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Health Impacts of Urban Oil Drilling in Los Angeles County

Introduction and Background

The County of Los Angeles "is home to the largest urban oil field in the country with thousands of active [and inactive] oil and gas wells in very close proximity to homes, schools and parks."[1] Unlike other environmentally hazardous sites and uses, oil wells in Los Angeles County are not relegated to disadvantaged neighborhoods, as these wells sprung up wherever there was oil to be extracted. In fact, "approximately one-third of L.A. County residents live less than 1 mile from an active drilling site — and some live as close as 60 feet."[2] As documented in a study by the University of Southern California, living or spending time close to an oil drilling site – which "emit hazardous air pollutants like benzene, hydrogen sulfide, particulate matter, black carbon and formaldehyde, many of which are known respiratory irritants"[3] – has been linked to negative health impacts such as wheezing, dizziness, and overall reduced lung function. Studies have shown that "reduced lung function has been associated with increased risk of mortality, including coronary artery disease and respiratory disease."[4] Even when an oil drilling site is no longer active, negative health impacts and environmental damage can continue to occur if it has not been properly decommissioned and cleaned up.

According to an analysis conducted by the *Los Angeles Times* and the Center for Public Integrity, there are almost 1,000 abandoned oil wells across the City of Los Angeles – and countless more across the County of LA – that continue to emit pollutants.[5] As the oil industry in California has declined in recent decades, more and more of these oil drilling sites have been closed and sometimes abandoned across the state, and oil companies have not always followed statewide cleanup and remediation regulations. Oil companies are required to post bonds to help cover the cost of cleanup, but if a company goes out of business, they can get away with not paying their

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[1] Jill E. Johnston et al., "Respiratory Health, Pulmonary Function and Local Engagement in Urban Communities near Oil Development," Environmental Research 197 (March 29, 2021): 2, https://doi.org/10.1016/j.envres.2021.111088.
[2] Leigh Hopper, "L.A.'s Legacy of Oil Drilling Impacts Lung Function in Residents Living near Active and Inactive Wells," USC Today, April 15, 2021, https://today.usc.edu/urban-oil-wells-drilling-lung-health-los-angeles-usc-research/.
[3] Ibid.
[4] Ibid.
[5] Mark Olalde and Ryan Menezes, "Deserted Oil Wells Haunt Los Angeles with Toxic Fumes and Enormous Cleanup Costs," Los Angeles Times, March 5, 2020, https://www.latimes.com/environment/story/2020-03-05/deserted-oil-wells-los-angeles-toxic-fumes-cleanup-costs.

fair share.[6] According to the *LA Times* analysis, the oil companies that make up three quarters of the state's wells have posted bonds worth about $230 per site, but it takes somewhere between $40,000 and $152,000 to safely and effectively decommission a drilling site.[7] While increased penalties aimed at getting oil companies to pay up have helped ease the problem to some extent, "companies continue to put off more expensive cleanup jobs in urban areas such as Los Angeles, instead focusing on rural wells that are easier to decommission, mainly in Kern County."[8] As a result, in addition to the thousands of active oil drilling sites located across the City and County of Los Angeles, inactive wells continue to cause both negative health and environmental impacts.

This project will explore where urban oil drilling occurs in Los Angeles County and some of the possible health impacts for those living close to these oil wells. In order to localize the impacts, a comparison between possible oil drilling impacts in the wealthy city of Beverly Hills and the less well-off city of Compton will also be included. The underlying question of this project is: *Does living in close proximity to an urban oil drilling site cause negative health impacts?* The two case study cities are vastly different in terms of demographics, access to resources such as healthcare, and proximity to other polluters, which may make direct correlation between oil drilling and public health impacts difficult to conclude.

Methods and Data

Two main datasets are included in this project. The first is data from the Los Angeles Geohub's map of Oil Wells in LA County, and consists of 22,781 points, representing that many oil wells across the County. The second dataset is CalEnviroScreen's Disadvantaged Communities Indicators, which measures various pollution and other burdens on populations across the state. I overlaid the CalEnviroScreen shapefile over the oil wells shapefile using ArcGIS in order to see if certain indicators – namely particulate matter 2.5 (PM 2.5), ozone, and asthma – were more prevalent near oil drilling sites. If higher rates of these indicators exist near large swaths of oil wells, it is possible there could be a link between them. However, due to other external factors, oil wells might not be the only entity causing high pollution rates in these areas. Therefore, this simple analysis might not be able to prove a link between oil wells, pollution levels, and related health impacts.

The CalEnviroscreen indicators are broken into two main categories: pollution burden indicators, categorized as either exposure indicators or environmental effects, and population characteristic indicators, categorized as either sensitive population indicators or socioeconomic factor indicators. I focused on two pollution burden exposure indicators: particulate matter 2.5 and ozone, both metrics that impact air quality, and one sensitive population indicator: asthma. I

[6] Mark Olalde and Ryan Menezes, "The Toxic Legacy of Old Oil Wells: California's Multibillion-Dollar Problem," Los Angeles Times, February 6, 2020, https://www.latimes.com/projects/california-oil-well-drilling-idle-cleanup/.
[7] Ibid.
[8] Ibid.

chose the pollution burden indicators because both of them can impact lung function, and issues with lung function have been found among people living in close proximity to oil wells. I chose asthma as the sensitive population indicator because it is a lung disease that can be caused by these types of polluters. Particulate matter 2.5 are 2.5 micrometer particulates that are made up of organic chemicals and debris from cars, trucks, and various industrial uses.[9] PM 2.5 is on the Environmental Protection Agency's (EPA's) list of six criteria air pollutants, and can cause negative health impacts like heart disease and lung disease.[10] Ozone, "the main ingredient of smog…is formed when pollutants chemically react in the presence of sunlight."[11] Similar to PM 2.5, ozone comes from cars, trucks, and factories, and is also one of the EPA's six criteria pollutants.[12] Exposure to ozone can lead to lung issues such as asthma, and can disproportionately impact women, the elderly, and African Americans.[13] CalEnviroScreen's data for PM 2.5 and ozone are collected via the California Air Resources Board's air monitoring stations across the state. Asthma rates in CalEnviroScreen are taken from the California Department of Health Care Access and Information's data on emergency room visits linked to asthma.[14]

Because of the vastness of scope of oil drilling across LA County, I also chose to compare the oil drilling sites, pollution levels, and possible health impacts in two smaller cities within the County: Compton and Beverly Hills. Compton is 10.03 square miles, and Beverly Hills is 5.71 square miles.[15] I used ArcGIS to extract the CalEnviroScreen data for just Compton and Beverly Hills, and the number of oil wells for just the two cities as well. I found that there are 86 oil wells in Compton, and 34 in Beverly Hills.

