ANALYSIS OF DRAFT CALENVIROSCREEN 2.0 SCORES AND RACE/ETHNICITY

The CalEnviroScreen 2.0 scores represent a combined measure of pollution and the potential vulnerability of a population to the effects of pollution. Unlike CalEnviroScreen 1.0, Version 2.0 scores do not include a measure of race/ethnicity in the calculation of the CalEnviroScreen score. The removal of race/ethnicity from the score does not minimize the importance of examining this issue in the context of environmental impacts and vulnerability. This section presents some of the scientific evidence related to the vulnerability to pollution of some racial/ethnic groups, and provides an analysis of the relationship between CalEnviroScreen scores and race/ethnicity.

Scientific research indicates that the relationship between pollutant exposure, stress, and health outcomes can vary based on the race and ethnicity of a population. For example, studies have shown that maternal exposure to particulate pollution results in a greater reduction in infant birth weight among African American mothers than white mothers (Bell *et al.*, 2007). Another study found that African American mothers of low socioeconomic status exposed to traffic-related air pollution had twice the likelihood of delivering a preterm infant compared to White mothers of low socioeconomic status (Ponce *et al.*, 2005). A study of traffic exposure and spontaneous abortion also found a greater effect for African American women than other racial and ethnic groups (Green *et al.*, 2009).

For children, a study of the effects of nitrogen dioxide (NO_2) on children without health insurance in Phoenix found that Hispanic/Latino children had twice the risk of hospitalization for asthma from NO_2 exposure as white children. African American children showed about twice the risk of asthma hospitalization from NO_2 exposure as Hispanic/Latino children, regardless of insurance status (Grineski *et al.*, 2010).

Differences have also been observed for the effect of PM2.5 exposure on emergency department visits for asthma among patients of different races. The effect was found to be significant and greater in African American populations compared to whites for the first three days following exposure (Glad *et al.*, 2012). Additionally, higher mortality has been observed among African American populations exposed to ozone than other populations exposed to the same levels (Medina-Ramon and Schwartz, 2008).

In Native American children, rates of being overweight and obese are higher than among non-native populations, potentially due in part to psychosocial stressors, lack of access to healthful food, and exposure to environmental obesogens (Schell and Gallo, 2012). Native Americans have lower life expectancy and higher rates of certain chronic diseases than the U.S. population as a whole.

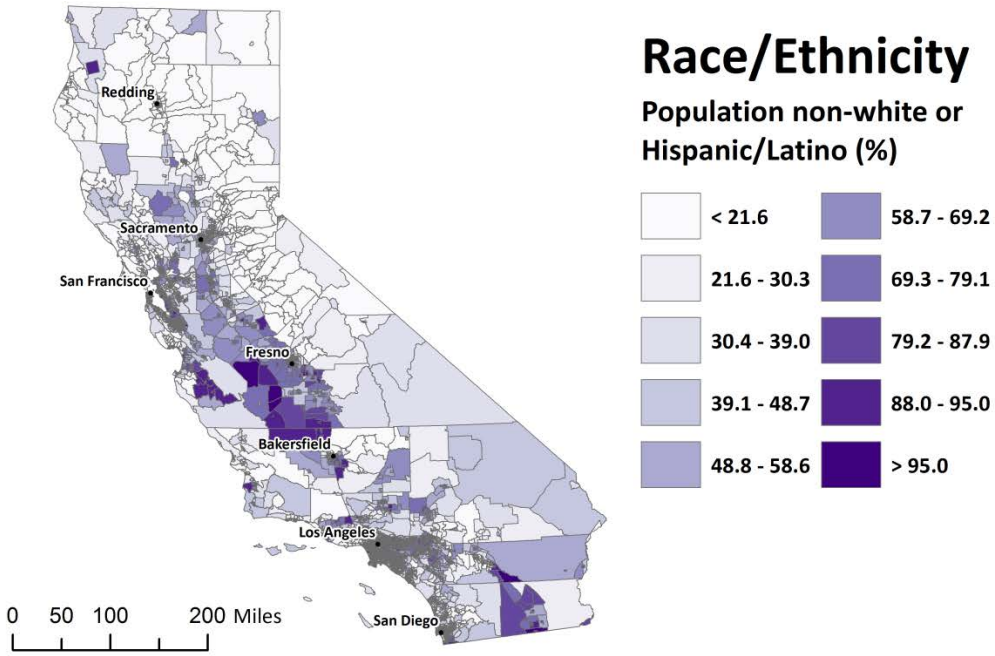
The mechanisms by which differences in race or ethnicity may lead to differences in health status and response to pollutants are complex and are not well understood. Some studies have explored the relationship between the experience of racism as a form of chronic stress and human health (Paradies, 2006; Kwate *et al.*, 2003), while others have looked at racial discrimination as an aspect of socioeconomic disadvantage, along with residential crowding, noise, poor housing quality, reduced access to health care, and exposure to violence (Evans and Marcynyszyn, 2004; Geronimus, 1996; Mertz and Grumbach, 2001, Williams and Williams-Morris, 2000; Clark *et al.*, 1999). A study of the effect of blood lead level on blood pressure found that there are significant racial and ethnic disparities, with the strongest association occurring in African Americans with symptoms of depression (Hicken *et al.*, 2013). The authors suggest that this finding presents evidence for the role that social stressors play in determining vulnerability to the health impacts of environmental exposures.

