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Professor Waite
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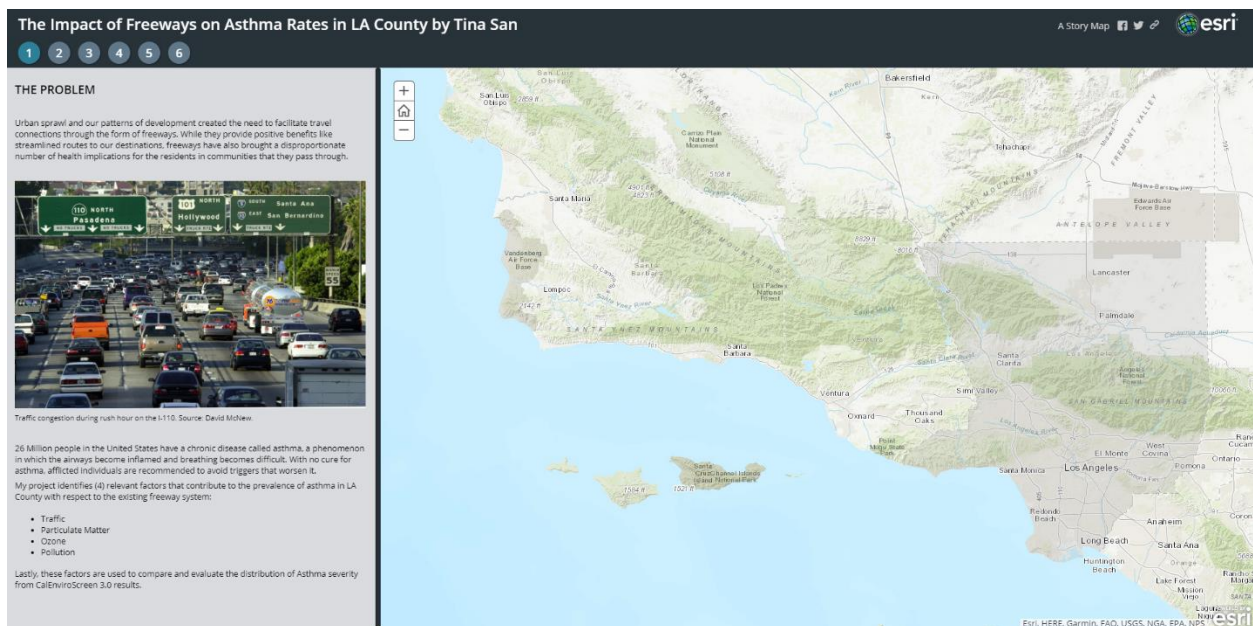
The Impact of Freeways on Asthma Rates in LA County

My project identifies (4) relevant factors that contribute to the prevalence of asthma in LA County with respect to the existing freeway system:

- Traffic
- Particulate Matter
- Ozone
- Pollution

I made a corresponding choropleth map for each relevant factor. The factors were then used to compare and evaluate the distribution of Asthma rates from CalEnviroScreen 3.0 results. The final product resulted in a story map, which can be viewed at this link:

<https://priceusc.maps.arcgis.com/apps/MapSeries/index.html?appid=34869c0f704e44b1b36c380ff61b8ace>.



Process

1. Downloaded the Master Plan of Highways shapefile from the LA County GIS Portal.
2. Downloaded the CalEnviroScreen 3.0 shapefile from the the CES website.
3. Added the "DRP_HIGHWAY_PLAN" shapefile to a blank map.

