Air Quality and Environmental Justice in Salt Lake County

Lessons Learned from Researching Local Pollution through NASA and the University of Utah

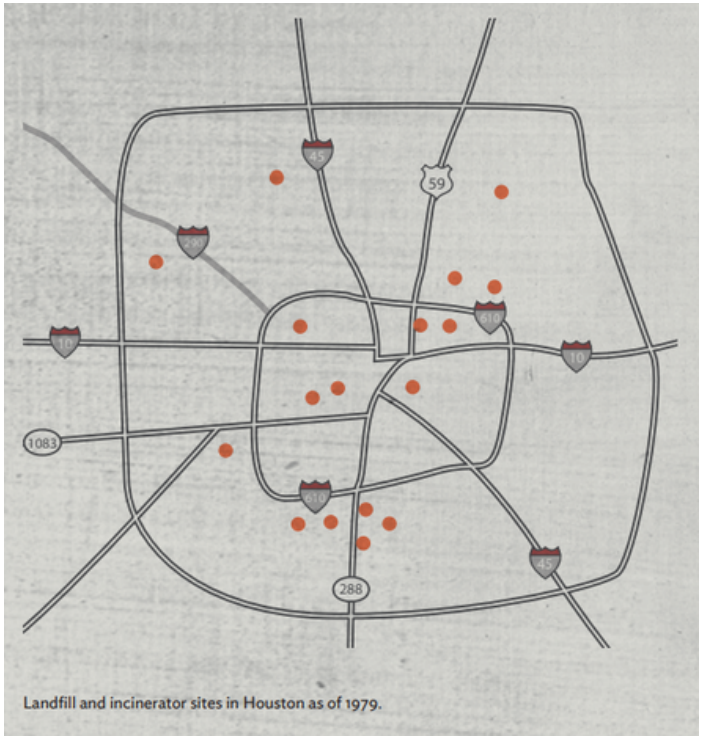
Presented by Piper Christian

A Bit About Me!

- Born and raised in Logan, Utah
- Graduated from the University of Utah in 2022
- Currently working for the NASA DEVELOP Program
- Interested in how mapping can be used to better understand and address environmental injustice

Dr. Robert Bullard: Mapping EJ

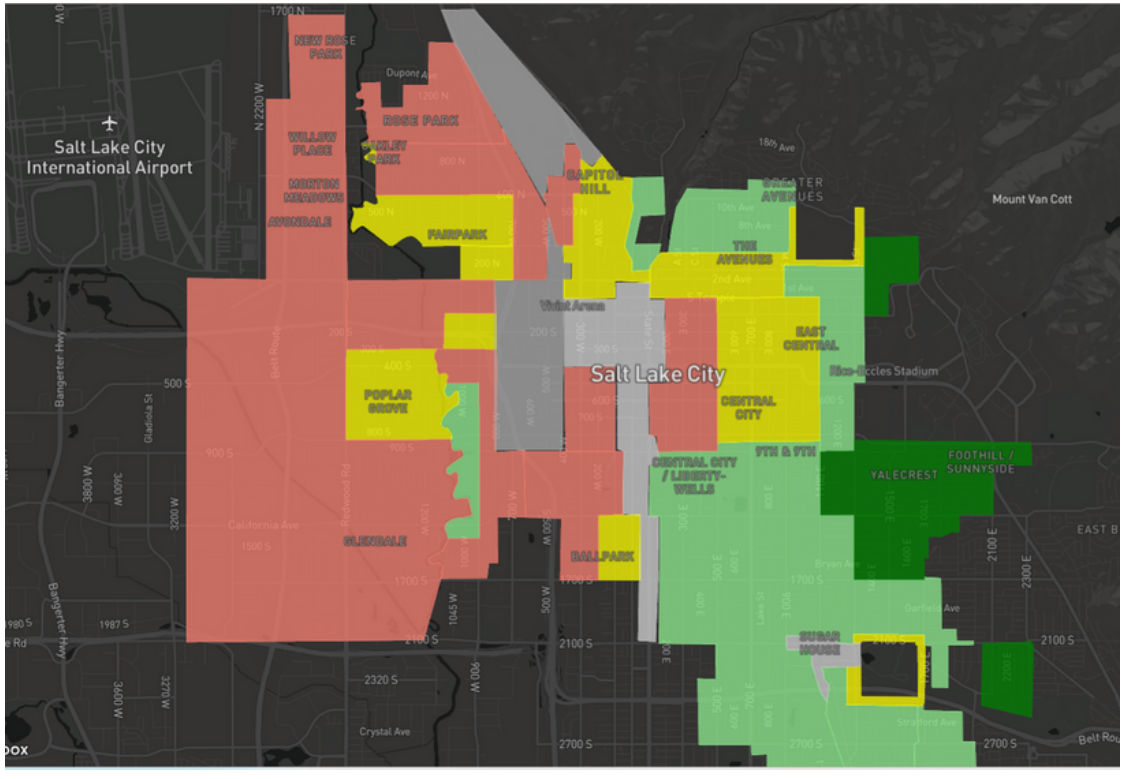
- Filed a lawsuit in 1978 against a company that was planning to put a landfill in a Black middle-class community
- Five out of five landfills in Houston were located in Black neighborhoods, and six out of eight incinerators were in Black neighborhoods
- First lawsuit using civil rights law to challenge environmental discrimination



Landfill and incinerator sites in Houston as of 1979.

History of Redlining in Salt Lake City

- Mortgage owners like the HOLC rated neighborhoods on spectrum from "desirable" to "hazardous"
- Used as a tool for segregation
- Legacies still present today

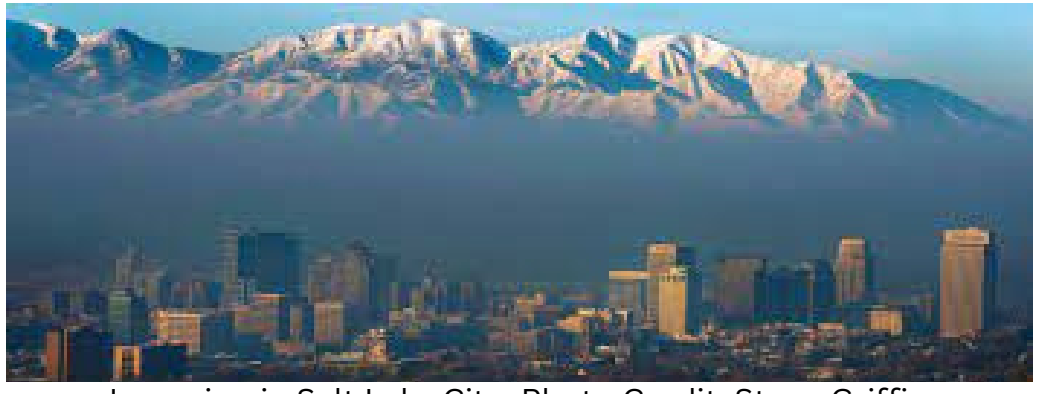


Inequitable Distribution of Pollution Exposure in Salt Lake County

- Variety of point-source pollutants on the Salt Lake City's Westside
- "Schools with higher proportions of racial/ethnic minority students were unequally exposed under all PM2.5 pollution scenarios, reflecting the robustness of racial/ethnic disparities in exposure” (Grineski et. al, 2020)

