American Lung Association

Something in the Air

Bridging the Air Quality Data Gap with Satellite Technology

A State of the Air Supplemental Report

Index

“Something in the Air: Bridging the Air Quality Data Gap with Satellite Technology” is an extension of the insights provided by the “State of the Air” report, focused on bridging the gaps in air quality data through innovative solutions. This report examines the opportunities to improve air pollution monitoring, particularly in areas lacking official monitors, and highlight the role that satellite technology has in enhancing the understanding of air quality. It is the first in the “Something in the Air” series.

The report uses satellite observations to quantify fine particulate matter, or $PM_{2.5}$, the most dangerous air pollutant impacting human health. Understanding $PM_{2.5}$ pollution levels is critical, as it poses acute and cumulative threats to public health, with strong links to adverse health outcomes. Satellite data provides a unique and valuable perspective to characterize the air we breathe, especially in regions where there is no traditional monitoring infrastructure.

Introduction

For 25 years, the American Lung Association’s “State of the Air” report has helped people across the country understand the quality of the air in their communities. “State of the Air” uses data from a national network of official regulatory monitors to show levels of ozone and particulate matter in counties and metro areas. Now, “Something in the Air” seeks to build on the success of “State of the Air”, as this report details ways in which emerging technologies reveal air quality information to fill in the map, while subsequent reports will delve into the unique challenges faced by diverse communities across various landscapes for a better understanding and more complete picture of the air people are breathing nationwide.

The “Something in the Air” series aligns with the objectives of the Clean Air Act, the foundational law for controlling air pollution and protecting public health and the environment in the U.S. The Act directs the Environmental Protection Agency (EPA) to establish and enforce National Ambient Air Quality Standards (NAAQS), which set limits on six criteria air pollutants, including particulate matter and ozone. These standards are required to be set at a level requisite to protect human health, with an adequate margin of safety. The standards are implemented by state and local agencies through State Implementation Plans (SIPs). These plans outline strategies for achieving and maintaining air quality standards, including reducing emissions and issuing air quality alerts. They should ensure that all communities, especially those historically underserved, receive adequate protection and benefit from strong air quality standards (U.S. Environmental Protection Agency, 2020).

While the implementation and strengthening of the NAAQS have led to significant reductions in air pollution nationwide, not all communities have benefited equally. Since the Clean Air Act’s enactment in 1970, emissions of these key pollutants have dropped by 78%, significantly improving public health (U.S. Environmental Protection Agency, 2024e). Despite this progress, the American Lung Association’s “State of the Air” 2024 report shows millions of Americans still face unhealthy air and found that 39% of people in America—131.2 million people—still live in places with failing grades for unhealthy levels of ozone or particle pollution. This is 11.7 million more people breathing unhealthy air compared to the previous year’s report.

Traditional ground-based monitors serve as the cornerstone of air quality assessments, playing a crucial role in regulating air pollution. However, nearly two-thirds of U.S. counties do not have official monitoring stations. Their distribution and coverage vary, offering reliable and effective data in areas with monitors while highlighting opportunities to enhance data collection in others. With limitations in coverage, many regions are left without comprehensive data. Some of these areas are experiencing high levels of pollution from wildfires, expanded oil and gas extraction and other sources. It is essential to address gaps in official monitoring to ensure communities can access comprehensive air quality data, which will support efforts to clean up pollution and protect public health. A more comprehensive approach to air quality monitoring is achieved by combining ground-based data, satellite-derived data and distributed monitoring, working together to offer a fuller picture of pollution levels.

The approach of this first report in the “Something in the Air” series focuses on the growing constellation of satellites, related technologies and potential of satellite-derived data by broadly comparing monitored levels of air pollution with satellite-derived air pollution estimates nationwide.

The report spotlights six counties that rank among the worst 2% of satellite-derived $PM_{2.5}$ concentration estimates for unmonitored counties nationwide. Preliminary estimates suggest that as many as 300 of the 2,700 counties in the U.S. with incomplete or no monitoring data for annual levels of $PM_{2.5}$ in the years 2020, 2021 and 2022 had estimated levels of pollution high enough that they might have earned a failing grade in the “State of the Air” report.

The approach of using satellite-derived data is not intended to replace the well-established “ground truth” of the regulatory monitors, which are proficient and reliable when measuring air within a designated area of examination. But this report shows that satellite data can serve as a powerful management tool to enhance and extend the capability for understanding air quality on a national scale, and in regions without access to monitoring.

The Importance of Air Quality Data for Health

Air pollution poses a significant health risk, affecting nearly every organ in the body. Major diseases linked to air pollution include stroke, heart disease, chronic obstructive pulmonary disease (COPD), lung cancer and pneumonia. It also affects pregnancy outcomes, leading to low birth weight and preterm births. Data shows that there are increases in all-cause mortality associated with PM. $PM_{2.5}$ can lead to premature death in individuals with heart or lung disease, nonfatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function and increased respiratory symptoms, including airway irritation, coughing and difficulty breathing (American Lung Association, 2024).

Unhealthy air disproportionately affects vulnerable populations. People with pre-existing health conditions or who live near major pollution sources are more likely to suffer from adverse health impacts, including respiratory and cardiovascular diseases. Unrecognized pollution hotspots are often overlooked due to limitations in current monitoring practices and can occur in near-source neighborhoods, rural areas and regions prone to wildfires. Improving air quality assessment in rural communities demands innovative approaches. These areas often face pollution from agriculture, mining and industry, yet lack adequate monitoring systems.

Wildfires, especially in the western U.S., are an increasing threat and source of air pollution. The smoke from wildfires is transient and smoke paths depend on many factors such as wind, weather and terrain, making it difficult to monitor and predict air quality impacts accurately. Communities near wildfires can experience sudden spikes in pollution levels, as the smoke contains fine particulate matter and toxic compounds that pose severe health risks. Neighborhoods near industrial facilities, highways and other major emission sources often experience high levels of particulate matter. Without monitoring stations capturing accurate pollution levels, communities may lack the resources or tools accessible to identify the quality of air they are breathing, even if they have long felt and experienced the impacts of potential pollution in their neighborhoods or environment.

Access to air quality data is vital for enabling individuals to take proactive measures to safeguard their health. In areas without air quality monitors, people often rely on smartphone weather apps for air quality information, which is generated through a data fusion process that combines satellite observations, computer models and ground-based measurements. In unmonitored areas, apps may draw from distant monitors, leading to averaged or less precise readings for specific locations. While this method can provide valuable insights into air quality, and checking air quality forecasts and adjusting plans accordingly is always advisable, having more localized data would be more protective, especially in unmonitored pollution hotspots (NASA, 2024b). It is important to recognize that communities often experience and feel the impacts of pollution firsthand, recognizing the toll it takes on their health and well-being, even without official monitoring data to confirm it. While the absence of reliable monitors can limit access to formal data, residents are acutely aware of the environmental challenges affecting their daily lives.

Regulatory Monitors Guide Pollution Control Efforts

The national network of regulatory monitors plays a crucial role in assessing and managing air pollution across the United States. This network comprises thousands of monitoring stations that measure criteria pollutants such as nitrogen dioxide (NO_2), ozone (O_3) and particulate matter (PM_{10} and $PM_{2.5}$). In addition to their regulatory role, these monitors are also the source of data used with EPA's Air Quality Index to inform individuals about their personal need to protect themselves when air pollution reaches unhealthy levels.

Where Monitors Are Placed and Why

The placement of EPA monitors is guided by the need to measure air quality against the National Ambient Air Quality Standards (NAAQS) and to fulfill the requirements of Tribal/State Implementation Plans (TIP/SIPs). These Plans outline strategies for implementing, maintaining and enforcing the NAAQS within each air quality control region of a Tribe or state (U.S. Environmental Protection Agency, 2020). States and Tribes are primarily responsible for the placement and operation of most air quality monitoring stations across the country, ensuring that these monitors are properly maintained, calibrated and operated according to established federal guidelines. Each state develops its own monitoring plan, which is reviewed and revised every five years, facilitating ongoing compliance with NAAQS.

Monitors are strategically located to capture data in areas of high population density, near significant emission sources such as roadways and industrial sites and in more remote locations to capture background pollution levels. Their placement is intended to provide a thorough understanding of air quality and to ensure the protection of public health (U.S. Environmental Protection Agency, 2024c).

Why are Some Counties Unmonitored?

Monitoring stations are expensive to install and maintain, so they are typically prioritized in areas where there is the greatest perceived need, such as urban centers with high traffic volumes or industrial activity. In some cases, the geographic and topographical features of a region can make it difficult to install and maintain regulatory monitors, e.g. remote or mountainous regions.

Recognizing that many counties are unmonitored highlights the promise of satellite data for filling these gaps. As noted above, monitors are typically placed, in accordance with EPA criteria, in areas with higher population densities to protect large numbers of people from pollution exposure. However, this leaves rural or sparsely populated areas with insufficient data on local air quality even if the lack of monitoring in these areas meets legal requirements and serves overarching regulatory goals (U.S. Environmental Protection Agency, 2024d).

Some unmonitored counties are located adjacent to metro areas with established monitoring networks, such that monitoring is considered to be representative of surrounding counties. Some counties may not have monitors because of rapid changes in land use, population growth or industrial development that have not yet been reflected in the placement of monitoring stations. The expansion of wildfire season, size and severity, especially in the West, has also brought new air quality risks to unmonitored counties. For the purposes of this report, counties are considered "unmonitored" if they lack the three years of air quality data necessary to produce a valid Design Value (DV). The majority of unmonitored counties lack monitoring infrastructure entirely, while a smaller subset has some data that is insufficient for establishing a DV. DVs are essential for comprehensive assessments and regulatory compliance. Overall, equipping individuals with data on the air they breathe is important, but the data also helps guide informed decisions on continued public health protections for individuals in unmonitored regions.

