

# >> Climate and Health in Oregon

2020 Report



Oregon  
**Health**  
Authority  
PUBLIC HEALTH DIVISION

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# Executive summary

## Rapidly accelerating climate change is intensifying public health crises in Oregon.

In the last five years, Oregon:

- Recorded its hottest years in state history (2015, 2016, 2018 and 2020 are all in the top 10 hottest years) and had the lowest snowpack ever on record (2015)
- Had the most severe wildfire seasons in modern history, with the 2020 wildfires burning more than 1 million acres and destroying or severely damaging more than 4,000 homes. By comparison, Oregon's next worst fire year, 2015, saw only 56 residences lost to conflagration fires.
- Had a major municipal drinking water system contaminated with cyanotoxins (2018)
- Was declared a national disaster area for damage caused by extreme storms, floods and landslides (2016, 2017, 2019, 2020)
- Had declarations of drought emergencies in 25 of 36 counties in the state in 2015 (11 counties declared drought emergencies in 2018 and 15 counties in 2020).

## We are feeling the effects of these disasters and we know it's only going to get worse.

- More frequent wildfires are expected to increase respiratory illnesses, heart disease and other poor health outcomes in the decades to come.
- Increases in average and extreme temperatures are projected to increase the number of heat-related hospitalizations and deaths.
- Future storms are projected to cause more extreme flooding events.
- Displacement and income loss associated with these climate impacts will increase the risk of homelessness, food insecurity and mental health effects.

## Climate change affects communities differently and requires us to acknowledge and address racial and economic inequities in Oregon.

- Communities of color and tribal communities are already disproportionately affected by social, economic and environmental impacts created by current and historical systems of oppression.
- Climate change adds additional layers of cumulative impacts, exacerbating existing disparities between white and non-white Oregonians.
- Lower-income people have fewer options for adapting to new challenges and are often forced to work and live on the frontlines with less financial stability and fewer alternatives.

## The current global pandemic further exposes these inequities and makes addressing the climate crises even more challenging.

- Populations most exposed and vulnerable to COVID-19 overlap with populations most exposed and vulnerable to extreme heat, air pollution and other climate hazards.

## People working on the frontlines, including in smoke and extreme heat, are at increased risk of illness and death.

- Rural communities are often more exposed to climate impacts and have less access to resources and opportunities to cope and adapt.
- Farmworkers are particularly vulnerable. Latinx immigrants make up a large majority of farmworkers in Oregon.
- Migrant farmworkers experience disproportionate rates of occupational injuries and illness because of social factors including racism, lack of housing and language barriers.
- Governor Kate Brown's Executive Order (EO) 20-04 directed OHA and Oregon Occupational Safety and Health (OR-OSHA) to develop a proposal for worker protection standards for heat and wildfire smoke in 2021.

## Climate change not only affects physical health, but also mental health.

- Mental health effects include those directly related to traumatic natural disasters such as the recent wildfire events, as well as anxiety, fear and distress associated with slower-moving stressors and the uncertainty of future climate impacts.
- These effects are not isolated but interact with other social and environmental determinants of health, including race, income and housing stability.
- Youth with depression and anxiety are at increased risk for worsening symptoms.
- Governor Brown's Executive Order (EO) 20-04 directed OHA to produce a study on youth depression and mental health effects of climate change in Oregon.

## Social resilience is a key consideration for adapting to these new realities.

- Social cohesion and social networks act as buffers against negative health impacts of climate disasters and help communities recover more quickly.

## We can build climate resilience through public health action.

This includes:

- Promoting climate mitigation that maximizes health co-benefits
- Collaborating across all levels of local, state and tribal government and with community partners to advance equitable climate adaptation
- Building environmental health capacity to identify and address emerging environmental health threats, including threats to workers
- Increasing understanding of mental health effects on individuals and the role of social resilience in fostering community resilience
- Supporting climate-related strategies in OHA's State Health Improvement Plan, *Healthier Together Oregon*.

# Opening letter from Pat Allen and Rachael Banks

On behalf of the Oregon Health Authority (OHA), we are pleased to submit this report in response to Governor Kate Brown’s Executive Order (EO) 20-04. Rapidly accelerating changes in our climate are already occurring and adversely affecting community health in Oregon. For example, during the recent wildfire events we saw a significant increase in respiratory-related hospital visits. As we continue to navigate the COVID-19 pandemic, many new challenging questions arise, such as how to safely open “clean air spaces” or cooling centers when social distancing is recommended. How does climate change, and the systems that accelerate climate change, influence the emergence and distribution of other novel diseases? And how do we prepare Oregon’s health system to respond to multiple and overlapping crises? At the same time, evidence shows that communities of color and low-income communities are more at risk of and experience greater climate-related health effects. They have fewer resources to adapt and also contend with systems that prevent their voices from being heard in public decision making about reducing, planning for and recovering from climate impacts.

OHA released its State Health Improvement Plan, *Healthier Together Oregon*, earlier this year. The plan charts the actions we need to take to improve the health of all people in Oregon, with a focus on five priorities that affect a lot of people. These actions are upstream determinants of downstream health outcomes, and influence some communities more than others: institutional bias; adversity, trauma and toxic stress; economic drivers of health; behavioral health; and access to equitable preventive health care. The *Healthier Together Oregon* plan includes strategies that straddle climate and health, such as increasing active transportation options that reduce greenhouse gas emissions while supporting a proven strategy for reducing major sources of death and disease in Oregon such as heart disease, obesity and diabetes.

OHA offers this report as a source of information, grounded in science and data, on the health risks from rapidly accelerating climate change, the people most vulnerable to those effects, and the public health actions we can take to build climate resilience in Oregon.



Pat Allen, Director  
Oregon Health Authority



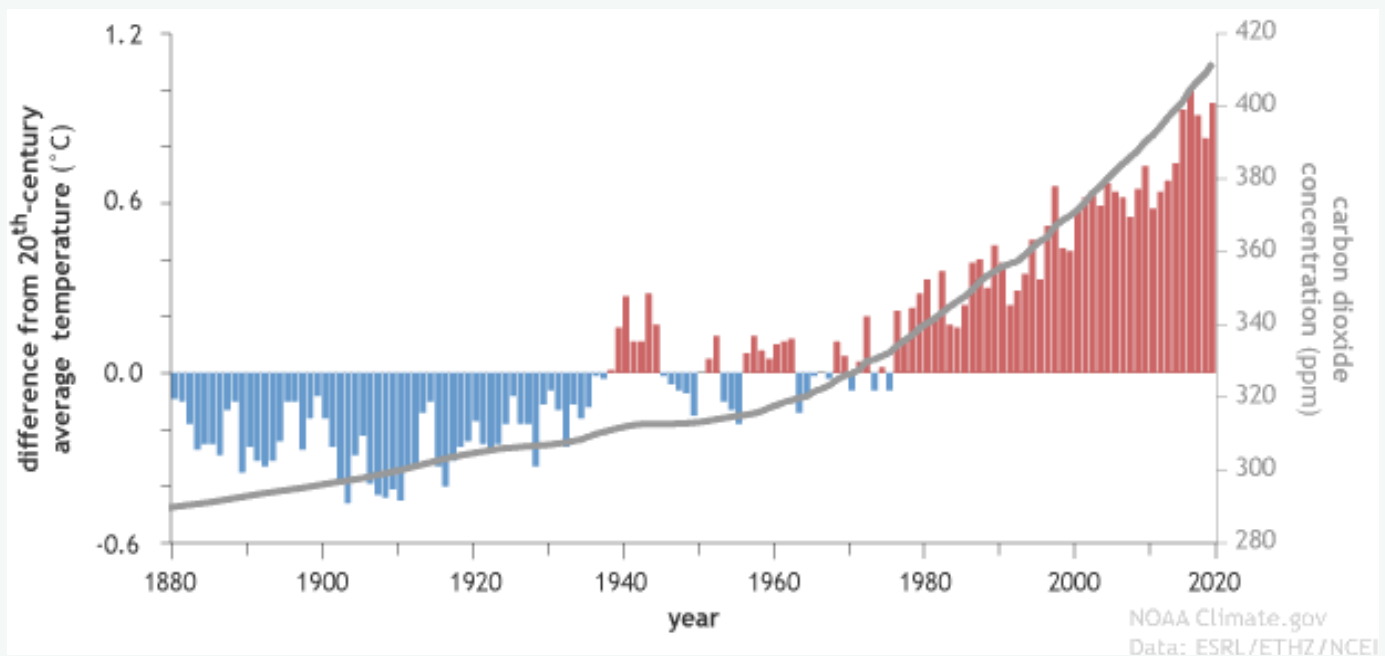
Rachael Banks, Public Health Director  
Oregon Health Authority

December 2020

# Introduction

A build up of human-generated greenhouse gases in the atmosphere is rapidly warming the planet and leading to a number of climate impacts in Oregon that affect health. The past decade was the warmest on record, with each decade warmer than the one that preceded it.(1) The Oregon Health Authority (OHA) developed this report in response to Governor Kate Brown’s Executive Order (EO) 20-04 that directs state agencies to prioritize climate action. OHA was directed to deliver a report in 2020 to the Governor, the Oregon Global Warming Commission and the Environmental Justice Task Force on the public health impacts of climate change in Oregon and to update this report annually. In response to the executive order, [OHA submitted a letter to the Governor’s Office](#) that provides background on our Climate and Health Program and how OHA plans to respond to the EO’s directives.

**Figure 1: Atmospheric carbon dioxide and Earth’s surface temperature (1880-2019)**



This report builds on the [2014 Climate and Health Profile Report](#) OHA produced through a cooperative agreement with the U.S. Centers for Disease Control and Prevention (CDC)’s Climate and Health Program. The 2014 report summarizes historic and projected climate data sets and assesses the health risks associated with climate projections. OHA prepared the 2014 report in consultation with the Oregon Climate Change Research Institute (OCCRI) and more than 50 technical experts and community partners.

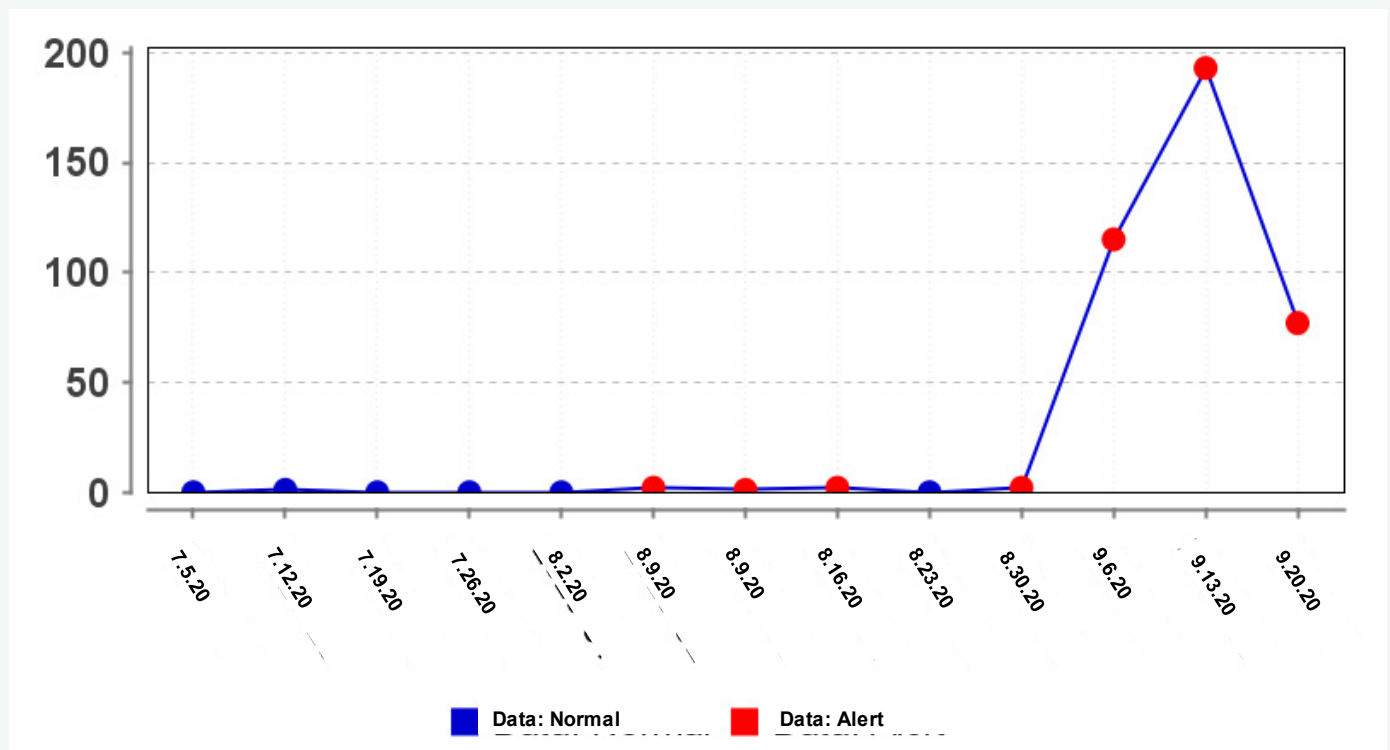
This 2020 report was developed over a shorter period but is supported by a larger body of climate and health evidence in both the literature and in our collective lived experience. The wildfires that occurred this year brought climate and health impacts into clear focus, as almost every Oregonian dealt with some level of health risk related to the poor air quality.