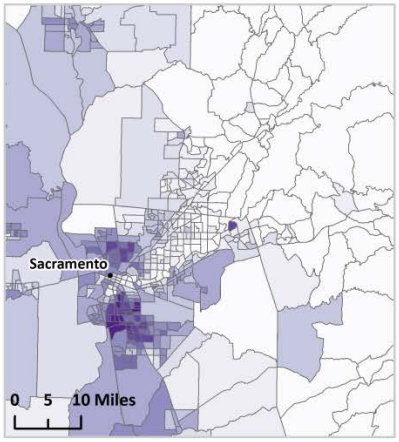
We evaluated potential associations between race/ethnicity and CalEnviroScreen 2.0 scores using data from the 2010 decennial census. The U.S. Census Bureau questionnaire asks all census respondents to identify if they are of Hispanic, Latino or Spanish origin, and in a separate question, asks their race. Datasets describing the number of individuals in different race and ethnicity categories are made available for California at different geographic scales on the American FactFinder website (http://factfinder2.census.gov/). Differences in racial and ethnic composition across California can be estimated using these data.

Our analysis examined race/ethnicity using the following steps:

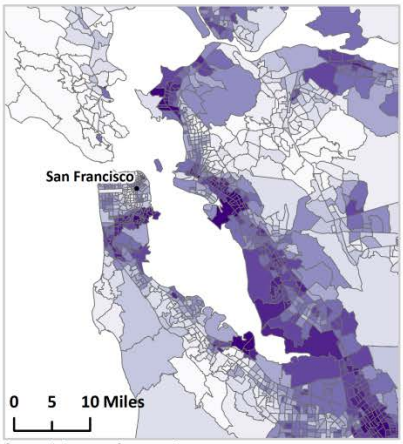
- A dataset containing the number of people by race/ethnicity was downloaded by census tract for the state.
- The population was categorized into six groups based on respondents' self-identified ethnicity and race as follows: Hispanic/Latino (of any race) or non-Hispanic and white; Asian, Native Hawaiian or Pacific Islander; African American; American Indian or Alaska Native; or other races, including multiple races.
- The non-white percentage of the population in each census tract was defined as the total number of people identifying as non-white or Hispanic/Latino divided by the total population.

The map shows the statewide distribution of California's non-White population (including Hispanics of any race).





