

Climate and Health in Oregon

2023 Report



Oregon
Health
Authority

PUBLIC HEALTH DIVISION

Climate and Health Program

Oregon Health Authority (OHA) developed this annual report in response to Governor's Executive Order (EO) 20-04. That order directed OHA to provide annual reports on the public health impacts of climate change in Oregon to the Governor, the Oregon Climate Action Commission (formerly the Oregon Global Warming Commission) and the state Environmental Justice Council.

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Commonly Used Terms

- AQI: Air Quality Index
- BIL: Bipartisan Infrastructure Law
- CBOs: Community-based Organizations
- CHA: Community Health Assessment
- CHIP: Community Health Improvement Plan
- COPD: Chronic Obstructive Pulmonary Disease
- CPRG: Climate Pollution Reduction Grant
- DEQ: Department of Environmental Quality
- DLCD: Department of Land Conservation and Development
- EJ: Environmental Justice
- HAB: Harmful Algae Blooms
- HHGP: Healthy Homes Grant Program
- LPHAs: Local Public Health Authorities
- NOAA: North America, South American and Africa
- NPAIHB: Northwest Portland Area Indian Health Board
- OAR: Oregon Administrative Rules
- OCCAF: Oregon Climate Change Adaptation Framework
- OCCRI: Oregon Climate Change Research Institute
- ODHS: Oregon Department of Human Services
- OHA: Oregon Health Authority
- OWRD: Oregon Water Resources Department
- PHAB: Public Health Advisory Board
- RAC: Rule Advisory Committee
- RFGA: Requests for Grant Application

Executive summary

While 2023 was the hottest year on record around the world, Oregon experienced a reprieve from large-scale, climate-related events like the 2020 wildfires and 2021 heat dome event. Oregon communities hit the hardest by these unprecedented events are still recovering. The Governor, Oregon Legislature, Oregon Health Authority (OHA) and other state agencies, health departments of federally recognized Tribes, local (county) public health authorities (LPHAs) and community-based organizations (CBOs) have learned from these climate-related events and made investments in strategies to prepare for the uncertain future.

- CBOs, LPHAs and Tribal health departments are essential to delivering equity-centered public health services to their communities. Together with OHA, they make up Oregon's public health system, working to build capacity to protect people in Oregon from climate and health threats. Public health modernization funding investments prioritized by Governor's budgets and appropriated by the Legislature are helping OHA, all LPHAs, 57 CBOs and the Nine Federally Recognized Tribes of Oregon identify climate hazards and at-risk populations, and develop and implement protective strategies.
- In 2023, OHA's Public Health Division established indicators to measure the public health system's progress in building community resilience to health effects of climate change, such as reducing the incidence of respiratory diseases and heat-related illnesses.
- In 2023, state and federal leaders increased investments to protect people in Oregon at highest risk of health impacts from climate change-driven health risks, to make homes more resilient to extreme weather, and to increase tree canopy across the state to reduce heat island effects.

While we are all vulnerable to the health impacts of climate change, communities of color and lower income, and rural communities are experiencing these impacts to a greater degree. Data from 2023 are helping us better understand which populations to prioritize in our public health strategies. In 2023, Oregon saw:

- Rates of health care visits for air quality-related respiratory illness among American Indian/Alaska Native, Black/African American and Native

Hawaiian/Other Pacific Islander communities that were double or near-double the statewide rates..

- Twelve counties, mostly rural, experiencing 14 or more days with high heat and compromised air quality occurring at the same time. When exposures to heat and smoke happen simultaneously, they can produce health impacts greater than the effects of exposure to just one of these.
- Health effects from heat on days when the Heat Index is at or above 80°F. This could be due to people in regions of the state who are not acclimatized to higher-than-average temperatures for the area.

OHA continues to collaborate with state agency partners to build resilience and promote health equity and well-being. Several commitments and initiatives continued or increased in 2023.

- The Oregon Legislature directed OHA to advise the Department of Land Conservation and Development (DLCD) as it establishes a Community Green Infrastructure Grant program, with \$6.5 million for green infrastructure projects that include green spaces and parks and tree planting. The program, which prioritizes communities most impacted by environmental hazards, has the potential to reduce temperatures and improve air quality.
- The 2023 Legislature directed and provided funding to OHA and the Department of Environmental Quality (DEQ) to establish a state Harmful Algae Blooms monitoring and advisory program to protect Oregonians recreating in the state's rivers, lakes and reservoirs, and strengthen protections for surface waters that are the source of drinking water for public water systems in the state.
- A bill modernizing the Oregon Climate Action Commission (formerly the Oregon Global Warming Commission) added the OHA director as a Commission member, acknowledging a comprehensive response to climate change in Oregon requires strategies to protect people from increasing climate hazards.

Letter from OHA and Public Health Directors

In 2023, climate-related statistics across the globe related to heat, wildfires, extreme precipitation and drought broke records. Oregon itself experienced record precipitation. These threats to Oregonians' health are likely only to grow over the coming years as extreme weather events become more frequent and severe.

In OHA's 2015 Climate and Health Profile report, OHA predicted increases in temperatures and more frequent and severe heat waves. In that same report and many since, OHA has also forecasted a worsening drought and more frequent and extensive wildfires. Some of these projections have been overtaken: the Portland heat dome of 2021 had not been projected until 2050. No less surprising to many was how severe wind and drought and heat conspired in 2020 to give rise to massive wildfires that blanketed the state with hazardous levels of smoke, burned thousands of homes and businesses in multiple counties, and largely destroyed the towns of Gates, Detroit, Phoenix and Talent.

It is important for us to assess the threat that climate change poses to the health and well-being of all Oregonians and recognize what this threat calls for: a comprehensive and robust public health response; a system that is equitable and resilient in the face of climate events; and a response that is adaptable, community-centered, collaborative and prepared. OHA has been working with community and state partners to do just this, through public health modernization.

A modern public health system needs to be climate resilient, and Oregon is leading the way. OHA is a national leader in providing funding across all our recognized public health system partners – all county health departments, community-based organizations across the state and health departments of the Nine Federally Recognized Tribes of Oregon – to reduce the health impacts of climate change. We have worked with the Oregon Public Health Advisory Board to drive focused collaboration across the public health system to reduce the health impacts of climate change. We have developed accountability metrics that will help us monitor and accelerate our progress toward eliminating health inequities related to exposure to smoke and heat. Our charge is clear. Climate change poses a significant and growing threat to public health. We can accept

nothing less than building a public health system equipped, resourced, and coordinated to prevent, mitigate, and adapt to the health impacts of climate change.



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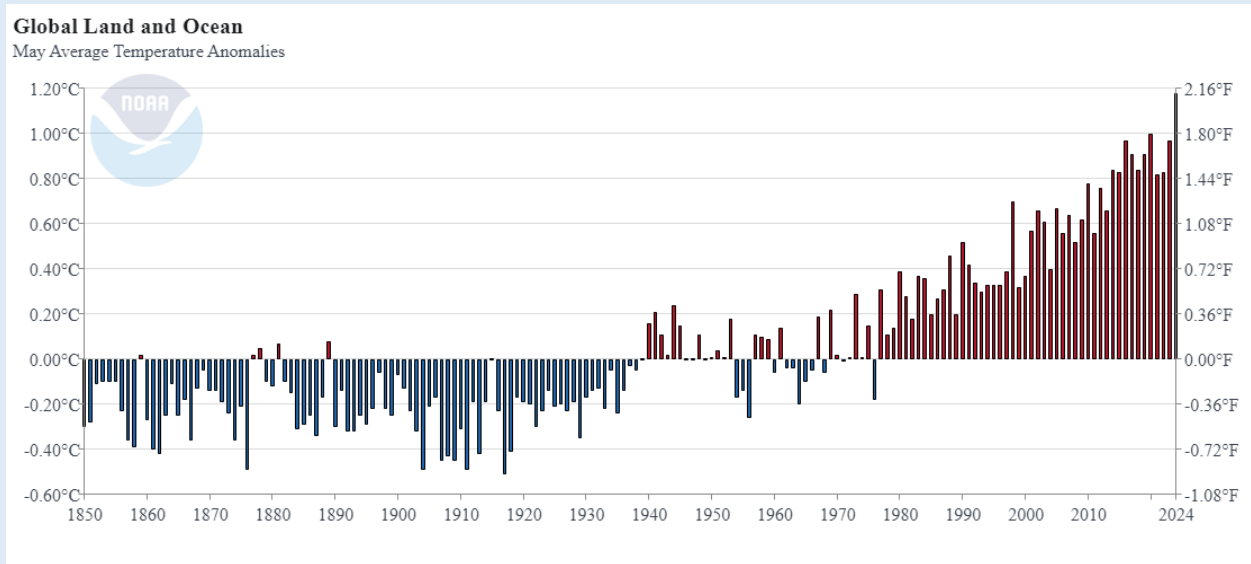
Introduction: Climate threats call for a robust public health system

Setting the context for climate and health in 2023

Climate change is recognized by many experts as the most pressing public health issue of this century. [1] It is considered a “risk multiplier,” which means it has the potential for worsening many other public health issues, including health inequities. For example, extreme heat and wildfire smoke increases health risks for people with chronic health conditions, and low income and communities of color experience higher rates of chronic health conditions. [2-4]

The year 2023 was the hottest year on record globally. In its 2023 annual report, the National Oceanic and Atmospheric Administration (NOAA) cites at least 20 significant climate anomalies and events worldwide (see Figure 1). It was the warmest year on record for North American, South American, and African continents. In Canada, a record-shattering 45.7 million acres were burned from wildfires causing a steep decline in air quality across large parts of Canada and the United States. Underlying these anomalies are steadily increasing global surface and ocean temperatures; the highest global average surface temperature was recorded in 2023. Global ocean temperatures were also notable; September 2023 saw the warmest ocean temperatures of any month on record. The increasing heat on the land and the ocean are driving extreme temperatures and events that are negatively affecting the health of communities in Oregon and worldwide.

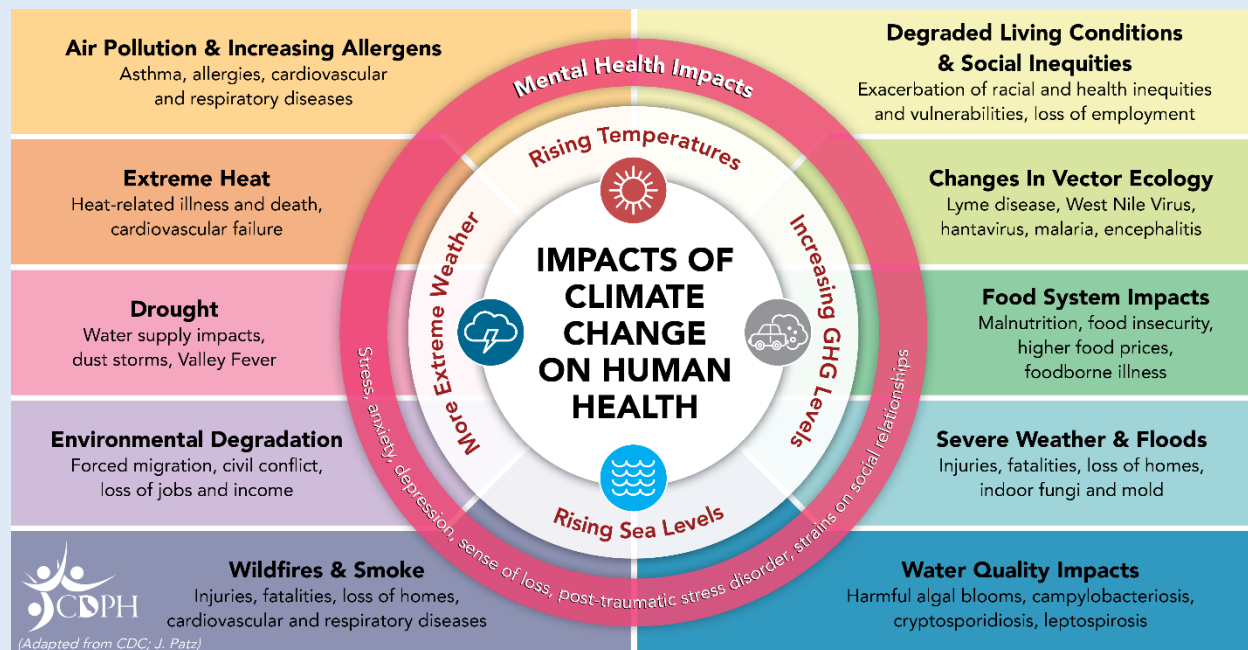
Figure 1: Global average surface temperature, 1880-2024 compared the 20th century average (1901 to 2000). Blue bars indicate cooler-than-average years; red bars show warmer-than-average years. (NOAA data in graphic from the National Centers for Environmental Information)



Public health impacts of climate change

The health of Oregonians depends on complex and dynamic natural and social systems. Climate change is disrupting these systems in a way that is decreasing our access to clean air, clean water, livable temperatures and fertile land for plants, fish and wildlife. Figure 2 shows the myriad of ways in which climate change affects our environment and human health.

Figure 2: Impacts of climate change on human health (adapted from the Centers for Disease Control and Prevention and J. Patz)



The Oregon Public Health Advisory Board (PHAB) which guides OHA’s work has prioritized building community resilience to the health impacts of climate change. Specifically, the PHAB has identified extreme heat, air quality, drinking water and mental health as focus areas for Oregon’s public health system. [5] The purpose of this Climate and Health in Oregon 2023 report is to provide updates on how these and other climate impacts are affecting the health of Oregonians and to shine a light on local and state efforts that are increasing our climate and health resilience and promoting health equity.