## 2020 wildfires

This summer was the warmest on record in the Northern Hemisphere,(2,3) with abnormally dry drought conditions across most of Oregon from mid-August to mid-September.(4) The Oregon wildfires that followed burned more than 1 million acres and caused widespread evacuations in many areas of the state.(5) Climate change has exacerbated these and other extreme weather events.(1)

During the wildfire events of September 2020, Oregon reached “unhealthy” or “hazardous” levels in all parts of the state based on the Air Quality Index, which categorizes how clean the air is and lists associated health risks. These include health effects ranging from headaches, coughing and shortness of breath to worsening asthma, heart attacks and strokes. At the peak of the wildfire events, one in 10 people checking into an ED or urgent care clinic reported asthma-like symptoms(6) significantly above expected levels.

**Figure 2: Wildfire-related visits to emergency departments and participating urgent care clinics in Oregon**





This chart shows that wildfire-related visits remained elevated for two weeks after the initial smoke waves swept over Oregon and began improving in the third week of September. The surge in emergency and urgent care center visits occurred during the COVID-19 pandemic, complicating the health response (discussed more in the “Climate change and COVID-19” section of this report).

## A recap of recent climate events: Trends in Oregon

In the last five years, Oregon:

- Recorded four of its hottest years in state history (2015, 2016, 2018 and 2020 are all in the top 10 hottest years) and had the lowest snowpack ever on record (2015)
- Had a major municipal drinking water system contaminated with cyanotoxins (2018)
- Was declared a national disaster area for damage caused by extreme storms, floods and landslides (2016, 2017, 2019, 2020)
- Had declarations of drought emergencies in 25 of 36 counties in the state in 2015 (11 counties in 2018, 15 counties in 2020)
- Had the most severe wildfire seasons in modern history, with the wildfires in 2020 burning more than 1 million acres and destroying or severely damaging more than 4,000 homes. By comparison, Oregon’s next worst fire year, 2015, saw only 56 residences lost to conflagration fires.

## A summary of climate projections: Oregon’s future

- Continued increases in temperature extremes are projected to increase the number of heat-related hospitalizations and deaths.
- More frequent wildfires are expected to increase respiratory illnesses, heart disease and other poor health outcomes in the decades to come.
- Nearly every location in Oregon has seen a decline in spring snowpack, and it will continue to significantly decline, contributing to drought conditions and worsening water quality.
- More precipitation will fall as rain rather than snow and in heavier rainfall events, increasing the risk of floods and landslides and associated threats to life and health.
- Sea level rise and ocean acidification are expected to continue, jeopardizing coastal communities and economies.

## For more detailed information on climate projections and impacts in Oregon, see:

- The forthcoming [2020 Oregon Climate Change Adaptation Framework \(CCAF\)](#) led by the Department of Land Conservation and Development (DLCD)
- The forthcoming [2021 Fifth Oregon Climate Assessment Report](#) produced by the [Oregon Climate Change Research Institute \(OCCRI\)](#).

## Summary of Climate and Health Community Survey findings

In response to the EO 20-04, the OHA Climate and Health Program hosted an informational webinar and an online survey to better understand the priorities and perspectives of our community partners. In June 2020, 227 Oregonians responded to the community survey and shared their climate and health concerns, along with ideas for how the public health system should prioritize actions. In this section we summarize the survey findings. We include quotes from survey respondents throughout the report.

Of 17 climate and health risks listed, respondents ranked **“Fossil fuel emissions and other greenhouse gases – not only causing climate change, but also pollution and other environmental health risks”** as their top climate and health concern. **“Air pollution – prolonged smokey air, smog in urban areas, dust, etc.”** and **“Water insecurity – drought, drinking water contamination, harmful algal blooms”** were collectively ranked as the next biggest concerns, followed by **“mental health effects, anxiety and chronic stress”** and **“income loss, job loss and economic impacts.”**

In addition to ranking climate and health impacts of greatest concern, an open-ended section asked respondents to share additional concerns. Most commenters did not think ranking climate and health impacts was helpful. Respondents made clear it was the cross-cutting and intersecting nature of climate impacts they were most concerned about:

### From Climate and Health Community Survey, June 2020

**“Most are interrelated and will be co-occurring which exponentially increases the impact on all lives.”**

**“Multiple disasters and emergencies (wildfire, blackouts, pandemic, drought, extreme heat, storms) happening at the same time, for prolonged periods of time, recurring, and in close succession.”**

**“It is really hard to rank these — I’d say the intersecting risks are concerning and the disproportionate impact these have on low-income and BIPOC communities.”**

Many other more specific and personal concerns were voiced in this open-ended section. Although this was not a scientific study, some key themes emerged:

- **Compounding and intersecting challenges — multiple disasters, complexity of the issue**
- **Intersections with racism, impacts to communities of color and hostility toward immigrants**
- **Intersections with the pandemic, infectious and emerging diseases**
- **Intersections with housing — low-quality housing, homelessness**
- **Distrust in government — influence of big money, misinformation, civil unrest**
- **Income inequality — poverty, lack of resources to prepare, respond or recover**
- **Under-resourced and overburdened health systems, social service systems, etc.**

Many of the Oregonians who responded to the survey emphasized the importance of prioritizing affected communities and supporting community-identified solutions to build resilience across multiple climate hazards.

OHA presented a list of 17 public health strategies (identified through previous public health assessment and planning) to survey respondents who were asked to prioritize these strategies. Two strategies rose to the top.

- **“Improve and protect air quality and water security using health data and implementing health-based standards.”** (22% ranked as top choice.)
- **“Actively engage with diverse frontline communities and elevate their voices to inform climate policies, programs and public investments.”** (15% ranked as top choice.)

## Who responded to the Climate and Health Community Survey?

Percent of respondents who said they either work with or identify as:

**Someone with lower income 47%**

**A person of color 38%**

**Someone who lives in an agricultural community 36%**

**Indigenous 28%**

**An immigrant or refugee 27%**

**Someone with a disability 25%**

## From Climate and Health Community Survey, June 2020

**“Talk to the frontline communities before deciding what solutions are necessary ... I am a privileged person and I think I know what would work but it should not be up to me.”**

The remainder of respondents (63%) ranked other strategies as their first choice, including:

- ***Investing in green infrastructure***
- ***Ensuring climate equity best practices***
- ***Conducting health cost and benefit analysis***
- ***Building capacity of environmental health infrastructure, and***
- ***Resourcing community-driven and place-based adaptation.***

However, many participants found the exercise of ranking strategies problematic because they see climate change as a complex cross-cutting challenge. This observation is consistent with research findings that discuss the need for interdisciplinary, community-based systems solutions to address climate change.<sup>(7,8)</sup>

## **Tribal consultation with Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians**

As part of the development of this report, OHA contacted Oregon's nine federally recognized tribes through a formal tribal consultation process. The Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians (CTCLUSI) requested additional consultation and invited OHA to join a Leadership Circle meeting to discuss the report. During the meeting, CTCLUSI described the importance of communicating not just with tribal health staff but also with natural resource staff regarding climate and health information and updates. CTCLUSI emphasized the importance of healthy waters, "Water is Life".

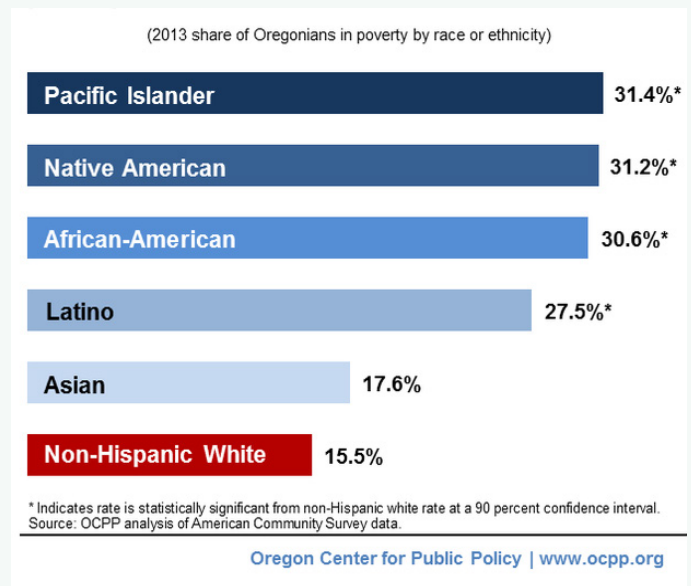
# Racial inequity and climate justice

The intersection of racism and environmental degradation, economic disinvestment and population-wide health disparities is well documented. For example, until the 1950s it was illegal to sell homes to Black and African American buyers in Portland's white neighborhoods.(9) The legacy of systemically racist housing policies is that Black and African American people throughout the United States are still more likely to live in neighborhoods with fewer trees and more heat-trapping pavement.(10) This pattern is evident in Portland, where a recent study documented strong links between the city's worst heat islands and historical discriminatory housing policies.(11)

The authors found that Portland neighborhoods denied municipal services and support for home ownership in the mid-20th century are now home to the hottest areas.(11) Similarly, national studies have shown the rate of heat-related deaths among Black and African American people far exceeds that of other race and ethnic groups.(10) Policies of intentional disinvestment coupled with ongoing systemic racism have resulted in higher levels of poverty and poorer health outcomes in communities of color.

Lower-income Oregonians, communities of color, tribal communities and underinvested rural communities face considerable inequities in the social, economic and environmental aspects of life that affect health, otherwise known as the "social determinants of health." These communities typically do not have the capacity or resources to adequately prepare for or recover from extreme weather events, and they often experience more economic hardship in the wake of climate-related disasters.(10)

**Figure 3: Oregonians of color are more likely to live in poverty**



**From Climate and Health Community Survey, June 2020**

***“Natural disasters which are a result of global warming will kill people who look like me (Black)...”***

**Table 1. Examples of social and environmental determinants of health**

Social stressors	Job safety and stability	Food security	Safe housing	Geographic vulnerabilities	Access to health-promoting assets
Interpersonal and systemic racism; other discrimination	Employment	Hunger	Affordable housing and utilities	Near sources of air pollution	Parks, nature
Toxic stress, trauma	Income	Access to healthy options	Clean indoor air quality	Urban heat islands	Transportation options
Social isolation	Worker protections		Weatherization	Flood plains	Culturally relevant healthcare
	Sick leave			Near fire-prone landscapes	Community connectedness

**Health outcomes:**  
Life expectancy, injuries, illnesses, functional limitations, medical expenses, etc.

Hardships across social determinants of health within Oregon’s communities of color and tribal communities are now being exacerbated by the COVID-19 pandemic and its economic fallout.(12) Unemployment rates are the highest they have been since the Great Depression, and rates are even higher among non-white people.(13,14) These new challenges are layered on top of multiple existing stressors that already overburden economically disadvantaged communities.

**From Climate and Health Community Survey, June 2020**

*“People in my community are exposed to a lot of pollution and can’t afford to leave their homes to move elsewhere. They are impacted greatly by climate change and don’t always have the funds or knowledge on how to prepare. They are doing the jobs that many others won’t do and are at risk of more exposure to all kinds of situations. They can’t afford to lose their income and have others to look after. Many don’t even have the appropriate PPE for their jobs. Right now I’m concerned about all these privileged white people not wanting to wear a mask because “they should be free to do what they want”, but people in my communities are being put at risk of getting COVID-19 because they can’t afford to not work and are in the front lines.”*

There are similar root causes of climate change and health inequities; our land use planning, transportation, housing, energy, food and socioeconomic systems are all key contributors to both climate pollution and quality of life outcomes.<sup>(10)</sup> Powerful institutions, largely responsible for constructing and maintaining these systems, influence and are influenced by people with power and privilege.<sup>(10)</sup>

An individual's and community's baseline status significantly moderate the health effects of climate change. Two critical components of climate vulnerability are pre-existing health conditions and living conditions. These factors differ by place, race and income because of inequities in money and power distribution, historical disinvestment, discriminatory practices and policies, structural racism, higher pollution burdens, and less access to health and wellness resources.<sup>(10)</sup>

Populations experiencing cumulative and multiple vulnerabilities in Oregon include tribal and indigenous communities, Black communities, migrant farmworker communities, other communities of color, and underinvested rural communities.