Sacramento Area



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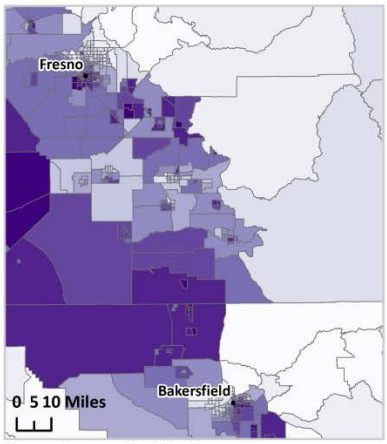
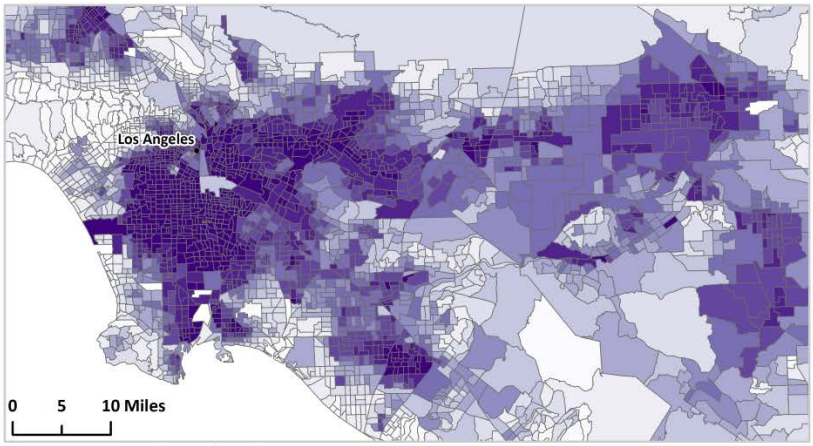
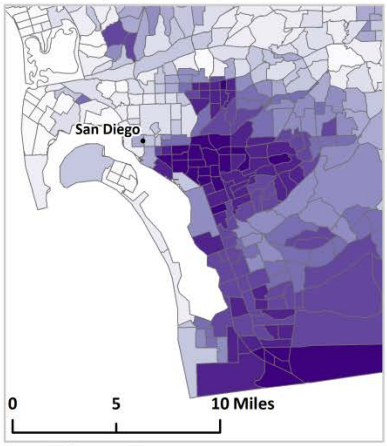