Building climate and health resilience through Oregon’s public health modernization

Recognizing the growing threat of climate change to the health of Oregonians, in 2023 the State of Oregon increased its investments in building a more robust equity-centered public health system. These investments are part of public health modernization and reflect Oregon’s commitment to supporting strong, vibrant communities in the face of complex stressors like climate change. Oregon’s public health system must have the capacity to:

- respond to and prepare for more frequent wildfires, heat waves and other extreme weather events;
- plan for chronic health stressors like poorer air quality, water insecurity;
- address the factors that contribute to making certain communities more vulnerable to climate change.

Below are short descriptions of the work OHA and its public health partners are doing through public health modernization funding:

Community-based organizations (CBOs). In the 2023-25 biennium OHA is funding 194 CBOs nearly \$42 million to lead and carry out activities that promote community health and well-being through its Public Health Equity Grant Program. These include continuing funding to 150 CBOs funded in the 2021-23 biennium and an additional 44 CBOs newly funded through 2023 legislative investments. Of these, 57 CBOs are engaged in climate adaptation and health resilience work. CBOs are encouraged to focus on the climate and health priorities of the communities they serve. Some of these priorities include access to greenspaces and community gardens, protection from wildfires, education and training, policy and advocacy, youth engagement, and nutrition and food sovereignty. The spectrum of these projects reflects the broad range of climate impacts in communities as well as the diverse opportunities there are for community-based climate solutions.

Local public health authorities (LPHAs). LPHAs (county health departments) are receiving just over \$50 million during the 2023-2025 biennium for public health modernization. This funding supports a range of public health activities including climate and health resilience work, communicable disease prevention and emergency preparedness. LPHAs are using funds to develop local or regional climate adaptation plans or incorporate climate and health components into their community health assessments and plans. LPHAs with a completed plan are using funds to implement their plan.

This continues to be relatively new work for many LPHAs as this is only the second biennium in which the legislative investment in modernization has included a focus on climate and health adaptation planning. LPHAs have partnered with OHA to convene a community of practice to share resources and ideas, to learn from one another's successes and challenges, and to open the door for regional collaborations.

Nine Federally Recognized Tribes of Oregon. Federally recognized Tribes, the Urban Indian Health Program and the Northwest Portland Area Indian Health Board (NPAIHB) are receiving \$9.667 million during the 2023-2025 biennium to continue modernizing public health systems that serve Tribes and Native people in Oregon. In this biennium, some of the modernization funds continue to support increased capacity in environmental health, emergency preparedness and traditional ecological knowledge. In addition, several Tribes are working with the NPAIHB on environmental health assessments during this biennium.

Oregon Health Authority (OHA). State investments are establishing a foundational environmental public health program driven by Oregon priorities. The 2023 Governor's budget requests and consequent legislative funding of approximately \$2.8 million continue to build out climate equity, healthy homes and schools, land use and health, healthy waters and epidemiology (how health outcomes affect populations and why) work. Each of these disciplines is compelled to address climate change-related impacts and to provide technical assistance to CBO, LPHA and Tribal public health system partners. Such work was limited or impossible to do prior to state public health modernization investments. Before these investments were made (initially in 2021), OHA's environmental health work was supported by multiple small and siloed federal grants that made up nearly 80 percent of state-funded environmental health work in Oregon; the remaining 20 percent came from fees from OHA-regulated food service and other facilities.

Public health accountability metrics

Public health accountability metrics are one way that Oregon's public health system demonstrates and ensures that it is improving health, eliminating inequities and effectively using public dollars through a modern public health system. These metrics are established by Oregon's Public Health Advisory Board (PHAB), a body that provides leadership to Oregon's governmental public health system. PHAB is responsible for tracking the governmental public health system's progress in achieving metrics.

Building community resilience for climate impacts on health is one of three priority areas for the accountability metrics. Within this priority area, the PHAB selected metrics related to extreme heat and wildfire smoke impacts to assess progress toward building community resilience for climate impacts on health. The PHAB also identified drinking

water security and mental health effects of climate change as priority areas; accountability metrics for these priority areas are under development.

Current goals for reducing climate impacts on health by 2030 include:

- Extreme heat:
 - Reduce heat-related illness by 50%
 - Reduce heat-related hospitalizations by 60%
 - Reduce heat-related deaths by 70%
- Wildfire smoke:
 - Reduce respiratory emergency department and urgent care visits by 20%

To chart progress on these longer-term goals, the PHAB also finalized process measures that local and state public health will report on annually. These process measures are grounded in data-informed decision-making, community partnerships and strategic communications and emphasize the importance of engaging and partnering with communities whose health is most impacted by climate hazards.

What is climate and health resilience?

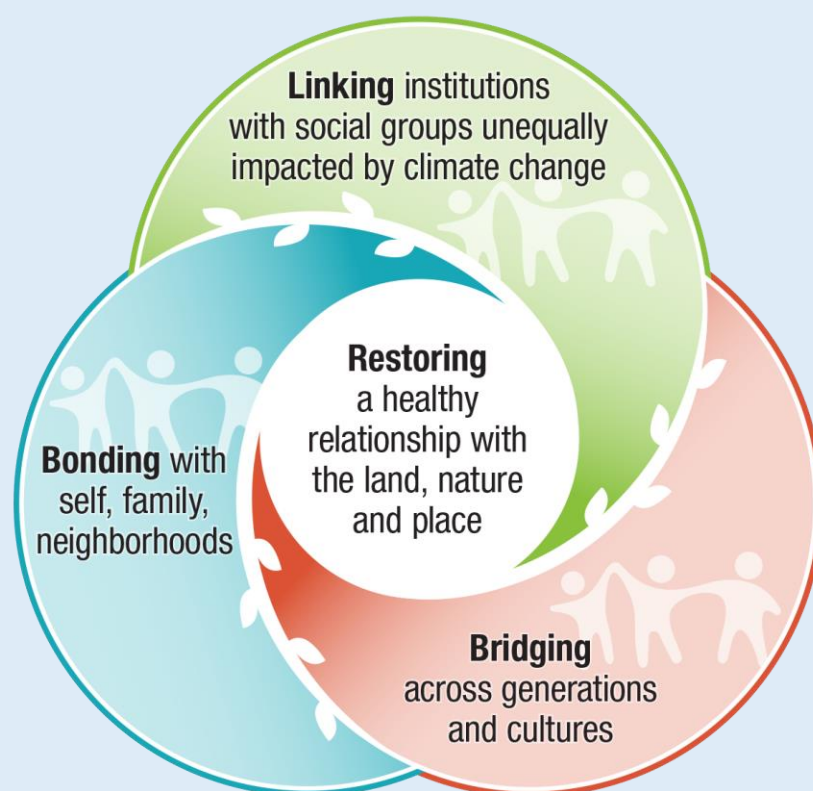
The OHA Climate and Health Program’s working definition of climate and health resilience is the capacity of a community to successfully anticipate and adapt to climate stressors while promoting equity and well-being.

Since 2017, OHA’s Climate and Health Program has developed, piloted and updated a climate and health resilience framework that is strengths-based, equity-centered, cross-cultural and applicable to all climate hazards. The program drew upon a diverse set of inputs to inform the development of the framework including:

- Research literature
- Community listening sessions with community health workers
- Focus groups with youth
- Interviews with public health and mental health experts
- Local public health partners workshop
- Community partner feedback

The framework recognizes relationships as foundational to addressing climate change. The [original version](#) of the framework identified three types of social relationships (bonding, bridging, linking) that are critical for adapting to stressors and making changes to address health inequities. Bonding refers to relationships with self, family, faith community or neighborhoods. Bridging refers to relationships across social groups related to class, culture, ethnicity, age, religion or politics. Linking refers to relationships between institutions with power, such as government with communities. These relationships could be referred to as friendships, family bonds, partnerships, social networks, coalitions, collaborations or community engagement. Through partner feedback, focus groups, interviews, and literature reviews over the last several years, a fourth element was added: **Restoring a healthy relationship with land, nature and place.**

Figure 3: Social Resilience Framework.



OHA is using this framework to provide guidance to CBOs on the kinds of strategies and activities that are eligible for climate and health funding through OHA's Public Health Equity grants. The framework aligns with the intent of these grants, which is to be flexible and allow CBOs to address their communities' priorities in ways that make sense for their communities. Below are a few examples of climate and health resilience strategies and projects that build climate and health resilience through strengthening these four types of relationships:

Bonding

- Developing culturally-grounded climate and health education curricula for community health workers.
- Offering culturally-specific spaces for youth to connect with each other and develop leadership and advocacy skills on climate-related issues.

Bridging

- Building coalitions across income, racial and cultural groups to advance equitable disaster resilience.
- Creating intergenerational (youth, older adults) programs that decrease social isolation and reduce the risks of extreme heat for lower income older adults.

Linking

- Educating and supporting community members to engage in governmental decision-making or planning processes related to climate change and health.
- Hosting an event or meeting that brings together governmental agency staff and community-based organizations to build trust and collaborate on increasing climate resilience.

Restoring

- Creating programs that bring youth to local farms to see what foods grow locally and learn about sustainable farming practices.
- Educate and engage community members in growing food in their neighborhood's community garden.

Many of the community perspectives informing this framework are captured in OHA's 2020 report [Climate Change and Social Resilience: Findings from Community Listening Sessions](#).

Learning from Oregon disasters

Climate change is bringing more frequent and severe climate-related disasters and events to communities across the globe. Oregon experienced two very large-scale climate change-driven events affecting all residents since 2020 — massive wildfires and a heat dome. The 2020 wildfires spread across the state and burned more than 1.2 million acres of land, destroyed more than 5,000 homes and businesses and took the lives of nine people. [6] Southern Oregon communities were hit the hardest. In June 2021, the Pacific Northwest region experienced an extreme heat event that is also referred to as a “heat dome.” The deaths of 102 people in Oregon were directly attributed to the excessive heat but this is likely an undercount. There were more than 250 deaths in Oregon for the week following the 2021 heat dome, surpassing the typical number of deaths for that time period based on historical trends. [7] There were other notable climate-related disasters during this time as well, four of which were declared major disasters by the Federal Emergency Management Agency. [8]

As the impacts of climate change accelerate, so do opportunities to learn how to prepare for, better respond to, recover from, and build resilience for future disasters. Learning from challenging experiences is also called “transformational growth” or “transformational resilience.” The idea behind this concept is that challenges bring about opportunities to learn, grow and improve the conditions in a community. [9] For example, wildfire recovery is considered a “hot moment” to create more fire-adapted communities. [10] As communities rebuild, they have an opportunity to make structural and policy changes in a way that reduces vulnerability to fires in the future. The period after a disaster or event is also an opportunity to understand how some social groups might have been more impacted than others and make changes to prevent inequities in the future. This section highlights research that emerged from these events as well as local and statewide partnerships that are charting a healthier and more resilient path forward for Oregon communities.

Building wildfire resilience after the 2020 wildfire disaster

The West Coast wildfires in 2020 were unprecedented in scale and mobilized organizations and institutions at the local, regional, state and federal level to address immediate needs, identify lessons learned, and to strengthen efforts to prepare for future climate-related disasters. The organizations discussed in this section include community-based organizations, local public health authorities, as well as researchers and academic institutions.

Research findings and initiatives

In the wake of the 2020 wildfires that impacted Oregon and neighboring West Coast jurisdictions, many academic and policy analysts have sought to better understand causes and impacts related to health that can inform actions to prevent or reduce the risks of these impacts from future disasters.

- **Mental health.** Researchers found that mental health symptoms such as uncontrollable worry was associated with extended durations of medium and heavy smoke in Oregon. [11]
- **Communications.** Researchers also conducted surveys with Oregon residents about their experiences during the 2020 wildfires to inform communications before and during these kinds of events. One study found that participants across age groups preferred to receive communications about smoke and wildfire through text messages, and that older adult participants favored local television. [12]
- **Smoke resilient homes.** OHA partnered with the University of Oregon to conduct a survey-based evaluation of wildfire smoke communications and impacts related to the 2020 wildfire season. One key finding was the importance of households having adequate household protections such as air filters, doors and windows that seal, and emergency supplies. [13]

Researchers are also looking at what we can learn from communities after a disaster.

- **Social resilience.** An Oregon-based study found that survey respondents who experienced more harm from the wildfires and were more concerned about climate change were more likely to report being involved in helping their community and preparing for future disasters.
- **Concurrent recovery and resilience building.** More broadly, researchers and policymakers have been observing and learning from disasters worldwide. Some have pointed out that prior disaster recovery models have not considered the increasing frequency and severity of disasters, which means communities are having to prepare and adapt to a future with climate change at the same time they are picking up the pieces after a large disaster. [14, 15] With this critique, some experts have proposed new models of disaster recovery that recognize several important factors for health:
 - The mental and emotional health impacts post-disaster can be significant and last for years beyond the disaster event
 - The effects of a disaster are not evenly distributed through a community
 - Increasing frequency of disasters means that adaptation and preparedness needs to be a part of recovery and rebuilding

Spotlight: Jackson County Community Long-Term Recovery Group

In the aftermath of the 2020 wildfires, southern Oregon saw many community-based organizations, businesses, governmental agencies, and others coming together to address the immediate needs of recovery. After these needs were addressed, community leaders turned their attention to long-term visions and goals to build back a more resilient community.

The Jackson County Community Long-Term Recovery Group (JCC LTRG) has been a key organization convening partners across jurisdictions to develop a plan for recovery and resilience, post-disaster. The JCC-LTRG was organized in the wake of the 2020 Almeda and South Obenchain fires. They facilitated a community-led disaster recovery to identify actionable, implementable projects that will help with longer term recovery. The product of this process is called Rogue Reimagined and is intended to align recovery resources with remaining needs and help affected, and surrounding, communities build resilience against

future disasters. Below are examples of goals from the plan that illustrate how recovery, preparedness, resilience, and health are connected.

