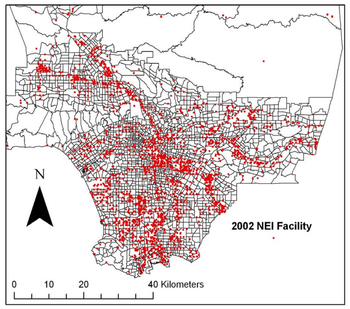
The Distributions of Various Socio-economic Demographic Variables and NEI Emissions Facilities in Los Angeles County

Geographic Distribution of 2002 NEI Facilities
Los Angeles County



It is important to analyze the geographic distribution of polluting facilities and their emissions to look for areas or neighborhoods that may more heavily experience the negative impacts associated with polluting centers, particularly those that release air pollutants that diffuse into the surrounding atmosphere. Based on previous findings (Ponce et al.) and personal observation, I hypothesized that the aforementioned neighborhoods would exhibit indicators of lower socio-economic conditions than those neighborhood less affected by polluting sources. In this study, I compare the spatial distribution of NEI facilities and their emissions with the distribution of key socio-demographic variables in Los Angeles County, CA.

Methods:

- First, I performed a spatial join to geographically associate the NEI data with the census tract data
- I then mapped the census data based on census tracts
- I then created density surface layers for NEI facilities and NEI Emissions (CAPS + HAPS) using the Spatial Analyst Tool
- I overlaid the density surface maps with underlying census demographic maps and visually assessed any correlation
- I then used the Zonal Statistics function to calculate the mean NEI facility and emissions densities per census tract (CT) and subsequently joined the output table to the census tract dataset
- To quantitatively assess correlation, I created scatter plots for socio-demographic variables versus mean facility and emissions density per CT and performed a correlation analysis to find any correlation between the two variables

Results:

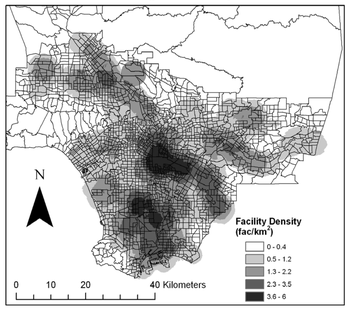
Based on visual assessment of the density surfaces overlaid on the underlying census maps, I observed a positive relationship between mean facility density and population density, poverty level, Hispanic/Latino population, foreign born population and the non-English speaking population. Oppositely, I saw a negative relationship between mean facility density and home value, income level and educational attainment. All of these observations were confirmed by the correlation analysis, with educational attainment, Hispanic/Latino population and non-English speaking population showing the strongest relationships. There was no correlation observed between these same socio-demographic variables and mean emissions density. Thus, the results indicate that census tracts with lower socio-economic conditions are associated with higher emissions facility densities than their better-off counter parts. It is critical to note that facility density serves only as a primitive proxy for ambient air quality conditions, as is seen by the fact that the emissions density surface does not directly parallel the facility density surface, due to that fact that facilities produce varying amounts of pollutants. In addition, the analysis fails to account for wind patterns that alter the atmospheric distribution of released emissions. The predominate west-to-east wind pattern would skew the emissions distribution in a easterly direction. Most critically, the only emissions data layer employed - for simplicity purposes - was a stationary–point data layer of facilities*. Thus, the analysis does not include data from non-NEI registered facilities, non-point stationary sources such as home air-conditioners and mobile sources (both on-road, namely automobile emissions and off-road emissions, generated by lawn mowers for example). These emissions sources constitute a large proportion of the total ambient emissions. To conclude, although correlation patterns were observed for nearly all of the variables, the visual and correlation analysis fail to comment on cause-and-effect, highlighting the importance of historical data when assessing cases of environmental injustice.

*~5% of the NEI facilities in the database were not correctly geo-coded and as such were not included in the analysis.

