Chelan-Douglas Health-Focused Climate Vulnerability Assessment

CHELAN AND DOUGLAS COUNTIES,
NORTH CENTRAL WASHINGTON

JUNE 23, 2025

Contents

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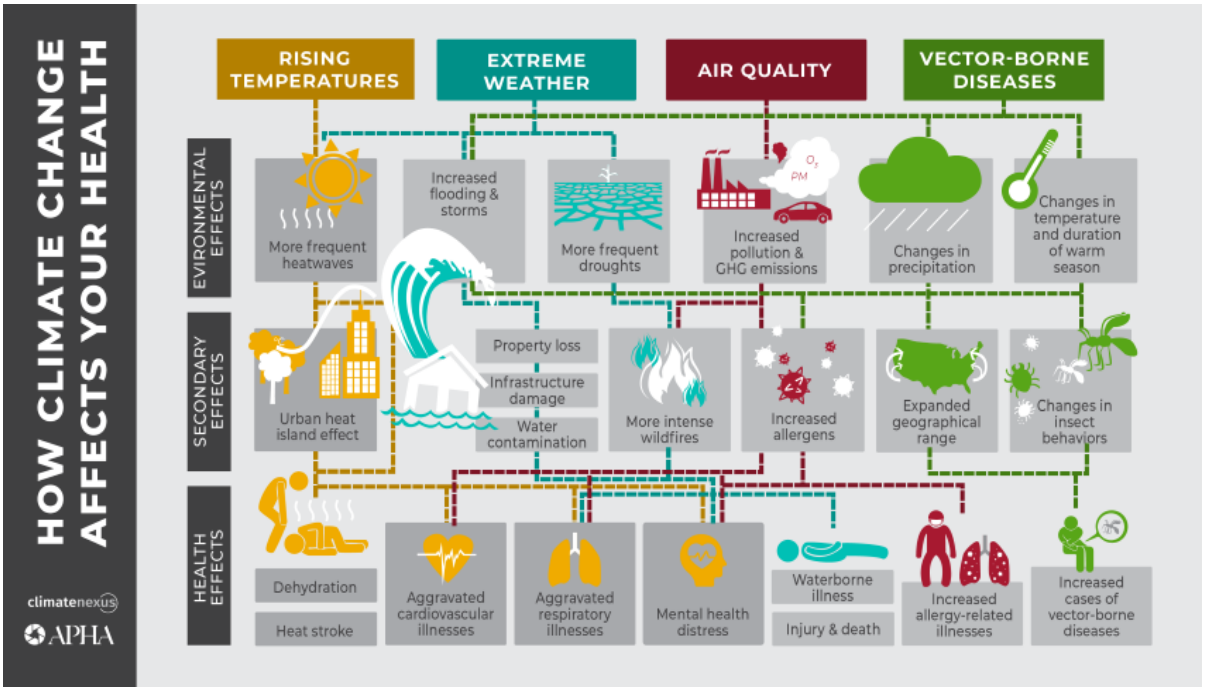
Cover Photo

Wildfire smoke fills the Wenatchee Valley. Photo credit: Wenatchee Valley Technical Skills Center, 2022.

Overview

Climate change can have negative impacts on human health, as shown in the figure below. This Climate Vulnerability Assessment looks at the health impacts anticipated in Chelan and Douglas Counties.



> "Climate impacts are not distributed equally. Who is at risk is a factor of both who is most exposed, and who has the ability to respond, adapt, and decide."
>
> -Washington State Department of Commerce, 2024

Communities and residents with higher rates of social vulnerability and exposure to environmental burden face increased risks for climate impacts and hazards. Both Chelan and Douglas County have high levels of overall social vulnerability compared to other counties in Washington state, as shown in the table below. Another consideration is exposure to environmental burden. One existing burden in the region is air pollution, including high rates of PM2.5 (particulate matter) relative to the rest of the state.

Example Vulnerable Community	Chelan County	Douglas County	Washington state
Senior residents (65 years and older)	21.6%	19%	17.1%
Youth under 18 years (and 5 years and younger)	22.4% (5.4%)	23.9% (5.8%)	21.8% (5.4%)
Persons in poverty	10.2%	8.6%	10.3%
Persons without health insurance (under 65 years)	12.8%	13%	7.4%
Adults with disabilities (under 65 years)	12.5%	12.1.%	9.3%
American Indian/Native American	2.1%	2.5%	2.0%
Hispanic or Latino	29.2%	35.8%	14.6%

Data from U.S. Census Bureau, Quick Facts, 2023.

Public Health and Safety

Focus: Risks to people and critical facilities from wildfire and flooding. This focus area also addresses the overall preparedness of the health system and emergency response system to climate impacts.

Key Climate Risks

- The region has some of the **highest wildfire risk** areas in the state, with high numbers of properties and residents located in the Wildland Urban Interface (WUI).
- **Flooding** is a lower risk, though there are some areas in the counties with flood risk. Land that has been burned by wildfires is also more prone to flooding and landslides.
- **Critical health infrastructure**: Many critical facilities, including hospitals and health services, could be impacted by wildfire, flooding and other climate impacts.
- **Emergency response:** First responders face heightened risks during disasters. Coordination challenges may delay emergency responses. Flooding and landslides complicate evacuations and increase the risk of waterborne diseases.

Adaptive Capacity Strengths

- **Fire risk management**: Local actors, including fire departments, are proactively engaging in vegetation management and controlled burns, creating defensible spaces, and other efforts to reduce wildfire risks.
- **Public health planning:** Local health districts and organizations like Confluence Health are beginning to engage in limited public health planning with adaptive measures for climate risks.

Adaptive Capacity Limitations and Opportunities for Action

- **Many defensible practices against wildfire remain voluntary.** Common local building practices and infrastructure are not well adapted to a high wildfire risk reality.
- **Many health, emergency and other critical facilities are not resilient themselves** to wildfire, heat or prolonged smoke events. Employee burnout is also a concern.

Example Action

The Chumstick Wildfire Stewardship Coalition has been integral to the fire risk management and adaptation process in the greater Leavenworth, Washington area for the past twelve years. The CWSC engages in collaboration, education and outreach, particularly to assist small private forest owners (50-300 acres) actively managing their lands. Their efforts help reduce wildfire risk to everyone in the region.

Physical Health

Focus: Impact of extreme heat and prolonged smoke events, particularly on vulnerable populations including youth and farmworkers.

Key Climate Risks

- **Wildfire smoke & poor air quality**: Increasing wildfire seasons are worsening air quality for everyone and exacerbating respiratory and cardiovascular conditions.
- **Asthma-related hospitalizations** increase dramatically during wildfire events, especially for youth from low-income and Latino households.
- **Extreme heat:** Rising temperatures compound health risks, especially for vulnerable populations including farmworkers.
- **Heat islands:** Some places in the County experience higher temperatures and more extreme heat than other, influenced by the built environment and variable tree canopy.

Adaptive Capacity Strengths

- **Air quality monitoring:** There is some air quality monitoring to track wildfire smoke and provide air quality updates to protect public health.
- **Cooling centers and urban greening**: Ten North Central Washington libraries serve as cooling centers during heat events. There have been efforts to add trees and greenery in built-up areas.
- **Worker protections:** Washington State has new worker protections around heat and smoke. Some employers have changed practices (e.g. to night-time picking) to reduce the impacts to workers. The Community for the Advancement of Family Education (CAFÉ) has organized local events to distribute face masks and informational flyers to farmworkers.

Adaptive Capacity Limitations and Opportunities for Action

- **Asthma prevalence:** In Chelan and Douglas County, 11.3% and 12% of adults have asthma, respectively. Respiratory health is a major concern during wildfire, drought, and heat seasons.
- **Uninsured population:** Nearly 12% of Chelan County residents and 13% of Douglas County residents lack health insurance, with over 75% being of two or more races or Hispanic/Latino origin.
- **Insufficient safety practices and adaptation measures for outdoors workers** are reported by farmworkers themselves.

Example Action

Confluence Health hospital researchers have analyzed patterns in children's ER visits during extended smoke events. They are advocating for Medicaid coverage for in-home visits for patients with asthma and any durable medical equipment interventions, such as air cleaners (also called air purifiers).

Economic Health

Focus: Impacts of climate change on the local economy, including to key sectors like agriculture and tourism. This focus area addresses the economic impacts of climate change to workers and low-income residents.

Key Climate Risks

- **Agricultural production:** Increasing drought, heat and smoke negatively affect crops and livestock. Recent impacts have included lower fruit production and cattle deaths.
- **Tourism**: Wildfire, extended smoke events, and less reliable winter snow are impacting recreation and tourist centers like Lake Chelan and Leavenworth.
- **Climate impacted workers** like agricultural workers and workers in the tourism industry face economic challenges when they lose work days.
- **Low-income residents** face rising costs from increased cooling demand in summer, and face barriers to recovering from economic impacts, like property damage due to fire and flooding.

Adaptive Capacity Strengths

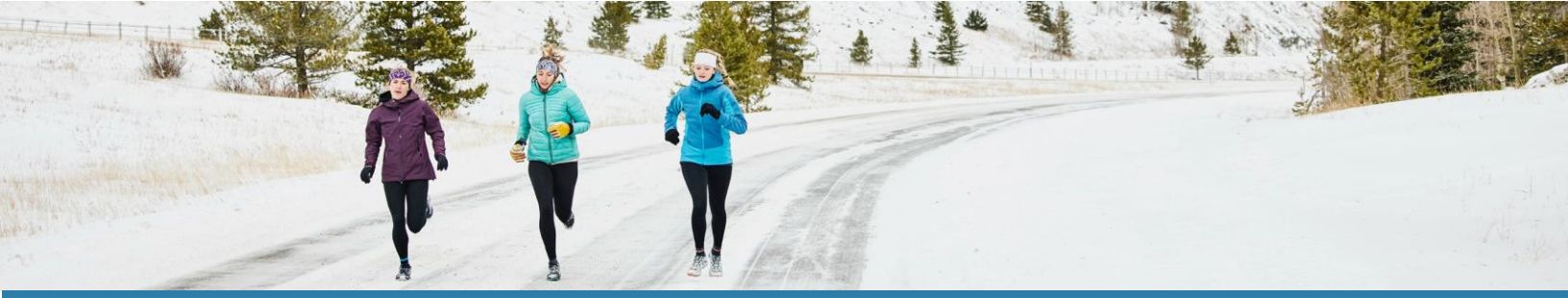
- **Agriculture:** Local producers, including fruit growers, have been adopting new practices to adapt to a changing climate, utilizing and contributing to research from Washington State University.
- **Tourism:** Local recreation facilities are engaged in strategies like snowmaking and shoulder season activities.
- **Low-income residents** may participate in weatherization and energy efficiency programs.

Adaptive Capacity Limitations/Opportunities for Action

- **Agriculture:** Farmers may struggle to afford and implement changing practices.
- **Climate impacted businesses and workers** do not have sufficient options for making up for economic losses due to climate impacts.
- **Program to assist low-income households** are limited.

Example Action

The Chelan-Douglas Action Council (with support from partners) manages Energy Assistance and Weatherization programs that assist low-income and other eligible residents (e.g. those with disabilities) deal with the economic hardships of heating and cooling their homes in a changing climate.



Mental Health and Community Well-Being

Focus: Explores the mental health impacts of climate change, including anxiety and depression. It also investigates the effects on community assets and services, including parks, ecosystems, green spaces, and food access, and the intersection with overall community well-being and social cohesion.

Key Climate Risks

- **Mental health:** Depression, anxiety and increased suicide rates are associated with experiencing climate hazards.
- **Rising costs**: Costs for energy/electricity, fuel and vehicle maintenance, and homeowners insurance are expected to increase- a huge concern for low- and middle-income households.
- **Food insecurity:** Both counties have food insecurity rates above the Washington state average.
- **Transportation barriers:** Most households are **reliant on personal vehicles.** Residents with disabilities, mobility challenges, and low income may struggle to access their needs and to make social connections.

Adaptive Capacity Strengths

- **Park access:** A high percentage of the population lives within a half mile of a park.
- **Transit**: The region has relatively robust transit service for a rural area, mainly concentrated in and connecting the towns.
- **Housing and other assistance:** Chelan Douglas Housing Authority and other local actors like CAFÉ provide benefits and assistance to low-income families and other groups.

Adaptive Capacity Limitations and Opportunities for Action

- Residents have **low access to mental health providers** in the region and report **mixed levels** of social and emotional support.
- **Assistance for low-income residents is insufficient** amid rising costs.
- Impacts to the local food system are likely to **exacerbate both local food insecurity** as well as national and global food supplies, since the region is an agricultural exporter.

Example Action

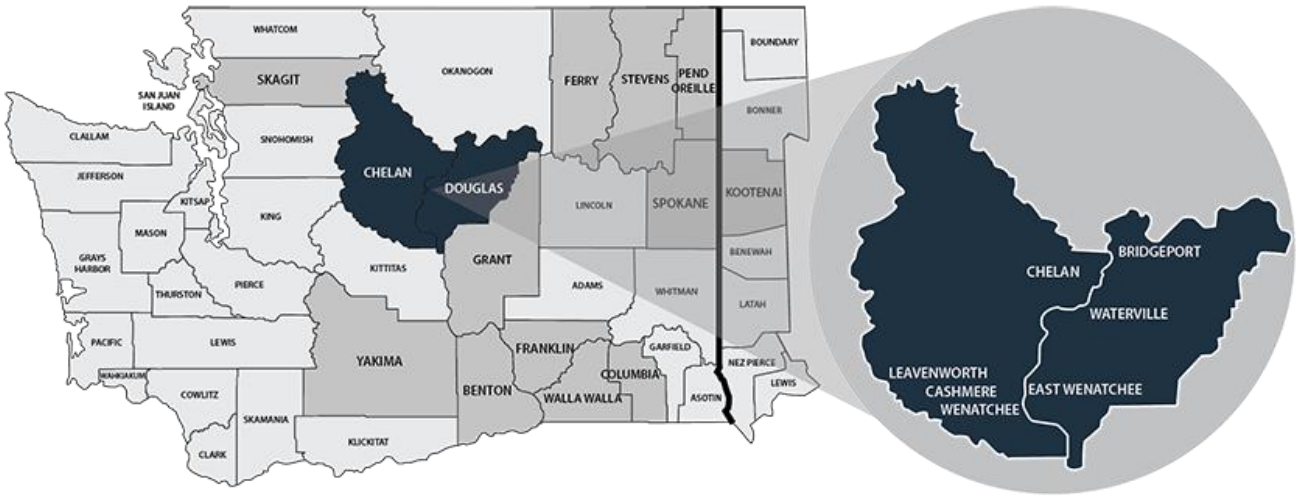
Trees bring important mental health and community benefits in addition to their environmental benefits. Wenatchee Valley College is a local leader in tree planting and maintenance, with over 460 trees currently on campus. The College is aiming to attain Tree Campus USA Designation. In the last 7 years, the College has led tree planting, tree dedications, tours, poetry readings, carbon measurement workshops, and more.

Introduction

Overall Context

Located in North Central Washington, Chelan and Douglas Counties are sparsely populated rural counties, home to towns including Leavenworth and Wenatchee (Figure 1). Chelan County has a population of just under 80,000, while Douglas County has around 43,000 residents (U.S. Census Bureau, 2022). The region's diverse geography—including mountains, high desert, lakes, and public lands—makes it an outdoor recreation haven. Popular tourist destinations, such as Lake Chelan, Leavenworth, and Mission Ridge and Badger Mountain Ski areas, draw visitors from near and far (Meseck, 2022).

Figure 1. Chelan and Douglas Counties in North Central Washington (Chelan Douglas Trends, n.d.).



Chelan and Douglas Counties are already experiencing climate impacts, like more frequent wildfires (Figure 2) and smoke events. In 2024, a wildfire near Lake Chelan burned more than 37,000 acres, prompting evacuations in the town of Stehiken (Wakayama, 2024). Even when no fires are actively burning in these counties, wildfire smoke from Oregon, California, Canada, and other areas can settle, resulting in poor air quality (Chelan County Natural Resources Department, 2024). The region has also been experiencing extreme heat events. In June 2021, the Pacific Northwest's historic heat dome set all-time high-temperature records across the region and contributed to over 130 deaths (Chelan County Natural Resources Department, 2024). During this event, Wenatchee recorded a high of 113°F, while Chelan reached 111°F.

Figure 2: News coverage of Pioneer Fire in 2024 (Lake Chelan Mirror, 2024) and of the wildfires in 2015 that destroyed a Chelan Fruit facility (Dininny & Mullinax, 2015).

Pioneer Fire expands to over 20,000 acres

Large smoke plume rises from the Pioneer Fire burning in the Okanogan-Wenatchee National Forest near Lake Chelan, as the wildfire grows to over 20,000 acres amid high temperatures and dry conditions. The intensity of the smoke indicates significant fire activity as crews work to protect nearby communities and contain the blaze.

PIONEER FIRE INFORMATION/FACEBOOK

Posted Tuesday, July 16, 2024 10:39 am

After the Washington fires

Packers work with insurers to recover from two wildfires that struck central Washington.

Shannon Dininny, TJ Mullinax // November 17, 2015

One of Chelan Fruit's facilities along Howser Road in Chelan, Washington, on September 23, 2015, after it was lost in an August wildfire. While the co-op lost around $60 million in building and equipment, it was able to rent additional storage to handle all of its fruit from the 300 growers it serves. Chelan Fruit is already looking at new technologies—with particular focus on robotics—as it rebuilds.

The first inhabitants of the area were Native people who were nomadic, following the seasons and food sources (Colville Confererated Tribes, n.d.). Main cultural practices included fishing, hunting game, and gathering roots and berries. These Indigenous peoples also extensively used controlled fire for land management towards ecological and cultural aims and benefit. However, war, disease, economic hardship, and the Yakima Treaty of 1855 dispossessed regional Tribes of millions of acres of land.[1] Today there are over 9,000 descendants of the original inhabitants, many of whom continue to make their homes in the Wenatchee Valley. Tribal members, their families, and non-Tribal members live on the Confederated Tribes of the Colville Reservation, just north of Douglas County. The Tribe is comprised of Twelve Bands (Chelan, Chief Joseph Band of Nez Perce, Colville, Entiat, Lakes, Methow, Moses-Columbia, Nespelem, Okanogan, Palus, San Poil, Wenatchi). In Washington state and globally, Tribal, Native and Indigenous community members are often impacted first and worst by climate impacts. At the same time, Tribes and Native people are often key leaders and collaborators for climate action. The Colville Tribe has a webpage detailing its climate action efforts (https://www.cct-fnw.com/events-news/).

The development of dams, irrigation systems and railroads were pivotal to the proliferation of agriculture in the 1900s (Meseck, 2022). Agriculture remains a cornerstone of the local economy for the region, with key crops including tree fruits such as apples, cherries, pears, and peaches. In recent years, some traditional orchards have transitioned to vineyards, contributing to a growing wine industry. Additionally, seasonal employment in retail, leisure, and hospitality sectors are significant sources of jobs (Meseck, 2022). In recent years, Microsoft data centers have been established in the area, with potential significant climate and other impacts (Safford, 2024).

Over the past decade, Chelan and Douglas Counties have experienced gradual yet consistent population growth (Meseck, 2022). Notably, both counties are home to a higher percentage of older adults and residents who identify as Hispanic or Latino compared to the state average (Meseck, 2022).

[1] For a more detailed history, see https://storymaps.arcgis.com/stories/bb31cd48d0284fa59d6f454cafabe962

Portions of Wenatchee and East Wenatchee, situated along the boundary between Chelan and Douglas Counties, are affected by air pollution, experiencing elevated mean and 98th percentile $PM_{2.5}$ concentrations in 2014-2017 compared to the rest of Washington State (Washington State Department of Ecology Air Quality Program, 2024). Residents in this area also have higher rates of poverty, asthma, and lack of health insurance, making the community more vulnerable to the adverse health effects of air pollution. Additionally, it has a substantial population of children under 18 and farmworkers, who are more sensitive to the impacts of climate change (Washington State Department of Ecology Air Quality Program, 2024). In 2022, the Department of Ecology designated Wenatchee and East Wenatchee one of 10 Washington communities over-burdened by air pollution.

Purpose

This climate vulnerability assessment (CVA) augments other climate planning in the region by focusing deeply on impacts to people's health- considered broadly. This CVA takes a broad, regional look across the two Counties. It is intended as a high-level synthesis for a wide range of audiences and users, rather than a technical analysis of individual issues.

We look at health holistically, organized by these four focus areas:

- Public Health & Safety
- Physical Health
- Economic Health
- Mental Health & Community Well-Being

Within each focus area, we identify key climate risks or hazards (such as wildfires and heat) and their potential impacts to specific health-related physical assets and the health consequences for communities and people. We particularly examine how vulnerable populations, or those impacted first and worst by climate change, are impacted.

One intention of this CVA is to support and direct action by community-based organizations (CBOs), local governments, and health-related actors. Within each focus area, we reflect on the adaptive capacity in the region. We discuss inspiring local examples to both acknowledge existing good work and to inspire additional actions. We also note some gaps and opportunities for improving adaptive capacity. We hope there will be ways for organizations and leaders to share their actions with one another, celebrate successes, and keep building momentum to address the health impacts of climate change!

This is not a full action plan, as we did not go through a prioritization process of impacts or recommended actions. Thus, all the issues discussed here merit more detailed investigation.

This CVA compliments other climate planning efforts in the region, that tend to focus more on intersections with natural resources and the built environment, including:

- The Chelan County Climate Resiliency Strategy;
- The Hazard Mitigation Plans (HMPs) and Community Wildfire Protection Plans (CWWPs) for each County; and
- The development of Climate Elements by the two Counties and by East Wenatchee, Leavenworth and other fully planning towns and cities for their Comprehensive Plans, as required under the Growth Management Act by HB 1181.

Climate Change and Health

There is growing attention to the health impacts of climate change and to how health-related actors can help increase adaptive capacity. Here we highlight a few efforts from various governments, professional associations, and universities to contextualize our focus in this CVA and offer readers other resources.

- The U.S. Global Change Research Program report, The Impacts of Climate Change on Human Health: A Scientific Assessment, identifies **different types of health threats from climate change**, including: foodborne Illness and nutrition, air quality, extreme weather events, mental health and well-being, vulnerable populations, temperature-related illnesses and deaths, vector-borne diseases, and water-related illnesses (Crimmins et al, 2016).
- The American Public Health Association produced Climate Change, Health, and Equity: A Guide for Local Health Departments **to help local public health departments integrate climate change and health equity** into practice (Figure 3).
- University of Washington, Climate Impacts Group researchers study **the community dimensions of health outcomes**, such as the association between climate change with increased absences from schools and work, emergency room visits, hospitalizations, and deaths.
- Washington State Department of Health is working to support the state's public health and medical emergency preparedness system and capabilities, in the context of climate resilience.

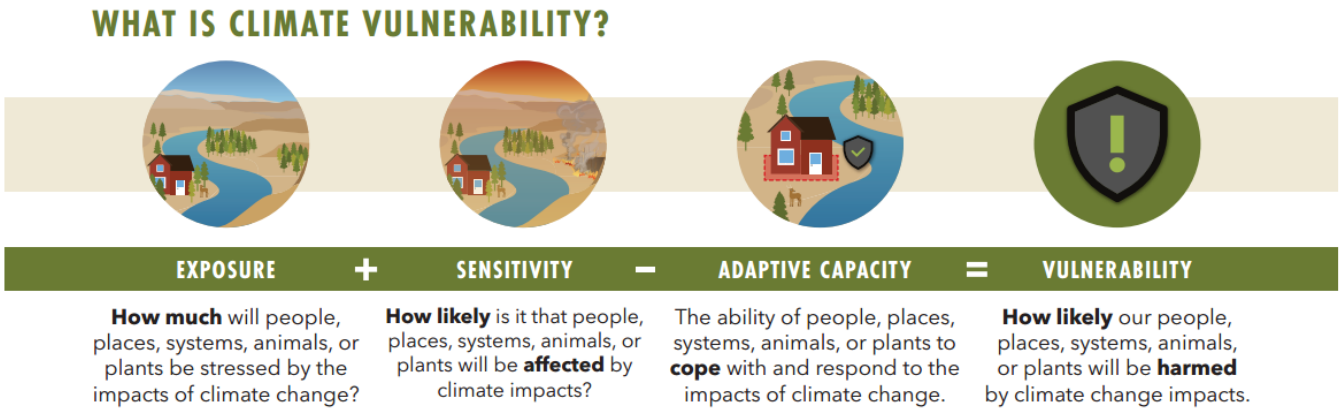
Figure 3. Climate change and health impacts (American Public Health Association, n.d.).

Climate Vulnerability Framework

Climate vulnerability (Figure 4) is the summation of exposure to climate risks, the sensitivity of people, infrastructure, and environments to it, minus the community's adaptive capacity to handle its impacts. Exposure and sensitivity increase vulnerability, while adaptive capacity helps to decrease vulnerability.

- **Exposure** refers to the extent to which a system is subject to climate hazards. For instance, coastal areas in towns and cities are more exposed to the effects of sea level rise compared to inland cities.
- **Sensitivity** indicates the degree to which that system is likely to be affected by climate change. For example, older adults are less capable of regulating their body temperatures, making them more physically sensitive to extreme heat than younger individuals.
- **Adaptive capacity** is the ability to mitigate damage, cope with, or adjust to climate change. For example, having access to a vehicle and health insurance enhances people's adaptive capacity to manage health impacts from extreme heat, smoke, and injuries related to climate hazards.

Figure 4: Climate vulnerability framework for Chelan and Douglas Counties (Cascadia Consulting)



Structure

We attempted to consider health holistically in this CVA. We organize our review by four primary health focus areas (Table 1). It was difficult to categorize impacts, since health is an issue that crosses topics. For example, we discuss issues of public health and safety and implications for Public Health practitioners in the first focus area (Public Health & Safety). However, some of the issues discussed in other focus areas, like respiratory health (addressed in the Physical Health focus area), are also relevant to Public Health actors. We made the best decisions we could and encourage readers to think holistically.

Table 1: Health focus areas in this CVA

Focus Area	Definition
Public Health & Safety 	Examines climate-related health outcomes in Chelan-Douglas counties, focusing on relative health risks of wildfire and the accessibility and resilience of critical health infrastructure, including hospitals and fire stations. This area also covers emergency response capabilities and the overall preparedness of the public health system to address climate-induced health emergencies.
Physical Health 	Assesses the impact of climate change on physical health, particularly respiratory and cardiovascular health. This focus area includes the examination of how increased temperatures, air pollution from smoke, and extreme weather events contribute to physical health issues and disease prevalence within the community.
Economic Health 	Evaluates the effects of climate change on the local economy, focusing on key sectors such as business, agriculture, and major industries. This area addresses how climate impacts economic stability, workforce productivity, and the viability of economic activities, including the cost of climate-related disruptions.
Mental Health & Community Well-being 	Investigates the effects of climate change on community assets and services, including parks, ecosystems, green spaces, and food access. This focus area also explores the mental health impacts of climate change, such as stress, anxiety, and other psychological effects, and how they affect overall community well-being and social cohesion.

Approach & Methodology

Sources of Information

This CVA leverages research, data, and stories from local, federal, state, and peer-reviewed sources and newspaper accounts. We synthesized this information to tell a story across the four focus areas, utilizing text as well as maps and figures (some from external sources and some made by us, utilizing public data).

There is a lot of existing climate planning and health work in the region. Table 2 indicates the main local documents and resources utilized.

Table 2: Main local documents and resources reviewed

Document	Year	Source
Chelan County Community Wildfire Protection Plan	2025	Chelan County
Chelan County Hazard Mitigation Plan and StoryMap	2024	Chelan County
Chelan County Climate Resiliency Strategy	2020	Chelan County
Chelan County Climate Resilience Round Table	2022	Chelan County
Chelan County PUD Climate Resilience Report	2018	Chelan County PUD
Chelan County PUD Integrated Resource Plan and Progress Report	2023	Chelan County PUD
Chelan-Douglas Trends	Ongoing	Eastern Washington University
City of Wenatchee Parks, Recreation and Open Space Plan	2024	City of Wenatchee
Douglas County Community Wildfire Protection Plan	2013	Douglas County
Douglas County Hazard Mitigation Plan	2019	Douglas County
Douglas County Integrated Resource Plan	2024	Douglas County
OVOF Community Input Report	2021	Our Valley Our Future
OVOF Action Plan	2022	Our Valley Our Future
Summary of Projected Changes in Physical Conditions Across the Colville Tribes Study Area	2017	UW Climate Impacts Group
Colville Tribes Natural Resources Climate Change Vulnerability Assessment	2018	UW Climate Impacts Group & Confederated Tribes of the Colville Reservation

While local reports and plans address climate change in Chelan and Douglas County, many of them do not address health holistically and often exclude mental health impacts. To address this gap, we also reviewed various health resources and datasets and utilized input from community leaders. These are identified throughout the report. Table 3 identifies some of the main federal, state, and academic resources used to assess climate risks and health impacts.

Table 3: Main federal, state, and academic resources

Resource or Document	Link
National Oceanic and Atmospheric Administration (NOAA), National	https://www.noaa.gov/climate

Resource or Document	Link
Centers for Environmental Information	
U.S. Climate Resilient Toolkit Climate Explorer	https://toolkit.climate.gov/tool/climate-explorer
University of Washington's Climate Mapping for a Resilient Washington	https://cig.uw.edu/resources/analysis-tools/climate-mapping-for-a-resilient-washington/
Centers for Disease Control, Social Vulnerability Index	https://www.atsdr.cdc.gov/place-health/php/svi/index.html
Centers for Disease Control, PLACES Local Data for Better Health	https://www.cdc.gov/places/index.html
Washington Environmental Health Disparities Map	https://doh.wa.gov/data-and-statistical-reports/washington-tracking-network-wtn/washington-environmental-health-disparities-map

There are strengths and limitations to using existing federal and state data sources. For example, census tracts are inconsistently identified as being disadvantaged or vulnerable across different datasets like the CDC's Social Vulnerability Index or the Washington Environmental Health Disparities Map (Linck, et al., 2024). This is due to the variation in specific indicators used, scale of analysis, and weighting of indicators. Thus, we practice caution in using a single health dataset or tool to rely on decisions, and instead draw from a range of datasets. We also tried to ground-truth our understanding by consulting with community members, discussed below.

Community Input

An importance source of information for the CVA was a 2.5-hour community workshop, held on October 24th, 2024. 19 participants attended, from different government agencies, health districts, and nonprofit and community-based organizations across the two counties (Figure 5). Participants shared their perspectives on local impacts and ideas for data sources. The latter part of the workshop included a presentation from Dr. Bindu Nayak from Confluence Health, and a conversation about collective actions. See Appendix B: Community Workshop Summary for a more detailed summary.