What is a Design Value? A Design Value (DV) is a statistical measure that reflects the air quality status of a specific location in relation to the National Ambient Air Quality Standards (NAAQS). It is essential for designating and classifying nonattainment areas and assessing progress toward meeting the NAAQS. DVs are computed and published annually by EPA's Office of Air Quality Planning and Standards, in collaboration with regional offices. For instance, the DV of a specific monitored area for the annual primary $PM_{2.5}$ NAAQS represents the annual mean averaged over three years of $PM_{2.5}$ levels measured at that monitor. If this DV exceeds the $PM_{2.5}$ NAAQS, that is an indication that the area has unhealthy levels of fine particulate matter, necessitating regulatory action to protect public health (U.S. Environmental Protection Agency, 2024b).

Limitations of Monitoring Data

EPA monitors have a long history of providing high-quality air pollution data, which supports nonattainment designations under the NAAQS, public health initiatives, regulatory enforcement and scientific research. The data collected helps assess the extent of pollution, track air quality trends, evaluate emissions control strategies and inform the public about air quality conditions. This consistent data collection has been crucial in achieving significant reductions in air pollution since the enactment of the Clean Air Act. Still, there are some significant limitations.

Many areas across the country lack sufficient monitoring data, or are unmonitored, because of resource constraints. Across the country, there are far fewer monitoring stations than are needed to provide a complete picture of real-time air quality for all localities.

AirNow, a voluntary EPA program established over 25 years ago, allows states to report air quality data independent of their regulatory reporting requirements. AirNow provides the public with nearly real-time air quality information, aggregating data from a network of federal, state and local monitoring stations to generate air quality forecasts and "nowcasts" for users across the country. While this program serves an important public health role, its effectiveness depends on the placement of monitors and their geographic assignment within the tool. In areas lacking nearby monitors, AirNow uses interpolation to estimate air quality by averaging readings from surrounding monitors, which may be miles away and could be an inaccurate representation of local conditions. Consequently, some users may be getting Air Quality Index estimates that are more reflective of their actual air quality than others (Dye et al., 2004).

The Promise of Satellite-Derived Data

There are three main sources for $PM_{2.5}$ exposure data: ground-based instruments (including regulatory monitors and low-cost sensors), satellite retrievals and computer models (Matz & Rivard, 2019). The suite of data sources can be used in combination to offer a more complete picture of air quality. The American Lung Association supports using satellite data to help fill gaps in air pollution monitoring and seeks to continue to partner with organizations to enhance and optimize satellite measurements to improve the understanding of air quality, especially in areas underserved by traditional monitoring.

Regulatory air quality monitors have long been the backbone of understanding air pollution, providing accurate, ground-based data essential for air quality management and public health decisions. Satellites offer a newer source of air pollution data, which has had decades of advancement in the research community with promising results. Already this technology may be used to identify areas where new regulatory monitors are needed, support the validation of existing air quality models and offer additional tools for real-time air quality alerts, giving populations access to timely information that they might not have had before (Holloway, 2023).

Where monitoring networks are limited by the availability and placement of ground-based stations, satellites can see Earth from space, typically providing spatially continuous coverage. Polar-orbiting satellites cover the entire globe, often with daily data. Geostationary satellites orbit with the planet, providing hourly or sub-hourly data over a single region such as North America. Recent advances in satellite technology and algorithms have significantly enhanced air quality monitoring by providing unprecedented spatial and temporal resolution.

Satellite data provides finer resolution capabilities that can capture community-level variations in air quality, offering insights into local pollution issues that might be missed by the regulatory monitoring network.

These advancements enable the detection of pollution patterns and trends that were previously difficult to observe, particularly in regions where traditional ground-based monitoring is limited or absent, and ultimately offer opportunities to continue transforming the way the public and decision-makers understand air quality. Satellites offer a macro-level view of air quality, which can be integrated with ground-based data to provide a more continuous, comprehensive picture and enhance the ability to detect trends. NASA's satellite data, for example, has been instrumental in identifying areas affected by wildfires, dust storms and urban pollution plumes, providing actionable insights for local and state governments.

How Satellites Measure Air Pollution

Satellites are equipped with sensors that detect different wavelengths of light, such as visible, infrared and ultraviolet (NASA, 2024c). The data collected represents a vertical column of the atmosphere from the satellite to the Earth's surface. This includes all the gases and particles present within that column. Algorithms process the raw satellite data to infer the abundance of pollutants within the column, including nitrogen dioxide (NO_2), sulfur dioxide (SO_2) and aerosol optical depth (AOD), an indicator of particles (NASA, 2024b). These column data may be considered as the vertical sum of the pollutants, but they do not directly report surface-level concentrations equivalent to monitors. Rather, data fusion methods are used to translate satellite data for the column to ground-level concentrations relevant to health. Since the satellite data is not used directly for $PM_{2.5}$ evaluation, it is referred to as satellite-derived.

As a global data product, $PM_{2.5}$ is estimated by combining polar-orbiting satellite AOD, a global atmospheric chemistry model and ground-based data where available. These data are combined to create a physically consistent estimate of annual average near-surface $PM_{2.5}$ and are not expected to perfectly agree with ground measurements, even where those measurements may have been used as input to the data fusion process. However, the data fusion approach effectively balances contributions from all three sources—satellite, model and ground-based measurements—allowing for estimates that are relatively close to actual ground-level conditions.

Limitations of Satellite Data

Satellite-derived data is valuable for understanding air quality on a large scale, but it has limitations that prevent it from being directly comparable to the "gold standard" of regulatory monitoring. Atmospheric conditions such as cloud cover can obscure the satellite's view, while highly reflective surfaces such as snow can reduce data reliability.

Satellite sensors collect data over viewing areas, so the resolution of the data depends on the instrument and post-processing methods. Ongoing research aims to determine whether current-generation satellites offer sufficient spatial resolution to accurately capture localized pollution levels. At this point, satellite measurements are inconsistent with the data requirements expected for compliance with regulatory standards, which rely on accurate, real-time ground-level data directly tied to health protections. Satellite data instead serves as a powerful supplementary data source, providing insights into pollution patterns and highlighting gaps in unmonitored areas.

The satellite-derived data used in this report is available to the public through the Washington University in St. Louis website (*see Methodology*). Earlier versions of the data set have been used for a wide range of public health applications, including the Global Burden of Disease report. Due to the large size of the data files, and specialized data formats, accessing and interpreting this data requires advanced data analysis tools and expertise. This limitation highlights the need for platforms that can translate satellite observations into actionable information for communities and policymakers.

While satellite data is not directly comparable to ground-based measurements, the evolving partnerships, science and retrieval methods are continuing to enhance the accuracy and usability of satellite data for air quality assessments. This includes refining methods to derive reliable values from satellite measurements and optimizing their application across the U.S., as room for improvement remains.

Looking Forward

Satellite data applications to health and air quality are growing. As these new space-based data products rapidly evolve, instruments advance and scientists refine algorithms which help interpret the data more accurately and address existing limitations. Although the field of satellite data still has limitations and may not yet match the precision of ground monitors, its continuous evolution holds significant promise for informing public health strategies, especially when complementing traditional methods of regulatory ground-based monitoring. They have the ability to bridge data gaps in air quality information, especially in underserved communities who lack official monitoring data across a varition of states, regions and populations. Revealing hotspots, pollution patterns and trends can provide potential strategic guidance for decision-makers and offer millions of Americans greater, and more official, insight and data on their air quality (NASA, 2024a).

Satellite Data at Work

- **National Aeronautics and Space Administration (NASA)** plays a critical role in the development and application of satellite technology for air quality monitoring and maintains collaborations such as the NASA Health and Air Quality Applied Sciences Team (HAQAST) that utilize satellite data to provide real-time and historical insights into air pollution patterns, including $PM_{2.5}$, ozone and other pollutants.
- **U.S. Environmental Protection Agency (EPA)** integrates satellite data into its air quality modeling and forecasting tools to enhance its regulatory assessments and policy development.
- **World Health Organization (WHO)** uses satellite data to assess global air quality levels, particularly in regions where ground-based monitoring is limited or unavailable.
- **National Oceanic and Atmospheric Administration (NOAA)** uses satellite data to support its air quality forecasts and research. This data helps improve models for predicting the dispersion of pollutants and understanding the impacts of events such as wildfires, volcanic eruptions and dust storms.
- **State & Local Environmental Agencies** utilize satellite data for various applications, including air quality monitoring, wildfire management, pollution source identification, public health studies and regulatory compliance. For example, the California Air Resources Board integrates satellite-derived measurements of pollutants like $PM_{2.5}$ to assess air quality and inform the public, while the Texas Commission on Environmental Quality uses satellite imagery to pinpoint industrial emissions and help enforce regulations on air quality.
- **Academic Institutions** worldwide use satellite data to study agriculture, meteorology, oceanography, geology, air quality, climate change and the health impacts of pollution.

Unmonitored Doesn't Mean Unpolluted

More than two-thirds of the 3,143 counties and equivalent subdivisions in the U.S. lack regulatory monitors. However, the lack of monitoring does not necessarily mean the absence of pollution. Satellite-derived data reveals that many unmonitored areas experience concerning levels of pollution, posing risks to millions, particularly in communities within larger metropolitan areas, near major emission sources or wildfire-prone regions. Air pollution is fluid and dynamic; pollutants can spread unpredictably due to wind patterns and weather conditions, affecting areas far from their sources. In rural regions, unique pollution challenges, especially those from agriculture and localized industries, often escape detection by broader monitoring networks.

Wildfires are especially problematic, releasing large amounts of fine particulate matter that impact both rural and urban areas across vast distances. Satellite-derived data can highlight regional variations in pollution levels within metropolitan areas that are not reflected in the "State of the Air" report. Satellite insights enable a closer and more comprehensive examination of air pollutants in regions that are under- or un-monitored, helping to address monitoring gaps and support strategies to improve air quality and protect public health.

