Los Angeles

SLOW DISASTER
CASE STUDY

ENVIRONMENTAL
INJUSTICE

Fall 2021

GROUP NO. 29

AUTHORS

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CITE AS

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ABOUT

This case study report was developed by students at the University of California Irvine for the undergraduate class, “Environmental Injustice,” taught by Kim Fortun and Kaitlyn Rabach for the Department of Anthropology, Summer 2021. The University of California Irvine is on the ancestral homelands of the Tongva and Acjachemen nations.

COVER PHOTO

LA. County’s Public Works Department uses heavy equipment to remove debris at Ballona Creek after a recent rainstorm (Shalby 2019). The county’s stormwater reduction goals are not likely to

be achieved until 2082, more than 60 years behind schedule, according to Heal the Bay.

(Screenshot by Ryan Tran, October 27, 2021)

Image source: *Shalby, Colleen. "Polluted Stormwater Is Fouling L.A. Beaches. Little Has Been Done About It, Report Finds." Los Angeles Times. Los Angeles Times, December 10, 2019. Polluted Stormwater is Fouling L.A. Beaches (accessed October 27, 2021)*

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Name	**Publish? (Y or N)**
Ryan Tran	**Y**
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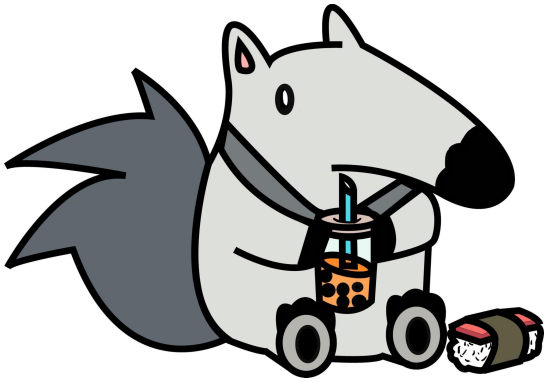
Christina Jiang	**Y**
Stephanie Le	**Y**
Cameron Smith	**Y**
Wilson Su	**Y**
Yicheng Ding	**Y**
Joshua Levering	**Y**
Chenhan Lyu	**Y**
Nelson Tran	**Y**
Jonamie Ordonez	**Y**
Emely Rivera	**Y**

Michelle Serrano Tula	**Y**
Nayeli A Carcamo	**Y**
Roberto Salazar	**Y**

BIOGRAPHICAL STATEMENT	PHOTO
Cameron Smith is a second year undergraduate student at the University of California Irvine. He plans on majoring in mechanical engineering, with hopes of getting a double major in aerospace engineering.	
Stephanie Le is a first year Business Administration major and attends University of California, Irvine. Born in San Diego, she recognizes different environmental injustices in different counties of California, and hopes to raise awareness of environmental racism and seek change.	

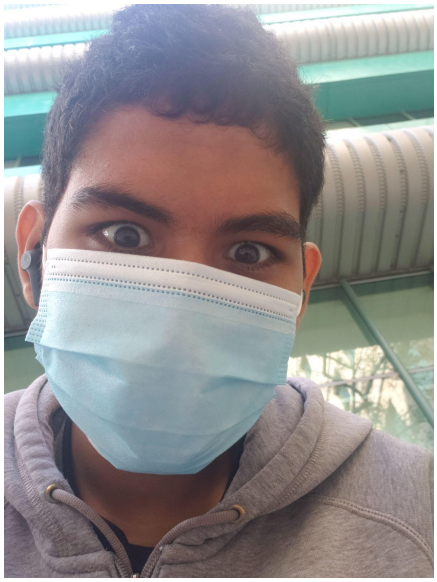
Nelson Tran is a second year Mathematics student at the University of California, Irvine. He is hoping to learn more about how environmental injustices are affecting his community and is seeking ways to make active changes in his city.	
Ryan Tran is a first year Civil Engineering Student at University of California, Irvine. Although he is a first year college student, he hopes that he can make a change in the world at an early age. Having seen the wildfires and earthquakes from his house in Anaheim, he hopes that with the knowledge learned from his environmental injustice class and his newfound engineering skills that he can better the environment that plagues the Los Angeles County.	

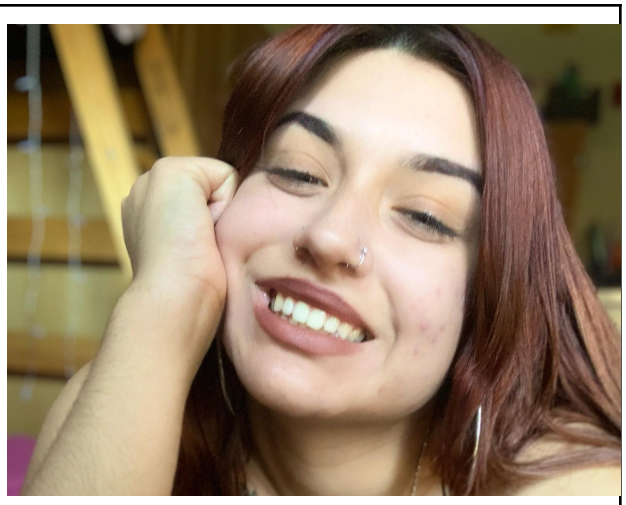
Chenhan Lyu is a fourth year student majoring in Computer Science at UC Irvine. He's interested in how to do analysis to evaluate current environmental injustice using computational tools. Learned much from natural disasters already and he is trying to learn more about human-caused disasters. He is also using BDA tools to do current research based on water-usage injustice.	
Nayeli A Carcamo is a first year Mechanical Engineering student at UC Irvine. Her biggest dream is to make our world a better place to be able to live in a healthy and safer environment.	

Jonamie Ordonez is a second year Psychology major at the University of California, Irvine. Coming from a city that is surrounded by refineries, they are interested in the current environmental injustice that is happening in their city and interested in looking for ways that can help.	
Christina Jiang is a first year biomedical engineering major at University of California, Irvine. She hopes to one day develop new medical devices to address the critical needs of cancer patients.	
Emely Rivera is a first year Biological Science major at the University of California, Irvine. She is planning on switching to majoring in nursing in hopes of becoming a pediatrician in the future. Although environmental injustice doesn't relate to the medical field she plans on using what she has learned in the class to raise awareness and to be more involved in her community.	

Michelle Serrano Tula is a second-year undeclared student at the University of California, Irvine. Being an immigrant student, Michelle wants a career in which she can become a mediator between cultures, and thus is interested in possibly pursuing an International Studies major.	
Yicheng Ding is a first year undeclared student at the University of California, Irvine. He is planning to major in Urban Studies and Psychology. Yicheng grew up outside the United States. He hopes to change the problem of environmental injustice with the perspective of the world. He collaborates with researchers from different cultural backgrounds to produce objective and global reports.	

Wilson Su is a first year computer science major at the University of California, Irvine. He has lived in many different places and wishes to use his experiences to help better the community he lives in. Though computer sciences does not seem to be related to environmental justice, he hopes to use his unique skillset to meaningfully contribute to the conversation.	
Bachhan Nguyenphan is a 2nd year Pharmaceutical Sciences born and raised in the Bay Area. They wish to go into the pharmaceutical industry after college and hopefully make a difference in the world.	

Roberto Salazar is a 2nd year psychology major at the University of California, Irvine. He seeks to broaden his knowledge on environmental issues to better help and understand the problems around his community.	
Joshua Levering attends the University of California, Irvine, where he is a first year Urban Studies major. He has always been interested in learning about environmental issues and ways to help solve them and seeks to broaden his knowledge and perspective on environmental injustices across the world. He hopes to promote and create more walkable and sustainable communities to help combat pollution in Southern California, as well as creating more access to public transportation to ease traffic and move away from car-centered development.	

Wendy Bullard attends University of Irvine Ca and is a major in philosophy . She reigns from a low income community affected and ill informed about surrounding pollution hot spots. She is passionate about demographic , global , and community issues , and will gain insight in order to better institutional systems and the world.	

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INTRODUCTION

This case study report focuses on routine, everyday air and water pollution in Los Angeles County

We describe routine pollution as "slow disaster" because the impacts are drawn out and cumulative, causing harm slowly, increasing rates of asthma, cancer and heart disease. In many ways, slow pollution disasters are more difficult to deal with than fast, explosive disasters because people don't pay attention to them or even think they are normal – especially in communities of color. Often, communities have to organize and fight to get their concerns about pollution heard and addressed by government officials. Often, particular people play important leadership roles. Sometimes, these people are residents impacted by a polluting facility. Sometimes, leading figures in fights for environmental justice are professionals – physicians who work in the community or engineers who work inside the polluting facilities. This case study describes many different stakeholders in routine pollution and the actions they have taken -- and not taken -- to improve environmental conditions.

The report addresses a series of ten questions (Fig. 2) that draw out local details in a manner that encourages comparison with other places. The research has been done quickly (within the constraints of a quarter-long undergraduate class) so is limited to and points to the need for further research and community engagement. The goal is to help build both a body of research on environmental injustice and a network of researchers ready to help conceptualize and implement next-generation environmental protections.

CONCEPT	DEFINITION
Cumulative Impacts	**The environmental health hazards that**

	are considered cumulative impacts are those that are drawn out, causing harm slowly, increasing rates of asthma,cancer, and heart disease. These kinds of impacts are harder to deal with because people do not pay attention to them or even think they are normal.
Health Disparities	**Disparity is often described if a health outcome is seen to a greater or lesser extent between populations. Race or ethnicity, sex, sexual identity, age, disability, socioecnomic status, and geographic location all contribute to an individual's ability to achieve good health. Efforts to eliminate such disparities and achieve health equity have focused primarily on diseases or illnesses and on health care services.**
Social Determinants of Health	**Our health is determined in part by access to social and economic opportunities; the resources and supports available in our communities; the quality of our schooling; safety in the workplace; the cleanliness of our water,food, and air; and the nature of our social interactions and relationships. According to the Healthy People 2020, social determinants of health include "creating social and physical environments that promote good health for all".**
Systemic Racism	**Refers to how ideas of white superiority are captured in everyday thinking at a systems level: taking in the big picture of how society operates, rather than looking at one-on-one interactions. These systems include laws and regulations, but also unquestioned social systems. Systemic Racism can also stem from education and hiring practices or access. It also assumes that white superiority individually,ideologically and institutionally. It is quite possible that**

	some individuals may not see themselves as racist, but they can still benefit from systems that privilege white faces and voices.
Green New Deal	**Is a proposal introduced by Representative Alexandria Ocasio-Cortez of New York and Senator Edward J. Markey of Massachusetts that calls for public policy to address climate change along with achieving other social aims like creating new jobs and reducing economic inequality. The main goal of the Green New Deal is to reduce greenhouse gas emissions in order to avoid the worst consequences of climate change while at the same time try to fix societal problems like economic inequality and racial injustice.**
Green Chemistry	**Is the design of chemical products and processes that reduce or eliminate the use of generation of hazardous substances. It applies across the life cycle of a chemical product, including its design, manufacture, use, and ultimate disposal. Green Chemistry prevents pollution at the molecular level, reduces the negative impacts of chemical products and processes on human health and the environment, and applies innovative scientific solutions to real-world problems. Some of Green Chemistry's principles include designing safer chemicals and products, increasing energy efficiency, and minimizing the potential for accidents.**
Green Zones	**Are a place-based strategy that uses community-led solutions to transform areas overburdened by pollution into healthy, thriving neighborhoods. Green Zones are prioritized in low-income communities and communities of color where residents organize to reduce**

	industrial pollution and create new opportunities that introduce community-based solutions. Some of the core principles that Green Zones live by is being comprehensive, community-based, solution-oriented, and collaborative.

QUOTES AND INTERPRETATION OF PRIOR UCI EIJ RESEARCH
source: [EIJ Slow Disaster Case Studies Fall 2019 - Long Beach Group 4] **quote:** **P(15): The City of Long Beach is creating solutions to some environmental hazards in the area by starting to use zero-emission buses and redesigning its districts in a way that is better suited for pedestrians and bicyclists. The state requires beach cities to test their water for bacteria once per week between April and October; however, the City of Long Beach goes beyond these expectations by testing their water every month, three to four times per week (Nahigyan 2019).** **Interpretation:** It is fascinating to see that the city of Long Beach is taking a step into creating an environment friendly city. Because the city is able to introduce new policies that benefit the environment like using "zero-emission buses" (Chen et al 2019, 15) , it will be easier to implement new policies like mandating companies to introduce environmental awareness workshops. The fact that the city has been testing their waters every month demonstrates how the city strives to make the environment a better place. This could indicate that the city of Long Beach is a well rounded economy and has a balanced culture that allows people to fund for such actions. It would not be so crazy to think that in the future, people would find living in the City of Long Beach as a better choice as the environment is more clean than other places.
source: [EIJ FALL 2020: SLOW DISASTER CASE STUDY LOS ANGELES COUNTY (GROUP 7)] **quote:** **P30: As you will see, certain stakeholders have done more to address pollution than others; the others being those that do nothing, or even try to deny and downplay it. Lucky for LA county, its leadership is taking it upon themselves to fight climate change head on; it will not all have to be in citizens' hands. The mayor, Eric Garcetti, is conscious of emissions and the world warming up. In February of this year, he signed off on his "Decade of Action", which accelerates the work of LA's own New Green Deal that he had set in motion the previous year (Office of LA 2020). The plan wants to cut water use, be carbon neutral by 2050, increase wind and solar use, and improve public transportation (electric vehicle ride sharing, biking, etc).**

Interpretation: It is discerning to see that while some stakeholders have done so much to address pollution, others have continued to deny such problems. There are bound to be people willing to listen to those raising awareness about pollution, but there are also those willing to listen to those downplaying the effects, which basically undos the progress made by those working to address and clean up polluting facilities. However, it is also great to see that LA county leadership is taking the issue into their own hands and taking action to reduce pollution causing factors. Transitioning to carbon neutral in 30 years is a complimentable feat, but only if it is acted upon and achieved. Improving public transportation will increase the incentive for people to use them, and hopefully decrease the pollution caused by LA traffic.

source: EIJ SUMMER 2020: SLOW DISASTER CASE STUDY TORRANCE (GROUP 4)

quote:
P42: To reduce the environmental vulnerability and injustice in Torrance, totally banning the refinery in the community seems to be unfeasible. The Torrance refinery is crucial to the whole oil field lying under Los Angeles County, abandoning the huge amount of profit to provide a better environment to the community seems impossible. Nevertheless, one solution people came up with is setting up a better air quality monitoring system. South Coast Air Quality Management District (AQMD) set up a series of air monitoring systems at the northern boundary of refinery and other stations in the city (NBC Los Angeles). Monitoring the pollutant released by the refinery is necessary.
Interpretation:
It's disheartening to note that although so many refineries and companies in the Torrance area are wreaking havoc on people's lives, it is not ideal to get rid of them. These corporations are a mainstay in Torrance since they produce a large amount of profit for the Los Angeles County economy. Although there is not much that can be done to directly help those affected by the pollution coming from these refiners, there are preventative measures that can be taken instead. The air quality monitoring system mentioned is a start in helping the Torrance community combat this issue.

source: EIJ FALL 2020: Slow Disaster Case Study Los Angeles County (Group 7)

quote:
P17: "The smog consists of nitrous oxide and volatile organic compounds (VOC's) which react to form ground level ozone. In 2016 alone, ground level ozone exceeded the regulated amount for 60 days, a sixth of the total year (Figure 10). Ozone makes its way into the lungs and is responsible for damaging and greatly weakening them in cases of respiratory tract infections and respiratory medical conditions. The American Lung Association has taken note of this, and has given the county a "Fail" in terms of its fine particulate and ozone concentrations (Figure 11)."

interpretation: Smog resulting from car and industrial emissions have a heavy toll on residents of Los Angeles County, where many people live within close proximity to large

contributors to the smog such as highways or industrial sites. There is unfortunately not much that can be done to prevent inhaling these substances other than regulations to cut down emissions. Los Angeles County has several days each year where the regulated ozone levels have exceeded standards, in 2016 that number being 60 days of unhealthy ozone levels, posing a great health threat to a vulnerable population. This has and will have an immense toll on the long-term health of the residents in this county, emphasizing the need to study emissions that contribute to smog and enact policies and regulations to further reduce harmful emissions and reduce - if not eradicate - the number of days a year where smog levels exceed regulated standards.