San Joaquin Valley

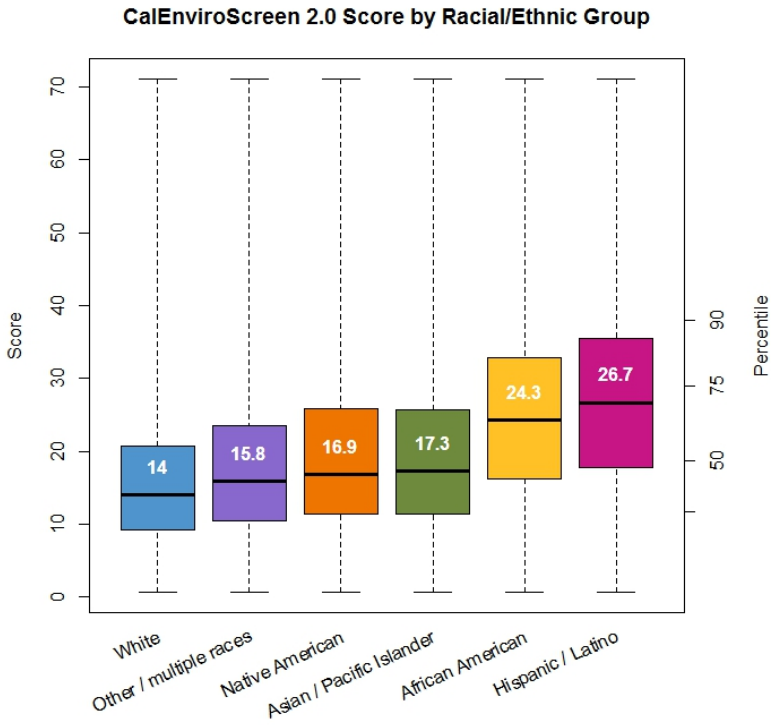


Greater Los Angeles Area



San Diego Area

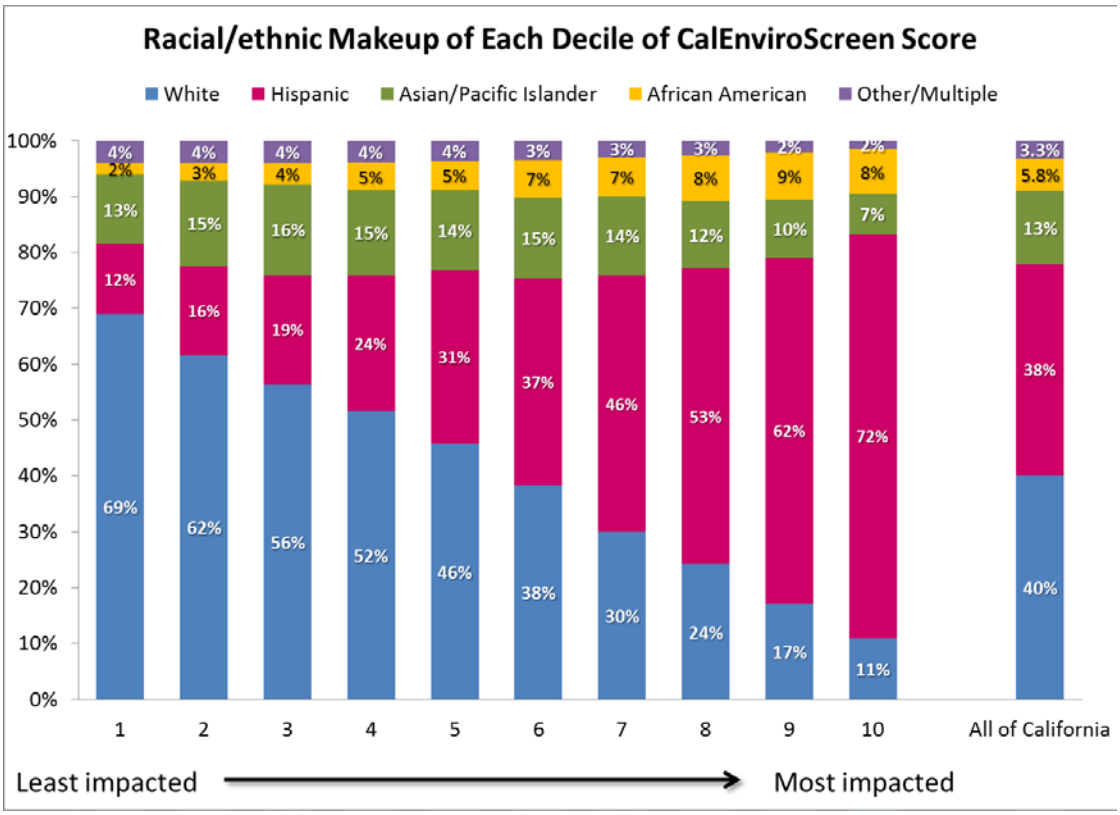
The chart to the right shows the range of CalEnviroScreen 2.0 scores experienced by Californians of different races and ethnicities. The dark horizontal lines in each box and the numbers above them indicate the median (average) CalEnviroScreen score for each group. The shaded boxes correspond to the "Interquartile Range" (IQR), or the range of values between the 25th to 75th percentile. The dashed vertical lines coming off each box show the most extreme values experienced by the groups.



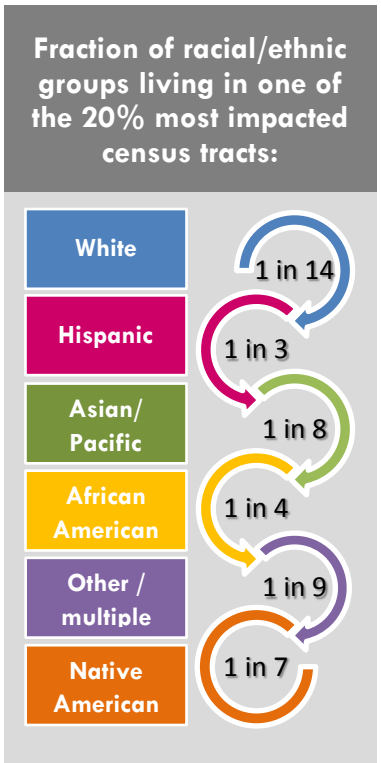
The dashed vertical lines show that all racial/ethnic groups have some members living in communities with the lowest and highest CalEnviroScreen score. However, the chart also shows that the average score is lowest for whites and much higher for African Americans and Hispanics/Latinos than other groups.

The chart on the following page further examines how communities grouped by their CalEnviroScreen score vary demographically. Census tracts across the state were divided into ten categories (deciles) with equal numbers of census tracts in each group. The left-most vertical bar shows the race/ethnic makeup of the least impacted census tracts (1-10th percentile of CES score), while the one next to it shows the makeup of the second-least impacted group of census tracts (11-20th percentile), and so on. The overall demographic makeup of the California population is shown in the last vertical bar on the right side of the chart.