Comparison of Monitor vs. Satellite-derived Data

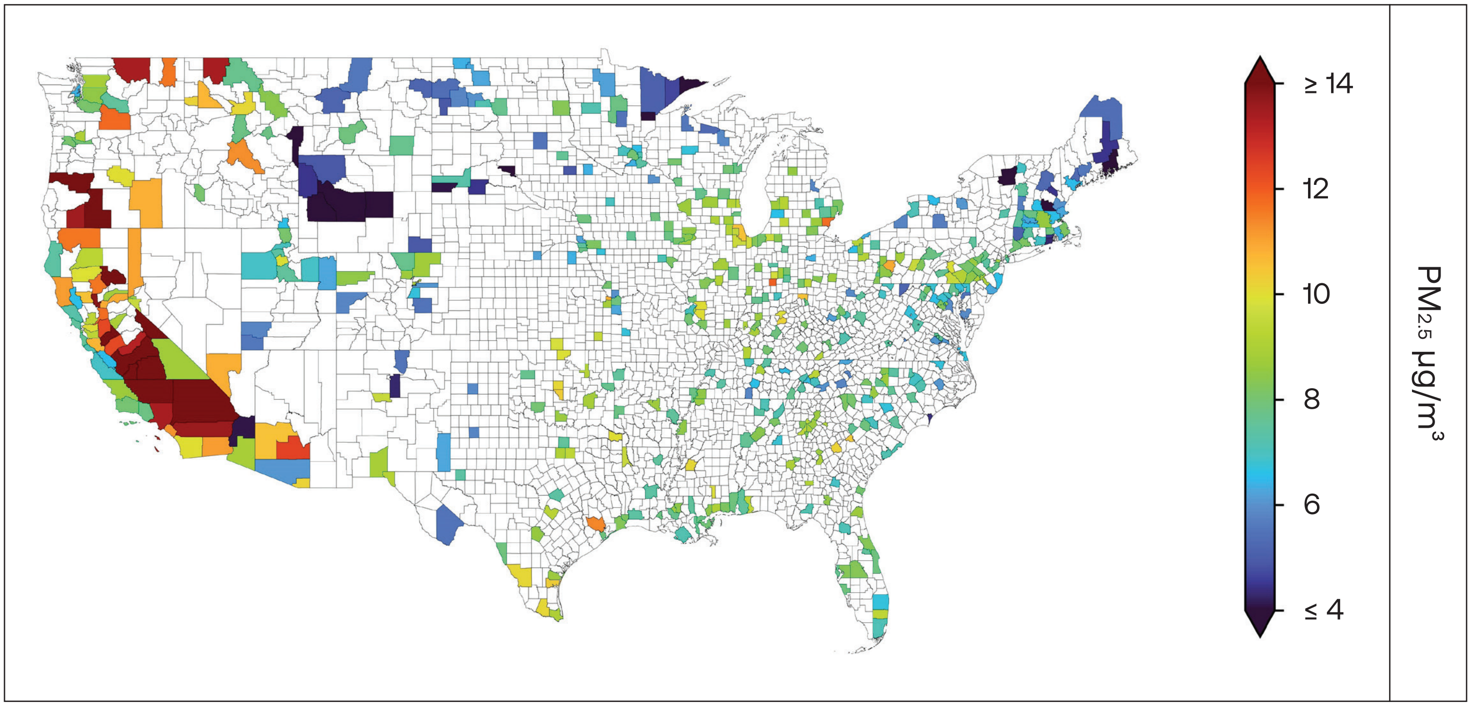


Figure 1: County DVs for $PM_{2.5}$ for the years 2020-2022.

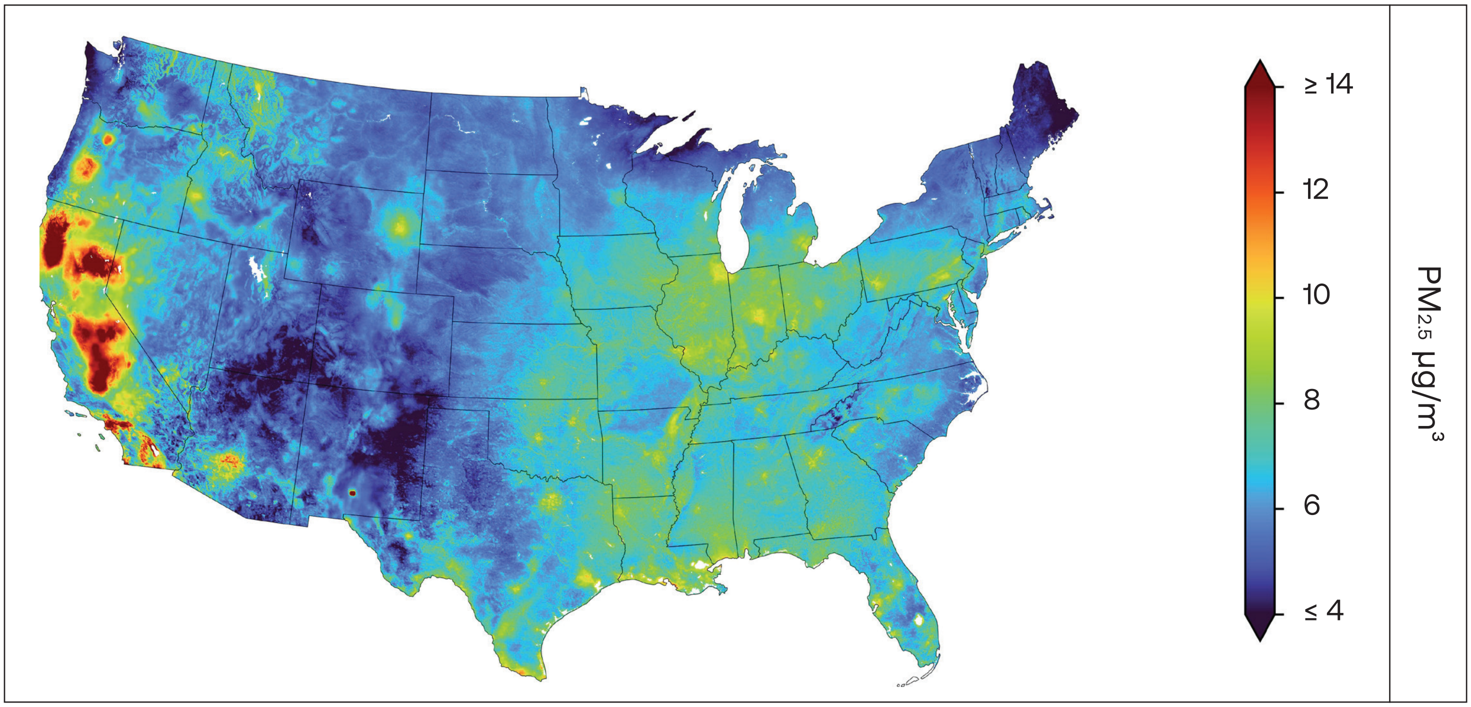


Figure 2: Satellite-derived estimates of $PM_{2.5}$ concentrations for 2020-2022

The maps above compare 2020-2022 design values for all monitored counties as calculated by EPA (Figure 1) with estimated $PM_{2.5}$ concentrations for the same time period based on satellite-derived data, V5.GL.05, developed by Washington University at 0.01° by 0.01° spatial resolution (Figure 2). These maps dramatically illustrate the gaps in available monitoring data and highlight areas where further monitoring could significantly enhance the public's understanding of air quality.

Spotlight Counties Reveal Data Gaps

Preliminary estimates suggest that as many as 300 of the 2,700 unmonitored counties in the U.S. might have earned a failing grade in the "State of the Air" report. This estimate is based on satellite-derived, annual levels of $PM_{2.5}$ in the years 2020, 2021 and 2022, and could be interpreted as areas that would have registered high pollution if ground-level monitors had been in place. Millions of people are likely living in areas with unhealthy air but lack official monitoring data on their exposure and risk.

To put a face on these unmonitored communities, "Something in the Air" spotlights six counties: Collin County, Texas; Forsyth County, Georgia; Marion County, Oregon; Mohave County, Arizona; St. Charles County, Missouri; and St. Tammany Parish, Louisiana.

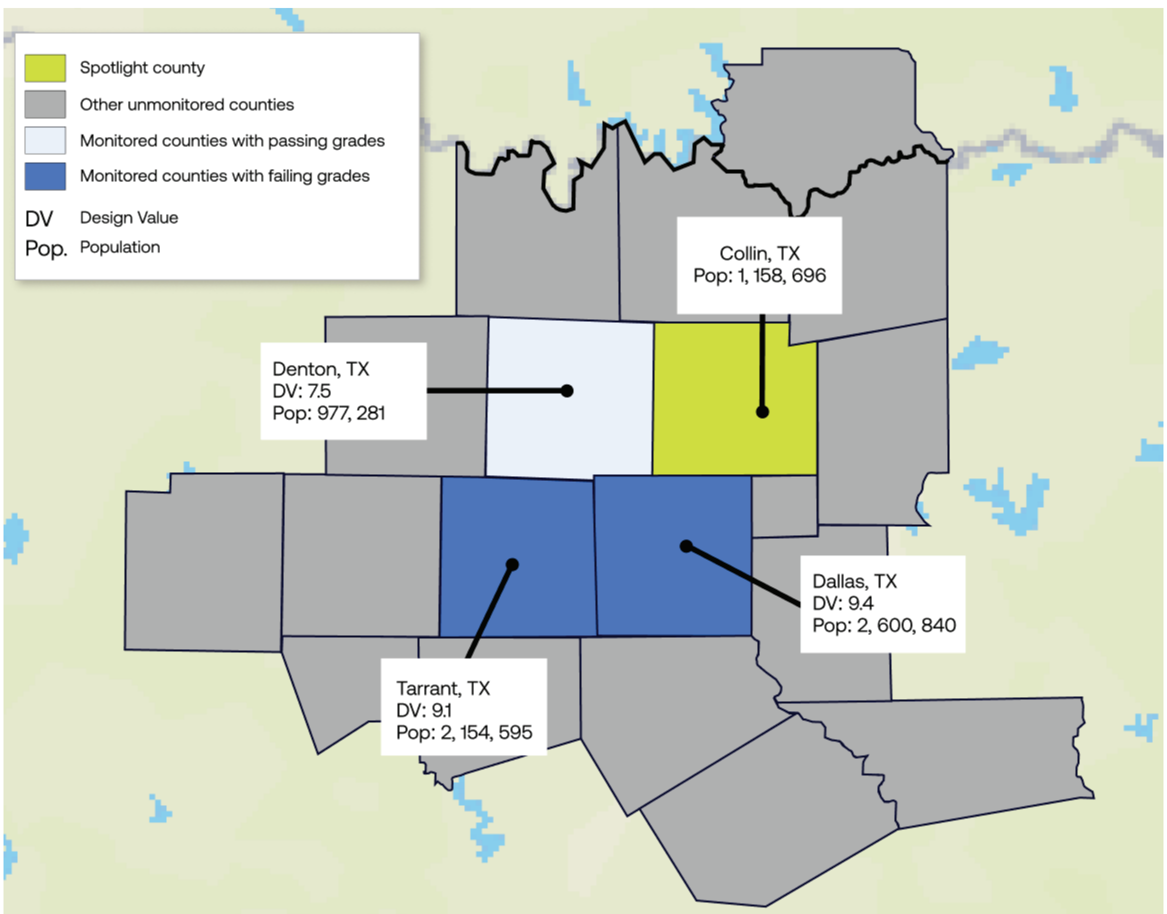
Satellite-derived data shows that these spotlight counties are among the most polluted 2% of unmonitored counties in the U.S. (they do not rank in the top 2% when considering all counties). All have populations greater than 200,000 people. The six counties were selected to represent geographic and demographic diversity as well as the range of broader issues faced by many unmonitored regions across the country. Some of these counties are directly adjacent to monitored regions. Others are heavily influenced by external factors including wildfires, which can cause sudden spikes in pollution levels. And some are affected by the transport of pollutants from nearby urban areas, industry and traffic corridors.