ENVIRONMENTAL INJUSTICE CASE STUDY FRAMEWORK

1. What is the setting of this case? What are its assets?
2. What environmental health threats (from explosions, everyday pollution, climate change, etc) are there in this setting?
3. What intersecting factors -- social, cultural, political, technological, ecological -- contribute to environmental health vulnerability and injustice in this setting?
4. Who are stakeholders, what are their characteristics, and what are their perceptions of the problems?
5. What have different stakeholder groups done (or not done) in response to the problems in this case?
6. How have environmental problems in this setting been reported by media, environmental groups, companies and government agencies?
7. What local actions would reduce environmental vulnerability and injustice in this setting?
8. What extra-local actions (at state, national or international levels) would reduce environmental vulnerability and injustice in this setting and similar settings?
9. What kinds of data and research would be useful in efforts to characterize and address environmental threats in this setting and similar settings?
10. What intersecting injustices -- data, economic, epistemic, gender, health, infrastructure, intergenerational, media, procedural, racial, reproductive -- contribute to environmental injustice in this setting?

FIGURE 1: This is the analytic framework that guided research for this case study.

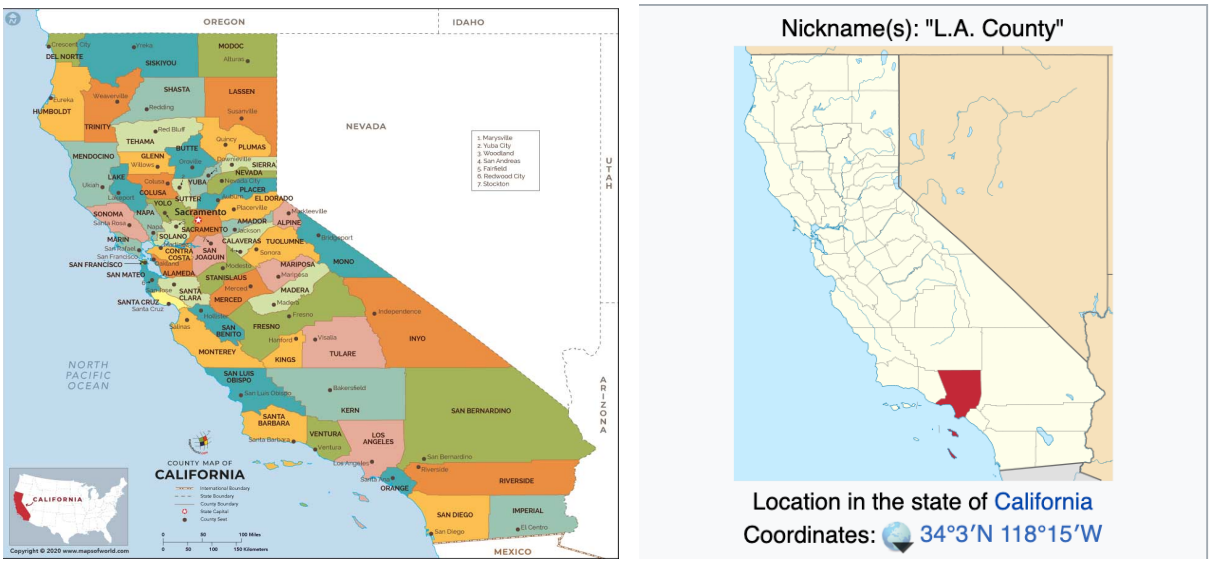


FIGURE 2:
Los Angeles County is located in Southern California along the coast. Because it is along the coast, the county receives a lot of daily boat traffic that contributes to the increase in ozone pollution in the L.A county area. The county is home to some of the worst pollution in the nation from cars and factories, and is extremely susceptible to wildfires annually.
https://www.mapsofworld.com/usa/states/california/california-county-map.html
(Screenshot by Ryan Tran, November 1. 2021)

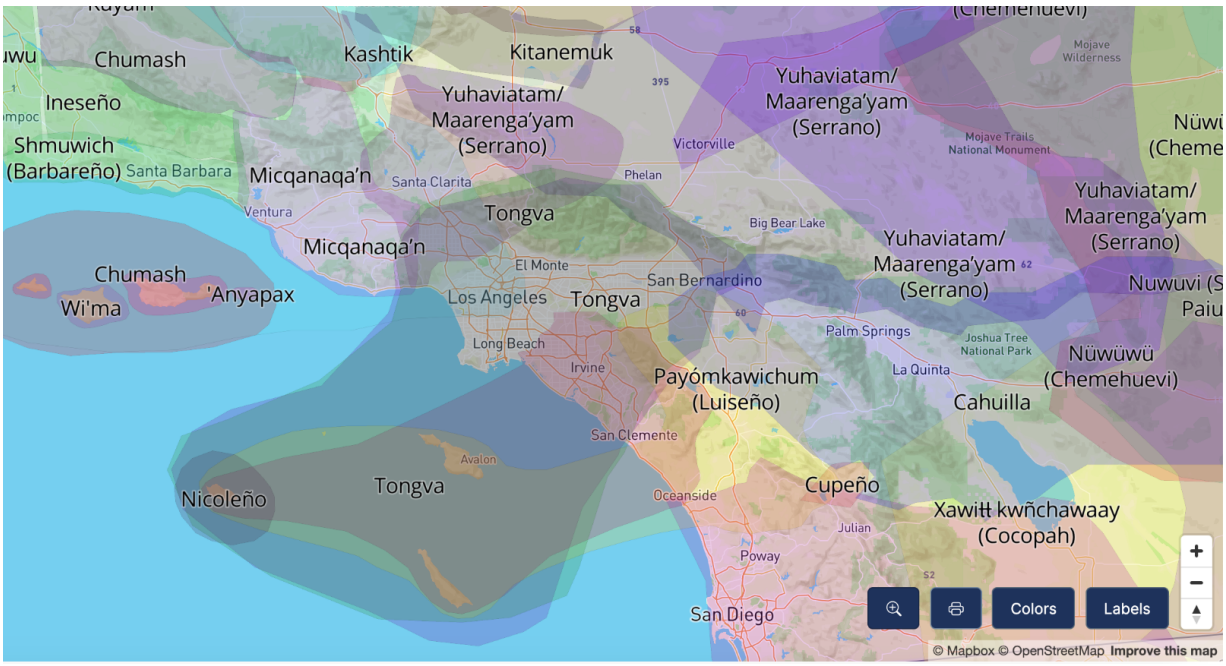


FIGURE 3:
Native Lands' digital maps show Los Angeles County on Gabrieleño, also known as Chumash, Tongva, and Kizh homelands. It is believed about 5,000 to 10,000 came from the Mojave Desert over 2,000 years ago. They occupied LA County, northern OC, and a bit of western San Bernardino and Riverside. The Gabrieleño were peaceful people as crimes were rare. Today, few tribespeople remain.
http://www.laalmanac.com/history/hi05.php (Accessed November 3, 2021)
https://native-land.ca/ (Screenshot by Christina Jiang, October 27.2021).

1. COMMUNITY ASSETS & SETTING

The City of Angels

Ryan Tran & Cameron Smith

The dry and hot area known as Los Angeles County is home to 10 million people making it the most populated county in the state. In addition to that, it is home to 650,000 acres of the Angeles National Forest and a large portion of the Santa Monica mountains (Los Angeles County 2020). Such a large area requires an efficient way to move around from place to place. The solution to this problem has been the creation of 38 highways such as the 405, 5, and 101 that navigate all throughout the county and even the state (Los Angeles Almanac 2021). These highways have been some of the stepping stones towards innovation and increased productivity over the years, but have also introduced a magnitude of problems for the air quality and those living in these areas.

Another stepping stone has been the aqueduct navigating through the county. Los Angeles' lack of rain has been a major issue over the years, especially more recently as global warming has magnified the problem, "Every year, LA gets about 15 inches of rain, while deserts typically hang below 10 inches" (The Times Editorial Board 2021). This lack of rain has done nothing to help during the fire season where the county can expect some wildfire to start and wipe out acres of forests and homes if it's not found quickly. The aqueduct has allowed residents in California to face minimal consequences of a drought and has now provided clean and usable water for over a century, "LA gets its water from,

‘the Sierra Nevada and the Rockies, via rivers, dams and aqueducts’” (The Times Editorial Board 2021).

LA sees an astounding “100 billion gallons of runoff every year. This ‘urban slobber’ carries pesticides and herbicides from our homes; oils and grease from our roads; heavy metals and other toxins from Los Angeles’ businesses; and trash, bacteria, and other contaminants from local communities, all of which flows untreated into our rivers, creeks, lakes, and ocean“ (LAWaterKeeper 2021). This excess runoff that seeps into the city threatens public health, the environment and economic health; causes flooding and other impacts that hurt many of the most impacted communities. This runoff is a waste of an invaluable resource that could be captured and treated to augment local water supplies. These water supplies then can be turned into significant resources where communities won’t have to worry about dirty water in their systems

There are several assets that inhabit the Los Angeles area. Some of these assets include environmental organizations that seek to eliminate the pollution problem that is currently hovering over Los Angeles County. One asset is LA Waterkeeper and their efforts to address ongoing pollution of L.A.'s waterways focuses predominantly on regulatory and legal enforcement around industrial and urban stormwater runoff regulations, as well as education and advocacy, while also tracking other sources of pollution to ensure there is no backsliding of gains already made. LA Waterkeeper is a significant asset to the area because it's a small community that specializes in one thing which means they work efficiently for those in need of filtering out the polluted water.

Another asset of the area is in the education system. The Los Angeles Unified School District supports over 1,000 schools and more than half a million students all in the span of 720 square miles of Southern California (LAUSD 2021). The wide range of coverage has provided a stable and singular education program, ensuring that students in any area of the county receive the same education. The challenge with such a large district covering a large area, is that individual issues can be overlooked or not addressed as much as they need to be. One example of this would be trying to address the more toxic air quality for

students in minority communities.

With such a large amount of land, the parks and recreation of Los Angeles has created and overlooked one of the largest system of parks in the state, "The County's parks and recreation system includes 63,000 acres of parks, lakes, trails, natural areas, and gardens, including the Arboretum and Descanso Gardens, and the world's largest public golf course system. These include 87 regional and local parks, 344 miles of horse and hiking trails, 19 golf courses and 31 public swimming pools" (County of Los Angeles 2021). These parks have provided a more green environment around the county, giving the land a break from the factories and housing communities. In addition to the scenery, the parks have also helped promote environmental friendliness in the fight to reduce the air pollution and release of toxic chemicals in the area.

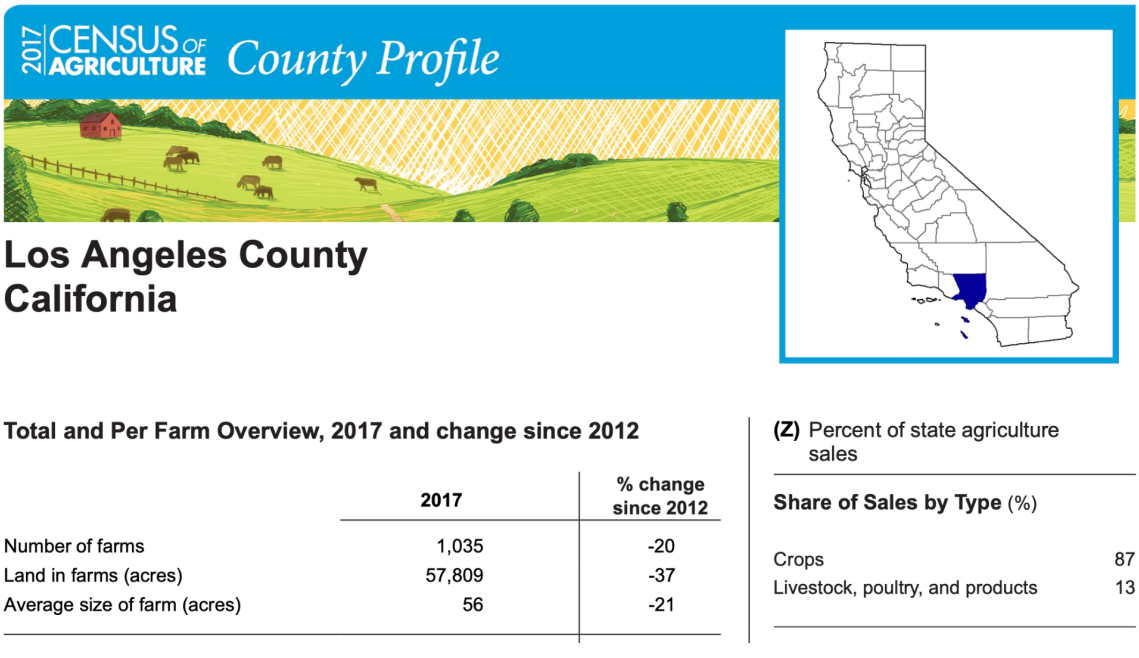
Another type of asset that is integrated into L.A. county would be its community air monitoring networks. An example of such an asset would be the IQAir Los Angeles where they convey how Los Angeles's air quality is at a "moderate level with an Air Quality index of 89" (IQAir Los Angeles 2021). This type of asset is significant to Los Angeles because the collaboration of both government and non-profit organizations will provide residents with daily air quality information. It allows residents to understand the living conditions they are in and helps them decide if they should perform certain activities in the environment that they are living in.

Another type of asset that contributes to the promotion of environmental awareness would be the local news organizations. One example of such an asset would be KCRW Los Angeles in which they provide numerous articles about the current news or culture events in Los Angeles (KCRW Los Angeles 2021). This is a significant asset for Los Angeles because it serves as a branch to news stories concerning the environment and environment issues in the county. The fact that it is a local news station means that residents will be able to listen in on current news which allows them to make decisions on

fixing the environment problems that plague the county.

FIGURE 4:
LA is known for its towering skyscrapers and bustling city life. However, this means that after a storm, urban runoff picks up trash, motor oil, fertilizers, and so much more. Because LA does not have a system in place to clean runoff, city pollutants end up contaminating bodies of water and other natural habitats.
https://downtownla.com/ Screenshot by Christina Jiang, October 27.2021).