According to the most recent Census data estimates, the population of Compton is 91,988, and the racial breakdown is 69.3% Hispanic or Latino, 27.1% Black or African American, 22.3% White, and 13.8% Two or More Races.[16] Nearly a third of Compton residents, 29.3%, are foreign born, and 65.9% speak a language other than English at home.[17] 63.5% of residents have a high school degree or higher, and only 9.5% have a bachelor's degree or higher.[18] The median home

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[9] "Air Quality: PM2.5," Oehha.ca.gov, accessed November 21, 2023, https://oehha.ca.gov/calenviroscreen/indicator/air-quality-pm25.
[10] Ibid.
[11] "Air Quality: Ozone," Oehha.ca.gov, accessed November 21, 2023, https://oehha.ca.gov/calenviroscreen/indicator/air-quality-ozone.
[12] Ibid.
[13] Ibid.
[14] "Asthma," Oehha.ca.gov, accessed November 21, 2023, https://oehha.ca.gov/calenviroscreen/indicator/asthma.
[15] "U.S. Census Bureau Quick Facts: Compton City, California," Census.Gov, July 1, 2022, https://www.census.gov/quickfacts/fact/table/comptoncitycalifornia/PST045222. and "U.S. Census Bureau Quick Facts: Beverly Hills City, California," Census.Gov, July 1, 2022, https://www.census.gov/quickfacts/fact/table/beverlyhillscitycalifornia,US/PST045222.
[16] "U.S. Census Bureau Quick Facts: Compton City, California," Census.Gov, July 1, 2022, https://www.census.gov/quickfacts/fact/table/comptoncitycalifornia/PST045222.
[17] Ibid.
[18] Ibid.

value in Compton is $423,000, the median household income is $62,297, the per capita income is $20,208, and 17.3% of residents are living in poverty.[19] 12.8% of those under 65, the age of public Medicare eligibility, do not have health insurance.[20]

Census estimates have the population of Beverly Hills at 31,326, and 77.9% are White alone, 11.3% are Asian alone, 7.5% are Hispanic or Latino, and 6.3% are Two or More Races.[21] Over a third of Beverly Hills residents, 36.3%, are foreign born, and 41.2% speak a language other than English at home.[22] 95.6% of residents have a high school degree or higher, and 64.2% have a bachelor's degree or higher.[23] The median home value in Beverly Hills is over $2 million, the median household income is $103,944, the per capita income is $90,706, and 10.2% of residents are living in poverty.[24] 5.1% of residents under 65 do not have health insurance.[25]

Based on these differing demographics, certain assumptions can be made about the population of Compton versus the population of Beverly Hills, and these assumptions might influence how one population is exposed to oil drilling versus the other. More than twice the number of Compton residents under 65 do not have healthcare than their counterparts in Beverly Hills, and the lower concentration of wealth in Compton could mean the health insurance that people do have access to is not as comprehensive as what people in Beverly Hills have available to them. Lower rates of educational attainment and higher rates of speaking a language other than English at home in Compton could also mean that residents have fewer tools to advocate for themselves against polluters such as oil wells in their neighborhoods. Furthermore, Compton is bounded by several freeways that likely have impacts on pollution and air quality, while only one minor surface-level highway goes through Beverly Hills.[26] Compton is also home to more industrial uses than Beverly Hills, which further degrades environmental conditions and air quality.[27] Based on these differing existing conditions in the two cities, it might be difficult to conclude that the oil wells specifically are causing health impacts in either city, as residents of Compton are dealing with more additional environmental hazards than residents of Beverly Hills. These assumptions and their implications will be further discussed in the limitations section of this project.

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[19] "U.S. Census Bureau Quick Facts: Compton City, California," Census.Gov, July 1, 2022, https://www.census.gov/quickfacts/fact/table/comptoncitycalifornia/PST045222.
[20] Ibid.
[21] "U.S. Census Bureau Quick Facts: Beverly Hills City, California," Census.Gov, July 1, 2022, https://www.census.gov/quickfacts/fact/table/beverlyhillscitycalifornia,US/PST045222.
[22] Ibid.
[23] Ibid.
[24] Ibid.
[25] Ibid.
[26] "Compton, CA," Google maps, accessed November 21, 2023, https://www.google.com/maps/place/Compton,+CA.
[27] Ibid.