Figure 5: Climate vulnerability assessment community workshop, October 2024 (Cascadia Consulting Group).

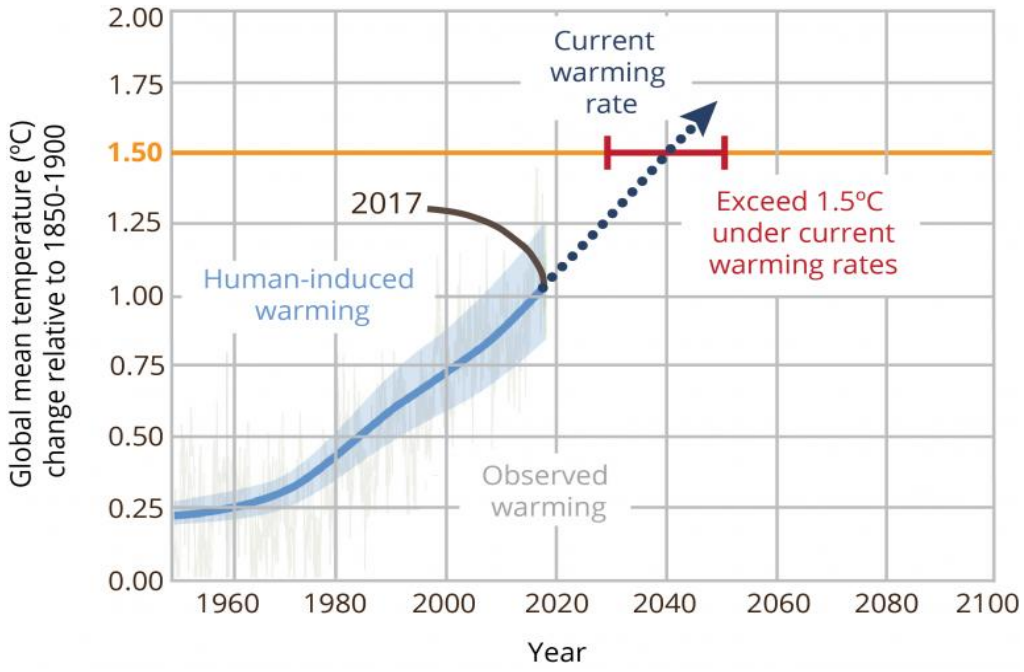
We also consulted with community members individually to gain a better understanding of climate risks and adaptive capacity, as relevant. While we made an effort to be comprehensive, we likely missed some data sources and community input.

Climate Impacts Summary

Climate Change and Variability: Global Perspective

Climate impacts are influenced by climate change. Climate change is the gradual warming of our planet caused by human activities, particularly the emission of greenhouse gas (GHG) emissions from burning fossil fuels. Human activities have caused at least 1ºC (2ºF) of global warming since pre-industrial times (1850-1900) (Figure 6) (National Oceanic and Atmospheric Adminsitration, 2024). While it may seem small, it represents a significant increase in accumulated heat. If current rates of warming continue, global warming could reach 1.5ºC as soon as 2030.

Figure 6: Global temperature rise showing human-induced warming, (Allen, et al., 2018)



While natural feedback processes such as changes in the sun's energy and volcanic eruptions contribute to variations in air temperature year to year and decade to decade, the rate of climate change caused by human activities far exceeds any natural variability from these processes (U.S. Environmental Protection Agency, 2024). The increase in temperatures is also linked to other impacts such as more frequent and intense heat waves, wildfires, storms, droughts, melting glaciers, sea-level rise, and ocean acidification. In the past century, Washington state has already experienced a warming of two degrees Fahrenheit (higher than the global average), retreating glaciers, earlier melt of snowpack, and changes in stream temperature and streamflow, and more frequent and severe drought wildfires (Global Change Research Program, 2023).

Climate Projections

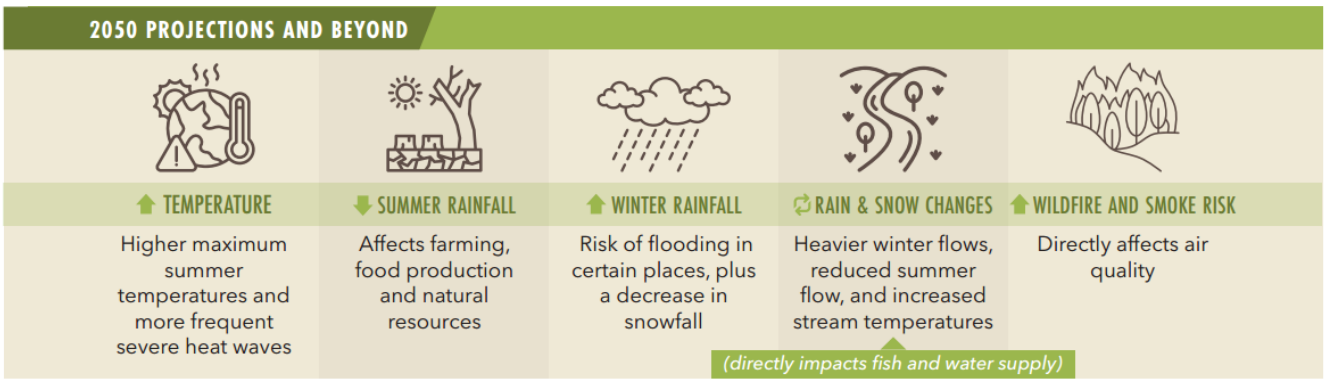
Models projecting future climate conditions and impacts, including how climate impacts will increase and intensify over the next century, use a variety of climate scenarios. These scenarios are based on factors such as future land use, population growth, technological innovation, and global GHG emission levels.

This CVA primarily uses Representative Concentration Pathway (RCP) 8.5. RCP 8.5 represents a "business-as-usual" scenario in which emissions continue at their current trajectory. It is the highest emissions scenario and projects a global temperature warming of about 4.3˚C by 2100 relative to pre-industrial temperatures.[2]

Climate Impacts in Chelan and Douglas Counties

The primary climate impacts in Chelan and Douglas County are below. For a detailed review of climate impacts in Appendix A.

Figure 7: Expected climate impacts



[2] This CVA primarily uses RCP 8.5, considered the high scenario or business as usual. As a comparison the Chelan Climate Resilience Strategy identified impacts associated with low, moderate, and high scenarios.

Vulnerable or Frontline Communities

> "Climate impacts are not distributed equally. Who is at risk is a factor of both who is most exposed, and who has the ability to respond, adapt, and decide."
>
> *-Washington State Department of Commerce, 2024*

Climate change worsens social inequities and puts the heaviest burden on the most socially vulnerable groups. These groups are sometimes called "frontline communities" since they are likely to be impacted first and worst by climate impacts. These communities can have greater or lesser vulnerability to health risks depending on their built environment and socioeconomic context (sometimes called social determinants of health). Often, people have limited control over their built environment surroundings and socioeconomic status. For example, people with lower incomes do not have many choices about their access to quality housing, transportation, and health services. The social determinants of health interact with the three elements of climate vulnerability – exposure, sensitivity, and adaptive capacity – as shown in Figure 8.

Figure 8: Intersection of social determinants of health and vulnerability (Adapted from Gamble, 2016)

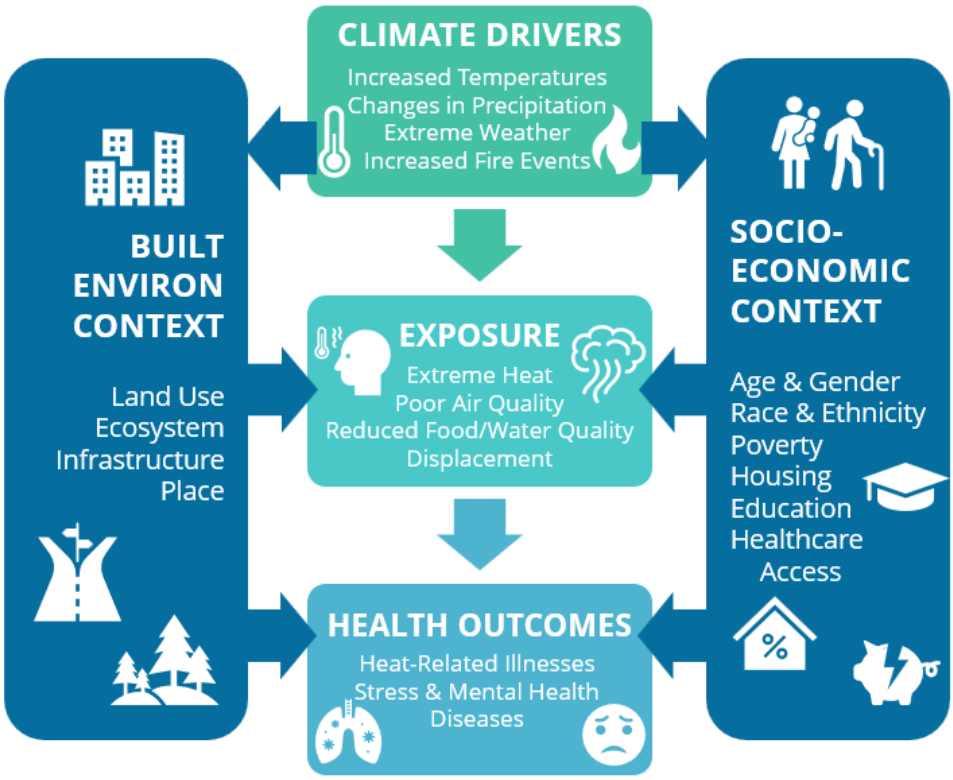
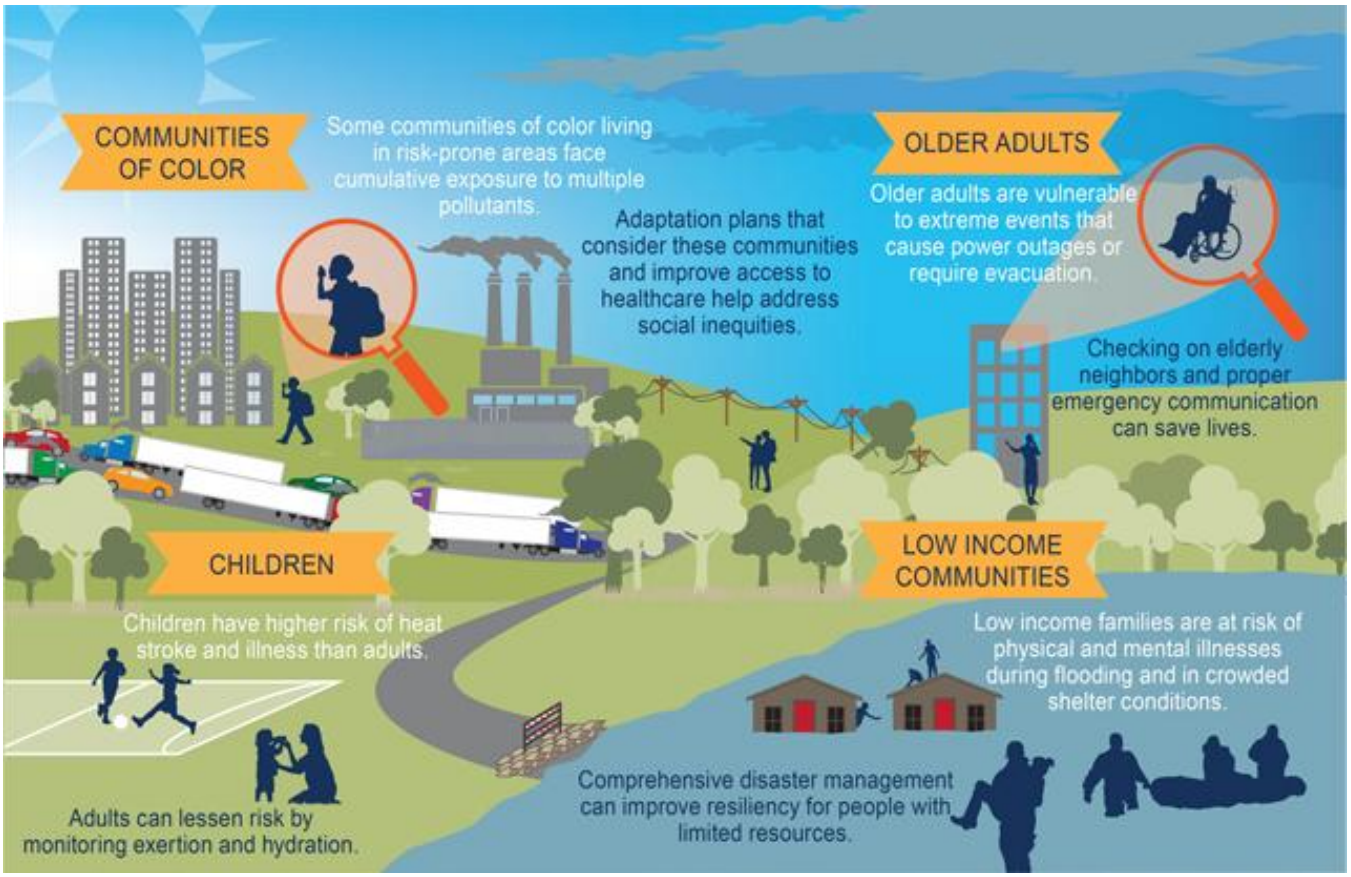


Figure 9 highlights some communities (in orange) that are likely to be negatively impacted by climate hazards (in white font). It also identifies adaptive capacity measures (blue font) that reduce vulnerability.

Figure 9: Examples of communities that are vulnerable to climate impacts. White text indicates the risks faced by those communities, while dark text indicates actions to reduce risks (Fourth National Climate Assessment)



In Chelan and Douglas Counties, vulnerable groups include, and are not limited to, those shown in Table Table 4. When considering the full range of climate risks, these groups are among the most exposed, most sensitive, and may have the least individual and community resources to prepare for and respond to health threats. Notably, people who are in more than one category face intersecting and often compounding vulnerabilities. In all categories noted, except persons in poverty, the percentage of the population in Chelan and Douglas Counties meets or exceeds the state average.[3]

Table 4: Some of the climate vulnerable or frontline communities, by percentage of overall population, in Chelan and Douglas Counties (U.S. Census Bureau, 2023)

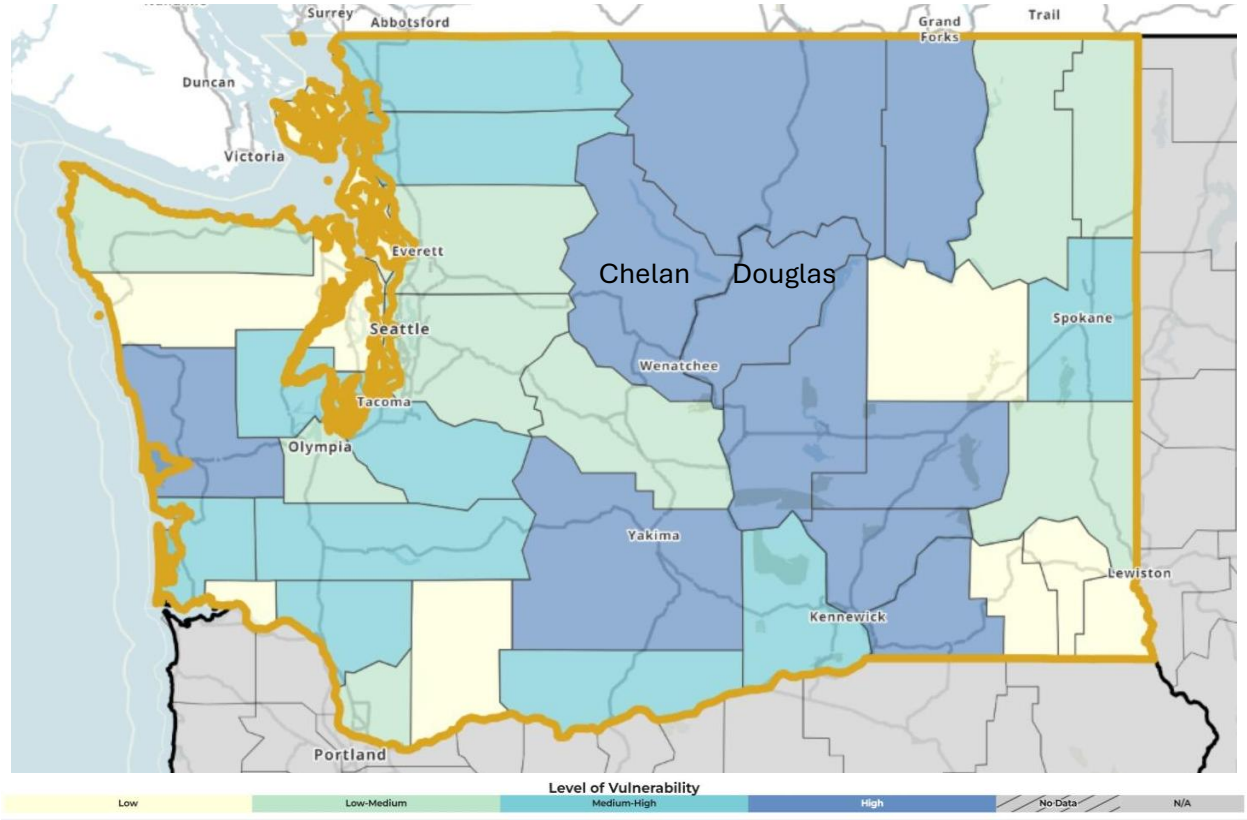
Example Vulnerable Community	Chelan County	Douglas County	Washington
Senior residents (65 years and older)	21.6%	19%	17.1%
Youth (5 years and younger)	5.4%	5.8%	5.4%
Youth (17 years and younger)	22.3%	25%	21.8%
Persons in poverty	9.3%	8.6%	10.3%
Persons without health insurance (under 65 years)	12.8%	13%	7.4%
Adults with disabilities (under 65 years)	12.3%	13.7%	9.3%

[3] For additional data, see CDC Places: Local Data for Better Health: PLACES Comparison Report | PLACES | CDC.

American Indian/Native American	2.1%	2.5%	2.0%
Hispanic or Latino	29.2%	35.8%	14.6%
Farmworkers[4]	16%	9%	3%

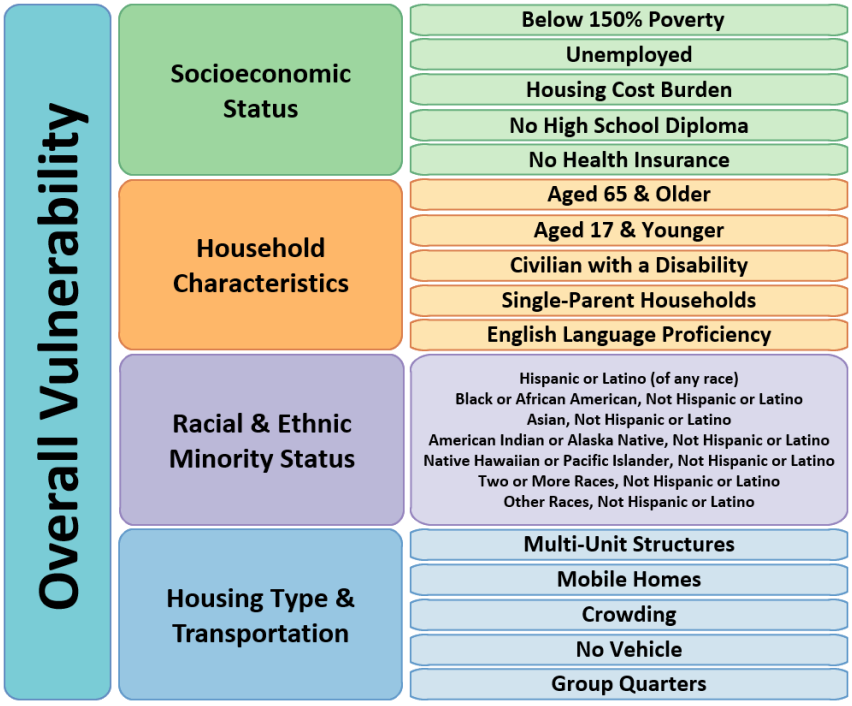
Both counties have high levels of social vulnerability compared to other counties in Washington state. (Figure 10), according to the Centers for Disease Control and Prevention's Social Vulnerability Index (SVI). The SVI uses 16 indicators across four areas of vulnerability- socioeconomic status, household characteristics, racial and ethnic minority status, and housing type and personal vehicle access. These are combined into a single measure of overall social vulnerability (Figure 11: Social Vulnerability Index.

Figure 10: Overall social vulnerability ranking of counties in Washington state. Note Chelan and Douglas Counties have high levels of vulnerability, similar to other counties in Central Washington and higher than in most of Western and Eastern Washington (CDC/ATSDR SVI)



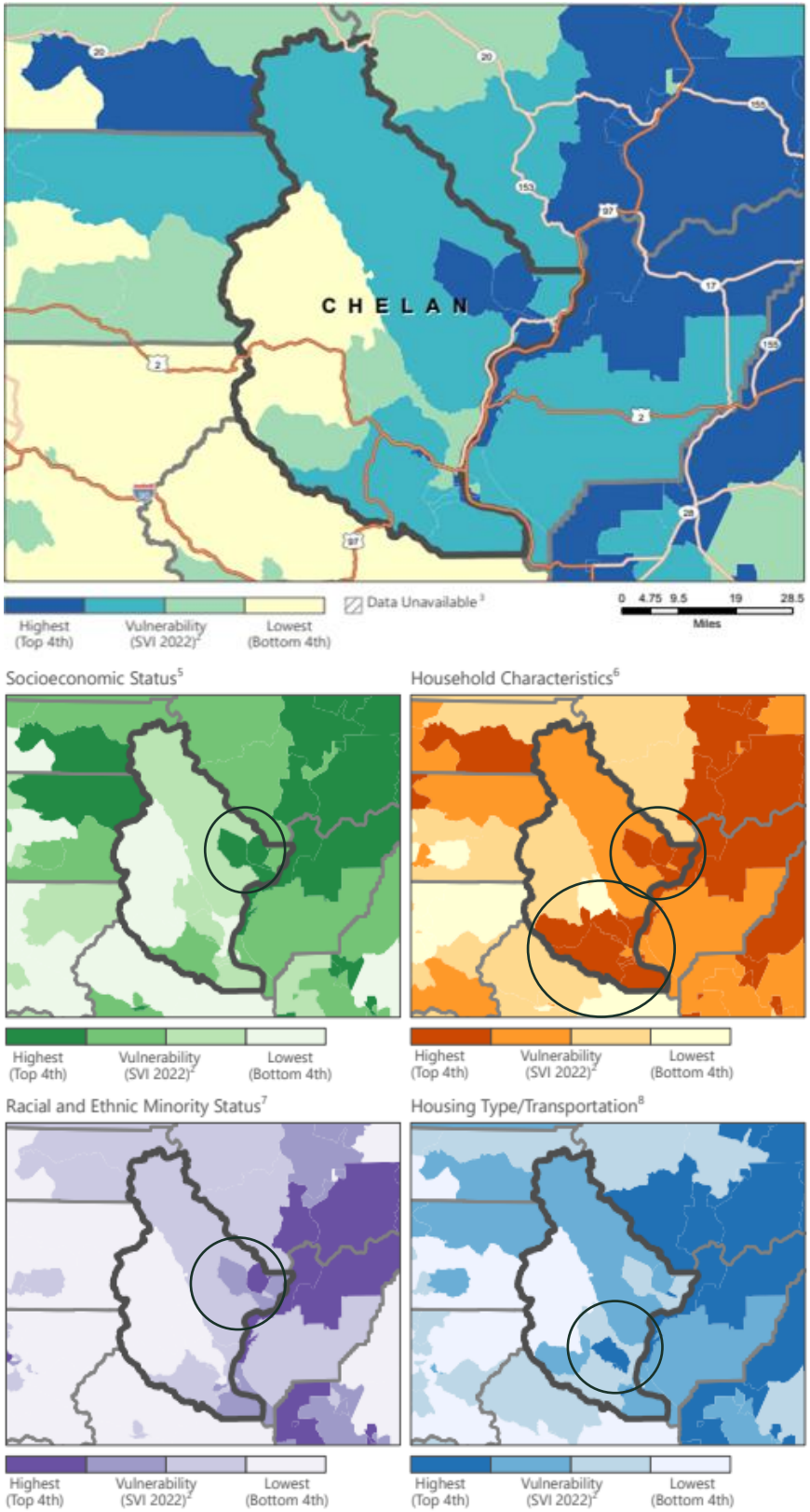
[4] This data comes from Berk Consulting, 2024.

Figure 11: Social Vulnerability Index



Taking a closer look, Chelan County shows higher rates of overall social vulnerability in and around the towns of Cashmere, Chelan and Wenatchee Figure 12). The census tracts around Chelan show higher levels of socioeconomic vulnerability (e.g. poverty, unemployment, housing cost burden, lack of high school diploma, and lack of health insurance). In terms of household characteristics (e.g. ages 65 & older, 17 & younger, with a disability, single-parent households, and English Language proficiency), southern parts of the County as well as an additional census tract east of Chelan also show high vulnerability. In terms of racial and ethnic minority status, several specific census tracts – one east of Chelan and one west of Wenatchee- show high levels of vulnerability. Finally, census tracts with higher levels of vulnerability related to housing type/transportation status (multi-unit structures, mobile homes, crowding, lack of access to a personal vehicle, and group quarters) are northwest of Wenatchee and east of Chelan. Since there is not one clear pattern in Chelan County according to the CDC SVI, it is important to look more closely into specific vulnerabilities, which we do in the next sections.

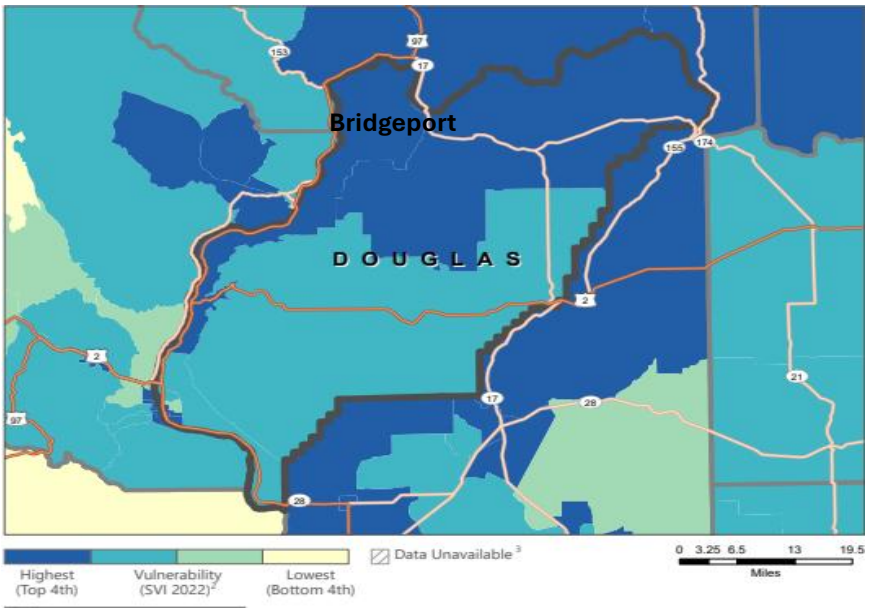
Figure 12: Profile of Chelan County showing Social Vulnerability according to the CDC SVI. The darker colors indicate higher levels of vulnerability. (Centers for Disease Control and Prevention & Agency for Toxic Substances and Disease Registry, 2022)

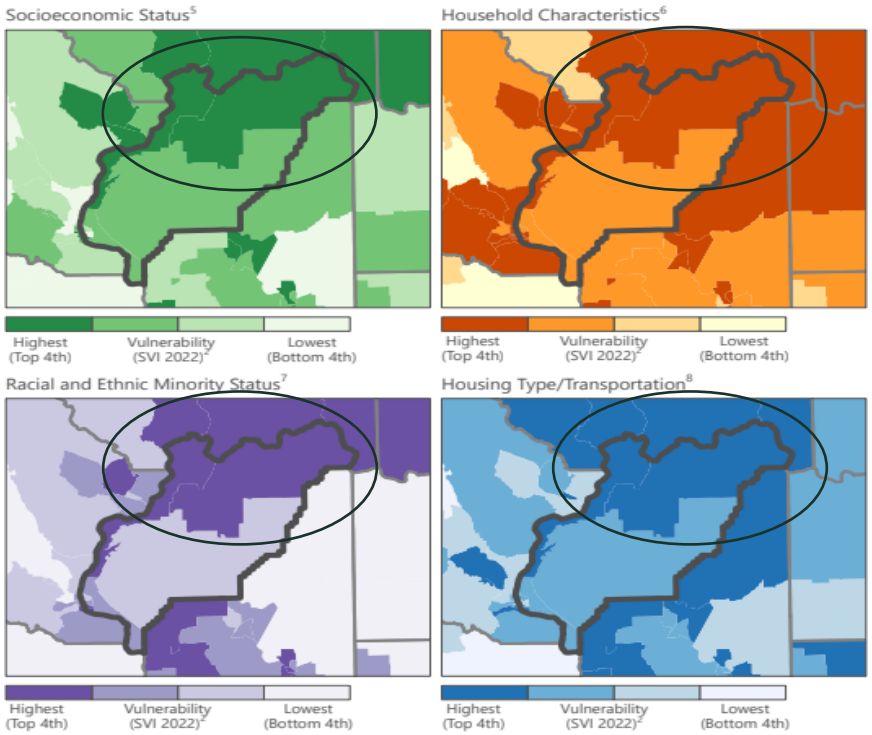


Douglas County shows higher rates of overall social vulnerability in East Wenatchee, east of Highway 2 more generally, and in the northern portion of the County which is sparsely populated but includes the town of Bridgeport (Figure 13). These same areas of the County also show the highest rates of vulnerability broken down by socioeconomic categories (e.g. poverty, unemployment, housing cost burden, lack of high school diploma, and lack of health insurance), household characteristics (e.g. ages 65 & older, 17 & younger, with a disability, single-parent households, and English Language proficiency), race and ethnic minority status, and household characteristics (multi-unit structures, mobile homes, crowding, lack of access to a personal vehicle, and group quarters).

Compared to the lack of a distinct pattern in Chelan County, Douglas County does show clearer patterns of social vulnerability according to the CDC SVI, though it is still important to use other sources for a more fine-grained analysis.