FIGURE 5:
This is a photo of the city of Vernon. It can be seen from the picture that Vernon has a more developed industry and a large number of factories. From the official website of Vernon City, we know that they have 1,800 businesses, and these businesses are likely to cause a slow disaster.
https://www.cityofvernon.org (Screenshot by Chenhan Lyu. October 27.2021)



2017 CENSUS OF AGRICULTURE *County Profile*

Los Angeles County
California

Total and Per Farm Overview, 2017 and change since 2012

	2017	% change since 2012
Number of farms	1,035	-20
Land in farms (acres)	57,809	-37
Average size of farm (acres)	56	-21

(Z) Percent of state agriculture sales

Share of Sales by Type (%)

Crops	87
Livestock, poultry, and products	13

FIGURE 6:
This figure shows how agriculture has become less important in Los Angeles County. Since 2012, the number of farms in the area have gone down 20%. Only 13% of shares in sales are agriculturally related, including livestock, poultry, and products.
https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/California/cp06037.pdf
(Screenshot by Chenhan Lyu, October 27. 2021)

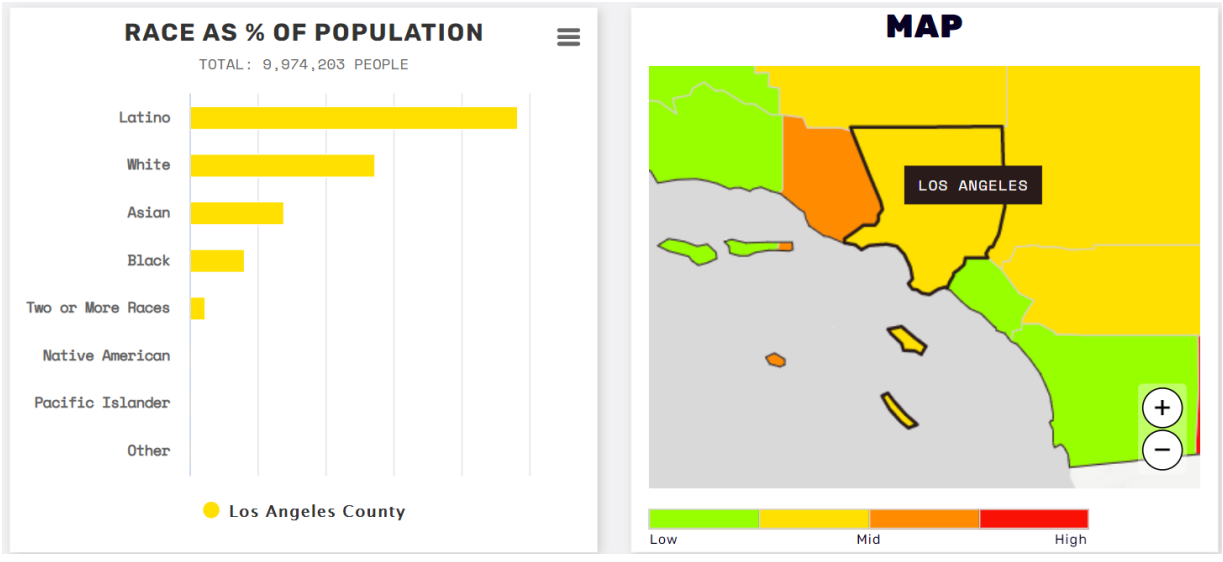


FIGURE 7:
The Race Counts data project shows Los Angeles County to have a large Latinx population. It describes Los Angeles County as "a low performance, low disparity, more populous county."
https://www.racecounts.org/county/los-angeles/ (Screenshot by Wilson Su, October 29, 2021).

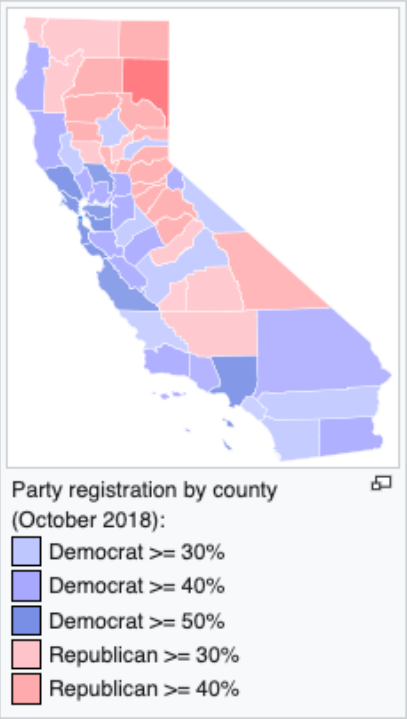


FIGURE 8:
This Wikipedia map shows that Los Angeles County has a Democratic majority (>=50%). Given that the Democratic party is pro-regulatory, it may be easier to create and enforce regulatory policies in order to protect against environmental hazards.
https://en.wikipedia.org/wiki/California_locations_by_voter_registration (Screenshot by Nelson Tran, October 27, 2021)

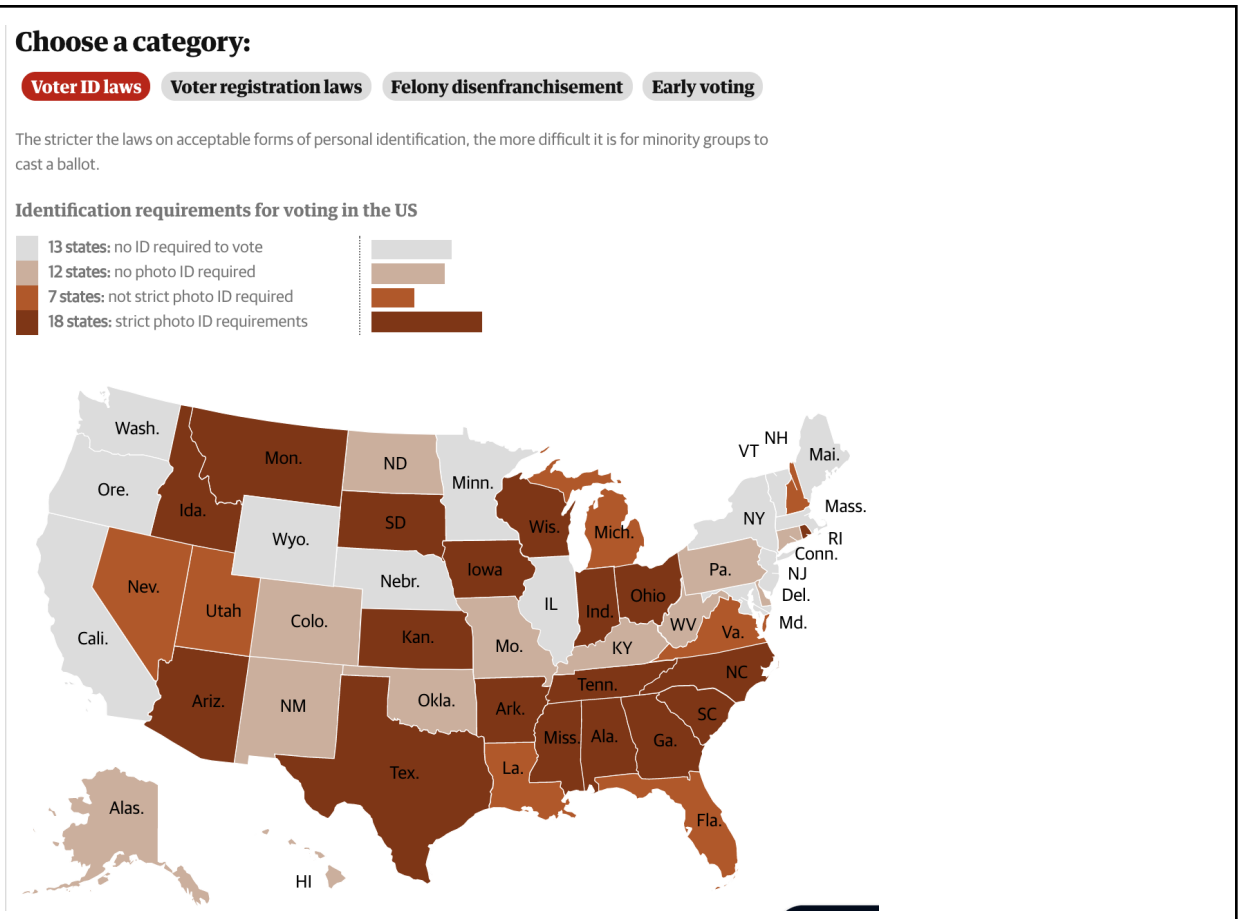


FIGURE 9:
The State of California has no ID requirements to vote, which means that marginalized communities have better access to voting than any other states and can strengthen the Democratic party in California. In recent news however, advocates in the L.A county have pushed for redistricting the county to better account for the county's diverse population; by doing this, different districts can better account and address issues that are particularly important to certain marginalized groups (Kamal 2021). https://calmatters.org/politics/2021/10/california-redistricting-community-groups-diversity/ (Screenshot by Bachhan Nguyenphan, October 25, 2021)

2. SLOW DISASTER & OTHER ENVIRONMENTAL THREATS

Slow Disasters, Immediate Threats

Christina Jiang & Cameron Smith

South Los Angeles is ranked in the top 10% most polluted communities in the state and is overburdened with industrial facilities, hazardous waste, and contaminated land (CalEnviroScreen2.0 2014). Since there is a list, locations higher up on the list should start taking into consideration how pollution is affecting their residents. Such pollution comes from various sources, and a non comprehensive list is listed below.

LA has many beaches that residents and tourists like to visit. However, LA's storm drainage system is the "single greatest source of pollutants in local rivers, lakes and the ocean" (Levin 2019). Levin explains how LA's storm drainage system works independently from their sewage system. Sewage is cleaned while storm water flows straight from the streets into storm drains, which connect directly to bodies of water. Because the storm water rolls off houses and down the road, it can pick up various oils, paints, pesticides, and

such. Environmental health threats in stormwater pollution include, "the unfiltered trash that piles onto the sand after flowing from rooftops, sidewalks and streets, picking up a trail of pesticides, bacteria, oil and grease before traveling through the storm drains" (Shalby 2019). Although the stormwater helps to lessen the impact of wildfires and droughts, it also brings many pollutants to nearby water sources. Those who swim in polluted waters can get "stomach flus, rashes and other illnesses" (Levin 2019). Additionally, pollution is especially worse "for 72 hours after a major rain event in LA county" (Levin 2019), so much so that LA county officials had to "issue a health warning against swimming, surfing and playing in ocean waters around discharging storm drains, creeks and rivers" (Levin 2019). Over time, this amounts to increased rates of various diseases and sicknesses.

LA has some of the worst air quality in the country. It is also not a coincidence that it is home to some of the most intense oil drilling in the country. Air pollution and higher rates of asthma, respiratory problems, and cancer go hand in hand. It has been found that "residents of South LA are expected to live nearly 12 years less than residents of Brentwood, in addition to experiencing higher rates of lung cancer, coronary heart disease, stroke, and diabetes" (Romann 2020). Oil drilling occurs right next to homes, schools, and hospitals, and residents commonly experience "nosebleeds, headaches, dizziness, and nausea" (Romann 2020). Low income and communities of color are the ones most affected by these environmental hazards. Zip code is a definite indicator of the quality of life, and "race is the most significant predictor of a person living near contaminated air, water, or soil, and people of color make up more than half of the population living near toxic waste sites...In Southeast Los Angeles – predominately a community of color – roughly 1/5 of its residents live adjacent to noxious land uses" (Romann 2020).

In addition to the air pollution from oil and cars, the county also struggles with toxic chemicals from polluting factories and containers dating as far back as World War II. The

machinery created by the factories during the war have been left in their places, the empty buildings still holding some of chemicals and supplies they used to create anything from artificial rubber to metal plates. These same chemicals have found their way into the land and have left a devastatingly toxic environment in the surrounding areas. Not only that, but other toxic chemicals have been left all over the county over the years. One incident actually close to home for me happened along Pearblossom Highway where "someone abandoned 18 barrels of the probable carcinogen PCB. Hunters shot them up and the stuff soaked 15 feet down into the desert soil. When the money to clean up the mess ran out, the crews just fenced off the area and left" (Morrison 2021). And this isn't a single incident, it has been happening all over the county, damaging the land we walk on, grow plants on, and live on. These toxins have created a magnitude of issues in most minority communities due to a lack of funding to fix the issue and make the area safe for those living around it.

Toxins don't just come from these chemical factories. They also come from the very facilities that provide much of the United States with food: the industrial agriculture industry. While agriculture has mostly faded away in present day LA, it was "was once the largest, most bountiful agricultural county in the U.S. for four decades, between 1909-1949" (Surls 2016). Now, most of LA's agricultural activity occurs in Antelope Valley, the negative effects of which are still rather prominent. The problem with agriculture in the county is the fact that the land that was once used has either been built over or was toxic from the pesticides and other chemicals they used in the past. In addition to that, the water used for agriculture in the Antelope Valley may not be growing healthy products. A study done from 2014 to 2018 noted that, "six Antelope Valley water providers had more than 10 violations each in the last five years" (Opinion 2020). The violations referring to the water violations highlights not only a problem with the water we grow our plants with, but the water we drink too.

EJSCREEN Report (Version 2020)

County: Los Angeles, CALIFORNIA, EPA Region 9

Approximate Population: 10,098,052

Input Area (sq. miles): 4751.09

(The study area contains 29 blockgroup(s) with zero population.)

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
EJ Indexes			
EJ Index for PM2.5	66	70	87
EJ Index for Ozone	66	68	85
EJ Index for NATA* Diesel PM	76	78	87
EJ Index for NATA* Air Toxics Cancer Risk	68	71	85
EJ Index for NATA* Respiratory Hazard Index	67	70	86
EJ Index for Traffic Proximity and Volume	85	88	96
EJ Index for Lead Paint Indicator	75	79	88
EJ Index for Superfund Proximity	84	87	93
EJ Index for RMP Proximity	81	84	92
EJ Index for Hazardous Waste Proximity	83	86	95
EJ Index for Wastewater Discharge Indicator	99	99	99

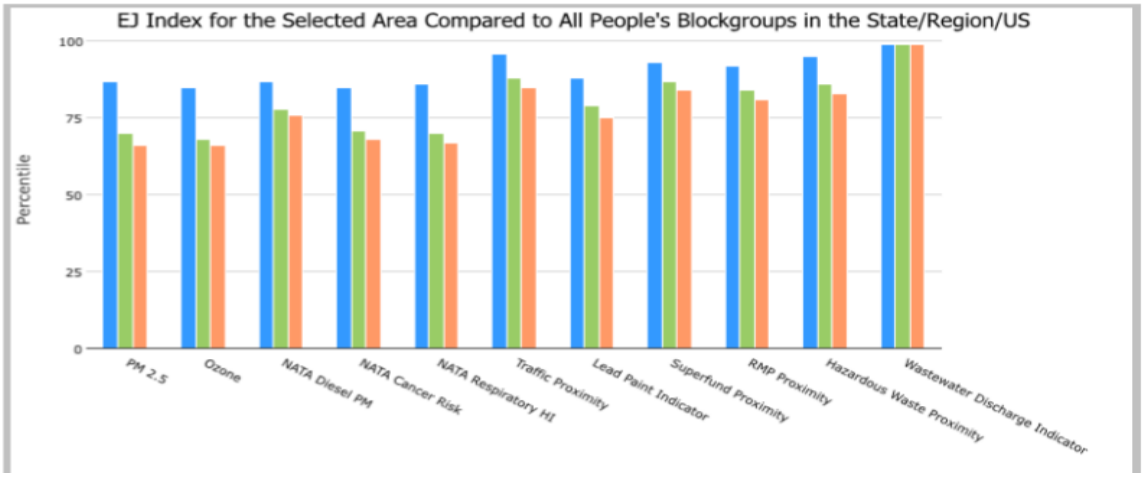


FIGURE 10:
This compilation of environmental indicators (provided by the US EPA's EJScreen tool) demonstrates that Los Angeles County in the 99th percentile nationwide for toxic wastewater discharge to streams, in the 88th percentile for lead paint, and in the 92th percentile for proximity to RMP facilities.RMP facilities uses hazardous substances to which they have to develop a RMP (Risk Management Plan) and these facilities are often close to POCs and low income communities in LA county.
Overview of Environmental Indicators in EJSCREEN | US EPA (Screenshot by Stephanie Le, October 27,2021)