Pollution Exposure within Salt Lake County Broadly

- Utah typically experiences "18 days with high PM2.5 levels exceeding the National Ambient Air Quality Standards" (UDEQ, 2021)
- Wintertime inversions linked to increased asthma Emergency Department visits (Beard et. al., 2012)
- Wildfire smoke and airborne dust present additional health hazards in Utah (Schoennagel et.al., 2017), (Flavelle and Tarnowski, 2022)



Inversion in Salt Lake City, Photo Credit: Steve Griffin

Declining Levels at the Great Salt Lake

- Over 50% of the lakebed, or "playa" exposed as of November 2022
- While lake levels have risen, insufficient to curb dust emissions, and may not be maintained long-term
- Eastern Great Basin experiences seasonal dust storms
- Storms may grow in frequency and intensity
- Trace metal dust content that is deposited along the Wasatch Front has exceeded EPA regulatory limits (Putman et al., 2022)
- Regardless of pollution content, dust is health harming

Pollutants of Concern

- PM2.5 pollution is a serious health concern worldwide
- Associated with eye, nose, throat and lung irritation, asthma attacks, acute or chronic bronchitis, heart and lung deterioration
- Ground-Level Ozone can damage the tissue of the respiratory tract, cause inflammation and irritation, and worsen asthma symptoms

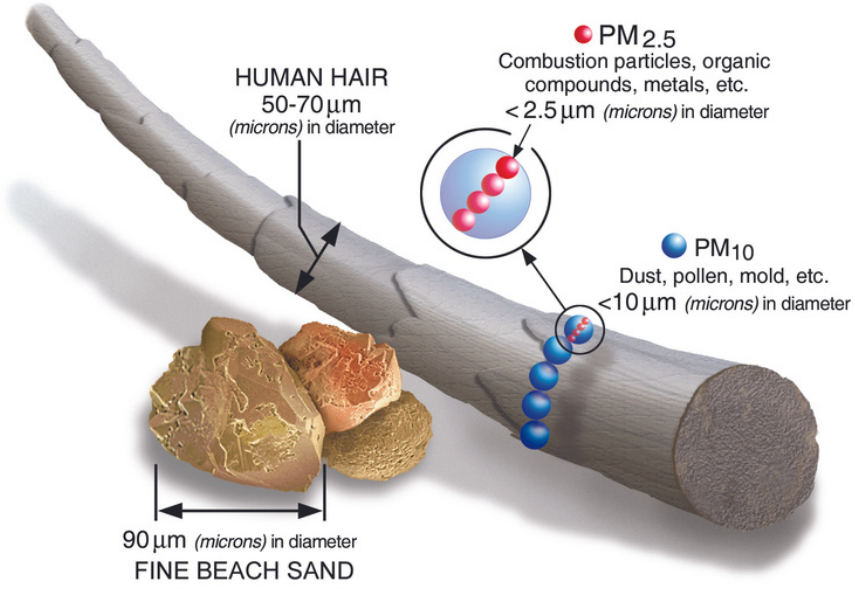


Diagram of Particulate Matter
Photo Credit: EPA

Great Salt Lake Health and Air Quality

Monitoring Lakebed Exposure and its Impact on Air Quality and Environmental Hazards in the Great Salt Lake Watershed

NASA DEVELOP Program

- "We work with communities and organizations to address environmental and policy concerns through the practical application of NASA Earth science information
- 10-week research projects in interdisciplinary teams of 4-5 people
- Our research teams work with end-users, which include federal agencies, state and local governments, non-profits, for-profits and others
- Participants assess how Earth observation data can inform decisions and actions" (DEVELOP, 2023)

Project Partners

State Government

- Utah Department of Environmental Quality, Division of Air Quality
- Utah Department of Natural Resources, Division of Forestry, Fires, and State Lands