Post-Fire Recovery Strategies

- Focus on below market-rate ownership housing *
- Provide for long-term behavioral health services

Long-Term Adaptation Strategies

- Expand hazardous fuels reduction
- Set one standard for fire-resistant homes

Regional Resiliency Strategies

- Be prepared for the next disaster
- Provide for multilingual communications
- Embrace sustainable funding
- Improve social determinants of health

Spotlight: Jackson and Josephine Counties Community Health Assessment

The community health assessment (CHA) is a planning process that engages with community members to evaluate the health needs and strengths in a community. CHAs are usually followed by Community Health Improvement Plans (CHIPs), which outlines actions needed to address the priority public health issues identified in the CHA. CHAs and CHIPs

* A Below-Market-Rate (BMR) home is priced to be affordable to households that are low to moderate income. BMR fire survivor households include low to moderate income and workforce housing, which are households that earn more than the median income but still can't afford a market-rate home. (See page 38 of the [Rogue Reimagined Plan](#) for more information)

can be led by LPHAs or health care organizations or by both. In southern Oregon, Jackson County Public Health, Josephine Public Health, All Care and Jackson Care Connect formed a regional collaborative called All In For Health and worked together to conduct a community health assessment for their region in 2023.

Climate-related disasters, like the 2020 wildfires, can cause displacement, leaving people and families without stable housing and fracturing the social networks that they rely on. Stable housing and strong social networks are important factors for individual and community health; re-establishing these after a disaster are critical for health.

The Almeda and Obenchain fires in Southern Oregon exacerbated ongoing public health issues in the region like affordable housing and behavioral health. The JCC LTRG has been engaged with Jackson County Public Health through the development of their CHA, which recognized housing and behavioral health as priority areas for community health in the region. The Jackson and Josephine County CHA, as well as a comprehensive health data dashboard, can be found at the All In For Health website. This region's CHA also identified "Behavioral Health & Wellbeing" as a priority area. These two priorities, housing and behavioral health, were also incorporated into the Rogue Reimagined recovery plan described above.

Community-centered disaster recovery and resilience efforts

CBOs, philanthropic organizations and governmental agencies have been coming together across the state to lead and support ongoing efforts to recover from the 2020 wildfires. Community leaders and CBOs have been instrumental in these efforts and are advocating for communities to be given more of a voice and leadership role in recovery and resilience efforts. A couple of notable examples of community-led efforts include:

Spotlight: Disaster Resilience Learning Network

In September 2020, when many CBOs were supporting their communities through the COVID-19 pandemic, massive wildfires burned across the state. United Way Columbia Willamette, a non-profit organization funding many of these organizations, pivoted toward

supporting these organizations and their communities in the area of wildfire response and recovery.

Listening to community partners, the United Way Columbia Willamette identified several needs. Community leaders were experiencing burnout from working long hours under very stressful and traumatic conditions. They also heard that the governmental agencies responsible for disaster response and recovery weren't making their services or resources accessible to communities. ([UWCW Wildfire Response and Recovery Fund, 2020-2021 Report](#)).

In direct response to these needs, the United Way Columbia Willamette partnered with Trauma Informed Oregon and OHA to pilot a Disaster Resilience Learning Collaborative to strengthen networks between communities of color nonprofit leaders and governmental agencies. The pilot grew into the [Disaster Resilience Learning Network](#) that continues to support community of color leaders in the disaster resilience space with funding support from an OHA Public Health Equity grant.

Spotlight: Oregon Resilience Summit

In 2023, five organizations came together to start planning a summit that would focus on community led disaster recovery and resilience. This summit was held in May 2024 and is the first statewide community-centered disaster recovery and resilience event of its kind. Lomakatsi Restoration, Raices de Bienestar, Unite Oregon, McKenzie Long Term Recovery Group, and Kelley Nonprofit Counseling hosted the event. The summit program was based on the priorities and experiences of CBOs across the state. The first half of the event included panels, interactive art, and storytelling that gave participants the opportunity to reflect on the 2020 wildfire event, response, and recovery; the second half was focused on “horizons” and thinking about how to build more resilient and prepared communities moving forward. The event also included opportunities for strengthening networks among participants and specifically for community-based organizations and disaster survivors to build relationships and speak with government officials.

Responding to the 2021 heat dome

The heat dome event in 2021 was unprecedented and devastating in terms of loss of human life. It did not result in the destruction of buildings or homes and therefore did not require resources or attention on recovering and rebuilding. However, it did have a similar effect to the 2020 Labor Day wildfires in terms of mobilizing organizations and institutions in Oregon, especially in the Portland Metro area and the Pacific Northwest to better understand what is needed to be better prepared for future extreme heat events.

Research findings and initiatives

Several policy and academic researchers have examined the health impacts and response of the 2021 heat dome in Oregon and have made recommendations to decrease the health impacts of future heat events. One hundred and two people in Oregon lost their lives in this extreme heat event, most of whom were elderly, isolated and living with low incomes. The data in these reports clearly show how low-income older adults were disproportionately impacted by the heat event. [7, 16] In a report that examined Portland's response to the heat events, researchers identified immediate, short, medium, and long-term policy interventions that could be implemented to reduce the health impacts of future heat events. [17]. Some of these include:

- voluntary screening at health-care facilities to identify high-risk individuals;
- providing air conditioning units to high-risk individuals;
- limiting employment involving outdoor work; and
- working with city land use planners to curb the urban heat island effect.

Many of these policy strategies are in the process of consideration or implementation among Multnomah, Washington and Clackamas County health departments and partners, who have been engaged in multiple projects and efforts to build resilience and address inequities associated with extreme heat (See Spotlight: Tri-County Heat Mapping Project, below).

Researchers in other parts of the region, like Canada, also published research related to the health impacts of the 2021 heat dome. In British Columbia, 619 people died from extreme heat; 309 people living with schizophrenia died during this event. [18, 19] Those with schizophrenia were more likely than those with other chronic conditions to

die. These researchers point to possible reasons why, but more research is needed to inform risk reduction strategies for this population. Researchers in Canada also found that the experience of the heat dome event increased people’s climate anxiety in British Columbia. This is one of the first studies that has looked at how the experience of a specific climate-related event can affect people’s level of climate anxiety. [20] Climate anxiety is defined in the Handbook of Climate Psychology as a “heightened emotional, mental or somatic distress in response to dangerous changes in the climate system.” [21]

Public health officials in Multnomah County, King County, and British Columbia, Canada have been learning from each other as part of a Collaborative on Extreme Heat Events. Staffed by the Urban@UW Research to Action Collaboratory, the collaborative has hosted several webinars and a workshop where governmental and community partners have had the opportunity to reflect on the heat dome of 2021 and identify needs and strategies for adapting and being more prepared for future events.

Spotlight: Tri-County Heat Mapping Project

The 2021 heat dome was a historic heat wave affecting the greater Pacific Northwest region. It resulted in record-breaking temperatures and many lives lost. Since the event, the Clackamas, Washington and Multnomah County health departments have come together to learn from this event and leverage their collaboration to reduce the health impacts of future extreme heat in the region. One of these collaborations includes a heat mapping project launched in 2021 that has increased understanding of heat distribution patterns across the Portland metro area. This collaborative event included community volunteers as well as partners from healthcare, water quality, parks and recreation, and academia. Federal partners included the National Oceanic and Atmospheric Administration and the National Weather Service.

As part of this project, 125 community volunteers measured temperatures across the tri-counties on July 22, 2023. The volunteers drove cars with sensors that captured the data along driving routes, providing a snapshot in time of how heat varies throughout neighborhoods. These [results](#) informed the development of a [new tool](#) that can be used to see how heat affects our communities differently.

As public health prepares for future extreme heat events, this heat map project provides a foundation to work towards improving health outcomes. Currently, the tri-counties are utilizing the results to inform climate adaptation emergency response plans. Project results may also be used to inform future policies such as land use planning, transportation and public housing.

Climate and health data

Climate change affects human health through many complex pathways (see Figure 2) such as environmental degradation and drought that can lead to loss of jobs and income, which in turn can negatively affect health. While significant, these impacts to health are indirect and difficult to track and predict. In contrast, health impacts from extreme heat and wildfire smoke can be tracked through quantitative data that are routinely collected in Oregon. OHA accesses emergency department, urgent care, hospitalization and death data to track heat-related and respiratory illnesses. OHA also compiles temperature and air quality data that help understand how health outcomes are associated with temperatures and air quality.

For indirect health impacts, OHA relies more on environmental data to understand trends and to inform public health interventions. For example, drought can reduce availability of clean drinking water, which is essential to health. [22] However, there are no discrete or acute health outcomes associated with this health risk that we can track and report. In the case of drought, OHA tracks and monitors drought status, as well as reports of wells going dry to inform what areas of the state are at risk and where the state may need to prioritize interventions like well safety education.

This section includes a review of the following climate and health risks that can help inform our understanding of how climate change is affecting the health of Oregonians:

Figure 4: Climate health risks and data

Climate-related impact	Type of data available
Extreme heat	Health outcomes, temperature
Wildfire smoke	Health outcomes, air quality
Mental health	Developmental focus area
Drought	Drought conditions, private wells reported dry
Harmful Algal Blooms (HAB)	HAB advisories
Vector-borne Diseases	Health outcomes

Extreme heat

Extreme heat conditions are defined as weather that is much hotter and sometimes more humid than average for a particular time and place. [23] Excessive heat affects everyone, has wide ranging health impacts and can worsen certain health conditions, sometimes resulting in premature death and disability. [24] Heat-related illness can occur when the body is unable to cool itself or when there is an electrolyte imbalance due to sweating or dehydration, resulting in heat cramps, heat exhaustion, heatstroke or hyperthermia. [23] The deaths of approximately 1,220 people in the United States are recorded as having been caused by extreme heat every year. Heat-related illnesses and deaths are largely preventable. [23]

Adults age 65 and over, people who are pregnant, infants and children, people with mental illness and chronic conditions, people with lower income, those who are houseless, and athletes and outdoor workers are at increased risk of heat-related illness. [23]

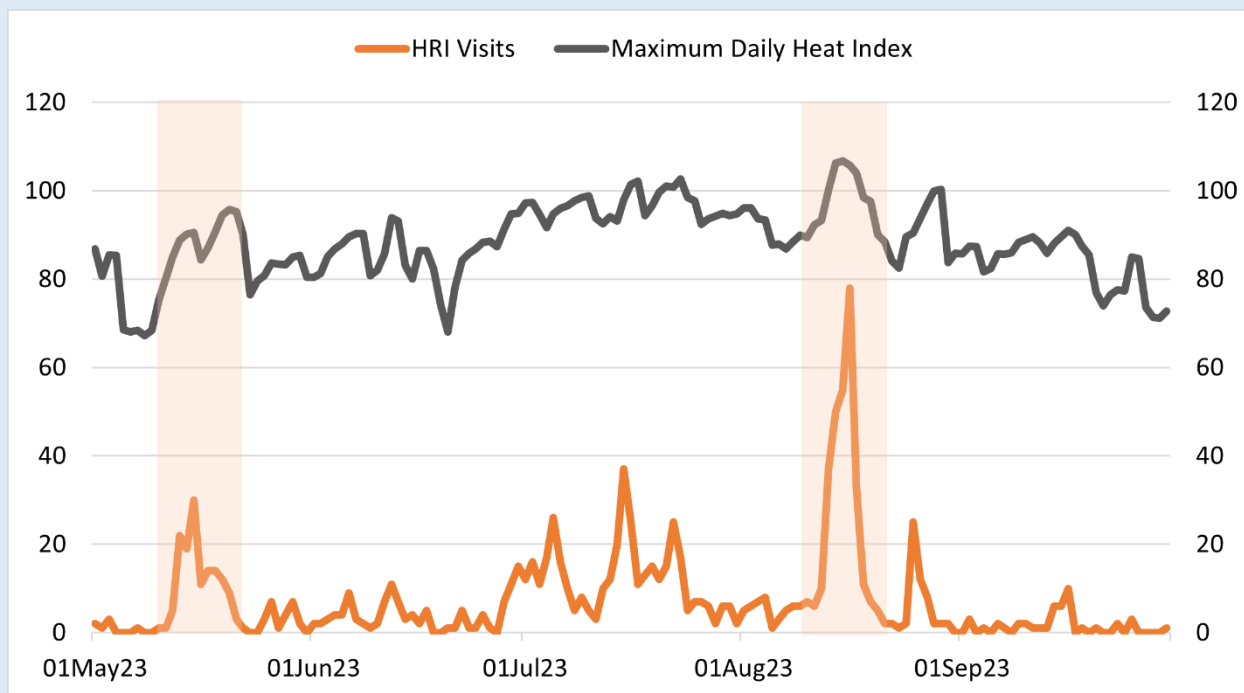
Other factors that make people more susceptible to heat-related illness include humidity, lack of acclimatization and exposure to consecutive days of heat with limited overnight cooling.

- Humidity is an important factor in how hot it feels. As air becomes more humid, the human body is less able to cool off by sweating when temperatures are high.
- The body can adapt to heat through acclimatization, which is achieved by gradually increasing the amount of time spent in hot conditions. [25] People who are less acclimatized to heat are more susceptible to heat-related illness.
- Consecutive days of heat (three or more days) and minimal overnight cooling compromises the body's ability to regulate temperature and recover from high daytime temperatures.

Oregon Climate Change Research Institute's (OCCRI) Sixth Oregon Climate Assessment reports that the number of nights that are warmer than 65°F is increasing across Oregon. [26] Warmer nights mean homes without air conditioning do not cool down overnight, and people cannot get relief from the high daytime temperatures, especially during consecutive days of high heat.