Figure 13: Profile of Douglas County showing Social Vulnerability according to the CDC SVI. The darker colors indicate higher levels of vulnerability. (Centers for Disease Control and Prevention & Agency for Toxic Substances and Disease Registry, 2022)



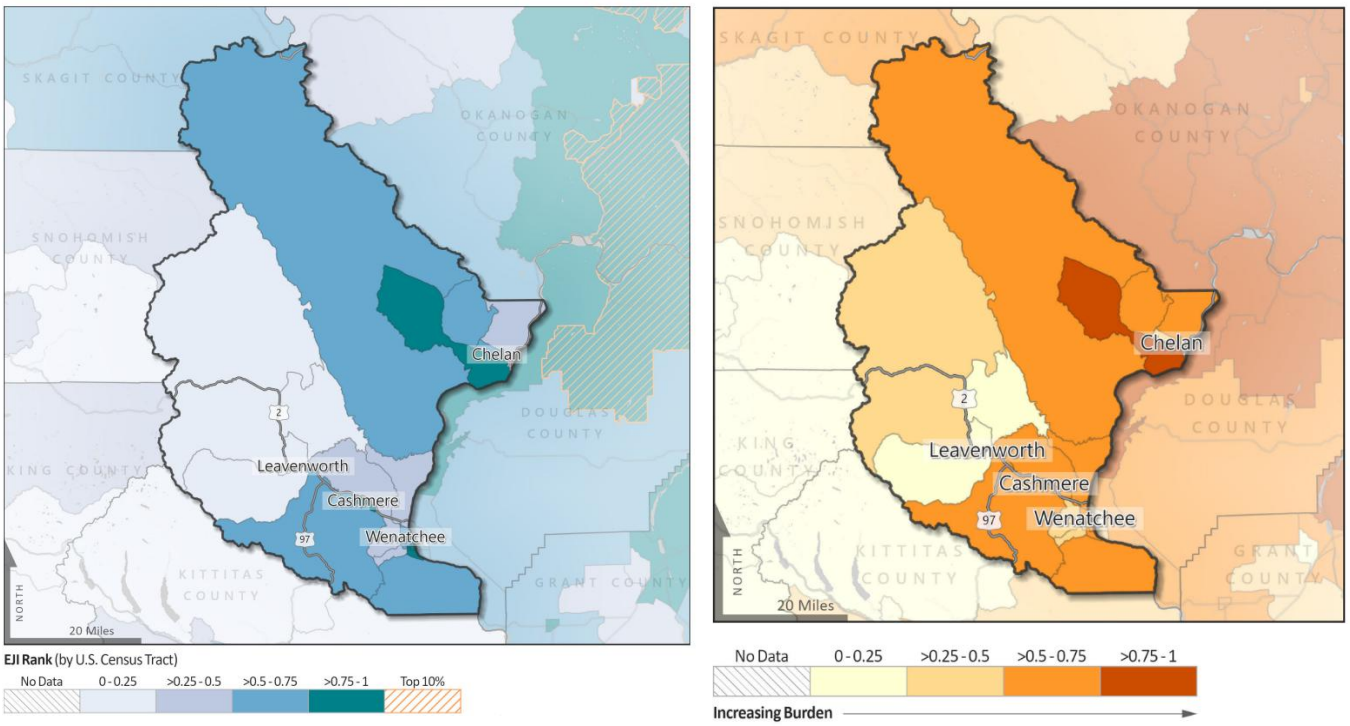


In addition to social vulnerability, another important aspect of vulnerability is existing environmental burdens. Existing burdens can intersect climate hazards and put people at even greater risk. One example is how areas with existing high air pollution from vehicle traffic face compounding pollution during wildfire events. The Environmental Justice Index (EJI) measures the cumulative impacts of environmental injustice in communities across the United States. The EJI ranks are based on percentile rankings of all tracts in the contiguous United States, based on 36 indicators and 3 modules, which are then combined to create one overall EJI rank. Meanwhile, the Climate Burden Module contains indicators relating to heat, wildfires, and extreme events. They are overlaid to provide an indication of the relative overall combined environmental and climate burden for each census tract in the county.

In Chelan County, one tract to the south and west of Chelan is considered highly burdened using the EJI + Climate Burden framework, due to environmental hazards combined with climate risks (Figure 14). The significant environmental burdens in that tract include a relatively high level of $PM_{2.5}$ (among the top 25% of census tracts with the highest $PM_{2.5}$ levels nationally)[5], Risk Management Plan sites, and high-volume roads. The top climate burdens are wildfire, wildfire smoke, and extreme heat days. Overall, over one in four Chelan residents live in a highly burdened census tract, compared to less than one in five in Washington state at large.

[5] The EJI uses data from the U.S. Environmental Protection Agency's AirToxScreen, which includes diesel particulate matter concentrations in air (μg/m^3) for 2019.

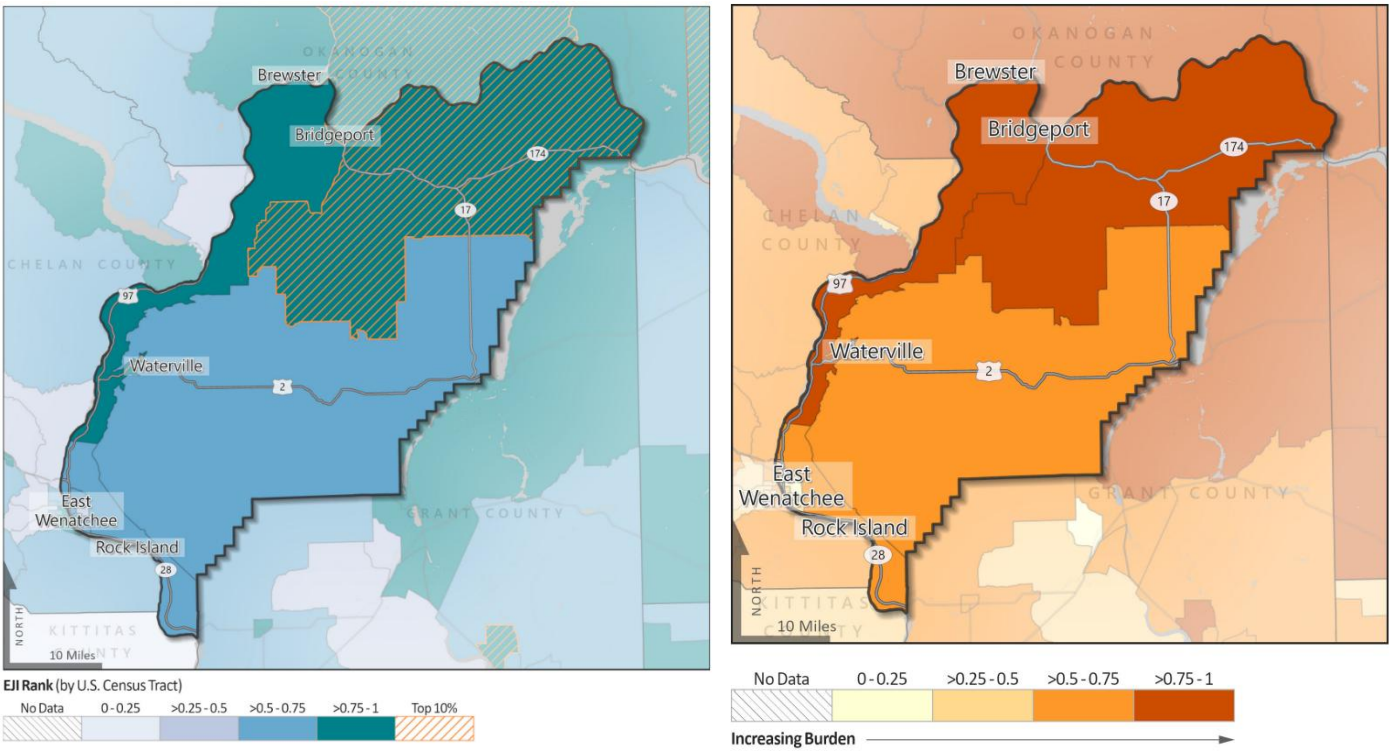
Figure 14: Chelan County Environment Justice Index Rank (left) and EJI + Climate Burden (right). The darker/more saturated colors indicate the census tracts considered most burdened.



In Douglas County, two tracts in the northern and eastern part of the County, including the town of Bridgeport) are identified as highly burdened using the EJI (Figure 15). The environmental burdens include airports, high particulate matter ($PM_{2.5}$)[6], and an overall lack of walkability. Meanwhile, the two tracts have a higher prevalence of asthma and poor mental health than 2/3 of all tracts in the U.S. The census tract to the northeast is considered in the top 10% of burdened tracts in the country. Altogether about 16% of Douglas County residents live in these environmentally burdened tracts, which is less than the state average.

[6] The EJI uses data from the U.S. Environmental Protection Agency's AirToxScreen, which includes diesel particulate matter concentrations in air (μg/m^3) for 2019

Figure 15: Douglas County Environmental Justice Index Rank (left) and EJI + Climate Burden (right). The darker/more saturated colors indicate the census tracts considered most burdened.



While the above federal indices provide a helpful high-level view, we also note caution that the large geographies of census tracts in rural counties can over-simplify more nuanced stories. Some of the tracts that appear most vulnerable have a very small number and percentage of the County residents living in them. They also are a composite index of different traits, and do not provide a detailed look at more specific groups (e.g., low-income children with asthma exposed to poor air quality from wildfire smoke). Another more localized data limit is that the CDC SVI data does not account for second homeowners, which are a significant part of the community in areas like around Lake Chelan.[7] This could mean that the CDC SVI may suggest a higher relative vulnerability than is accurate in and around Lake Chelan.

For this reason, we take a closer look at specific vulnerability considerations in the next set of maps. Figure 16 indicates that census tracts Wenatchee and East Wenatchee and the northern and eastern parts of Douglas County are home to a high percentage of people living below the Federal Poverty Level, relative to the rest of the Counties and state (ranked 9 out of 10 in the state). People living in poverty face financial barriers in installing air filters and air conditioners. They also may struggle to recover, for example, from lost wages or from expenses related to repairing homes from wildfire or flooding.

[7] Chelan County has 6,971 vacant housing units/18.7% of units, while Douglas County has 1,903 vacant units/11%, many of which may be second homes. See https://data.usatoday.com/census/total-population/total-population-change/chelan-county-washington/050-53007/ for maps showing where highest concentrations of vacant units are.

Figure 16: Population living in poverty <=185% of Federal Poverty Level (%) (Washington Environmental Health Disparities Map)

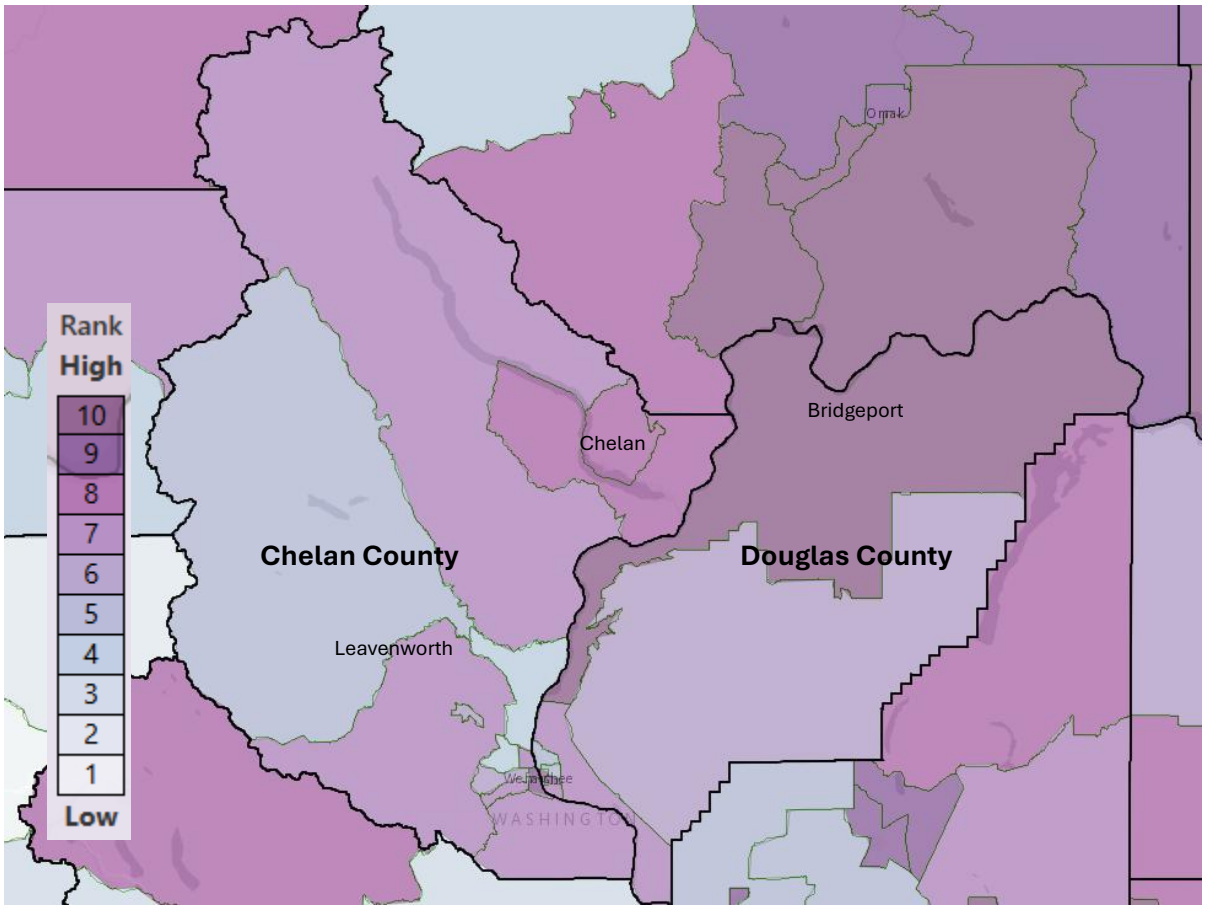


Figure 17 below indicates that parts of Wenatchee and Chelan and the northern and eastern parts of Douglas County are home to a high percentage of people whose primary language is a language other than English. This is an important climate vulnerability consideration, since people who do not speak English at home may not readily understand emergency alerts in English about evacuations or about preventive actions they are advised to take for their respiratory health during wildfire smoke events.

Figure 17: Primary language other than English (Washington Environmental Health Disparities Map)

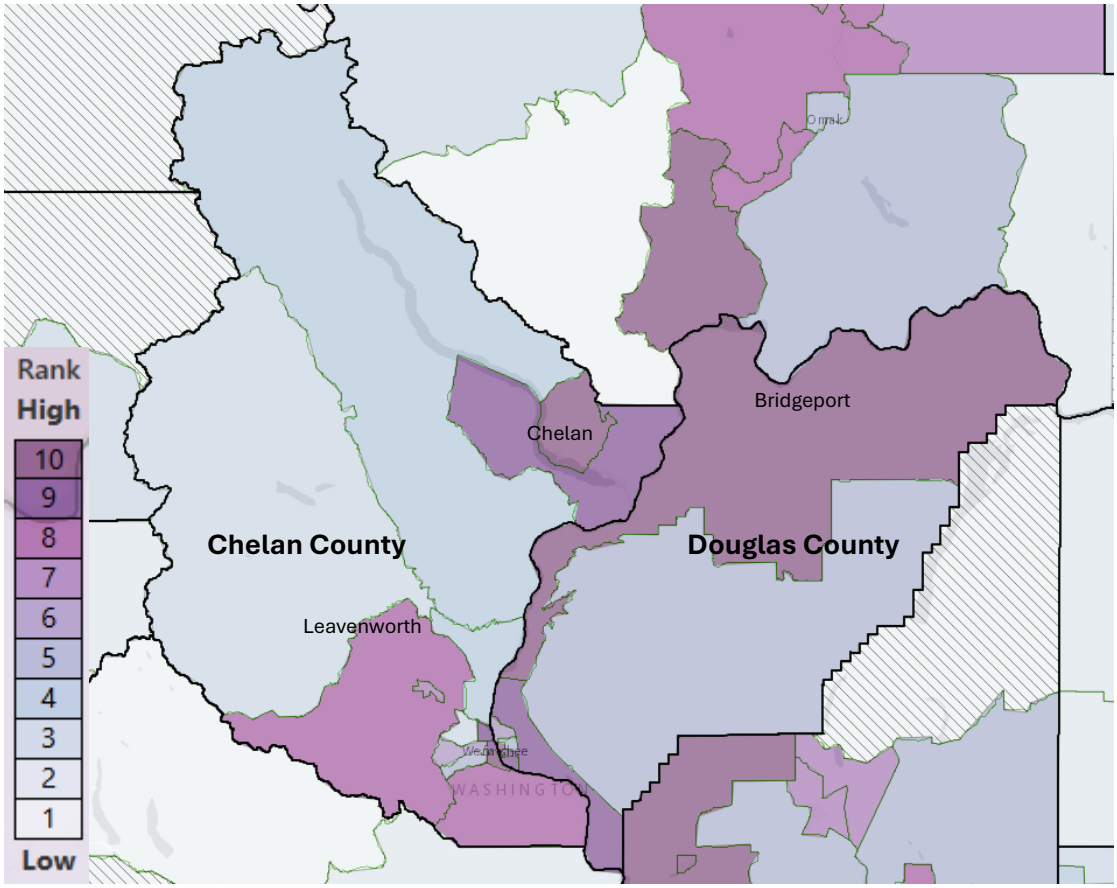
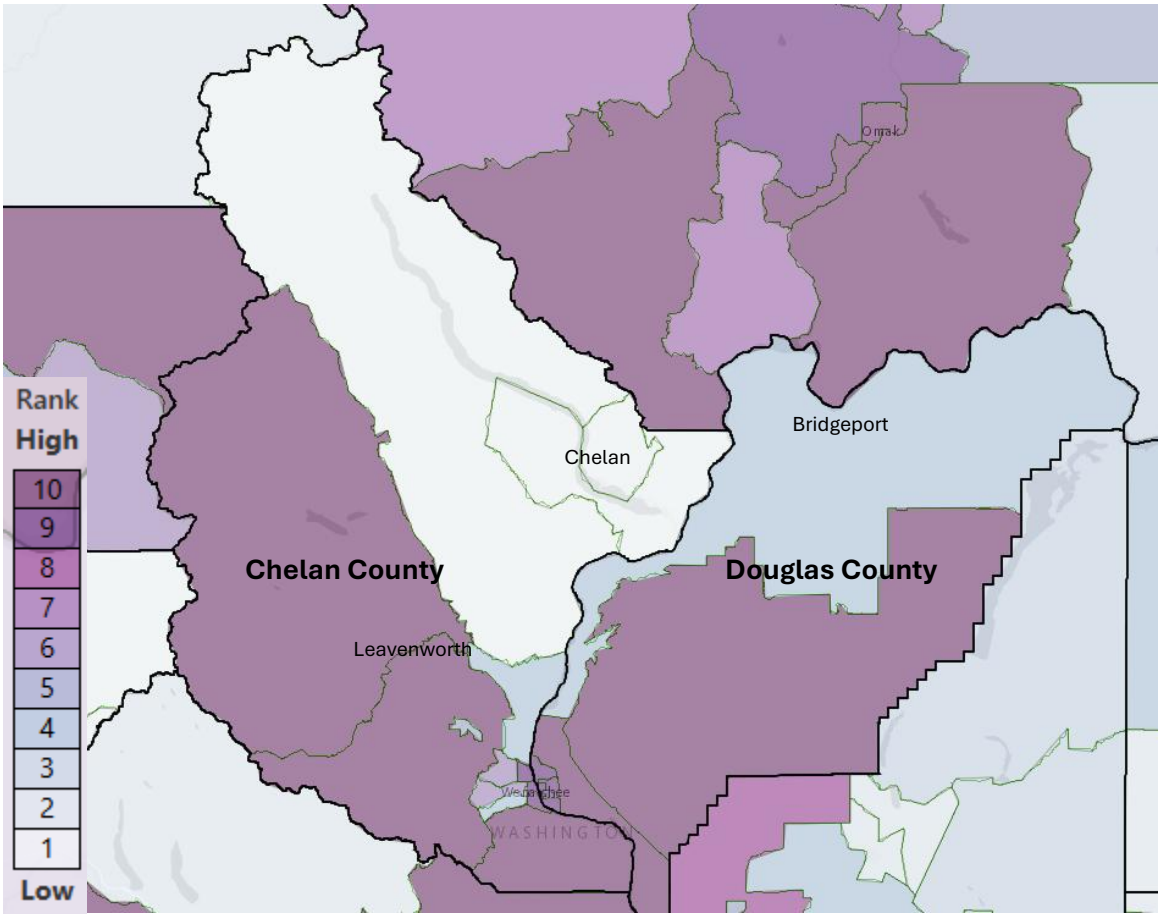


Figure 18 shows a different pattern geographically. It shows that large parts of the southern parts of both Counties face higher concentrations of $PM_{2.5}$, or tiny air pollution particles, likely linked to proximity to highways and certain industrial activities as well as wildfire. $PM_{2.5}$ is also influenced by topography and wind, among other factors. The areas with high $PM_{2.5}$ levels are a concern because air quality in these areas worsens during wildfire smoke events, particularly impacting residents with respiratory and cardiopulmonary conditions such as asthma. Note that areas in white, or with low $PM_{2.5}$ during the time period analyzed in this map (2014-2018) may not always have low $PM_{2.5}$. Air quality concerns are discussed further in the Physical Health section.

Figure 18: $PM_{2.5}$ concentration in 2014-2018 (Washington Environmental Health Disparities Map)



In addition to the County-wide patterns in the above maps, we also do a more in-depth look at the most populous towns of Wenatchee and East Wenatchee in following sections of this CVA, as both have vulnerable communities and some exposure to environmental burdens as noted above.

While this CVA introduces some local-level social vulnerabilities, we also encourage local actors to do more localized analysis of their own communities. A few useful tools for further exploration include:

- Center for Disease Control Places Interactive Map and County Comparison Tool
- Washington Environmental Health Disparities Map

Public Health & Safety

Climate Risks

One of the primary risks to public health and safety in North Central Washington is wildfire (and smoke, which is addressed in the Physical Health section). Wildfire is especially a concern for communities with a high number of housing units in the wildland-urban interface (WUI) and limited evacuation options. Across the west, wildfires have been increasing in extent and cost of control. Meanwhile, extreme events like flooding and fire also threaten critical infrastructure, such as healthcare facilities and transportation systems. Another public health concern is extreme heat, which is a particular concern for sensitive communities like outdoors workers and those without air conditioning.

Wildfire

Federal, state and local analyses (including the Hazard Mitigation and Community Wildfire Protection Plans for each county) all indicate that fire is a significant risk in the two counties. The Douglas Couty HMP (2019) notes that **"An inability to properly evacuate is a population's greatest vulnerability. They can be caught off guard due to improper warning systems and become trapped in a growing wildland fire."**

Much of the region is already experiencing wildfires on an annual basis. Historically, Chelan and Douglas Counties experienced 53-55 high fire days.[8] According to our Climate Impacts Summary (Appendix A: Climate Impacts Summary), by the time period 2040-2069, both counties are projected to see an increase of 10 additional high fire danger days each per year. There are multiple factors contributing to this risk, including increasing summer drought, higher temperatures, and high fire risk days, along with a greater number of residents living near wildfire urban interface (WUI) areas and an increasing population overall.

Below we walk through key findings from different sources, from federal to local. We note that while their approach to assessing wildfire risk varies, ultimately all the sources tell a similar story about relatively high fire risk in North Central Washington.

The **Federal Emergency Management Agency (FEMA)'s National Fire Risk Index Map** classifies Chelan County overall as Relatively High Risk and Douglas County as Relatively Moderate Risk (Figure 19). [9]

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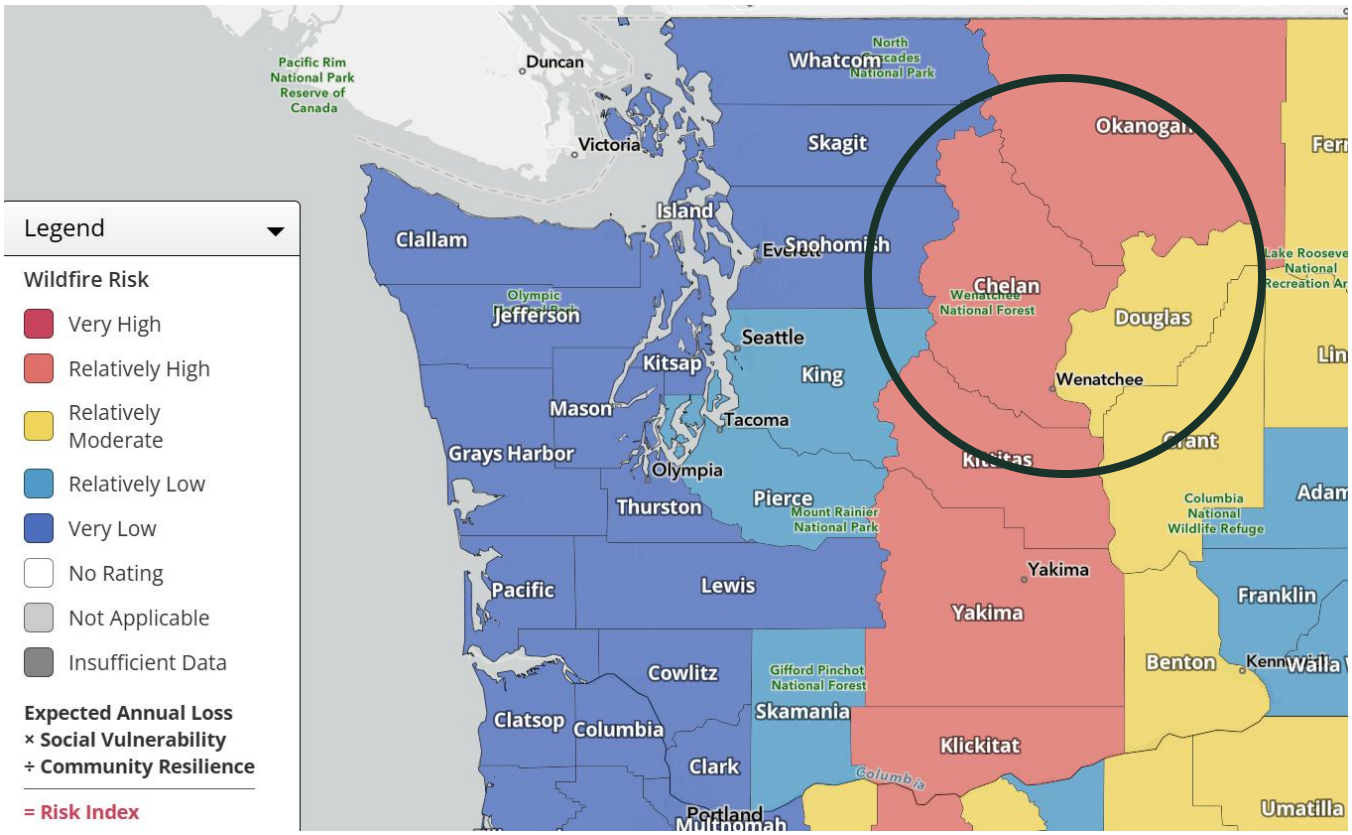
[8] Note that our Climate Impacts Summary relies on RCP 8.5 (the so-called "business as usual" or high emissions scenario; see Appendix A: Climate Impacts Summary and estimates a higher number of fire danger days than the Chelan County's 2024 HMP does, due to different data sources. Chelan County's HMP estimates that the County will go tom from 30 to 34-36 Very High fire danger days. Both show a similar upward trend.

[9] FEMA's National Risk Index Map is based on a consideration of:

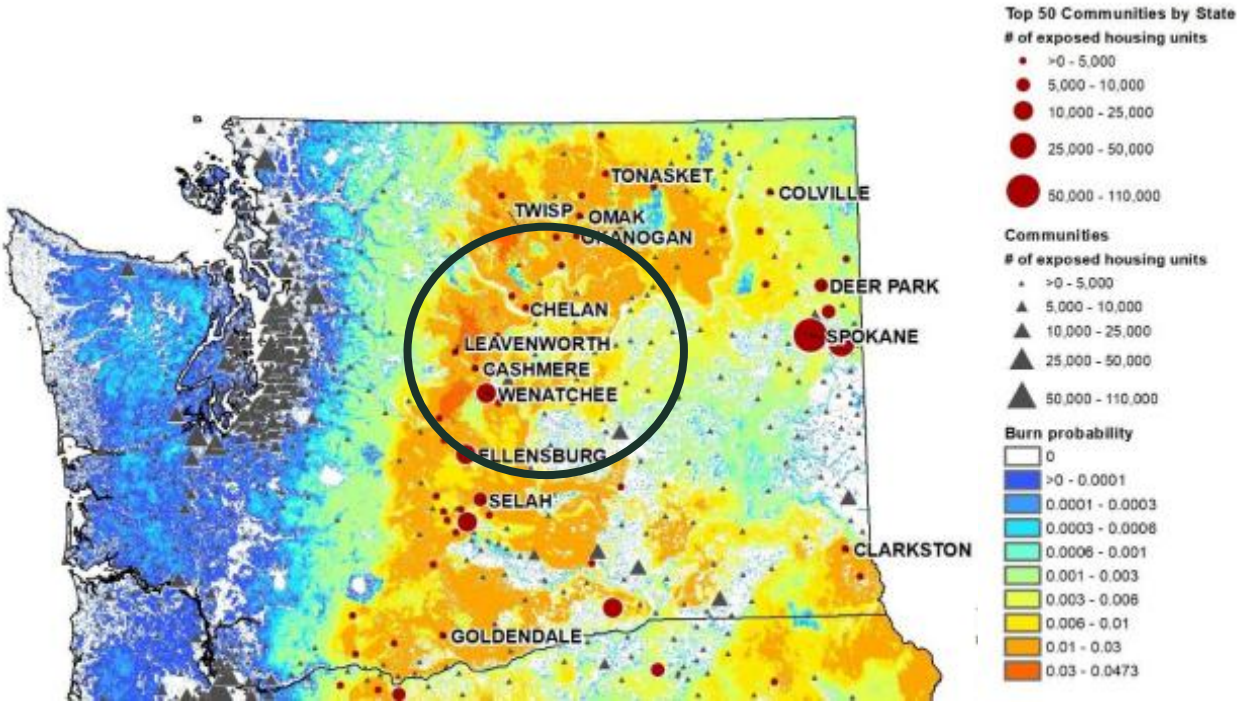
- **Expected Annual Loss:** the representative value of buildings, population, or agriculture potentially exposed to a natural hazard occurrence.
- **Social Vulnerability**: the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood (based on CDC SVI).
- **Community Resilience:** the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions (based on Baseline Resilience Indicators for Communities (HVRI BRIC) published by the University of South Carolina's Hazards and Vulnerability Research Institute (HVRI).