4. Opened the attribute table for the “DRP_HIGHWAY_PLAN” shapefile and selected all existing freeways.
5. Exported data as feature class and added as a new layer to isolate them into the “existingfreeways” shapefile.
6. Took the “existingfreeways” shapefile and exported each respective freeway into their own shape files:
 - a. Antelope Valley Freeway (CA-14)
 - b. Foothill Freeway (I-210)
 - c. Artesia Freeway (CA-91)
 - d. Glendale Freeway (CA-2)
 - e. Glenn M Anderson Freeway & Transit (I-105)
 - f. Golden State Freeway (I-5)
 - g. Harbor Freeway (I-110)
 - h. Hollywood Freeway (I-101)
 - i. Long Beach Freeway (I-710)
 - j. Marina Freeway (CA-90)
 - k. Orange Freeway (CA-57)
 - l. Ronald Reagan Freeway (CA-18)
 - m. Pasadena Freeway (I-110)
 - n. Pomona Freeway (CA-60)
 - o. San Bernardino Freeway (I-10)
 - p. San Diego Freeway (I-405)
 - q. San Gabriel River Freeway (I-605)
 - r. Santa Ana Freeway (I-5)
 - s. Ventura Freeway (US-101)
7. Added a new field to the attribute table to each of the freeway shapefiles for “Symbol” and input the corresponding number (e.g. Harbor Freeway = 110).
8. Added interstate, state route, and US highway shields for each shapefile.

This end result essentially became my base map to show traffic, particulate matter, ozone, pollution, and asthma data from CalEnviroScreen 3.0.

9. Took CES3June2018Update" shape file and selected all rows located in LA County. Exported selected to isolate them into the "LACounty" shape file.
10. Opened layer properties, changed field values to “asthmap” and added a red gradient color ramp.

The end result became my Asthma Score Distribution in LA County map and I repeated these steps to isolate and create a choropleth map for Traffic, Particulate Matter, Ozone, and Pollution Score Distributions.

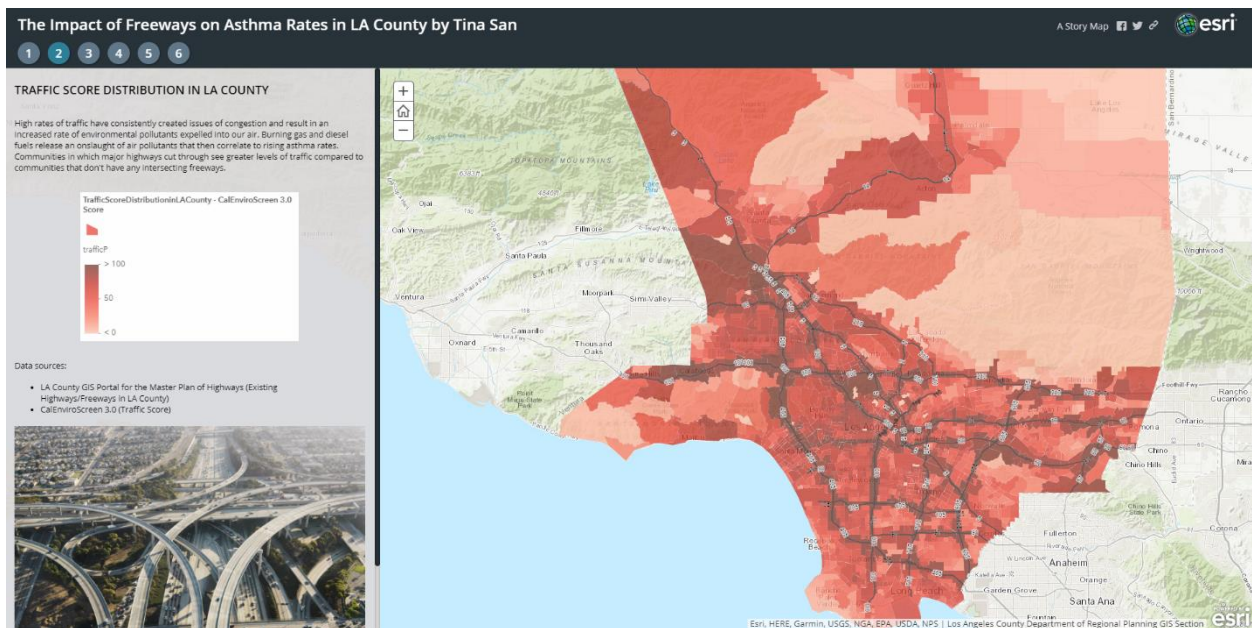
Finally, I wanted to make a story map because I thought it would be the best way to pair text information with a map in a way that was interactive. Each parcel can be clicked on individually and you can see detailed CalEnviroScreen results embedded right on the story map website.