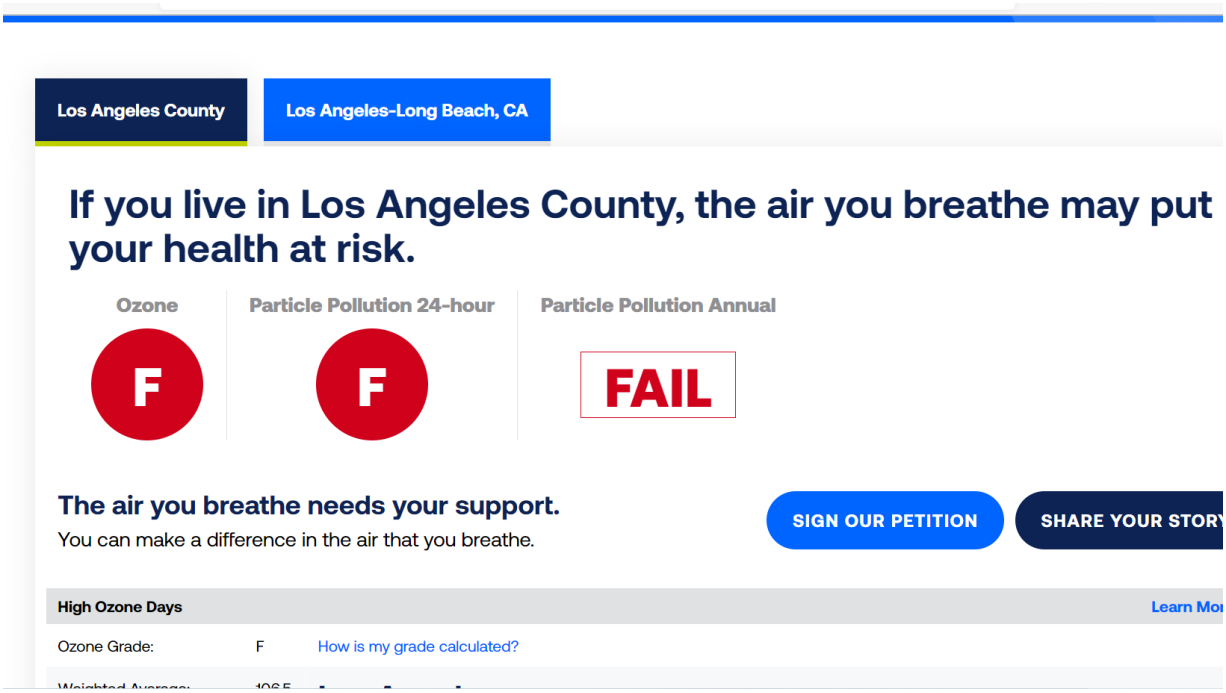


FIGURE 11:
Caption: The American Lung Association gave LA County a fail grade on the level of annual particle pollution in the air. The high density of vehicles in LA County, along with the many factories that lie around the area may be the reason for such an awful quality in air. It is worth noting that the annual weighted average number of high ozone days have fallen since 2001, but they are still not at the level they need to be for great quality air.
Los Angeles | American Lung Association (Screenshot by Roberto Salazar, October 29, 2021)

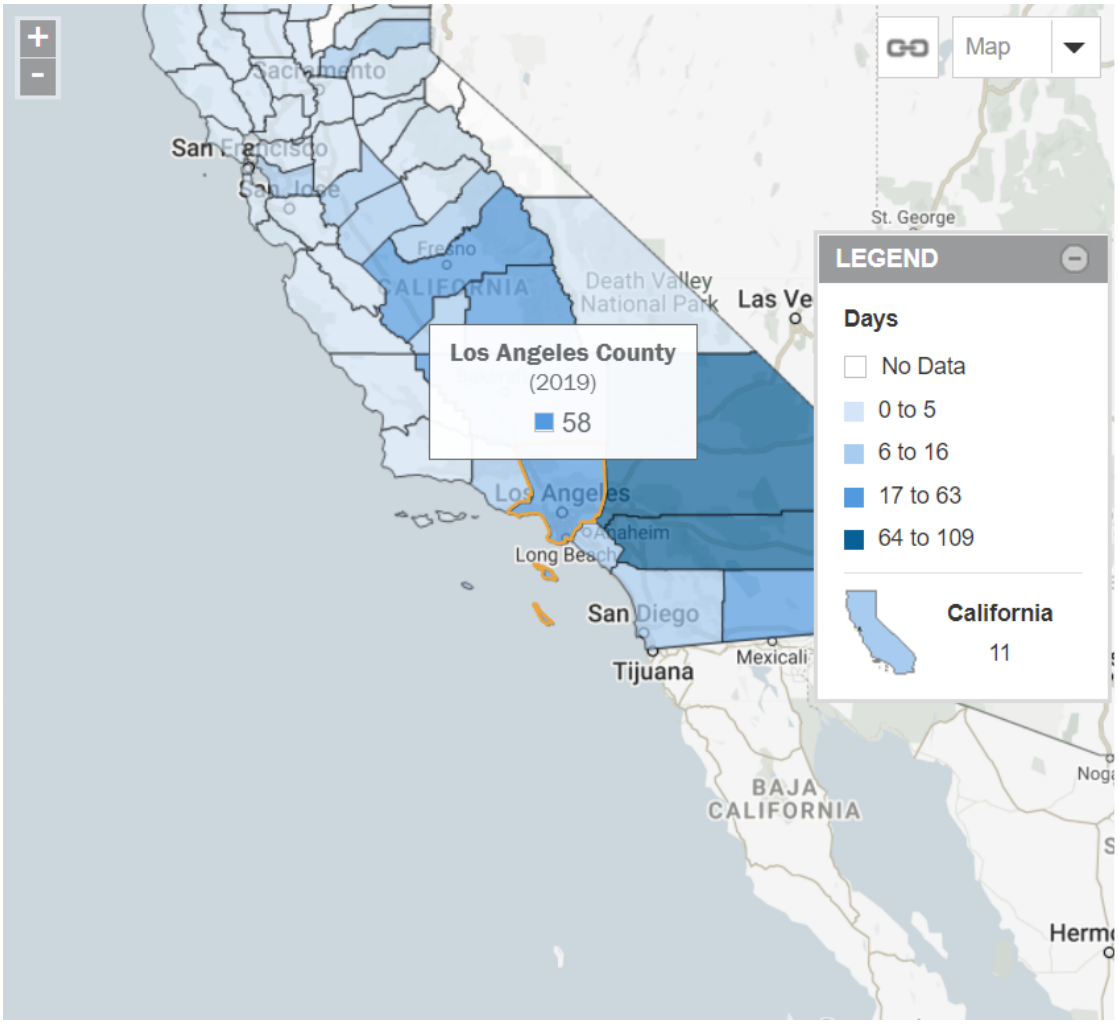


FIGURE 12:
Los Angeles County had 58 days in 2019 where the levels of Ozone were deemed unsafe and above the regulatory standards (0.070 parts per million). This provides serious health risks especially for children, who are more at risk due to air pollution than teenagers or adults.
Days with Unhealthy Ozone Concentrations in Air (Screenshot by Joshua Levering, October 29, 2021)

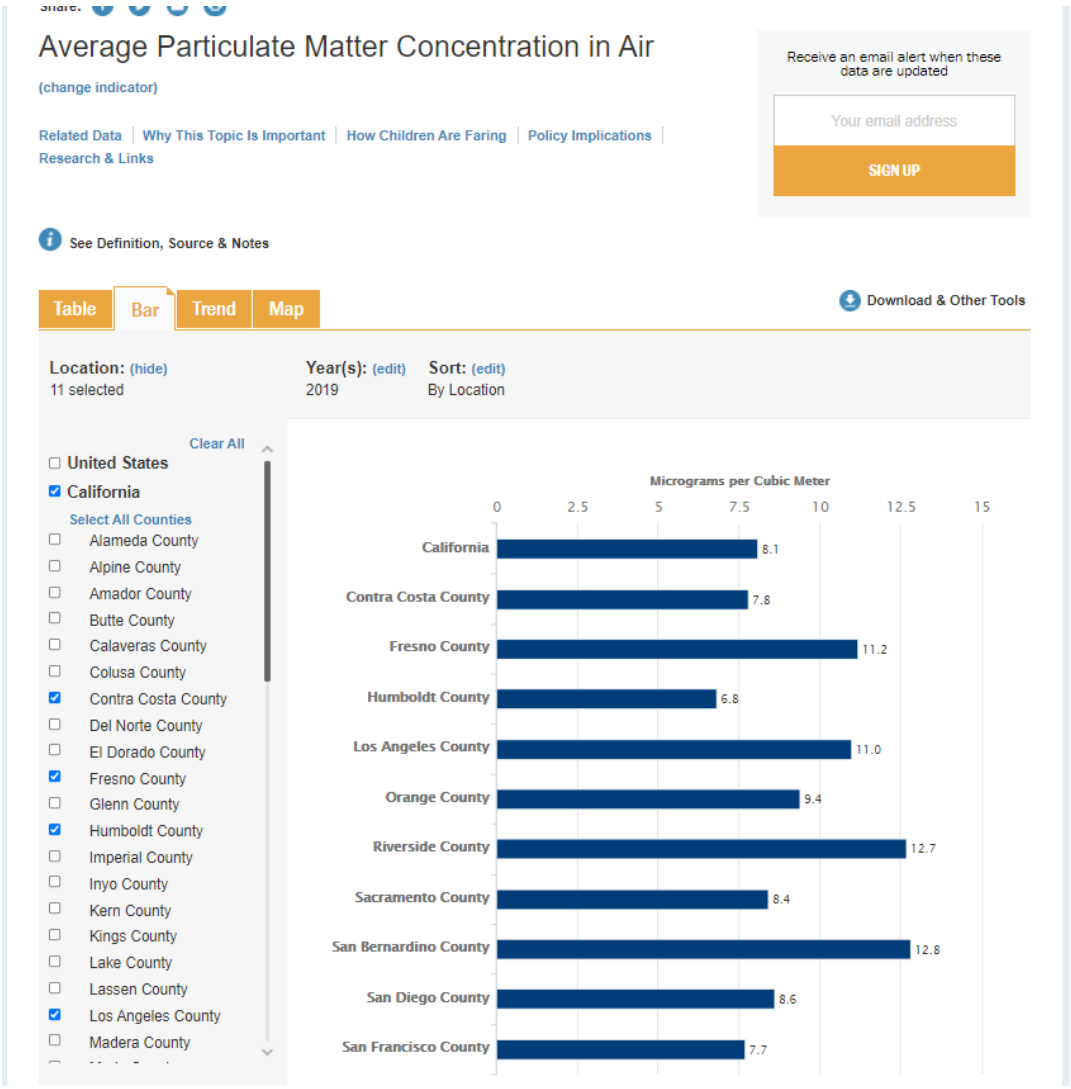


FIGURE 13:
A bar graph of Los Angeles County and 10 other counties are presented. The larger the bar the higher the concentration of fine particulate matter in the air. PM2.5 is an air pollutant commonly found in diesel exhaust. The national ambient air quality standard for PM2.5 is 12 micrograms per cubic meter (μg/m^3); annual concentrations above 12 μg/m^3 are considered unhealthy, especially for sensitive groups such as children, asthmatics, and the elderly. Air pollution is a serious threat to children's health, with links to adverse birth outcomes, obesity, cardiovascular and respiratory diseases, and cancer.
"Average Particulate Matter Concentration in Air." Kidsdata.org. California Air Resources Board, December 2020. Average Particulate Matter Concentration in Air.
(Screenshot by Ryan Tran, October 27, 2021)

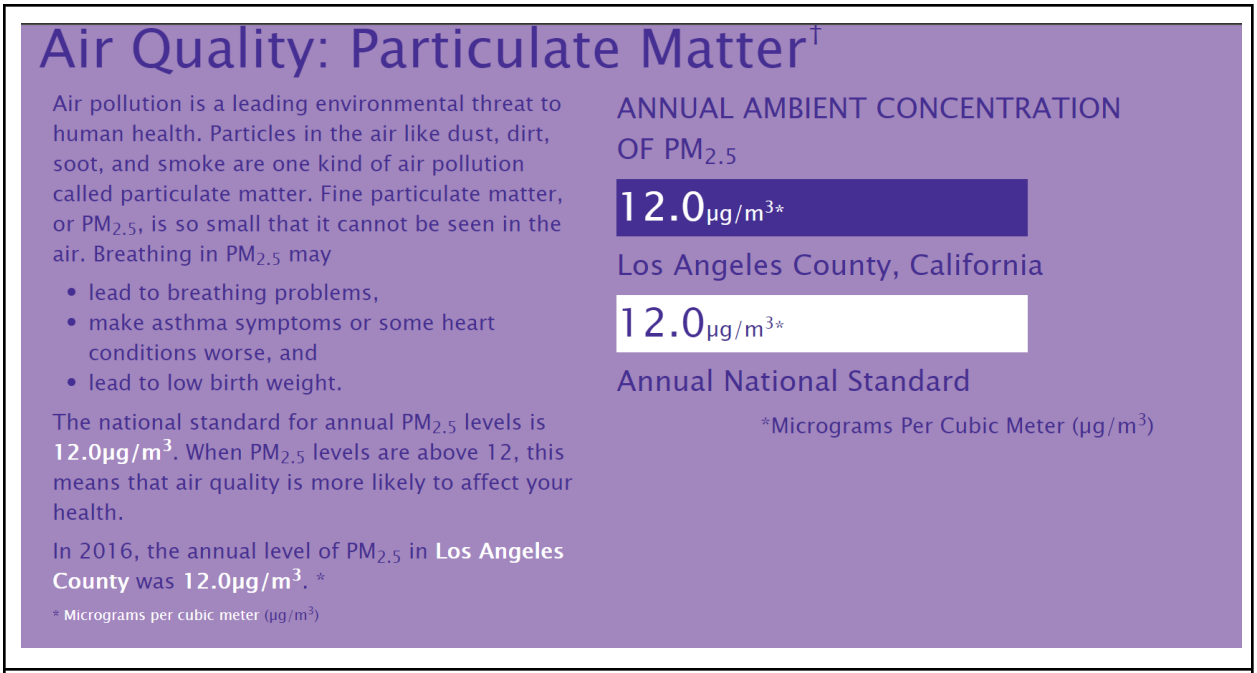


FIGURE 14:
This figure shows the annual ambient concentration of PM 2.5 in Los Angeles to be at the US National standard in 2016. This means that the air in Los Angeles is at the average and is somewhat safe enough to breathe. In combination with the increasing car traffic and new factories being built, we can see the annual ambient concentration of PM 2.5 to increase in the next several years decreasing the living condition in the Los Angeles area.
https://ephtracking.cdc.gov/showInfoByLocationExt/?&FIPS=06037 (Screenshot by Ryan Tran, November 3, 2021)