Figure 19: Fire Risk Index according to FEMA. The map shows Chelan County as Relatively High Risk and Douglas County as Relatively Moderate Risk (FEMA Fire Risk Index)



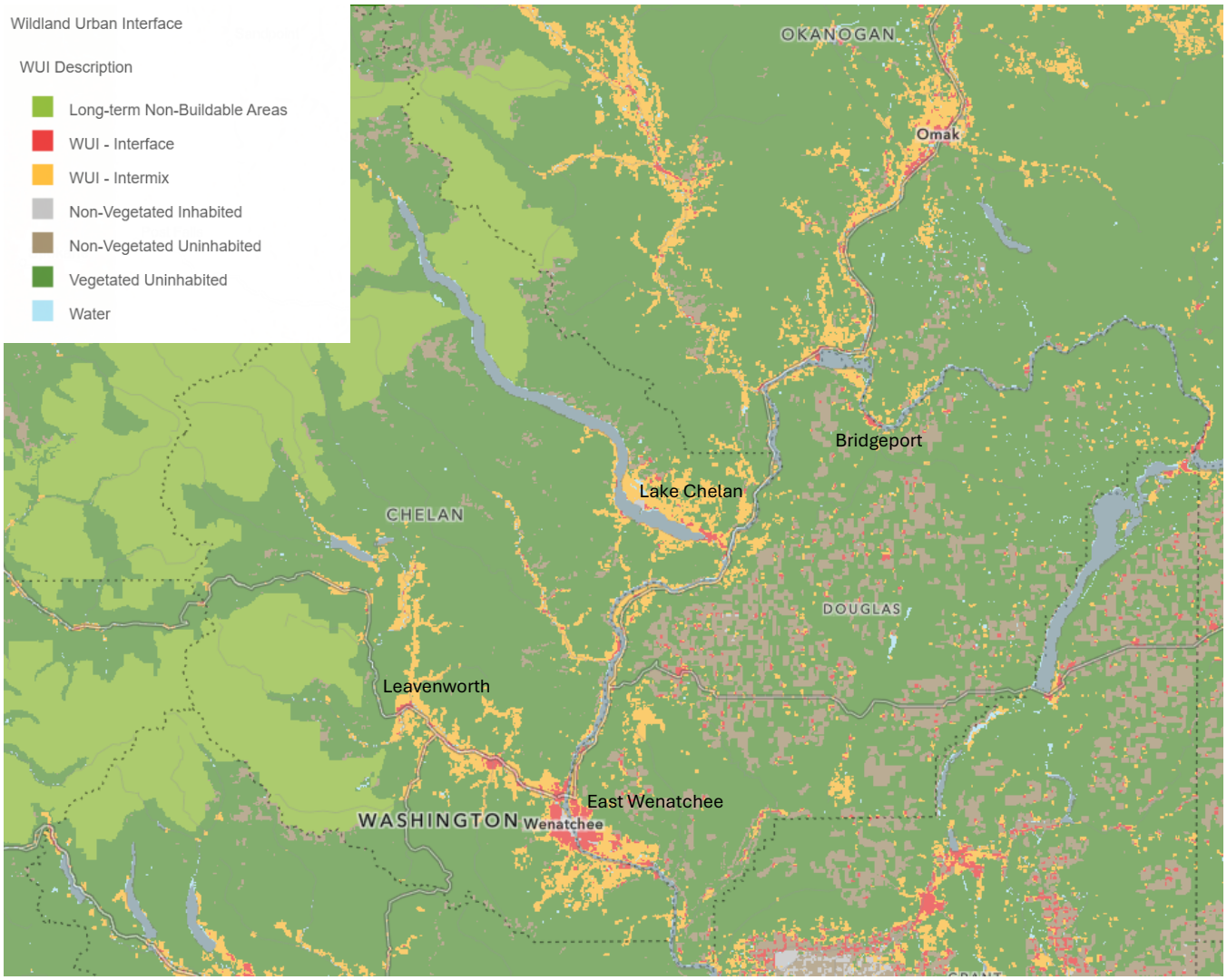
Many population centers and towns in the region, including Cashmere, Chelan, Leavenworth, and Wenatchee, have significant number of housing units in their communities exposed to wildfire risk, according to a report for the United States Forest Service, Pacific Northwest Regional Office (Figure 20). In Chelan County, Leavenworth is particularly vulnerable to wildfire risks. It ranks first among the top 50 Washington communities in terms of cumulative housing-units exposed to wildfire, primarily due to the area's dense population, long fire-free interval, and limited evacuation options (Community Workshop, 2024; Scott, Gilbertson-Day, & and Stratton, 2018). The lack of fire evacuation routes, a major threat to human life, also affects communities such as Bridgeport, Cashmere, Manson, and Waterville (U.S. Forest Service, n.d.). While addressing this issue is critical, adding evacuation routes is expensive.

Figure 20: Burn probability across Washington and Oregon, showing the top communities per state (in red dots) with greatest cumulative housing-unit exposure to wildfire (Scott et al., 2018)



The Washington State Department of Natural Resources has conducted statewide mapping to highlight the problem of high numbers of structures near wildlands prone to wildfire. There is a significant amount of Wildland Urban Interface land in North Central Washington. The map in Figure 21 depicts areas of North Central Washington where structures and wildland meet or intermingle. The red areas indicate WUI in and round the region's towns like Chelan, Leavenworth and Wenatchee and also scattered especially along roads. The orange/yellow areas indicate Wildland Urban Intermix, which includes more of a mix of developed and more rural areas. In these counties, it is generally between the WUI and wildlands, and in the undeveloped and lower density parts of existing towns. While these are not explicitly wildfire hazard maps, they do show areas where it is prudent to build adaptive capacity towards wildfire.

Figure 21: Map showing the Wildland Urban Interface in Chelan and Douglas Counties (Washington State Department of Natural Resources, 2024)



For a more local look at fire risk in the Counties, their recent **Hazard Mitigation Plans and Community Wildfire Protection Plans** discuss fire risk in depth. Overall, the HMPs and CWPPs make the point that wildfire risk is significant in both counties. While the HMP and CWPP for each County address similar topics, they are organized a bit differently from one another and emphasize different points. They sometimes use different data sources so are not directly comparable or easily summarized together.

Chelan County: Countywide wildfire risk is characterized as Very High in the 2024 HMP and in the 2025 CWPP. Highlights of the two plans include:

- Since 1990, there have been about **46 ignitions per year on average**. Wildfires burned about 1,155,000 acres from 1990-2024, or about 73 total fires/33,00 acres per year (CWPP).More than half of ignitions were caused by lightning, and about 43% were caused by humans (HMP). One notable lighting-started fire was the 1994 Tyee Creek Fire, which burned 135,000 acres north of Wenatchee.
- In Chelan County, about **54,000 community members (66% of the total population) are** considered vulnerable to wildfire according to the HMP fire risk zone mapping (Table 5). The HMP

notes that other community embers may also face risks, including hikers and campers in the mountains.

- There are over **30,000 buildings, valued at over $14 billion**, vulnerable to wildfire (HMP) The 2025 CWPP indicates that 6% of addresses could be exposed to radiant heat and 66% to embers.
- An estimated **26% of the critical facilities (which includes communications, safety, health and medical, safety and security facilities, and more) in the planning area are directly exposed** to wildfire and an estimated 73% of critical facilities are indirectly exposed to wildfire. These facilities could have a significant amount of functional downtime after a wildfire. This creates not only a need for risk mitigation but also a need for continuity of operations planning to develop procedures for providing services without access to critical facilities.
- Several **vulnerable and isolated populations** are directly exposed to wildfire.
- WUI areas are a significant concern. Several WUI communities in the county are designated as high-risk by the State Forester, including the cities of Cashmere, Entiat, Leavenworth, and Wenatchee, as well as the rural communities of Stehekin, Peshastin, and Manson.

The 2025 CWPP includes the below map (Figure 22), depicting burn probability from the 2023 Pacific Northwest Quantitative Wildfire Risk Assessment. The areas with the highest burn probabilities include the mountains from northeast of Lake Wenatchee down east of Chumstick and to the Wenatchee River by Cashmere, along the Icicle River and up into the Alpine Lakes Wilderness, and the area south of Leavenworth and Cashmere heading toward Blewett Pass. Other populated areas with higher burn probability include the Wenatchee National Forest land north of eastern Lake Chelan around Chelan and Manson, and the Wenatchee National Forest and Washington DNR land north and west of Entiat.

Figure 22: Relative burn probability in Chelan County (Chelan County CWPP, 2025)

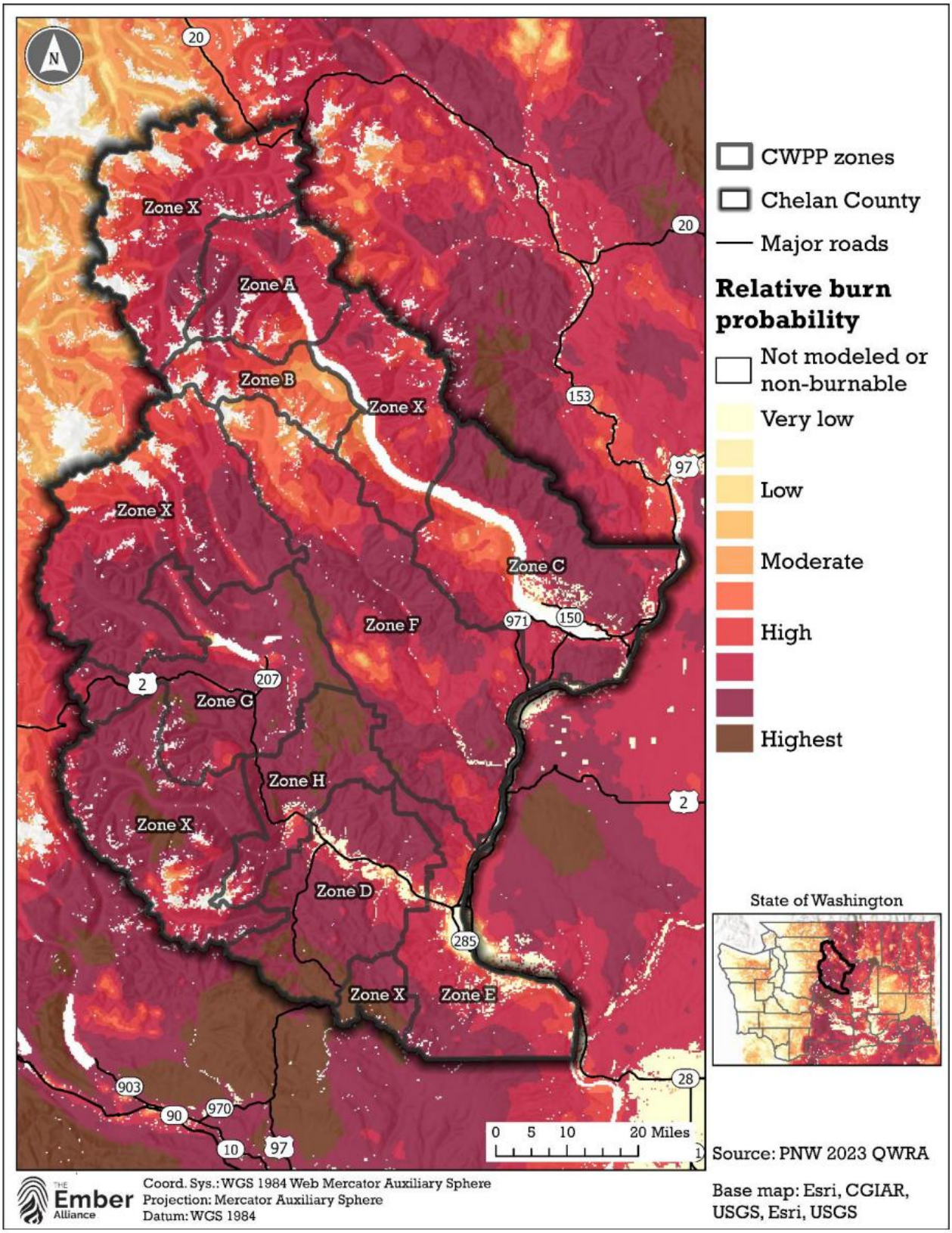


Table 5: Number and percent of population in Chelan County vulnerable to wildfire (according to exposure to radian heat and embers). Note the numbers in the right column reflect the percentage of the county's overall residents.[10] (Chelan County HMP, 2024)

	Total Vulnerable Residents	Percentage of County Population
Cashmere	2,983	3.7%
Chelan	3,342	4.1%
Entiat	817	1%
Leavenworth	2,590	3.2%
Wenatchee	6,894	8.5%
Unincorporated	29,258	35.9%
Total County-wide	54,202	66.5%

Douglas County: The most recent HMP was completed in 2019 and a 2025 update is expected for both the HMP and CWPP. The 2019 HMP analysis of wildfire risk is based on WUI data obtained from FEMA and USDA (a different source than the DNR map discussed earlier, though the maps show the same broad concerns despite some differences in details).

- Since 2006, the planning area has experienced 72 significant wildfires or **5.14 fires per year.**
- The 42,907 residents of Douglas County are all considered at risk to wildfires while **26,740 are in identified WUI zones** and are considered highly vulnerable (Figure 23 and Table 6).
- Of the planning area's 50 critical facilities, all are considered at risk to wildfires. Of the 50, **16 are considered high risk** as they are within identified Wildland Urban Interface (WUI) zones.
- Of the total 16,985 housing units in the planning area that are vulnerable to wildfires, **10,730 are considered highly vulnerable** to wildfires.
- Unincorporated Douglas County, Bridgeport, East Wenatchee, and Rock Island have seen **significant population growth in their WUIs** since the last HMP.

[10] This table comes directly from the HMP. We note the numbers in both columns do not quite add up, so there may be some missing data. That said, the larger overall trend is likely accurate. See the HMP for more context.

Figure 23: Map showing WUI lands in Douglas County (Douglas County HMP, 2019)

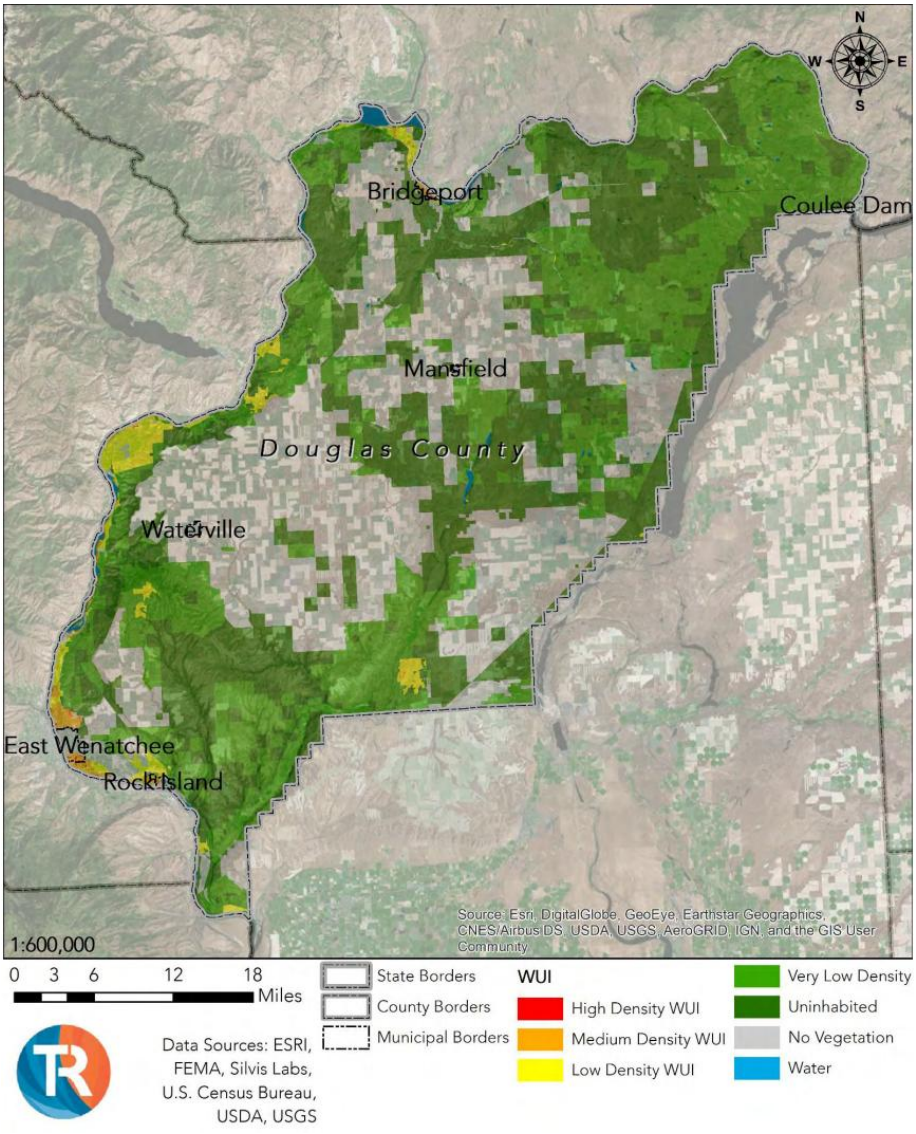


Table 6: Number of residents and housing units vulnerable to wildfire (e.g. located within the Wildland Urban Interface) in Douglas County (Douglas County HMP, 2019)

Municipality	Population	Housing Units
Unincorporated Douglas County	20,509	8,525
Bridgeport	2,409	745
Coulee Dam	187	94
East Wenatchee	2,791	1,071
Mansfield	0	0

Municipality	Population	Housing Units
Rock Island	844	295
Waterville	0	0
Total County-wide	26,740	10,730

Fire is a risk to everyone, but vulnerable groups such as people with disabilities, seniors, people in poverty, and people without personal vehicle access may face additional difficulty evacuating their homes or recovering if their housing or economic livelihood is impacted by fire.

Flooding

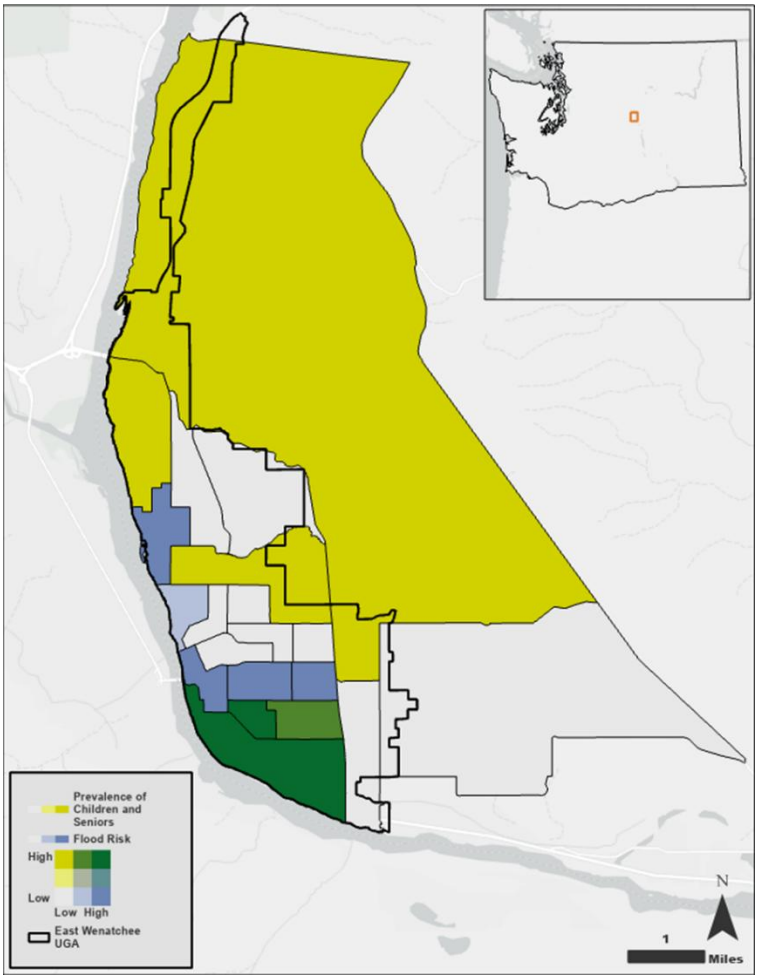
Flooding is a public health concern because people can drown or become trapped on rooftops or points of high elevations without basic protections and services if waters rise quickly (Douglas County HMP, 2019). Assisted care facilities, where seniors and people with mobility disabilities live, can take longer to evacuate. In addition, water that is long lasting and slow to drain will encourage the growth of mold and other bio-hazardous material, rendering a facility like a home, school or health clinic hazardous or unusable until remediation is finished.

The Chelan County HMP (2024) notes that flooding is one of the most common natural hazards, especially in populated low-lying areas near steep drainage areas. FEMA's National Risk Index characterizes Chelan County's flood risk as Relatively Low overall (FEMA National Risk Index). Wildfires can lead to increased flood and associated landslide risk in the future. Several areas in the County, like near the Antoine Creek Basin (where the Chelan Complex Fire burned in 2015), experienced flooding and road damage in 2021 (Chelan County HMP 2024). The western edge of Wenatchee has experienced flooding near No. 1 Canyon, No. 2 Canyon, and Dry Gulch, exacerbated by development, channelized streams, and wildfire. Businesses adjacent to Crescent Street and Snohomish Street in South Wenatchee have experienced multiple flooding issues during rain events (City of Wenatchee 2024). The City's Hazard Mitigation Annex notes that over 66% of the population lives in 0.2 percent annual chance flood hazard area. This flood event could displace over 18,000 people and generate over 20,000 tons of structure debris. A 100-year flood event would impact approximately 799 structures and over 2,100 people. It also notes that the City has limited evacuation routes and some areas (e.g. the Broadview neighborhood and neighborhoods in No. 1 Canyon) have only one evacuation route.

The Douglas County HMP (2019) notes that areas in the County prone to flooding are low-lying areas with poor drainage and suburban sprawl/high rates of impervious surface. FEMA's National Risk Index characterizes the County flood risk as Very Low overall. Historically, areas around Douglas Creek have experienced flash flooding. The Douglas County HMP (2019) notes that the Bridgeport Water Treatment Facility is located within an identified floodplain.

Certain vulnerable groups, like seniors and children, face additional risk from flooding, due to their need for assistance in evacuating. As one example of this intersection of these risks, the below map shows areas in East Wenatchee in green where there is a higher flood risk and higher rates of children and seniors (Figure 24).

Figure 24: Map of East Wenatchee showing prevalence of children and seniors overlaid with flood risk, with highest overlap indicated in dark green on the southwestern edge of the town (Cascadia Consulting Group, made for East Wenatchee CVA)

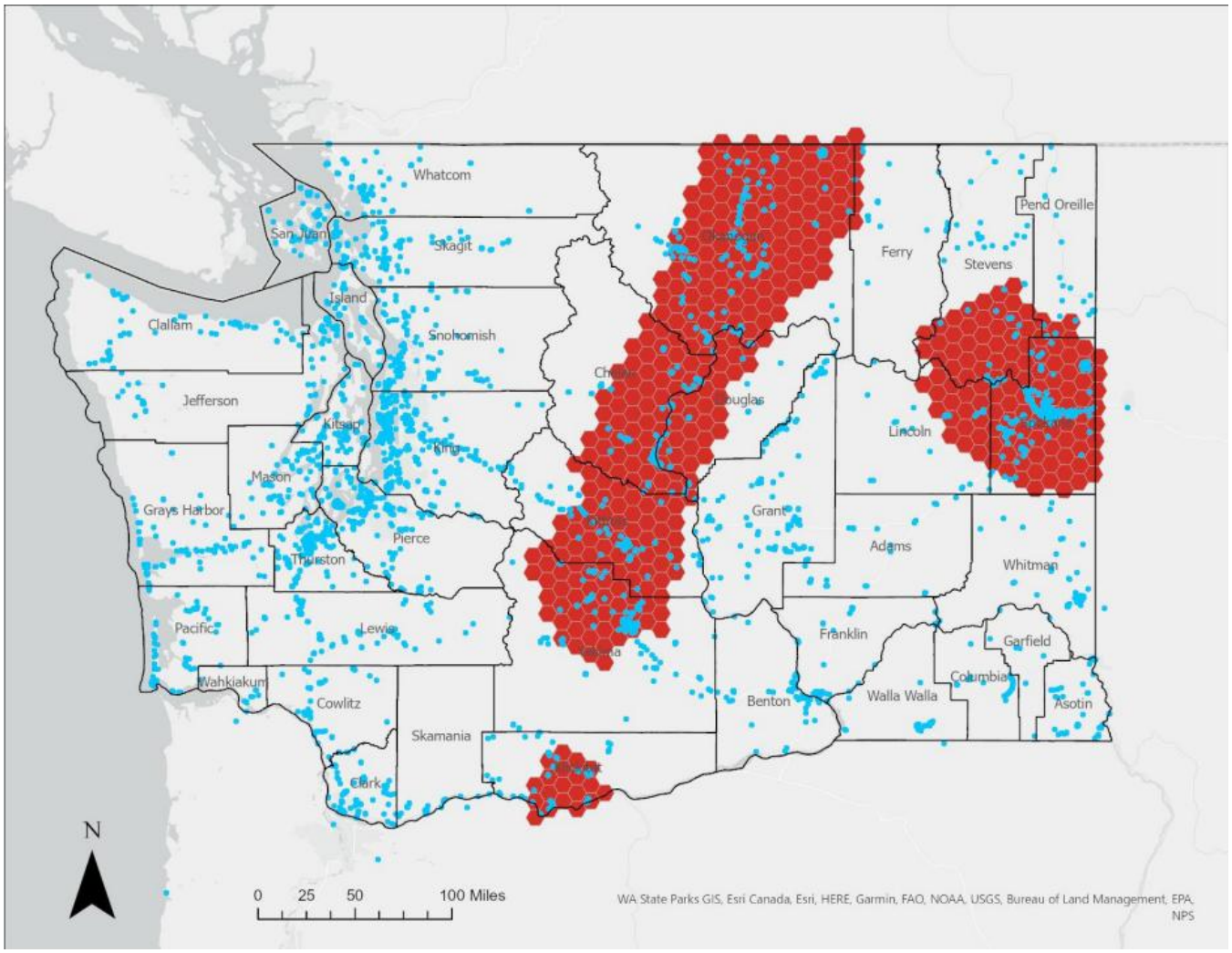


Healthcare and Critical Infrastructure

Healthcare and other critical infrastructure facilities in Chelan and Douglas counties may experience operational disruptions during wildfire or flooding events. There are only 5 medical facilities (including hospitals and health/medical centers), in Chelan County and 1 hospital in Douglas County, so people have relatively few other options. Meanwhile, Wenatchee is a regional hub for a large geographic region. Wenatchee's medical facilities provide services for not just all of Chelan and Douglas residents but also some in Okanogan, Grant, Ferry, and other nearby counties, so if something happens to the main Confluence Health facility, many could be affected.

As Figure 25 below shows, state-owned facilities like Confluence Health and Lake Chelan Community Hospital are identified by the State of Washington as located in wildfire prone areas (Washington State Emergency Management Division, 2023) .

Figure 25: State-owned facilities (blue points) within and outside the most wildfire-prone areas, or hot spots of the state (Washington State Emergency Management Division, 2023)



The Chelan County HMP (2024), meanwhile, notes that 118 FEMA lifelines or critical facilities are indirectly exposed to wildfire through short-range embers and radiant heat (Table 7).[11] Many of these are located along the Columbia River.

Table 7: Critical facilities – categorized as "lifelines" following FEMA guidance – in Chelan County exposed to possible radiant heat or short-range embers and long-range embers. (Chelan County HMP, 2024).

[11] The Federal Emergency Management Agency says that "A lifeline enables the continuous operation of critical government and business functions and is essential to human health and safety or economic security." Community Lifelines | FEMA.gov

Lifeline category	Number of lifelines in location	Number of lifelines vulnerable to radiant heat or short-range embers	Number of lifelines exposed to long-range embers
Countywide			
Communications	53	17	29
Energy (Power and Fuel)	9	0	7
Food, Hydration, Shelter	26	1	16
Hazardous Materials	8	0	5
Health and Medical	35	2	9
Safety and Security	86	6	43
Transportation	225	91	212
Water Systems	14	1	13
Total in County	**456**	**118**	**334**
Cashmere			
Communications	1	0	0
Food, Hydration, Shelter	2	0	2
Hazardous Materials	1	0	1
Health and Medical	3	0	1
Safety and Security	4	0	3
Transportation	4	0	4
Water Systems	1	0	1
Total in Cashmere	**16**	**0**	**12**
Chelan			
Communications	7	0	1
Food, Hydration, Shelter	2	0	1
Health and Medical	8	0	1
Safety and Security	17	0	12
Transportation	4	0	4
Water Systems	1	0	1
Total in Chelan	**39**	**0**	**20**
Entiat			
Safety and Security	3	0	3
Total in Entiat	**3**	**0**	**3**
Leavenworth			
Communications	3	0	3
Food, Hydration, Shelter	1	0	1
Health and Medical	3	1	3
Safety and Security	6	1	6
Transportation	1	0	1
Total in Leavenworth	**14**	**2**	**14**
Wenatchee			
Communications	19	0	2
Energy (Power and Fuel)	1	0	0
Food, Hydration, Shelter	12	0	3
Hazardous Materials	4	0	1
Health and Medical	20	0	3
Safety and Security	31	0	1
Transportation	14	0	9
Water Systems	1	0	0
Total in Wenatchee	**102**	**0**	**19**

The Douglas County HMP (2019) considers all 50 critical facilities in the County at risk, and 16 at high risk to wildfire, due to being in the WUI (Table 8).[12]

[12] Note that the Chelan and Douglas County HMP take different approaches to identifying wildfire risk, so their numbers are not directly comparable.