Academic

- Westminster College, Great Salt Lake Institute
- Dust^2

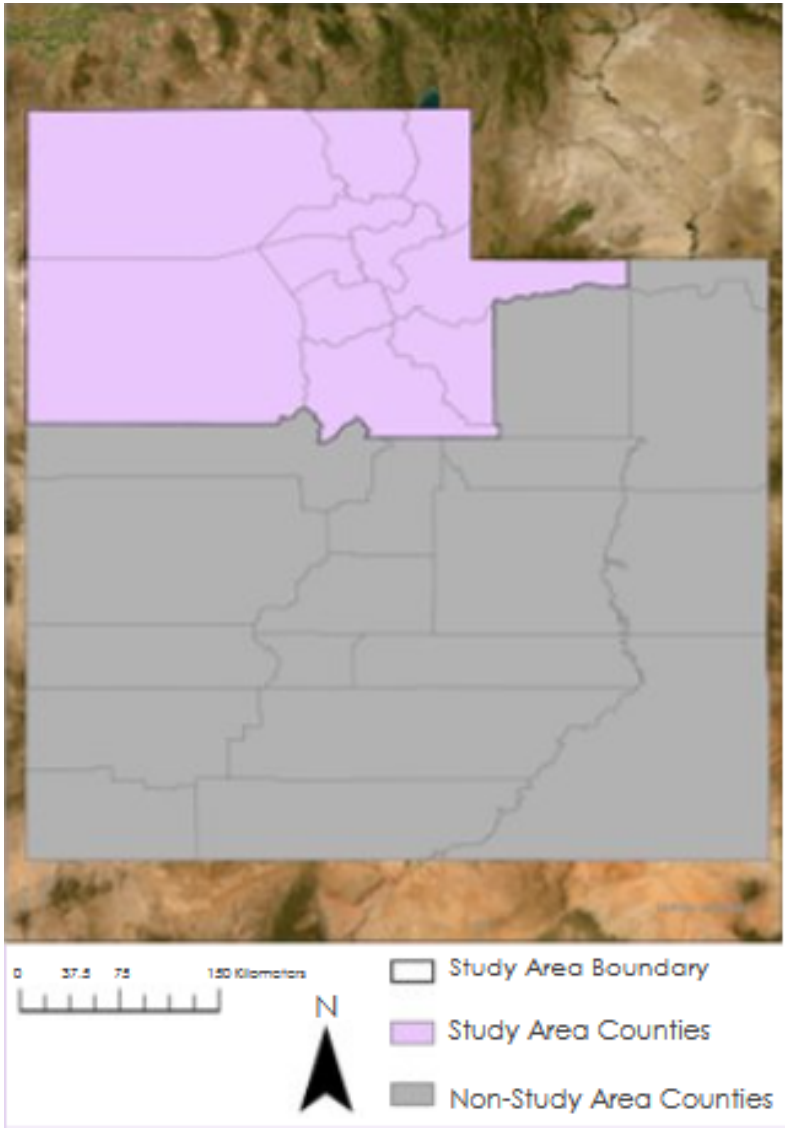
Non-Profit

- Great Salt Lake Coalition
- Utah Physicians for Healthy Environment

Local Organization

- Westside Coalition

Study Area and Period



Great Salt Lake (GSL), Utah, USA

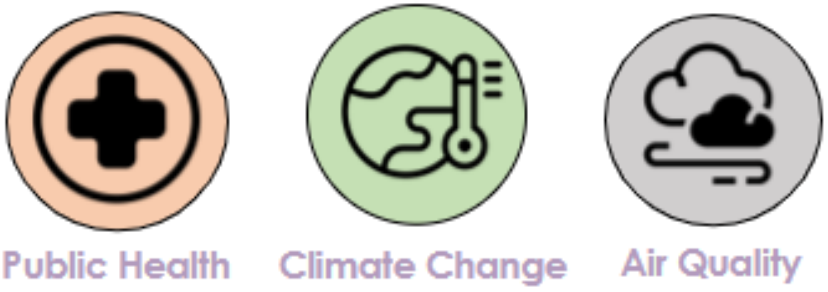
Target Counties

- Box Elder*, Cache, Rich, Weber, Tooele*, Davis*, Morgan, Salt Lake*, Summit, Utah, and Wasatch Counties

Population: 2.5M

2010-2022

Community Concerns



Redlining

- Legacy of redlining results in inequitable pollution exposure

Industrial Air Pollution

- Multiple point-source pollutants impact those near GSL

Great Salt Lake Dust

- GSL dust may exacerbate existing environmental health disparities

Objectives

Map regional dust & air quality indices

Map regional dust & air quality vulnerability

Understand the relationship between lakebed exposure & AQ

Produce impactful visual & storytelling materials

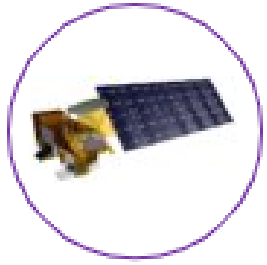
Earth Observations

Landsat 5, 7, 8

OLI/TIRS (JRC)
Lake Surface Area (SA)

Terra

MODIS
Aerosol Optical Depth (AOD)

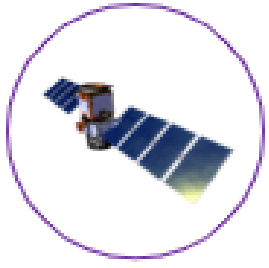


Aqua

MODIS
Aerosol Optical Depth (AOD)

Sentinel-5

TROPOMI
Nitrogen Dioxide (NO2)
Formaldehyde (HCHO)
Carbon Monoxide (CO)