Socio-economic Demographic Variables As Defined In the 2000 US Census

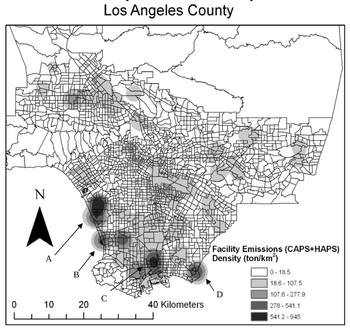
Variable	Description
Population Density	People per square mile of land area
Home Value	Specified owners; median home value 1999 ($)
Income Level	Per capita income in 1999 ($)
Poverty	Income in 1999 below poverty level; % pop for whom poverty status determined; all ages
Educational Attainment	Population 25 years and older; percent with bachelor's degree or higher
Hispanic/Latino Population	Percent of total pop; Hispanic or Latino (of any race)
Non-English Speaking Population	Population 5 years and older – percent who speak a language other than English at home

2002 NEI Facility Density Surface
Los Angeles County



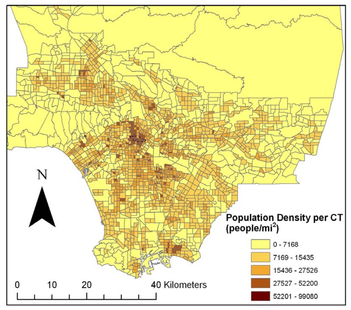
The NEI facility density surface shows three "epicenters" - where facilities appear to be concentrated. One is located in northern LA county, while the other two — a central epicenter located near East LA and a southern center — both of which are located inland. You can also see "facility corridors" that stretch westward and northward.

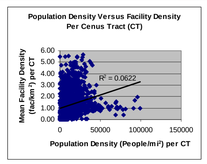
2002 NEI Facility Emissions Density Surface
Los Angeles County



The total emissions (as defined by the aggregate of criteria air pollutants (CAPS) and hazardous air pollutants (HAPS)) density surface reveals four epicenters. These epicenters pertain to distinct source areas, for example epicenter A is situated at LAX, while epicenter C is the site of a refinery complex. Epicenters B and D are located in areas of high socio-economic conditions (SEC), while B is located in an area of lower SEC.

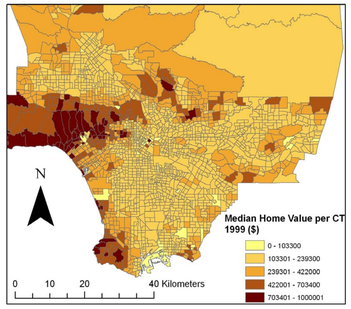
Population Density per Census Tract (CT)
2000 Census - Los Angeles County

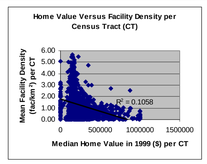




The population density appears to be concentrated near downtown and near areas with high facility densities. While the correlation coefficient is positive, it does not show a strong relationship. In fact, the facilities appear to be located in CTs with low population densities, but the positive relationship may be the results of surrounding CTs with higher population densities.

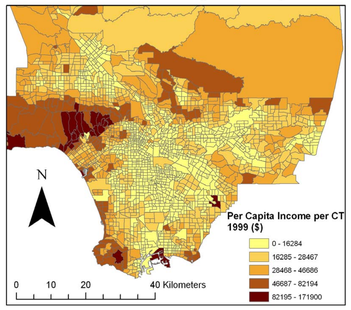
Home Value per Census Tract (CT)
2000 Census - Los Angeles County

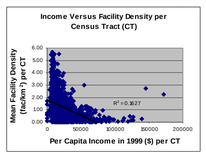




Home values are generally higher in coastal areas. Home value shows a negative relationship (r = -0.3252) with mean facility density.

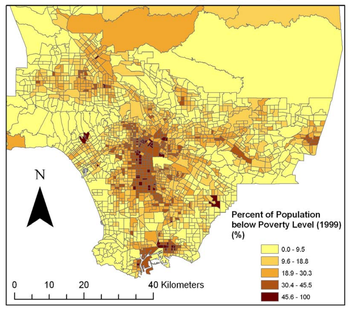
Income Level per Census Tract (CT)
2000 Census - Los Angeles County

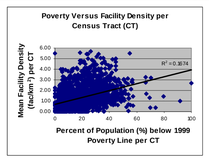




CTs with higher income levels tend to parallel CTs with higher home values. Income showed a negative relationship (r = -0.40339) with mean facility density.