By comparing satellite-derived $PM_{2.5}$ levels in these unmonitored counties with DVs from nearby monitored regions, the spotlights illustrate examples of places where the potential health risk from air pollution merits attention. Each of the unique county spotlights that follow includes a description of the county setting and surrounding landscape, some information about the local economy, potential pollution sources and a portrait of the people that live there, including a table showing the populations at greatest risk of health harms from exposure to particle pollution from "State of the Air" 2024. The spotlight county maps include adjacent counties for context. Those counties that are monitored are labeled with their DVs for annual $PM_{2.5}$ and are shaded to indicate whether they received passing or failing grades in the 2024 "State of the Air" report.

Collin County, Texas

Collin County is the most populous of the six spotlight counties in this report, with over a million residents. It spans 886 square miles of what used to be prairie in northeastern Texas, directly north of the city of Dallas and part of the expansive Dallas-Fort Worth metroplex. While much of the county's landscape consists of gently rolling hills, some areas are prone to flooding. With an average rainfall of 35 inches annually and a growing season of 237 days, the county experiences periods of significant heat and drought (Minor, 2020). According to the EPA, during periods of drought, dry and exposed soil generates increased amounts of dust, leading to higher levels of particulate matter in the air (2024d).

As one of the fastest-growing counties in the nation, Collin is significantly impacted by its geographic proximity to major urban hubs, including Arlington, Fort Worth, Denton and Plano, in addition to Dallas. Some of the main industries in the region are technology, finance, healthcare, defense and professional services. The growing region is heavily car-dependent and crisscrossed by highways, including critical east-west and north-south interstates (Texas Comptroller of Public Accounts, 2020).



Collin County, Texas

The Dallas metro area is tied for 48th worst for annual particle pollution out of 204 metropolitan areas in the U.S. in "State of the Air" 2024. Only 3 of the 19 counties in the Dallas metro area had monitoring data for $PM_{2.5}$., and two of those received failing grades. Dallas County, with a population of 2.6 million had a DV of 9.4 μg/m^3, and Tarrant County to the southwest, also with a population of more than 2 million, had a DV of 9.1 μg/m^3. Collin County is included in the 2024 Dallas-Fort Worth Air Quality Improvement Plan and related strategic plans to reduce pollutant emissions, reduce the region's environmental impact and improve public health.

Health metrics are essential for identifying populations most at risk from air pollution, offering insights into potential health impacts. In Collin County, nearly half of the population consists of people of color (almost 49%), a vulnerable group when it comes to air pollution exposure. Collin County is home to hundreds of thousands of residents who are at increased risk of health harm from exposure to unhealthy levels of particle pollution, including more than 418,000 vulnerable children and seniors. These demographics highlight the need for targeted air quality assessment and interventions to protect these high-risk populations.

Populations At Risk

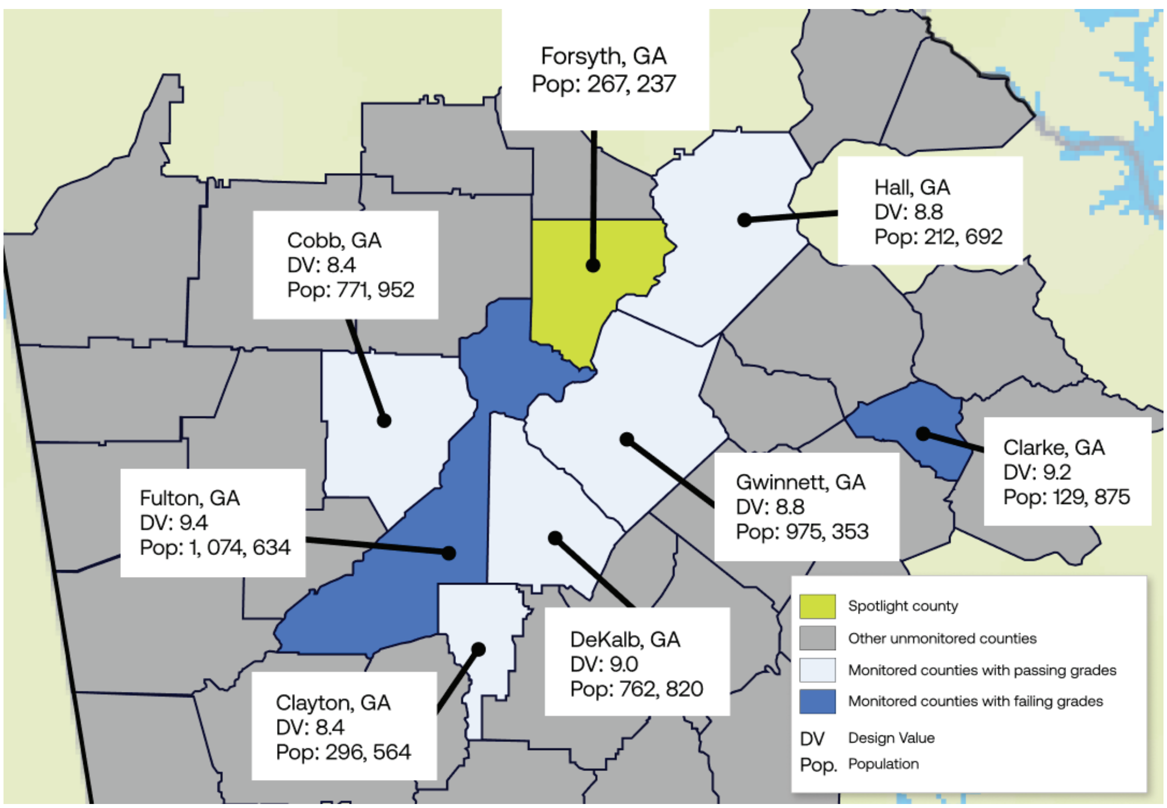
Total Population:	1,158,696
Children Under 18:	283,701
Adults 65 & Over:	135,234
Pediatric Asthma:	18,026
Adult Asthma:	68,574
COPD:	48,112
Lung Cancer:	471
Cardiovascular Disease:	75,765
Pregnancy:	15,278
Poverty Estimate:	55,552
People of Color:	564,447

Despite its large population and proximity to areas with high pollution levels, Collin County lacks local air quality monitoring, leaving residents underinformed on official monitoring data. This limits their ability to advocate for change, especially if they are unaware of potential health risks from elevated $PM_{2.5}$ or acutely experience these already. With nearby counties such as Dallas and Tarrant having some of the highest DVs in the country and Collin County's ranking among the worst satellite-derived $PM_{2.5}$ estimated concentrations, it is critical that supplemental data help bridge air quality gaps for actionable and informed management and planning, ultimately to protect the health of all of Collin County's residents.

Forsyth County, Georgia

Forsyth County is near the northern edge of the large Atlanta metropolitan area, situated in the warm, humid woodlands of northwestern Georgia. More than seven million people live in the large 42-county metro area (not all shown). According to the U.S. Census Bureau (2024), in 2023 Atlanta was the third fastest growing metro area in the country. With over a quarter million residents, Forsyth County itself is one of the fastest-growing counties in Georgia, reflecting an influx of residents drawn by economic opportunities and proximity to Atlanta (Forsyth County Government, 2024).

However, this rapid development has also led to increased local emissions from construction, traffic and residential energy use, which add to the pollution burden. Forsyth County's location makes it highly susceptible to air pollution due to its presence in the Atlanta metropolitan area, one of the largest urban centers in the southeastern United States. The economy of the Atlanta region is a diverse and dynamic mix of professional and business services, finance, government, higher education, healthcare and biomedical, communications and more. As in other metropolitan areas, much of the suburban and exurban population of Forsyth County moves throughout the region for employment and leisure. Several major highways run through the area, public transit is limited and the traffic is notorious.



Forsyth County, Georgia

Air quality has generally improved in the Atlanta metro area over the 25 years covered by the “State of the Air” report. But it still ranks in a tie for 48th worst for annual particle pollution out of 204 metropolitan areas in the U.S. Under the stronger 2024 standard for annual $PM_{2.5}$ now in place, two of the seven monitored counties in the region received failing grades this year. Fulton County, with a population of over a million, had a DV of 9.4 μg/m^3, and the smaller Clark County to the east had a DV of 9.2 μg/m^3. The other five neighboring counties with monitors all had DVs above 8 μg/m^3. These counties offer some insight into potential pollution levels in Forsyth. However, without direct monitoring, there is a significant gap in understanding Forsyth County’s air quality.