Challenges

One of the main challenges I had was individually having to label the freeways with interstate/state/US shield symbols. I was trying to figure out how to place the symbols in a way that each route was clearly labeled, and without any annoyingly placed or duplicated. I also felt that a lot of the things I did could've been simplified. I probably could've been more efficient with my time and I wouldn't have to repeat many of the same steps. I think my color ramp values should have been properly standardized so that my results would be consistent through each specific factor pertaining to asthma (e.g. lightest red = 0-20, light red = 21-40, medium red = 41-60, dark red = 61-80, darkest red = 81-100). The very last thing I had trouble with was importing my map data from my ArcMap file into ArcGIS Online, but I eventually was able to find my solution and successfully created a story map.

Outcomes

I think overall my project showed me the results I expected. There have been multiple studies on whether freeways and more generally highways have contributed to a greater prevalence of asthma and exacerbated symptoms. By putting together a comprehensive picture of *how* the prevalence of asthma cases are so numerous, we can work towards pinpointing root causes and preventing greater health complications for individuals who have asthma or who are at risk of developing it.



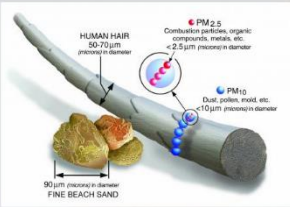
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PARTICULATE MATTER SCORE DISTRIBUTION IN LA COUNTY

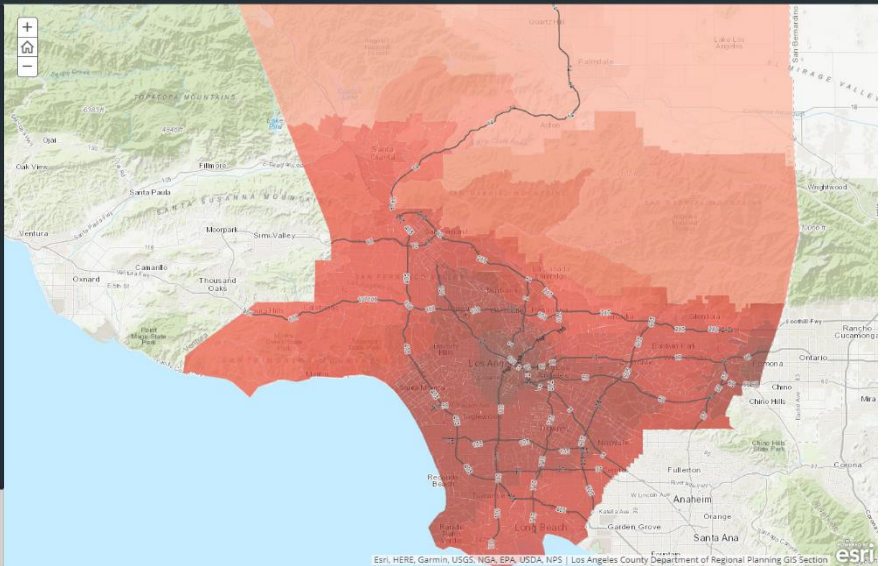
Burning gas and diesel fuels release a number of hazardous materials into the environment and affect the quality of air in our communities. Particulate matter is especially harmful for people and can cause respiratory and cardiovascular issues, as well as exacerbated asthma attacks.