Table 8: Douglas County critical facilities in the Wildland Urban Interface (Douglas County HMP)

Facility	Type	Owner	Location
Aging & Adult Care of Central Washington	Assisted Living	Private	East Wenatchee
Bridgeport City Hall	Local Government	Bridgeport	Bridgeport
Bridgeport Fire Station	Fire Prevention	Bridgeport	Bridgeport
Coulee Dam City Hall	Local Government	Coulee Dam	Coulee Dam
Coulee Dam Sewage Lagoon	Water Treatment	Coulee Dam	Coulee Dam
Douglas County Sewage Lagoons #1	Water Treatment	County	County
Electrical Substation #2	Utility	County	County
Electrical Substation #3	Utility	County	County
Electrical Substation #4	Utility	County	County
Fire District 2 - Rock Island Station 3	Fire Prevention	Rock Island	Fire District 2
Fire District 4 - Main Station	Fire Prevention	County	Fire District 4
Prestige Senior Living	Assisted Living	Private	East Wenatchee
Rock Island City Clerk Office	Local Government	Rock Island	Rock Island
Rock Island Substation	Utility	Rock Island	County
Rocky Reach Substation #1	Utility	County	County
Rocky Reach Substation #2	Utility	County	County

Even outside of climate events, residents of rural areas like Douglas County struggle with limited healthcare options and a shortage of medical specialists. Residents often need to travel long distances for medical care, which can lead to delayed or missed appointments at any time of the year (Community Workshop, 2024). Transportation delays caused by climate impacts like flooding, wildfires, or landslides can make it more difficult for patients to reach healthcare facilities during emergencies (Douglas County HMP, 2019; Chelan County HMP, 2019). Individuals who depend on devices like oxygen tanks, dialysis machines, or ventilators may face life-threatening consequences if they are unable to reach medical appointments or obtain necessary treatments during emergencies (National Council on Disability, 2023). Similarly, people with disabilities, who may rely on mobility aids such as wheelchairs or scooters, can experience additional transportation challenges.

Emergency and Fire Response

Wildfires, floods, and landslides present escalating risks to emergency response systems and personnel in both counties. First responders face an increased likelihood of injury or death due to hazardous conditions like extreme heat, dense smoke, falling debris, and unstable terrain. Wildfires not only expose responders to immediate physical dangers but also increase the risk of heat-related illnesses and respiratory issues from prolonged exposure to smoke and particulate matter (Williams et.al., 2020). The cumulative frequency and intensity of such events can lead to staff burnout and shortages (Montgomery, 2024). As one account puts it, nationwide “hundreds of thousands of emergency responders are facing unprecedented challenges —from burnout to post-traumatic stress disorder to tighter budgets — as they battle hurricanes, windstorms, wildfires, floods and other natural disasters that are more frequent and intense than those in the past” (Montgomery, 2024).

The growing severity of disasters also exacerbates coordination challenges within emergency response systems. Infrastructure dependencies, such as transportation networks and power systems, further complicate response efforts when they fail during emergencies (Hertelendy et.al., 2024). Evacuations, critical for saving lives during fast-moving disasters, are complex to execute. Blocked roads, insufficient shelter capacity, and a lack of communication with vulnerable populations—including those with mobility challenges, individuals over 65 years, and non-English speakers—can slow or disrupt evacuation efforts, placing more people at risk (National Council on Disability, 2023).

Fire stations, as key hubs for emergency response, are increasingly vulnerable to service disruptions during flood and wildfire events. Stations located in flood-prone areas are at risk of inundation, which can damage critical equipment, vehicles, and communication systems, rendering them inoperable during disasters (Chelan County HMP, 2019; Douglas County HMP, 2019). Flooding also impacts access routes, preventing emergency vehicles from reaching affected areas quickly. Similarly, fire stations in landslide-prone regions face structural damage or isolation as landslides block roadways, cutting off access to essential resources. These vulnerabilities can severely delay emergency responses, particularly during disasters when time is critical to saving lives and property.

Adaptive Capacity

Chelan and Douglas Counties are implementing a variety of programs and initiatives to mitigate wildfire and flooding risk and to enhance the resiliency of critical facilities. These measures reflect attempted interagency collaboration, ongoing community engagement, and forward-looking planning efforts. That said, we also identify gaps where adaptive capacity can be strengthened.

Wildfire Risk Management

> "As Chelan County grows and residents continue to build in the wildland urban interface, wildfire potential grows and the probability of fire starts increases. Combined with a lack of public understanding and the lack of preventive measures on the part of the public, the potential for devastating losses continues to increase."
>
> -Chelan County HMP, 2024

Addressing wildfire risk on both public and private land is a cornerstone of the counties' safety initiatives. The Counties HMPs and CWWPS include a lot of recommendations for improved wildfire risk management, though the implementation status of the recommendations is not clear.

On public land, controlled burning programs are used to reduce vegetation loads, decreasing the likelihood of large-scale wildfires (Chelan County HMP, 2019). However, the wildfire risk remains high in the area's public forests. The Central Washington Initiative, launched in 2022 by the US Forest Service, is a 10-year strategy to reduce wildfire risk, mainly through hazardous fuel reduction, fuel breaks, landscape restoration, and forest maintenance on about 2.5 million acres of federal, state, Tribal, and other land in Chelan, Okanogan, Kittitas, and Yakima counties (Lake Chelan Now, 2022; U.S. Forest Service, Central Washington Initiative, 2022). It is a promising endeavor, though some workshop participants suggested that insufficient funding will limit its impact (Community Workshop, 2024). See proposed work by year at: https://experience.arcgis.com/experience/1ec4891a99c8441fb6704b44de71bb74/.

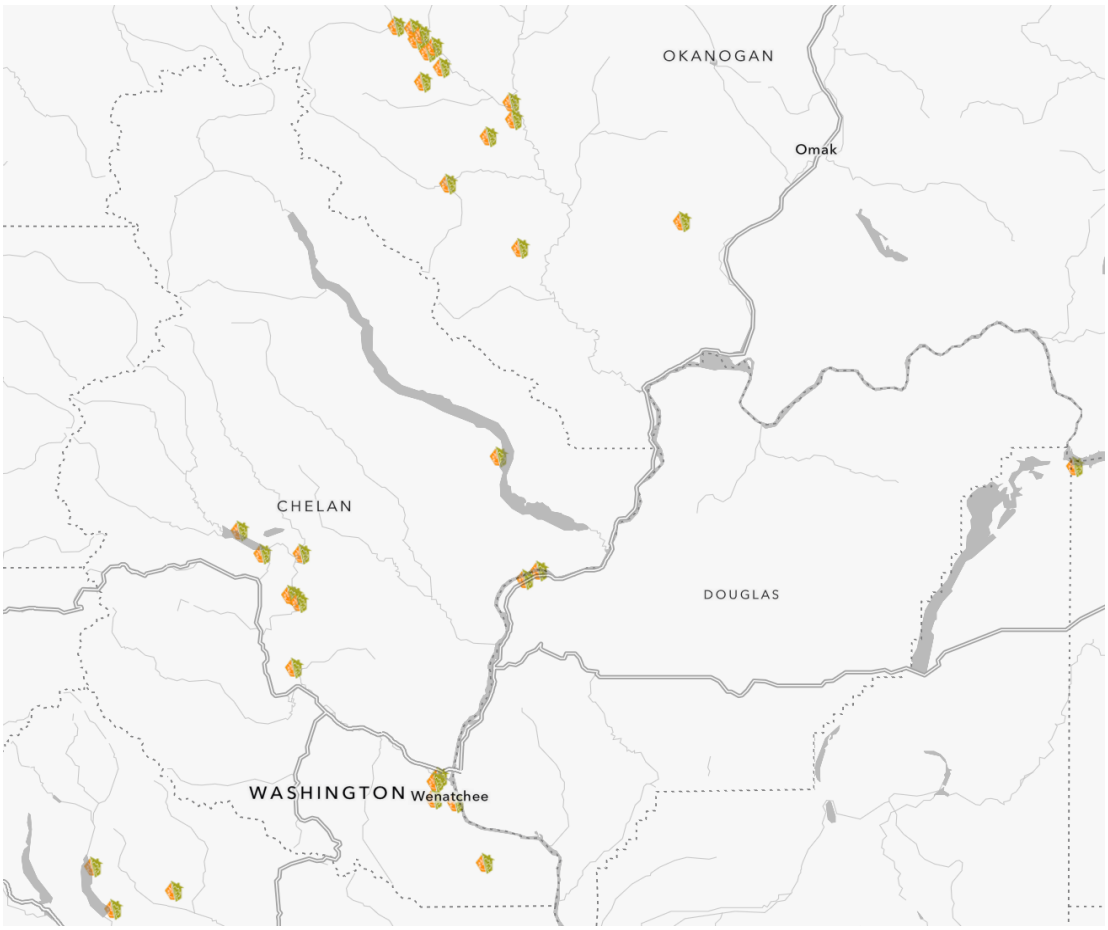
Strong land use and building codes are critical to reducing wildfire risk to buildings. Both Counties have WUI specific design and construction regulations that apply to new construction or major alterations (and are voluntary for existing buildings). The Counties also encourage property owners to adopt defensible practices for fire-resistant structures and landscape. While these are good starts, a stronger approach would more deeply restrict development in WUI areas altogether, and/or implement stricter building requirements. Such requirements may not be popular with developers or property owners.

Educational programs, run by local governments, Conservation Districts, and Fire Districts can empower residents to understand and address fire risks on their properties. The Chumstick Wildfire Stewardship Coalition is utilizing USDA grant funding to help property owners implement defensible space around their properties. The City of Leavenworth offers fire retrofitting assistance for low-income households (City of

Leavenworth, 2024). Fire Districts, like Chelan County Fire District #2, offer a free chipping service which helps reduce flammable vegetation. Cascadia and Foster Creek Conservation Districts offers technical assistance to homeowners on fire safety as well.

Even with all these efforts, enrollment in the federal Firewise program is limited in the region, as shown in Figure 26. The Chelan County CWPP (2025) counts 20 active Firewise Communities. Looking ahead, WUI practices may not be sufficient if a major wildfire breaks out, as has happened recently in California. To increase their adaptive capacity, Chelan and Douglas County may enact stronger development restrictions, support the defensibility of existing buildings, and evolve local standards to meet evolving best practices.

Figure 26: Map showing where Firewise USA® sites (site with 8-2,500 dwelling units that have completed requirements[13]) are located. There are some, but not many, Firewise communities in Chelan County and none in Douglas County (National Fire Protection Association)



[13] The national Firewise USA® recognition program provides a collaborative framework to help neighbors in a geographic area get organized, find direction, and take action to increase the ignition resistance of their homes and community and to reduce wildfire risks at the local level. Any community that meets a set of voluntary criteria on an annual basis and retains an "In Good Standing Status" may identify itself as being a Firewise® Site. See How to become a Firewise USA® site

Flood Risk Management

In Chelan County, with a higher flood risk than Douglas County, the County has taken steps to mitigate flooding concerns issues. The County recently used a FEMA grant to upgrade culverts and reduce the risk of future post-fire flooding (Chelan County Public Utility District, 2021). In 2022, Chelan County received a $1 million grant from FEMA to build a debris basin in Number 1 Canyon to mitigate flood risk.

Chelan County's Flood Chapter 3.20 is fully compliant with National Flood Insurance Program and State floodplain management regulations. This chapter exceeds the FEMA and state requirements in the following ways:

- New residences in the floodplain must be elevated three feet above the base flood elevation; nonresidential buildings must be one foot above the base flood elevation.
- No fill, grading, or excavation that unduly affects the efficiency or capacity of the channel or floodway, or decreases flood storage, is permitted. Fills must be protected against erosion.
- Critical facilities must be located outside the floodplain to the extent possible, or must be elevated at least three feet above the base flood elevation.
- Where base flood elevation data has not been provided by FEMA, applicants must develop such data for subdivision proposals and other proposed developments (exceeds FEMA's 50 lot-5 acre criteria).

While these are good steps, one reality is that some buildings are already constructed in flood-prone areas, and there are ongoing needs to wildfire-burned areas to reduce post-wildfire flood risk.

Healthcare and Critical Infrastructure

PUBLIC HEALTH MONITORING

Local health organizations are central to monitoring public health trends and responding to emerging climate-related risks. Eastern Washington University maintains Chelan Douglas Trends, which tracks information like air quality over time and maintains publicly available data.

The Chelan-Douglas Health District (CDHD) collects health data and surveys residents and releases a Community Health Needs Assessment regularly. These survey efforts could be expanded to, for example, better gauge residents' literacy with air quality data and steps to take to reduce exposure to smoke. CDHD also actively assists small businesses with hazardous waste removal and pollution prevention, reducing environmental health threats that can be exacerbated by climate impacts.

Moreover, Chelan and Douglas Counties have developed some public health measures to address risks like heatwaves, wildfire smoke, and the spread of vector-borne diseases (Chelan County HMP, 2019 and 2014; Douglas County, 2024). There is a need for jurisdictional coordination, trained staff, and funding to implement the recommended measures.

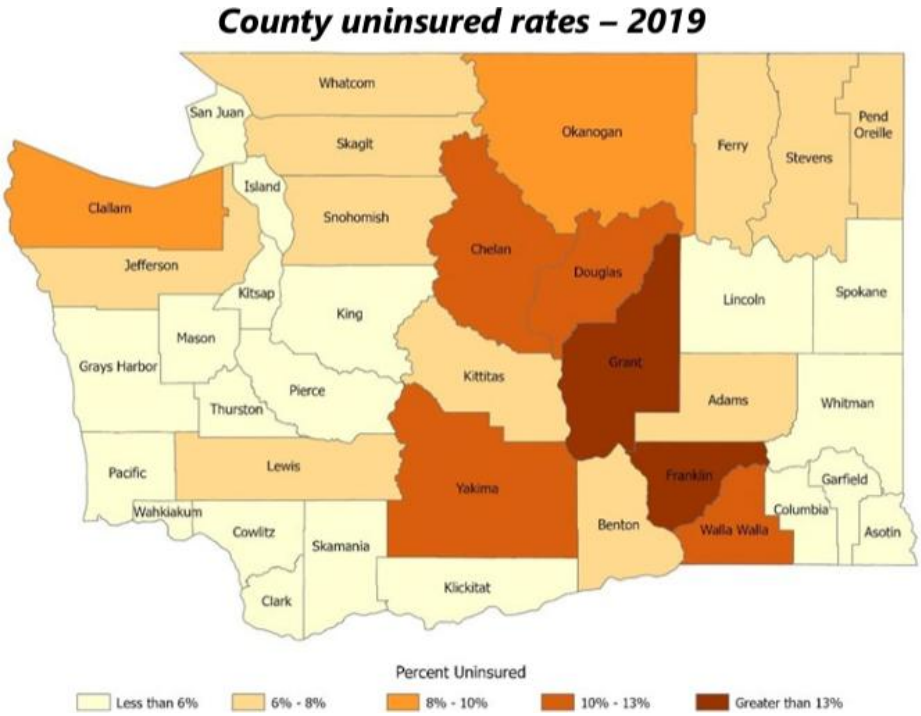
Another key actor in the region is Confluence Health, where researchers have been at the forefront of analyzing hospital visits related to wildfire events and advocating for policy changes to enhance respiratory health, discussed in other sections of this report.

HEALTHCARE ACCESS

Access to healthcare is a significant barrier to adaptive capacity. In Chelan and Douglas Counties, 12.8% and 13% of residents under 65, respectively, lack health insurance (U.S. Census Bureau, 2022). Figure 27 shows that the two counties have among the highest rates of uninsured adults in Washington. In Chelan County, over 75% of the uninsured population are of two or more races or Hispanic or Latino origin, reflecting racial and ethnic disparities in access to health insurance and healthcare services.

This lack of coverage limits access to preventive and emergency care, increasing risks during climate-related events like extreme heat and wildfire smoke exposure. Uninsured residents, including migrant agricultural workers, face heightened vulnerabilities due to financial, language, and transportation barriers, often delaying or avoiding necessary care. The intersection of the lack of health insurance and wildfire smoke impacts to children with asthma is discussed in the Physical Health section.

Figure 27: Percent of adults without health insurance in Chelan and Douglas Counties in 2019 (Kreidler, 2021).



INFRASTRUCTURE READINESS

Rural healthcare infrastructure across the U.S. tend to struggle to meet demand surges during extreme weather events (Dewi, Kasim, & Dykgraaf, 2024). Locally, hospitals and health facilities in the region are likely not all well equipped to continue functioning at their highest capacity during extreme climate events. For example, buildings might lack appropriate flood mitigation, cooling and air filtering systems in the face of anticipated increased climate impacts. To our knowledge, there has not been an assessment of all health facilities and hospitals for their individual climate readiness.

Fire stations and emergency service infrastructure are being adapted to withstand climate-related hazards, such as flooding and landslides, to ensure uninterrupted operation during emergencies. The County HMPs each note that both Counties are undertaking efforts to enhance the resilience of emergency response systems include creating defensible spaces and improving evacuation planning.

Physical Health

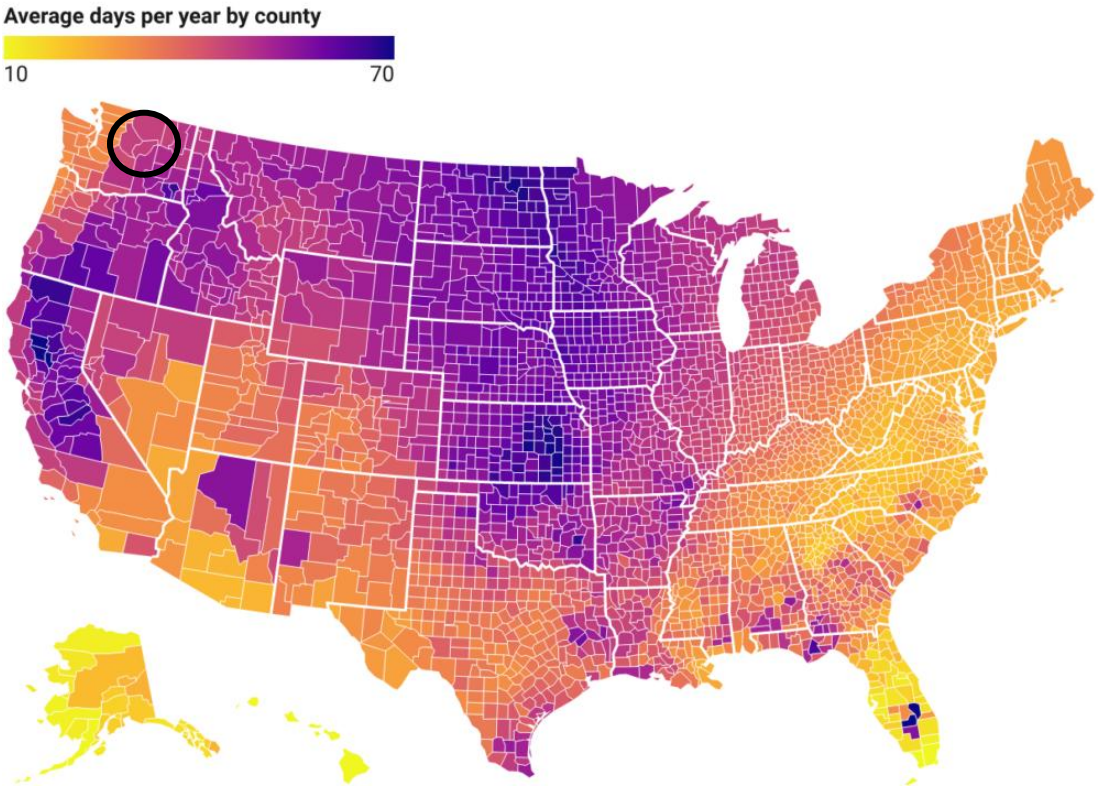
Climate Risks

Chelan and Douglas County residents face physical health impacts from climate hazards such as wildfire smoke, extreme heat, and drought conditions. Individuals who fall into multiple risk categories, such as those who are both low-income and have asthma, face compounded health risks. This section discusses those issues and highlights gaps in access to healthcare and protective resources that exacerbate these challenges.

Wildfire Smoke

Residents in the region face health risks from extended poor air quality events caused by wildfire smoke. Smoke seasons are getting longer in Washington state. From 2016-2020, the region experienced 40-50 smoke days per year, an increase from 2009-2014 (Figure 28). This is among the highest smoke exposure in the country, though not as high as parts of central California, southeastern Washington, and the Midwest. Even if there are no fires burning locally, wildfire smoke from California, Canada, and beyond can settle into the Valley (Chelan County HMP, 2024).

Figure 28: Wildfire smoke exposure across U.S. counties, showing Chelan and Douglas Counties (indicated by the circle) with over 50 smoke days per year during 2016-2020 (Saldanha, 2021)



Particulate matter ($PM_{2.5}$) in wildfire smoke can trigger asthma attacks, worsen chronic respiratory conditions like asthma and COPD, and increase emergency room visits (Doubleday et al., 2023). $PM_{2.5}$ is especially concerning, since it is made of tiny bits of airborne ash that are 30 times smaller than the width of a single strand of human hair. It can be inhaled deep into the lungs and even enter the bloodstream. $PM_{2.5}$ is known to aggravate heart and lung conditions, such as cardiac arrhythmias, heart attacks, bronchitis and asthma. Young children and older people are especially vulnerable to its harmful effects.

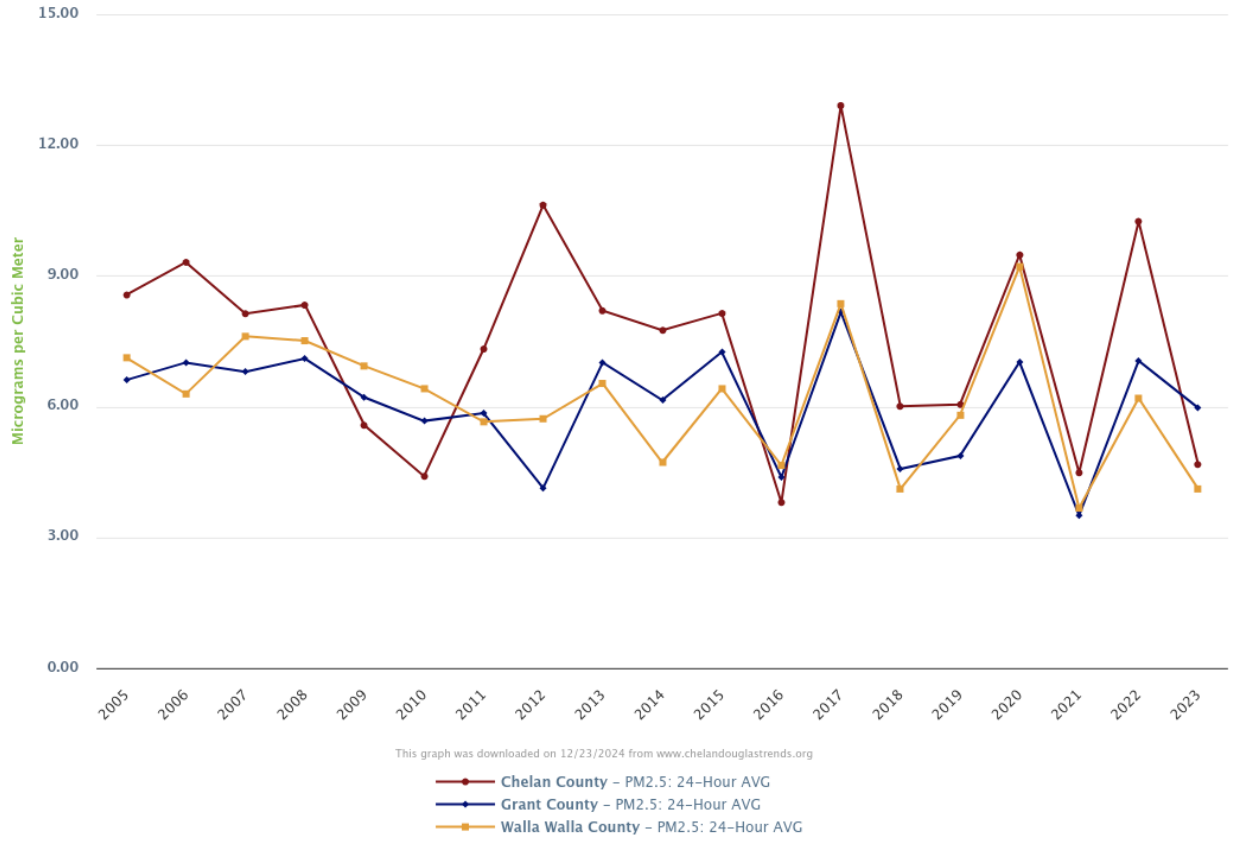
$PM_{2.5}$ is a particular risk for pregnant women and their fetuses (Sbiroli et al, 2022). Exposure to $PM_{2.5}$ and ozone increases risk of preterm birth, stillbirth and low birth weight. These effects are more pronounced in patients with asthma.

Pregnant women and their fetuses are more vulnerable than the general population to the full range of climate impacts, beyond wildfire smoke. According to the U.S. Environmental Protection Agency (2025), pregnant women and their fetuses are more vulnerable to the health impacts of climate change because:

- There is some evidence of negative impacts of wildfire smoke on **birth outcomes** (e.g., reduced birth weight), and that **stress** from the wildfire event itself could affect the developing fetus.
- Climate-related hazards, including extreme heat, flooding, and wildfires, have been linked to certain **health problems,** such as anemia, eclampsia, low birth weight, preterm birth, and even miscarriage.
- Pregnant women need **reliable access to transportation and medical care,** which can be disrupted during and after extreme weather events
- There are many biological and behavioral changes that occur during pregnancy and the postpartum period that can make women more **prone to insect-, food-, and water-related illnesses.** Some of these illnesses, which may increase due to climate change, can also threaten maternal and fetal health.
- Pregnant and postpartum women can be at increased risk of experiencing **post-traumatic stress disorder (PTSD) and depression** after natural disasters and extreme weather events.

On average, the area experiences 13 days of unhealthy air quality per year, the highest among overburdened communities in Washington (Washington State Department of Ecology, 2024). During the 2012 wildfires, Chelan and Wenatchee experienced some of the worst air quality in the state, with average Air Quality Index (AQI) levels averaging 194.44 (ug/m3) (Washington State Department of Health, 2015). Figure 29 shows that Chelan County consistently has had higher $PM_{2.5}$ levels than Grant and Walla Counties in the past two decades.

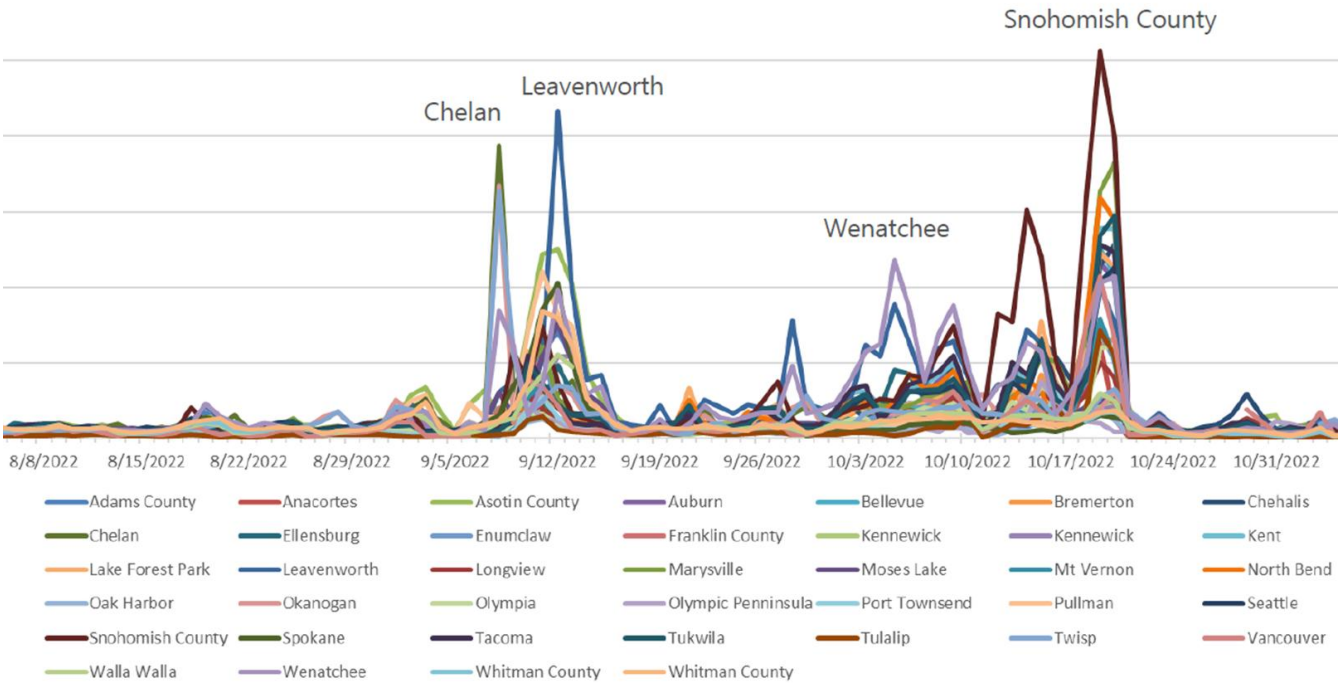
Figure 29: Annual average of the 24-Hour $PM_{2.5}$ concentration levels, demonstrating poor air quality in Chelan County in 2012 and 2017 due to wildfires (Chelan Douglas Trends, n.d.)[14]



More urban areas like Wenatchee and East Wenatchee, already burdened by pollution from vehicle emissions and other sources, face compounded risks during wildfire events. Meanwhile, residents in these towns have higher than average rates of poverty, asthma, uninsured populations, and a large proportion of children under 18 (Washington State Department of Ecology, 2024). The combined effects of existing pollution and wildfire smoke significantly worsen respiratory health outcomes for residents. As shown in Figure 30, daily $PM_{2.5}$ levels in Chelan, Leavenworth and Wenatchee were among the highest in the state in 2022.

[14] Douglas County is not included in this chart from Chelan-Douglas Trends: Chelan-Douglas Trends

Figure 30: Daily average $PM_{2.5}$ in late summer/fall 2022 in various locations across Washington, showing Chelan and Wenatchee with among the highest levels (Nayak, 2024)[15]



About 11.3% and 11.2% of adults report having asthma in Chelan and Douglas County, respectively (Centers for Disease Control and Prevention, 2024). The impacts of wildfire smoke on asthma were starkly evident during the 2012 wildfire season in North Central Washington (Nayak, 2024). Outpatient visits for asthma surged from 256 before the fires to 1,090 during the event, with nearly half of those visits (450) involving individuals 18 years and under (Table 9).