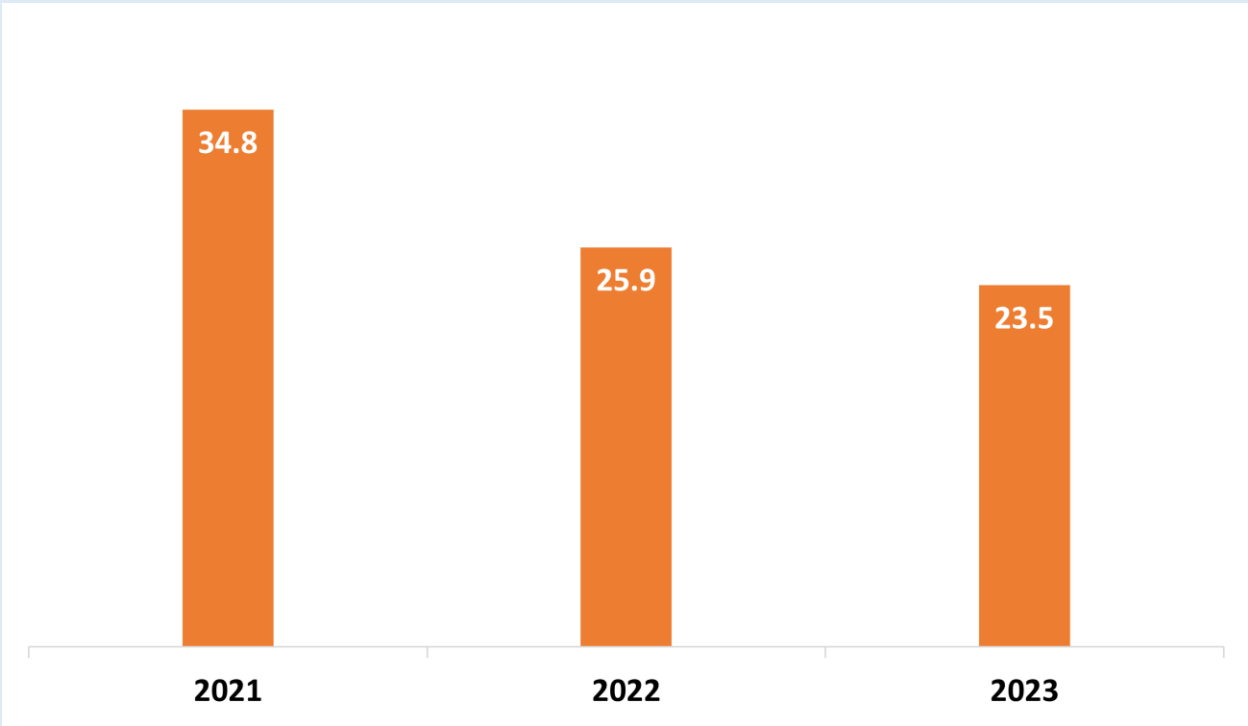
OHA is seeing health effects on days when the Heat Index is at or above 80°F, in the form of people visiting emergency departments and urgent care centers at higher-than-expected levels (see Appendix A). During May-September 2023, 210 heat-related illness emergency department visits occurred on days when the heat index was 80°F-89°F. During May 2023, thirty-three Oregon counties experienced consecutive days when the Heat Index was at or above 80°F, coinciding with an increase in statewide early season heat-related illness (173 HRI visits) (see Figure 5). During August 13-17, 2023, a heat wave of five consecutive Heat Index days above 100°F caused a spike in statewide heat-related illness (253 HRI visits).

Figure 5: Daily heat-related illness emergency department and urgent care visits and maximum daily heat index in Oregon, May-September, 2023.



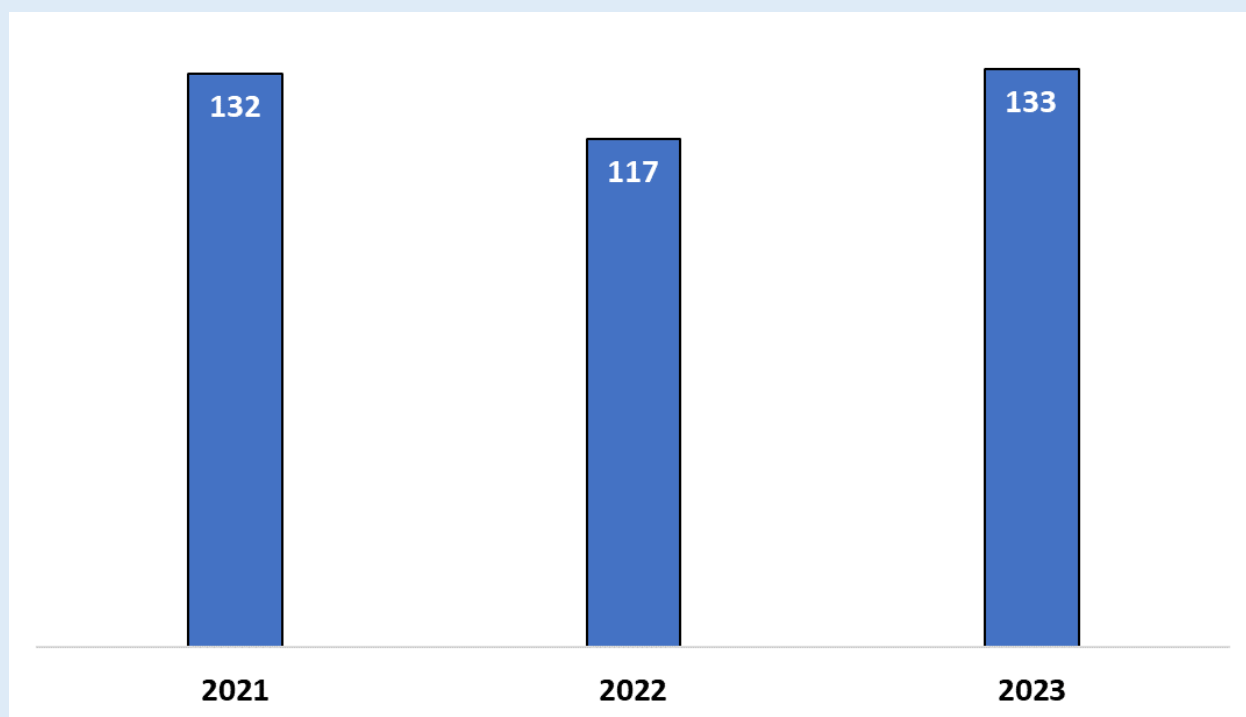
Statewide HRI visit rates were lower in 2023 than in 2021 and 2022, despite having more days with the heat index equal to or greater than 80°F (see Figure 6 and 7). A possible reason for lower rates in 2023 is improvements in protective public health actions after the 2021 heat dome year, such as increased and more targeted risk communications messaging and state-funded air conditioner distribution through Program Section 7 of [Senate Bill 1536](#), 2022. Other factors affecting year-to-year health outcomes from excessive heat are regional differences in heat index and temperature ranges, acclimatization, consecutive days of heat and overnight cooling.

Figure 6: Statewide heat-related illness visit rates per 100,000 people May 1-September 30, 2021-2023. †



† Note: We used American Community Survey (ACS) 2022 5-Year population estimates for 2021 and 2022. 2023 ACS population estimates were not available; Portland State University Population Research Center’s Certified Mid-Year Population Estimates were used for 2023 statewide population adjusted heat-related illness rates. The difference in estimates between ACS and Population Research Center is negligible.

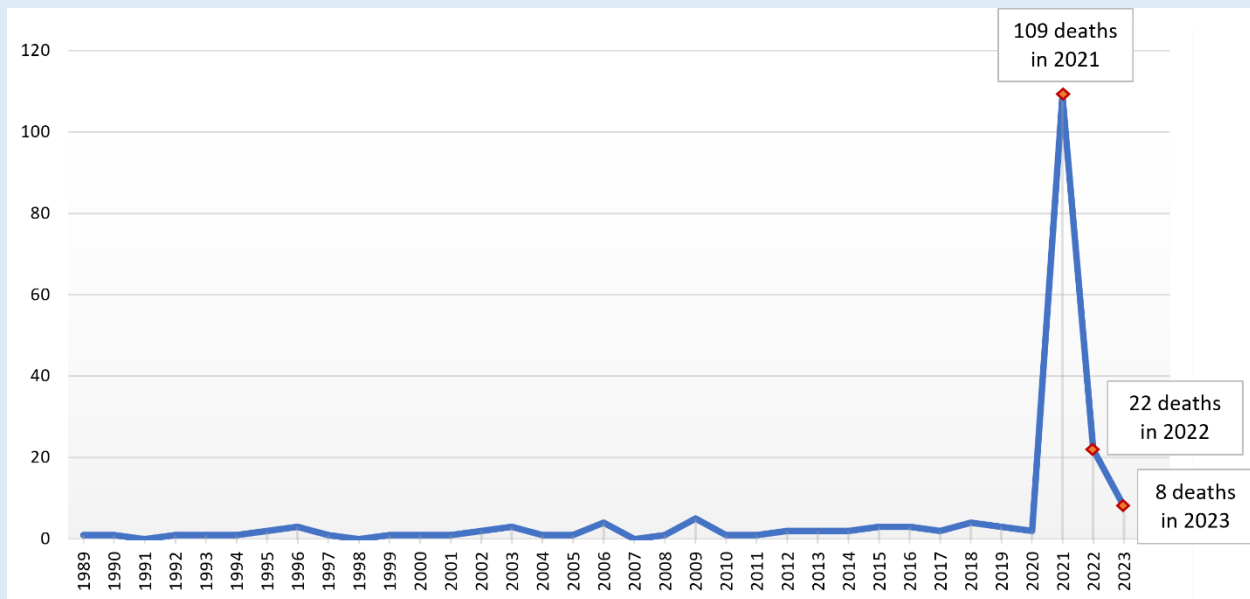
Figure 7: Number of days when the Heat Index is at or above 80°F May 1-September 30, 2021-2023.



The data in Figure 8 below represent deaths of residents occurring in Oregon due to excessive heat. There was a total of 139 heat-related deaths in 2021, 2022 and 2023 combined. There were 8 total heat-related deaths in 2023, which is more than the heat-related deaths in the decade before 2021, when heat deaths did not exceed four per year.

Multiple contributing factors can lead to heat-related mortality in addition to extreme heat. These factors may include chronic health conditions, age, sex, and substance use (illicit drugs and alcohol), among others. During 2021-2023, cardiovascular disease was a contributing cause of 25 percent of heat-related deaths. People ages 50 and older accounted for 87% of heat-related deaths. About 70% of deaths were among males. Substance use was a contributing cause of nearly 1 in 5 heat-related deaths (19%).

Figure 8: Deaths in Oregon from excessive heat, 1989-2023.



Wildfire smoke

Inhalable fine particles generated by combustion, including from wildfires, are bad for health, and are the most concerning form of air pollution from wildfires. They can travel deep into the lungs and into the bloodstream, causing damage to the lungs, heart and other organs. Many researchers study the effects of particulate matter 2.5 microns or smaller in size, referred to as “fine particles” or “PM2.5.” About 30 PM2.5 particles strung together measure the width of a human hair. OCCRI’s Sixth Climate Assessment projects larger and more extreme wildfires if greenhouse gas emissions do not decrease globally. This would be associated with a doubling or tripling of particulate matter contributions from wildfire smoke in Oregon by the end of the century. [26] One example of what this means for health is that increases in smoke PM2.5 predicted for Oregon in 2050 are estimated to cause increased excess asthma emergency department (ED) visits at a rate of 42 excess asthma events per 10,000 population, the highest predicted rate increase across all Western States. The projected Oregon rate

increases are highest in western and northeastern areas of the state. These additional smoke-related asthma ED visits will add an estimated \$99.7 million to health care costs in Oregon in the 2050s. [27]

Many people have become familiar with the green, yellow, orange, red and purple color coding of the US Environmental Protection Agency’s (EPA) Air Quality Index (AQI), corresponding to “good,” “moderate,” “unhealthy for sensitive groups,” “unhealthy,” “very unhealthy” and “hazardous” air quality. In 2024, EPA revised the level of PM2.5 for a number of these categories to reflect increasing evidence of adverse health effects at lower levels of fine particulate pollution. [28] This revision will increase the number of days designated as “moderate air quality” per season going forward.

Figure 9: Policy change for national air quality standards for PM2.5 (adapted from EPA)

AQI Category and Index Value	Previous AQI Category Breakpoints (ug/m3 PM2.5)	Updated AQI Category Breakpoints (ug/m3 PM2.5)	What changed?
Good (0-50)	0.0 to 12.0	0.0 to 9.0	EPA lowered the breakpoint between Good and Moderate to reflect the updated annual standard of 9 micrograms per cubic meter.
Moderate (51-100)	12.1 to 35.4	9.1 to 35.4	
Unhealthy for Sensitive Groups (101-150)	35.5 to 55.4	35.5 to 55.4	No change because EPA retained the 24-hour fine PM standard of 35 micrograms per cubic meter.
Unhealthy (151-200)	55.5 to 150.4	55.5 to 125.4	EPA lowered the breakpoints at the upper end of the unhealthy, very unhealthy, and hazardous categories based on scientific evidence about particle pollution and health. The Agency also combined two sets of breakpoints for the Hazardous category into one.
Very Unhealthy (201-300)	150.5 to 250.4	125.5 to 225.4	
Hazardous (301+)	250.5 to 350.4 and 350.5 to 500	225.5+	

An important near real-time source of data for OHA in assessing risks to health from wildfire smoke during wildfire season is the Oregon Electronic Surveillance System for the Early Notification of Community-Based Epidemics, or “OR-ESSENCE.” This system receives air quality data from the AirNow system and patient visit data from all non-federal emergency departments and many urgent care centers in the state. OHA analyzes these data to help identify populations most at risk of harm to health from climate change effects. [29]

As seen in Figure 10 below, the 2023 data show that people who self-identified as non-Hispanic American Indian/Alaska Native, non-Hispanic Black/African American and non-Hispanic Native Hawaiian/Other Pacific Islander have rates of non-infectious respiratory illness visits that are double or near-double the statewide rate of 22.0 out of every 1,000 people. In 2023, 95% of patient visits reported to OR-ESSENCE for non-infectious respiratory illness visits included race and ethnicity data.