Health metrics offer insights into the vulnerabilities within the community and the potential health impacts. With approximately 25% of the population under 18, the county has a significant number of young people whose developing lungs make them particularly susceptible to the adverse effects of air pollution. With approximately 36% of Forsyth’s population being people of color, this group is often disproportionately exposed to higher levels of pollution. Additionally, there are tens of thousands of adults living with asthma, COPD and cardiovascular disease, all of which can be exacerbated by exposure to fine particulate pollution.

Populations At Risk

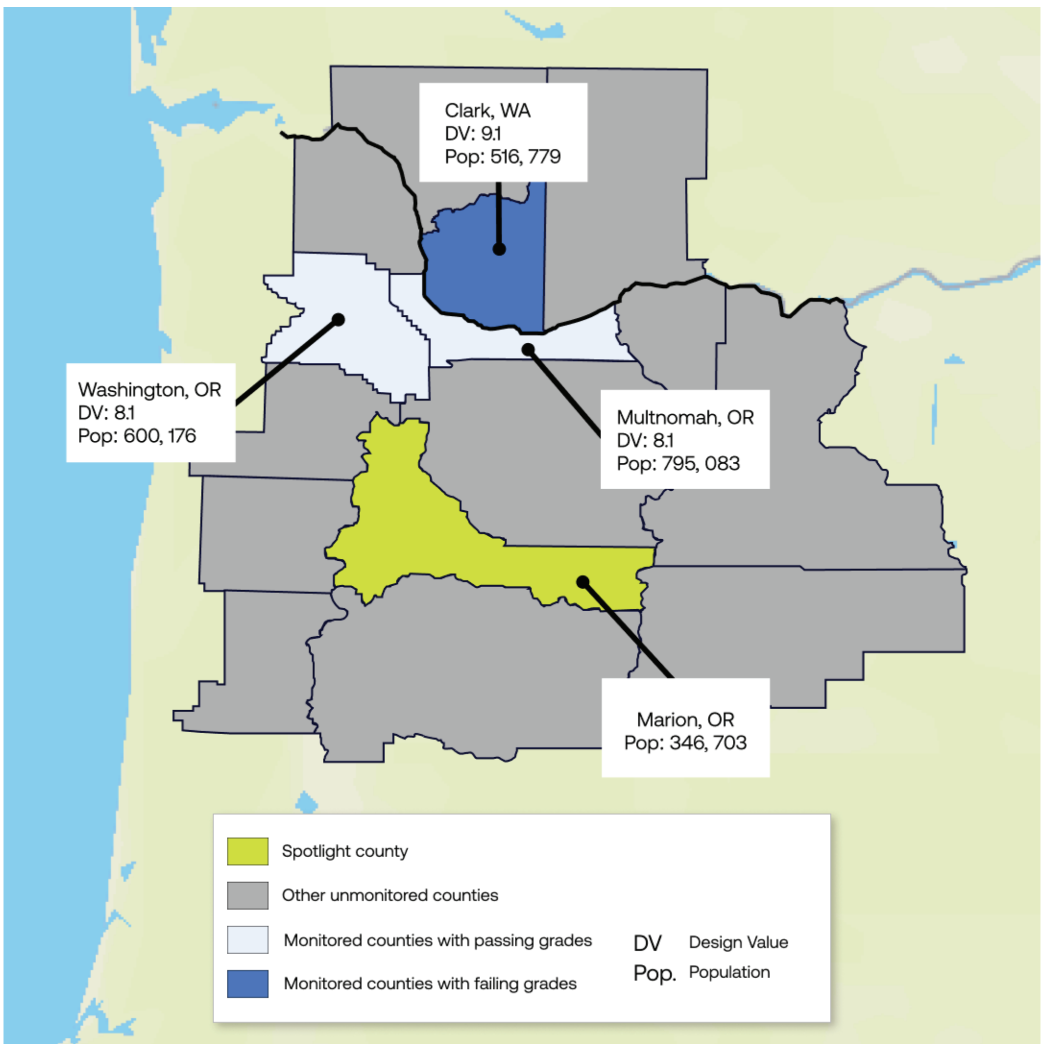
Total Population:	267,237
Children Under 18:	67,877
Adults 65 & Over:	34,384
Pediatric Asthma:	5,278
Adult Asthma:	19,167
COPD:	14,272
Lung Cancer:	141
Cardiovascular Disease:	18,209
Pregnancy:	2,921
Poverty Estimate:	10,836
People of Color:	96,375

Forsyth County ranks among the healthiest counties in Georgia, and well above the national average across a range of health metrics (County Health Rankings & Roadmaps, 2024a). Exposure to particle pollution is not one of them, however, and its most vulnerable residents often remain without official data on the extent of their exposure to harmful air pollution. This lack of information limits their ability to advocate effectively for change and to protect their health.

Marion County, Oregon

Marion County is in the heart of the Willamette Valley in northwestern Oregon. The area is known for its temperate climate, agricultural productivity and diverse landscape of urban areas, farmlands, forests and river valleys. It is the home of the Salem, the state capitol. Marion's population of nearly 350,000 makes it one of Oregon's more populous counties (Marion County, 2015).

Marion County is part of the greater Portland-Vancouver-Salem metro area, which ranked 65th worst for annual particle pollution out of 204 metropolitan areas in the U.S. It is surrounded by all unmonitored counties, so little information is available about the potential influence of its immediate neighbors on its air quality. The closest monitored counties for $PM_{2.5}$, Washington and Multnomah, got passing grades in "State of the Air" 2024, each with a DV of 8.1 µg/m³. North of Multnomah, Clark County Washington got a failing grade with a DV of 9.1µg/m³.



Marion County's topography appears to contribute to its potential for elevated levels of $PM_{2.5}$. The Willamette Valley lies between two mountain ranges, the Cascades to the east and the Coast Range to the west. The ranges converge to the north and the south, trapping the pollution that is generated in the valley by industry, vehicle traffic along the busy I-5 corridor and agricultural practices, including burning of farm fields (Marion County, 2024). Similar to much of the Pacific Northwest, the area has been increasingly impacted by wildfires in recent years. Winds can carry smoke and other airborne pollutants from fires burning in the Cascade Range and other parts of Oregon, Washington and California, directly into the Willamette Valley.

Health metrics help identify populations most at risk from air pollution and offer insights into the vulnerabilities within the community. In 2018, the population of Marion County was reported to over 13,000 migrant and seasonal farmworkers, the second-largest number in the state after Wasco County (Oregon Health Authority, 2018). These farmworkers and their families may be especially vulnerable to the health harm from $PM_{2.5}$.

Populations At Risk

Total Population:	346,703
Children Under 18:	81,028
Adults 65 & Over:	58,491
Pediatric Asthma:	5,631
Adult Asthma:	30,654
COPD:	17,025
Lung Cancer:	145
Cardiovascular Disease:	24,094
Pregnancy:	3,140
Poverty Estimate:	45,903
People of Color:	129,433

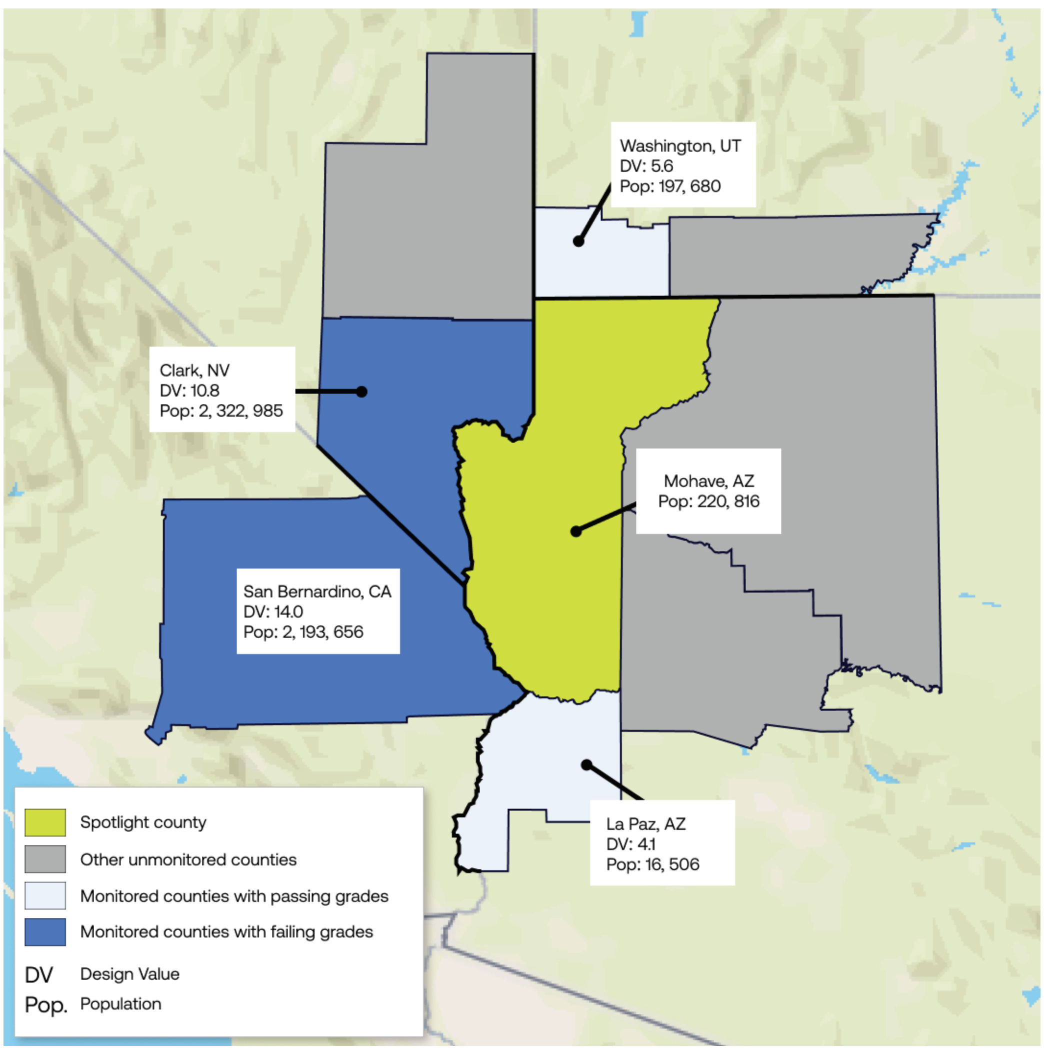
As outdoor workers doing physically demanding labor, they are exposed to wildfire smoke, agricultural chemicals, diesel farm equipment and other sources of particle pollution. They and the other many tens of thousands of Marion County residents in high-risk groups all deserve timely and accurate information about the quality of the air they breathe, especially official information that can be translated into other languages, etc. With almost 24% of the population consisting of children under 18, roughly 26% of the population are Latino and around 37% being people of color, Marion County includes significant populations particularly vulnerable to air pollution, emphasizing the need for tailored public health interventions.