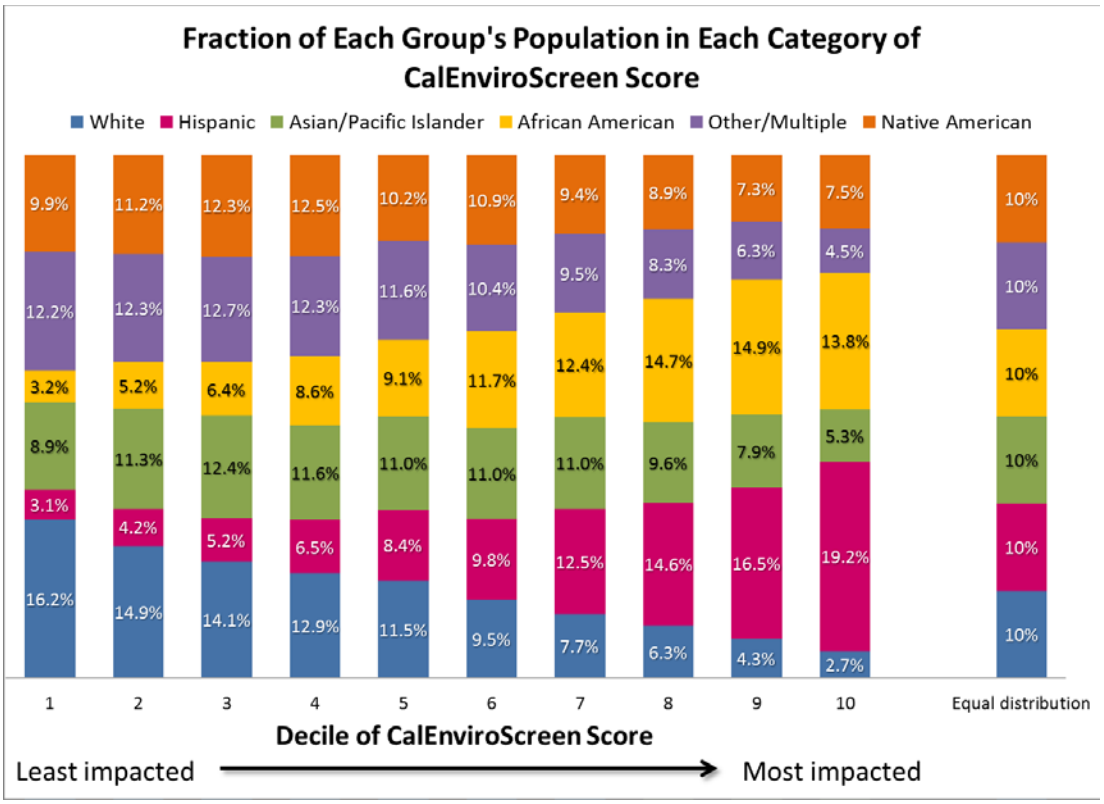
If impacts were distributed equally across the California population, the proportion of each racial/ethnic group in each decile would be equal to its overall proportion in the California population. That is, an even distribution of pollution burden and population vulnerability across racial and ethnic groups would mean that all the bars would resemble the right-most bar in the chart. However it is clear from the chart that this is not the case. Instead, Hispanic/Latinos and African Americans disproportionately reside in highly impacted communities while other groups tend to reside disproportionately in less impacted communities. Whites are over-represented in the least burdened communities.



Another way to look at this question is to consider the proportion of each race/ethnic group's population that resides in each category of impact. For example, what fraction of Calfornia's Hispanic/Latino residents live in the most highly impacted communities? As the illustration shows, the fraction of different racial/ethnic groups living in one of the 20 percent most impacted communities are lowest for white Californians, and highest for Hispanic/Latino Californians, closely followed by African American Californians. (These fractions are calculated by dividing the population living in the most impacted 20 percent by the total population of that group.)



Were pollution burden and population vulnerability evenly distributed across the state, 10 percent of each racial/ethnic group's population would live in each decile of CES score. The chart below instead shows that a larger fraction of California's Hispanic/Latino and African American residents live in the more impacted communities. Over 19 percent of the state's Hispanic/Latino population resides in one of the 10% most



burdened communities, while fewer than 3 percent of the state's white population live in those communities.

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