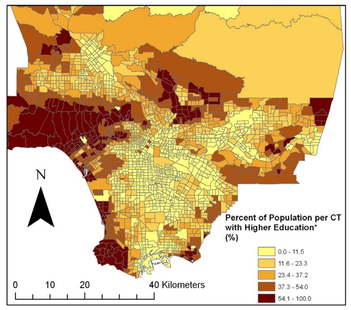
Poverty per Census Tract (CT)
2000 Census - Los Angeles County

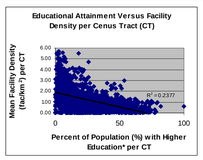




CTs with high poverty are concentrated near downtown and the port of LA . Poverty showed a positive relationship (r = 0.409087) with mean facility density.

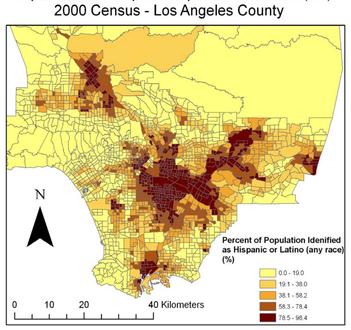
Educational Attainment per Census Tract (CT)
2000 Census - Los Angeles County

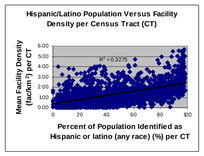




Educational Attainment showed a strong negative relationship (r = -0.4875) with mean facility density.

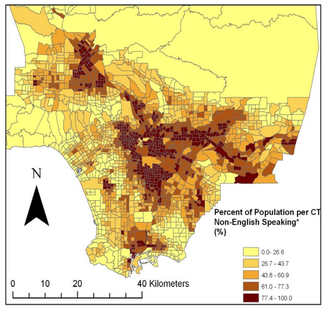
Hispanic/Latino Population per Census Tract (CT)
2000 Census - Los Angeles County

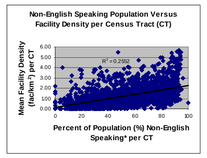




The Hispanic/Latino Community is concentrated near downtown and East LA, as well as near the port of LA. Hispanic/Latino population showed a strong positive relationship (r = 0.572294) with mean facility density.

Non-English Speaking Population per Census Tract (CT)
2000 Census - Los Angeles County





The non-English speaking population — distributed throughout the inland LA basin and near the port of LA— showed a strong positive relationship (r = 0.505157) with mean facility density.

Correlation Statistics for Various Socio-demographic Variables and Facility Density Surface per Census Tract (CT)

Socio-demographic Variable	Correlation coefficient (r)	Coefficient of determination (r^2)
Population Density	0.249469	0.062235
Home Value	-0.3252	0.105755
Income Level	-0.40339	0.162726
Poverty Level	0.409087	0.167353
Educational Attainment	-0.4875	0.237659
Hispanic/Latino Population	0.572294	0.327521
Foreign Born Population	0.386965	0.149742
Non-English Speaking Population	0.505157	0.255183

The correlation coefficient (r) indicates directionality and in general, values closer to either –1 or 1 indicate a stronger correlation or linear relationship while those near zero indicate less correlation. The coefficient of determination (r^2) relates how much of the variation in variable x (in this case, a given socio-economic demographic variable) explains the variation in variable y (in this case, mean facility density per CT). It appears that all of analyzed socio-economic demographic variables are related to mean facility density per CT.

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Data Sources: 2002 NEI database (EPA); 2000 US Census (US Census Bureau)
Date: 05/04/09

Citation: Ponce N. et al. (2005). Preterm birth: the interaction of traffic-related air pollution with economic hardship in Los Angeles neighborhoods. American Journal of Epidemiology: vol. 162, no.2; p. 140-148.

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