Figure 10: Statewide rates of non-infectious respiratory illness visits by Race and Ethnicity, May 1-October 31, 2023.

Race/Ethnicity	2023 Rate of Visits (per 1,000 people)
NH-American Indian/Alaska Native	44.2
NH-Asian	10.3
NH-Black/African American	45.2
NH-Native Hawaiian/Other Pacific Islander	42.3
NH-White	23.5
Hispanic or Latino (of any race)	13.7
STATEWIDE RATE	22.0

OR-ESSENCE data also show where in the state wildfire smoke impacts hit hardest. The figures below overlay PM_{2.5} pollution with non-infectious respiratory visits to emergency departments and urgent care centers for the 2023 wildfire season. The PM_{2.5} concentration is the maximum daily average from all air quality monitors in the five counties in Oregon most-impacted by particulate pollution. During May-October 2023, the five counties with the highest number of days at or above moderate AQI due to PM_{2.5} concentrations were Deschutes, Jackson, Josephine, Klamath, and Lane counties (see Figure 11). These counties experienced some notable air quality events, starting in May 2023 and into late October 2023. The counties with the least number of days at or above moderate AQI (due to PM_{2.5} concentrations) were Coos, Lincoln, Malheur, Tillamook and Yamhill (see Figure 12).

Changes in respiratory visits are not always directly proportionate to the PM_{2.5} concentration. For example, in response to an early event in Lane County in May 2023 where the AQI was in the moderate category, the proportion of non-infectious respiratory illness visits steadily increased during the next week, nearly doubling ten days after the event, then decreasing. In August, however, the proportion of daily non-infectious respiratory visits showed smaller increases following a smoke event. It could be that residents experienced more health impacts from the early season events and may have taken more protective measures later in the season, preventing a spike in visits following those events, some of which occurred over an extended period of time. These observations are consistent with research that shows the relationship between acute (short-term) respiratory effects and PM_{2.5} concentrations are non-linear, with a higher rate of increase at lower levels of exposure to PM_{2.5} (10-30 ug/m³, in the “moderate” AQI range) compared to PM_{2.5} levels above 100ug/m³ (“unhealthy” AQI and above). [30]

Pre-existing chronic health conditions contribute to differences in observed respiratory health impacts of PM_{2.5}. Non-infectious respiratory visits include exacerbations of chronic respiratory conditions such as asthma and COPD. Some of the counties in Figure 12 have higher rates of non-infectious respiratory illness visits (see Appendix B). For example, Coos and Lincoln Counties have high rates of non-infectious respiratory illness visits (see Appendix B) in addition to rates of asthma and COPD above the state rate and a high prevalence of one or more chronic health conditions. In contrast, Malheur County has the lowest rate statewide of non-infectious respiratory illness visits (See Appendix B), and the prevalence of asthma, COPD, and one or more chronic conditions are lower than statewide rates. [31]

Figure 11: Non-infectious respiratory visits and PM2.5 in counties (Deschutes, Jackson, Josephine, Klamath and Lane) with the most days at or above moderate AQI, May-October, 2023.

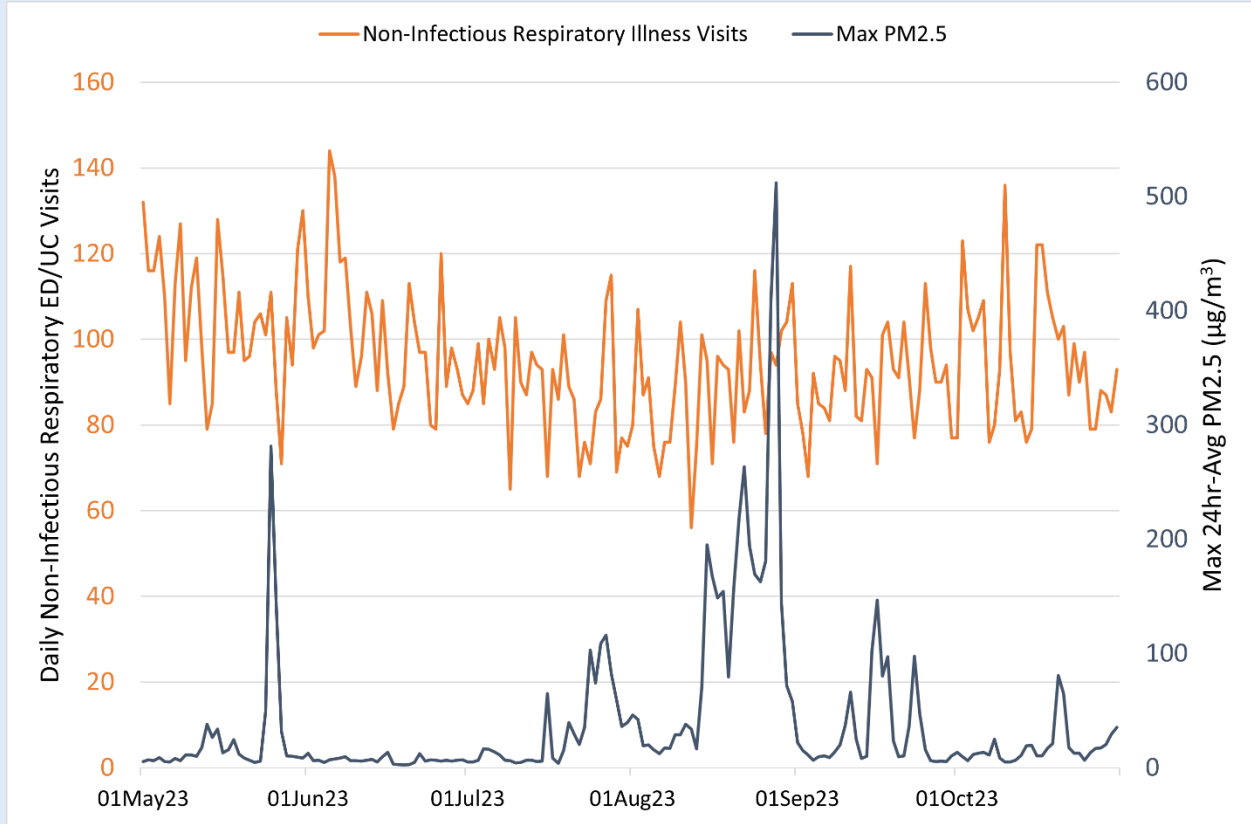
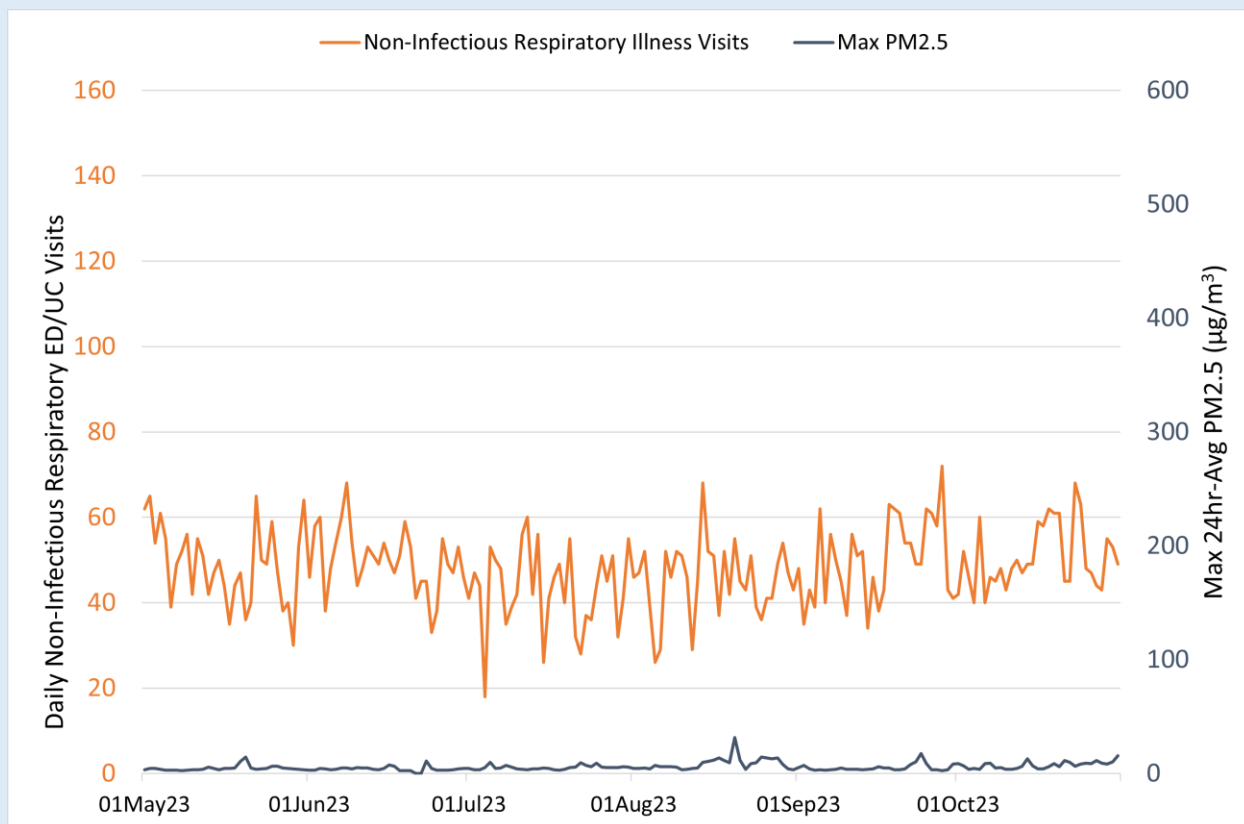


Figure 12: Non-infectious respiratory visits and PM2.5 in counties (Coos, Lincoln, Malheur, Tillamook and Yamhill)) with the least days at or above moderate AQI, May-October, 2023.

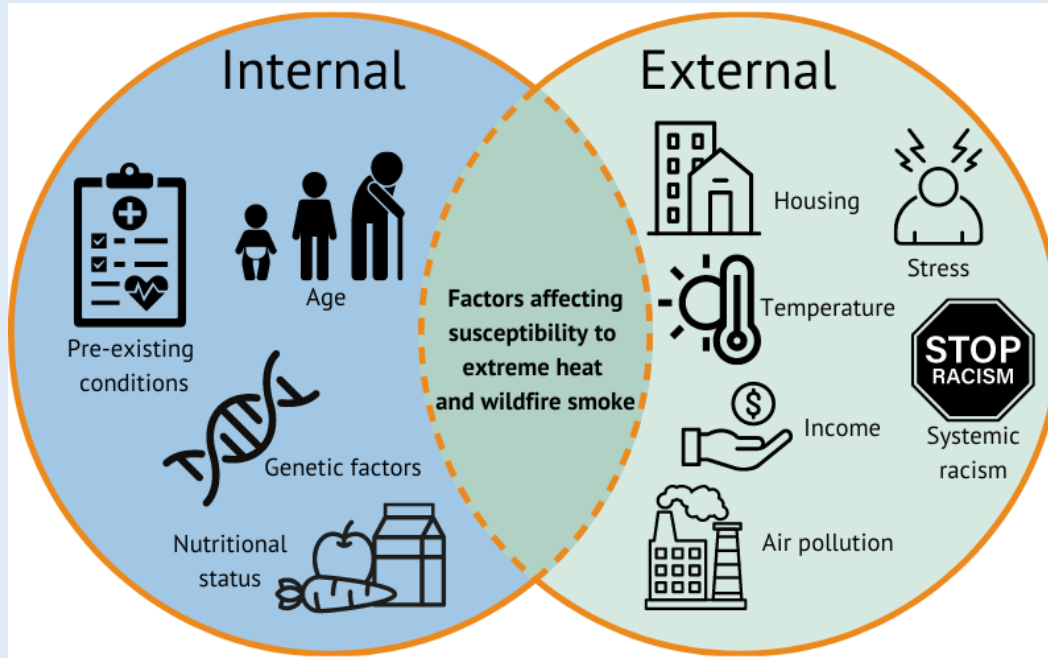


Applying the new AQI category thresholds to air quality data from May-October 2023, all counties in Oregon would have seen an increase in days that were classified as moderate. The lowest increase was two days and the largest increase was 25 days. Overall, there was a median increase of 12 days across counties at or above moderate AQI.