These demographics, along with other risk factors, highlight the importance of providing detailed air quality data to ensure the health and well-being of these communities. Although utilizing satellite data and calculated values can offer insights into potential pollution hotspots, there is no direct $PM_{2.5}$ data for Marion County or its immediate neighbors due to the lack of ground-based monitors in the area. The nearest counties with monitors—Clark, Washington, and Multnomah—are not adjacent, leaving a significant gap in localized air quality data.

Mohave County, Arizona

Mohave County is a large county in the northwest corner of Arizona, bordering southern California and Nevada to the west and southwestern Utah to the north. It spans two distinct landscapes: the Arizona Strip in the north and the Mojave Desert in the south, divided by the Colorado River (Arizona State Library, Archives & Public Records, 2016). The county is largely rural and desert-like, with significant areas of public land, including the westernmost reaches of the Grand Canyon and Lake Mead. The Kaibab, Fort Mojave and Hualapai Indian Reservations also lie within the county. The roughly 220,000 county residents are mostly concentrated in the population centers of Lake Havasu City, Bullhead City and the county seat of Kingman.

According to the Arizona Commerce Authority (2023), tourism-related businesses are a major force in the local economy, as are education and healthcare. Considering its setting and lack of heavy industry, Mohave County seems an unlikely place for a pollution hotspot but estimates from satellite imaging place it among the ten worst unmonitored counties in the U.S. for annual levels of $PM_{2.5}$. Its neighbors may provide a reference for understanding the local air quality problem.



Mohave County, Arizona

Of the seven counties that border Mohave, four are monitored for $PM_{2.5}$ and have established Design Values. San Bernardino County, California and Clark County, Nevada, both located directly upwind to Mohave's west are both among the 30 counties nationwide that received failing grades for all three measures of air pollution in "State of the Air" 2024, including annual levels of $PM_{2.5}$. San Bernadino, with a DV of 14.0 $\mu g/m^3$, is known for its vast network of warehouses, distribution centers and high volume of trucking activity to support the region's shipping and freight industry. Clark, with a DV of 10.8 $\mu g/m^3$ is home to Las Vegas, a major urban center with significant pollution sources including traffic, industry and tourism-related activities. Mohave County's hot, arid climate also make it vulnerable to wildfires and dust storms, both of which can contribute to elevated particulate matter levels.

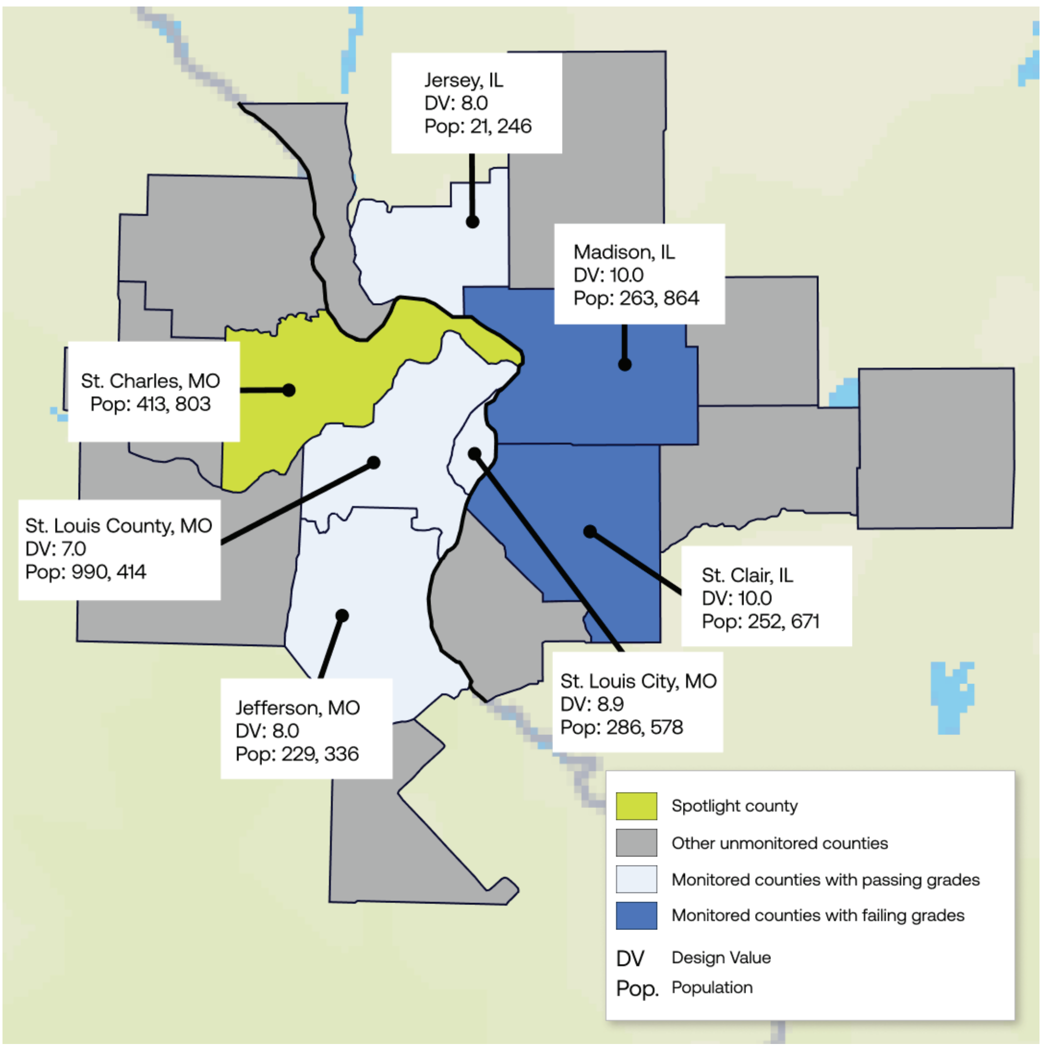
Health metrics highlight populations most vulnerable to air pollution, providing valuable insights into community risks and potential health outcomes. A large proportion of the population consists of older adults, a group particularly vulnerable to air pollution, with over 32% being over the age of 65. Additionally, nearly 25% of the population are people of color, who often face disproportionate environmental risks. The high poverty rate, over 16%, further emphasizes the need for accurate air quality data and targeted interventions to protect these vulnerable populations. Taking a closer look at Mohave County's air quality is crucial to providing accessible and accurate data that can empower residents to make more informed decisions about their health and advocate for cleaner air in their region. The county, home to Grand Canyon National Park, Lake Mead and Tribal Nations, highlights that significant air quality challenges exist in places without regulatory monitors, where residents may or may not acutely experience or acknowledge health impacts from pollutant exposure, but continue to lack access to vital information on immediate public health interventions to protect themselves.

Populations At Risk

Total Population:	220,816
Children Under 18:	35,664
Adults 65 & Over:	71,473
Pediatric Asthma:	2,875
Adult Asthma:	18,240
COPD:	15,279
Lung Cancer:	80
Cardiovascular Disease:	22,887
Pregnancy:	1,626
Poverty Estimate:	36,075
People of Color:	54,514

St. Charles County is nestled in the flood plain at the confluence of the Missouri River on its southern border and the Mississippi River to its north. It is part of the St. Louis metropolitan area. The landscape in the area was originally prairie grassland and forest, but it has a long history as an important population center and hub for transportation and industry. With over 400 thousand residents, St. Charles County is the third most populous county in Missouri. It is also the wealthiest. The county seat is St. Charles, and the largest city is O'Fallon. St. Charles County is mostly a mix of small cities, towns and suburbs.

The main industries are manufacturing, healthcare and social services and retail. The surrounding metro region encompasses some heavily industrial areas, including chemical manufacturing, refineries and several coal-fired power plants (U.S. Census Bureau, 2023). The region's extensive transportation network includes multiple interstate highways, as well as numerous ports and rail yards. The east-west artery I-70 cuts through the county.



St. Charles County, Missouri

The St. Louis metro region was ranked 33rd worst out of 204 metro areas in "State of the Air" 2024. Particle pollution in the region, as in much of the industrial Midwest, has been slowly improving over the years. But with the 2024 strengthening of the $PM_{2.5}$ NAAQS, the year-round level of $PM_{2.5}$ in the St. Louis metro area has been recognized to still be in the unhealthy, failing range. Of the 17 jurisdictions in Illinois and Missouri that make up the metro area, only 6 of them are monitored for particle pollution. Madison County and St. Clair County Illinois, across the Mississippi River to the east are the two that got failing grades, with DVs of 10 μg/m^3, respectively. The others 4 surrounding St. Charles, including the city of St. Louis, got passing DVs.