## OHA's goal: to eliminate health inequities in our state by 2030

Oregon will have established a health system that creates health equity when all people can reach their full health potential and well-being and are not disadvantaged by their race, ethnicity, language, disability, gender, gender identity, sexual orientation, social class, intersections among these communities or identities, or other socially determined circumstances.

Achieving health equity requires the ongoing collaboration of all regions and sectors of the state, including tribal governments to address:

- The equitable distribution or redistribution of resources and power, and
- Recognizing, reconciling and rectifying historical and contemporary injustices.

### From Climate and Health Community Survey, June 2020

***“My children are not in the most vulnerable group, but it’s important to me that equity is the foundation of the world my children live in.”***

### From Climate and Health Community Survey, June 2020

***“[There is a] Lack of overt governmental priorities and mandates that direct resources to, and include, BIPOC leaders in decision making processes and the predictable inequitable outcomes.”***

## 2020 Oregon climate equity actions

In July 2020 Governor Kate Brown launched a new [Racial Justice Council \(RJC\)](#) to recommend to the Governor and legislature concrete actions to advance racial equity in the state and how to listen to, engage with, respond to, and support Black, indigenous, communities of color and tribal members in Oregon. Health equity and environmental equity are two of the RJC's focus areas.

In March 2020, EO 20-04 established an Interagency Workgroup on Climate Impacts to Impacted Communities with representatives from state agencies, the Oregon Environmental Justice Task Force, the Oregon Global Warming Commission and the Oregon Sustainability Board.

The Department of Land Conservation and Development (DLCD) coordinated a two-year collaboration among more than 20 state agencies to develop the 2020 interagency [Oregon Climate Change Adaptation Framework \(CCAF\)](#). OHA's Climate and Health Program led an interagency Climate Equity Workgroup to help state agencies center equity in climate planning and action. One of the outputs of this workgroup is a new living document, the Climate Equity Blueprint, which includes best practices, case studies and tools for:

- Building internal capacity to advance climate equity
- Embedding equity and accountability into design of climate programs and policies
- Leading meaningful community engagement, and
- Improving data collection and use.

### From Climate and Health Community Survey, June 2020

***“Equity and inclusion’ is a term often used to fund white-led tasks forces that are not capable of making meaningful structural change. I hope we as public health workers will defer to the leadership of marginalized communities. I hope we will hire BIPOC specifically. I hope we will develop a zero-tolerance policy for white supremacy.”***

State law (SB 420, 2007) established the Oregon Environmental Justice Task Force (EJTF) to advise the Governor and state agencies on environmental justice issues. The EJTF convenes quarterly and serves as a forum to engage community members and review agency actions related to environmental justice, including most recently providing feedback on the Climate Change feedback on the Climate Change Adaptation Framework and Climate Equity Blueprint noted above.



# Cross-cutting impacts

Oregonians depend on a web of natural and social systems to maintain our health. These systems are continuously shifting, interacting and responding to stressors. From time immemorial, indigenous people have understood that human health relies on the vitality of our living systems. Climate change brings new conditions that affect our access to clean air, clean water, livable temperatures and fertile land for plants, fish and wildlife.<sup>(1)</sup> We are challenged not only by the direct effects to our health, such as hotter summers leading to higher risks of heat-related illness, but also through many indirect pathways that are harder to track and predict.

**From Climate and Health Community Survey, June 2020**

***“I am worried about access to water, sufficient preparedness for disease and natural disasters. As part of the AAPI [Asian American Pacific Islander] diaspora, I am worried about disappearance of cultures and people due to rising sea levels and subsequent migration. I am worried that those most impacted by climate change are not the elected decision makers, both nationally and globally. Ranking the concerns below is really difficult because they are all important and interrelated. I am interested in promoting solutions that address the root causes and centers voices that have been most impacted by the legacy of colonialization, environmental injustice, and changing climate.”***

To accurately assess the risks associated with climate change, we must acknowledge the complex dynamics that arise across natural and social systems.<sup>(15)</sup> Instead of focusing solely on hazard events, climate and health adaptation involves working to understand and address cross-cutting risk pathways.<sup>(16)</sup> Economic disruptions in climate-affected sectors can create job loss across multiple industries and will especially affect the health of families already living in poverty.<sup>(1)</sup> Decreased access to First Foods will continue to affect physical, social and spiritual health of tribal and indigenous peoples.<sup>(1)</sup> Exposure to an increase in frequency and severity of climate-related disasters will increase toxic stress, anxiety, depression, trauma and other mental health effects.<sup>(17)</sup> Lack of safe housing and disaster-driven displacement will place extreme burdens on families and the social service providers attempting to support them.<sup>(18)</sup> These are some of the cross-cutting climate impacts discussed below, but they do not capture the full breadth of climate and health causal pathways or the complex interactions between climate and non-climate stressors.

Children and youth, in general, will experience cumulative physical and mental health effects of climate change over their lifetimes.(19) Greenhouse gas emissions remain in the atmosphere for centuries, creating intergenerational inequities that will be traced back to planning and policy decisions made today.(20)

## Climate change and COVID-19

People have experienced major changes in their health, livelihoods, families and communities this year. The COVID-19 global pandemic intersects with climate change in many ways and highlights the interconnectedness of our critical systems. Like climate change, the pandemic is a planetary health crisis that requires international and collaborative leadership. Although global in nature, both require local action to keep Oregonians safe.

Populations most exposed and vulnerable to COVID-19 overlap with populations most exposed and vulnerable to extreme heat, air pollution and other climate hazards. Many communities of color are at risk because of long-standing systemic health and social inequities that increase the risk of getting sick and dying from COVID-19. Social determinants of health, such as poverty and health care access, are interrelated and influence health outcomes related to both COVID-19 and climate hazards.

Health experts recommend communities continue to take most of the same actions to protect themselves from climate hazards. However, the pandemic requires special considerations. For example:

- Cooling shelters and cleaner air spaces to keep people safe may increase risk of COVID-19 transmission, if special precautions are not made.
- Most masks used to slow the spread of COVID-19 offer little protection against wildfire smoke, yet people may think they do.
- Studies show that air pollution increases rates of infection and severity of symptoms.(21) Some symptoms, such as dry cough, sore throat and difficulty breathing, can be caused by both wildfire smoke and COVID-19.
- Similarly, heat-related illness has overlapping symptoms with COVID-19 including fatigue, headache, nausea and vomiting. This can create stress and uncertainty for community members and overburden local health care systems.

The acceleration of climate change increases the chance of communities being forced to face overlapping and cascading stressors and disasters that will further drive health systems into surge capacity.(1) This leads to potential disruptions in access to vital care, prescription medications and heightened anxiety and trauma among patients and frontline workers.(22)

**From Climate and Health  
Community Survey, June 2020**

***“COVID19 is related to climate change in my opinion as it’s connected to urbanization and zoonotic diseases. It’s showing us how much our current systems are set up to protect those who already have most of the resources.”***

# Economic instability, impacts to workers and food insecurity

Job loss and income loss in climate-affected industries will result in poorer mental and physical health, especially for low-income families.<sup>(1)</sup> More than 10% of Oregon's workers are in the natural resource industries and these jobs are particularly susceptible to climate disruptions. Oregon's rural and tribal communities are largely dependent on these climate-exposed industries.<sup>(1)</sup>

Hazardous events such as wildfire and flooding can disrupt major transportation systems such as highways and interstates. For example, Interstate 84 in Eastern Oregon was shut down after major floods hit the Pendleton area in February 2020, cutting off the main connection for travel and commerce between Eastern Oregon, Western Oregon and Idaho.

Climate-driven economic hardship will lead to greater food insecurity.<sup>(23)</sup> For example, in 2015 a harmful algal bloom affected communities dependent on shellfish and tourism along the coast just north of Oregon in Long Beach, Wash. The local food bank recorded an almost 25% increase in the number of families requesting assistance in the six months that followed.<sup>(1)</sup> At a regional or global level, crop failures could also lead to spikes in food prices, making it harder for working families to put food on the table.

Communities with higher existing rates of illness often have less adaptive capacity and are more vulnerable to climate stressors.<sup>(24)</sup> Many Oregonians already struggle to meet basic needs that could serve as protective factors; these numbers could increase. For example, roughly one in five children already live in a food-insecure household<sup>(25)</sup> and are at higher risk of poorer health outcomes such as asthma and diabetes.<sup>(26)</sup> Among children and adolescents, evidence suggests food insecurity is also associated with higher prevalence and severity of mental health problems.<sup>(27)</sup>

**From Climate and Health  
Community Survey, June 2020**

***“The world will change dramatically as a result of climate change and today’s college students will deal with the ill effects of that damage in multiple ways.”***

**From Climate and Health  
Community Survey, June 2020**

***“[I’m concerned about] food shortages because of regional/global droughts, local growing failures because of unstable weather, social unrest in response to shortages”***

## Tribal and indigenous communities

Climate change is already endangering wildlife, fish and plants, which are intimately tied to traditional economies and ways of life. This affects cultural identity, heritage and the health of Oregon tribal and indigenous people.(1) First Foods are foods that Tribes historically cultivate for subsistence and for economic and ceremonial purposes. First Foods vary among tribes but often include berries, roots, fish and local wildlife, all of which are at risk of decline due to changing temperatures and ecosystems.(28) The cultural practice of harvesting and consuming First Foods is integral to tribal economies and indigenous health.

OHA is committed to honoring the government-to-government relationship with Oregon's nine Federally Recognized Tribes to hear from them on these impacts.

Members of the Confederated Tribes of Warm Springs described some of these health concerns in stories they told through a 2017 collaboration with OHA: [Voices of the Confederated Tribes of Warm Springs](#). Many Tribes, such as the Confederated Tribes of the Umatilla Indian Reservation, are already beginning to assess and adapt to changes in first foods.(29)

Oregonians who hold jobs in climate-affected and/or natural resource industries are more at risk of direct exposures such as extreme heat. They also are more prone to indirect health effects arising from increased stress, lost work days and income loss.

## Fishers and shellfish farmers

Storm surges can cause significant harm in harbors, where marinas and boats supporting the fishing industry can be damaged and lead to significant repair costs and income losses.(30) Harmful algal blooms caused by rising water temperatures will lead to losses in commercial fishing and shellfish industries and affect coastal economies that rely on tourism related to recreational fishing and shellfish harvesting.(31)

## Growers, ranchers and farmworkers

Drought will reduce crop yields and food quality and affect meat production. This will affect the prices farmers can set on food products, creating economic strain and potentially food insecurity.(31) For example, higher temperatures can burn apples and lead to softer berry crops resulting in decreased fruit quality and selling prices.(31)

### From Climate and Health Community Survey, June 2020

***“farmers and farm workers throughout the state are on the front lines of dealing with the physical impacts of high heat days, wildfire smoke, more intense storms, there’s also the economic and mental health impacts of increased uncertainties about water availability, harvest yields...”***

## Farmworker communities

Farmworkers are an indispensable part of our food system and face higher risks of both COVID-19 and climate-related hazards. Despite increased risks, they report a lack of access to personal protective equipment, worksites without social distancing and unreliable access to COVID-19 testing. They have also suffered from wildfire smoke when most Oregonians were sheltering indoors.(32)

The vast majority of Oregon farmworkers are Latinx immigrants. Their work is place-based and time-bound (due to crop harvest windows), which puts them at higher risk of adverse health effects from prolonged exposure to extreme heat and wildfire smoke. Wildfires happen most often during peak harvesting season when workers can earn the most money and may be forced to choose between their health and putting food on their families' table.(33)

Migrant farmworkers experience disproportionate rates of occupational injuries and illness because of these increased exposures as well as social factors such as racism, lack of housing, access to health care and language barriers. Migrant farmworkers may not know about workers' rights, or they may choose not to speak up when their rights are violated out of fear of job loss or retribution.