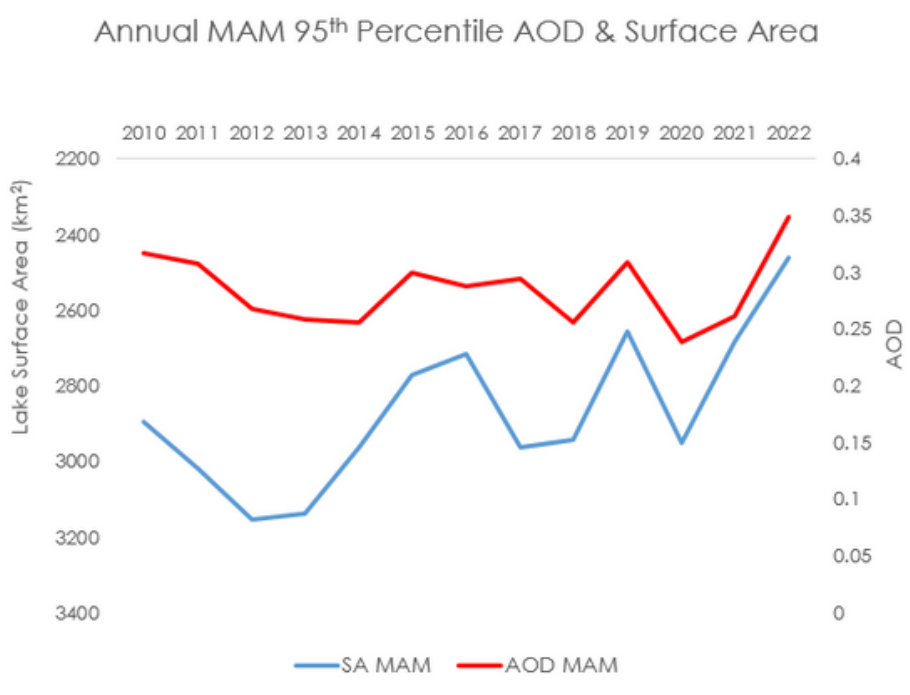


CALIPSO

CALIOP
Aerosol Type/Height

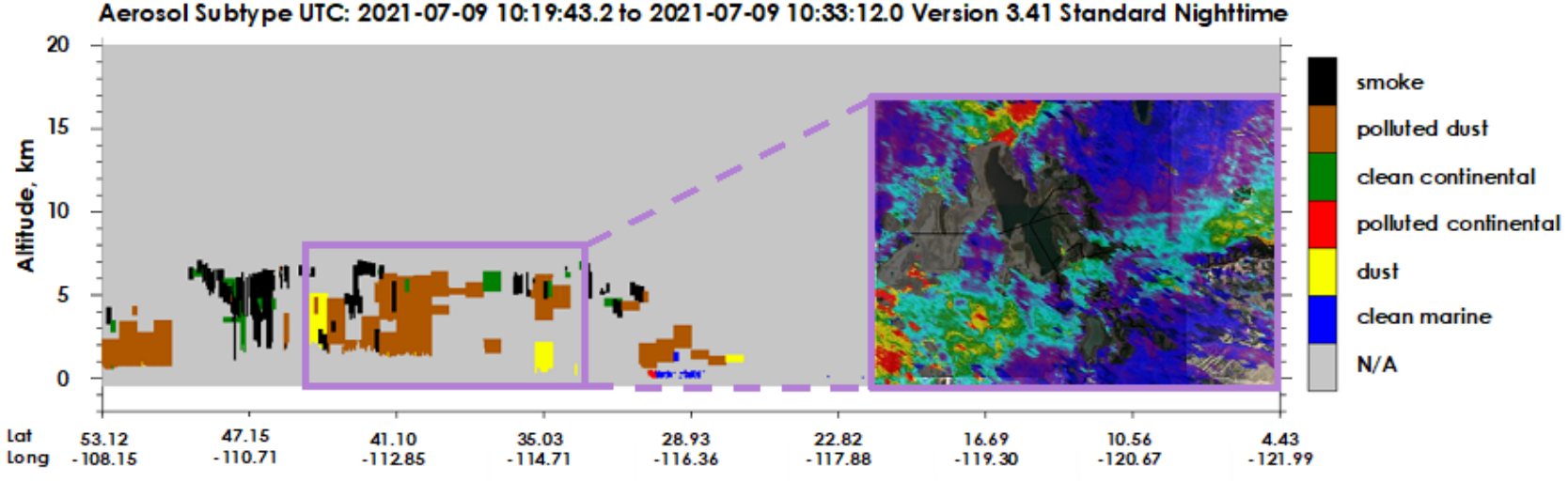
Finding 1: Dust and the GSL

- We found an inverse relationship (R2 =0.3423) between lake surface area and dust levels
- In other words, as the lake shrinks, the dust is getting worse