Findings and Analysis

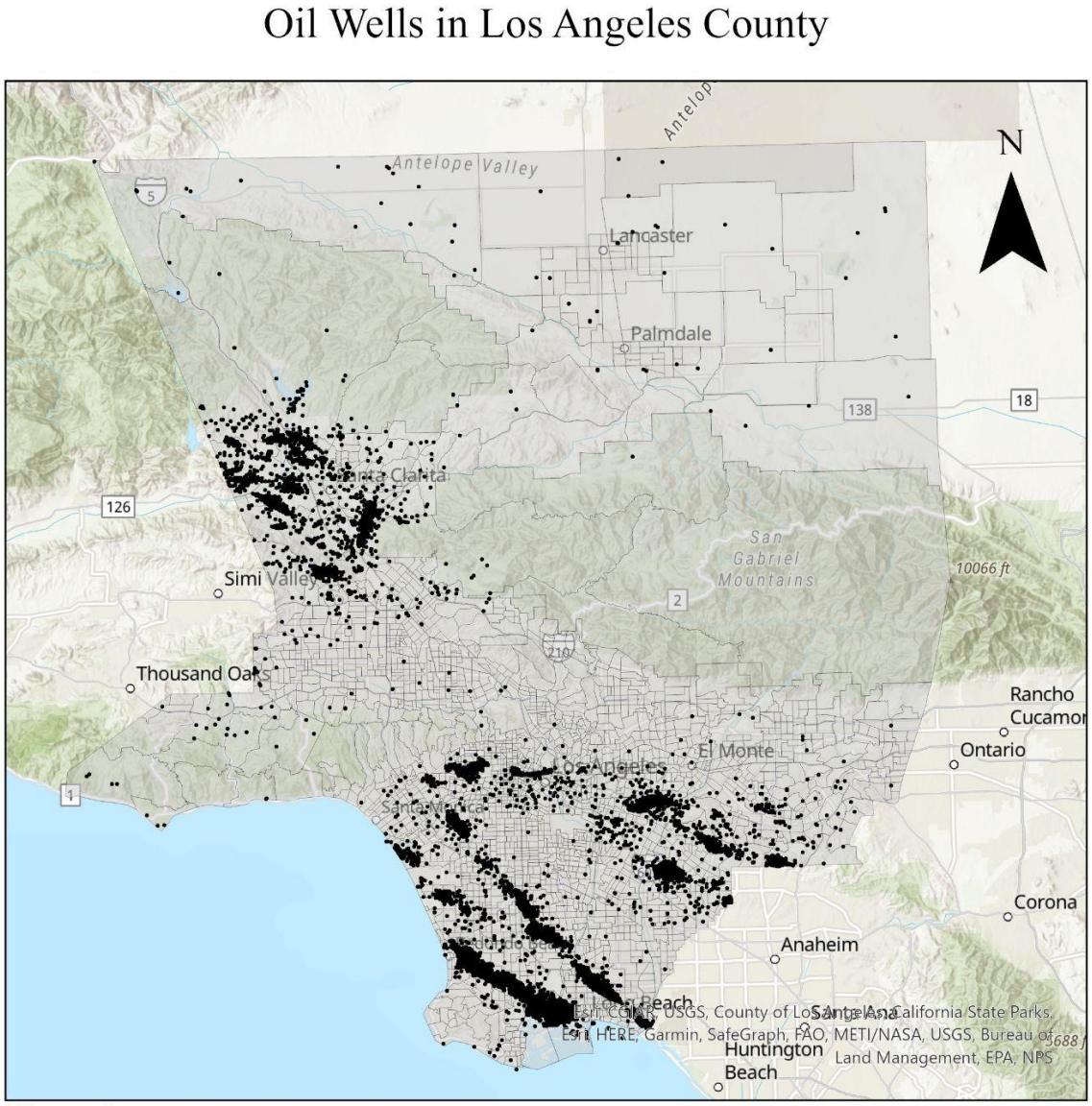

Figure 1.

Figure 1., a map of the oil wells across LA County, shows that there are oil wells virtually everywhere across the County, with prominent pockets in the Santa Clarita Valley, as well as northeast and southwest of Central Los Angeles. As mentioned in the introduction, oil drilling has historically occurred anywhere in LA where there is oil, while other industrial uses have been contained to disadvantaged areas such as Southeast and East LA.