### From Climate and Health Community Survey, June 2020

***“I’m concerned that the people with the fewest resources will be both impacted the most and least able to respond. I’m also concerned that immigrants will not receive the benefits they deserve because they will be afraid to apply for them.”***

## Tourism and service industry workers

Oregon’s tourism industry depends largely on outdoor events and attractions. High heat and poor air quality will result in cancelling these events and outdoor recreation opportunities.(1) With more precipitation falling as rain instead of snow, Oregon will see a dramatic loss of snowpack that will negatively affect mountain communities that rely on snow-based recreation.(31)

## First responders and health care workers

Firefighters are exposed to smoke inhalation, particulate matter and toxins from burned building materials.(10) Workers who clean up after wildfires are also at risk of exposure to chemicals (e.g., pesticides, propane, plastic) that can become very concentrated when burned and reduced to ash.(10) Utility workers are at increased risk for injury and death during extreme weather events. They are more likely to be out during the event (e.g., working to restore power), which makes them more vulnerable to injury or death from flooding, high winds and other conditions.(10) Overstretched health care and social systems will be further challenged to meet the needs of patients and clients experiencing climate-related trauma and health effects.(1)

## Protection of workers from exposure to wildfire smoke and excessive heat

In response to Executive Order 20-04, OHA will partner with the Oregon Occupational Safety and Health Administration (OR-OSHA) to develop a proposal for standards to protect workers from exposure to wildfire smoke and excessive heat. We anticipate this work will include convening stakeholders and experts to inform development of the proposal. The OHA Public Health Division's Occupational Public Health and Climate and Health programs will lead OHA's work under this task.

## Risks of maladaptation

Challenges in climate-affected industries require careful adaptation. However, not all adaptation action promises to improve workers' health and safety. Maladaptations are poor choices that unfairly burden the most vulnerable, reduce incentives to adapt in more sustainable ways or limit choices available to future generations.<sup>(34)</sup> For example, farmers may try to offset climate impacts to crops by increasing the application of pesticides or they may try to address drought conditions by using recycled water to irrigate fields, which could increase the risk of *Salmonella* outbreaks if not done properly.<sup>(34)</sup>

### From Climate and Health Community Survey, June 2020

***“I’m most concerned with how climate change will, well, change how health and wellness are accessed. People already struggling with issues like food insecurity and access to care are likely to have those issues exacerbated by the direct effects and general destabilization that comes with climate change.”***

## Rising insurance and health care costs

As climate change increases the frequency and intensity of extreme weather events, disaster insurance premiums will rise and disproportionately affect low-income individuals and families.<sup>(10)</sup> Insurance policies are maladaptive when they support risky behavior or promote replacement (building back the same thing) rather than a redesign or relocation according to changing conditions.<sup>(35)</sup>

Peer-reviewed research, analyzing just a sample of climate disasters that occurred in 2012, identified more than 900 deaths, 20,000 hospitalizations and 17,000 emergency room visits. The total bill for those damages to human health was \$10 billion.<sup>(36)</sup> The study found that Medicare and Medicaid patients shouldered a disproportionate share of those costs, almost two-thirds. This reinforces the scientific understanding that economically disadvantaged populations are more likely to suffer from health effects of climate change.

Oregon will be responsible for increased health care costs among the 25% of the state’s population covered by the Oregon Health Plan. It is not possible to calculate the total cost of disease caused by climate change. However, we know that the social and economic burden of chronic diseases in our state is already very high. Oregon Health Authority data indicate elevated baseline health risks in several of the populations on the front lines of climate change. While we know that climate-related exposures can increase the risk of health outcomes, we are not able to calculate the degree to which they influence the rates of disease.

**From Climate and Health Community Survey, June 2020**

*“I’m worried that because people can buy their way out of some of the consequences, that those who don’t have as much money or who are living in poverty are even worse off.”*

**Table 2. Estimated cost of health outcomes and populations facing disproportionate burden, Oregon, 2008 and 2010 U.S. Census**

Health outcome	Total estimated cost burden in Oregon*	Populations facing a disproportionate burden(37,38)
<b>Heart disease</b>	\$3.6 billion spent on direct medical costs each year.	<b>Low-income people:</b> Adults with household incomes of less than \$20,000 are two times as likely to report heart disease and nearly three times as likely to have had a heart attack as adults with household incomes above \$50,000. <b>African Americans, American Indians and Alaska Native peoples:</b> The prevalence of high blood pressure and heart attacks is higher among non-Latinx African American and non-Latinx American Indians and Alaska Native Oregonians than in other racial and ethnic groups in Oregon.
<b>Stroke</b>	\$1.9 billion spent on direct medical costs each year.	<b>Low-income people:</b> Adults with household incomes of less than \$20,000 are almost two times as likely to have had a stroke as adults with incomes greater than \$50,000. <b>Non-Latinx African American and non-Latinx American Indian and Alaska Native Oregonians</b> are almost twice as likely to have had a stroke as non-Latinx white Oregonians.
<b>Asthma</b>	\$411 million spent on medical costs each year.	<b>American Indian and African American</b> people in Oregon experience higher rates of asthma than any other group in Oregon. <b>Low-income people:</b> People living in households with an annual income of less than \$20,000 report higher rates of asthma than Oregonians with higher household incomes.
<b>Premature birth</b>	\$111 million spent on medical costs each year.	<b>African Americans:</b> African American mothers are more likely to give birth to low birthweight babies than other mothers in Oregon.

\* Calculated using the CDC Chronic Disease Cost Calculator based on 2008 prevalence and cost statistics and 2010 census data.

## Mental health, substance use and violence

The mental health effects of climate change include those directly related to the physical and traumatic consequences of severe weather events. They also include anxiety, fear and distress associated with slower-moving stressors, perceptions and attempts to understand and respond appropriately to climate change and its implications.(39)

The effects of climate change on mental health and well-being are not isolated but interact with other social and environmental determinants of health, including race, income and housing stability.(40) Livelihoods and cultural identities are negatively affected by Oregon's changing landscapes and will disproportionately affect farmworkers, fishers, and tribal and indigenous people.(41) Youth with depression and anxiety are at increased risk for worsening symptoms.(42)

Children who experience floods or other disasters often have mental health issues such as anxiety, depression and PTSD. These issues can last for years after the disaster.(43) Oregon ranks among the top 10 states in prevalence of mental illness and lowest access to mental health care.(44)

There is a well-established connection between higher temperatures and aggression and violence.(45) For example, a recent study of police data from Philadelphia found that violent crime rates increased by 16% on average during days that reached 70 degrees or higher compared to cooler days.(46) In a similar study, domestic crimes including intimate partner violence occurred more frequently in neighborhoods where homes were less likely to have air conditioning. Analysis of depressive language in more than 600 million social media posts further suggests that mental well-being deteriorates during warmer periods.(47) We may see significant increases in violence as the climate warms —not only in violent crime but also in a growing population of adults with antisocial tendencies.(45)

Another recent study provided evidence of a connection between domestic violence and wildfire events in Australia this year. The authors concluded that the loss of normal routines in work, school and home environment created stressors that led to aggression and violence against their partners. Some also turned to alcohol and drugs to cope with the trauma, which further increased the risk of domestic violence.(48) OHA saw a 70% increase in drug overdose deaths in Oregon this spring.(49) It is unclear what effect the pandemic had. However, OHA acknowledges that stressors related to jobs, school and social isolation can increase anxiety and depression that can lead to harmful alcohol or other drug use.

**From Climate and Health  
Community Survey, June 2020**

***“The young people I  
work with live under  
daily stress and fear  
that they will not have  
a future.”***



First responders and health care workers are at increased risk for trauma and PTSD when dealing with the fallout of disasters and emergency events.(10) Tracking population-wide trauma and administering training related to climate anxiety and post-disaster trauma is not yet systematically occurring.(50) One initiative working to address these needs is the Oregon-based International Transformational Resilience Coalition (ITRC), a coalition of mental health providers and other professionals working to build population level psycho-social resilience.

A recent CDC report on mental health reported that more than a quarter of the nation's 18- to 24-year-olds reported seriously considering suicide within the last 30 days of being surveyed.(51) Since 2011, suicide rates have seen significant increases in Oregon.(52) One study estimates that climate change may cause an additional 26,000 more U.S. suicides by 2050.(53)

## From Climate and Health Community Survey, June 2020

*“What does not being able to see the night sky do to people? What about the people who are arming up because they expect a civil war over resources?”*

## Impacts of climate change on youth depression and mental health in Oregon

In response to Executive Order 20-04, OHA will study the impacts of climate change on youth depression and mental health in Oregon in 2021. The OHA Climate and Health Program will submit a report to the Governor, in collaboration with youth organizations and with support from other OHA programs with expertise in mental health.

# Housing, displacement and migration

Climate-related income loss and more climate disasters could increase the risk of people and families experiencing homelessness in Oregon.(54) Oregon already has one of the highest rates of unsheltered homeless families in the nation.(55) People lacking adequate shelter face increased climate risks (such as direct exposure to extreme heat or winter storms) while also having increased vulnerability (such as poorer health and less access to resources).

For those with roofs over their heads, not all structures adequately protect inhabitants against climate hazards. Homes that are poorly sealed and/or poorly insulated do not maintain healthy temperatures during cold snaps or extreme heat events. They're also not able to maintain clean indoor air quality, especially when the home lacks appropriate air filtration.(56) Approximately 40% of single-family homes in Oregon do not have a form of air conditioning and 72% of multifamily buildings lack mechanical cooling.(57)

Initiatives to increase energy efficiency of housing stock, thereby lowering the Oregon's greenhouse gas (GHG) emissions, can also increase the safety of a home.(58) Energy efficiency upgrades, such as insulating and tightening the building envelope, can improve a home's climate resilience. However, if the home does not have proper ventilation, this "upgrade" can create the conditions for mold, mildew and unhealthy indoor air quality.(59) Those working in the energy efficiency industry understand these dynamics. However, many low-income households are unable to do the additional "healthy homes" improvements that may be needed in combination with the energy efficiency upgrades that may be subsidized through programs such as Oregon's Low-Income Energy Assistance Program (LIHEAP).

Having a safe and climate-resilient home is not only dependent on a structure's quality, but also its location and condition of the surrounding area. People are at higher risk of experiencing climate hazards if they reside in urban heat islands, floodplains, regions with chronic drought conditions, coastal areas vulnerable to sea-level rise and saltwater intrusion and in wildfire-prone areas. In many cases, the most unsafe neighborhoods and rural areas are also low-income. For example, mobile home park and other low-income housing community residents are nearly three times as likely as residents in other housing units to experience water insecurity.(60)

From Climate and Health  
Community Survey, June 2020

***“[I’m concerned with] massive displacement as wealthy people move to Oregon to escape more extreme climate change and drive up housing prices.”***

From Climate and Health  
Community Survey, June 2020

***“LIHEAP [Low-income Home Energy Assistance Program] is underfunded so those who need help cooling/warming often can’t get it. Changes to rental properties that make them more energy efficient will lead landlords to raise their rents. Rents are already too high.”***

Americans who live in hotter climates and in places with water security issues may migrate to northern parts of the country.(61) Increased domestic migration to the Northwest could place increasing pressures on housing markets, infrastructure, and health and social service systems.(62)











### From Climate and Health Community Survey, June 2020

***“Changing migration patterns are not a concern: the concern is whether we will be appropriately prepared to care for people to come to Oregon and welcome them warmly with available and affordable housing, a solid social safety net, and adequate health services. Oregon is not densely populated and will likely be an ideal destination for many fleeing unlivable climates elsewhere. We should plan ahead to welcome, not fear, new Oregonians.”***

# Climate hazards

Public health officials are continuously engaged in hazard assessment, monitoring and planning. In the 2017 Oregon Public Health Hazard Vulnerability Assessment, local public health authorities (LPHAs) both east and west of the Cascades ranked wildfires, infectious disease outbreaks, storms and floods in their top five hazards posing the largest risk to public health.(67)

**Figure 4. Top five probability hazards, by region**

	Western Oregon	Central/Eastern Oregon
1	 Earthquake — Cascadia (3–5 minutes)	 Winter storm
2	 Public health emergency	 Wildfire (with urban interface)
3	 Flood — riverine	 Flood — riverine
4	 Winter storm	 Public health emergency
5	 Wildfire (with urban interface)	 Drought

The next section discusses the following climate hazards:

- Storms, floods, landslides and sea-level rise
- Wildfire
- Infectious disease
- Drought and water quality
- Extreme heat
- Air quality and allergens

Many climate hazards are interconnected; one event increases the likelihood of another occurring.(68) For example, chronic drought conditions increase the likelihood of wildfire events, which then create the conditions for more hazardous flood and landslides to occur.(69)

During climate-related emergencies, OHA and public health partners monitor emergency room visits through the Electronic Surveillance System for the Early Notification of Community-Based Epidemics (ESSENCE). This system provides real-time data for public health and hospitals to monitor what is happening in emergency departments and participating urgent care centers across Oregon. OHA and public health partners also conduct retroactive analysis using hospital and other health and environmental data, when capacity allows.