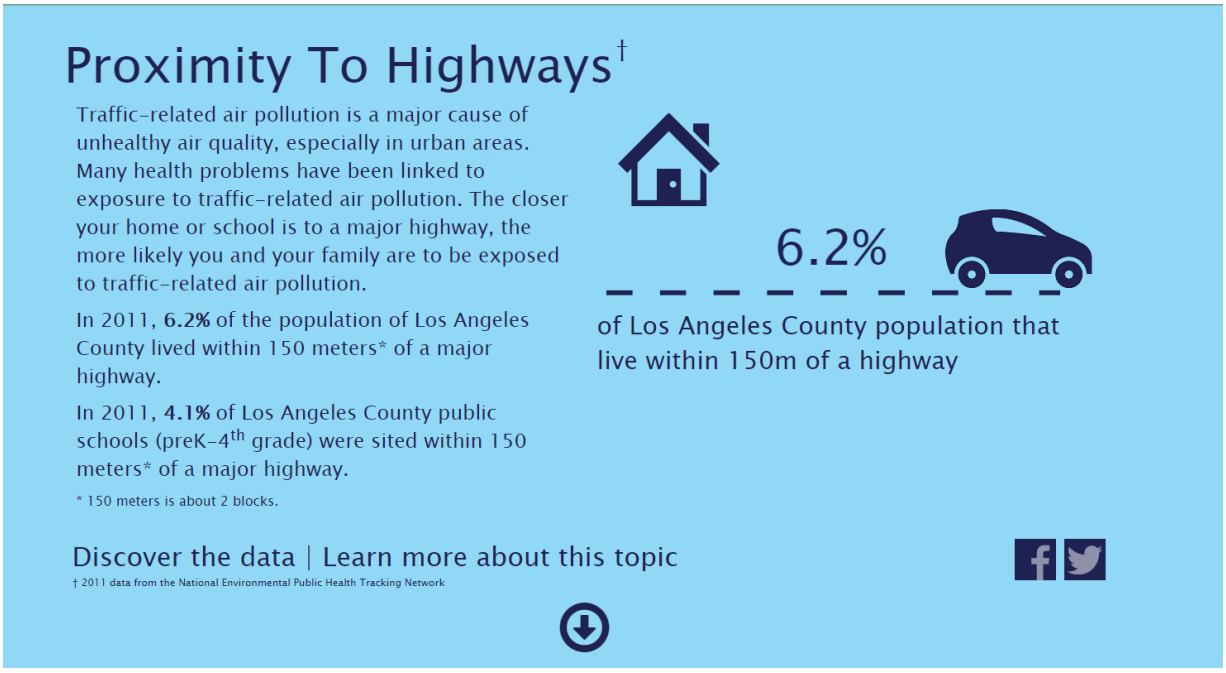


FIGURE 15:
This figure shows the schools and percentage of the population of Los Angeles County that are near a major highway. The number is higher than other counties because the county is urban.The US Center for Disease Control reports that traffic pollution has been linked to increased asthma, childhood cancer and cardiovascular disease
https://ephtracking.cdc.gov/showInfoByLocationExt/?&FIPS=06037
(Screenshot by Ryan Tran November 3, 2021)

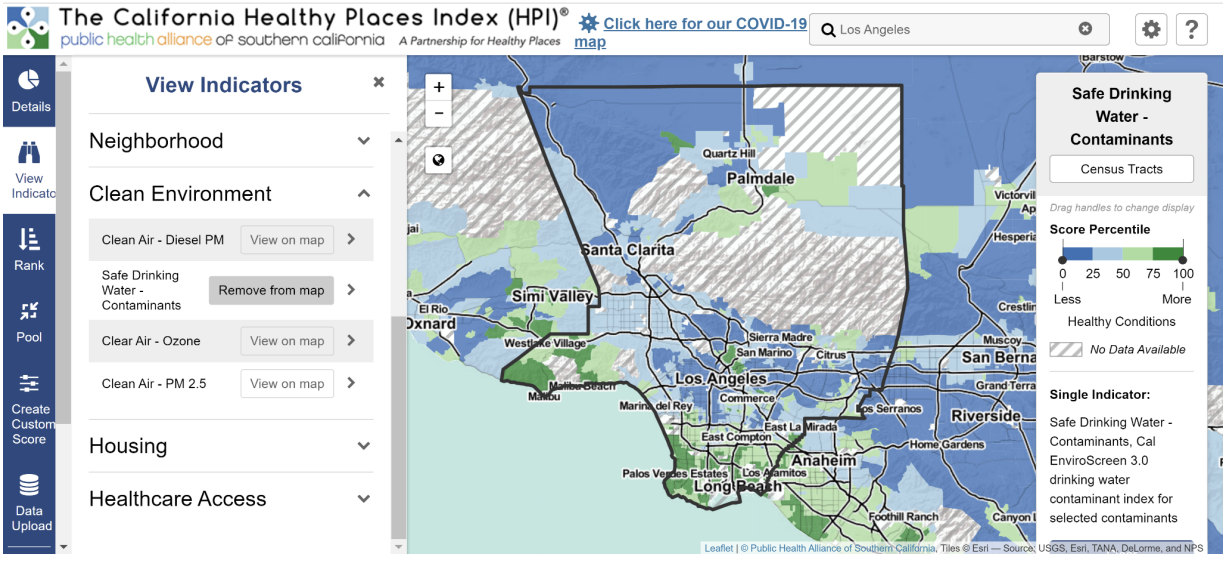


FIGURE 16:
In maps provided by the California Health Places Index, Los Angeles County has relatively low safe drinking water. However, according to the Los Angeles Tap Water Organization, they argue how the Los Angeles Department of Water and Power announces the city's tap water is so clean and it's bottled water quality. (Drew 2021) Most of the more healthy drinking water is found south and west of the county, while the rest of the county has unhealthier drinking water.
https://map.healthyplacesindex.org/(Screenshot by Michelle Serrano Tula October 27, 2021)

3. COMPOUND VULNERABILITIES

When Diversity Leads to Vulnerability

Bachhan Nguyenphan and Jonamie Ordonez

Social factors like poverty contribute to higher levels of lead in blood. Those that own older homes are at a greater risk to exposure. In addition, many landlords don't want to spend the money to fix up the houses they put up for rent, endangering those who are forced to rent because of a lack of affordable housing (Schenyer 2017). Poverty would be a social factor that would exacerbate vulnerability in Los Angeles County because it would limit educational and healthcare resources, along with opportunities to improve quality of life.

In addition, low income and communities of color are the ones most affected by these environmental hazards. In this instance, race would serve as a social factor because many black and hispanic demographics are often in communities that lack quality education, fresh produce, and other amenities that would otherwise be accessible in white affluent neighborhoods. Oftentimes, black and hispanic communities live in proximity to toxic waste sites, which only leads to more vulnerability. The article claims that "race is the most significant predictor of a person living near contaminated air, water, or soil, and people of color make up more than half of the population living near toxic waste sites...In Southeast Los Angeles – predominately a community of color – roughly 1/5 of its residents live

adjacent to noxious land uses" (Romann 2020).

Figure 20 illustrates the social factors – race and poverty – contributing to environmental health vulnerability and the correlation between population density and exposure to health risks as many parts of Los Angeles County, especially in Southeast LA, live in areas with the highest level of poverty. Keep in mind that many people living in cities with the highest level of poverty – Compton and Commerce for example – are minorities.

An article written by Neighborhood Data for Social Change highlights ecological factors that contribute to environmental vulnerabilities – particularly the lack of parks in Southeast LA, which is an area that is predominantly Latino. The article states, "While environmental factors such as air pollution impact health outcomes, other physical surroundings play a significant role in community health as well. For example, parks offer opportunities for fresh air and exercise, and can alleviate issues caused by pollution since trees help filter out atmospheric pollutants. Areas such as Southeast Los Angeles can be densely populated and access to recreational spaces are hard to find, especially in low-income areas. According to the 2016 LA County Park Needs Assessment, Los Angeles County on average has 1,000 people per 3.3 acres of park. While over half of Southeast Los Angeles residents (57%) live within half a mile walking distance of a park, Southeast Los Angeles had three times less recreational space than the rest of Los Angeles County with only 1 acre of park per 1,000 people in 2016" (Neighborhood Data for Social Change 2021). There is no coincidence that areas with low-income communities and communities of color would lack access to parks that would be helpful to alleviate air pollutants.

Political factors play a role as out of date protocols to manage waste in Los Angeles County have led to pollution across the county and updating such protocols would improve waste management procedures (Pfau 2021).

Figure 17 provides demographics and gives a score based on the opportunity, economy, education, community, and health compared to California, similar counties, and the US.

The scores for each category are slightly lower than the rest of California, however it still makes a huge difference when looking at how LA County differs from other counties.

Figure 18 highlights the lack of educational attainment in Los Angeles County since 57% of the population are Non-English speakers and only 32% have received a bachelor's degree or higher. Education can serve as a social factor that contributes to environmental health vulnerability because many of these residents will have limited resources or knowledge to protect themselves from slow disasters.

Figure 19 also communicates the education indicators, which point to an average reading and math capacity. This suggests that information about environmental hazards made available in this county may be difficult for some people to understand. Education indicators also point to a very high indicator of 12th graders who graduated high school on time which means many students are able to comprehend information about environmental hazards but do not have the resources to do so. Overall this suggests that education in this county is at a very medium level which means there is room for improvement for schools if they were to operate as community assets. *Figure 21* illustrates the Clean Air Act and how differences are from now and in 10 years, in the year 2030. With the implementation of the Clean Air Act, we could be saving thousands of lives each year. By 2030, the amount of avoided premature deaths would rise to 14,172 lives compared to 202 which avoided 10,710 lives. Although it may not seem like much, if this act is held throughout the 10 years, we can slowly start helping improve everyone's health, starting from babies.

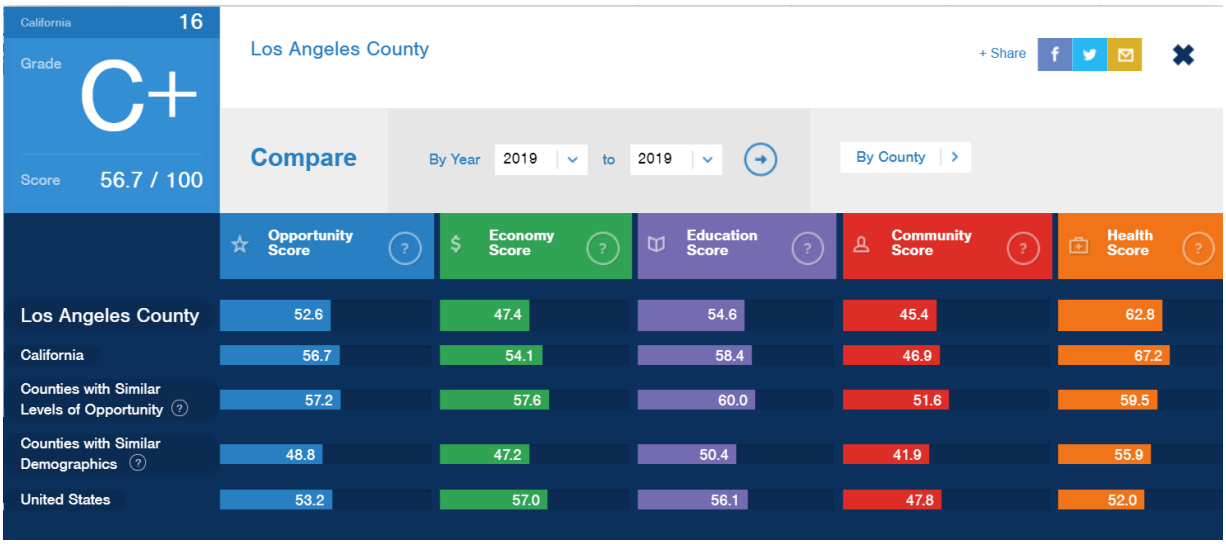


FIGURE 17: Los Angeles has a 56.7 opportunity index score. The state of California ranks 16 (out of 51) among US States for opportunity. The opportunity index provides a multidimensional view of opportunity by combining data on economics, education, community and health. The score for each of these is based on multiple indicators. The score for health, for example is based on low birth health, health insurance coverage and deaths due to suicide or alcohol/drug uses. Low birth rate has been linked to pollution exposures. There is a 62.8 health score for Los Angeles County which means it is at an average health score when compared to the rest of the counties in the United States. The opportunity index draws various US government data sets, including the US Census.

Los Angeles County Opportunity Index (Screenshot by Ryan Tran, November 1, 2021).

	2014 - 2018 ACS Estimates	Percent	MOE (±)
Population 25+ by Educational Attainment			
Total	6,845,489	100%	0
Less than 9th Grade	862,926	13%	6,687
9th - 12th Grade, No Diploma	597,792	9%	5,455
High School Graduate	1,416,482	21%	8,590
Some College, No Degree	1,790,808	26%	9,561
Associate Degree	476,265	7%	4,654
Bachelor's Degree or more	2,177,481	32%	9,699
Population Age 5+ Years by Ability to Speak English			
Total	9,473,307	100%	0
Speak only English	4,107,932	43%	12,902
Non-English at Home[1+2+3+4]	5,365,375	57%	11,720
[1]Speak English "very well"	3,098,743	33%	11,724
[2]Speak English "well"	969,608	10%	6,596
[3]Speak English "not well"	874,411	9%	6,615
[4]Speak English "not at all"	422,613	4%	5,418
[3+4]Speak English "less than well"	1,297,024	14%	8,551
[2+3+4]Speak English "less than very well"	2,266,632	24%	10,799
Linguistically Isolated Households*			
Total	426,291	100%	4,415
Speak Spanish	235,044	55%	3,339
Speak Other Indo-European Languages	55,318	13%	1,805
Speak Asian-Pacific Island Languages	128,321	30%	2,173
Speak Other Languages	7,608	2%	601
Households by Household Income			
Household Income Base	3,306,109	100%	5,533
< $15,000	361,072	11%	4,028
$15,000 - $25,000	296,864	9%	3,205
$25,000 - $50,000	668,478	20%	5,151
$50,000 - $75,000	534,611	16%	4,970
$75,000 +	1,445,084	44%	7,911

FIGURE 18: The following figure draws a correlation between educational attainment and health disparities due to environmental issues in Los Angeles County. 57% of the population in the county are Non-English speakers, which will limit one's ability to receive health treatment due to pollution, along with only 32% of the population receiving a Bachelor's Degree or more.

https://ejscreen.epa.gov/mapper/demogreportpdf.aspx?report=acs2018 (Screenshot by Bachhan Nguyenphan, October 25, 2021)

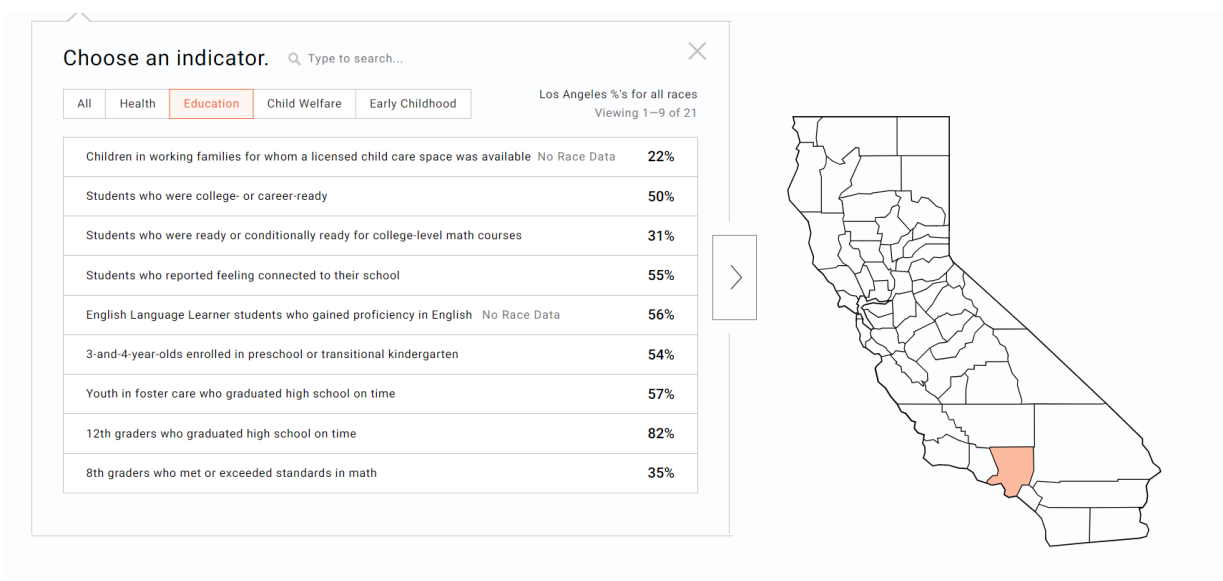


FIGURE 19: Data Visualization is drawn from the "2020-21 California County Scorecard of Children's Well-Being." Education indicators point to an average reading and math capacity, which suggests that information about environmental hazards made available in this country may be difficult for some people to understand. Education indicators also point to a very high indicator of 12th graders who graduated high school on time which means many students are able to comprehend information about environmental hazards but do not have the resources to do so. Overall this suggests that education in this county is at a very medium level which means there is room for improvement.for schools if they were to operate as community assets.