Rates of Particulate Matter 2.5 and Oil Wells in LA County

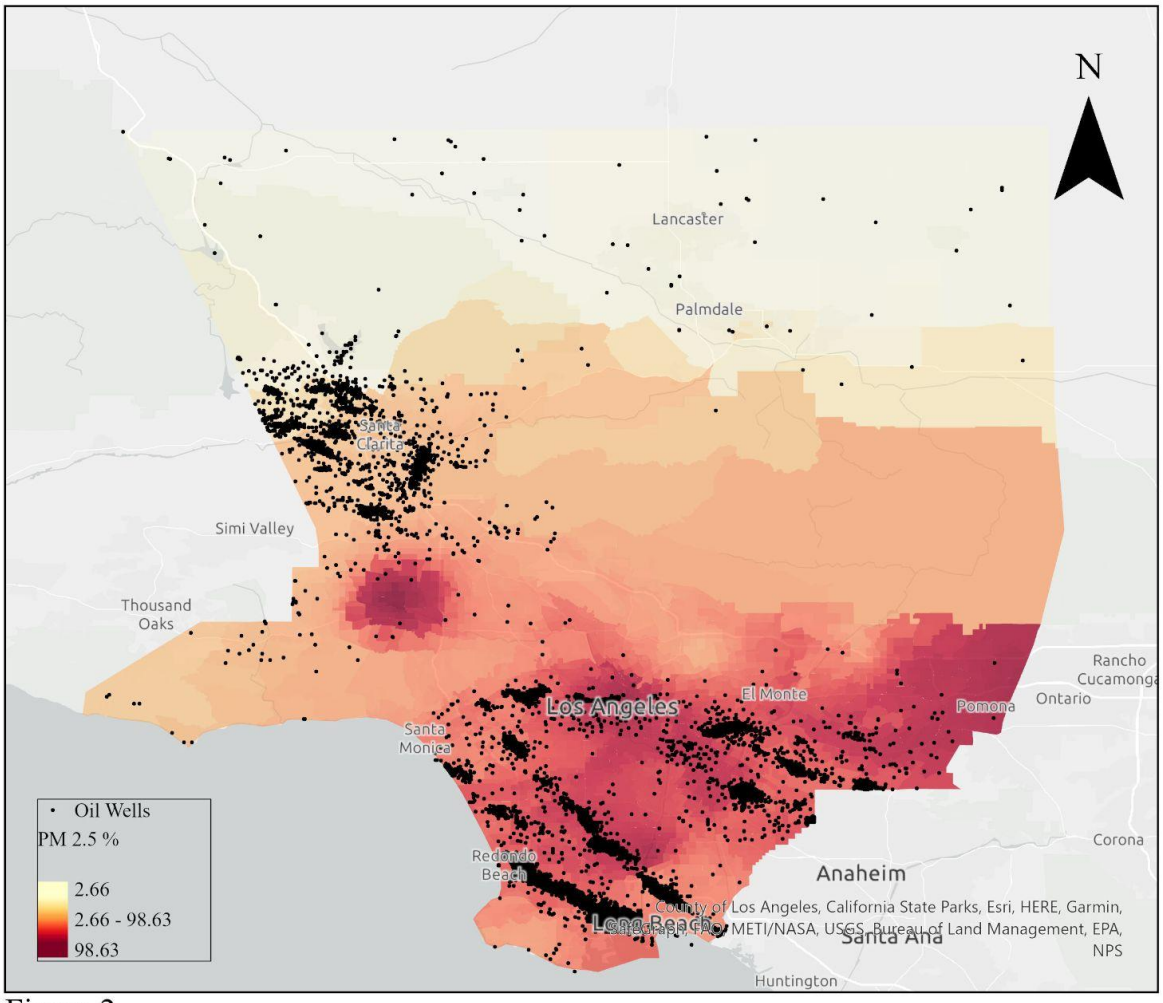

Figure 2.

In order to begin answering the question of whether there is a link between oil drilling and health impacts, I created a map, (Figure 2), with the particulate matter 2.5 percentage indicator to see if percentages of PM2.5 were higher near oil wells. There appears to be some relationship between levels of PM 2.5 and oil wells in the densely populated central and eastern parts of LA County, but there are other polluters in these areas, especially in Southeast LA, that could also impact levels of particulate matter, making it difficult to claim correlation here. On the other hand, PM 2.5 levels are relatively low near the large concentration of wells in the Santa Clarita Valley.

Ozone Level and Oil Wells in LA County

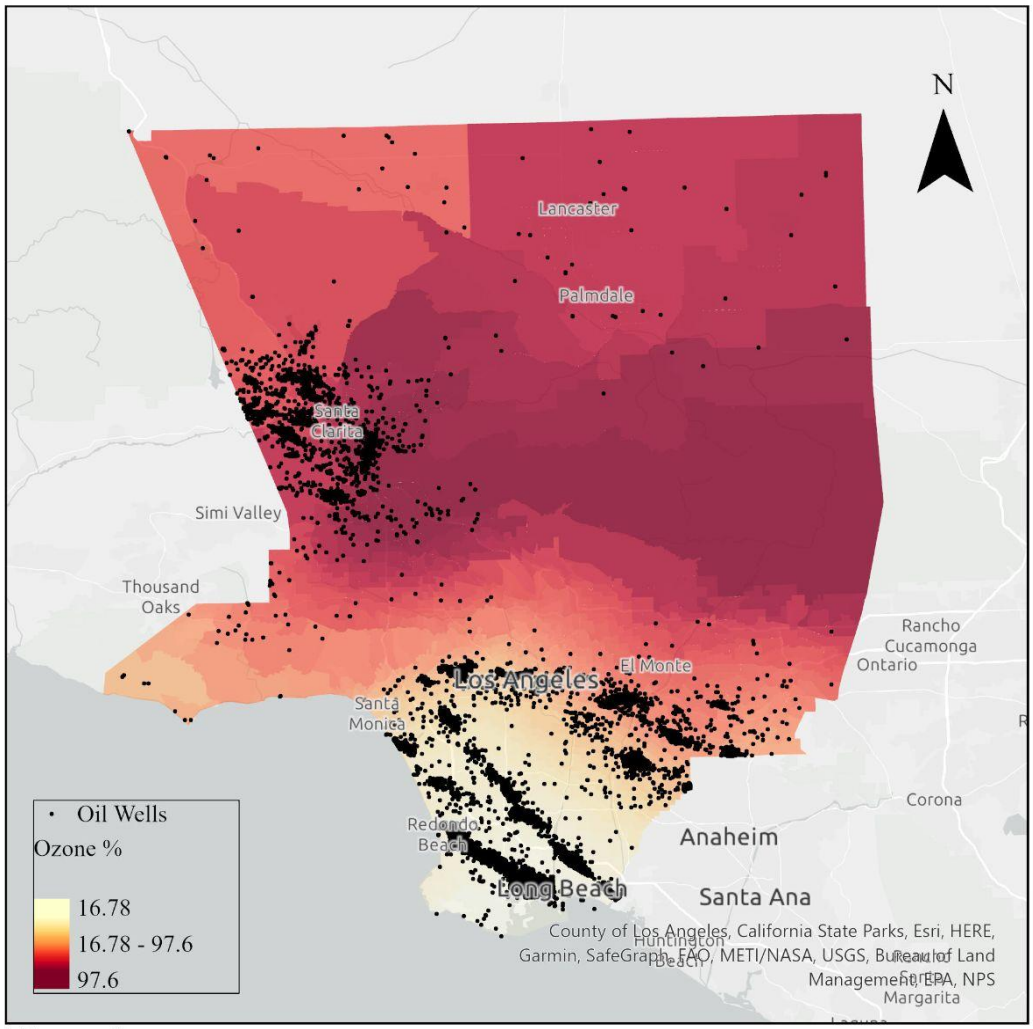

Figure 3.