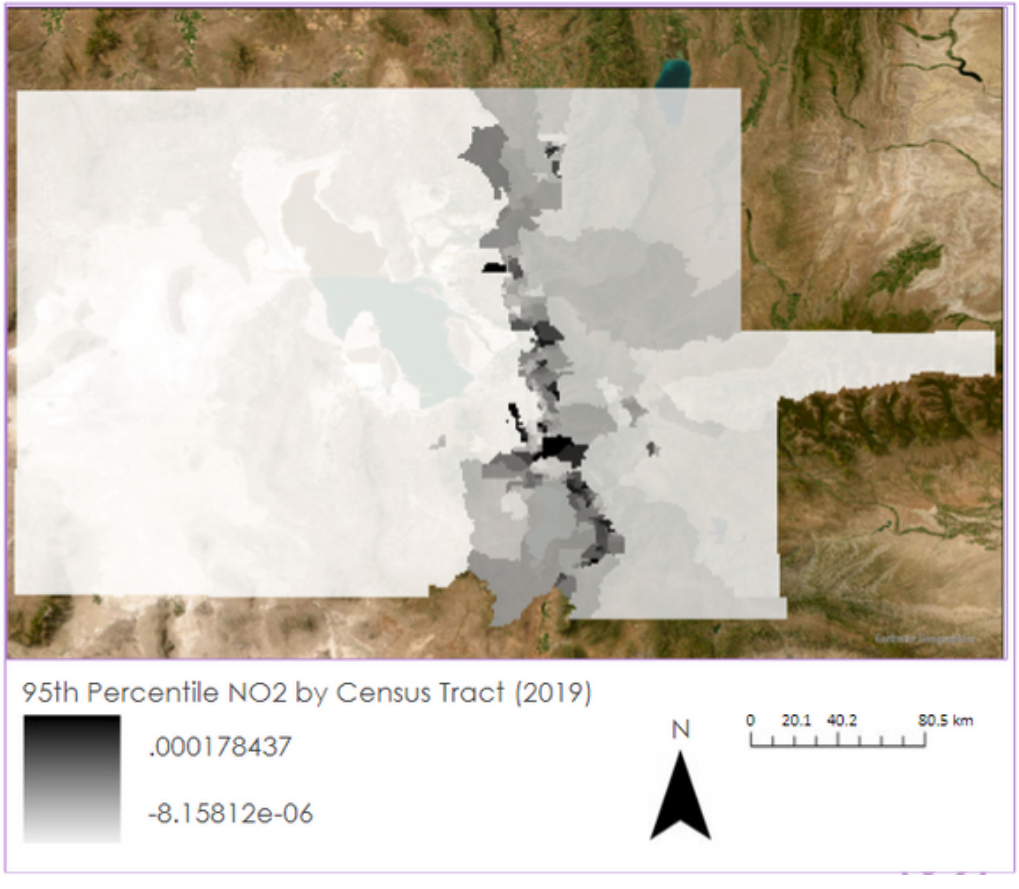
Finding 2: Aerosol Type and Height

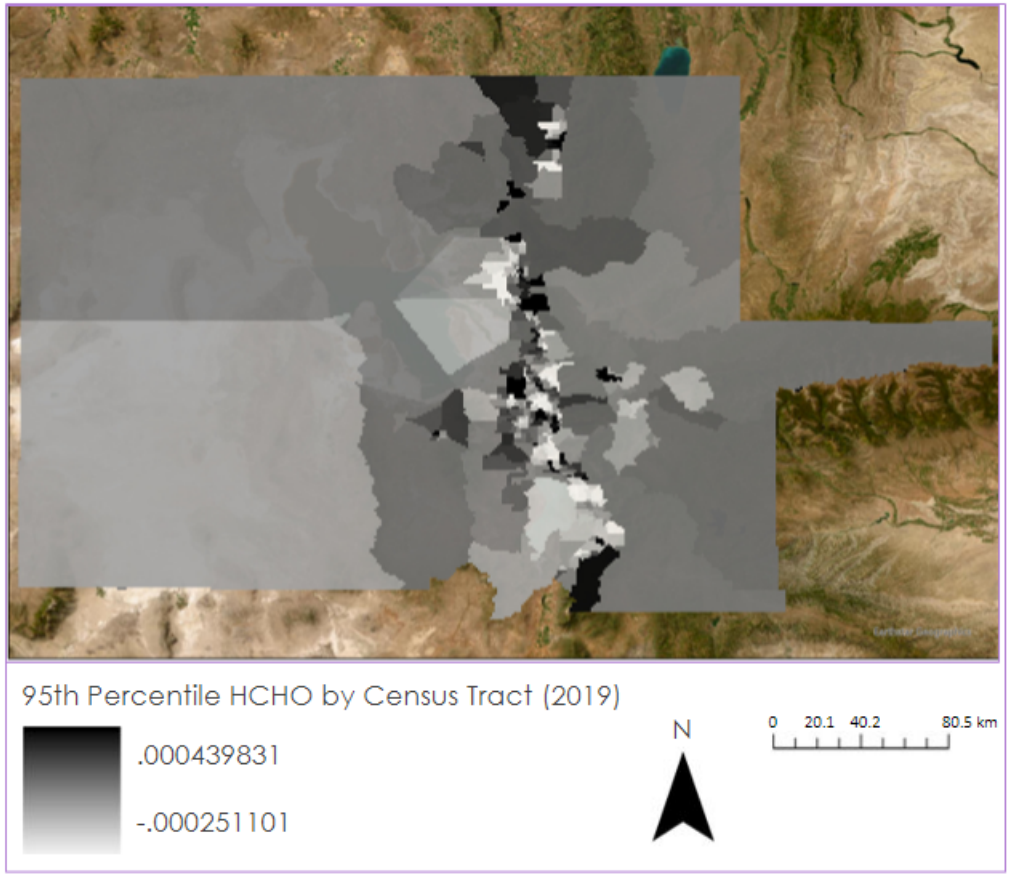
- Certain dust events demonstrated an aerosol subtype primarily composed of polluted dust
- Pollution located near the surface in the troposphere, which poses a potential public health hazard



Finding 3: Distribution of HCHO and NO2 Across Northern Utah

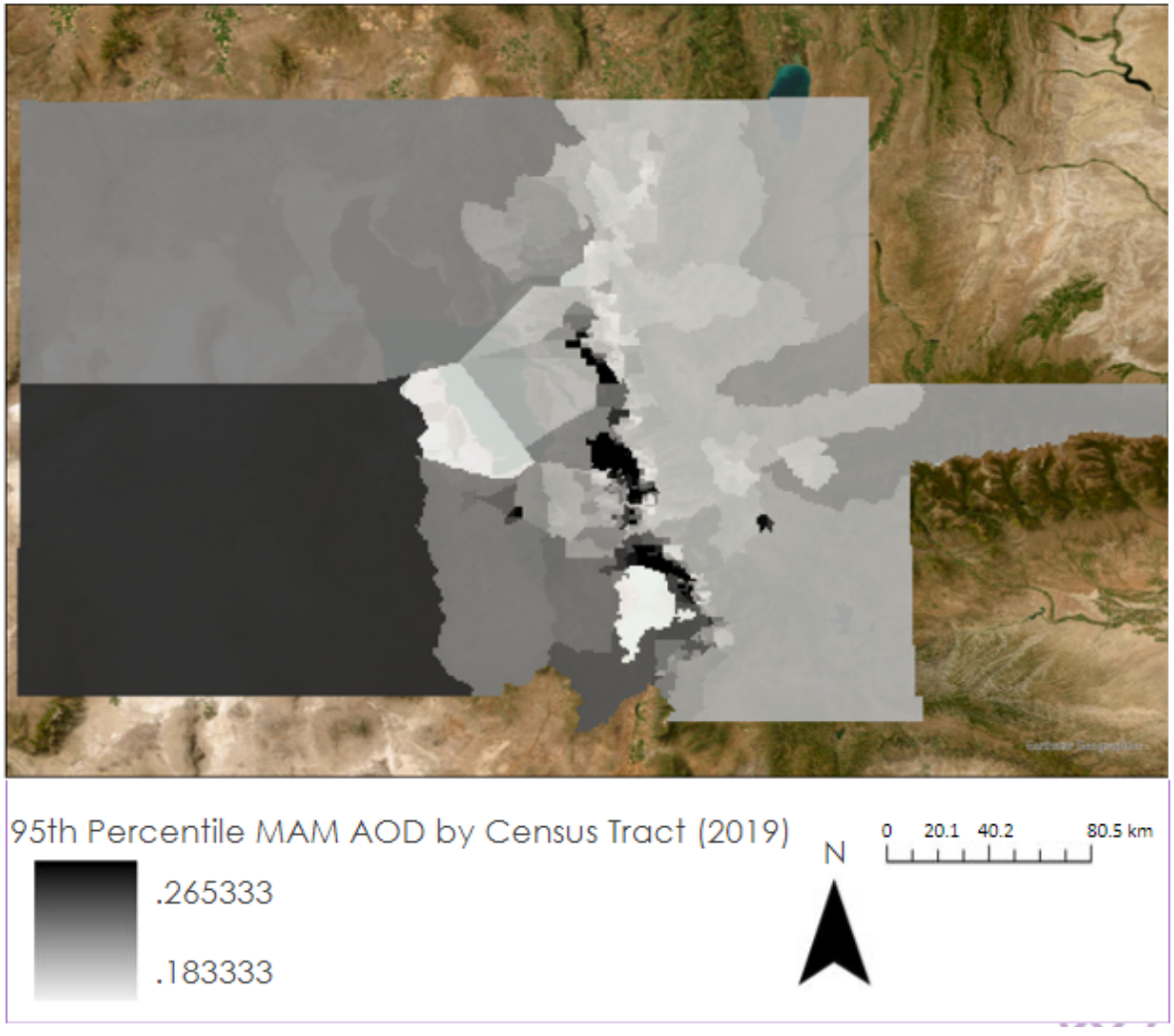
- High HCHO and NO2 along the I-15 corridor
- In other words, risk of elevated ground level ozone for those living near the interstate





