 1980, the model also includes a dummy variable for 1980 to account for any unmeasured noise associated with having different units.

As with the study of aviation noise, this analysis use a Tobit specification because of the large number of observations that have no TRIF locating there, and after which the dependent measure is ratio. That is, the mean value of the dependent measure — the number of TRIFs per km2 — is 0.012, and just 95 of the 4,184 observations report having a least one new TRIF. An alternate analysis examined the number of TRIFs (rather than the number of TRIFs per km2) using a Poisson estimation to test for robustness, and the findings were essentially the same.

It is clear that the model is not spare. Its very comprehensiveness, combined with its clear matching of *existing* residents to *new* disamenity locations, makes it a strong test of the hypothesis of environmental discrimination. If, carefully controlling for factors that should affect standard firm economic costs, and carefully controlling for factors that should affect political costs — and within a setting where we can carefully match location decisions to the population at the time of location — there is evidence that race or ethnicity increases the likelihood of TRIF location, then this provides strong evidence that environmental discrimination exists, at least sometimes.

The original study reports on all of the hypotheses tested, but here we report just on the most striking finding, which relates to the effects of race and ethnicity on TRIF

locations. Having carefully controlled for many factors that are correlated with race and ethnicity — including income levels, population densities, and education levels — the analysis finds important evidence of environmental discrimination. The coefficients are positive — as one would expect in the case of discrimination — for the percent of the population that is Hispanic, American Indian and Asian; and the coefficient for the percent of the population that is Asian is statistically significant, offering confidence in the magnitude of its coefficient estimate. Further, the percent Asian is estimated to have the largest effect of any variable in the model (except for the number of existing TRIFs and the 1980 dummy). A ten-percentage-point increase in the Asian population results in more than four-fold increase in the predicted probability that a new TRIF will locate in a Census unit.

## Conclusions

In spite of decades of EJ research, many still question the extent to which environmental disamenities are disproportionately co-located with racial and ethnic minorities even after taking into account other factors. Many of the reasons for continued uncertainty boil down to methodological criticisms of earlier research (Anderton et al., 1994; Bowman, 1997; Hamilton, 1995; Liu, 2001). The two studies reported on here pay careful attention to methodology and provide two different, yet appropriate, approaches for overcoming such criticism. In the case of noise pollution, having comparison tracts that could have been — but were not — subject to aviation footprint policy change allows researchers to estimate the effect of race and ethnicity, as well as other important, variables. In the case of TRIF's location decisions, researchers introduce cross-time analysis that allows sorting out which came first.

With these methodological problems overcome, both studies find evidence of discrimination, even after controlling for other factors that matter. Aviation noise in Phoenix appears to have disproportionately targeted Hispanic neighborhoods, and TRIFs appear to disproportionately locate in neighborhoods of greater Asian density. The mechanisms through which these outcomes arose are not clear, but the implications are: particular minority populations have been disadvantaged in the processes by which disamenities are located, and this is unjust. Different people may discriminate against different groups; different organizations, industries, and cities will have their own cultures. Therefore, demonstrating environmental discrimination in one industry or setting indicates that it exists. Showing no evidence of environmental discrimination in another industry or setting may show that it does not exist there, but does not necessarily invalidate other findings. At the very least these findings imply the need for ongoing research and careful attention in future policy processes that distribute disamenities across society.

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