"Particulate matter contains microscopic solids or liquid droplets that are so small that they can be inhaled and cause serious health problems. Some particles less than 10 micrometers in diameter can get deep into your lungs and some may even get into your bloodstream. Of these, particles less than 2.5 micrometers in diameter, also known as fine particles or PM2.5, pose the greatest risk to health." - US Environmental Protection Agency



Source: US Environmental Protection Agency

We can see the highest scoring tracts for particulate matter are clustered mostly in the central and southern portions of the County. This could be due to higher levels of human activity and vehicular emissions in the largest metros within the area. In the south, the high particulate matter scores are probably attributed to the freeways and accompanying truck diesel emissions leading down to the Ports of Los Angeles and Long Beach.



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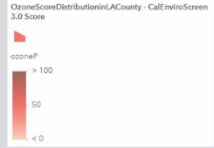
OZONE SCORE DISTRIBUTION IN LA COUNTY

When fossil fuels such as gas, diesel, or coal are burned, nitrous oxide (NOx) and volatile organic compounds (VOC) are released into the atmosphere. As the gases react to sunlight, ozone (O3), also known as smog, is formed.

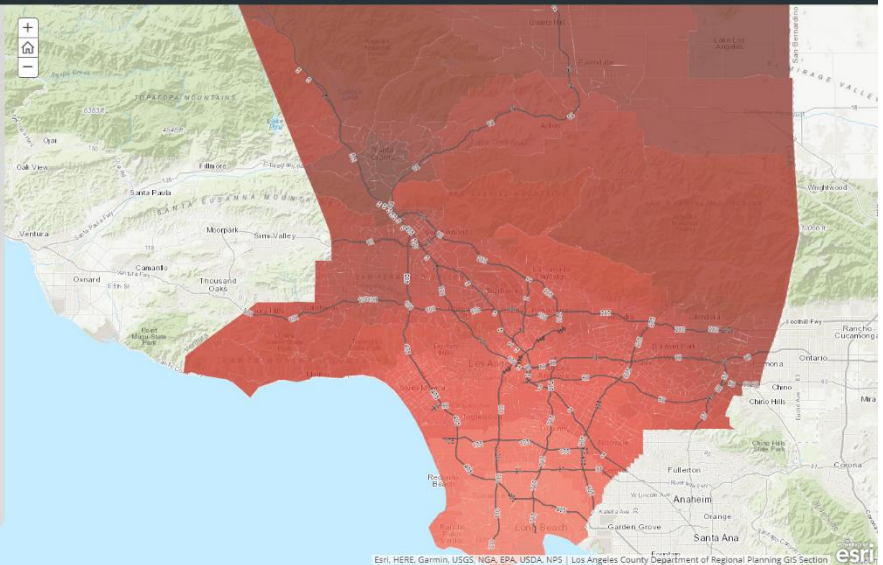


Source: American Lung Association

Breathing in ozone poses significant health risks especially to young children, the elderly, and people who do physical activity outside. Common side effects of inhaling ozone can include reduced lung function and damage to lung tissue, coughing, airway inflammation, and throat irritation. Greater exposure to ozone can exacerbate the effects of asthma.



We can see that the northern portion of LA County is most impacted by high ozone scores. Studies have found that ozone exposure is generally worse at higher elevations, which is linked to the fact that the reddest areas are mountainous parts of the County (e.g. Angeles National Forest). However, we do see that there are connections between the placement of freeways and an increased score for ozone pollution.