K-12 Education Indicators for Los Angeles County (Screenshot by Ryan Tran, November 1, 2021).

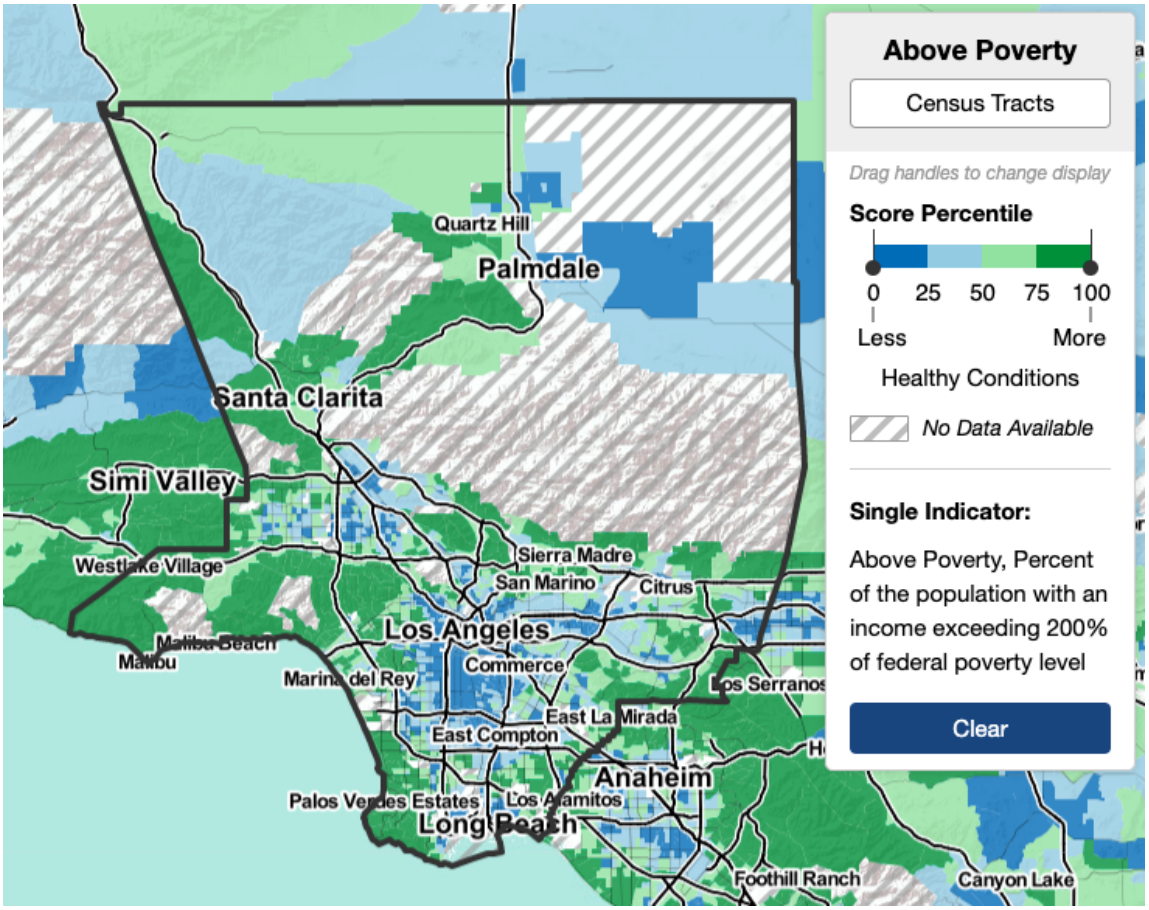


FIGURE 20: The California Health Places Index (HPI) shows different poverty levels throughout California counties. The dark blue on the map indicates the highest level of poverty while dark green indicates the lowest.

https://map.healthyplacesindex.org/ (Screenshot by Nelson Tran, October 27, 2021)

4. STAKEHOLDER ANALYSIS

Concerned Cities vs. Careless Companies

Chenhan Lyu & Nelson Tran

Lead poisoning is a very prevalent slow disaster that has been brewing in Los Angeles County for decades. In fact, more than 15,000 children have been identified to carry higher levels of lead in their blood than normal across the county (Schneyer 2019). Children affected by lead poisoning typically display several developmental issues such as trouble with reading and writing, lower attention spans, and lower IQ levels (Karlamangla 2019). Though many communities have been plagued by high levels of lead exposure, this section will focus specifically on stakeholders in the cities of San Marino and Vernon.

San Marino is known to be one of the most healthy and prosperous cities in Los Angeles County. Despite this, there are several pockets of poor communities existing in the city. More than seventeen percent of children in San Marino's neighborhoods have tested positive for high concentrations of lead in their blood, with the majority of these children residing in older homes. Many houses in Los Angeles County were built before the ban of lead-based paint in 1978. Over the years, the paint used in these houses have started to peel and chip. As paint starts to deteriorate, the lead in them gets exposed to the air. This makes young children crawling and playing around the house more susceptible to lead poisoning as the lead from the old paint settles into the floor and dust. Because low

income families typically cannot afford new housing, they are at a greater risk for high lead exposure while living in these old homes. As affordable housing becomes less abundant, landlords have also not been able to keep up with renovating more worn down apartments. This means low income renters also face the danger of lead poisoning when renting out old apartments. Unfortunately, many people subjected to these dangers are not able to do much about it. "California's current policy is to test children with known risk factors, including those enrolled in government assistance programs for the poor like Medicaid. The protocol, applied unevenly by healthcare providers, can miss poisoned kids'' (Schneyer 2019). The best these families can do is to test their children for lead in their blood at a young age, but many do not until it is too late.

To remedy this issue, Los Angeles County has funded a lead remediation project that began in 2020. The project was aimed to identify the most lead-vulnerable homes in the county to refurbish and repair them . This plan was funded by a $305 million settlement in a lawsuit against three paint companies: ConAgra, NL Industries, and Sherwin-Williams Co. These companies are more stakeholders in this issue. Los Angeles County sued the companies for producing and selling the lead-based paints that are affecting the many families across the county today. However, the companies never admitted their fault in this situation. They claimed that they were not aware of the risks of lead while manufacturing their products and that once the dangers were made aware to the public in 1978, they stopped producing lead-based paint. They also stated that they were not responsible for the chipping of their paint in old homes because it was the fault of homeowners for not providing proper upkeep of their residency. Through these claims, it is evident that the companies try to avoid responsibility for their actions and pin a part of the blame on citizens in the county. Since the end of the lawsuit, the money acquired is now being used to renovate thousands of homes in Los Angeles County in hopes of creating a safer environment for new families.

In contrast to the affluent city of San Marino, Vernon is an industrial city dominated by corrupt corporations and lead pollution. A notable slow disaster that occured in this city

was the Exide Technologies lead contamination case. The Exide company in Vernon is infamous for processing millions of lead batteries every year, exposing the city to a large amount of pollutants. They have created numerous health problems by exposing many neighborhoods, such as Boyle Heights, one of the primary stakeholders in this case, to high levels of lead. The residents of this Boyle Heights were noted to suffer from asthma, strokes, and cancer stemming from long-term lead pollution (Ribakoff 2019). Through testing children's teeth, it was found that lead poisoning in Vernon occurred very early in children, some even getting poisoned while still developing inside their mothers' wombs (Martin et al. 2019). Many residents have lost confidence that the pollution left behind by Exide will be cleaned up anytime soon. In addition, most residents believe that both the Department of Toxic Substance Control (DTSC) and Exide should be responsible for creating these issues.

Exide is one of the world's largest producers of lead-based batteries. Day to day plant operations include crushing used lead batteries while recycling the parts in them that are still serviceable. After being destroyed, most of the lead in the batteries are released into the atmosphere as pollutants. They know how lead pollution could cause health problems and they absolutely understand their plant operation. Because of this, Exide has received more than one hundred violations from the Department of Toxic Substances Control. The DTSC found that Exide discharged dangerous levels of lead and arsenic to the Vernon community and unsafely transported and disposed of toxic waste products. In 2015, the US Department of Justice and Exide reached a non-prosecution agreement in which Exide acknowledged its role as a major hazardous waste site and agreed to permanently close Vernon's battery recycling facility. At the same time, they also admitted to criminal acts, including illegal storage, disposal, shipment, and transportation of hazardous waste. Exide was also appointed to fully fund and lead the cleanup for their facilities to further compensate the community they harmed (United States Department of Justice 2015). However, since the case has ended, Exide has been repeatedly denying that they were responsible for the lead pollution crisis. They have pointed out that widespread lead-based paint pollution in the area is the real cause of the health disparities in Vernon.

Exide began avoiding responsibility in the Vernon lead disaster in order to evade mounting lawsuits as their profits plummeted. After years of dodging financial responsibility, Exide filed for bankruptcy in 2020, which freed the company from their obligations to fully repair and clean up the former lead-acid battery recycling plant in Vernon (Capital & Main 2020).

5. STAKEHOLDER ACTIONS

Slow Disaster Even Slower Response

Roberto Salazar & Nayeli A Carcamo

Slow disasters are sometimes difficult to monitor, which makes taking action against them more difficult. Residents around LA County affected by air, water, or chemical pollution may rely on researchers to help them figure out exactly what is causing so many health disparities in their communities. Researchers are the catalyst which help spring the community into action, telling them who is responsible and how to fight them. The companies responsible for slow disasters often use their ambiguity to try to prevent action against them and also to keep causing pollution in the areas they operate. The fight against these disasters always begins with discovering them.

Companies are always focused on their bottom line, sometimes to the point of putting others or even the planet at risk just so they can make more profit. One great example of this is how Exxonmobil knew of the effects of co2 on the atmosphere and tried to hide it so that they could continue burning fossil fuels. In LA County a similar action by paint companies led to the lead poisoning of Los Angeles children. As mentioned in an LA times article, “Santa Clara County Superior Court Judge James P. Kleinberg ruled that ConAgra, NL Industries and Sherwin-Williams created a ‘public nuisance’ by selling lead-based paint for decades before it was banned in 1978, finding them liable for exposing children to a

known poison (Barboza 2013)." These companies exposed people to lead based painting even though they knew that their health would suffer. When they find out of the damage that they are causing companies don't try to prevent it, or even stop, they try to hide it as much as they can. They often hire their own scientists to tell the government and communities being affected that their product has been found to be safe and in cases like Exxon act as advocates of climate justice so that the public forgets.

The main course of action taken by these companies when they are sued is to deny that they ever knew or that the science was not concrete at the time. In the article it is explained that, "The companies, however, argued that they never deliberately sold a hazardous product and relied on experts that did not determine the levels of lead in their paints were a public health problem until they were taken off the market in the 1970s (Barboza 2013)." The goal of Sherwin-Williams, ConAgra, and NL industries is to distance themselves as much as they can from the information. They said that they did not know of the effects of lead because others reviewed their paint, and that they took lead paint off the market when it was made illegal. Sherwin-Williams even appealed some of the suits in other states successfully. The affected families are supposed to get their homes fixed, but the damage that some of their children suffered is still there.

LA County took major action to remedy the issue by using these companies in 2000, which will give Los Angeles $605 million for lead inspections and lead abatement on the inside of walls (Barboza 2013). Suing is usually one of the best actions taken by stakeholders because it can give them the resources they need to amend an environmental injustice, or prevent one from happening. Usually when groups bring attention to an issue they want the government to take direct action like the LA County did. Still, the reason why slow disasters can be so devastating is that even if the company polluting stops it can take years to take care of the problem, and the money may not be enough.

While LA County sued Sherwin and ConAgra, it should have done more to protect its residents. As mentioned by Schneyer, “In the decades it took the local governments to prevail, tens of thousands more children in California have been exposed to dangerous levels of lead, state public health data shows (Schneyer 2019).” There are multiple ways to tackle an issue. LA County could have mobilized departments such as the South Coast Air Quality Management District which is supposed to focus on regulating stationary sources of air pollution, which includes lead painting that can chip off. Solely focusing on the lawsuit while giving little support to the families affected worsened the situation and has caused harm to even more children. Mismanagement of the situation is why organizations putting pressure and showing data to the local government in affected areas is necessary.

Slow disasters like water and soil pollution can take years to recover from. One of the best assets a community can have to fight slow disasters are organizations who can help them when the government won’t. When wastewater pits made by Chevron were leaking and contaminating bodies of water such as the California Aqueduct, groups like Physicians, Scientists, and Engineers for Healthy Energy studied the effects of the contamination in wastewater pits near the Los Angeles aqueduct. The group explained that, “About 1.7 kilometers northwest of the facility, chloride and salt levels are more than six times and four times greater than background levels, respectively. The research leaves little doubt: The contaminants are migrating toward the aqueduct (Sadasivam 2021).” Chevron said it was complying with state regulations, but that is why the data is so important. The information shows that the state regulations are not enough, and that if a big enough leak happened, then the water of Los Angeles residents and of crops around the area would be contaminated. These wastewater pits already cause problems by just contaminating the soil and the water around them, but their potential for bigger disaster is there. The group also mentioned that, “The definition of groundwater that is “too salty” for use varies across California… For unlined wastewater pits, however, that threshold has been set at 3,000 mg/L. The inconsistency allows oil and gas companies to pollute potential sources of groundwater (Sadasivam 2021).” In a legal fight evidence is everything, just like LA County

sued Sherwin-Williams, if people want to sue Chevron for polluting the water they will need to show them the limitations of current restrictions. This data shows that wastewater pits are being allowed to pollute water by federal regulations.

Linking disasters with the company that caused them is the best way to hold these shareholders accountable. Without enough data the communities affected by air and water pollution would have no way of stopping them, and the government would not put new regulations or change old ones.

6. ROLE OF MEDIA AND BIG ENVIRONMENTAL ORGANIZATIONS

Dim Spotlight?

Christina Jiang

Because Los Angeles is a relatively well known place within the US and around the world, there is no shortage of news regarding LA. However, when it comes to the general reports that come out of LA, news and media outlets prefer the glamour and glitz. But that is not to say the media does not focus on environmental justice either. In fact, the Los Angeles Times does a good job on reporting the various events regarding environmental injustice. In their environmental injustice segment Boiling Point, various authors report on "the latest news about rising temperatures, public lands, water, clean energy and more" (Roth 2021). Over the years, LA Times Boiling Point has been in the forefront of media coverage in environmental issues and has done a good job covering topics in its Climate & Environmental section. The articles are always of high quality, complete with pictures, figures, and statistics backed up by studies. The articles highlight important, concerning issues in a concise manner that is easily digestible and relevant to the general public, such as the "microplastics, bisphenol A (BPA), per- and polyfluoroalkyl substances (PFAS) and other toxics so unnatural they don't seem to ever go away" (Xia 2020). Not so long ago,

“from 1947 to 1982, the nation’s largest manufacturer of DDT — a pesticide so powerful that it poisoned birds and fish — was based in Los Angeles” (Xia 2020). The companies got rid of DDT by dumping them into “sewage pipes that poured into the ocean,” but unfortunately at the time, “all the DDT that was barged out to sea drew comparatively little attention” (Xia 2020). Fortunately in the present future, the expansion of technology and media is able to bring more awareness to these issues than ever before.