Combined heat and smoke events

PM2.5 and extreme heat are individually associated with negative health impacts. These exposures often happen concurrently and may produce synergistic health impacts that are greater than the effects of individual exposures combined. [32]

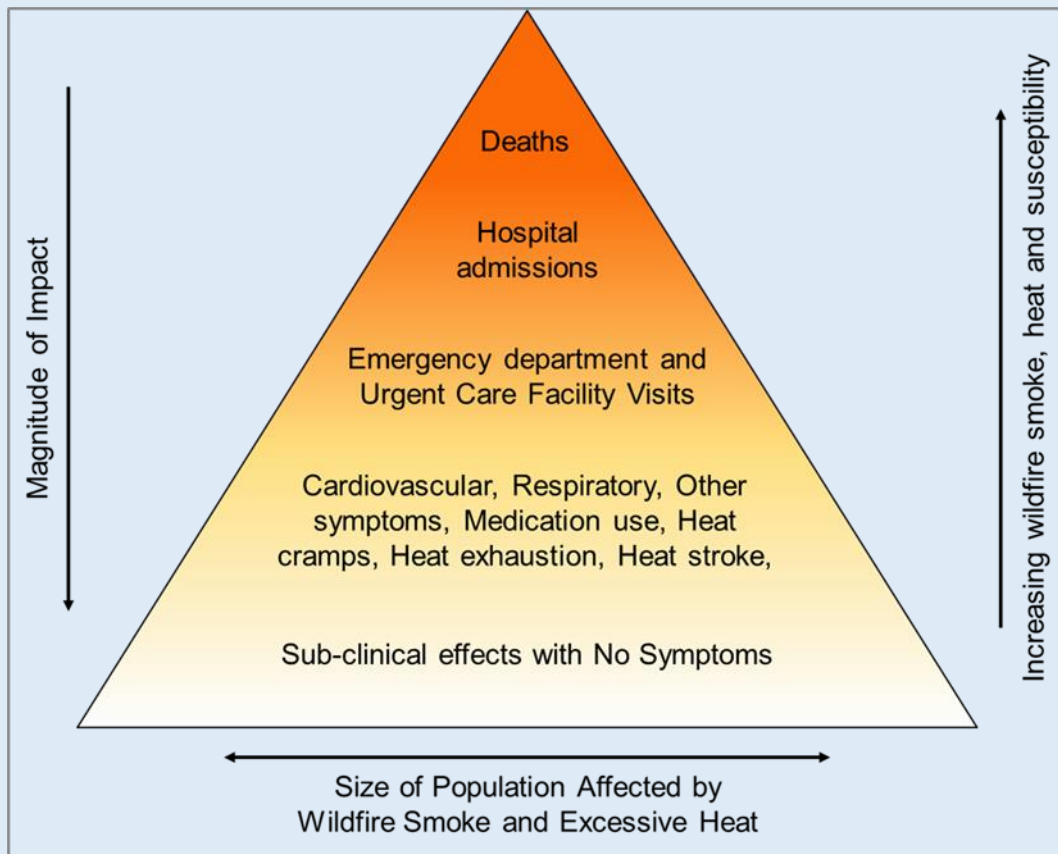
Figure 12: Factors affecting susceptibility to extreme heat and wildfire smoke.



An individual's social and neighborhood environment can affect susceptibility to extreme heat and wildfire smoke (see Figure 12). Social determinants of health include housing, income and systemic racism, among others. Social determinants affect health status, which in turn factors into a person's resilience to extreme heat or smoke. In addition to social determinants, age and genetic factors play a role. Nearly 25% of Oregonians are at greater risk of adverse health effects from environmental hazards based on age alone (5% are less than 5 years old and 18% are 65 years or older). [33] In terms of health status, 5% of youth ages 0-17 have asthma [34] and 57% of Oregon adults (18 and over) report one or more chronic health conditions. [31]

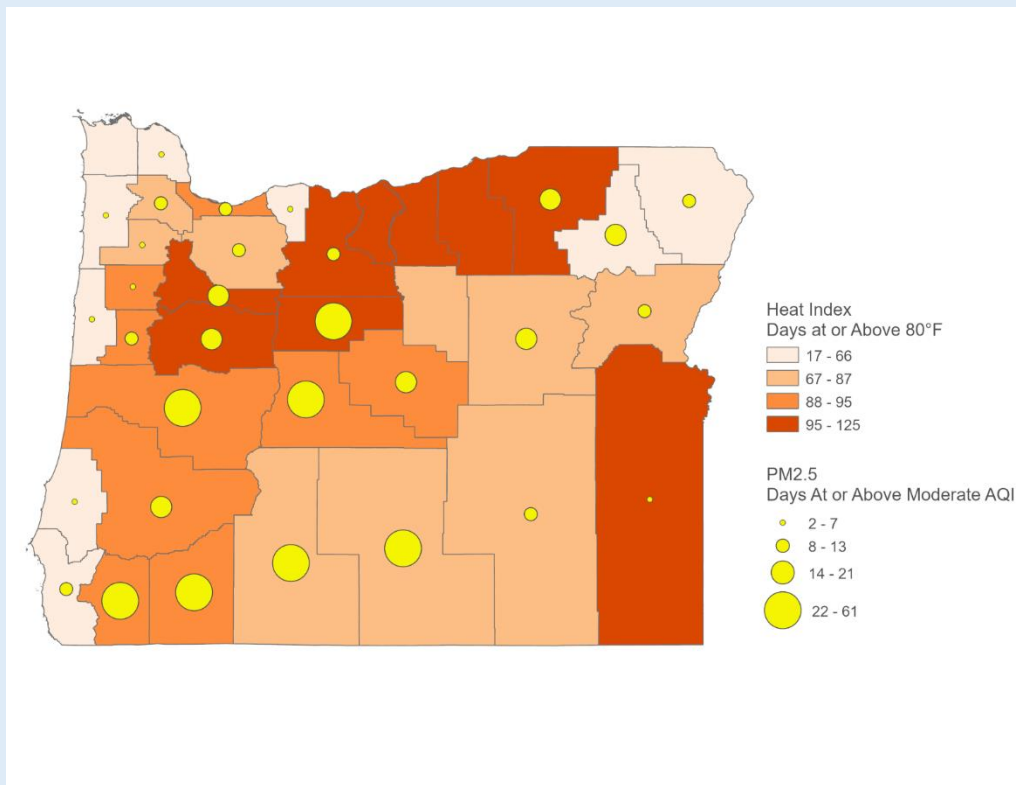
Figure 13 below illustrates how exposure to wildfire smoke PM2.5 and heat can cause mild symptoms and increase to more severe symptoms, leading to emergency department visits, hospitalizations and even death. Illnesses and deaths from these environmental hazards can occur rapidly (same day) or have a lagged effect (days to weeks later). [32]

Figure 13: Pyramid of Health Effects from Wildfire Smoke and Excessive Heat (Adapted from Cascio, Proceedings of the 2nd Int'l Smoke Symposium).



This model is relevant for Oregon, where many counties experience numerous days of both elevated particulate air pollution (PM_{2.5}) and high heat from May through September (see Figure 14). In some areas of Oregon, the presence of ozone, another air pollutant increased by combustion, including wildfires and burning fossil fuels, may worsen health effects.

Figure 14: Oregon counties showing days with a heat index at or above 80°F and at or above moderate air quality index levels.‡



Seven counties – Crook, Deschutes, Douglas, Jackson, Jefferson, Josephine and Lane – exceed the state average for both air quality days at or above moderate Air Quality Index (AQI; state average is 17 days) and heat index (HI) above 80°F (state average is 81 days).

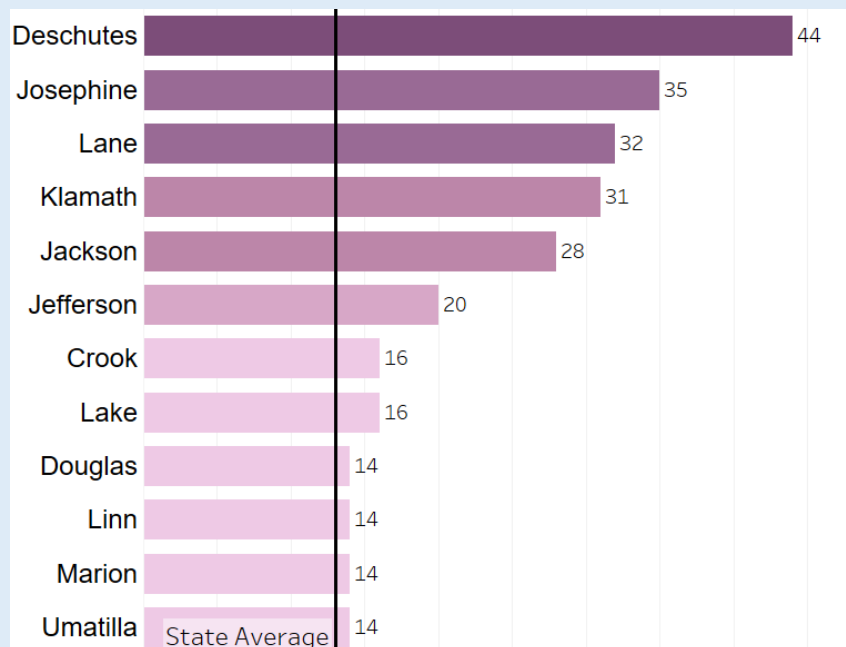
Nearly forty percent of Oregonians (1.7 million) live in the 12 counties that experienced a total of 14 or more days with heat at or above 80°F and compromised air quality occurring on the same day during May-September 2023 (see Figure 15). All of these

‡ Air pollution monitor data from permanent monitors are not available for Clatsop, Gilliam, Morrow, Sherman and Wheeler counties.

counties are home to Oregonians who report a higher chronic disease burden than the state average. [31] For example, the percent of adults:

- ever diagnosed with coronary heart disease, heart attack or stroke is above the state average of 6.8% in all but one county. [§]
- ever diagnosed with chronic obstructive pulmonary disease (COPD) is above the state average of 5.7% in all but one county. ^{**}
- with current asthma in 9 of these 12 counties is above the state average of 11.5%.

Figure 15: Concurrent impacts of Oregon counties experiencing 14 or more days with heat index at or above 80°F and compromised air quality (at or above moderate AQI) occurring on the same day during May-September 2023.



[§] Percent of adults ever diagnosed with coronary heart disease, heart attack or stroke in Jefferson County is 6.7%.

^{**} Lake County rates are unreliable for the percent of adults ever diagnosed with COPD due to small number of people surveyed.

As this and previous OHA Climate and Health in Oregon annual reports have documented, data show individual climate hazards can disproportionately impact communities of color, people with low incomes, and Tribal communities. While a study on the synergistic effects of compound climate hazards on these populations in Oregon has not yet been undertaken, such a study has been completed for California. The study showed that “communities with lower education attainment, lower health insurance coverage, lower income, lower proportion of automobile ownership, lower tree canopy coverage, higher population density and higher proportions of racial/ethnic minorities experienced higher synergistic effects” on daily cardiorespiratory hospitalizations. [32] State agencies are currently developing an Environmental Justice Mapping Tool (see state initiatives, page 47). This tool will one day make it easier to conduct a similar analysis in Oregon.

Mental health impacts of climate change

There are three main pathways through which climate change can affect mental health. A person could experience mental health challenges through one or more of these pathways.

- Severe weather events, where people can suddenly lose a home or people and places that are significant to them. These experiences can lead to post-traumatic stress disorder and increased anxiety and depression. [35]
- Slower moving climate-related impacts (such as drought) that involve environmental degradation can lead people to lose their livelihoods, sense of place or cultural practices.
- The knowledge of climate change, future climate projections and impacts as well as current effects on communities can lead people to experience climate or eco- anxiety.

Specific climate hazards may also cause or exacerbate mental health symptoms. For example, extreme heat and poor air quality have been associated with a range of negative mental health symptoms and outcomes. [11, 36-37]

OHA published a 2022 study of the impacts of climate change on youth mental health and depression. The report was based on a literature review and qualitative data from interviews with mental and public health professionals and educators and focus group

with youth. [38] The study findings increased our understanding of the unique ways in which climate change can affect youth mental health, but it did not measure the prevalence or severity of the issue for youth in Oregon.

The Oregon PHAB identified the mental health effects of climate change as a developmental focus area and established the goal of identifying and developing datasets that would allow OHA to measure and track the mental health effects of climate change in Oregon in the future. [5] Progress has been made toward this goal. OHA will include climate and mental health questions in the 2024 version of the Oregon Student Health Survey with results from the survey to be included in future Climate and Health in Oregon reports.

Drought and water

Changes to the climate are increasing the frequency and severity of droughts, floods, wildfires and other natural disasters, posing risks to water security in Oregon. [39] OHA defines water security as adequate and equitable access to clean, safe and affordable water for drinking, food preparation, sanitation and hygiene, recreation, cultural and spiritual uses. Health outcomes from inadequate and inequitable access to clean, safe and affordable water include water-borne illness, exposure to harmful contaminants, dehydration and malnutrition and poor mental health.