Health metrics are essential for pinpointing populations most susceptible to air pollution. The population of St. Charles County is older and more likely to be living in poverty than average for the U.S. A little more than 32% of residents are over the age of 65, nearly twice the 17% senior population nation-wide. Roughly 16.7% of residents have incomes that put them below the poverty line, compared to the 12.6% of people nationally that are living in poverty. Additionally, 24.7% of the population are people of color, a group that often faces disproportionate environmental health risks. Older age, lower income and the concentration of people of color are risk factors for health harm from air pollution, and indicators that the population of St. Charles County is at some disproportionate risk from the levels of $PM_{2.5}$ to which they are being exposed. According to the County Health Rankings & Roadmaps, residents of St. Charles County score quite well on overall measures of health and well-being. With a majority white population, this county has higher incomes and greater access to education and health insurance coverage than most Missourians. However, given its sizeable population, including several hundred thousand people in high-risk groups and its proximity to multiple pollution sources, St. Charles County's high satellite-derived estimate of $PM_{2.5}$ should indicate a critical need for a closer examination of its air quality.

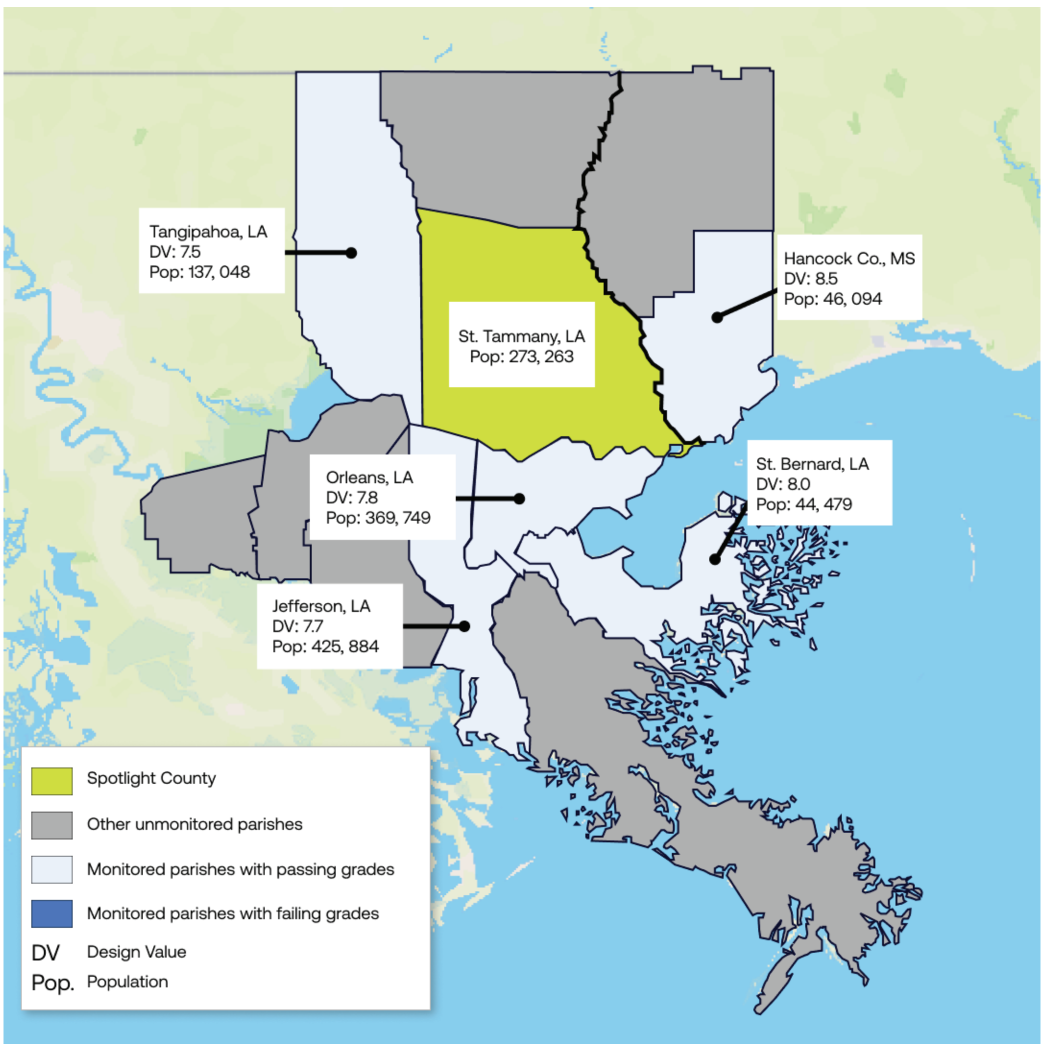
Populations At Risk

Total Population:	413,803
Children Under 18:	92,296
Adults 65 & Over:	70,807
Pediatric Asthma:	7,508
Adult Asthma:	33,926
COPD:	26,886
Lung Cancer:	263
Cardiovascular Disease:	32,496
Pregnancy:	4,539
Poverty Estimate:	21,209
People of Color:	61,898

St. Tammany Parish, Louisiana

St. Tammany Parish is located in the southeastern corner of Louisiana. It is part of the greater New Orleans metropolitan area, across Lake Pontchartrain to the north from the city of New Orleans. The parish is known for its abundant freshwater resources and natural areas. With a population of more than a quarter million people, St. Tammany Parish has been part of a rapidly expanding suburban area, absorbing population growth and hurricane refugees from the urban core of New Orleans. The county seat is Covington, and Slidell is the largest city in the parish (St. Tammany Parish Government, 2024).

The largest employers in the parish are healthcare and social services, retail and education, but there are also industries that include mining, quarrying and oil and gas extraction. The area's air quality is influenced by local and regional industrial activities and by vehicle emissions from resident commuters and tourists using the three interstate highways that run through the parish.



St. Tammany Parish, Louisiana

Of the 11 counties in the New Orleans metro area, five of them are monitored, and all five got passing grades for annual particle pollution in “State of the Air” 2024. Hancock County, Mississippi to St. Tammany’s east had the highest DV of the five, at 8.5 µg/m^3. The others were at or below 8.0 µg/m^3. When comparing the national map of satellite-derived data for $PM_{2.5}$ with the map of DVs from official monitors, some regional discrepancies emerge. In a few areas of the country, satellite imaging appears to over-estimate or under-estimate pollution levels. Overestimation of $PM_{2.5}$ levels tends to be more prevalent in southern regions compared to northern ones, particularly in areas with higher average annual temperatures and precipitation levels. The Gulf Coast of Louisiana and Mississippi appears to be one of those areas that could indicate overestimation. That may explain why St. Tammany Parish is showing up as among the 2% of most polluted unmonitored counties nationwide even though neighboring monitored counties all get passing grades. However, this is likely only one factor, and further analysis is necessary to distinguish between satellite overestimation and actual pollution levels.

Populations At Risk

Total Population:	**273,263**
Children Under 18:	63,664
Adults 65 & Over:	51,114
Pediatric Asthma:	5,571
Adult Asthma:	20,871
COPD:	20,143
Lung Cancer:	148
Cardiovascular Disease:	25,701
Pregnancy:	3,068
Poverty Estimate:	29,091
People of Color:	67,025

Health metrics play a crucial role in highlighting populations most vulnerable to air pollution, shedding light on the health risk communities face. Nearly a quarter of the population consists of children under 18 (over 23%) and people of color (over 25%), two groups that are particularly vulnerable to the adverse health impacts of air pollution. Additionally, there are tens of thousands of adults living with asthma, COPD and cardiovascular disease, all of which can be exacerbated by exposure to fine particulate pollution. These demographics underscore the importance of providing accurate air quality data to ensure these communities have the resources and protections they need.

However, given the moderate $PM_{2.5}$ levels in nearby monitored parishes and the known sources of potentially harmful pollutants, gathering more localized air quality information for St. Tammany Parish would provide a valuable tool for obtaining a clearer picture of local air quality and its impact on the health of the population, including the tens of thousands of residents living with health conditions that put them at increased risk.

Recommendations for Action

Satellite retrieval and the availability of air quality data are becoming more robust all the time. Although there are still some limitations, it holds great promise to fill in the map with air quality information for the millions of people living in unmonitored counties across the country. To enhance the technology, bridge the existing data gaps and protect public health from air pollution, the American Lung Association offers the following calls to action:

Calls to action for EPA

- Fully implement the updated 2024 annual PM NAAQS, ensuring that no areas with unhealthy levels of PM are unreasonably exempted from cleanup. Implementing and enforcing strong NAAQS is the most important tool for improving communities' air.
- Because health-protective NAAQS are the basis for both cleanup and for communities' understanding of local air quality, EPA must also set strong, science-based standards for all criteria pollutants, including ozone and NO2.
- Ensure research using supplemental air pollution data sources such as satellite-derived data is incorporated into future NAAQS reviews when available.
- Enable partnerships between state agencies, research institutions, and satellite data providers including NASA to develop more comprehensive, adaptable and innovative approaches for integrating satellite data with data from ground-level monitors.
- Continue to invest in development of data fusion products that improve timely accurate air quality information that all communities nationwide can use to protect public health.
- Develop the infrastructure and support needed to make satellite-derived data tools widely accessible to state and local governments, and the public.

Calls to action for states

- Support initiatives to establish research monitoring programs that can provide data and justification for future regulatory monitoring stations.
- Explore the use of satellite technology to supplement monitoring and modeling when developing State Implementation Plans for $PM_{2.5}$ that ensure clean-up plans maximize benefits for health, particularly in environmental justice communities.
- Ensure that all regulatory monitors are incorporated into data reporting areas for AQI reports, and update these boundaries to enhance accuracy, especially in unmonitored areas.
- Embrace the opportunity to integrate supplemental data sources into non-regulatory air quality advisory and alert systems for public health protection.
- Collaborate across state lines to accurately estimate AQI for regions affected by cross-border pollutant transport, while working with the EPA to ensure that AirNow.gov reflects local air quality conditions effectively and that all monitors feed into AirNow.