My next map, (Figure 3), looks at ozone in relation to oil wells across LA County. Overall, ozone levels are lowest closest to the water, and higher more north and inland. This makes intuitive sense, as air quality near the water is generally cleaner than in more built-up, industrialized areas. There are also heavy industrial areas in the northeast of LA County that could contribute to the high ozone levels there. However, while ozone levels are high around the oil wells in the Santa Clarita Valley, they are low around the centrally-located oil wells, so correlation between oil wells and ozone levels cannot be determined.

Rates of Particulate Matter 2.5 in Compton and Beverly Hills

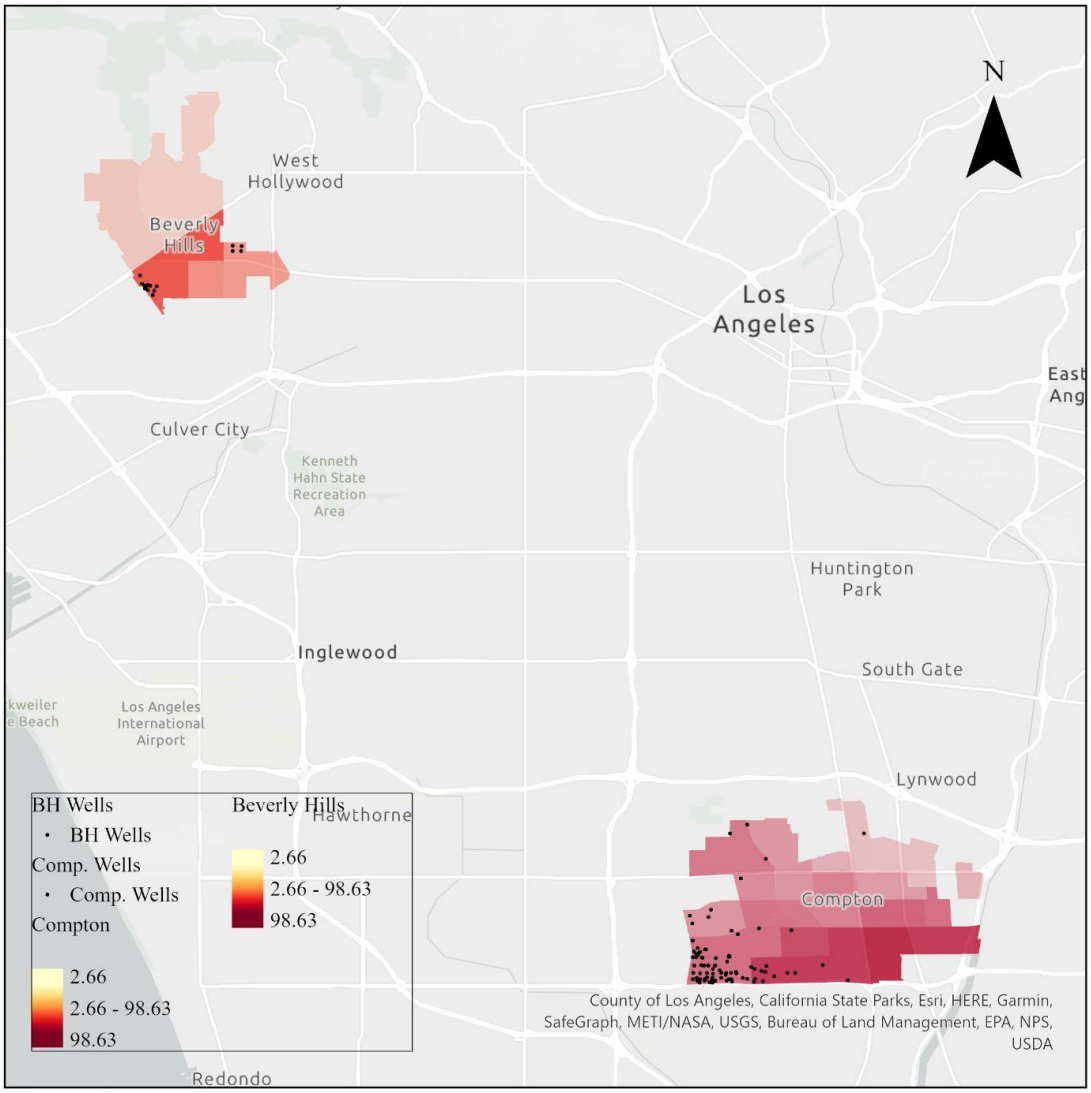

Figure 4.

After making overview maps of LA County, I focused in on my study areas of Compton and Beverly Hills. First, I looked at levels of particulate matter 2.5 in Compton and Beverly Hills (Figure 4). In the map, it can be seen that there are higher concentrations of PM 2.5 in Compton, and while there are 86 oil wells in Compton and only 34 in Beverly Hills, there are other factors at play that could affect this. As discussed in the methods and data section and legible in this map, Compton is located close to several major freeways, and Beverly Hills is not. Additionally, there are many industrial uses in the southeast of Compton, where the PM 2.5 levels are highest. Meanwhile, most of the oil wells are located within the southwest of the City. There are likely other factors impacting the differing PM 2.5 rates in Compton and Beverly Hills, in addition to the oil drilling sites.