OHA publishes up-to-date information on its website regarding current, seasonal and potential hazards on the agency’s website. It includes what to do before, during and after hazard events. OHA also issues recreational advisories and provides hazard-specific tool kits for public health partners providing hazard risk communication.

In 2019, Clackamas, Multnomah and Washington county health departments (the three most populous counties in Oregon) joined together to produce a new [Regional Climate and Health Monitoring Report](#). The report provides baseline data on 12 health conditions influenced by climate hazards, summarized in the table below.

**Table 3. Climate and health indicators**

Climate hazard	Health indicator
<b>Extreme heat</b>	Heat-related emergency department (ED) visits
	Heat-related hospitalizations
	Heat-related deaths
<b>Extreme weather</b>	Extreme weather-related injury
	Extreme weather-related deaths
<b>Vector-borne disease</b>	West Nile virus
	Lyme disease
<b>Communicable disease</b>	Salmonellosis
	Campylobacteriosis
	Tuberculosis
<b>Air quality</b>	Asthma-like ED visits
	Allergic disease ED visits

OHA will support the next phase of this work and engage in similar monitoring at the state level as part of the Environmental Public Health Tracking Program’s new [Environmental Health Data Explorer](#).

# Storms, floods, landslides and sea-level rise

Flooding is a widespread, common and costly natural hazard for Oregon. The National Flood Insurance Program (NFIP) identifies 251 Oregon communities as flood prone, including locations in all 36 counties, 212 cities and three tribal nations. Warming temperatures increase the amount of precipitation falling as rain and will melt snowpack in ways that increase flood risk.

Storms, floods and landslides can cause traumatic evacuations, some permanent displacement and major disruptions in a person's quality of life. Road closures can lead to disruptions in access to essential services such as health care and may prevent people from being able to get food and supplies.<sup>(70)</sup> People may be exposed to floodwater that contains sewage or other contaminants harmful to health. After a home floods, people are at increased risk of exposure to toxic molds, mildew and chemicals.<sup>(10)</sup> Displacement of pregnant women caused by flooding appears to increase the likelihood of low birthweight and contribute to decreases in milk supply because women lack access to nutritious food and clean drinking water.<sup>(43)</sup>

Oregon's coastline is expected to face greater coastal flooding and erosion hazards due to sea level rise.<sup>(71)</sup> Storms can push masses of water, called "storm surges," toward shore. As climate change continues to cause sea level rise, weather-related floods along the coast will happen more regularly and effects will be more severe, especially when events overlap with other natural phenomena such as El Niño or king tides.<sup>(72)</sup>

Storm-driven power outages may increase people's use of gasoline-powered generators, candles or wood-fired stoves, which can cause carbon monoxide poisoning or start fires.<sup>(73)</sup> Power outages may have serious implications for people who rely on electricity for medical needs such as oxygen, dialysis and refrigerated insulin.<sup>(74)</sup>

## Recent events in Oregon

In four of the last five years (2016, 2017, 2019, 2020), Oregon has had national disaster declarations for communities hit by extreme storms, floods and landslides. In February 2020, communities in Eastern Oregon experienced extensive floods and landslides from heavy rain and snowmelt that caused three major rivers to overflow. The flooding damaged nearly 500 buildings, cost one person their life and stranded 54 people who the National Guard had to rescue. A 200-mile stretch of I-84 was shut down between Hermiston and Ontario, cutting off the main connection for travel and commerce between Eastern Oregon, Western Oregon and Idaho. Mobile homes in trailer parks were hardest hit by these floods.<sup>(75)</sup>

## Future projections of storms, floods and sea-level rise in Oregon

The 2020 water supply outlook for Oregon shows an increased likelihood of both above-average precipitation and above-average temperatures across most of Oregon for the remainder of the year.<sup>(76)</sup> This could lead to an increased risk of flooding and landslides, especially in areas already hit by the wildfires.<sup>(77)</sup>

Researchers project that climate change will lead to more frequent and intense flooding throughout the United States.(70) In Oregon, more rain and less snow mean higher average wintertime streamflow, which will increase flooding risk in some basins, especially in Eastern Oregon.(31) More than 7,400 people live in areas that will likely experience annual flooding events by the end of the century. Accounting for future population growth, this could be approximately 12,700 people at risk. In Newport alone, sea level is projected to rise by 12 to 47 inches by 2100, placing thousands of people and more than 100 miles of roads at risk of coverage by annual flood events reaching four feet above current high tides.(71)

### From Climate and Health Community Survey, June 2020

***“I serve communities that are at extremely high risk due to the current and escalating flooding, fires, sea level rise, and low-quality housing. My greatest concern is they will not be able to financially offset the effects of climate change and will be less resilient to it, especially the communities of color I serve.”***

## Examples of public health action

- OHA partnered with the Oregon Department of Transportation (ODOT) to conduct a case study: [How Tillamook Weathered the Storm: A Case Study on Creating Climate Resilience on Oregon’s North Coast](#). The project involved interviewing state and local transportation and health leaders to document lessons learned from responding to floods that closed major highways and led to the relocation of residents of an assisted living facility. The report highlights the importance of strengthening cross-sector coordination and building community capacity and social cohesion, among other actions identified as priorities for building resilience to climate-related hazards.
- OHA provided funding and technical assistance to Benton County Health Department to develop and begin implementation of a local climate and health adaptation plan. Benton County Health Department used the opportunity to convene a county-wide interagency climate adaptation assessment and planning project that focused on adapting to increased flooding risk. The work resulted in county commissioners adopting a climate adaptation resolution. Watch a video documenting this work: [Climate Change Collaboration in Benton County](#).

# Wildfire

Fire seasons in Oregon are roughly 100 days longer than they were in the 1970s. Longer seasons mean more smoke in Oregon communities. The lengthening of the fire season is largely due to declining mountain snowpack and earlier spring snowmelt.<sup>(77)</sup> Although humans start most fires, climate-related factors such as hotter temperatures and increasingly severe droughts exacerbate fire risk and severity. During 1984–2015, approximately half of the observed increase in fuel aridity and 4.2 million hectares (more than 16,000 square miles) of burned area in the western United States were attributed to climate change.<sup>(78)</sup>

Wildfires create significant amounts of particulate matter in the air, which increases the risk of respiratory and cardiovascular diseases.<sup>(10)</sup> Studies have documented evidence of psychological impairment related to wildfires<sup>(79)</sup> and behavioral health effects including depression, anxiety and increased substance use.<sup>(80)</sup> To date, there is not enough research on the health effects of prolonged smoke exposure. However, chronic repeated exposure has been associated with cancer<sup>(81)</sup> and potential effects to developing fetuses or infants in ways that could alter their life course.<sup>(82)</sup>

While everyone can experience symptoms of smoke exposure, susceptible populations include pregnant women, children, the elderly, people with preexisting conditions and people who work outdoors or lack shelter and basic protections. Pregnant women exposed to wildfire smoke and the particulate matter it produces are more likely to give birth to babies with lower birth weights.<sup>(10)</sup>

Wildfires burn everything in their path including buildings, paint, chemicals, propane tanks and other hazardous materials.<sup>(10)</sup> Additional chemicals are sometimes introduced when using fire retardant.<sup>(83)</sup> After a fire, the land soaks up the contaminants from these materials, which can travel through runoff to lakes and rivers that provide drinking water.<sup>(84)</sup> In addition, heavy rains can cause fire-damaged soil to erode and spill mud and debris into water supplies.<sup>(84)</sup>

## Recent wildfire events in Oregon

This report's introduction discusses the 2020 wildfires. The coming years will yield more analysis of these events' health impacts.

In 2017, the Eagle Creek Fire in the Columbia Gorge caused many schools to cancel the first days of school because they were not able to ensure healthy conditions in school facilities.<sup>(85, 86)</sup> The fires nearly reached the Bull Run watershed that supports the primary sources of drinking water for approximately 1 million Oregonians. This brought attention to the potential impact wildfire can have on water security, especially in states such as Oregon where major water supplies come from forested watersheds that are inherently vulnerable to wildfires.<sup>(87)</sup>



A recent Natural Resources Defense Council study estimated that wildfire smoke in Oregon in just one year (2012) caused hundreds of premature deaths, nearly 2,000 emergency room visits and more than \$2 billion in health costs.(88)

## Future wildfire projections in Oregon

One study estimates that wildfire smoke-related deaths in the United States currently average 15,000/year, but could rise to 40,000 annually by the end of the century.(89) Air pollution from increased wildfire smoke in western states is expected to increase the risk of respiratory and cardiovascular illnesses by 160% by midcentury.(90) These increased wildfire impacts will layer on top of projected increases in ground level ozone (smog) and airborne allergens to exacerbate respiratory conditions.

## Examples of public health action

- In October 2020 the Oregon Legislature granted an OHA request for \$600,000 to provide owners of approximately 2,000 residential properties destroyed or damaged by wildfire access to domestic well testing services. These tests will assess their drinking water's safety as they begin to rebuild.
- OHA partnered for two years with the Oregon Department of Forestry (ODF) and the Oregon Department of Environmental Quality (DEQ) to revise the state's [Prescribed Burning and Smoke Management Program](#). The revision expands the use of intentional fires to reduce forest fuels and, over time, the risk of wildfire conflagrations and widespread smoke events. New rules adopted in 2019 incorporated requirements for collaboration with local public health officials, advance communication and outreach efforts to reduce potential smoke exposures to the public. In 2020, the agencies again collaborated to reimpose stricter controls where smoke could further elevate or exacerbate COVID-19 impacts.
- In 2019, OHA published [More Days with Haze: How Oregon is Adapting to the Public Health Risks of Increasing Wildfires](#). The report, based on 2018 interviews with Oregon public health officials, identifies ways in which the public health system is adapting to the increasing severity of wildfires and opportunities for future climate adaptation.
- In 2017, OHA partnered with members of the Confederated Tribes of Warm Springs on a digital storytelling project. Listen to Karlen Yallup talk about the impact of wildfires and poor air quality on children and elderly residents living on the reservation: [Survival](#).

# Infectious disease

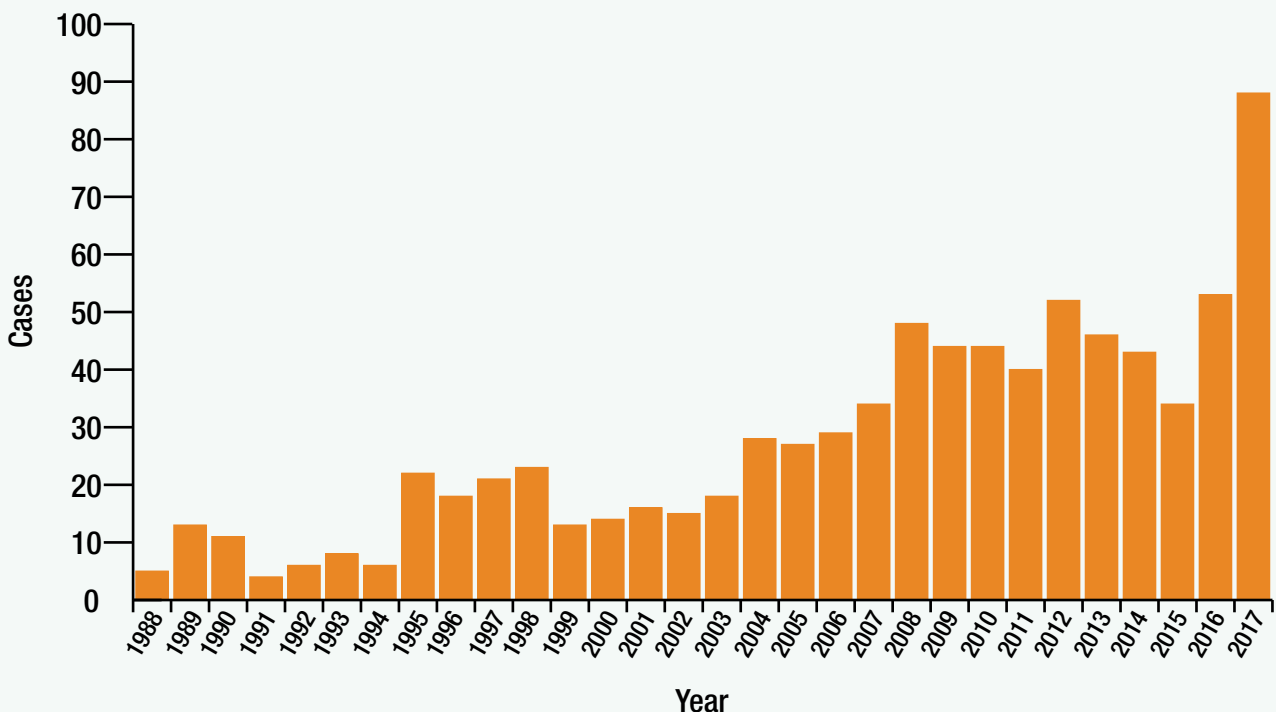
Many vector-borne and zoonotic diseases (VBZD) are climate-sensitive. Ecological shifts associated with climate change are expected to affect the distribution of vectors such as mosquitos, ticks, bats and mice. Changing environmental factors affect infectious disease transmission and can cause the unpredictable emergence or re-emergence of infectious diseases.(91)

## Recent events in Oregon

Lyme disease is the most common vector-borne disease in the United States and is contracted through tick bites. Oregon is still considered a low-incidence state. However, confirmed cases are rising as tick populations expand their range and habitat, partly due to Oregon’s warming temperatures. The number of cases of tick-borne disease in Oregon is steadily rising and is associated with warmer temperatures and changing tick habitat.(92) Symptoms include fever, headache, fatigue and skin rash. If treated with antibiotics within a few weeks of the bite, patients usually recover. However, if patients are not treated over time, the infection spreads to joints, the heart and the nervous system.