Calls to action for individuals

- Use resources such as the EPA's AirNow website (airnow.gov) to check stay current on air quality conditions in your area that might affect your health.
- Sign up for air quality alerts through your state or local health departments, EPA's EnviroFlash, or other alert systems that notify you of changes in local air quality.
- Help improve your local air quality information by finding and participating in community air monitoring projects in your area.
- Engage with local and state agencies to advocate for increased air quality monitoring in underserved areas.
- Become an advocate in support of local and national policies that aim to improve air quality and reduce pollution by joining the American Lung Association's Lung Action Network.

Conclusion

The future of air quality management will benefit from leveraging both ground-based monitoring and satellite data. The U.S. network of ground monitors, the highest standard of air quality monitoring, remains essential for delivering precise, localized data critical for regulatory compliance. However, due to limitations in coverage, often rural and smaller communities are underinformed on official monitoring data and information, which creates obstacles to advocate for change and understand the extent of pollution risks they face in real time. As satellite data improves and progresses, it has the potential to be used to inform regulatory processes. The aim is to augment traditional ground monitors, not to replace them, weaving together a more comprehensive understanding of the nation's air quality and guiding more informed policy decisions and public health protections.

The American Lung Association supports the potential of satellite data as a dynamic tool because it brings unique advantages, offering expansive coverage and new perspectives on air pollution, including $PM_{2.5}$, that are especially valuable in underserved areas. The technology is evolving and optimizing its use across the U.S. is an ongoing process, and as satellite retrieval evolves, the goal is to continue refining and enhancing the use of satellite data alongside existing monitoring networks, ensuring that every community, regardless of size or location, has access to reliable information about the air they breathe.

Interest in satellite technology isn't just about more data—it's about providing every community with the information they need to protect their health and advocate for cleaner air.

Coming Soon

Future reports in the "Something in the Air" series will continue to explore the potential of emerging technologies to enhance air quality monitoring and management. This includes evaluating the effectiveness of integrating satellite and community sensor data into existing frameworks and assessing their impact on public health and environmental policies. Additionally, upcoming reports will aim to dive into unique challenges faced by diverse communities, providing a more detailed analysis of specific regions, landscape and populations. This will include identifying new opportunities to use technology to address air quality challenges and promote environmental equity. Finally, the series will emphasize the importance of incorporating community perspectives and highlighting their strengths in addressing pollution impacts, with the goal of gaining deeper insight into the air people breathe and implementing actionable public health measures to protect them.

References

American Lung Association. (2024). Health risks associated with air pollution. American Lung Association. https://www.lung.org/research/sota/health-risks

Arizona Commerce Authority. (2023). Mohave County profile. Arizona Commerce Authority. https://www.azcommerce.com/a/profiles/ViewProfile/10/Mohave+County/

Arizona State Library, Archives & Public Records. (2016, May 1). Colorado River Boundary Commission: Agency history. Arizona State Library, Archives & Public Records. https://azlibrary.gov/sla/agency_histories/colorado-river-boundary-commission-commission

County Health Rankings & Roadmaps. (2024a). Forsyth County, Georgia: 2024 health data. University of Wisconsin Population Health Institute. https://www.countyhealthrankings.org/health-data/georgia/forsyth?year=2024

County Health Rankings & Roadmaps. (2024b). St. Charles County, Missouri: 2024 health Data. University of Wisconsin Population Health Institute. https://www.countyhealthrankings.org/health-data/missouri/st-charles?year=2024

Dye, T. S., Chan, A. C., Anderson, C. B., Strohm, D. E., Wayland, R. A., & White, J. E. (2004). From raw air quality data to the nightly news: An overview of how EPA's AirNow program operates. Sonoma Technology, Inc. & U.S. Environmental Protection Agency. https://archive.epa.gov/international/air/web/pdf/airnow.pdf

Forsyth County Government. (2024). Explore Forsyth County. Forsyth County Government. https://www.forsythco.com/Careers/Explore-Forsyth-County

Holloway, T. (2023). Review of satellite monitoring for air quality and health. NASA. https://ntrs.nasa.gov/api/citations/20230000905/downloads/Holloway_review_satellite%20monitoring%20for%20air%20quality%20and%20health.pdf

Marion County. (2015). About Marion County. Marion County Government. https://www.co.marion.or.us/about

Marion County. (2024, August 21). Chapter 2.09: Transportation goals and policies. Code Publishing Company. https://www.codepublishing.com/OR/MarionCounty/#!/MarionComp02/MarionComp0209.html

Matz, M., & Rivard, C. (2019). The role of community-based participatory research in air Quality management. Journal of Environmental Health, 82(1), 24-31.
https://doi.org/10.1080/10962247.2019.1668498

Minor, D. (2020). Collin County. Texas State Historical Association. https://www.tshaonline.org/handbook/entries/collin-county

NASA. (2024a, April 5). NASA releases new high-quality, near real-time air quality data. https://www.nasa.gov/missions/tempo/nasa-releases-new-high-quality-near-real-time-air-quality-data/

NASA. (2024b, April 12). Air quality: Monitoring and modeling. NASA Air Quality Portal. https://airquality.gsfc.nasa.gov/

NASA. (2024c, September 17). Part II: Track pollution from space. NASA. https://terra.nasa.gov/citizen-science/air-quality/part-ii-track-pollution-from-space

Oregon Health Authority. (2018). 2018 updates to Migrant and Seasonal Farmworker (MSFW) enumeration studies report. oregon.gov/oha/HPA/HP-PCO/Documents/2018 Updates to MSFW Enumberation Studies Report.pdf

St. Tammany Parish Government. (2024). *Initiatives*. St. Tammany Parish Government.
https://www.stpgov.org/government/initiatives/index.php

Texas Commission on Environmental Quality. (2024, August 30). Air quality monitoring operations. https://www.tceq.texas.gov/airquality/monops

Texas Comptroller of Public Accounts. (2020). *Metroplex region overview*. Texas Comptroller of Public Accounts. https://comptroller.texas.gov/economy/economic-data/regions/2020/metroplex.php

U.S. Census Bureau. (2023). *QuickFacts: St. Charles County, Missouri*. U.S. Department of Commerce. https://www.census.gov/quickfacts/stcharlescountymissouri

U.S. Census Bureau. (2024, March 28). *Population estimates show more counties experienced growth in 2023*. U.S. Department of Commerce. https://www.census.gov/newsroom/press-releases/2024/population-estimates-more-counties-population-gains-2023.html

U.S. Environmental Protection Agency. (2020). *Final handbook: Document 1*. U.S.Environmental Protection Agency. https://www.epa.gov/sites/default/files/2020-10/documents/final_handbook_document_1_17.pdf

U.S. Environmental Protection Agency. (2024a, August 9). Air quality design values. https://www.epa.gov/air-trends/air-quality-design-values.

U.S. Environmental Protection Agency. (2024b, August 16). *Who decides where monitors get placed?* U.S. Environmental Protection Agency. https://www.epa.gov/outdoor-air-quality-data/who-decides-where-monitors-get-placed

U.S. Environmental Protection Agency. (2024c, August 30). Why isn't there an outdoor air monitor in my county? *EPA*. https://www.epa.gov/outdoor-air-quality-data/why-isnt-there-outdoor-air-monitor-my-county

U.S. Environmental Protection Agency. (2024d, September 23). Climate Change Impacts on Air Quality. https://www.epa.gov/climateimpacts/climate-change-impacts-air-quality

U.S. Environmental Protection Agency. (2024e). Our nation's air: Status and trends through 2024. U.S. Environmental Protection Agency. https://gispub.epa.gov/air/trendsreport/2024/#growth

Appendix: Methodology and Acknowledgements

Methodology

Population at Risk Tables:

The Lung Association calculates the county population at risk from these pollutants based on the population from the entire county where the monitor is located. Total Population is based on 2022 U.S. Census and represents the at-risk populations in counties with ozone or $PM_{2.5}$ pollution monitors; it does not represent the entire state's sensitive populations. Poverty estimates include all ages and come from the U.S. Census Bureau's Small Area Income and Poverty Estimates program. People of color are defined as anyone Hispanic or as non-Hispanic Black, Asian, American Indian/Alaska Native, Native Hawaiian and Other Pacific Islander, or two or more races, based on 2022 county population estimates (U.S Census).

Monitor Data and Design Values:

The $PM_{2.5}$ data for monitored counties referred to in this report are sourced from a network of regulatory-grade monitoring sites. The EPA calculates annual mean $PM_{2.5}$ values from quarterly averages, and for each county assigns a Design Value (DV) for each monitored county's highest three-year average. Design values are used by EPA to assess compliance with the National Ambient Air Quality Standard (NAAQS) for annual levels of fine particle pollution, which in February 2024 was strengthened to 9.0 micrograms per cubic meter (μg/m^3).

Satellite-Derived Data:

Satellite-derived data for near-surface $PM_{2.5}$ levels are provided by and available from the Atmospheric Composition Analysis Group at Washington University in St. Louis (WashU). The data are produced by integrating satellite observations, computer models, and ground-based measurements, offering high-resolution coverage (0.01° by 0.01°). For this report, three-year averages of $PM_{2.5}$ were calculated for each county, and used to create estimated "satellite-derived county DVs.", which is described below.

Data Allocation to Counties:

After averaging across the three-year period, grid cell data points were assigned to their respective county boundaries. Because county DVs from monitors reflect the highest monitor in the county, an analogous approach was used for the satellite-derived data, wherein the highest gridded value within each county was selected as the representative DV. This approach aims to fill gaps in traditional monitoring, providing a broader view of air quality across unmonitored or under-monitored areas.

Acknowledgements

The analysis of satellite-derived data was conducted by Dr. Tracey Holloway, Ms. Lizzy Kysela, and other members of the Holloway Group at the University of Wisconsin—Madison's Nelson Institute Center for Sustainability and the Global Environment (SAGE). Funding was provided by the American Lung Association and by NASA through the Health and Air Quality Applied Sciences Team (HAQAST). Satellite-derived data developed by Dr. Randall Martin and his group at WashU, with funding from NASA HAQAST and other sources.

Something in the Air

Bridging the Air Quality Data Gap with Satellite Technology

A State of the Air Supplemental Report

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