There are also various environmental groups that focus on environmental justice as a whole or focus on a certain sector of it. Prominent environmental groups include Earthjustice, Greenpeace, Sierra Club, and Earthworks. These groups all have chapters stationed in Los Angeles and are active in reporting on LA. Earthjustice is a law firm that works towards environmental change starting with the law. They are a non-profit that represents their clients for free. Previously known as the Sierra Club Legal Defense Fund, they have been fighting for environmental justice since 1971. In 1972, they “helped establish the right of citizens to sue for environmental damages” (Fox 2014). Most importantly, in 2008, they won a court case that helped limit greenhouse gas emissions, which was “the first Supreme Court case to ever address the issue of climate change” (Fox 2014). In 2016, they helped petition for southern LA against drilling oil near communities. Earthjustice hits the nail on the head: “The point is that certain communities seem to merit a level of protection or response when dirty fossil fuels negatively impact them—while others do not. As a matter of law and equity, the city should provide the same protections for every community in Los Angeles” (Meszaros 2020). The Sierra Club was originally founded to preserve the Sierra Nevada mountains. They aim to strengthen national environmental policies and support clean energy resources. Earthworks is a nonprofit organization dedicated to clean air, water and land, healthy communities, and corporate accountability. Earthworks is the merge of two organizations: the Mineral Policy Center and the Oil & Gas Accountability Project. The Mineral Policy Center was founded to help reform mining laws and practices. The Oil & Gas Accountability Project to protect the people in rural, tribal and urban communities.

The wiki has a brief paragraph describing environmental issues. It mainly focuses on air pollution only, with a small nod towards oil drilling. Due to “geography, heavy reliance on automobiles, and the Los Angeles/Long Beach port complex, Los Angeles suffers from air pollution in the form of smog” (Wikipedia 2021). LA’s rate of particulate matter is much greater than other cities, and the type produced “from vehicles in the city can get as high as 55 percent” (Wikipedia 2021). Environmental problems are not talked about in the talk section of Wikipedia. There is only one edit mentioning the fact that LA’s particulate matter 2.5 is greater than the average PM 2.5 in the US.

Overall, coverage of LA pollution is extensive, but that may also be due to its popularity. LA has the advantage of fame to bring awareness to its issues, however it is unfortunately up to its people to fight against the environmental injustices brought upon by larger corporations, and sometimes, it isn’t enough.

7. RECOMMENDED LOCAL ACTIONS

Saving our Environment, One Action at a Time

Stephanie Le and Jonamie Ordonez

In LA county, there are many environmental vulnerabilities and injustices such as stormwater and air pollution and sea levels rising. Air pollution due to oil rigs have contributed to many problems as it contributes to climate change and worse health for residents in Wilmington, a city in LA. Residents are especially vulnerable in L.A. County, where there is an oil rig, Inglewood Oil Field. Many are faced with health problems as oil rigs and wells as it “releases hazardous air pollutants like benzene, hydrogen sulfide, particulate matter and formaldehyde" (Newburger 2021). Pollution from oil rigs is linked with people having asthma, cancer and other respiratory problems. Educating disadvantaged communities is one of the most efficient ways for change. It will educate communities who were previously unaware about environmental hazards such as air pollution, earthquake and wildfire safety protocols. It will also let communities know health hazards leading to protesting and activism like STAND- L.A. for government change. With the increased pollution, residents are becoming more educated with advocacy groups such as STAND - L.A. and are working to protest against oil refineries being built in residential areas. Due to the advocacy, L.A. County supervisors voted to phase out oil and gas drilling and ban new drill sites in the unincorporated areas and protect the health and safety of people.

Stormwater pollution impacts many however not much is being done to fix due to the lack of awareness on it. The most important local action is educating residents and making people self aware of pollution problems as that will eventually lead to activism and change. Heal the Bay is a non profit organization and finds ways to improve water quality in LA. They are demanding transparency from the government about the health hazards and more policies to help storm water pollution. As local rivers, creeks and oceans are polluted more needs to be done from the government. Heal the Bay strongly encourages people in Los Angeles County to “safely document photos and videos of trashed waterways and beaches, clogged storm drains, and stormwater pollution in LA County after it rains” (Moe 2019). This is one way we can help to manage runoff pollution following storms and help tackle the environmental threats this issue poses.

NBC Los Angeles warns people to not swim in the beaches however not everyone is aware and is aware about the health hazards. LA has many beaches that residents and tourists like to visit. However, LA's storm drainage system is the "single greatest source of pollutants in local rivers, lakes and the ocean" (Levin 2019). The local government should educate all residents about water and storm pollution to know what actions everyone should do. The second most important action to take is to have stronger regulation such as banning certain chemical containment should be enforced to protect the oceans and people. Become stricter to fining people who litter and have a higher fine to discourage people from littering. Another important action LA county should take is that the local government should be more transparent about sharing data about pollution. These actions should be taken as residents should have a right to know their environmental problems. Making local governments be transparent about pollution and its data will educate the residents and ultimately lead to action from the residents for change. Runoff is a problems as chemical contaminants, animal waste, etc goes into the ocean having stronger regulations and stricter fines will ultimately help runoff problem

Sea level rising is a slow disaster and the cause of sea level rising is climate change which

raises the overall temperature to a small degree however we are already seeing catastrophic impacts. With the increased global temperatures, glaciers and ice sheets will begin melting, leading to negative and costly impacts to LA county as it is a coastal county. Flooding will occur as advancing seas and waves will cause flooding impacting buildings and natural resources. Another impact of sea levels rising is waves going further up shore leading to eroding sand away from beaches and coastal cliff walls meaning that housing near beaches will be at risk. Lastly, rising groundwater means higher ocean waters and will lead to ocean water getting in our fresh groundwater supplies. Many coastal communities are vulnerable as they face the risk of higher frequent flooding and damage from erosion. In order to reduce the environmental vulnerability and injustice, the last most important action to take is that the local government should implement local planning and adaptation projects for sea level rising and better infrastructure plans to mitigate and adapt to sea level impacts. Taking this action will better protect coastal communities and prevent costly infrastructure disasters. There are many impacts to these slow disasters, like the increase of pollution and climate change. There needs to be both local and extra local actions that need to be taken to adapt and mitigate in order to protect everyone.

Even high schoolers can help with the right programs and interests. Students who are interested in environmental hazards and advocacy, focusing on industrial agriculture should have a program that expands these interests. A proposal for a program that would be really helpful would be a program called Go Green. Some activities that this program can do is taking care of a vegetable garden, raising some animals, and planting trees. Through this program, we can educate more students on how their city affects nearby agriculture, engage in activities that can help to lessen their burden on the climate, and help to conserve water efficiently and understand how much water is put into agriculture. Some ways to promote this is through social media, demonstrations, short videos, advocating and advertising by word of mouth. As this program grows, creating blogs of the struggles and benefits of what the students are doing, giving out the vegetables that the

students grow, and partaking in farmer's markets will help to educate everyone else on how important this program is and will be for everyone else.

8. RECOMMENDED EXTRA-LOCAL ACTIONS

Extra Actions for Extra Protection

Joshua Levering, Wendy Bullard, and Wilson Su

One of the most important actions taken is to address the quality of the air in low income and other marginalized communities. Approximately 93.1% of black individuals (non hispanic) in California are introduced and have been, " exposed to 8 or more micrograms per cubic meter of PM 2.5. (Esri 2020)." That is why extra-local legislation should be a major priority to prevent long term health effects. The Clean Air Act, which was originally enacted in 1970 by the Environmental Protection Agency and has since been amended several times, seeks to limit the emissions of greenhouse gases such as carbon dioxide and methane through multiple avenues. This includes direct pollution prevention to prevent companies from emitting harmful gasses, education and research in mitigating damage from air pollution, and economic incentives (such as emissions caps, emissions trading, and emissions credits) to use market forces to promote greener practices (US EPA OAR, 2015). Solutions like these will greatly improve the well being of many individuals, especially those of Los Angeles County, as seen in *Figure 21*.

Though it may be a bit less feasible, another important action to take in Los Angeles County is to set a minimum distance between industry and the populace. Many schools,

residential areas, and playgrounds within Los Angeles are often close to hazardous industrial sites, which are known to be heavy pollutants and often cause lasting health effects for vulnerable individuals. However, a state bill introduced named AB 345: Natural Resources may help. This bill mandates a minimum distance between oil and gas industrial centers and vulnerable areas, such as residential areas and playgrants. Additionally, it will create a state-mandated local program as a violation of the distances will be a crime (Muratsuchi 2019). By forcing companies to move hazardous sites away from vulnerable areas, this bill could save the lives of many people from dire health issues. Though it may be difficult to move large companies or dense populations, it will ultimately result in a healthier Los Angeles County.

Additionally, cleaning up water sources such as stormwater is very important to sustaining the health of Los Angeles County. Stormwater from rain is commonly deposited into natural water sources like the ocean. If that stormwater carries pollutants, that runoff will pollute anything it comes into contact with. When it enters the ocean, it will not only harm the local marine ecosystem, but if people ingest fish caught in these waters, the accumulated toxins will harm them in turn. The 2020 renewal of the MS4 stormwater permit helped regulate stormwater discharge. The permit was issued to the Los Angeles region in 1990 and was most recently renewed in 2012, when the latest stormwater requirements were set. But according to Heal the Bay, environmental groups have said that the existing permit is too lax to force major water quality improvements and fear that a renewed permit will be even weaker" (Shalby 2019). In addition, "new funding to improve stormwater quality, which will be allocated throughout Los Angeles County in 2020 from Measure W — also known as the Safe, Clean Water Program — could assist in cleanup efforts. Measure W is expected to bring in $300 million in annual parcel-tax revenue, which will be used to improve water quality and increase stormwater capture. Heal the Bay endorsed the measure in 2018" (Shalby 2019. Taking care of waste properly is one of the pillars of environmental justice. If Measure W could pass, then water would hopefully be cleaner and safer for the county and the environment.

Lastly, with proper official government oversight, these plans could not only come to fruition, but in the case of a slow disaster in the future, these cases can be properly mitigated. In response to the Exide toxic waste leakage in 2013, L.A. County Supervisor Hilda Solis urged Gov. Jerry Brown to appoint an independent expert to oversee the cleanup and to establish a commission to investigate what went wrong at Exide and who is responsible (Brug 2015). As scientific experts have insight that many government officials are not aware of, appointing experts would have helped to mitigate the damages of future incidents and may help prevent incidents from happening in the future. In addition, scientific experts are able to help on large scale projects like the ones we just described. Thus, appointing an environmental sciences expert to oversee environmental health is an important extra-local action to take.

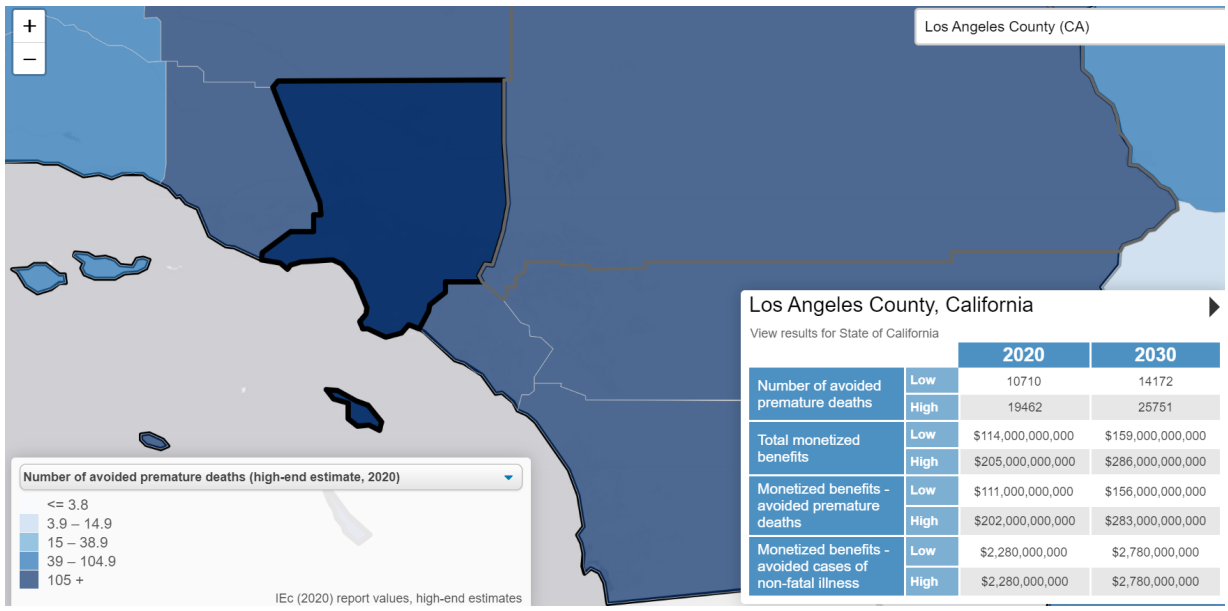


FIGURE 21:
The Clean Air Act (CAA) is the federal law designed to control air quality and pollution in which state based programs develop plans to meet air quality standards. With the Clean Air Act, Los Angeles is regulating and reducing their fossil fuel usage as it is the main cause of air pollution.
https://www.nrdc.org/resources/clean-air-acts-benefits-map. (Screenshot by Stephanie Le, October 27,2021)

9. RECOMMENDATIONS FOR FUTURE RESEARCH

Our Missions

Yicheng Ding & Joshua Levering

In Los Angeles County there are many sources for pollution that slowly builds up and contributes to long-term health problems within its communities. By researching and understanding these problems, as well as identifying and addressing vulnerable groups and communities at risk, it becomes more possible to help mitigate or even eliminate these problems in similar settings (NCCOS 2020). Pollution from industry has been known to pollute the ground and release small, harmful particles into the air. Living within close proximity to highways has been proven to have several negative impacts on health due to emissions from heavy truck and automobile traffic. Storm water runoff directly enters our waterways and oceans, carrying toxins from herbicides or oil, harming the local environment and economy, as well as causing flooding. Communities should be aware of what threats to public health exist around them. Continued research relating to these topics can prove to be useful in addressing and finding solutions to environmental issues.

Collecting data about health disparities and particulate emissions and its effects on people living nearby highways is important to understanding and working through similar issues. South Los Angeles has several transportation corridors where residents live within close proximity to this infrastructure and therefore suffer from corresponding health

issues, especially along the I-710, 405, and 110 highways as they see heavy logistics transportation traffic. In Southern California, 1.2 million people live along the highway systems, most of whom live within 500 feet of a highway, and this figure is growing annually (Caprara 2019). Data collection and researching the effects of such pollution from noise, exhaust, oil, or tires on respiratory health conditions in neighborhoods within close proximity to highways is important to maintaining health as well as leading to further research on how these emissions can be reduced. Furthermore, experiments can be run to estimate the health effects in a scenario where mostly electric cars and trucks are used as opposed to gasoline-powered vehicles. Researching emissions and health disparities can be used to address environmental threats and sources of issues in other settings.

Cars, ships, and industrial facilities all have one thing in common when it comes to environmental pollution — they emit great amounts of chemical pollutants such as lead and carbon monoxide. These accumulated pollutants can affect human health in many different ways. In order to solve it from the root cause, the chemical composition of the fuel used in the facility should be modified. Therefore, new energy which is totally green can provide a direction for future research. Solar energy, one of the new energy sources of concern in recent years, helps to combat greenhouse gas emissions and the reduction of our collectives on fossil fuels. (New Energy Equity 2017) The disadvantage of solar energy is the power generation efficiency because solar power only produces .5% of the total energy of the consumption. (Rentar 2018) If the future research of solar material that can convert all consumed energy can come through, then solar power which is totally green will finally join our lives. The popularity of solar applications led by successful future research can reduce the prices of solar-powered cars so there will be no exhaust pipes on the car in the future. When vehicles using gasoline as fuel are slowly phased out, the reduced emissions will gradually solve the air pollution issues. To make it even more significant, the government could introduce policies in the future to help spread new energy vehicles. For example, providing highway fast lanes for new energy vehicles would result in a large association for drivers, operators, and truck brokers to invest in

zero-emission trucks if they can have extra time by having a dedicated lane. (Fonseca 2019)

On the other hand, one of the other great causes of air pollution problems in Los Angeles County is wildfires caused by dry weather. Vehicle emission is far less harmful than the forest fires smoke because wildfire emissions generate larger aerosols than those produced by vehicles—up to 0.4 micrometers (urn) in diameter compared with less than 0.15 um. (Potera 2009) Smoke from combustion can cause serious lung disease when it is blown into residential areas so "differences in health effects from different wildfire fuel types or combustion phases (burning versus flaming)" is a perfect future health research topic. (U.S. EPA 2017) Residents around forest fires may inhale toxic gases released by thousands of combustibles in forests because fires exist by oxygen and oxygen is everywhere. The perimeter of the 2018 Woolsey Fire in Los Angeles shows that almost none of this landscape has escaped burning. (Keeley and Syphard 2019) To solve the difficulties of air pollution treatment caused by a variety of comburent, this future study could be used as an important medical reference. For example, certain drugs used during rescue may have an allergic reaction when combined with unknown combustion ingredients. In fact, when doctors analyze the condition in conjunction with research reports and medical records, the risk of medical errors will drop dramatically.