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POLLUTION SCORE DISTRIBUTION IN LA COUNTY

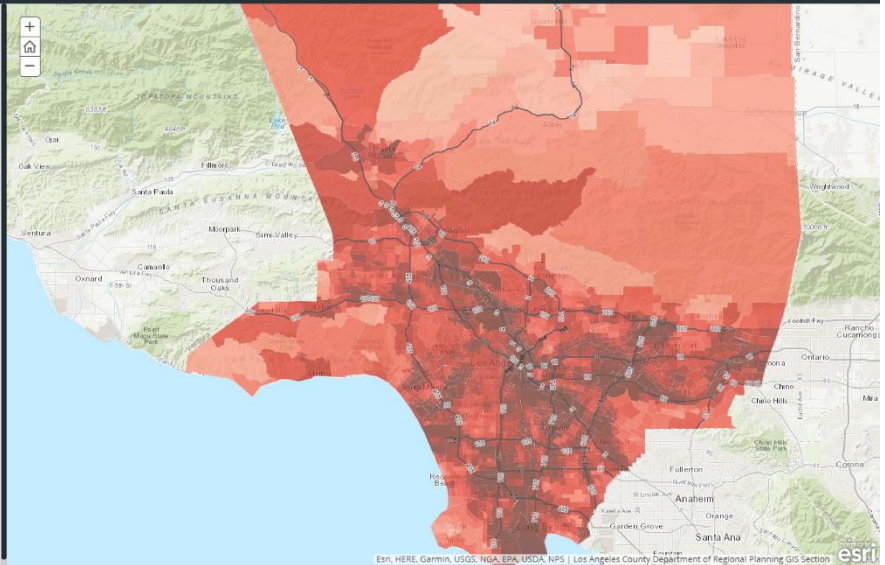
According to the Asthma and Allergy Foundation of America, air pollution worsens asthma symptoms. Pollution often comes from man-made sources, like vehicle emissions. Freeways and traffic congestion have released large amounts of particulate matter and ozone into our breathing air. Particulate matter and ozone are just two pollutants that contribute to the overall pollution score from CalEnviroScreen 3.0.



In accordance to the previous maps, we can see that tracts with the highest pollution scores are generally located by or around freeways in LA County.



Source: Daniel Hernandez



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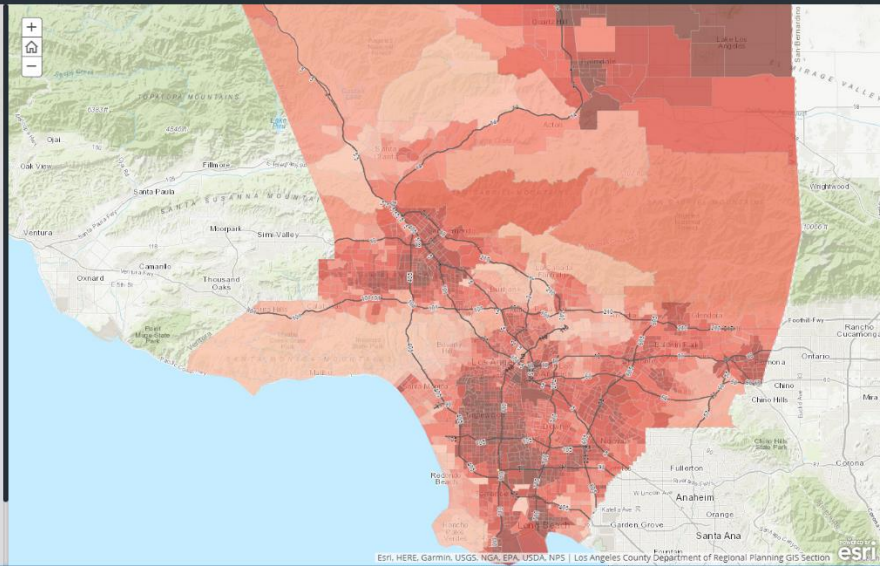
ASTHMA SCORE DISTRIBUTION IN LA COUNTY

As pollutants like ground-level ozone and particulate matter are released in large concentrated quantities due to traffic congestion, the severity of asthma across the County also increases.

CalEnviroScreen 3.0 measures asthma scores based on the number of people living with asthma, emergency department visits for asthma symptoms, and deaths from asthma in each respective tract.



We can see that the tracts with highest asthma scores are those in which freeways either intersect directly or are in close proximity to communities. Since treating asthma is primarily with preventative care, it is recommended that affected individuals and those at risk of developing symptoms should try to avoid living close to freeways.



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