Ozone Levels in Compton and Beverly Hills

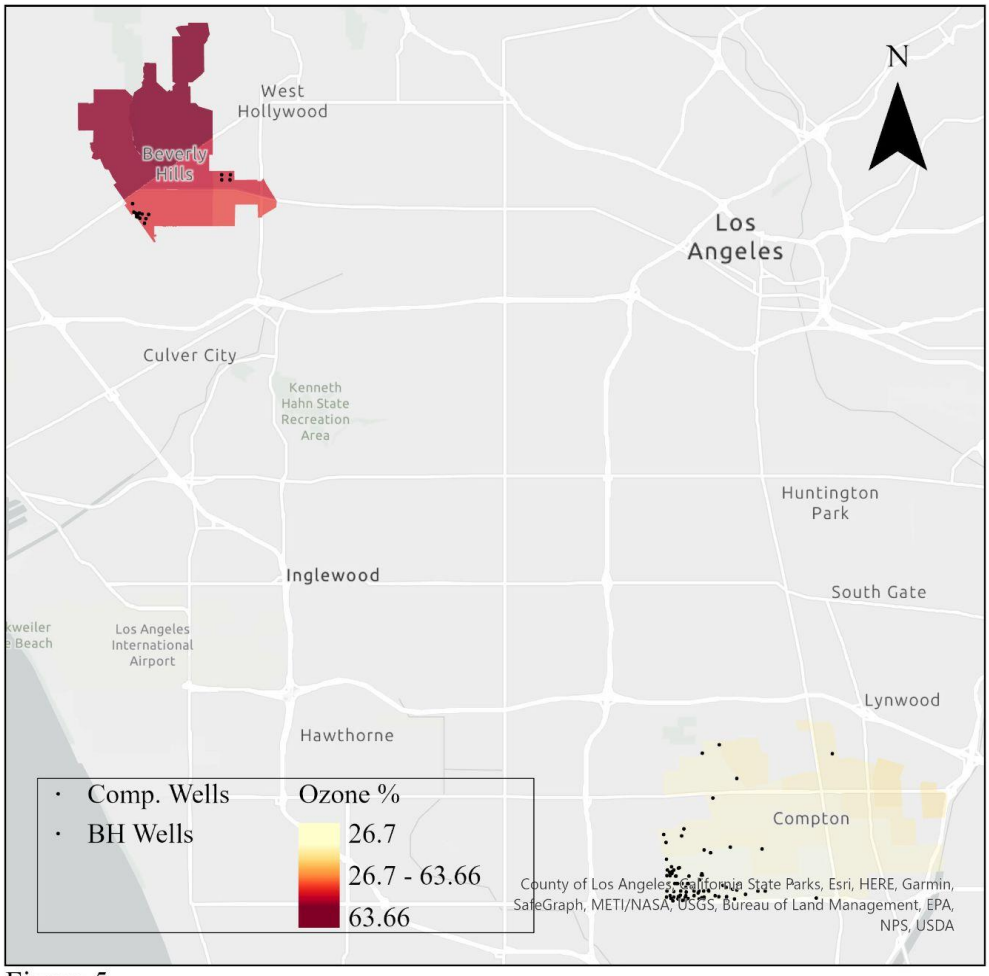

Figure 5.

My next map (Figure 5.), represents ozone levels in Compton and Beverly Hills. Based on my previously-discussed assumptions, I was surprised to see that the ozone levels were higher in Beverly Hills. However, referring back to Figure 3., as well as the CalEnviroScreen dataset, it is clear that the coastal areas of LA County have the lowest ozone levels, likely due to the winds coming off the water. Thus, the western and southern edges of LA County have the lowest ozone levels, as they are closest to the coast. While Compton is further from the western coast of the County than Beverly Hills is, it is closer to the southern coast of the County than Beverly Hills is, and this proximity to two coastal areas could improve its ozone levels.

Asthma Rates and Oil Wells in LA County

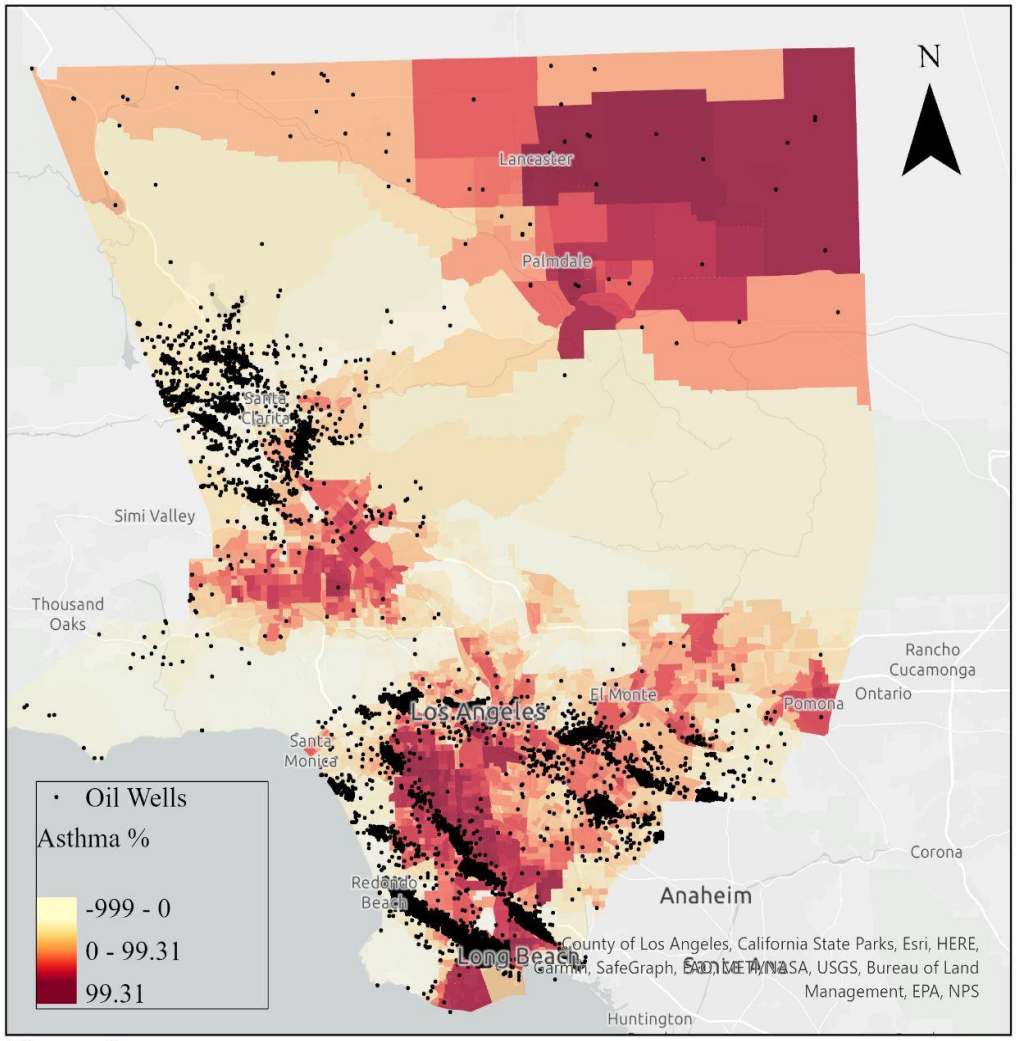

Figure 6.