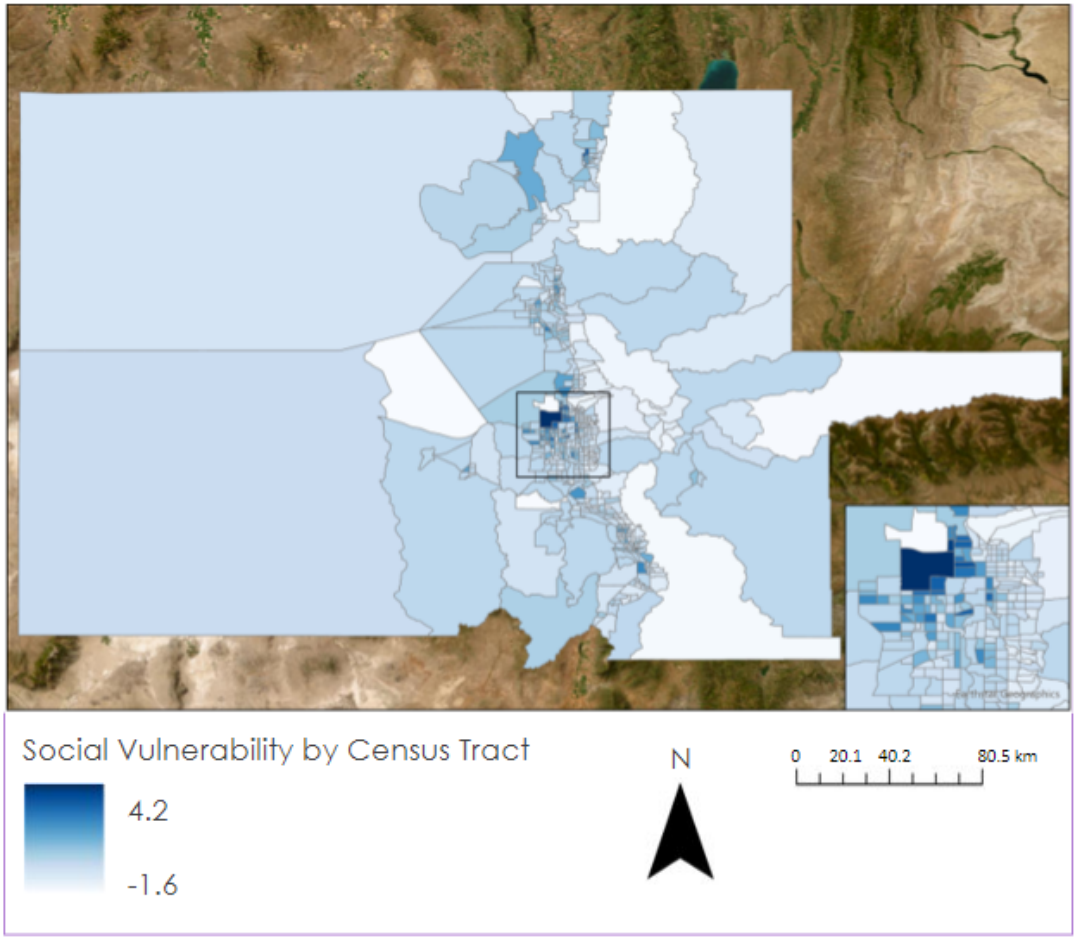
Finding 4: Distribution of Dust Across Northern Utah

- Toelle County and I-15 corridor worst impacted regions



Finding 5: Social Vulnerability Across Northern Utah

- Informed by partner feedback
- Produced an index of social vulnerability across Northern Utah at the census tract level, aggregating data on age, race, and income



Future Work

- Earth Observations can be utilized to better understand dust, air quality, lakebed exposure, and community vulnerability
- Satellite imagery may fill present gaps in air quality monitoring networks
- Replicating methodology in the San Joaquin Valley

Laura García, Resident of Fresno County's Raisin City

Takeaways

- Iterative process of producing maps and figures that are useful and understandable for community partners
- Be adaptable as priorities and needs change
- Recognize the knowledge of those living in the areas you study: research often simply confirms what residents already know
- Data (alone) isn't the solution

Short-Term Pollution Interventions through Community Engaged Learning

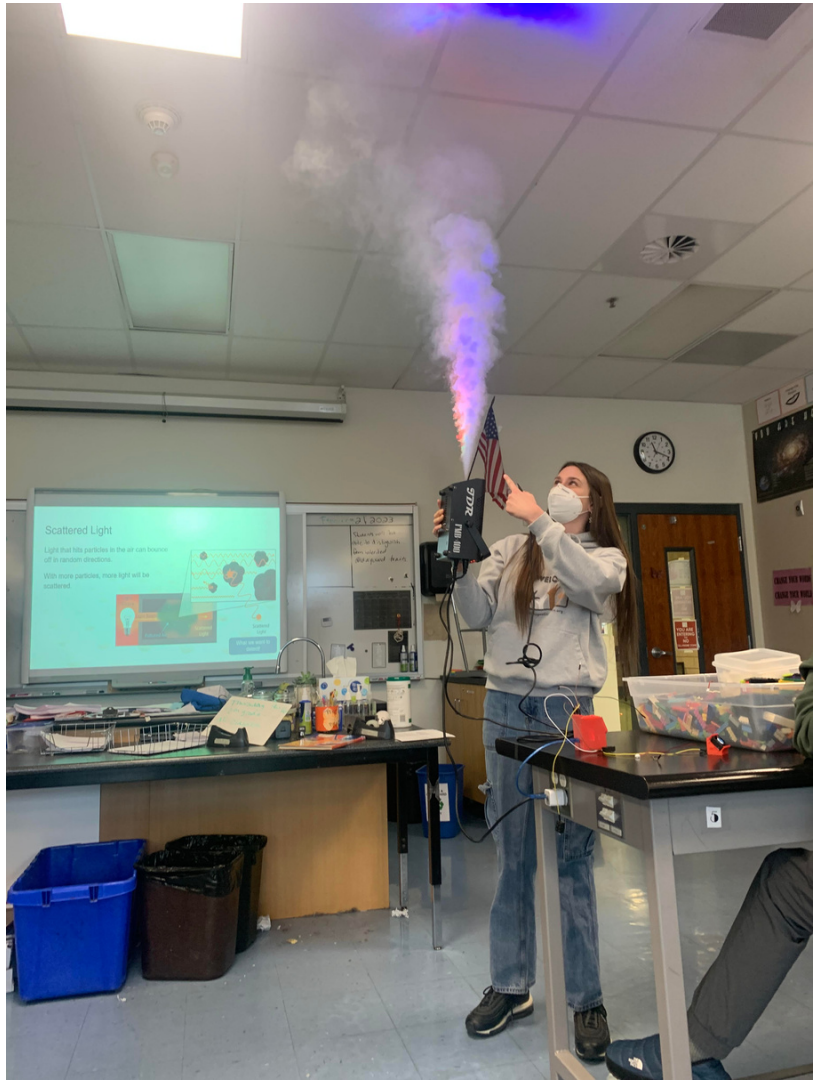
Lessons Learned and Experiences from working with the SPARC Environmental Justice Lab

