M E M O R A N D U M

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From: Jeffrey Roth
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The State of Air Pollution in Los Angeles

Southern California has a long history dealing with pollution generated by vehicle emissions. On any given day, one can look at the city from a distance and see a dense layer of smog, ruining some of the most spectacular views of a rising city against the majestic San Gabriel Mountains. According to a study conducted by the American Lung Association, over the course of three years from 2014 to 2016, Los Angeles had 112 days that were considered unhealthy, or days when ozone and particulate matter exceeded federal safety levels.[1] Common examples of outdoor air pollution are fine particles caused by the burning of fossil fuels, noxious gases, and ozone.[2] In addition to ruining the views of the mountains, air pollution is much more nefarious, it is the world's leading cause of death.

Air pollution can cause significant harm to people, especially youth and elderly populations. According to the Environmental Defense Fund, air pollution is the cause of approximately 1 in 9 deaths per year.[3] In addition to fatal consequences, prolonged exposure to air pollution can lead to respiratory diseases like asthma, cardiovascular diseases, and even issues with pregnancy.[4]

In order to combat air pollution, California has implemented many different measures. The California Air Resources Control Board was created in 1967 to address air pollution in the state. The CARB is responsible for defining air quality standards and setting standards for emissions. Some key examples of CARB emission standards are the tailpipe emissions standards set in 1966, 1971, and 1982, requiring automobile manufacturers to increase the number of zero emission vehicles produced, and more recently the California Advanced Clean Cars Program of 2012.

However, despite this work, Los Angeles still struggles to deal with air quality issues. Air pollution caused by vehicles can enter into nearby homes, exposing inhabitants to the toxic pollution. Home air filtration systems can capture some of the particulate matter, but even the

[1] Scauzillo, Steve. 2018. Southern California still has some of the worst air pollution in the country, report finds. *Los Angeles Daily News.* Retrieved from https://www.dailynews.com/2018/04/18/southern-california-has-some-of-the-worst-air-pollution-in-the-country-report-finds/
[2] NIH. 2018. Air Pollution. Retrieved from https://www.niehs.nih.gov/health/topics/agents/air-pollution/index.cfm
[3] EDF. 2018. Health Impacts of Air Pollution. Retrieved from https://www.edf.org/health/health-impacts-air-pollution
[4] NIH. 2018. Air Pollution. Retrieved from https://www.niehs.nih.gov/health/topics/agents/air-pollution/index.cfm

highest efficiency air filters allow some to pass through, and do not filter any exhaust gases.[5] Los Angeles now requires that new homes near freeways maintain high efficiency air filters, but many living near freeways are not in new developments. It is especially important that air quality issues are addressed in the context of wealth and poverty because of the financial burden frequent changing of air filters can impose. In order to have maximum protection, air filters must be replaced as many as four times per year and can cost up to $90 each.[6] Without the financial resources or even knowledge about the issues, poor communities are most likely be the most vulnerable to health impacts of air pollution.

As shown in figure 1 below, large concentrations of households below, at, or near the poverty line of $24,000 for a household, live near major freeways, a significant source of local air pollution. Figure 2 shows the concentration of PM2.5, or Particulate Matter 2.5, for Los Angeles. PM2.5 are particulates in the air that are smaller than 2.5 micrometers in diameter. They can come from many sources, but most commonly from vehicles. [7] When inhaled, these particulates can cause serious harm from damaging the heart and lungs, to exacerbating existing respiratory diseases.[8] The US EPA has set new standards for acceptable concentrations of PM2.5 in the air at 12 $\mu g/m^3$.[9] Figure 2 shows that most of Los Angeles exceeds the acceptable concentration, with the city center being in the worst shape.

[5] Barboza, Tony. 2017. L.A. requires air filters to protect residents near freeways. Are they doing the job?. *Los Angeles Times*. Retrieved from http://www.latimes.com/local/lanow/la-me-ln-freeway-pollution-filters-20170709-story.html

[6] Ibid.

[7] Rodriquez, Matthew and Lauren Zeise. 2017. CalEnviroScreen 3.0. *CalEPA and OEHHA.* Retrieved from https://oehha.ca.gov/media/downloads/calenviroscreen/report/ces3report.pdf

[8] Ibid.