OHA interviewed 31 people who had confirmed Lyme disease last year. Less than 10 knew that they had been bitten or saw a tick prior to their illness. At least 800 people have been treated for Lyme disease due to symptoms presented at the doctor’s office, whereas the following graph shows only laboratory tested results of confirmed cases.

Figure 5. Lyme disease, by year, Oregon, 1988–2017



In Oregon, warmer temperatures and changes in rainfall have led to longer mosquito seasons.(93) These conditions are more favorable to the types of mosquitos that carry viruses such as West Nile and Zika. Mosquitos in Oregon have not yet been found to carry Zika virus. However, the changing climate has prompted public health officials to regularly test mosquitos throughout the state.(94) Oregon public health officials also track cases of West Nile virus, found in a small number of humans, animals and mosquitos in 2017 and 2018.(94)

The spread of fungal disease is also a concern. The fungus that causes cryptococcal infections, which before 1999 was limited to the tropics, is now established in Northwest soil. Oregon saw 78 cases of human infection in 2015 (one of the hottest and driest years on record in the state), 54 cases in 2016, 65 in 2017 and 75 in 2018.(95) In addition to *Cryptococcus gattii* (*C. gattii*), *Coccidioides*, which causes Valley fever and typically grows only in hotter and dryer climates, has also made an appearance in the Pacific Northwest in recent years.(96)

The Oregon Health Authority recorded spikes in cases of *Salmonella* and *E. coli* during months with extreme heat in 2015.(96) A large outbreak of Shigellosis (a bacterial diarrheal disease) occurred in late 2015, affecting many homeless people in the Portland Metro region; this outbreak was associated with unusually extreme precipitation.(97)

## Future projections of infectious disease in Oregon

Hotter temperatures and changes in precipitation brought on by climate warming will reshape the risk of people's exposure to certain fungal diseases.(98) In addition to *Cryptococcus gattii* (*C. gattii*), *Coccidioides* has also made an appearance in the Pacific Northwest in recent years. It causes valley fever and typically grows only in hotter and dryer climates.

## Public health action

- OHA developed the capacity to test ticks at the OSU Veterinary Laboratory, allowing us to track positive ticks for Lyme disease and other tickborne pathogens. Survey tick data are analyzed geospatially in a few counties. We use this information to educate local medical providers on tickborne illness-related risks.
- In 2016, OHA developed a guidance document for public health officials to use weather and environmental data with syndromic surveillance data to quickly assess the correlation between weather factors or air quality measures and health outcomes including infectious disease. OHA provided a training on climate-sensitive syndromic surveillance to Oregon's ESSENCE User Group. For a video on the topic, see: [Syndromic Surveillance in Oregon](#).

# Drought and water quality hazards

As the climate warms and more precipitation falls as rain instead of snow, the risk of water insecurity will rise across the state.<sup>(31)</sup> Lower water levels and reduced streamflow will also increase the prevalence of stagnant water that, combined with warmer temperatures, provides excellent breeding grounds for mosquitos that can transmit serious diseases.<sup>(99)</sup>

Water insecurity refers to not having enough good quality water to meet people's basic needs (i.e., drinking water and sanitation) and support their livelihoods (e.g., farming). A lack of access to clean drinking water has immediate effects on human health such as dehydration, and it can also lead to diminished living conditions and diseases.<sup>(100)</sup> Areas with concentrated poverty, such as mobile home parks and other low-income housing communities, are nearly three times as likely as residents in other housing units to experience water insecurity.<sup>(60)</sup>

Both natural sources of nutrients to water bodies (nitrogen and phosphorous from plant and mineral sources) and human activities such as the use of chemical fertilizers in agriculture and home gardens can cause nutrients to exceed healthy levels in water bodies. Combined with increased sunlight and warmer water temperatures, certain toxin-producing cyanobacteria, also known as harmful algal blooms (HABs), can quickly grow and become a risk to people and animals that swallow contaminated water. Health effects include stomach and liver illnesses, trouble breathing and even neurological effects.<sup>(101)</sup>

## Recent events in Oregon

Oregon experienced major droughts in 2015 and 2018 due in part to significant declines in mountain snowpack. Oregon relies on mountain snowpack to act as a natural reservoir and enhance groundwater supply in the warmer seasons.<sup>(31)</sup>

Changes in drought conditions and increased water temperatures have increased the potential for freshwater cyanotoxin blooms, also known as harmful algal blooms, in water bodies used for recreation and as drinking water sources.<sup>(102)</sup> While there is no systematic monitoring of recreational waters in Oregon, water body managers may voluntarily sample waters with visual indications of HABs and send laboratory results to OHA, which issues health advisories when levels are high enough to harm people's and animals' health. The cyanotoxin contamination of drinking water in 2018 in communities served by Salem's public water system spurred the state to update regulations to require monitoring for cyanobacteria in drinking water systems with vulnerable water supplies. A 2017 bloom in a Lake County stock pond resulted in the death of 32 cattle in a matter of days.<sup>(103)</sup>

In the marine environment, a variety of microalgae produce biotoxins that contaminate shellfish. This poses public health risks, causes economic harm to local economies dependent on shellfish harvests, and reduces tribal access to traditional foods. Elevated levels of marine biotoxins close recreational and commercial shellfish harvests and, in recent years, have caused significant delays to the start dates for Oregon's ocean commercial crab seasons

that are scheduled to begin Dec. 1 each year.(104) In 2015, during the largest harmful algal bloom ever observed off the West Coast, high levels of domoic acid contributed to the greatest disruption of shellfish harvesting documented in much of the Northwest.(105)

## Future projections of drought and water insecurity in Oregon

The predicted increase in droughts due to climate change will affect the availability and quality of water and likely lead to water insecurity. Future extreme precipitation events could increase the risk of exposure to water-related illnesses as the runoff introduces contaminants and pathogens (such as *Cryptosporidium*, *Giardia* and viruses) into drinking water.(106) HABs occur when the water is warmer than usual, which is likely to become more common with future climate warming. Researchers expect further negative impacts of HABs on Northwest fishing with climate warming, which will have economic, social and cultural consequences for Oregon. The loss of salmon fishing will have especially severe consequences for the region's Tribes.(1)

## Examples of public health action

- In 2020, OHA published a peer-reviewed journal article, *A Systematic Literature Review of Water Insecurity from An Oregon Public Health Perspective*, in a peer-reviewed journal.(107) The article documented the evidence base for developing public health water insecurity intervention strategies in Oregon. The paper identifies the intersections between rapidly accelerating climate changes that strain our aging infrastructure and expand water insecurity threats to vulnerable communities (e.g., frequency and severity of droughts, floods, wildfires and other natural disasters). OHA is drawing on this information to inform policy from a public health and water insecurity perspective, including the deliberations of the Governor's 100-year Water Vision and the Oregon Business Council's Water Policy Roundtable.
- In 2017, OHA partnered with members of the Confederated Tribes of Warm Springs on a digital storytelling project, *Listen to Danny Martinez tell how climate-driven changes in rivers are affecting salmon fishing and water quality in [Cycles of Life](#)*. Listen to Lorena Medina talk about water shortages and food security on the reservation in [Ready](#).
- In 2017, OHA created a [Story Map on Domestic Wells in Oregon](#) that displays information on arsenic and nitrates, two of the most commonly found contaminants along with *E. coli* bacteria. Approximately 23% of Oregonians rely on a private domestic well for drinking water.
- OHA partnered with the North Central Health District (which includes Wasco, Gillam and Sherman counties) to address the health impacts of drought. Strategies included providing free water quality testing to domestic well owners and educating them on drought-related health risks.(108)

# Extreme heat

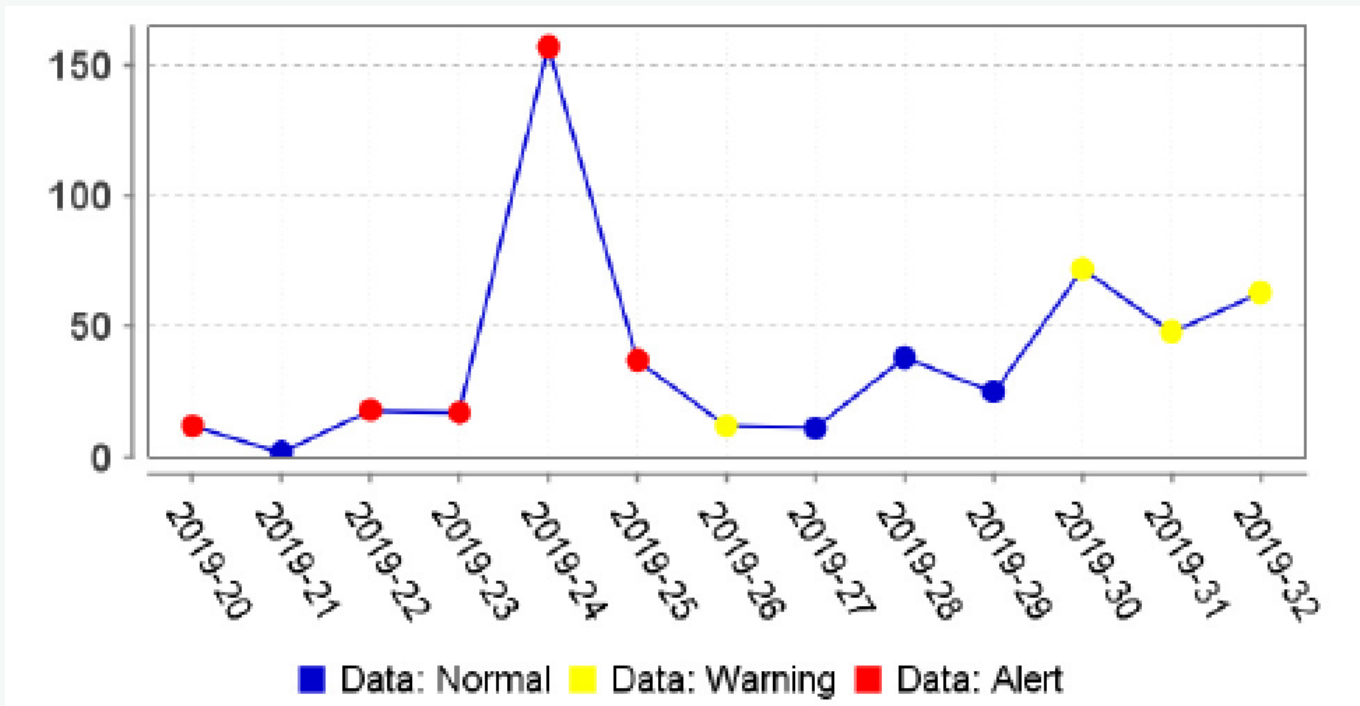
Exposure to higher temperatures and extreme heat is on the rise because of the frequency, length and intensity of heat waves due to climate change.(109) Some researchers estimate that extreme heat causes more deaths annually than all other weather events combined.(110)