My next two maps look at how asthma rates may or may not be higher near oil drilling sites. Figure 6. shows the highest asthma rates in northeast and central LA County. Notably, there is not a high concentration of oil drilling in the northeast part of the County, east of the cities of Lancaster and Palmdale, but there are high asthma rates. Other industrial uses that cause pollution, such as Amazon warehouses, could be adding to these high rates of asthma. In Central and South LA County, there are both high rates of oil drilling and high rates of asthma, but it is difficult to make the direct link that these oil wells are causing the asthma because of the abundance of other industrial uses and external factors. Additionally, there are not high asthma rates in the Santa Clarita Valley, yet there is a large concentration of oil drilling in the area. Each of these scenarios makes it nearly impossible to say whether or not the oil drilling across LA County is responsible for asthma-related hospital visits.

Asthma Rates in Compton and Beverly Hills

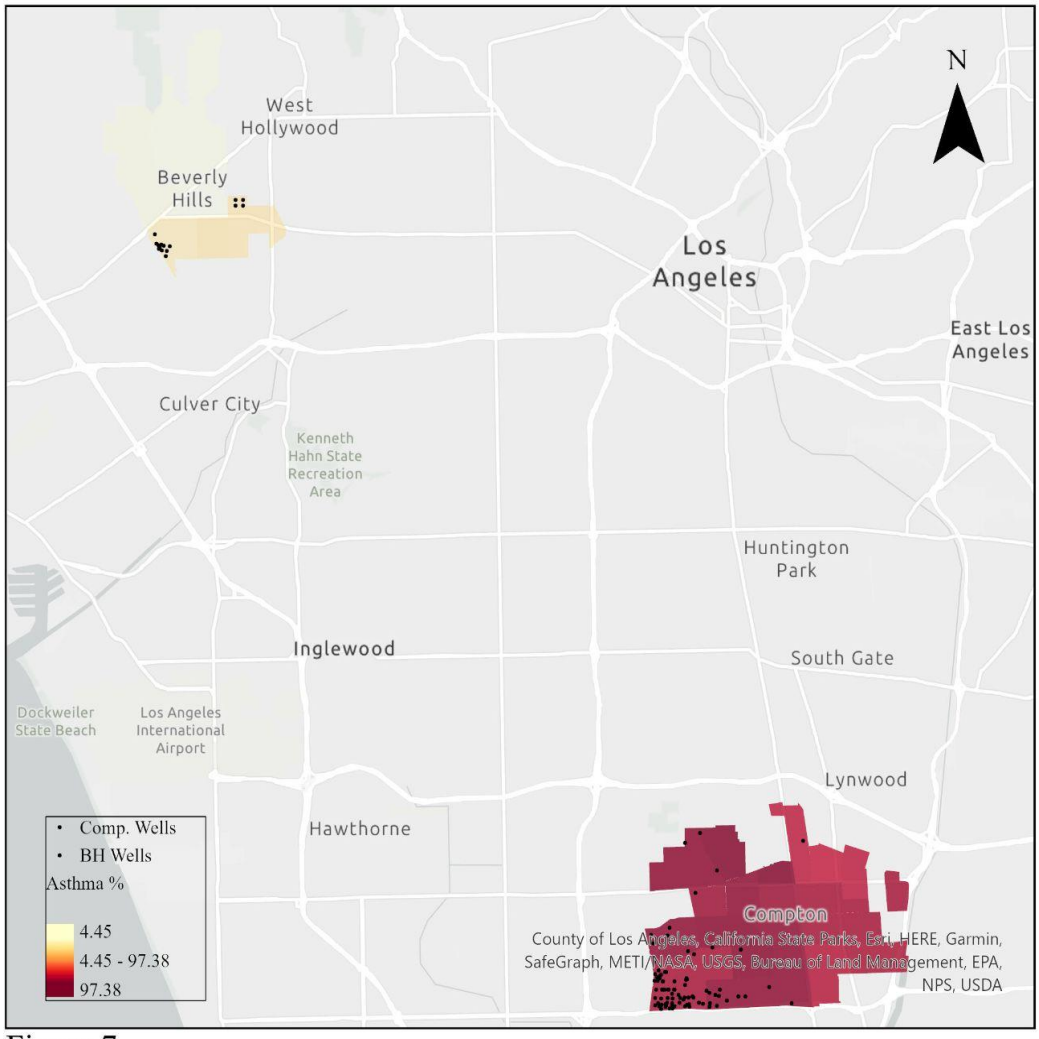

Figure 7.

Figure 7. represents asthma rates in Compton and Beverly Hills. Based on the map, it can be concluded that asthma rates are much higher in Compton than in Beverly Hills. The majority of the Compton map is made up of darker shading, representing nearly 100% asthma hospitalization rates, while the majority of the Beverly Hills map is made up of lighter shading representing around 5% asthma hospitalization rates. Clearly there are higher asthma rates in Compton, but the oil drilling sites are not the only polluters in Compton causing this. The oil drilling in Compton is mostly concentrated in the southwest of the City, and the asthma rates are relatively uniform throughout. In Beverly Hills, the tracts with oil drilling do have higher asthma rates than those without drilling, but the rates are still relatively low near the drilling sites.