DIY Air Purifiers

- Comparable in efficiency to commercial-grade air purifiers
- Cost $60 to produce
- Fifty built in total
  - Breathe Clean Festival, Glendale Library
  - YouthCity, Glendale Library
  - 7th Grade Health Class, Glendale Middle School

Lego Air Quality Sensors

- Expands literacy about air pollution and air quality monitoring through community science
- Lesson taught with sixth-grade classes across Salt Lake City



Clean Air Spaces

- Community spaces with industrial-grade air purifiers
- Designated as public refuges during wildfire smoke events

Air Filter Exchange Program

- Exchanged furnace filters in 11 homes in Glendale and Poplar Grove
- Recorded air quality before and after filter exchange
- Interviewed families about indoor and outdoor air quality concerns
- Intended to advocate for more robust filter exchange programs on the Westside

Promoting Change through Policy Interventions

Recommendations for Schools, Healthcare Providers and Policymakers from Parents of Asthmatic Children

Parent Recommendations for Schools

Salt Lake County
Photo Credit: HappyKimmy, istock.com

1. Provided air quality sensors to twenty-seven families with asthmatic children in Salt Lake County
2. Sensors used to monitor connections between air quality and children's health
3. Coded participant interviews for emergent themes
4. Compiled recommendations for healthcare providers, policy makers, and schools

Parent Recommendations for Schools

1. Recognize and respond to asthma symptoms
2. Improve Indoor Air Quality
3. Install Air Quality Sensors at Schools
4. Regulate PE and Athletic Events based on Air Quality Index (AQI)
5. Encourage Anti-Idling Measures

Parent Recommendations for Schools

Our Study

During the 2021-22 academic year, a University of Utah research team conducted a study in which twenty-seven families across Salt Lake County who had asthmatic children were given low-cost air quality sensors and asked to observe connections between air pollution and their children's respiratory symptoms. This document draws from interviews with these parents and is focused on their ideas for how schools could better address outdoor and indoor air pollution and children's health.

01. Recognize and Respond to Asthma Symptoms

- Know common asthma triggers: Triggers that may be present in and around schools include outdoor and indoor air pollution such as particulate matter, dust mites, mold, and chemicals from cleaning and disinfection. Click here for an in-depth list of asthma triggers and measures to reduce them.
- Know common asthma symptoms: Symptoms include wheezing, or "a scratchy whistling sound when breathing," shortness of breath or rapid breathing, chest tightness or pain, fatigue, and frequent coughing. Click here for a detailed information on asthma signs and symptoms.
- Know how to respond to asthma symptoms: The Asthma School Nurse Toolkit provides information for parents, students, and staff about asthma care.

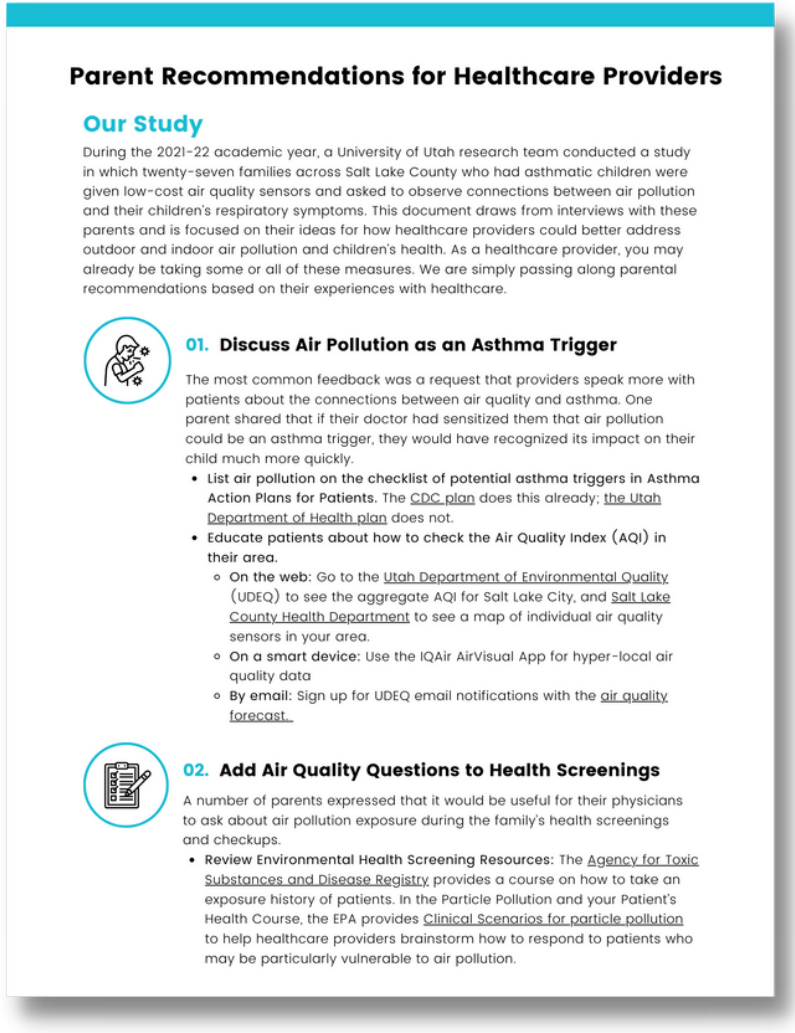
02. Improve Indoor Air Quality

While there are not regulations that explicitly pertain to indoor air quality within Utah schools (Environmental Law Institute, 2021), there are a number of resources that schools may utilize to evaluate and improve their indoor air quality.

- Evaluate your school's indoor air quality: The EPA provides a Tools for Schools Action Kit to help schools identify potential sources of indoor air pollution.
- Obtain free air purifiers for school classrooms: Through July of 2023, schools can apply to receive free air purifiers for classroom through Utah Physicians for a Healthy Environment.

Parent Recommendations for Healthcare Providers

1. Discuss air pollution as an asthma trigger
2. Add air quality questions to health screenings
3. Inform patients of clean air resources
4. Stay up to speed on air quality resources for healthcare professionals
5. Provide a flyer to patients about pollution and health



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01. Discuss Air Pollution as an Asthma Trigger

The most common feedback was a request that providers speak more with patients about the connections between air quality and asthma. One parent shared that if their doctor had sensitized them that air pollution could be an asthma trigger, they would have recognized its impact on their child much more quickly.