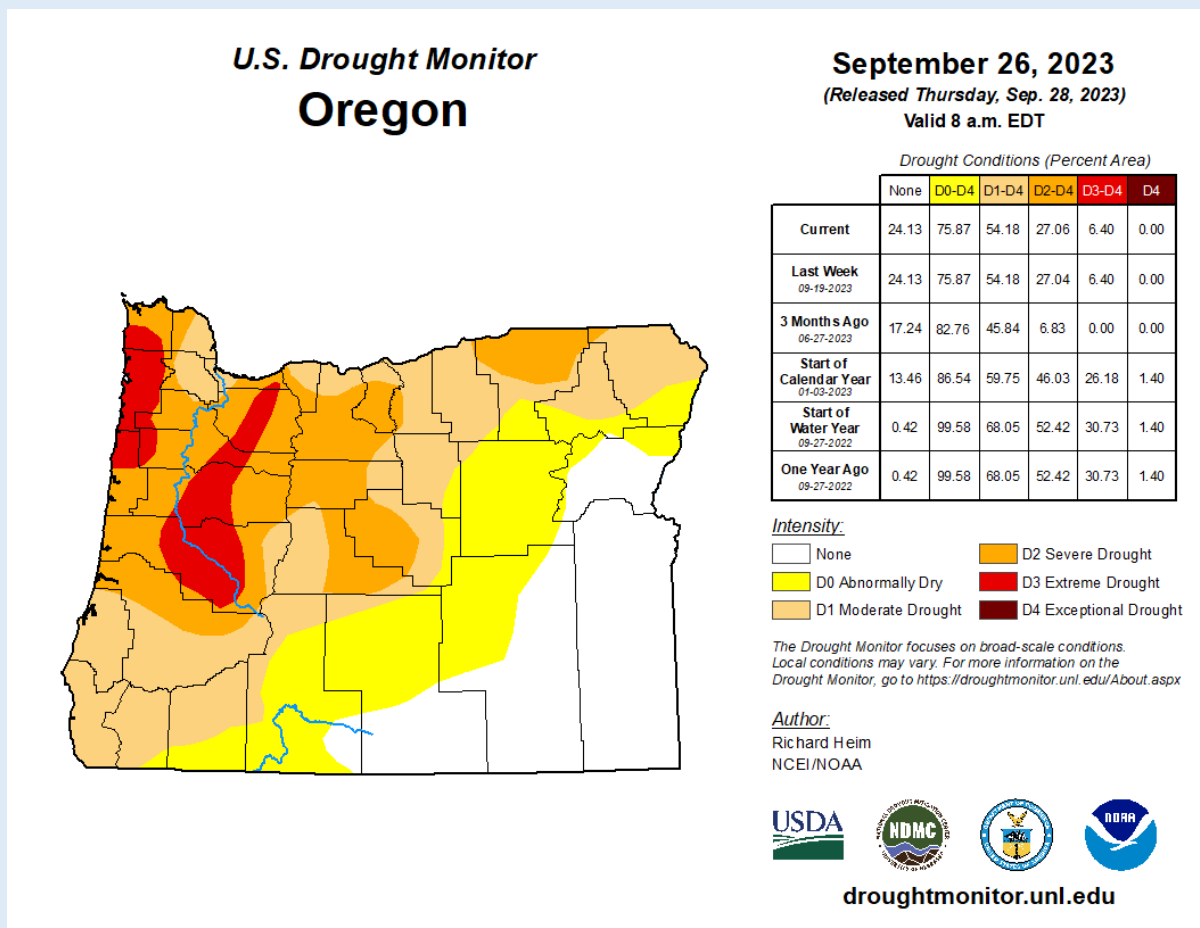
Drought

Droughts are slow-moving, with impacts that can persist despite the return of rain or snow. [40] In the Pacific Northwest, droughts have increased over the past 20 years, becoming more widespread and severe. [26]

Snow droughts are projected to increase in the coming decades as snow precipitation and mountain snowpack are likely to decrease. [26] Snowpack can affect drought severity, summer water supply, soil moisture and vegetation conditions. These, in turn, can affect wildfire conditions, water supply and agricultural conditions. [41] The snowstorms in January 2023 provided some much-needed mountain snowpack, but the warmer temperatures in March caused early and quick snowmelt. [42] Snowmelt fills reservoirs and groundwater aquifers, providing drinking water to Oregonians on public water systems and private domestic wells.

In September 2023, more than half of Oregon’s land area experienced severe drought (52%), while 30 percent experienced extreme drought. There were 13 counties with Governor drought declarations in 2023, compared to 26 counties in 2021 and 17 counties in 2022. Although drought conditions in 2023 were less widespread than in previous years, there were some notable regional impacts. Dryness in the Pacific Northwest during 2023 was especially extreme along the Oregon coast, which ranked as the driest May-July on record (see Figure 16). [43] Tillamook County community water systems experienced water supply issues, with several cities issuing water conservation notices to the public. [44] Adequate water supply for coastal communities is crucial for their economies during the summer season when water demands increase. Oregon State Parks at the coast received an average of 30 million visitors per year in the last few years. [45]

Figure 16: Drought conditions, September 26, 2023.



Klamath County has been experiencing consecutive years of drought. During 2021-2023, Oregon Water Resources Department (OWRD) received 516 dry or slow recharge domestic well complaints from Klamath County domestic well users, leaving many homes without running water. [46] In 2021, Governor Brown signed Executive Order No. 21-07 declaring a State of Drought Emergency in Klamath County, which initiated several opportunities for financial assistance to residents experiencing domestic well challenges. [47]

Harmful algal blooms

People who recreate in Oregon waters will unfortunately become more aware of harmful algal bloom (HABs) that can affect human health as climate impacts increase. In marine waters, rising ocean temperatures are boosting the conditions that promote the growth of certain algae that release toxins and contaminate shellfish, leading the Oregon Department of Agriculture to close recreational shellfish harvesting and impose restrictions on commercial crab harvests. [48]

Certain freshwater bacteria known as cyanobacteria are also popularly referred to as HABs because they look similar to mats of algae. Cyanobacteria that release toxins in rivers, lakes and reservoirs can cause serious illness or death in pets, livestock and wildlife, and in sensitive individuals also cause a red, raised rash or skin, ear and eye irritation. [49] Warm weather, nutrients and low water flow can help these freshwater bacteria multiply quickly. In 2023, OHA's [Harmful Algae Bloom Surveillance program](#) issued 12 recreational use health advisories for rivers, lakes and reservoirs, including the permanent advisory for South Umpqua River and mainstem Umpqua River. [50]

As noted elsewhere in this report the 2023 Oregon Legislature directed and provided resources to OHA and DEQ to jointly establish a state harmful algal bloom surveillance and monitoring program that will for the first time allow systematic monitoring of recreational waters in Oregon. This will increase the likelihood of generating data to allow reporting in the future on the status and trends of this health hazard in Oregon.

Vector-borne diseases

Climate change increases the number and geographic range of disease-carrying insects such as ticks. These changes create new opportunities for diseases to emerge and become more prevalent in new places. The risk of human exposure to Lyme Disease and West Nile Virus are expected to rise as a result. [51]

- Rising temperatures, changing precipitation patterns and extreme weather events are expanding the geographic and seasonal distributions of vectors and vector-borne diseases.
- Climatologists project that Oregon will face more droughts in the decades to come. These conditions may increase the likelihood of wildlife (such as deer, a host species for ticks) moving into more populated areas in search of water and food.
- Intense precipitation can create more stagnant water pools that contribute to increased mosquito populations.
- Drought conditions can affect mosquito populations and increase transmission risk of West Nile Virus.

Lyme disease, West Nile Virus and Zika virus infections are reportable conditions in Oregon. OHA's Acute and Communicable Disease Program publishes [weekly](#) and [monthly](#) communicable disease reports that include vector-borne diseases. In 2023 there were 65 cases of Lyme disease reported in Oregon, with cases occurring in all months of the year, comparable to the 63 cases in 2022 but below the 73 cases reported in 2021. West Nile Virus cases occurred during July through October in 2023; 17 cases were reported compared to 5 cases each year in 2022 and 2021. There were no cases of Zika reported in Oregon during 2021-2023. Data for these conditions are omitted for 2020 due to lack of reliability.

Emerging climate and health equity issue: perinatal health

Perinatal health refers to the health and well-being of both the pregnant person and the baby before, during and after birth. The well-being of pregnant people and babies

determines the health of the next generation and can impact future public health challenges for families, communities, and the health care system. Climate change threatens to worsen health outcomes and ongoing racial inequities in this area.

Overview of perinatal health in Oregon

Maternal health outcomes. Pregnancy-related deaths in the United States have been on the rise since the 1980s. A study by the Centers for Disease Control and Prevention found that about 80% of deaths due to pregnancy-related causes could have been prevented, most of these deaths occurred in the year following childbirth. [52] Oregon’s Maternal Mortality and Morbidity Review Committee found that more than half of all pregnancy related deaths in Oregon were preventable. [53] Research has also found that there are significant disparities in death rates among different racial and ethnic groups, especially among American Indian/Alaskan Native and Black/African American individuals. [54]

Infant health outcomes. Preterm birth rates, low birth weight, and infant mortality are areas of concern. The rate of preterm birth in Oregon is highest for Native American/Alaska Native infants followed by Black/African American, Hispanic/Latinx, Asian/Pacific Islander and White infants. [55]

Factors impacting perinatal health. Underlying health conditions, age, social determinants of health such as poverty, housing instability, environmental exposures, access to maternity services, and lack of culturally and linguistically appropriate care can impact perinatal health outcomes. [56]

Climate-related perinatal health risks

Climate-related hazards, such as extreme heat, flooding, and wildfires, have been associated with various health issues, including anemia, worsened respiratory conditions, eclampsia, low birth weight, preterm birth, and miscarriage.

- **Heat waves:** Extreme heat can pose significant risks to pregnant women, increasing the likelihood of preterm birth, low birth weight, and other adverse outcomes. [57]
- **Wildfires:** Exposure to wildfire smoke during pregnancy can have adverse effects on fetal development and increase the risk of respiratory problems in newborns. [58]

- **Water quality:** Climate change affects the quality, quantity and safety of our water through drought, increased flooding and the warming of surface waters. Infants are highly susceptible to waterborne illnesses and dehydration, and rely on clean water for formula preparation, cleaning bottles, and sterilizing pump parts. [59]
- **Other risks:** Pregnant and postpartum people can be at increased risk of experiencing post-traumatic stress disorder (PTSD) and depression after an extreme weather event. Pregnant people need reliable access to transportation access and medical care which can be disrupted due to climate hazards. [57]

A need for cross-sectoral strategies

Perinatal health and climate risks are interconnected and require collaboration across different sectors. These strategies can incorporate systems-level approaches to shift the burden of reducing exposure to environmental threats during pregnancy from the individual and instead focus on addressing historical inequalities that have led to disparate health outcomes.

Here are possible strategies for people working in different sectors:

- **Climate and emergency planning practitioners** can engage with people who understand perinatal health, especially people who provide care for pregnant people living in communities that have higher rates of poor birth outcomes. This can be done when developing, implementing, and prioritizing strategies. While people are only pregnant for a relatively short time, exposures and injuries during this time could have serious and lifelong impacts for a developing baby and pregnant person.
- **Healthcare leaders** can work with local governmental agencies, health care providers and community members to increase public awareness about the risks of climate change to perinatal health. This could include co-developing culturally relevant and linguistically appropriate educational materials and workshops. Other strategies include:
- **Community outreach and education** that target employers and employees on workplace measures and laws that protect pregnant workers

- **Investment in culturally specific health** navigation staff who are familiar with the connection between climate change and perinatal health and can help access to resources for pregnant and postpartum people and can assist them with accessing the services they need
- **Environmental justice** considerations in maternal and infant health initiatives
- **Learning more about links** between environmental and occupational health and the health of pregnant people, postpartum people, and newborns

State leadership and investments in climate resilience

Building climate and health resilience means ensuring that everyone has access to healthy water and food and that homes, neighborhoods and schools are resilient to smoke, extreme heat and other climate hazards. Increasing tree canopy in neighborhoods and communities, providing air filtration devices and air conditioners to lower income households, and providing resources for house repairs and weatherization are some examples of how to build climate resilience. These kinds of climate adaptation strategies require investments and cross-sectoral collaboration among public health, housing, health care, forestry, land use and community partners. Below are initiatives and investments in 2023 that are increasing our collective climate and health resilience and where OHA has a leadership role.

Harmful algal blooms

The 2023 Oregon Legislature allocated \$188,664 to OHA, with additional resources to DEQ, for the two agencies to jointly establish a state harmful algal bloom surveillance and monitoring program. This new funding will support systematic monitoring of recreational waters for the first time in the state. These investments in surveillance and monitoring will improve our ability to identify lakes and rivers with toxic blooms present in order to protect drinking water sourced from these areas and better inform the public about protecting themselves when recreating in Oregon rivers, lakes and reservoirs.

Environmental justice and drinking water systems

The Bipartisan Infrastructure Law (BIL) has made funding available for communities to make improvements to their public drinking water systems. This could include infrastructure improvements as well as projects that reduce people's exposures to emerging contaminants. Emerging contaminants are those that could pose a risk to humans but are not currently regulated such as manganese, and cyanotoxins generated by harmful algal blooms. A key priority of the BIL is to ensure that disadvantaged communities benefit equitably from this funding.

Green infrastructure funding

In 2023, the Oregon Legislature passed [House Bill 3409](#), establishing the [Community Green Infrastructure Grant Program](#) to be administered by the Oregon Department of Land Conservation and Development (DLCD). A total of \$6.5 million will be available to fund green infrastructure projects that provide social, environmental, or economic benefits to environmental justice communities. Green infrastructure projects may include green spaces and parks, tree planting, and native seed banks or plant nurseries. OHA is one of the state agencies with whom DLCD may enter into an intergovernmental agreement to assist in the design and implementation of the grant program, readiness to acquire and administer federal funding related to green infrastructure projects, and technical advice or feedback on the grant review process.

Healthy homes grant program

The Oregon Legislature established the Healthy Homes Grant Program (HHGP) in 2021 and in the 2021, 2022 and 2024 legislative sessions appropriated a total of \$30 million for the program. HHGP has the goal to improve housing conditions and health outcomes for low-income and environmental justice communities. Funding can be used to make homes more resilient to climate change and weather impacts and address a wide array of other safety hazards.

In 2023, HHGP worked with advisory committees to adopt final rules for the program and inform development of the inaugural HHGP Request for Grant Application (RFGA), to be opened in early 2024. OHA expects to award \$1.5 million in non-competitive grants to Tribes and \$8.5 million in competitive grants to a wide array of eligible entities who will use grants to leverage existing funding streams and ensure a more

comprehensive delivery of services for low income and environmental justice communities across Oregon.

DEQ included HHGP in the State of Oregon's application to the US Environmental Protection Agency (EPA) for federal Inflation Reduction Act funding via the EPA Climate Pollution Reduction Grant (CPRG) program to reduce greenhouse gas emissions. If the state's application is successful, HHGP would receive additional funding for home weatherization; EPA will announce grant awards in 2024.