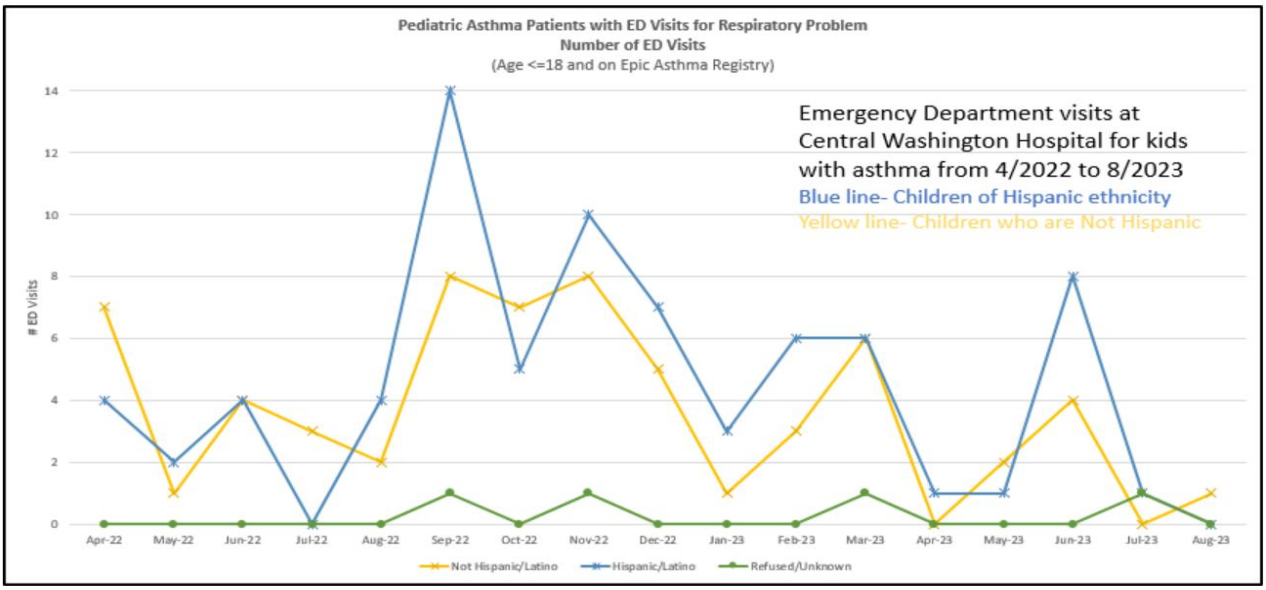
Table 9: Outpatient visits for respiratory disease, especially asthma (highlighted by red box), surged during the 2012 wildfires in North Central Washington, with visits going from 17 daily on average to 32 (Nayak, 2024)

Age group	Visits Before		Visits During		Before to During Comparisons			Visits After		Before to After Comparisons		
	Number	Average daily	Number	Average daily	Excess[1]	O/E[2]	95% CI[3]	Number	Average daily	Excess[1]	O/E[2]	95% CI[3]
Chronic obstructive pulmonary disease and allied conditions excluding asthma (ICD-9-CM 490-492, 494-496)												
All	252	17	912	27	10	**1.60**	1.05-2.32	501	26	10	**1.57**	1.03-2.30
0–18	10	1	63	2	1	2.78	0.33-10.59	44	2	2	3.47	0.53-11.53
19—64	81	5	314	9	4	1.71	0.79-3.21	193	10	5	1.88	0.91-3.45
65+	161	11	535	16	5	1.47	0.83-2.39	264	14	3	1.29	0.71-2.18
Asthma (ICD-9-CM 493)												
All	256	17	1090	32	15	**1.88**	1.[illegible]9-2.65	430	23	6	1.33	0.84-1.99
0–18	94	6	450	13	7	**2.11**	1.[illegible]3-3.59	161	8	2	1.35	0.60-2.62
19–64	127	8	501	15	6	1.74	0.97-2.88	206	11	2	1.28	0.63-2.29
65+	35	2	139	4	2	1.75	0.49-4.45	63	3	1	1.42	0.33-3.95
Pneumoconiosis and other lung diseases due to external agents (ICD-9-CM 500-508)												
All	16	1	49	1	0	1.35	0.11-5.84	14	1	-0	0.69	0.02-4.50

[15] Douglas County was not included in this chart provided by Dr. Nayak.

Meanwhile, analysis of pediatric visits in Wenatchee during 2022 and 2023 demonstrates an important sensitivity: Hispanic/Latino children had much higher rates of emergency room visits for asthma-related reasons during wildfire events, relative to other times when their emergency room visits track more closely to the broader population (Figure 31). Hispanic/Latino households in the region are also more likely to be low income or in poverty and thus face economic barriers to affording air filters and other preventive measures. Medicaid does not cover air filters, leaving many without tools to protect themselves during wildfire smoke events and can lead to spikes in asthmatic events. Households without air conditioning, or without the means to pay for the extra cost of air conditioning, also may need to keep windows open at night for cooling, which compounds exposure to harmful particulate matter. Meanwhile, Spanish-speaking residents may experience language access barriers to information about air quality.

Figure 31: Pediatric asthma patients with Emergency Room visits for respiratory problems in 2022-2023 (Nayak, 2024)



The region's unhoused population is especially vulnerable during hazardous air quality events. In 2022, Chelan and Douglas Counties reported 141 individuals experiencing homelessness, a 16.5% increase from the previous year's count of 121 (Douglas County, 2024). Many of these individuals live outdoors or in vehicles, making them particularly susceptible to health risks from wildfire smoke.

Extreme Heat

Temperatures in Chelan and Douglas Counties are likely to keep rising, leading to more frequent and intense heatwaves. By 2100, Douglas County could see 54 more hot days each year, and Chelan County could see about 28 more days, where the temperature feels hotter than 90°F compared to past averages from 1952-2004 (University of Washington Climate Impacts Group, 2024). Events like the June 2021 extended extreme heat event (influenced by a persistent high-pressure system and called a "heat dome") may also become more common. The dangers of extreme heat were starkly illustrated during the 2021 heatwave, when Douglas County reported two heat-related deaths (Washington State Department of Health, 2021).

High temperatures heighten the risk of dehydration and cardiovascular strain and exacerbate the physiological impacts of poor air quality. Combined heat and smoke events amplify the risk of asthma

attacks, respiratory distress, dehydration, cardiovascular strain, and heat exhaustion (Crimmins, et al., 2016). These health impacts are particularly severe for vulnerable populations, including children, adults aged 65 years and over, pregnant women, individuals with preexisting conditions such as asthma or heart disease, and those in climate-exposed occupations like agriculture and outdoor labor.

Some areas of the region, like lower elevation areas with more heat-absorbing surfaces (concrete, asphalt and buildings) and low tree canopy and vegetation, tend to be significantly hotter than surrounding areas during both the day and nighttime. Taking East Wenatchee as an example, Figure 32 shows that areas on the eastern and northern edges of the city center have low tree canopy and high heat exposure, relative to the rest of the town. The data sources and other information about the sensitivity indicators used are noted in Table 10.

Figure 32: Tree canopy deficiency and heat exposure. The tree canopy indicator measures % tree canopy by block group using data from the Tree Equity score National Explorer. A high sensitivity value was given to block groups below 10% canopy coverage, a medium value represents between 10-15% canopy coverage, and a low sensitivity value is above 15% canopy coverage. (Cascadia Consulting Group, made for East Wenatchee CVA)

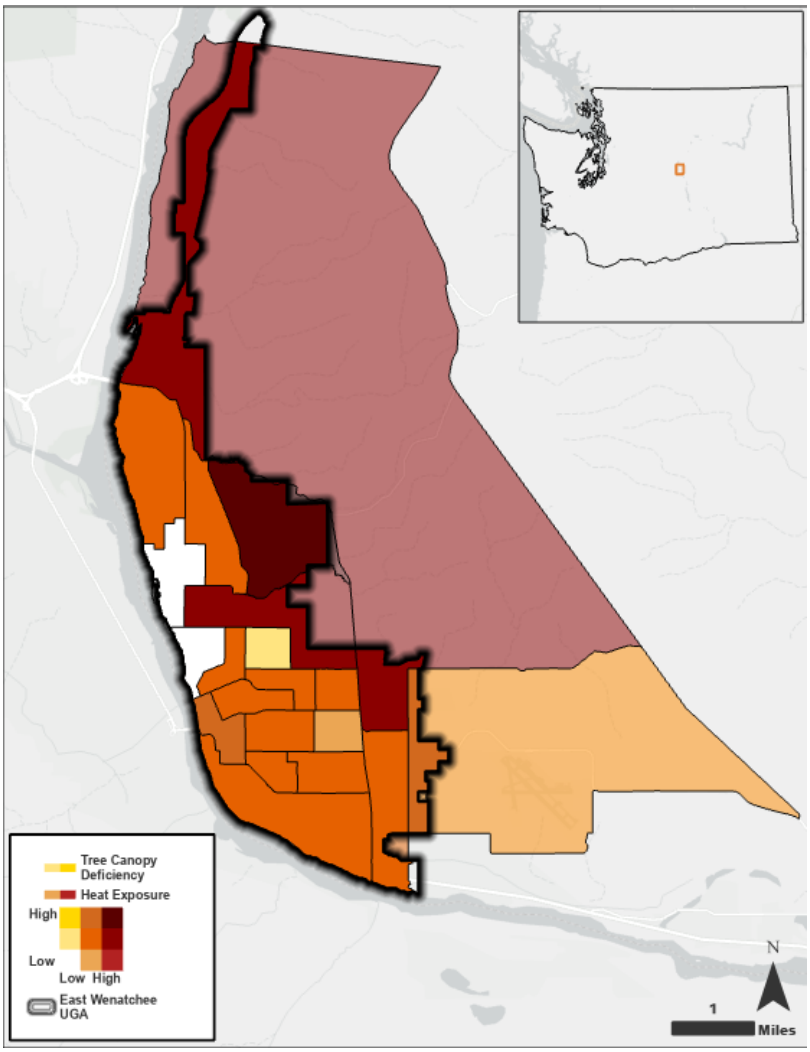


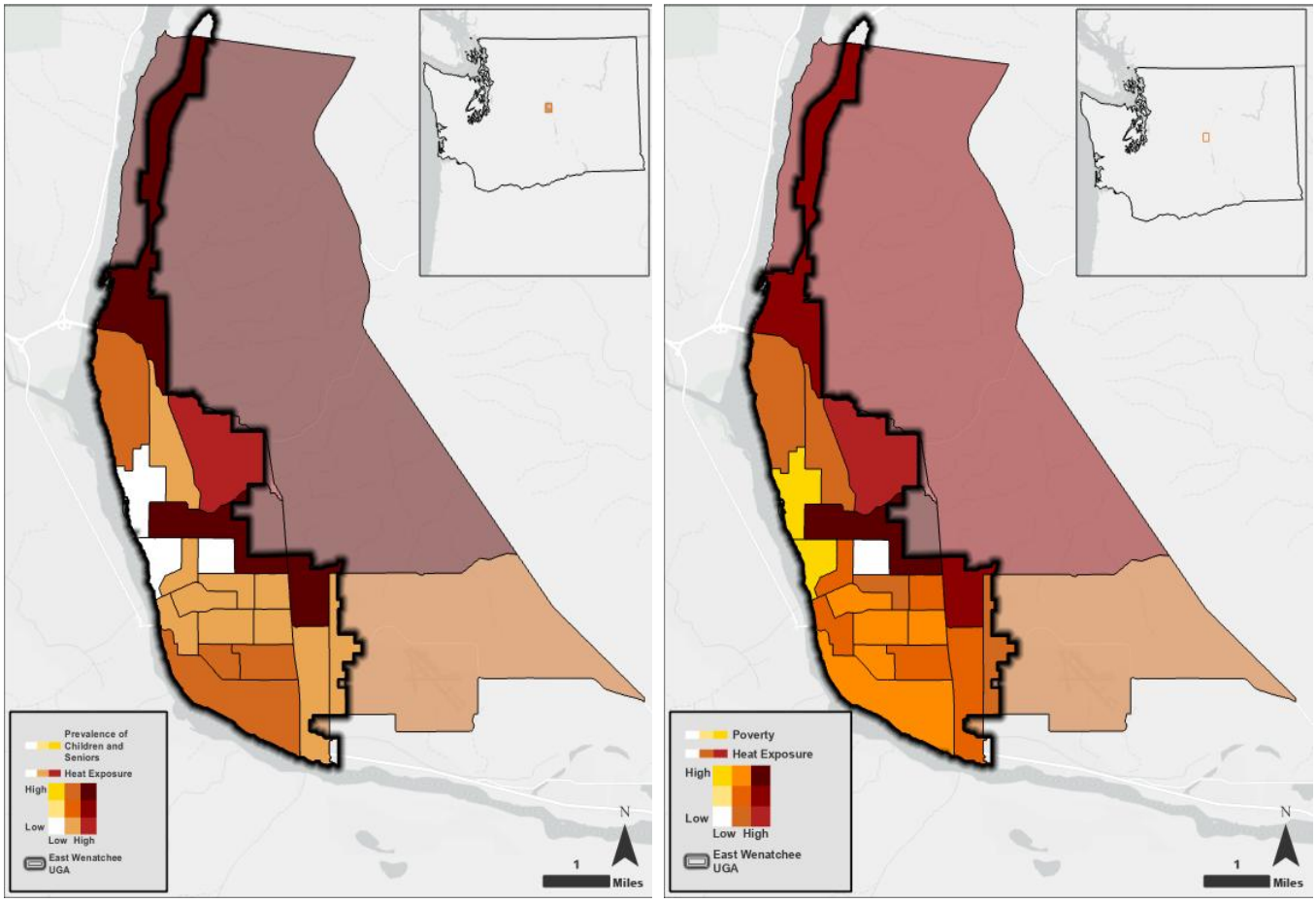
Table 10: Information on Sensitivity Indicators for Figures 33-34

Sensitivity Indicator	Data Source and Unit of Measurement	Description of Low, Medium, High Values
Tree canopy	Percent tree canopy coverage (Tree Equity Score National Explorer)	**High:** below 10% canopy coverage **Medium**: between 10-15% canopy coverage **Low**: above 15% canopy coverage
People experiencing poverty	Percentage of people living on incomes below 200% of the federal poverty line (ACS 2017-2021) (Tree Equity Score National Explorer)	High: above 30% Medium: between 15-30% Low: below 15%
Children and older adults	Percent seniors (65+) and children (0-17) (ACS 2017-2021) (Tree Equity Score National Explorer)	High: above 45% Medium: between 30-45% Low: below 30%

The below maps (Figure 33) overlay areas with higher rates of children and seniors (left), and higher rates of people in poverty (right), with extreme heat. All block groups in East Wenatchee demonstrate medium or high sensitivity to heat impacts for the children and older adults. Block groups around the city South of Grant Road show a higher percentage of children and seniors compared to the rest of the city, as well as the areas above Wenatchi Landing. When comparing the percentage of children and seniors to heat exposure across the city, North of Wenatchi Landing, North of Grant Road Corridor, and Sand Canyon demonstrate the highest vulnerability due to their combined sensitivity and exposure ratings. These populations will be disproportionately affected by the effects of extreme heat due to their exposure and reduced ability to regulate body temperature and higher susceptibility to heat-related illnesses.

Meanwhile, parts of East Wenatchee demonstrate low, medium, and high sensitivity to heat impacts for people experiencing poverty. When comparing the percentage of people experiencing poverty to heat exposure across the city, Sand Canyon and the southern area of the City demonstrate the highest heat vulnerability due to combined sensitivity and exposure ratings. These populations will be disproportionately affected by the effects of extreme heat because they may live in older housing stock or in neighborhoods with less access to cooling resources, making it more difficult to mitigate heat impacts. Another issue, not shown in the maps, and mentioned in the City's Hazard Mitigation Plan (2024) is that there are many old and decaying trees, which can lose branches or fall down during a wind event, reducing tree canopy.

Figure 33: Map on left overlays high heat exposure with high prevalence of seniors (65+) and children (0-17 years). Map on left overlays high heat exposure with high prevalence of people living on incomes below 200% of the federal poverty line (Cascadia Consulting Group, made for East Wenatchee CVA).



Outdoors Workers

People who work outdoors (which includes agriculture, construction, field research, recreation, and more) are exposed regularly to impacts like heat and smoke. Physical activity on hot days can damage the heart, lungs, and kidneys, and in extreme cases, lead to death. Across the U.S., farmworkers are currently exposed on average to twenty-one unsafe working days due to heat, and their mortality from heat-related illness is 20 times higher than nonagricultural workers (Environmental Defense Fund, 2023). This exposure will worsen in the future.

> Heat has always been a consideration for growers—for the safety of their workforce and for the quality of the fruit…What is changing is that weather patterns have been less predictable. We've had some of these high heat days in June or early July when they aren't as expected.
>
> -The president of the Washington State Fruit Tree Association, 2024.

Longer and more intense wildfire seasons have also increased health risks for outdoor workers. Farmworkers in Central Washington report coughing and burning eyes during smoke events. During a community listening session in Wenatchee, farmworkers shared concerns about the impacts of wildfire smoke on their families' physical and mental well-being and their challenges navigating unpredictable

work and childcare (D'Evelyn, 2024). They expressed worries about their own exposure and the exposure of their kids, especially those with asthma, to smoke. They felt forced to go to work, due to not wanting to lose their jobs or their wages. Below are some quotes from farmworkers in the area:

> When I'm working in the warehouse, the doors are open, because the forklifts go in and out. .... And the fires are nearby... because around the work area there is just pines. Then, the smoke goes all the way inside, you can see it as the sunbeams enter... is possible to detect all the smoke and all that. Imagine, not even inside the packing facility are safe, now imagine out here when we leave.
>
> - Chelan County Farmworker Interviewee 1

> It is necessary because we must work, because if we do not work, we do not have money to pay the bills or the rent.
>
> - Chelan County Farmworker Interviewee 2

> When it is more than 15 days of smoke, not only do the children get stressed, or your children are stressed, but you already begin to stress yourself too."
>
> - Chelan County Farmworker Interviewee 3

Some of the barriers that local farmworkers identified to dealing with extreme heat and smoke include (D'Evelyn, et al. 2024):

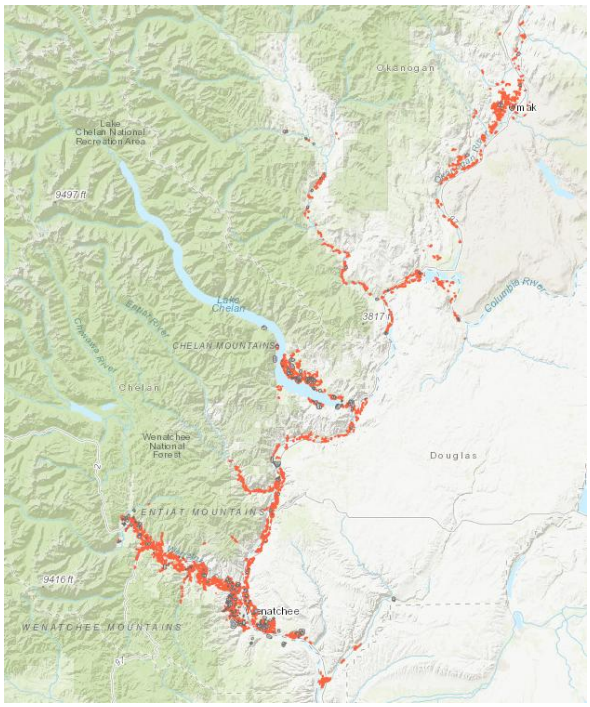
- Lack of accessible and timely information and training,
- Lack of financial resources to acquire N-95 masks and portable air cleaners,
- Unpredictable and inadequate worksite responses, like lack of appropriate masks,
- Unreliable or inaccessible childcare; and
- Evacuation notices and smoke information were not widely shared in their communities.

Another risk for outdoors workers is increased pollen and other allergens that cause hay fever or asthma (Washington State Department of Health). Pollen and asthma seasons are projected to worsen under climate change. The risks to farmworkers and other outdoor workers from climate impacts is compounded by other factors, including low pay, poor access to medical care and health insurance, and factors related to national origin, language barriers and immigration status. Meanwhile, farmworkers often live in substandard housing, and experience additional stressors and risks related to their work including toxic pesticides and use of dangerous machinery and sharp objects (Environmental Defense Fund, 2023).

Figure 34: Farmworker wears a bandana (notably, bandanas alone are not sufficient at filtering smoke) to protect against wildfire smoke in a Washington orchard (Jenkins, 2021)

Farmworkers in Chelan and Douglas Counties also face potential exposure to lead and arsenic, both of which are linked to negative health impacts. Climate impacts like flooding and high temperatures can mobilize arsenic and lead release (McQuate, 2019). The map below shows where historical orchards were located, using old aerial photographs (Figure 35). From the 1890s to the 1950s, orchards commonly used lead arsenate to control pests, meaning lead and arsenic potentially remain in the soil.

Figure 35: Former Orchard Lands in Chelan and Douglas Counties, which commonly used lead arsenate to control pests (Washington State Department of Ecology, 2024).



Adaptive Capacity

Air Quality

The region's adaptive capacity in terms of physical health reflects both challenges and ongoing efforts to address these issues. A significant concern is the lack of adequate air quality sensors in schools, public places, and other vulnerable facilities. Another issue is the lack of adequate filtration systems to ensure clean indoor air in public, institutional, and private spaces (including homes).

Currently, there is an air quality station in Wenatchee on 5th Street, which tracks wildfire smoke and displays real-time air quality notifications, ranging from "good" to "hazardous," enabling residents to make informed decisions to protect their health (Chelan County HMP, 2019). However, there is a need for more intuitive systems that provide real-time updates across more locations throughout both counties. The existing monitors do not sufficiently cover all areas, making it hard for residents to know the exact conditions they are experiencing (Chelan County HMP, 2019). While the Chelan Douglas Health Districts offers guidance on its website about how to interpret the numbers and colors and what protective measures to take, not all community members know to look at their website, have internet access, or an understanding of how to interpret the data.

Organizations in the region are using air quality data to make decisions about events and closures. For example, the Wenatchee School District uses real-time air quality data to inform their decisions about closing school and changing activities. Activities including recess, sports events, and marching band are not held outdoors when air quality reaches unhealthy levels (151 or above). While decisions like this help minimize the physical health impacts, closures, cancellations and changed activities can negatively impact student well-being and mental health. Meanwhile, not all school districts, institutions, or organizations have air quality monitoring plans or strategies.

Any efforts to improve air pollution should reduce overall exposure and improve population health. For example, the community organization Sustainable NCW is leading a campaign to reduce idling, which contributes to local air pollution as well as greenhouse gas emissions (Sustainable NCW, n.d.). They focus on educating community members particularly at preschools, daycare centers, and schools (Figure 36).

Figure 36: Promotion of the Idle-Free Zones campaign, in Spanish (Sustainable Northcentral Washington)

Addressing Heat through Environmental and Land Use Planning

Efforts to mitigate extreme heat and improve livability in the region are underway in the region. For example, the City of Wenatchee already has some tree-lined areas (Figure 37) and has been implementing shade and vegetation enhancements in targeted areas. The City requires street trees for all new developments in most zoning districts where the sidewalks are wide enough for them. Wenatchee City Code's landscaping standards also require street frontage landscaping, which often takes the place of street trees, but provides a similar experience.

The ongoing North Wenatchee Avenue project includes landscape planting and street trees (City of Wenatchee, 2025). The streets in front of Confluence Health (e.g. Miller Road) have been redone with landscaping and young trees, meeting City requirements to do so (Figure 37). The young trees will hopefully eventually grow large enough to provide more shade, and meanwhile, the additional vegetation is beneficial for birds, animals and insects. However, many roads are currently determined as undersized for street trees, which limits the planting of trees in much of the City.

Figure 37: The tree-lined Pioneer Drive in Wenatchee helps provide shade during extended heat events (left). Newly planted landscaping- a new implementation with young trees meeting the City's updated street frontage standards- along Miller Street in front of a Confluence Hospital parking garage also provides positive environmental benefits. (Google Maps Street View)

Beyond the City of Wenatchee, Chelan County's land use planning policies focus on preventing urban sprawl, preserving natural habitats, and minimizing environmental degradation that could impact public health. These initiatives help enable communities to be better equipped to adapt to changing environmental conditions while maintaining access to essential services (Chelan County HMP, 2019).

While the above are good starts, there are opportunities to add greenery, mandate drought-resistant vegetation, and reduce sprawling patterns of development and high heat-trapping built environments (Community Workshop, 2024).

Cooling Centers

Cooling centers can provide refuge for residents, particularly those without adequate home cooling, during extreme heat events. They can also function as community hubs where residents can access resources and information about heat safety. In Chelan and Douglas Counties, 10 designated cooling and resilience centers exist, including the Town Toyota Center in Wenatchee and various libraries.

However, there are limits to the efficacy and use of cooling centers. The limited hours of some cooling facilities may be a barrier for some. Many residents prefer to shelter in place with their pets and other family members (Community Workshop, 2024). Some residents face transportation and other access barriers. Questions persist about the scalability and capacity of cooling centers to meet growing demand under increasingly severe and prolonged heat conditions.

Supports for Climate-Impacted Workers

As of 2023, Washington Labor and Industries mandates temperature-related breaks, shade, cool drinking water access, and heat awareness training for outdoors workers. The state's Wildfire Smoke Rule requires that N95 respirators be made available for workers when air quality crosses a $PM_{2.5}$ level of 101 µg/m^3 as air quality worsens. While these laws may offer some relief to outdoors workers, working in 90-100-degree heat and/or during wildfire smoke events may still be a risk (Bohnert, 2023).

Some fruit-growing operations in the region have already been adapting their practices to offset the impact of heat on workers. Some growers start harvesting at dawn, while others have switched to nighttime harvesting under artificial lights. Changing schedules can be hard for workers, though, especially those with children.

Initiatives like the Columbia Valley Community Health (CVCH) mobile unit help address the needs of vulnerable worker populations (Columbia Valley Community Health Center, 2024). This mobile unit visits migrant camps and other locations where farmworkers and their families gather, providing essential health services and information directly to at-risk individuals.

The local nonprofit CAFÉ, or the Community for the Advancement of Family Education, organized a drive-through event for agricultural workers to distribute face masks and informational flyers (Diaz, 2024). Such targeted outreach efforts are crucial in ensuring that climate-impacted workers receive necessary health education and support to cope with the challenges posed by smoke and extreme heat conditions.

Economic Health

Climate Risks

The varied terrain of the region supports two major climate sensitive industries in the region: agriculture and tourism (Meseck, 2022). These are shown in Table 11 below. This section discusses the economic implications of climate change impacts to those sectors, as well as to other climate-impacted workers and to low-income residents. This section also addresses data servers, an emerging important land use and economic consideration in this region that also has potential impacts to climate vulnerability.

Table 11: Employment by Industry in Chelan and Douglas Counties. The most likely climate-impacted industries are bolded (Meseck, 2022).

Industry Sector	**Chelan County:** Number of jobs	**Chelan County:** Share of employment (rank)	**Douglas County:** Number of jobs	**Douglas County:** Share of employment (rank)
Agriculture, forestry and fishing	**8,708**	**21.3% (1st)**	**2,690**	**22.7% (1st)**
Retail trade	4,182	10.2% (4th	1,837	15.5% (2nd)
Local government	4,963	12.1% (3rd)	1,806	15.2% (3rd)
Accommodation and food services	**3,623**	**8.9% (5th)**	**843**	**7.1% (4th)**
Health services	6,478	15.8% (2nd)	839	7.1% (5th)
Total covered employment	40,871	100%	11,875	100%

Agriculture

Chelan County has 712 farms, which is a 15% decline since 2017 (U.S. Department of Agriculture, 2022). Main crops are tree fruits (apples, pears, cherries and stone fruit), forage (e.g. hay), and wine grapes. The farms are generally small, with 29% being 1-9 acres, 39% spanning 10-49 acres, and 23% covering 50-179 acres. The farming population is aging, with 634 farmers aged 65 and older. 113 of the 1,395 producers identify as Hispanic or Latino.

Douglas County is home to 618 farms, which also represent a 15% decline since 2017 (U.S. Department of Agriculture, 2022). The county's farmland is a mix of cropland and pastureland, with the largest crops by acreage being wheat, apples, canola, forage, and cherries. Additionally, cattle and calves are raised on many farms. Some of the farms in Douglas County are larger in scale, including 26 that span over 1,000 acres. In terms of revenue, 42 farms generate less than $2,500 annually, while 34 produce more than $100,000. Like Chelan County, the farming population is aging, with 628 farmers aged 65 and older. About 100 of the 1,197 producers identify as Hispanic or Latino.

Besides direct farming, non-farm employment in food processing, fruit packinghouses, and transportation accounts for agricultural employment in both counties (Meseck, 2022).

Drought, heat, and wildfire is already impacting agriculture in the region. Farmers have been facing water restrictions. The president of the Washington State Fruit Tree Association notes that a low water supply stresses fruit trees, leading to sunburned fruit and lower quality size and shape of fruit (Garcia, 2024). Wheat growers in Eastern Washington experienced a drastic drop in yields during the drought and extreme heat of 2021 (Hoang, 2024). The Washington Apple Commission estimated a 5-10% reduction in crop volume for Washington apples in 2020 due to the heat dome in June that year (Apple Valley News, 2020). Chelan Fruit lost $60 million in buildings and equipment to wildfire in 2015 (Figure 38).

Figure 38: Chelan Fruit lost a major warehouse to wildfire in 2015 (Dininny & Mullinax, 2015)

Another climate impact is heavier winter rains. These can delay crop planting, deplete availability of oxygen in waterlogged soil available to crops, and lead to flooding, which increases disease risk and causes nitrogen loss (Chelan County HMP, 2019).

Agricultural challenges extend beyond crops to livestock. In 2021, 1,000 or more cattle in Washington state died during the prolonged June heat event (Stormo, 2021). Dairy farmers are also impacted, since lactating cows produce less milk during extreme heat. There also is lower production of feed crops like alfalfa, which leads to higher costs for dairy farmers.

Wildfire smoke also negatively impacts agriculture (Brannan, 2025). Livestock that are exposed to long-term wildfire smoke experience premature birth and decreased birth weight, decreases in weight gain milk production, and respiratory impacts (O'Hara et al., 2021). Scientific research has linked wildfire smoke to both pink eye and permanent blindness in livestock (Saldanha et al., 2021).

Additionally, impacts of climate change on the hydropower system will affect the food processing industry. The freezing of fruits and vegetables is energy-intensive and has depended on the relatively low cost of energy historically, but energy costs may increase in the future. Potential impacts of climate change on the state's transportation infrastructure and the cost of fuels could also affect the region's agricultural

exports, which depend on high quality infrastructure that provides fast, low-cost transportation (Washington State Department of Ecology, 2012).

Expected disruptions in agriculture can ripple through the local food supply and could lead to increased prices of food, affecting food security locally and more broadly, since Chelan and Douglas County are key exporters of food domestically and internationally.

Forestry

> "Chelan County is the highest risk community in the state for potential wildfire damage."
>
> - Mike Kaputa, director of Chelan County Natural Resources (Chelan County Natural Resources Department, 2024).

The total number of jobs in the forest industry in 2021 were 711 direct and 1,197 indirect jobs for Chelan and 55 and 77 for Douglas County (Mason, Bruce & Girard, Inc, 2021). Meanwhile, revenues for the forest products industry were over $523 million in Chelan and $32 million in Douglas County in 2021.