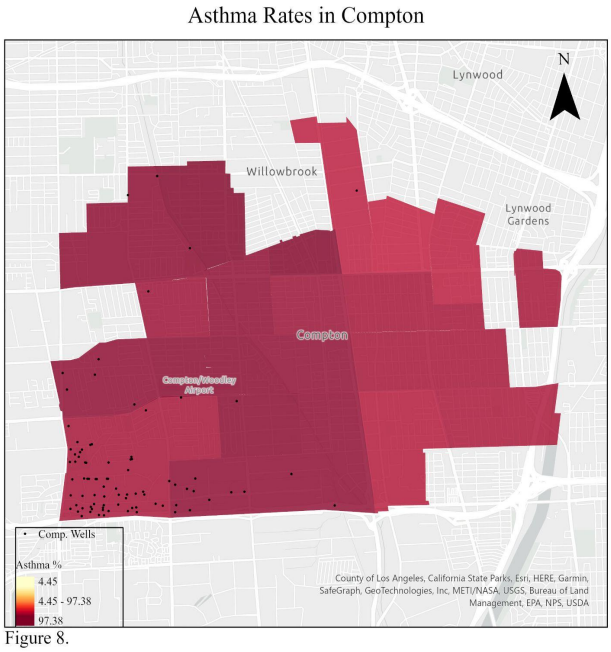

Figure 8.

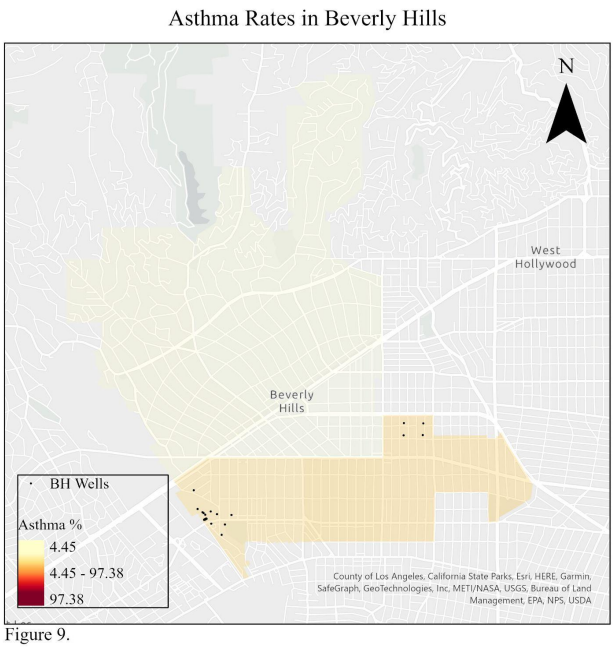

Figure 9.

Finally, Figure 8. And Figure 9. further show the discrepancy shown in Figure 7. between the asthma rates in Compton versus the asthma rates in Beverly Hills. The extreme rates of asthma hospitalization in Compton might not be directly related to oil drilling, but there is no question that the issue is widespread, and should be addressed accordingly.

Limitations and Future Research

This project had numerous limitations that impacted the quality of the observations and conclusions. Because Los Angeles County is a highly urbanized area with an extensive freeway system and several notable pockets of industry, it is difficult to link the impacts of one industry – such as oil drilling – to pollution levels and the subsequent health impacts. Because this project only looked at oil drilling, and not every polluting industry, it is impossible to say that the oil drilling alone is to blame for the pollution in certain areas. Furthermore, I only looked at three of the CalEnviroScreen indicators – particulate matter 2.5, ozone, and asthma. While I was able to supplement this with demographic data from the Census of both of my study area cities, visualizing some of the sociodemographic CalEnviroScreen indicators on a map could have been helpful in order to further evaluate how these factors coincide with pollution.

Additionally, I hoped to create bivariate maps showing how different indicators look against each other, but was again constrained by time and my basic ArcGIS proficiency. Further research could explore additional indicators from CalEnviroScreen to get a greater picture of how oil drilling might impact pollution burden across LA County, as well as within Compton and Beverly Hills, and how demographic characteristics might also come into play here. Finally, as

discussed throughout the paper, certain assumptions were made about the populations in the two study area cities, and that makes it hard to claim definitive conclusions about how oil drilling might impact pollution levels in one area versus another, especially if other sources are also contributing to pollution at different rates. Additional assumptions were mentioned regarding how the means of one population might contribute to them having better healthcare access, which could result in potentially suffering fewer health impacts from various polluters.

Conclusion

Based on my background research, it is clear that there is a link between oil drilling, the pollution it causes, and negative health impacts. In Los Angeles County, the thousands of active and inactive oil drilling sites spread throughout the County have been linked to urban pollution that in turn causes respiratory issues such as decreased lung capacity. However, the initial question I sought to answer – *Does living in close proximity to an urban oil drilling site cause negative health impacts?* – proved impossible to answer within the scope of this project. I visually explored where rates of particulate matter 2.5 and ozone levels are highest throughout the County, and where oil drilling sites are in relation to these two types of pollution. Furthermore, I looked at how asthma hospitalization rates, a health issue often caused by bad air quality, are distributed throughout LA County. Due to external factors such as other sources of pollution, I was unable to determine whether or not these oil drilling sites were causing high levels of PM2.5, ozone, or asthma. Notably, the areas with the highest pollution and asthma rates did not always correspond with the highest concentration of oil wells. To further my analysis, I looked at the same relationships between these three CalEnviroScreen indicators and the oil wells in the vastly different LA County cities of Compton and Beverly Hills. Again, correlation was not proven, and external factors such as additional polluters in Compton were also considered. Assumptions based on the demographics of each city and how that might impact health outcomes of both populations were also noted. While previous studies have been able to link oil drilling and the pollution it emits to respiratory issues like asthma, this study was not able to make any similar conclusions due to its limited scope.

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