Air conditioner and air filter deployment program

In 2022, the Oregon Legislature enacted [Senate Bill 1536](#) directing OHA to establish an [Air Conditioner and Air Filter Deployment Program](#) with a \$5 million appropriation to fund the program through mid-2023. OHA provided 3,000 air conditioners and 4,500 air filtration devices to low-income households to protect Oregonians from extreme heat and wildfire smoke, and OHA has continued to make improvements and investments into the program.

Environmental justice mapping tool

In 2023, OHA continued working closely with DEQ, the Environmental Justice Council and other state agency partners to develop an Oregon-specific environmental justice mapping tool. In 2022, this mapping tool was funded by the Oregon Legislature by [House Bill 4077](#), which strengthens and diversifies the state's Environmental Justice Task Force, now called the Environmental Justice (EJ) Council. This bill directs the EJ Council to oversee creating an environmental justice mapping tool to provide geospatial information about environmental justice impacts and provide guidance for state agencies when adopting rules and policies. This type of tool increases state agencies' capacity to prioritize populations that experience disproportionate risks of environmental exposures in program development and resource allocation. It may inform where to focus state climate resilience investments (see "Public health modernization" section) and programming. In April 2024, the EJ Council voted to include a Climate Change Risk indicator domain in the Oregon Environmental Justice Mapping Tool. Indicator domains will include environmental benefits and community opportunities. Community listening sessions are scheduled to begin in August 2024, in Gold Beach.

Other cross-sector initiatives that build climate and health

resilience

Oregon Health Authority supports other agencies by providing public health data and expertise to inform rulemaking, program development, grantmaking and climate planning. Below are some examples of initiatives that are active in 2023.

Resilience hubs and networks grant. In 2023, the Oregon Legislature passed [House Bill 3409](#), directing the Oregon Department of Human Services (OHDS) to provide grants, support, and technical assistance for Resilience Hubs and Networks in Oregon. The Legislature allocated \$10 million to the Resilience Hubs and Networks Grant. OHA was named one of the state agencies that ODHS shall consult with in this process. Applications for this grant closed on April 30, 2024. Examples of activities and items that may be funded by this grant include but are not limited to basic medical supplies, childcare, emergency communications equipment, generators, grant writing assistance for other grants, training, and water purification.

Oregon climate action commission. In 2023, the Oregon Legislature passed House Bill 3409, which modernized the Oregon Climate Action Commission. The bill directs the Oregon Climate Action Commission to prepare detailed forecasts of expected greenhouse gas emissions reductions and provide recommendations to the Legislature based on best available science. The bill added the OHA Director as a nonvoting Commission member, acknowledging a comprehensive response to climate change in Oregon requires strategies to protect people from climate impacts. The Oregon Climate Action Commission, formerly the Oregon Global Warming Commission, was created by the 2007 Oregon Legislature to track trends in greenhouse gas emissions, recommend opportunities to coordinate state and local efforts to reduce emissions, and prepare communities for the effects of climate change.

Preview of 2024 report topics

These are some of the developments OHA will detail in next year's Climate and Health in Oregon annual report.

OHA Medicaid waiver climate and health related social needs benefits

In 2022, the federal government approved Oregon's application for a waiver allowing the state to tailor the Oregon Health Plan (the state's Medicaid program providing free or low-cost health care to people with limited income) to provide housing, climate and nutrition support for people in challenging situations, including those who are: homeless or at risk of losing housing; impacted by extreme weather events; leaving state or Tribal custody. New or existing organizations that provide housing, climate or nutrition support can apply for Community Capacity Building Funds to help them get ready to become a provider of these services. OHA will begin rolling out these services in 2024.

Climate change adaptation framework update

The Oregon Climate Change Adaptation Framework (OCCAF) identifies how state agencies can effectively respond to the impacts of climate change on Oregon communities. The Department of Land Conservation and Development (DLCDD) facilitated involvement of 24 state agencies in developing the framework in 2021. In 2024, DLCDD will facilitate an update to the OCCAF, with the goal of integrating the framework into the Natural Hazards Mitigation Plan in 2025. Oregon Health Authority will continue to work with DLCDD and other agencies on the update and implementation of the OCCAF.

Regional agreement expanding the pace and scale of prescribed fire

A federal [memorandum of understanding](#) signed among four federal agencies in late 2023 is the impetus for [an agreement signed in 2024](#) by the regional directors of EPA and the US Forest Service (USFS), together with directors of state health, environmental and forestry agencies of Oregon and Washington, to protect vulnerable

communities from wildfire risks and promote healthier forests through expanded application of prescribed fire. USFS received funding under the federal Bipartisan Infrastructure Law to support this work, with the inaugural implementation occurring in Oregon the West Bend Prescribed Fire Pilot Project in spring 2024. Central to the regional agreement is a commitment to “ensure that vulnerable populations and communities disproportionately burdened by smoke from all fires are protected by pursuing increased public health interventions to meet the community need.”

Air conditioner and air filter deployment program continuation

With an additional \$3.5 million in funding approved by the 2024 Oregon Legislature, OHA anticipates distributing 4,400 portable air conditioners and 1,200 air filtration devices in advance of the summer hazards season.

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Appendix A

Heat risk tools. There are several National Weather Service (NWS) tools the public can use to assess heat risk (see Figure A). The [Heat Index](#) measures heat stress, or how hot it feels when relative humidity is factored in with the actual air temperature (apparent temperature). Heat Index values consider light physical activity in the shade, best suited for use by the general public in areas with higher humidity. The [Wet Bulb Globe Temperature \(WBGT\)](#) measures heat stress using temperature, relative humidity, direct sunlight (solar radiation), dewpoint and wind. WBGT is best suited for measuring heat stress on acclimatized, active, outdoor communities such as outdoor workers. The [NWS HeatRisk](#) is an experimental forecast tool, combining both overnight lows and daily highs to create color-coded heat risk categories occurring over a 24-hour period and seven-day period at a given location. Another tool called [HeatRisk](#) (Figure B) is a health-based heat forecast developed by the NWS and the CDC. The tool allows users to check heat and health risk levels in specific areas, searchable by zip code.

Figure A: National Weather Service HeatRisk Tools.

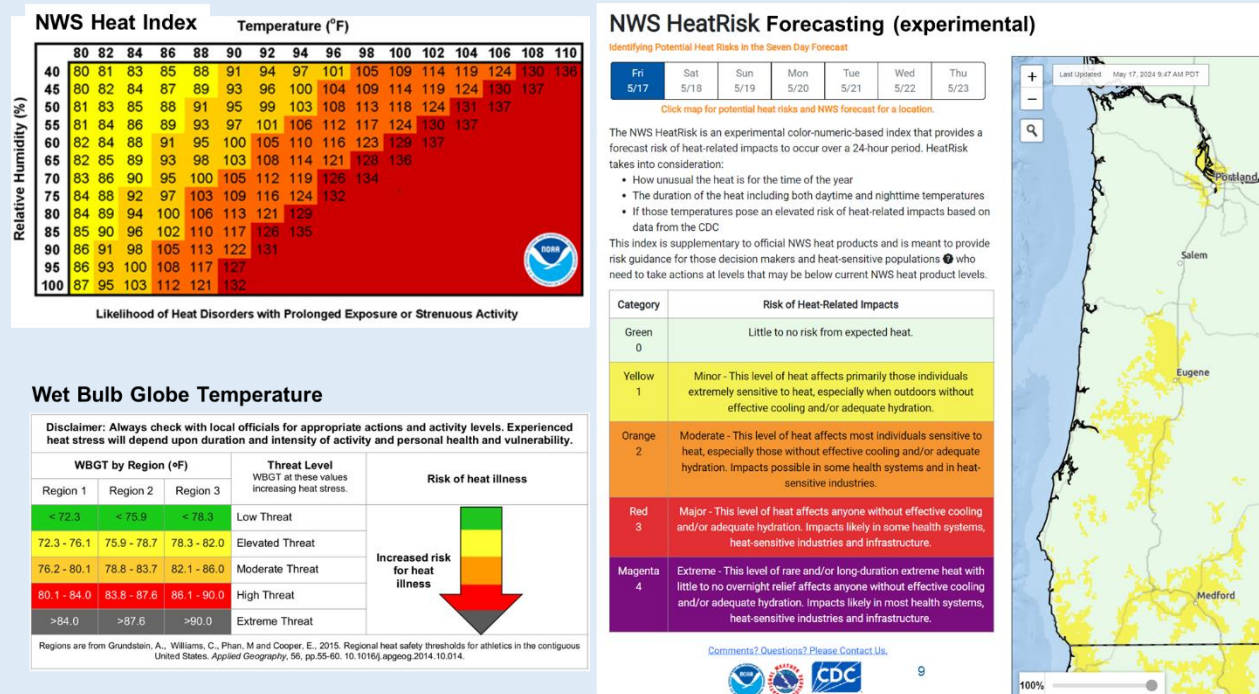
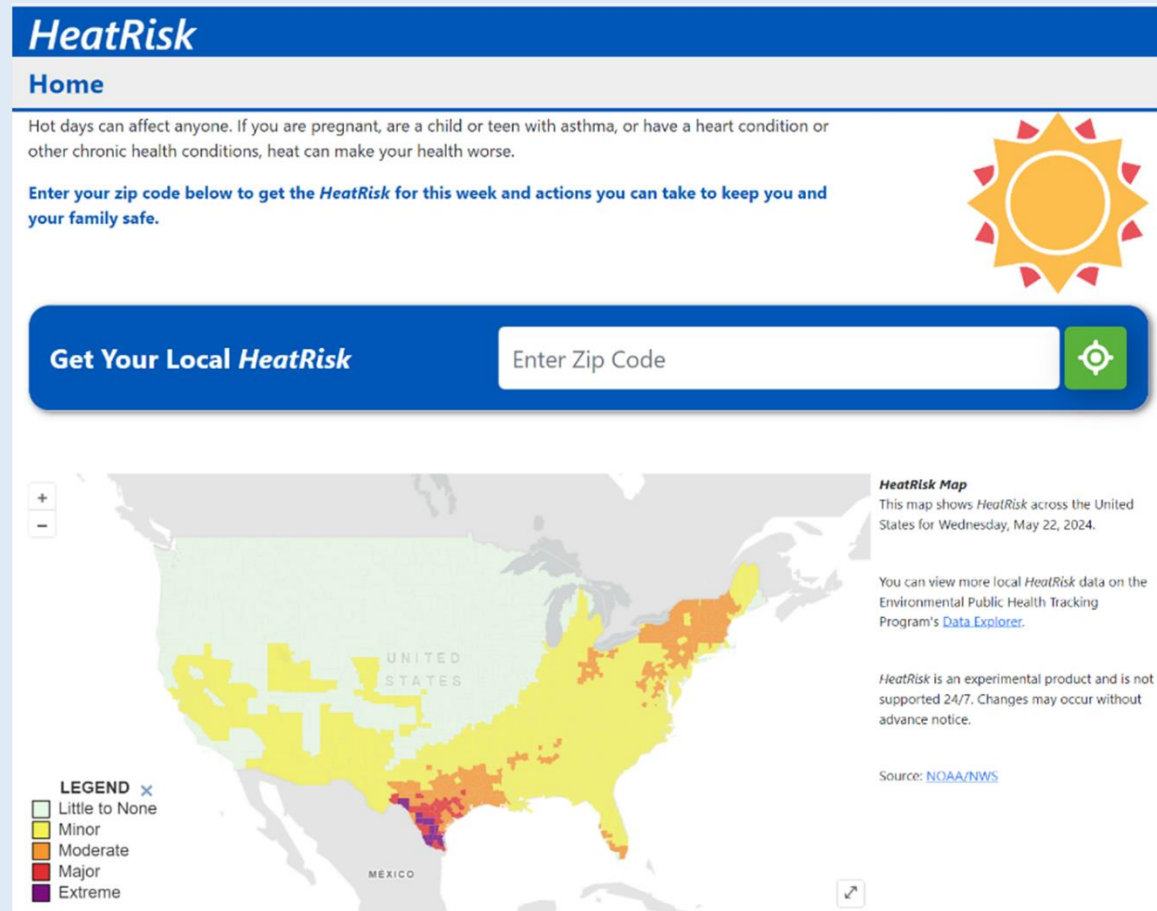


Figure B: Center for Disease Control and Prevention HeatRisk Tool.



Appendix B

Table of Non-Infectious Respiratory Illness Visit Rates in descending order and Moderate AQI Days by County. Clatsop, Gilliam, Morrow, Sherman and Wheeler counties do not have permanent air quality monitors; air quality data not shown.

County	May-Oct. 2023 Non-Infectious Respiratory Illness Visits (per 1,000)	May-Oct 2023 Days at or Above Moderate AQI (PM2.5 \geq 12.1 μ g/m ³)
Crook	50	22
Coos	49.7	5
Douglas	47.8	30
Harney	38.2	16
Curry	35.6	11
Jefferson	35.2	31
Lincoln	33.7	4
Wheeler	31.3	-
Linn	29.4	27
Lake	29.3	30
Yamhill	28.2	5
Deschutes	26.6	77
Morrow	26.4	-
Umatilla	25.7	19
Clatsop	24.1	-
Union	23.9	19

Grant	22.9	19
Wallowa	22.6	16
Josephine	22.4	51
Marion	22.1	27
Clackamas	20.8	13
Wasco	20.8	10
Jackson	20.7	38
Multnomah	19.7	15
Washington	19.7	18
Tillamook	18.7	2
Polk	18.2	8
Sherman	16.8	-
Gilliam	16.6	-
Columbia	15	8
Baker	14.8	12
Klamath	14.6	46
Lane	14.2	50
Benton	13	9
Hood River	11.5	11
Malheur	10.6	3