[9] Ibid.

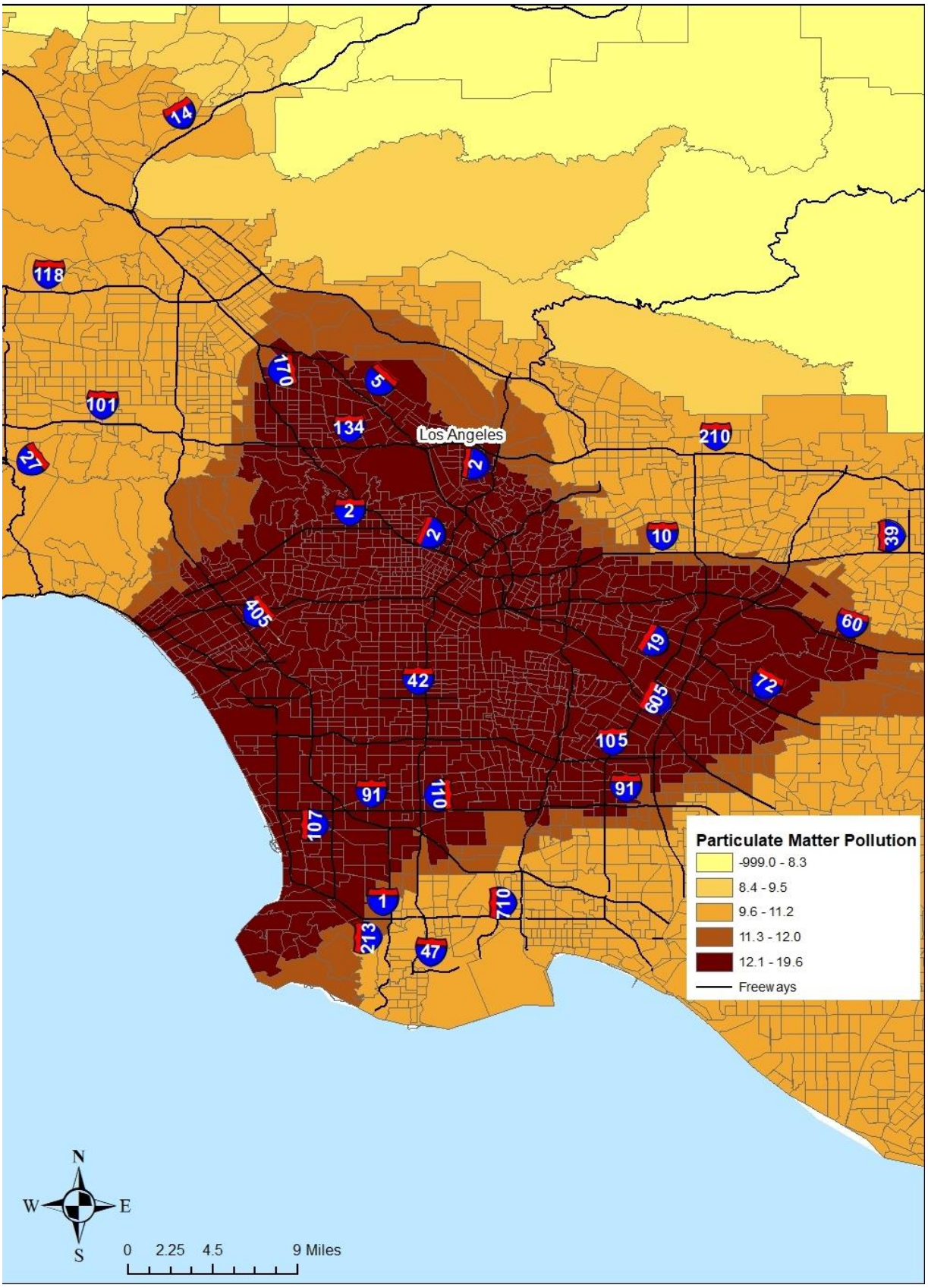

Figure 1: Particulate Matter 2.5 concentration in Los Angeles

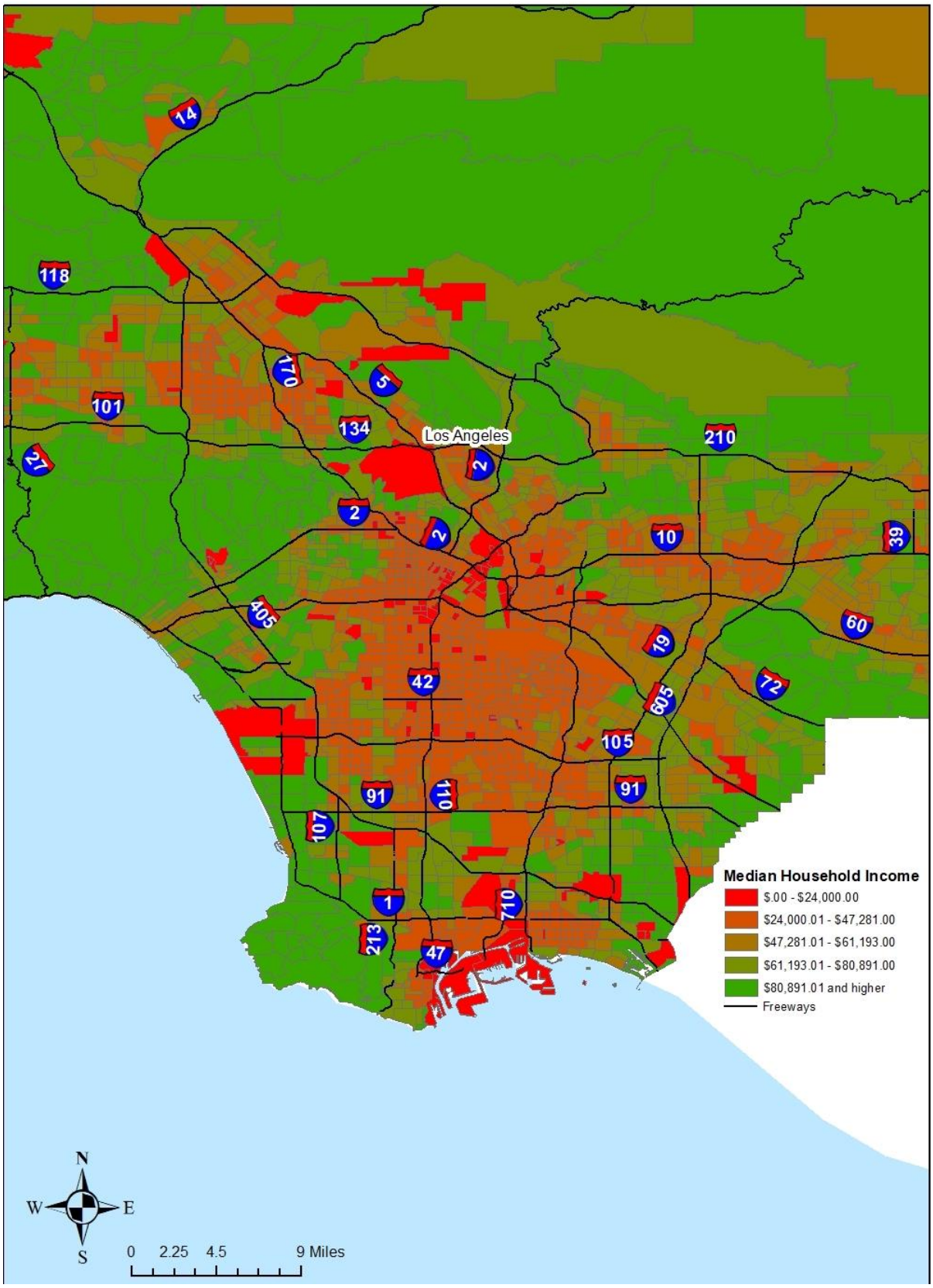

Figure 2: Median Household Income by Census Tract in Los Angeles

Data

To create the base map layers, I used data from the Los Angeles County GIS Data Portal and the Census. Using the Census for the geographic boundary of Los Angeles County as a starting point, I added census tracts and the LA County GIS Data Portal's Master Plan of Highways to create the general layout.