Extreme heat decreases the body’s ability to cool itself, which can lead to a range of symptoms from headaches and fatigue to heat stroke, kidney failure and death.(109) People with chronic conditions worsened by heat (e.g., respiratory diseases, high blood pressure and heart disease) and those who are unable to escape hot environments (e.g., people without air conditioning or access to cooling facilities) are more likely to die during heat waves.(111)

## Extreme heat events in Oregon

Oregon has seen an increase in average annual temperatures of 1.5°F compared to the first half of the 20th century.(112) In 2016, the Portland region saw 13 days over 90°F, increasing to 22 days in 2017 and 29 days in 2018.(113) The Oregon Health Authority monitors heat-related emergency room visits and often sees spikes during heat waves. For example, the graph below shows a spike in heat-related emergency room visits during record-breaking heat in early June 2019.(114)

Figure 6. Heat-related illness during June 2019 heat wave



Agricultural workers, fishers, forestry workers and hunters account for 20% of heat-related deaths.(111) In urban areas, people who reside in urban heat islands are more at risk. A recent study on the correlation of “redlining” (the historical practice of refusing home loans or insurance to whole neighborhoods based on race) with present-day “urban heat islands” (summertime intra-urban land surface temperature anomalies) found that redlined Portland neighborhoods are dangerously warmer than other neighborhoods in the city.(11) Of 108 urban areas analyzed, Portland came in with the worst temperature discrepancy between rich and poor, a difference of almost 13 degrees.(9)

## Future projections of extreme heat in Oregon

Climate scientists project that most Oregon communities will experience an increase of more than 30 days over 86°F by mid-century compared to the recent past.(31) Increases in average and extreme temperatures are projected to increase the number of heat-related deaths.(115) Mid-century climate in Portland may result in more than 80 additional heat-related deaths per year.(116) If greenhouse gas emissions remain high, most of the state will experience significantly more days with temperatures above 86°F (i.e., “hot days”) with some places in Oregon experiencing double the number of hot days by the year 2040.(31)

## Examples of public health action

- OHA contributed to the [State of Oregon’s 2020 Natural Hazard Mitigation Plan](#). For the first time, the plan will include a chapter on extreme heat. Inclusion makes the state eligible for Federal Emergency Management Agency funding for mitigation actions that reduce identified risks.
- In 2017, OHA partnered with the Multnomah County Health Department to support extreme heat interventions that included risk communication, creating [new tools for outdoor athletic event organizers](#) to reduce risk among event participants, and incorporating these tools into the event permitting process.
- In 2017, OHA partnered with members of the Confederated Tribes of Warm Springs on a digital storytelling project. Listen to Tamera Calhoun share how she witnessed the impacts of extreme heat on the reservation as she worked to ensure people had adequate air conditioning in [Through the Eyes of a Native Veteran](#).

## Air quality and allergens

In addition to the air quality impacts of increased wildfire smoke discussed earlier in this report, there is growing evidence that climate change yields conditions more conducive to forming and exacerbating ambient air pollutants such as ozone (a major component of “smog”) and fine particles from heating and cooling, transportation and industrial emissions, increasing the health risks associated with poor air quality.(117)

Other air contaminants influenced by warming temperatures and climate-driven events include airborne pollens and molds. Expanded growing seasons and increased concentrations of carbon dioxide are leading to an increase in prevalence and potency of airborne pollens.(118) Increased storm and flooding events can lead to proliferation of mold growth in damp, water-damaged homes.(119) Aeroallergens can inflame airways and induce symptoms of bronchial asthma.

Low-income communities and communities of color are more likely to have neighborhood characteristics that increase exposure to climate-related air pollution, such as proximity to highways, railyards, polluting industries, lack of green space and urban heat islands. (120,121,122) In Portland, income and race are strongly correlated with vegetation cover.(123) Across the state, industrial facilities reporting air emissions are disproportionately located in areas with higher proportion of low-income households and racial and ethnic minorities.(124)

## Air quality events in Oregon

The most severe recent air quality events in Oregon are due to wildfire smoke and discussed in the previous wildfire section.

In Oregon, transportation is the largest source of greenhouse gas emissions.(125) Traffic and diesel trucks emit particulate matter and complex mixtures of other climate co-pollutants that harm health, increasing risk of cancer,(126) stroke(127) and premature death.(128) An EPA analysis estimated that the direct and indirect public health costs of diesel exhaust may be up to \$3.5 billion per year in Oregon alone.(129)

## Future air quality projections

Future ozone pollution will vary considerably depending on the implementation of policies to reduce transportation-related emissions. State-level estimates are not available for Oregon. However, recent national studies suggest that increased ozone levels due to climate change could result in thousands of additional illnesses and deaths per year in coming decades,(130) with some portion of those occurring in Oregon.

Projected rises in regional temperatures and atmospheric CO<sub>2</sub> levels are expected to increase the number of people affected by seasonal allergies in Oregon.(131) The World Allergy Organization, comprising medical societies from around the world, stated that climate change will expand the start, duration and intensity of the pollen season and exacerbate the synergistic effects of pollutants and respiratory infections on asthma.(132)



In response to Executive Order 20-04, DEQ is commissioning a study on how changes in Oregon's transportation fuels related to expanding the Clean Fuels Program (CFP) could affect local air pollution. The study will provide information about the lifecycle of greenhouse gases and the associated changes in social and health costs due to the reduction in tailpipe emissions. A separate DEQ study will evaluate the economic and health implications of the new [program DEQ is developing to cap and reduce greenhouse gas \(GHG\) emissions](#) from large facilities and the transportation sector.

## Examples of public health action

- OHA provides consultation to DEQ on health and equity aspects of studies it has commissioned to support expansion of the Clean Fuels Program reducing the carbon intensity of fossil fuels used in Oregon. OHA also supports the new Cap and Reduce Program to reduce emissions from large facilities and the transportation sector assigned to DEQ under E.O. 20-04.
- OHA participates in the Zero-Emission Vehicle Interagency Working Group tasked with implementing Governor Kate Brown's Executive Order 17-21. It includes a statewide goal to increase the number of zero-emission vehicles in the state to 50,000 by the end of 2020. OHA informed recommendations to increase access to electric vehicle infrastructure among communities of color and low-income communities, and identified scenarios that maximize health benefits to these populations.
- In 2018, OHA prepared a [Climate Change and Public Health in Oregon Policy Paper](#) at the request of the Oregon Governor's Carbon Policy Office. The paper identifies communities most affected by health risks of climate hazards and co-pollutants of greenhouse gas emissions. OHA shared this paper in December 2018 with state lawmakers on the Oregon Joint Legislative Committee on Carbon Reduction.
- OHA conducted three health impact assessments (HIAs) on a series of decisions within Metro's Climate Smart Communities (CSS) planning project between 2011 and 2014. The HIAs found that scenarios considered during the CSS planning process could affect health by influencing physical activity levels, road safety for all users and exposure to transportation-related air pollutants. It projected a climate smart strategy would reduce health care spending by more than \$100 million each year.
- In 2016, OHA partnered with Crook County Health Department to address air quality. Crook County Health Department analyzed air quality data with asthma ER visits and participated in a cross-sector air quality planning project. Watch this video to learn more: [Air Quality Planning in Crook County](#).

**Table 4. Summary of climate effects, health risks, priority populations and example actions**

Climate effects	Health risks	Priority populations	Example action
<b>Cross-cutting effects</b>			
<b>Economic instability, impacts to workers, food insecurity</b>	<ul style="list-style-type: none"> <li>• Mental health effects</li> <li>• Poor nutrition</li> <li>• Chronic diseases including heart disease and respiratory diseases</li> <li>• Heat-related illness</li> </ul>	<ul style="list-style-type: none"> <li>• Tribal and indigenous communities</li> <li>• Farmworker communities</li> <li>• Fishing, timber, and farming communities</li> <li>• Rural communities</li> </ul>	In response to <a href="#">Executive Order 20-04</a> , OHA will partner with the Oregon Occupational Safety and Health Administration (OR-OSHA) to develop a proposal for standards to protect workers from exposure to wildfire smoke and excessive heat.
<b>Mental health, substance use, violence</b>	<ul style="list-style-type: none"> <li>• Post-traumatic stress (PTSD)</li> <li>• Depression, anxiety</li> <li>• Suicide</li> <li>• Drug overdose</li> <li>• Domestic violence</li> </ul>	<ul style="list-style-type: none"> <li>• Youth</li> <li>• Communities of color</li> <li>• Tribal and indigenous communities</li> <li>• Rural communities</li> <li>• Women and children</li> </ul>	In response to <a href="#">Executive Order 20-04</a> , OHA will study the impacts of climate change on youth depression and mental health in Oregon.
<b>Housing, displacement, migration</b>	<ul style="list-style-type: none"> <li>• Disaster-related injuries</li> <li>• Asthma and respiratory disease</li> <li>• Heat-related illness</li> <li>• Toxic exposures</li> </ul>	<ul style="list-style-type: none"> <li>• Low-income communities</li> <li>• Communities of color</li> <li>• People experiencing homelessness</li> <li>• Coastal communities</li> </ul>	OHA's 5-year state health improvement plan (2020-2025), <i>Healthier Together Oregon</i> , calls for addressing economic drivers of health which include elements related to housing and climate resilience.
<b>Climate hazards</b>			
<b>Storms, floods, landslides and sea-level rise</b>	<ul style="list-style-type: none"> <li>• Injuries</li> <li>• Toxic exposures</li> <li>• Displacement</li> <li>• Disruptions in medical care</li> <li>• Mental health effects</li> </ul>	<ul style="list-style-type: none"> <li>• People dependent on medical equipment that requires electricity</li> <li>• Socially isolated</li> <li>• Older adults</li> <li>• Coastal communities</li> <li>• Children and pregnant women</li> </ul>	OHA partnered with the Oregon Department of Transportation (ODOT) to conduct a case study: <a href="#">How Tillamook Weathered the Storm: A Case Study on Creating Climate Resilience on Oregon's North Coast</a> . The project involved interviewing state and local transportation and health leaders to document lessons learned.
<b>Wildfire</b>	<ul style="list-style-type: none"> <li>• Respiratory diseases</li> <li>• Cardiovascular diseases</li> <li>• Cancer</li> <li>• Injuries</li> <li>• Displacement</li> <li>• Toxic exposures</li> <li>• Mental health effects</li> </ul>	<ul style="list-style-type: none"> <li>• People with pre-existing conditions</li> <li>• Outdoor workers</li> <li>• Children, pregnant women</li> <li>• Older adults</li> <li>• Rural communities</li> <li>• Tribal communities</li> </ul>	In 2019, OHA published <a href="#">More Days with Haze: How Oregon is Adapting to the Public Health Risks of Increasing Wildfires</a> . The report, based on 2018 interviews with Oregon public health officials, identifies ways in which the public health system is adapting to the increasing severity of wildfires and opportunities for future climate adaptation.

*continued on next page*

Climate effects	Health risks	Priority populations	Example action
<b>Infectious disease</b>	<ul style="list-style-type: none"> <li>• Lyme disease</li> <li>• West Nile disease</li> <li>• Fungal diseases</li> <li>• Shigellosis</li> </ul>	<ul style="list-style-type: none"> <li>• Outdoor workers</li> <li>• Outdoor recreationalists</li> <li>• People experiencing homelessness</li> <li>• Tribal communities</li> <li>• Rural communities</li> </ul>	In 2016, OHA developed a guidance document for public health officials to use <a href="#">weather and environmental data with syndromic surveillance data</a> to quickly assess the correlation between weather factors or air quality measures and health outcomes including infectious disease.
<b>Drought and water quality hazards</b>	<ul style="list-style-type: none"> <li>• Mental health effects</li> <li>• Dehydration</li> <li>• Toxic exposures</li> <li>• Diminished living conditions</li> </ul>	<ul style="list-style-type: none"> <li>• Low-income communities</li> <li>• Tribal communities</li> <li>• Rural communities</li> <li>• Farming and farmworker communities</li> <li>• Coastal communities</li> </ul>	In 2017, OHA partnered with members of the <a href="#">Confederated Tribes of Warm Springs on a digital storytelling project</a> that documented climate-driven changes in water quality in rivers and water shortages on the reservation. OHA has also <a href="#">assessed the issue of water insecurity in Oregon</a> .
<b>Extreme heat</b>	<ul style="list-style-type: none"> <li>• Heat-related illness and death</li> <li>• Violence</li> </ul>	<ul style="list-style-type: none"> <li>• People with pre-existing conditions</li> <li>• Outdoor workers</li> <li>• Outdoor athletes</li> <li>• People without air conditioning or housing</li> <li>• People living in urban heat islands</li> <li>• Children, pregnant women</li> <li>• Low-income communities</li> <li>• Communities of color</li> </ul>	OHA contributed to the <a href="#">State of Oregon's 2020 Natural Hazard Mitigation Plan</a> . For the first time, the plan will include a chapter on extreme heat. Inclusion makes the state eligible for Federal Emergency Management Agency funding for mitigation actions that reduce identified risks.
<b>Air quality and allergens</b>	<ul style="list-style-type: none"> <li>• Ozone / “smog”</li> <li>• Airborne pollens</li> <li>• Airborne molds</li> </ul>	<ul style="list-style-type: none"> <li>• Low-income communities</li> <li>• Communities of color</li> <li>• Communities near highways and industrial facilities</li> <li>• Outdoor workers</li> <li>• People with pre-existing conditions</li> <li>• Farmworker communities</li> </ul>	In 2018, OHA prepared a <a href="#">Climate Change and Public Health in Oregon Policy Paper</a> at the request of the Oregon Governor's Carbon Policy Office. The paper identifies communities most affected by health risks of climate hazards and copollutants of greenhouse gas emissions.