- **List air pollution on the checklist of potential asthma triggers in Asthma Action Plans for Patients.** The CDC plan does this already; the Utah Department of Health plan does not.
- **Educate patients about how to check the Air Quality Index (AQI) in their area.**
  - **On the web:** Go to the Utah Department of Environmental Quality (UDEQ) to see the aggregate AQI for Salt Lake City, and Salt Lake County Health Department to see a map of individual air quality sensors in your area.
  - **On a smart device:** Use the IQAir AirVisual App for hyper-local air quality data
  - **By email:** Sign up for UDEQ email notifications with the air quality forecast.

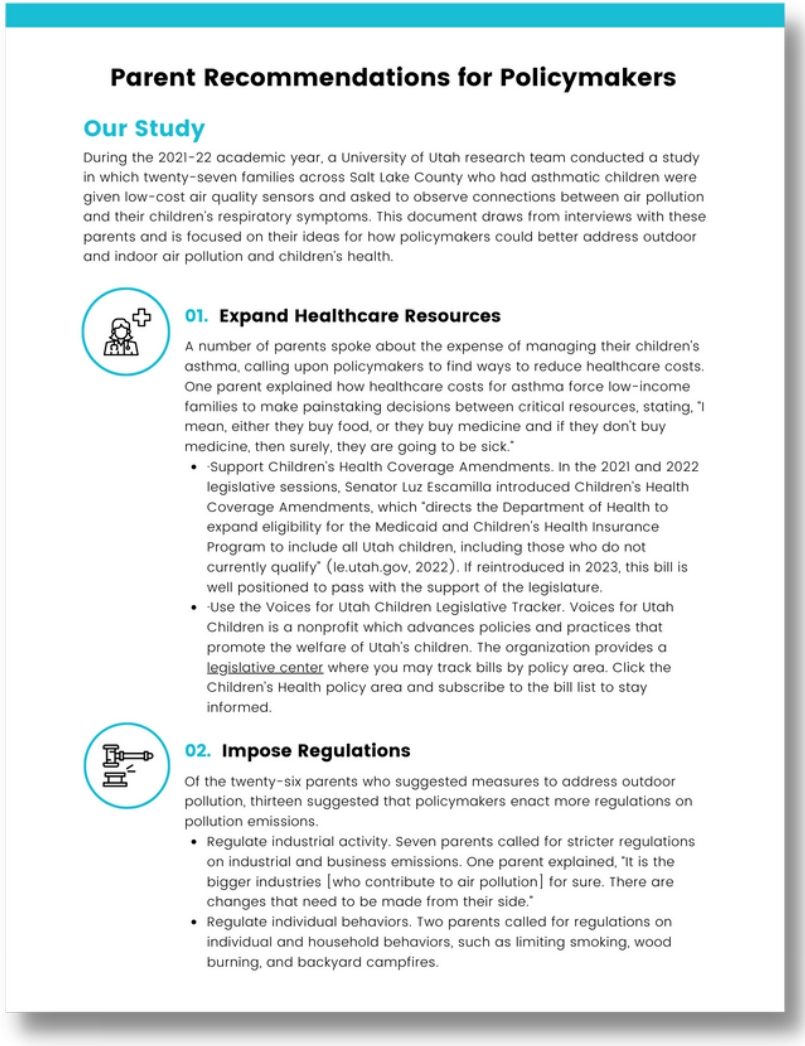
02. Add Air Quality Questions to Health Screenings

A number of parents expressed that it would be useful for their physicians to ask about air pollution exposure during the family's health screenings and checkups.

- **Review Environmental Health Screening Resources:** The Agency for Toxic Substances and Disease Registry provides a course on how to take an exposure history of patients. In the Particle Pollution and your Patient's Health Course, the EPA provides Clinical Scenarios for particle pollution to help healthcare providers brainstorm how to respond to patients who may be particularly vulnerable to air pollution.

Parent Recommendations for Policymakers

1. Expand healthcare resources
2. Impose regulations
3. Expand air quality monitoring networks
4. Discuss air quality with constituents
5. Expand clean energy
6. Expand transportation options
7. Address indoor pollution



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01. Expand Healthcare Resources

A number of parents spoke about the expense of managing their children's asthma, calling upon policymakers to find ways to reduce healthcare costs. One parent explained how healthcare costs for asthma force low-income families to make painstaking decisions between critical resources, stating, "I mean, either they buy food, or they buy medicine and if they don't buy medicine, then surely, they are going to be sick."

- ·Support Children's Health Coverage Amendments. In the 2021 and 2022 legislative sessions, Senator Luz Escamilla introduced Children's Health Coverage Amendments, which "directs the Department of Health to expand eligibility for the Medicaid and Children's Health Insurance Program to include all Utah children, including those who do not currently qualify" (le.utah.gov, 2022). If reintroduced in 2023, this bill is well positioned to pass with the support of the legislature.
- ·Use the Voices for Utah Children Legislative Tracker. Voices for Utah Children is a nonprofit which advances policies and practices that promote the welfare of Utah's children. The organization provides a legislative center where you may track bills by policy area. Click the Children's Health policy area and subscribe to the bill list to stay informed.

02. Impose Regulations

Of the twenty-six parents who suggested measures to address outdoor pollution, thirteen suggested that policymakers enact more regulations on pollution emissions.

- Regulate industrial activity. Seven parents called for stricter regulations on industrial and business emissions. One parent explained, "It is the bigger industries [who contribute to air pollution] for sure. There are changes that need to be made from their side."
- Regulate individual behaviors. Two parents called for regulations on individual and household behaviors, such as limiting smoking, wood burning, and backyard campfires.

Lessons Learned

- Allow time for relationship and trust building
- If you're identifying a problem, identify a solution as well
- Build research around community's interests and needs, not the other way around
- Ensure that your work is mutually beneficial

Photo Credit: David Khal, WiStudio, Kasan Rotonophan

Acknowledgements

Honors Thesis:

- Derived from Doctoral Dissertation, "Managing Air Pollution Risk through Participatory Sensing"
- Led by Casey Mullen, Doctoral Candidate in Sociology at University of Utah
- Advised by Dr. Sara Grineski, Sociology Professor at University of Utah
- Manuela Herrera, Jessica Cuello, and Piper Christian served as Undergraduate Research Assistants

NASA Research:

- NASA Fellow: Julianne Liu
- Particiants: Maria Manuela Herrera, Yoana Vargas Magana, Fiona Summers

SPARC Lab Work:

- Dr. Adrienne Cachelin
- Dr. Daniel Mendoza

Community Partners:

- NeighborWorks Salt Lake, Glendale Middle School, Glendale Library, Westside Coalition, Westside Community Councils