Particularly in Chelan County, where forestry is a major employer and economic driver, forests face climate risks. Chelan County has been identified in numerous risk assessments as facing higher wildfire risk than nearly all of Washington state and the western United States (Chelan County Natural Resources Department, 2024). The Okanogan-Wenatchee National Forest was recently designated a National Priority Landscape, one of only 21 in the United States, underlining the heightened risk in the area. The economic impacts include that timber can be destroyed and lead to smaller available timber harvests (Chelan County HMP, 2024), as well as lost jobs and income.

Tourism

Tourism-related businesses, especially hotels, eating and drinking places, and amusement and recreation services, are important to the local economies of both counties. Besides this, tourism also generates local spending. One study estimates that Chelan and Douglas Counties combined benefited from over $700 million in direct travel and tourism spending, up by 135% since 2000 (Richter & Jones). Annually, Chelan County awards grants to local organizations from lodging tax revenue to do infrastructure improvements and marketing/events (Chelan County, County Awards).

Chelan County particularly sees itself as an outdoors paradise, especially for outdoors recreation including snow-based activities in and around Leavenworth and for hiking, biking and watersports and agritourism activities in and around Lake Chelan. The industry, with its tight association with outdoor recreation, is highly sensitive to climate impacts including changing precipitation and wildfire.

Wenatchee's Mission Ridge, Leavenworth's Ski Hill and its Nordic ski trails, and Lake Chelan's Echo Valley Ski and Tubing Area are all popular winter destinations that will be impacted by warmer winters. One academic study suggests that in the worst-case scenario climate model, ski seasons in 90% of Western North America ski areas will be shorter than 120 days by 2085 (Wenzelburger, 2021). Local ski resort managers already acknowledge that winters are becoming shorter and snowpacks are often below historic levels. A staff member from Leavenworth Winter Sports Club noted that their season hasn't necessarily shortened in the last decade, but that's in part due to snow making and to better grooming equipment (and off-season trail clearing) that helps prolong the amount of time with a skiable surface. The worst winter, by far, in recent history was 2014. Some recreational companies and organizations may be reluctant to talk too much about climate change impacts as they hope to develop the area (Community Workshop, 2024).

Important regional events, like the state's Special Olympics and Rails and Ales winter festival in Wenatchee, are also reliant on cold weather and snow.

Another climate risk is wildfires, which can lead to closures of recreation areas. Extended smoke events can deter tourism and outdoor recreation, like in Lake Chelan in the summer of 2015, when several large wildfires destroyed 75 homes and businesses and caused tourists to flee and avoid the area (Associated Press, 2015). Businesses like Lake Chelan Winery/BBQ and Wapato Point Resort reported significant drops in their customers during that wildfire season (Grande, 2015).

Wildfires can also lead to evacuations. In June 2024, a severe wildfire forced an evacuation of all tourist-related visitors to Stehiken, a remote community accessible only by boat or float plane, at the head of Lake Chelan (Figure 39). Many tourist businesses, from outfitters to hotels and lodges and employees like cooks and cleaners, were hurt (Bernstein, 2024).

Figure 39: Pioneer Wildfire impacts tourist town of Stehekin, summer 2024 (Bernstein, 2024)

Drought and less summer water availability can negatively impact river recreation, reservoir-boating, and sport fishing in the region. Lake Chelan is experiencing increasing nearshore algae blooms, elevated pathogen indicators, and aquatic invasive species. These are not exclusively caused by climate change, but many of these issues are exacerbated by warmer temperatures (Lake Chelan Research Institute, 2021).

Even when there are no direct current climate impacts, some local businesses, like hotel owners, worry about the perceptions of the region being hot or full of smoke as being a deterrent to potential visitors. There is not yet a comprehensive study of the impact on climate change to tourism, though a forthcoming study commissioned by Chelan County Economic Services may do so.

Economic Impacts to Workers

Climate-impacted workers face potential economic impacts from climate change (U.S. Environmental Protection Agency). Farmworkers are among those impacted. Farmworkers already typically face economic challenges. A study estimates that annual wages for farmworkers in North Central Washington is the lowest in the state, at around $25,771 and well below the median family income for 2018, $56,135 (BERK Consulting, 2022).

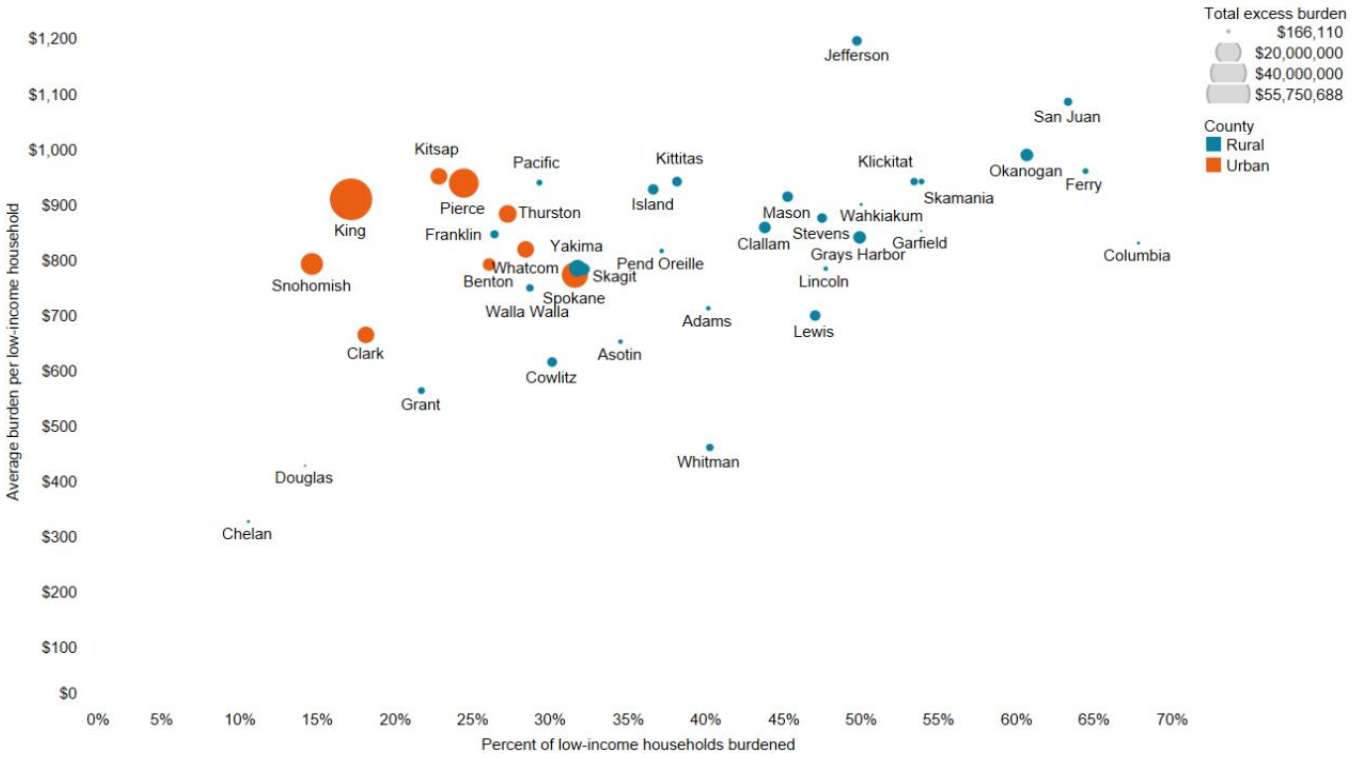
Farmworkers often only work part-time, and even less when there are climate impacts. For example, the pear season was really bad in 2024 due to extreme winter storms, with a reported pear yield 20-30% below the 5-year average (Clouse, 2024). As a result, many employees only worked a minimal schedule with much lower pay than other years (Community Workshop, 2024).

As mentioned earlier, climate impacts are affecting the tourism industry, For people who work in the ski and snow-related tourism industry in the area, the lack of snow can be devastating. In the early 2000s, each low-snow year in the Northwest was associated with annual economic losses of $173 million and 2,100 fewer jobs, compared to high-snow years (Mapes, 2012).

Impacts on Low-Income Residents

Economically disadvantaged residents have fewer resources to respond, rebuild and recover from the expenses of climate impacts. Low-income residents tend to live in older and less efficient housing and thus experience higher heating and cooling needs. In Chelan and Douglas Counties, a lower percentage of low-income households experience energy burden relative to the rest of Washington state as shown in Figure 40. About 5% and 4% of households have energy burdens overall, and 14% and 11% of low-income households in Douglas and Chelan County, respectively (Washington State Department of Commerce, 2023).

Figure 40: Energy burdens of low-income households by county, showing Chelan and Douglas Counties as among the least burdened (Washington State Department of Commerce, 2023)



Looking to the future, climate impacts like reduced snowpack and reduced summer streamflow, as well as rising energy demand for air conditioning during heat events, are likely to lead to rising energy costs, especially for summer electricity (Chelan County Public Utility District, 2008). This will likely impact energy-burdened residents most.

Another economic concern is the risk of damage to homes from wildfire, flooding, and associated mudslide or landslide risks. There is significant research suggesting that people with lower economic means are more vulnerable in the face of disasters and are more likely to suffer more serious consequences during impact, from property damage to homelessness to physical and financial impacts (Substance Abuse and Mental Health Services Administration, 2017). Meanwhile, low-income survivors are less likely than more affluent people to get federal emergency assistance (Kellman, 2021).

In Chelan County, about 4% of the population lives in the 100-year floodplain, and nearly 32% live in the 500-year floodplain (Chelan County HMP, 2019). About half of Chelan County's vulnerable buildings are in Wenatchee. Not all structures within FEMA identified flood hazard areas are covered by flood insurance (Chelan County HMP, 2019). In Chelan County, over 16 percent of the people in the census blocks that intersect the 100-year floodplain have annual household incomes of $20,000 or less. People with low or fixed incomes face additional barriers to recovering from damage to their homes or property and from any income loss. Approximately 28 percent of the over-65 population in the floodplain also have incomes below $20,000 (Chelan County HMP, 2019). There have already been some flood events which have caused property damage in the region, as shown in the photos in Figure 41.

Figure 41: Flooding and mudslides severely damaged homes in South Wenatchee in 2019 (Fitzsimmons, 2019)

Data Centers

Data centers have become a critical driver of economic growth in Douglas and Chelan counties, with the Chelan-Douglas Regional Port Authority claiming new Microsoft Data Centers on the Malaga-Alcoa Highway will result in an approximately $2.4 billion investment in each county (Safford, 2024). Roughly 75 jobs per each of the 6 buildings are anticipated. While they may bring economic growth, data centers are placing significant strain on the region's hydropower resources. Chelan Public Utility District is considering how to manage the increasing number of high-demand customers, including the new Microsoft data center in Malaga (Taylor, 2024).

Adaptive Capacity

Agriculture

The adaptive capacity of the agricultural sector to climate change is mixed. One contributing factor is whether irrigation districts and managers, as well as individual farmers, can better manage agricultural practices, rivers and irrigation systems, considering changing conditions. The Chelan Climate Resiliency Strategy identifies specific actions to build a climate resilient water supply, including: better monitoring, rural water management, increased water storage solutions for producers, and agricultural water conservation and efficiency efforts. The Strategy notes that these actions have only been partially implemented.

Large fruit companies, such as Stemilt, have adopted some more sustainable irrigation practices, but it is not well publicized or known (Community Workshop, 2024). Some growers are changing what they grow,

like some grape growers are changing varieties to ones that perform in today's climate conditions, but again this is not well publicized (Community Workshop, 2024).

Washington State University researchers are experimenting with apple and wheat varieties that may grow better under drought conditions or temperature fluctuations (Hoang, 2024). Meanwhile, some growers use shade cloth to reduce the amount of sunlight on trees. It can cost $800-$1,000 an acres (in 2021) plus the labor costs to install it and take it down (Garcia, 2024) Other tactics are to change from overhead sprinklers to misters or drip systems, to install technology to monitor soil moisture, and/or to use ponds as a water source when irrigation districts turn off water supply.

The Washington State Department of Ecology provides detailed recommendations for agriculture and working lands to deal with climate change (Washington State Department of Ecology, 2012). Top strategies are: protection of productive agricultural land, reduction of impacts of severe droughts and floods, prevention and control of invasive species, and engagement of agricultural communities in research, data sharing, and adaptation policies and actions. Again, the status on the implementation of this is mixed. Changes like these have costs and not all growers can afford them.

Looking to the future, there is likely to be more competition for water resources. Some Community Workshop participants suggested there should be programs that restore less productive agricultural lands to less water intensive uses, for example to sage and other native plants.

Forestry

In recognition of Chelan County's forest industry ranking among the most at risk in the nation, local and state partners have pledged more than $100,000,000 investment in fuels reduction and wildfire risk mitigation projects over the next decade through the Central Washington Initiative (Chelan County Natural Resources Department, 2024). The Central Washington Initiative is a collaborative effort led by local, federal, and tribal partners to invest in forest restoration projects to address the wildfire crisis. It focuses on restoring fire-prone forests, implementing fire resilience management, developing economic opportunities, and connecting partners across land ownership (https://www.sustainablenorthwest.org/central-wa#:~:text=Restoring%20forest%20health%20and%20protecting,project%20in%20Washington%20state%20history.). Chelan County aims to develop an engineered sawmill, biomass and mass timber facility that would process small dimension logs thinned from the local forest.

Tourism and Other Local Businesses

The adaptive capacity of the overall tourist industry is difficult to assess. This is in part constrained by the industry – which include many small businesses – not wanting to be perceived by potential tourists as having major climate impacts.

Some ski resorts and recreation organizations are adapting to changing snow levels in a variety of ways. The Leavenworth Winter Sports Club (LWSC) receive approval to start making snow in 2016 and has since purchased equipment to do so. Snow-making has helped it extend the season in recent years (according to communication with a staff member). In 2024, LWSC made snow four times. Snow-making takes a lor of money and energy, LWSC has an agreement with the City of Leavenworth to use municipal water at reasonable rates, with some stipulations restricting its use if the water level gets too low.

In terms of planning for climate change impacts, LWSC's board and staff are considering climate change in their next strategic plan. They might consider buying property at higher elevation. LWCD is also considering expanding its non-winter recreation operations and focus, including potentially its name.

Mission Ridge also has developed non-snow dependent activities, including hiking and events like the Tamarack festival and concerts like Pray for Snow.

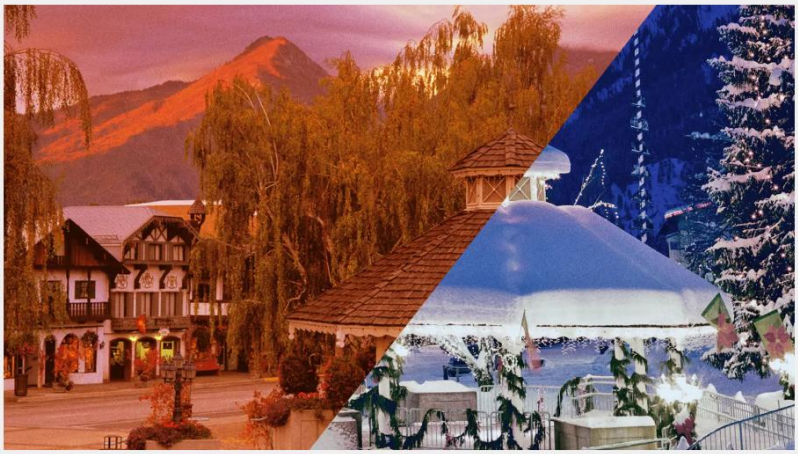
While some organization in Leavenworth have already been adapting to changing snow patterns, it is not clear that it will be able to continue its status as a snowy destination far into the future (Figure 42).

Figure 42: Article questioning the future identity of Leavenworth as a "winter wonderland" (Winters, 2020)

Grist

Leavenworth Lost

My Christmassy hometown is looking less and less like a winter wonderland.



Grist / Connie Coleman / Getty Images

As for other impacts like heat and wildfire, while Lake Chelan and Stehekin's tourist industries have been impacted, the overall trajectory of tourism spending has been rising in recent years (with pandemic years aside). It remains to be seen if tourist-dependent businesses like hotels and restaurants will continue to thrive, with likely more intense, longer, and compounding climate impacts. One adaptive capacity measure may be to expand shoulder-season tourism into later fall and early spring.

One limitation for small businesses, tourism-related and beyond, is the difficulty in accessing clear information about best practices. There seems to be a lack of information on innovative steps that organizations, people and communities can take to "build resiliency" (Community Workshop, 2024). For example, the large fruit growers have adopted more sustainable irrigation practices but there is little public knowledge about that or relevant scaled down and affordable practices for smaller operations. The costs of adopting more sustainable practices (like compostable cutlery) and adapting to changing climate conditions is another barrier. Hispanic and Latino small business owners are very cost sensitive and also

face language barriers to access resources and programs (Community Workshop, 2024). One useful idea could be a small business owner toolkit in Spanish that is culturally relevant.

Support for Low-Income Residents

Local utilities operate programs supporting low-income weatherization, low-income energy efficiency measures, grocery and restaurant rebates, and more. Chelan County reports that about 125 burdened households receive current support through low-income efficiency and direct assistance programs (Chelan County Public Utility District, 2021). Organizations including the Chelan-Douglas Community Action Council support low-income residents in accessing weatherization, energy assistance, and other resources. That said, such programs are limited in the number of people they can serve and the amount of assistance that is provided.

Data Centers

Community members have voiced concerns about the possible impacts of data centers – and their extraordinary energy use – on reliable and affordable power rates. There is also community interest in requiring rooftop solar installations for data centers and other large power users to reduce the pressure on the state's hydropower grid and use renewable energy sources, though there is no action on that as of early 2025 (Ramadan& Brownstone, 2024).

Mental Health & Community Well-being

Climate Risks

Climate impacts, like flooding and prolonged smoke and heat events, will profoundly affect the mental health and well-being of communities, in both direct and indirect ways. Other issues, like transit access, housing affordability, and food security, are also important to community well-being.

Mental Health Impacts

Most people in Washington state (68%) are worried about climate change (Yale Program for Climate Communication, 2024). This anxiety is concurrent with above-average levels of mental illness in North Central Washington, and reduced access to mental health care in parts, relative to other parts of the state.

Some of the ways that climate impacts affect mental health include:

- **Air pollution**: Poor air quality is linked to increased anxiety, mental health disorders, self-harm, and suicide (Lu, 2020). This link is especially pronounced in rural communities and especially in relation to prolonged wildfire smoke events (Ma, et al., 2024).
- **Drought**: Increasing drought conditions correlate with an increase in suicide risk (Dzombak, 2022).
- **Extreme Heat**: Rising temperatures are linked to increased rates of anxiety, suicidality, anger, and violence (USDA, 2024). These effects disproportionately impact individuals already struggling with mental health issues. In addition, a significant percentage (10-28%) of heat stroke survivors experience persistent brain damage issues (Bouchama, et al., 2022).
- **Fire:** Extended exposure to medium or heavy wildfire smoke (two weeks or more per year) is linked with symptoms of mental health issues such as anxiety for people of all demographics (Mirabelli et al., 2022).
- **Flooding**: Greater exposure to flooding is associated with long-term mental health issues such as anxiety, depression, and PTSD (Stanke, et al., 2012).

More generally, the following mental health challenges are linked with climate change:

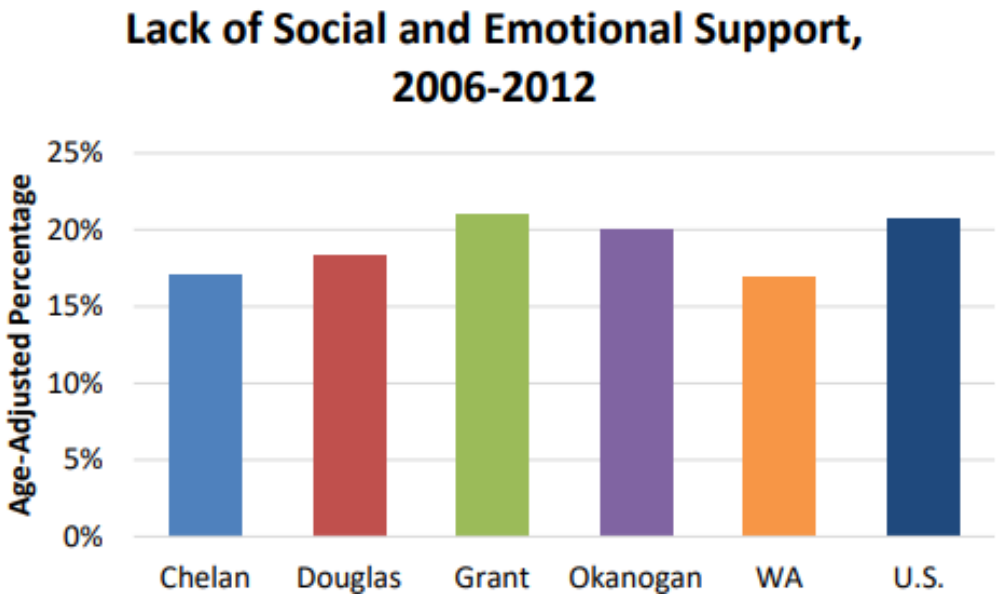
- Aggression and violence;
- Community displacement and migration, which is linked with stress;
- Depression, anxiety, and suicide and suicidal thoughts;
- Eco-anxiety (or eco-grief) or the feeling of anxiety, sorrow, or mourning at the current and projected impacts of climate change;
- Feelings of loss around impact to or loss of personally and culturally significant places, identity, livelihood, and autonomy;
- Immediate and severe trauma when people experience a climate-related disaster;
- Post-traumatic stress disorder (PTSD);
- Strains on social relationships; and

- Substance abuse.

The negative mental health effects of climate change do not impact all people equally. Some of the most impacted communities include low-income communities, outdoors and emergency workers, those with pre-existing physical and mental health conditions, youth, and Native Americans (American Public Health Association, n.d.).

Chelan and Douglas Counties have depression rates of 24.5 and 24%, higher than the national average (Centers for Disease Control and Prevention, 2024). 42% of Chelan County respondents and 43% of Douglas County stated that mental health issues were among the most important "health problems" in their communities, underscoring that this is a prevalent concern.

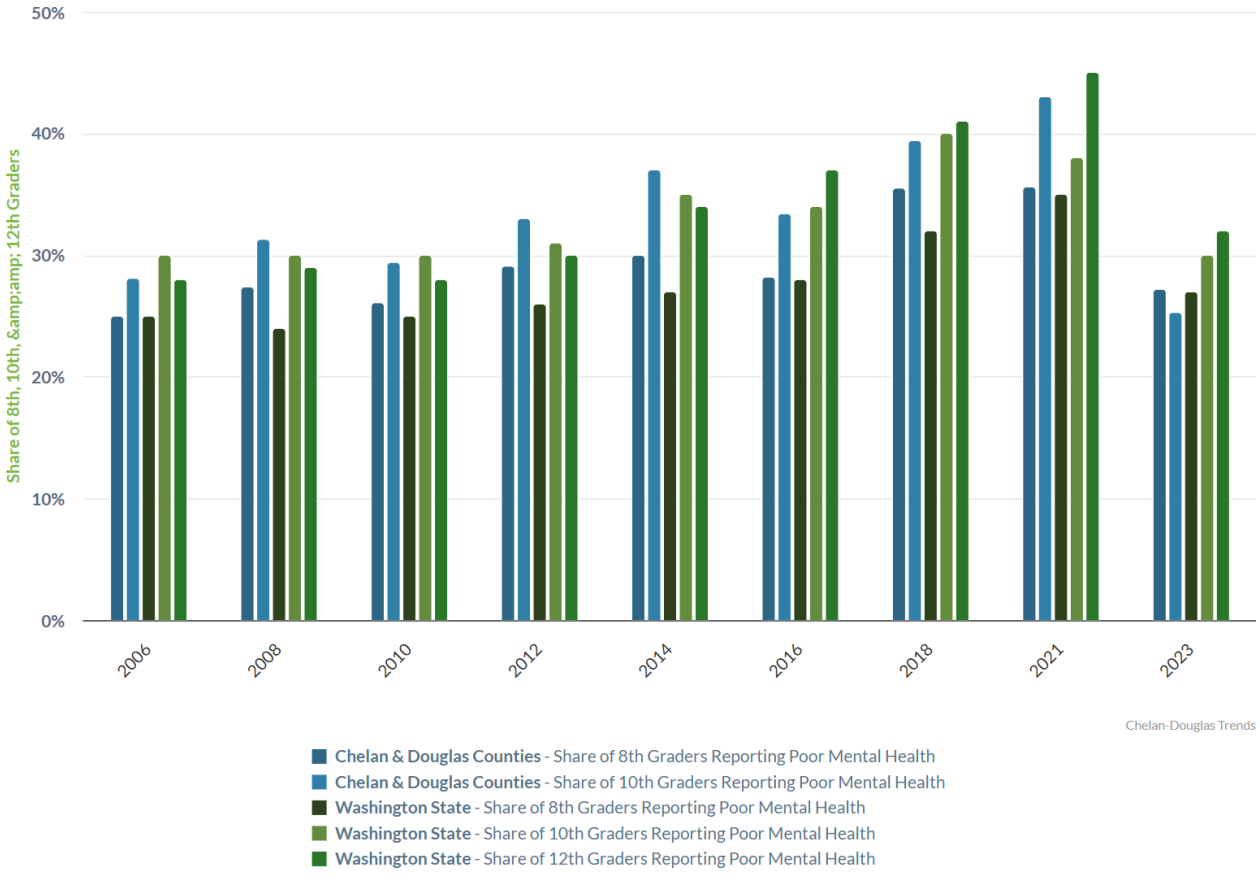
Figure 43: Percent of adults who feel a lack of social and emotional support (Sanderson, et al., 2019)



Chelan and Douglas County each have Post Traumatic Stress Disorder (PTSD) rates of 17.0 and 16.4 for every 100,000 people, respectively (Mental Health America). Moreover, much of the population feels that they are still recovering from the impacts brought on by the COVID-19 pandemic. Residents stated that their mental, spiritual, and physical health, health care system, culture, housing, and community involvement was negatively affected by Covid-19 (OVOF Community Outreach Report, 2022). Despite some recovery, many residents continue to see income loss, endure isolation, and experience stress and anxiety from the impacts brought on by Covid-19 (OVOF Community Outreach Report, 2022). These issues may be exacerbated by climate impacts.

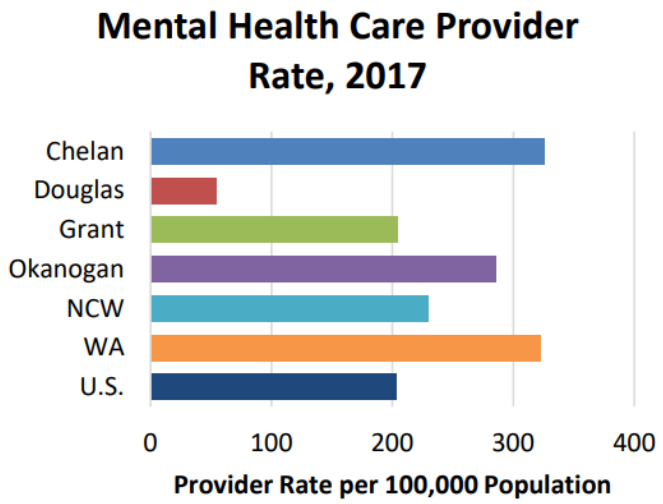
Youth can be particularly vulnerable. Over 27% and 25% of 8th and 10th graders in Chelan and Douglas Counties, respectively, already report feeling sad or hopeless. While this is slightly less than the Washington state average, it is still high and may worsen as climate change worsens (Figure 44).

Figure 44: Share of 8th, 10th, and 12th graders reporting feeling sad or hopeless in Chelan and Douglas Counties when compared to Washington state (Chelan Douglas Trends, n.d.)



Mental health care is crucial in an era of climate change. While Chelan County has about one provider per 300 residents, or about the state average, Douglas County has about one mental health care provider per 1,800 residents, well below the state and country average (Figure 45).

Figure 45: Mental health care provider rate, showing limited mental health care providers in Douglas County. (Sanderson, et al., 2019)



Transportation Access

Another aspect contributing to community well-being in Chelan and Douglas Counties is transportation access. Access to transportation is an integral part of community well-being as it allows residents to travel, have interactions with others, and participate in social events (Reinhard, et. al., 2018).

In rural areas like North Central Washington, many residents rely on personal vehicles to get around, due to long distances and the type of land use mixes. This reliance on personal vehicles can mean high transportation expenses, including vehicle purchase or lease, maintenance, and gas. The Housing and Transportation Index, which factors in both housing and transportation costs, shows that in both counties, households making a regional moderate income spend 60% in Chelan County on combined housing and transportation costs and 62% in Douglas County (Housing and Transportation Affordability Index, 2024). This is well above the suggested 50%. Another issue is that not all residents- such as people with disabilities, with low incomes, and aging residents- have access to personal vehicles.

One intervention is public transit. While difficult to finance, public transportation systems can support economic vitality and encourage alternatives to driving and active lifestyles (Litman, 2023). Additionally, access to public transit in rural areas helps reduce social isolation (Heaps, Abramsohn, & Skillen, 2021). A lack of reliable transportation, on the other hand, can inhibit access to mental healthcare and other supports (Rural Health Information Hub, 2022).

The transit agency Link Transit offers relatively robust transit service for a rural region, including urban routes in Wenatchee and East Wenatchee and intercity routes between, for example, Wenatchee and Leavenworth and Wenatchee and Malaga (Figure 46). Notably, Link Transit offers a zero-fare system which makes it one of the most equitable transit systems in the region. Dail-A-Ride (DART) and LinkPlus provide residents with disabilities and others who cannot use the fixed-route system transportation service. There were over 1.2 million rides on its fixed routes in 2024 (Link Transit).

Residents of Wenatchee and East Wenatchee particularly benefit from high-frequency transit stops (every 15 minutes or less) (Figure 47). These are some of the only cities in Washington outside of the Seattle area with a high-frequency transit route. Despite relatively strong transit services for a rural area, some parts of Chelan and Douglas Counties still face challenges with infrequent or inaccessible transit, limiting mobility for residents in these regions (Front and Centered and the Center for Neighborhood Technology, 2022).