There are, unfortunately, areas in our research we found lacking in sufficient data to determine the true effects of an issue, type of pollution, or facility on the communities within Los Angeles County. In some cases, we truly *don't* know what is hurting us due to the lack of transparency in data presentation. One area which lacks data transparency is the Concentrated Animal Feeding Operations, known as CAFO. According to the National Resource Defense Council, California, along with forty other states, has low transparency when it comes to any kind of data about these operations (see *Figure 22*). The EPA, which is in charge of regulating these operations through the Clean Water Act, lacks even the most basic information about CAFO data. This includes the names and locations of these facilities, the permit status, the number of livestock in the facility, or even the type of

animal (NRDC 2019). Without this data presented in a transparent manner, it becomes very difficult to truly understand what is impacting our communities, to monitor emissions, and enforce regulations. We do know that CAFOs contribute to significant air and water pollution, providing serious health threats such as asthma or bronchitis due to fumes, nitrates, and polluted runoff that drains into waterways. Access to transparent data is crucial to addressing problems and finding solutions. Transparent qualitative data collection and research studies can help bridge the gap where data is missing, allowing communities to understand what health risks they face, and establishing pathways for new regulations, technologies, or policies to address issues head on.

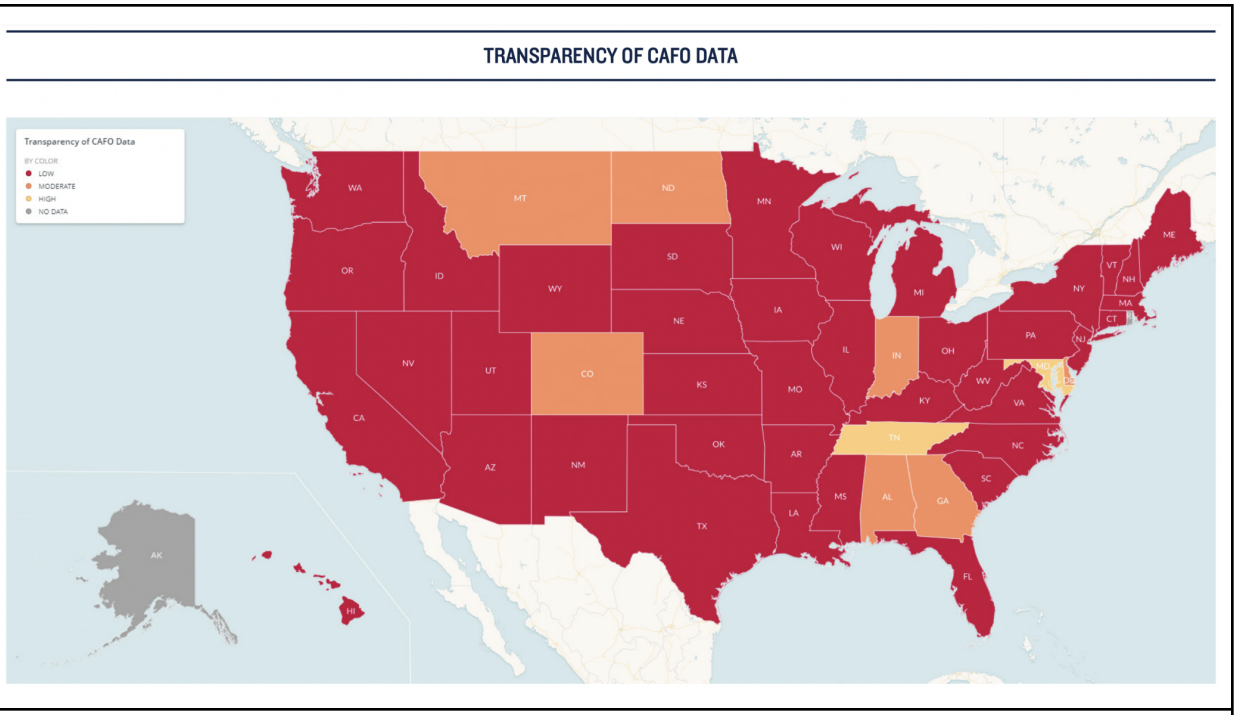


FIGURE 22:
We are feeling frustrated that only nine of the 50 states in the United States have relatively transparent CAFO data. CAFO, or Concentrated Animal Feeding Operation, can cause severe respiratory diseases in the surrounding residents, but the relevant research data is not transparent enough. There is even no relevant data in some weeks. https://www.nrdc.org/resources/cafos-what-we-dont-know-hurting-us
(Screenshot by Yicheng Ding 2021)

The reasons for the enormous health impact of slow disasters on people are not one-sided. In addition to future pollution and health research, a qualitative study is also suggested for humans to reflect on the connection between environmental and health hazards and social problems. However, there are some areas where we lack data to present a qualitative study, which shows why this recommended research is important in understanding impacts on public health. The qualitative study can focus on the following question: “When developers are introducing a new house to the customer, is the avoidance of pollution problems caused by social aspects like the customer's income and skin color?” Because of the involvement of social problems, the research subjects for the study must be conditioned by choice. To make the final research results objective, participants must be chosen from random communities and various incomes. The study should first be conducted mainly in the form of online surveys. For privacy protection purposes, not only is it important to choose a trusted questionnaire creation platform, but investigators also must clearly state on the answer page that all data will be protected. Researchers should ask about the intention of joining the focus groups in the survey so they can only invite those who are willing to participate. In addition, participant observations can be used in the verification of polluted communities. Observers are recommended to participate in some heavily polluted areas that frequently be discussed online. This is because the observer can make the authenticity of the actual pollution amount to make up for the lack of authenticity of the surveys. It also gives observers the opportunity to make friends with focus group interviewers in advance by increasing social trust.

When designing the survey, researchers would start questioning broad topics before narrowing it down to the specific aspects relating to pollution. Some qualitative survey questions could be, for example, “What do you look for when you consider purchasing a property? What type of development are you considering? Single-family homes, duplexes, multi-family homes or buildings, higher density development? What about a property’s location do you look for? Is pollution something that would affect your decision on

purchasing a property? Are you aware of what sources of pollution affect your own neighborhood or the one you are looking at? If so, do you know what health risks these sources pose to your community?" After that, more relevant topics like "Has the developer or salesperson ever mentioned the pollution problems located in your area?" or " Have you ever asked the developer or salesperson about the environmental pollution and health rate?" could be discussed. Once the results are collected, the researchers can begin to organize some focus groups for in-depth research. In focus groups, researchers can allow residents of different communities to exchange views and knowledge on local pollution. At the same time, residents can show others the recall of the process of the deal at that time, as well as the words spoken by developers. Researchers can extract from the discussion results whether the developer is biased in introducing the house by not mentioning any pollution problems.

If the results are positive, then all research data in this study can be handed over to the state government law department. The government can use these data to issue laws and policies that force all developers to directly talk about pollution issues with their customers during the sales process. In addition, community residents' self-protection awareness data on slow disasters can help education departments improve basic education. Environmental protection should be one of the important subjects in primary school and high school.

10. INJUSTICE ANALYSIS

The Silent But Cumulatively Deadly Factors of Environmental Injustice

Michelle Serrano Tula, Emily Rivera

In slow disasters, environmental justice becomes hard to pursue, since the problems that permeate society tend to become invisible and go unnoticed, and the affected populations are unjustly burdened with the repercussions of pollution. In Los Angeles County, there are many intersecting injustices that contribute to environmental injustice, with the biggest intersecting injustices being racial injustice, economic injustice, health injustice, and infrastructure injustice.

Racial injustice is a very prominent intersecting environmental injustice in Los Angeles County, and it is primarily seen with communities of color being disproportionately affected by pollution. As stated in an article, "on average, African Americans and Latinos breathe in about 40 percent more particulate matter from cars, trucks and buses than white Californians, according to the study by the Union of Concerned Scientists. Asians are exposed to about 20 percent more pollution" (Boyd-Barrett 2021). This demonstrates that African Americans, Asians, and Latinos are disproportionately affected by air pollution, that environmental injustice is affecting this disadvantaged group. Moreover, the same article also noted that "households earning less than $20,000 a year and people who don't own cars suffer vehicle pollution levels about 20 percent higher than the state average, the findings show" (Boyd-Barrett 2021). This shows that the less wealthy

individuals tend to be more burdened by daily pollutants, hinting to economic injustice in this setting. Low-income and minority groups tend to suffer the repercussions of pollution. Unfortunately, when these injustices intersect the group becomes even more vulnerable as a group that is both a minority group and a less wealthy group suffers the greatest negative effects from long-term exposure to pollutants.

In addition to the racial and economic injustices that exist within environmental injustice, there is also another intersecting injustice that stems from the previous injustices: infrastructure injustice in the county of Los Angeles. Zoning in urban communities like Los Angeles can be disadvantageous as many low-income and people of color are often designated to less desirable locations and vulnerable to environmental hazards. For example, "Zoning has even been used to restrict new fast food establishments in low-income, racially segregated areas. But low-density residential zoning further affects both the viability of alternatives to the automobile and the likelihood that low-income people will live in areas with unhealthy food options" (Lens 2021). Moreover, "Black, Asian and Latino Californians are more likely to live in these hotter areas, in part because of a history of discriminatory redlining policies that excluded them from real estate investment, and environmental racism that targeted their neighborhoods for industrial facilities and freeways instead of parks and green space... During heat waves, indoor temperatures can build to levels higher than outdoors and persist well into the night as buildings slowly radiate the heat they've absorbed. People living in older, less insulated homes are at higher risk from extreme heat, especially if they lack air conditioning or can't afford to run it" (Barboza 2013). This highlights the unfair zone planning for minority groups, alluding to the infrastructure injustice that stems from the systemic racism, since zone planning for these demographics rarely take into account the health risks that might rise from lack of better zone planning, and as a result of the poor city planning, the residents are disproportionately affected by health risks that would otherwise be minimized or not exist at all if good infrastructures existed in these communities.

These injustices culminate in the health injustices within Los Angeles County. As stated in an article by the Neighborhood Data for Social Change, "Research shows that a high pollution score correlates with poorer community health outcomes, such as cardiovascular disease, asthma, and childhood obesity, making Southeast Los Angeles residents especially vulnerable to these conditions," and "Latino/a populations in Los Angeles County have been found to be particularly susceptible to obesity. Roughly half (52%) of all students attending schools in Southeast Los Angeles neighborhoods experienced childhood obesity in 2018, compared to the average of Los Angeles County students at 37%" (Neighborhood Data for Social Change 2021). This disproportionate susceptibility to diseases is no coincidence, because of greater exposure to pollution due to racist policies and poor zone planning, minority groups are found to be more likely to obtain a disease. As it was stated in another article, "Greater air pollution, lacking access to healthy food options either because they are too expensive or too far away, and not being insured – what healthcare professionals call the "social determinants of health" – cause or exacerbate underlying medical conditions. Those underlying conditions, in turn, can trim years off a person's life" (Munguia 2021). These intersecting injustices are disproportionately affecting our most vulnerable populations. Due to racial injustices that make opportunities for minority groups, economic injustices and infrastructure injustices exist, which culminate to create a health injustice that creates health disparities between different racial groups. And these issues are particularly hard to fix because it implies correcting issues at the systemic level.

It is too evident that action towards fixing these injustices needs to be taken. And the first step towards fixing a problem is recognizing that a problem exists. After this, we need to take deliberate actions to fight against systemic racism, so that racial environmental injustices and other intersecting injustices begin to be addressed.

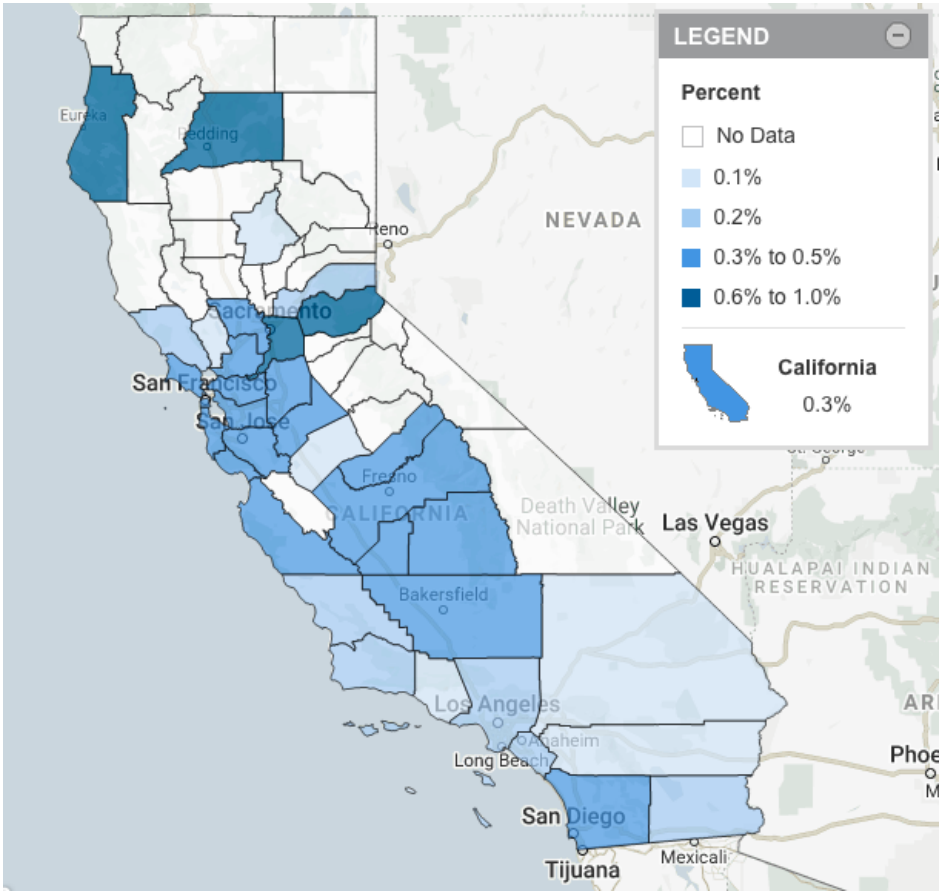


FIGURE 23:
According to data from 2018, 0.2% of kids ages 0 to 5 in Los Angeles County have elevated blood lead levels (9.5 milligrams per deciliter or higher). A 2020 study by Case Western Reserve University found that adults who were exposed to high levels of lead during their childhood tended to be behind in educational benchmarks. In addition, those children grew up to be more likely to be dependent on public systems (Bamforth 2020). To combat this, a new law was passed in California that required schools to test for lead in their water (Savidge 2018).
https://www.kidsdata.org/topic/529/blood-lead-level/map#loct=3&fmt=706&tf=108&ch=484,1474&center=-13278625.180196,4516369.3471634&zoom=1 (Screenshot by Nelson Tran, October 28, 2021)

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FIGURES

COVER IMAGE