# Priorities for future public health action

This report provides evidence of increasing risks to public health from rapidly accelerating climate change. It also details effective interventions to protect population health from these threats and build climate resilience. Actions OHA plans to advance in the months and years ahead include:

- Promoting climate mitigation that maximizes health co-benefits
- Collaborating across all levels of local, state and tribal government and with community partners to advance equitable climate adaptation
- Building environmental health capacity to identify and address emerging environmental health threats, including threats to workers
- Increasing understanding of mental health effects on individuals and the role of social resilience in fostering a community's capacity to adapt
- Supporting climate-related strategies in OHA's State Health Improvement Plan, *Healthier Together Oregon*.

## Promoting climate mitigation that maximizes health co-benefits

Efforts to mitigate climate change through reducing greenhouse gas (GHG) emissions have the potential to create multiple health co-benefits (improvements to population health in addition to the mitigation of climate change). These health benefits arise from lowering exposure to co-pollutants of GHG emissions and through the creation of healthy alternatives and community assets, such as increased access and use of active transportation infrastructure.

When decision-makers can incorporate the analysis of health benefits and burdens associated with proposed policies, they can make a more informed decision that optimizes the policy's overall impacts. Some existing public health tools for this kind of alignment include health impact assessments (HIAs), health analysis incorporation, inclusion of public health experts on advisory groups, and developing inter-agency agreements between public health departments and partner agencies to inform policies and programs. For example, OHA has an existing memorandum of understanding with the Oregon Department of Transportation (ODOT) and will prioritize collaboration with ODOT's new Climate Office and Equity Office to inform their work.

**Table 5. Health co-benefits of climate investment**

Example climate investments in other sectors	Health co-benefits
<b>Example climate investments in other sectors</b>	<ul style="list-style-type: none"> <li>• Decreased risk of chronic diseases due to increased physical activity and reduced air pollution</li> <li>• Fewer injuries due to enhanced safety</li> </ul>
<b>Green infrastructure and healthy ecosystems</b>	<ul style="list-style-type: none"> <li>• Reduced heat-related illness and death due to reduced temperature; urban heat islands</li> <li>• Decreased risk of chronic diseases due to reduced air pollution</li> <li>• Reduced injury, displacement, water contamination and mold exposures due to flood mitigation</li> </ul>
<b>Energy efficiency improvements</b>	<ul style="list-style-type: none"> <li>• Decreased risk of food insecurity, mental health impacts due to reduced energy cost burden</li> <li>• Decreased risk of heat-related illness and death, domestic violence due to cooler homes</li> </ul>
<b>Energy efficiency improvements</b>	<ul style="list-style-type: none"> <li>• Decreased risk of food insecurity, mental health impacts due to improved access to healthy foods</li> <li>• Improved farmworker health due to safer more sustainable practices</li> </ul>

## Collaborating to advance equitable climate adaptation

Adapting to climate change requires us to plan for specific single emergencies, as we have in the past. It also entails engaging in all hazards resilience planning. This kind of planning involves exploring what could go right, not just what could go wrong. It prioritizes community-identified solutions with the potential to build community resilience across multiple stressors and hazards.(133) This approach can begin to address some of the more cross-cutting, longer-term and slower-moving disasters, many of which are included in the state’s [2020 Climate Change Adaptation Framework](#).

The important and ongoing work of hazard mitigation and preparedness planning continues to integrate more public health and climate change considerations, as evidenced in the latest [2020 Oregon Natural Hazards Mitigation Plan](#). However, public health planners have limited capacity to participate at the local level.

At the state level, OHA will continue to prioritize participation in the new Interagency Workgroup on Climate Impacts and Impacted Communities led by the Governor’s Office under Executive Order 20-04. OHA

### From Climate and Health Community Survey, June 2020

***“In truth I am very concerned about many of these factors and I don’t think they can easily be compartmentalized.”***

will also continue to implement the [2020 Climate Change Adaptation Framework](#) and new [Climate Equity Blueprint](#). This cross-sector work, combined with deeper community engagement over the next year, will help to inform the update of [OHA's Climate and Health Resilience Plan](#), which will continue to guide the work of the Climate and Health Program.

Another upcoming action that will support equity, health and climate adaptation is the task assigned jointly to OHA and Oregon Occupational Safety and Health (OR-OSHA) under the Governor's EO 20-04: The two agencies will develop a proposal for occupational standards that protect workers from heat and wildfire smoke. The proposal, to be developed in 2021, will align with the state's Occupational Safety and Health Act to facilitate an efficient subsequent rulemaking process.

## Building environmental health capacity

Environmental health infrastructure, including policies and programs related to safe drinking water, clean air and worker protections, can be implemented in a way that considers future climate risks and potential adaptations. Rather than waiting for public health emergencies to act, Oregon can use climate and health data, community-specific expertise and lessons learned from other jurisdictions to make informed policy changes that protect health.

However, current environmental public health infrastructure is lacking capacity to implement protective policies and programs. A 2016 assessment of Oregon's public health system revealed that 97% (or 32 out of 33) of local public health authorities are not equipped to identify and address existing environmental health hazards,<sup>(133)</sup> let alone future and emerging hazards caused by climate change. Oregon's [2016 Public Health Modernization Plan](#) identifies the investments needed at the state and local level to achieve a modern public health system, including environmental health. The Governor and Legislature started making phased investments in modernization beginning with the 2017 legislative session; OHA anticipates that upcoming legislative sessions will consider funding the plan's environmental health components.

**Figure 7: Selection from Road to Resilience: Building Stronger, More Sustainable Communities**



***“Our county is drafting [natural hazard] mitigation plans and my greatest concern is meaningfully engaging community partners, especially now — I think this is a Public Health role but we are overwhelmed with the COVID response and unable to help lead the planning effort at this time.”***

Currently, federal grants fund OHA’s climate and health work. In 2020, OHA successfully competed for a new federal grant from the Centers for Disease Control and Prevention (CDC) to complement and expand on our existing CDC-funded [OHA Climate and Public Health Program](#). This new grant will allow OHA to deliver culturally relevant wildfire risk and resilience communication and training in partnership with Tribes, community-based organizations serving migrant and seasonal farmworkers, local health departments and other partners working with communities affected by climate-related disasters.

## Increasing understanding of mental health effects and the role of social resilience

In response to another task assigned to OHA by EO 20-04, in 2021 OHA will produce a study on the impacts of climate change on youth depression and mental health in Oregon. This study will focus on the mental health impacts of climate change in Oregon, especially focusing on youth of color. OHA will use a community-based participatory approach including collaboration with youth-oriented advocacy groups, community-based organizations and experts in behavioral and mental health. The Climate and Health Program will begin to engage with external partners in early 2021.

From Climate and Health Community Survey, June 2020

***“Tribes and farm worker unions should be asked what they want and given the resources to accomplish that.”***

Social connectedness increases a community’s resilience to trauma and supports overall health and mental well-being.<sup>(135)</sup> Social networks within a community can be instrumental in mobilizing and responding to disasters. “Social resilience” can be defined as communities’ capacity to use their social networks to transform by successfully anticipating and adapting to collective challenges and stressors. Social isolation, the opposite of social connectedness, is associated with an increase in fear and distrust.<sup>(136)</sup>

OHA’s Climate and Health Program has been working with partners to better understand, measure and build [social resilience in Oregon](#) communities. Evidence shows that social inequities in a community decrease trust among people who experience diverse levels of advantage or treatment. Social inequities also affect trust in institutions.<sup>(137, 138)</sup> It is not possible to increase social resilience in our diverse communities without actively working to eliminate these inequities.

***“People in fear tend to isolate rather than cooperating for the common good.”***

In 2019, the program partnered with the Oregon Community Health Workers Association (ORCHWA) to host four listening sessions to hear from communities about climate change and social resilience. The listening sessions were facilitated by community health workers who live and work in the Latino community in the Hood River area, white community in Southern Oregon, African-American and African immigrant communities in the Portland area, and urban American Indian community in the Portland area. Below is a short summary of findings from the listening sessions.

People across different social groups come together for acute shared crises but not ongoing problems.

- Climate change affects people’s sense of hope for the future.
- Cultural identity and spirituality are important components of resilience.
- Community health workers strengthen social relationships in communities.
- Inequities cause social division.

For more information from the listening sessions, see the full report: [Climate Change and Social Resilience: Findings from Community Listening Sessions](#).

The report recommends the following strategies with more detailed next steps for agencies and organizations to take to build social resilience in Oregon’s communities. OHA will seek ways to incorporate these strategies in its work and disseminate them to partner agencies and organizations:

- Make and follow through on commitments to equity.
- Prioritize and support interventions, initiatives and projects that strengthen social resilience, even if the primary objective is not directly related to climate change.
- Incorporate strategies that build social capital into community engagement planning and implementation.
- Invest in the workforce’s community engagement and bridging skills. A workforce with the experience and skills to meet communities where they are and convene people from different social groups will increase an organization’s ability to strengthen community resilience.



## Implementing the State Health Improvement Plan – *Healthier Together Oregon*

*Healthier Together Oregon* is the 2020–2024 State Health Improvement Plan. More than 100 people from 68 organizations created it with broad public input. Community priorities drive the plan and will help to guide the work of Oregon’s Public Health Division and community partners for the next five years, including our work focused on climate change.

The people who helped to develop the plan agreed that it should focus on priority populations that face challenges to good health: Black, indigenous, people of color, and American Indian/Alaska Native people (BIPOC AI/AN\*); people with low income; people with disabilities; people living in rural areas of the state; and people who identify as lesbian, gay, bisexual, transgender, queer and questioning (LGBTQ+).

Some of the *Healthier Together Oregon* strategies that intersect with building climate resilience include:

- Build climate resilience among priority populations.
- Enhance community resilience through promotion of art and cultural events for priority populations.
- Build family resiliency through trainings and other interventions.
- Build a resilient food system that provides access to healthy, affordable and culturally appropriate food for all communities.
- Center BIPOC-AI/AN communities in decision-making about land use planning to create safer, more accessible affordable and healthy neighborhoods.
- Develop community awareness of toxic stress, its impact on health and the importance of protective factors.
- Increase affordable housing that has close access to active transportation options.
- Increase affordable access to high-speed internet in rural Oregon.
- Require state agencies to commit to racial equity for BIPOC-AI/AN in planning, policy, agency performance metrics and investment.
- Require all public-facing state agencies and state contractors to implement trauma-informed policy and procedure.

As part of this plan’s implementation, OHA has committed to connect partners that may not have worked together before; coordinate across tribal, state and local agencies; bridge the divide between rural and urban areas; and lift up the work of community-based organizations.

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\*The term BIPOC appears in this section of the report because it quotes directly from the State Health Improvement Plan, *Healthier Together Oregon*. Otherwise, this report uses the terms “tribes,” “tribal communities” and “communities of color.”

# Conclusion

Climate change creates greater uncertainties, amplifies existing inequities and affects health in a multitude of ways. A growing number of evidence-based public health interventions address the climate hazards and inequities discussed in this report. OHA looks forward to continuing to work with partners to build our collective capacity to address the climate and health needs of Oregon's diverse communities.

The release of this report will be followed by community engagement designed to help inform the next annual 2021 report, as well as the update to [OHA's Climate and Health Resilience Plan](#). We encourage partners to contact us with any questions, ideas or opportunities to collaborate on this work.

# Acknowledgments

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## Please cite this publication as follows:

York EA, Braun MJF, Goldfarb GG, Sifuentes JE. Climate and health in Oregon: 2020 report. Oregon Health Authority. December 2020: Portland, OR

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