Also, for this GIS analysis, I used census data from American FactFinder and air pollution data from the Los Angeles GIS Data Portal. The census data I used was the 2016 Median Household Income in the Past 12 Months data from table S1903. This table breaks down the median household income by census tract, race, and other demographic features. For this project, I used the total estimate for annual median household income for each census tract. Figure 1 shows median household income for all of Los Angeles County.

Air Pollution data was downloaded as a shapefile from the CalEnviroScreen, a tool used to monitor the environmental health of communities. CalEnviroScreen is a collaboration of data from the Office of Environmental Health Hazard Assessment (OEHHA) and the California Environmental Protection Agency (CalEPA). Through the Los Angeles GIS Data Portal, I was able to download shapefiles of CalEnviroScreen's PM2.5 air quality data for Los Angeles.

Methodology

After downloading the census data on median household income as an excel sheet, the file was processed and cleaned using Microsoft Excel to be inputted into GIS. Once the table could be imported to GIS, the table was joined with the census tracts shapefile layer. Next, I set the classification of median household to quantile, and revised the threshold so that showed census tracts where the median household income was at the poverty line of $24,000 or less. CalEnviroScreen's GIS data was already processed as a shapefile based on census tracts, so no additional joining steps were necessary. Using quantile as the base classification, I adjusted the last break to reflect the safe concentration threshold per the EPA.

Discussion

Poverty and environmental issues have shown to coincide more often than not. Oftentimes, the poorest communities face the harshest environmental conditions caused by various forms of environmental pollution or climate change impacts. This is what motivated me to look particularly at household income as a measure of poverty so that I could better understand where there are significant communities in poverty. However, in the case of air quality, the geographic impact is much broader and distributed throughout the area so that everyone in that area is affected to some extent. This is confirmed as shown in figure two, the concentration of PM 2.5 exceeds the acceptable concentration set by the EPA throughout a significant geographic range of Los Angeles county. However, poverty and air quality is still a critical nexus to examine because of the implications of how we can protect ourselves from breathing polluted air. The most significant step we can take to protect ourselves is to ensure the air in our homes is properly filtered. This requires the use of costly premium air filters that must be replaced many times throughout a year.

Recommendation

The first step that should be taken to address air quality concerns, particularly for people living near freeways, is to implement an educational campaign. Educational campaigns have proven to be successful at raising awareness of particular issues. For example, the "Save Our Water" program had many different ways to reach out to people throughout the state to help identify ways to change habits and brought a focus to water conservation.[10] Using that as an example, Los Angeles should implement an educational campaign focused on brining awareness to the issue of living near freeways, and the importance of using the right filters, and changing them frequently. Educational campaigns serve as a great first step to bringing awareness around the issue because it will ensure that everyone, regardless of poverty status, is aware of the consequences of air pollution and can make the necessary adjustments within their own financial capacity.

In addition to the educational campaign, the state of California should offer a subsidy program for people living in the areas defined in figure 1 with median household incomes at or below the poverty line. People living in dire financial situations are not going to worry about buying and replacing air filters, instead whether or not they have the means to put a hot meal on the table for their family. While some may have chosen to live by the freeway for one reason or another, their economic circumstance may not have given them much choice, as often times homes near freeways are less expensive. In order to fund this subsidy program, the state could either raise fuel taxes more or allocate a portion of existing fuel taxes to cover the expense. By offering a subsidy on air filters, it will help household with less financial means to ensure they can properly protect themselves from poor air quality, and also emphasize the state's commitment to environmental justice.

Limitations

PM 2.5 has a very broad and concentrated impact in Los Angeles as a whole. When starting this project, I was hoping to isolate smaller areas as a focus, but air quality is too widespread to be able to do so. Another limitation is the age of the census data. While data that is two years old is not necessarily the worst dataset to have, there has been significant economic changes over the last couple years that would be interesting to see how they have impacted median household income. Also, the 2016 data from the census are only estimates, as true census data is only collected every 10 years, there is a moderate amount of error that should be considered.

[10] EPA. 2015. California Water Action Plan and Save Our Water Program Public Education Campaigns. Retrieved from https://www.epa.gov/sites/production/files/2015-11/documents/ca_save_our_water_final.pdf