Figure 46: Link Transit offers a relatively large number of both urban and intercity routes (Link Transit,2025)

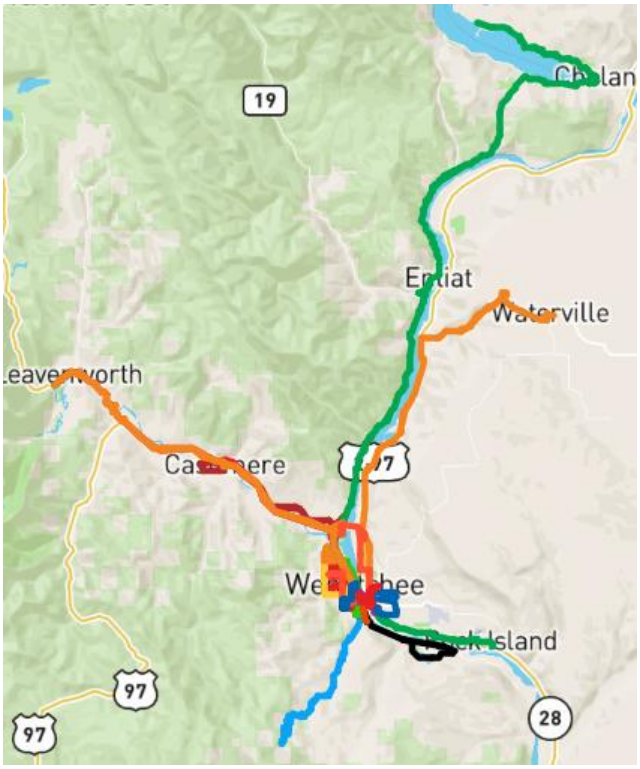
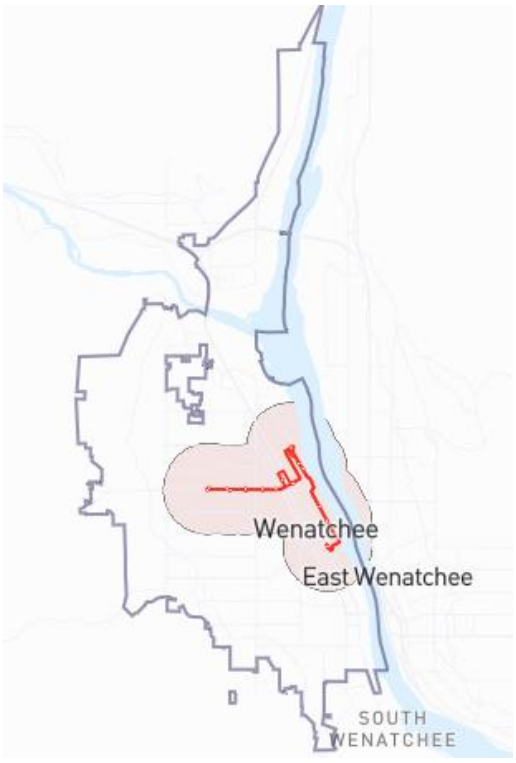


Figure 47: Transit stops in Wenatchee and East Wenatchee with 15-minute headways and a ½-mile buffer, representing high-quality transit zones (Front and Centered and the Center for Neighborhood Technology, 2024)

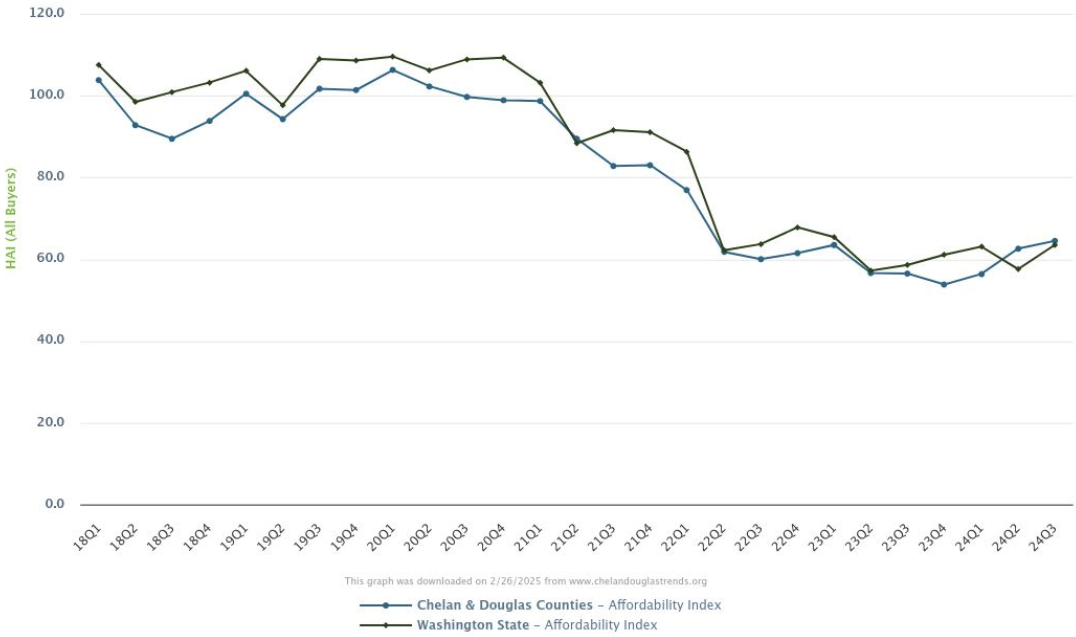


Housing

Affordable quality housing can support community well-being and mental health. Stable, affordable housing alleviates financial stress and improves mental health outcomes by reducing rates of mental disorders and providing safe, healthy living environments (Keene, Cowan, & Baker, 2015). Housing is also critical to economic health, though it is discussed here.

Recent trends (Figure 48) indicate that the overall Housing Affordability Index[16] in the region has declined significantly from 2018 (Jones, 2024). Homeownership is becoming increasingly out of reach for a typical family. This trend underscores a broader affordability crisis, with housing in Chelan and Douglas now less affordable than the Washington state average. Notably, no other metro area in eastern Washington has reached such a low level of affordability (Jones, 2024).

Figure 48: Housing Affordability Index for all buyers from 2018-2024 in Chelan County, Douglas County, and Washington state. The HAI has declined from about 100 in 2018 to about 64 in 2024. A value of 100 or above implies that a household earning the median income can afford a median-priced home. Values less than 100 indicate a level of un-affordability (Chelan-Douglas Trends).



Among the most impacted residents are farmworkers. While housing affordability is a statewide concern for all farmworkers, estimated wages are least compatible with average rents in Chelan and Douglas counties (BERK Consulting, 2022). In Chelan and Douglas counties, farmworkers spend an estimated two-

[16] A measure of housing affordability for a typical family. An HAI of 100 means a median-income family can afford a 100% of a median-priced home; above 100 indicates greater affordability, while below 100 means the home is less affordable without additional support (Jones, 2024).

thirds of their income on housing. In Chelan County only 12% of houses for sale, and 7% in Douglas County, are within the affordable range of the average farmworker salary.

Rising housing costs are likely a factor in homelessness. In the 2025 Point in Time Count for Chelan County, outreach teams surveyed 104 people experiencing homelessness in the two counties, meaning they were living outside or in a vehicle or RV or other (Chelan County, 2025). The 2025 number is down 37 people from 2024. Another 405 people were recorded staying in emergency shelters – including the RV Safe Parks, transitional housing programs or in a hotel through an emergency hotel/motel voucher program. This sheltered number is up 64 people from last year. Those experiencing homelessness- especially those unsheltered- are especially vulnerable to storms, heat, and wildfire smoke, compounding their challenges (Figure 49).

Figure 49: Those experiencing homelessness are especially vulnerable to climate change impacts due to lack of adequate shelter (Douglas County, 2024)

In addition to the worsening affordability crisis, the quality of the housing stock presents another concern. Around half of all homes in Chelan (59%) and Douglas (46%) counties were built before 1980 (bolded in Table 12). Older homes tend to be less energy efficient and may require costly health and safety upgrades in addition to typical energy efficiency investments like insulation and windows. They also are less likely to have central air conditioning or air filters, notable in the context of the projected increase in extreme heat and wildfire smoke events.

Table 12: Household stock by year built in Chelan and Douglas County (U.S. Census Bureau's American Community Survey (ACS) 2019-2023 5-year estimates)

Built Year	Chelan County: Number of Houses	Chelan County: Percent	Douglas County: Number of Houses	Douglas County: Percent
2020 or later	448	1%	196	1%

Built Year	Chelan County: Number of Houses	Chelan County: Percent	Douglas County: Number of Houses	Douglas County: Percent
2010 to 2019	3,471	9%	1,954	11%
2000 to 2009	6,010	16%	3,267	18%
1990 to 1999	5,740	15%	2,643	15%
1980 to 1989	4,334	11%	1,446	8%
1970 to 1979	4,628	12%	3,123	18%
1960 to 1969	2,912	8%	1,293	7%
1950 to 1959	3,201	8%	1,693	10%
1940 to 1949	2,363	6%	671	4%
1939 or earlier	5,022	13%	1,435	8%

Food Insecurity

Climate change poses can affect agriculture and food distribution by altering growing seasons, causing water shortages, and increasing the frequency of extreme events such as wildfires and floods (United States Department of Agriculture, n.d.). One critical impact to community well-being is the relationship between rising temperatures and food insecurity. Research shows that for every 1°C increase in temperature, both severe and moderate-to-severe food insecurity rates rise accordingly (Table 13). This indicates that not only is food insecurity becoming more common as temperatures increase, but the severity of its effects is also intensifying (Shouro & Robinson, 2022).

Table 13: Global increase in food insecurity rates for every 1°C rise in temperature.

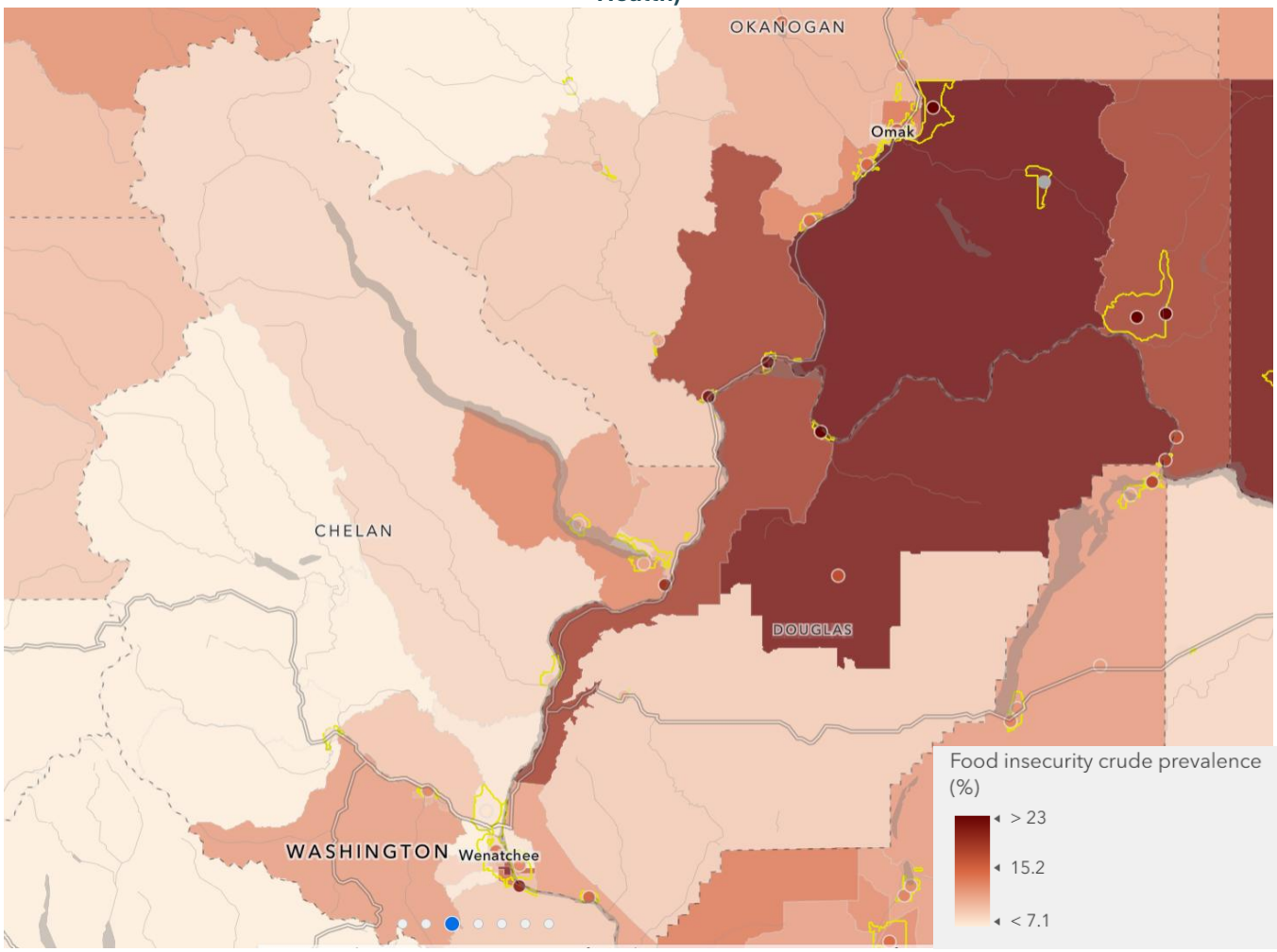
Year	Increase in Temperature	Severe Food Insecurity (%)	Moderate to Severe Food Insecurity (%)
2014	1°C	1.4	1.58
2019	1°C	1.6	2.14

Food-insecure people report significantly higher levels of depression, anxiety, and stress (Drewnowski, et al., 2021). Given that rural populations consistently experience elevated rates of food insecurity compared to the general population (Shanks, et al., 2022), it is reasonable to infer that mental health and community well-being issues that are linked to food insecurity are amplified in these areas.

In Chelan and Douglas Counties, food insecurity rates exceed the state average of 11.5%, with Chelan at 13% and Douglas at 12.5% (Feeding America, 2022). Notably, in parts of Wenatchee and in northern Douglas County, food insecurity rates exceed 20% (Figure 50). Residents themselves note that there are existing food disparities when it comes to access and assistance (OVOF, 2022).

In addition to higher food insecurity rates, another issue is lack of geographic access to food. Many low-income census tracts in the region face limited access to grocery stores—defined as being located more than one mile away in urban areas and more than ten miles away in rural areas (U.S. Department of Agriculture, 2024). Furthermore, some existing grocery stores do not always carry affordable or fresh produce or culturally relevant foods.

Figure 50: Map showing food insecurity rates in North Central Washington (CDC PLACES: Local Data for Better Health)



Adaptive Capacity

There are many positive efforts underway in Chelan and Douglas Counties to enhance mental health and community well-being in the context of climate change. These efforts can help residents, especially the most vulnerable ones, deal with the consequences to individuals and communities.

Mental Health

The Chelan Douglas Health District (CDHD) manages a website, Wenatchee Valley Resources (https://www.cdhd.wa.gov/health/local-resources), which intends to serve as an umbrella for mental health and other community services in the region. Other key actors in the region include NAMI North Central WA, which serves residents with free mental health support, online groups, resources and education. We were unable to verify any mental health services specific to helping residents cope with climate change. This is an area for improving the adaptive capacity in the region.

Figure 51 shows some key take-ways for what mental health leaders can do and tips to support communities, from a recent report “Mental Health and Our Changing Climate”.

Figure 51: Key take-aways for what mental health leaders can do and tips to support communities in the context of climate change (Clayton, 2017)

KEY TAKEAWAYS:
What Mental Health Leaders Can Do

As trusted messengers, mental health leaders have the opportunity to help make the link between health and climate. Here are some ideas to try:

- Become a climate-literate professional and stay up-to-date with current climate change news and communications best practices.
- Engage other mental health professionals by facilitating conversations and workshops that allow your colleagues to be more effective in inspiring action.
- Be vocal, model leaders within your community by getting involved locally to create support for climate solutions.
- Support national and international solutions by publicly sharing your expertise to influence the media, health leaders, and policymakers.

KEY TAKEAWAYS:
Tips to Support Communities

Community planners, policymakers, and additional leaders may have experience preparing for the physical impacts of climate change, but it is also important to be well-equipped for the potential mental health impacts. Here are some tips to help with preparing and responding to acute and gradual change:

1. Assess and expand the community mental health infrastructure.
2. Facilitate social cohesion through community design.
3. Train the people who will serve the community during a disaster.
4. Provide clear and frequent information.
5. Reduce disparities.
6. Pay special attention to vulnerable populations.
7. Develop trusted and action-focused warning systems.
8. Provide a fast response.
9. Have a post-disaster plan.
10. Ensure equitable and transparent distribution of resources.
11. Engage community members.
12. Increase cooperation and social cohesion.
13. Provide opportunities for meaningful action.

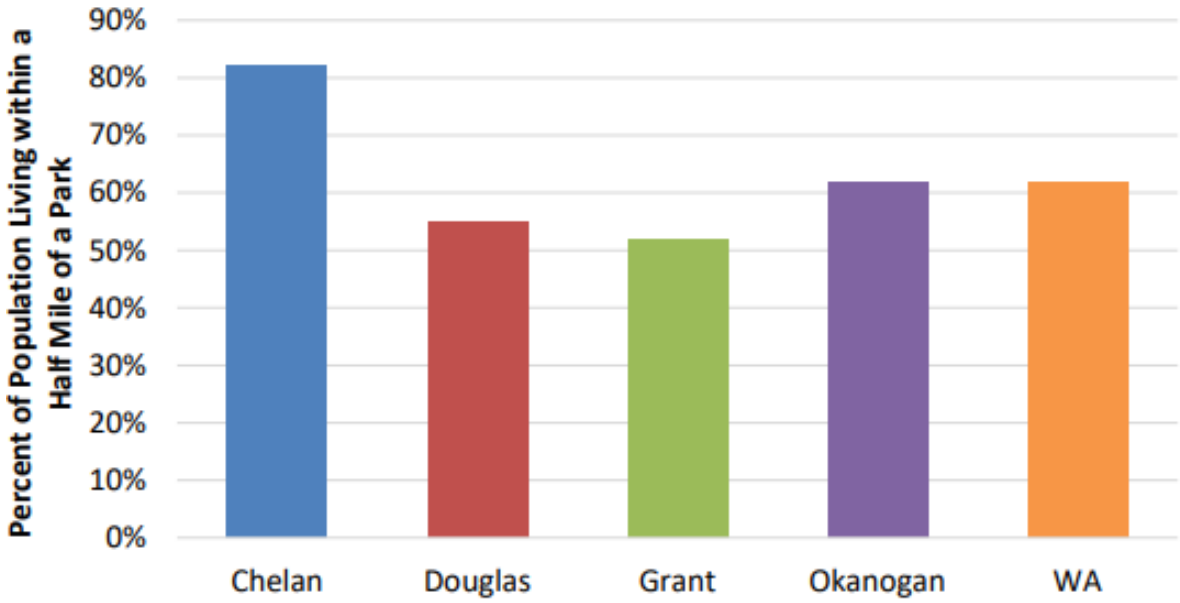
Parks, Open Spaces, and Tree Canopy

Parks, open spaces, and tree canopy mitigate impacts brought on by climate change, by retaining and filtering runoff during extreme flooding and precipitation events, reducing the heat island effect, and sequestering greenhouse gas and pollutants from the air (Schottland, 2019). Parks and open spaces also provide numerous mental health benefits. Neighborhoods with higher access to green spaces tend to have

lower rates of mental health and walks through parks or natural recreation areas have been shown to reduce anxiety and depression in at-risk populations (White, Elliott, & Grellier, 2021).

Chelan and Douglas Counties both have a good amount of park access overall. 80% of Chelan residents and 50% of Douglas residents live within ½ mile of a park (Figure 52). Each of the Public Utilities District in Chelan and Douglas Counties stewards 17 parks and more than 700 acres. Meanwhile, there are state parks in the region (e.g. Wenatchee Confluence State Park) as well as natural areas (e.g. Horan Natural Area). There are also outdoor recreation opportunities that offer some relief from heat, like shaded, higher elevation trails such as Squilchuk, for those who can access them. The Chelan-Douglas Land Trust is working to protect acres in the foothills of the Wenatchee Valley from development and for public access.

Figure 52: Percentage of the population living within 1/2 miles of a park as of 2015 (Sanderson, et al., 2019)

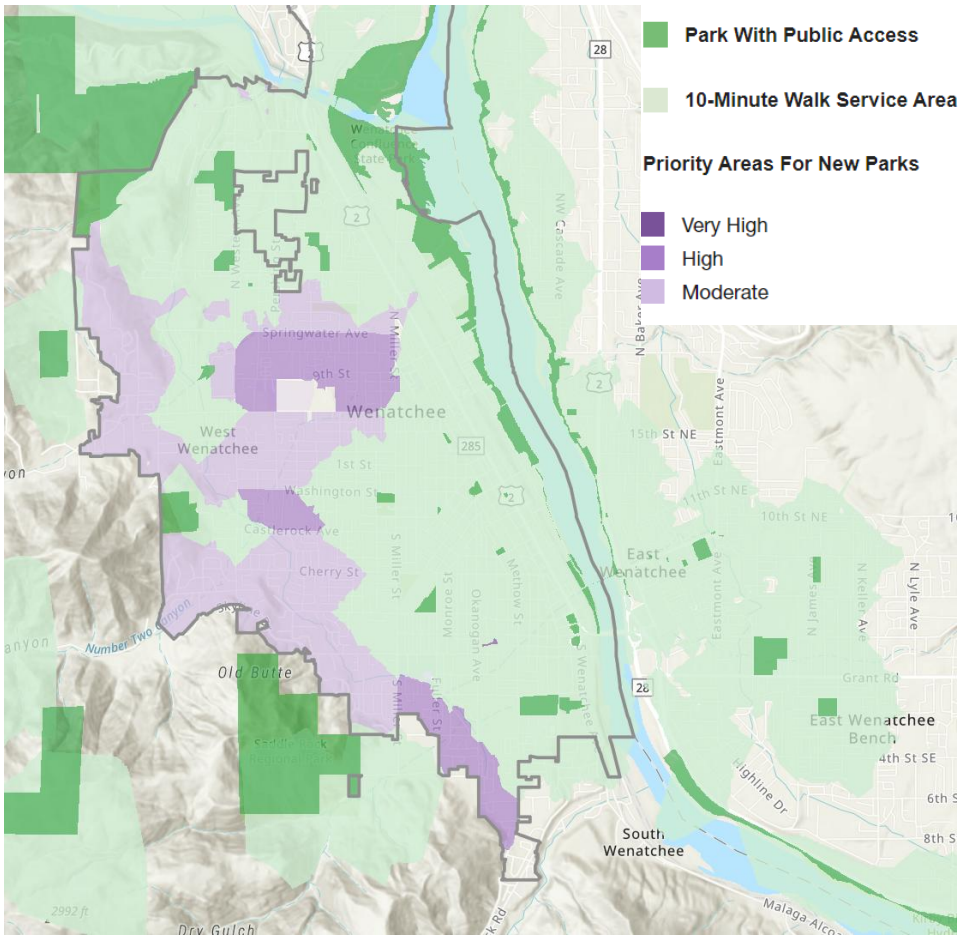


Access to green space is strongly linked to improved mental health outcomes and reduced psychological distress (Vegaraju & Solmaz, 2024). In the largest city in the region, the City of Wenatchee manages about 17 public parks and recreation areas spanning over 1,600 acres. Most Wenatchee residents express positive opinions about these parks (City of Wenatchee, 2023), suggesting they likely experience mental health benefits from their park access.

For a small city, Wenatchee has a good proportion of park land, walkable or bikable from many places throughout the city (Wenatchee City Parks Map). The Apple Capital Loop Trail is well loved, and Wenatchee residents have good access to the River. Chelan PUD just completed some upgrades along the Loop Trail, including a splash pad , improved trails, and more trees. 82% of residents in Wenatchee live within a 10-minute walk of a park, which is a high number relative to other parts of Washington State (Trust for Public Land, n.d.). There are many trails just outside the city limits as well.

However, there are some disparities in park access even in a park-rich city like Wenatchee. The Trust for Public Land (TPL) estimates that only 65% of seniors live within a 10-minute walk. TPL identified areas of West Wenatchee as priority areas for new parks (Figure 53).

Figure 53: Areas in purple were identified as priority areas for new parks in Wenatchee (Trust for Public Land, n.d.).



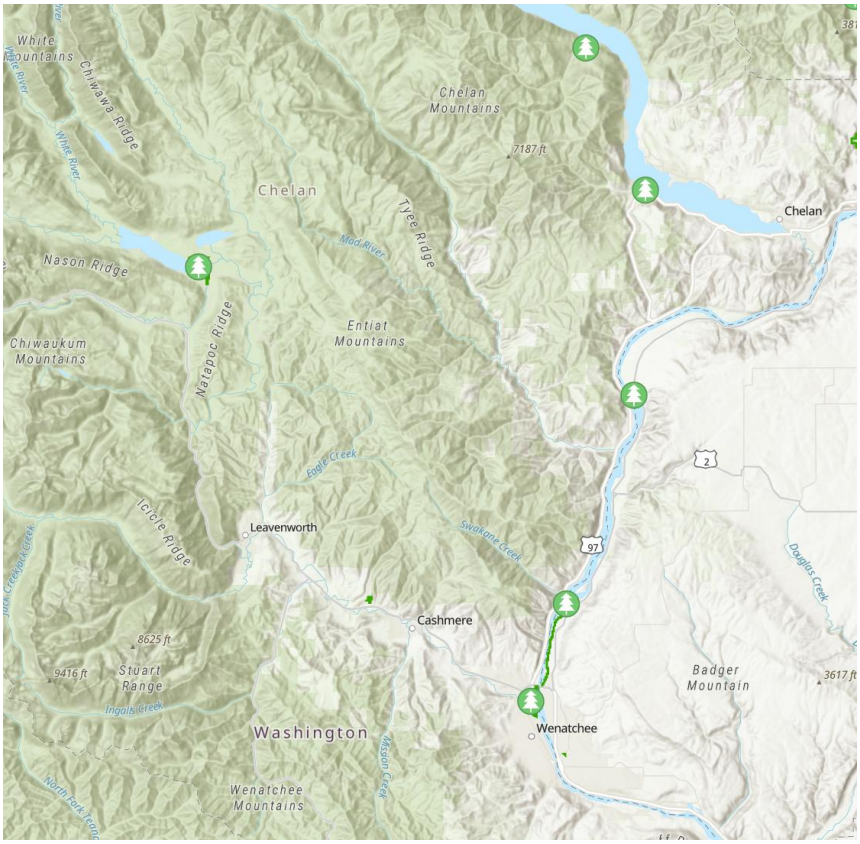
Some residents may live in Chelan and Doulas County more rural counties, because of close proximity to state or federal forest lands for recreation. For many, it is a big amenity of more rural living. That said, some residents face barriers in accessing parks and green spaces. This includes people who do not have a car or do not drive. Additionally, financial barriers often restrict participation in popular regional activities like skiing and climbing, which have high costs and are less accessible to lower-income residents.

The North Central Washington Equity Alliance and TREAD are addressing some access disparities through their *Belonging in the Outdoors* initiative. It outlines 17 actions (Table 14) to improve park and natural space access for people with disabilities and communities of color (North Central Washington Equity Alliance & TREAD, 2023). Wenatchee Outdoors offers free guidebook maps and information for local trails that helps with accessibility (www.wenatcheeoutdoors.org) and Team Naturaleza (https://www.teamnaturaleza.org/) and Chelan-Douglas Land Trust are leading Spanish language hikes and other activities. Beyond local organizations, Washington State is investing in infrastructure improvements to state parks to make them more accessible for people with physical disabilities (Figure 54).

Table 14: Examples of Belonging in the Outdoors initiative action steps to help make outdoor spaces more accessible (North Central Washington Equity Alliance & TREAD, 2023)

Action	Description	Potential leads
Model Trail	Build a "model" trail for people with disabilities to demonstrate barrier-free design.	City of Rock Island, Chelan-Douglas Land Trust, Chelan County PUD, City of Wenatchee, State Parks
Wheelchair and Walking Routes	Conduct audits of sidewalks and crossings to assess accessibility; add pathways, sidewalks, and crossing signals for walkability.	City of Wenatchee, City of East Wenatchee, Chelan-Douglas Coalition for Health Improvement, NCW Equity Alliance
Inventory of Trails and Outdoor Facilities	Identify accessibility barriers on trails and outdoor facilities.	Cities, Chelan-Douglas Land Trust, Chelan County PUD, TREAD, State Parks
Inclusive Planning for Trails and Outdoor Facilities	Center marginalized groups in outdoor planning; reduce barriers with accessible designs, parking, and amenities.	Chelan-Douglas Transportation Council, Chelan-Douglas Land Trust, TREAD, Evergreen Mountain Bike Alliance, State Parks

Figure 54: Map showing state parks with ADA accessible options in the region Washington State Parks).



Besides parks and open spaces, tree canopy also provides mental health and community benefits. As a local leader in tree planting and maintenance, Wenatchee Valley College (WVC) has the goal of attaining and maintaining Tree Campus USA recognition. On the WVC Wenatchee campus alone, there are over 470 trees (https://storymaps.arcgis.com/stories/3a0100970c974ec9bab4e5a2d2e455a0). Over the last 7 years, WVC has done tree planting, tree dedications, campus tree tours, poetry readings, carbon measurement workshops, and collecting Ginkgo leaves as part of a community science event. As of 2025, WVC students are in the process of measuring the pounds of carbon sequestered in each tree using forester tape and clinometers. Former Sustainability Coordinator, Joan Qazi, notes that "our trees on campus help us adapt to a changing climate in several ways, including giving us shade on those extreme heat days, providing a cooling affect. They help filter rainwater in flood events to protect our stormwater management. We continue to focus on goals of mitigating for and recovering from drought periods and water stress in our trees." There are also educational benefits, as studies show improvements in student focus and creative performance after spending time with trees or in green spaces (Wolf & Flora, 2010).

Figure 55: Wenatchee Main Campus Interactive Tree Map, with blue and red dots showing trees (Wenatchee Valley College)

Transportation Investments

The region is making some transportation investments that will help adaptive capacity. One is that Link Transit has extended its transportation offerings through the Transportation Reimbursement Intercommunity Program (TRIP). This innovative volunteer driver program serves residents who fall outside of regular Link Transit routes, but do not own a vehicle, are unable to drive, or need assistance traveling to essential appointments (Link Transit, 2023). DART stands for Dial a Ride Transportation and adds public transit options beyond the routes in Leavenworth and Chelan via reservation, which can become a regular booking. By filling service gaps, TRIP helps to meet the transportation needs of underserved community members. In 2024, Link Transit received a $4.5 million federal grant to achieve 100 percent electrification of its urban fixed-route buses, which will enable it to reduce greenhouse emissions and pollution.

Some communities are also improving bicycling and walking options. For example, in Wenatchee, the City has made recent infrastructure improvements to enhance walking and bicycling. For example, along First Street installed curb cuts at intersections to enable safer use by people using wheelchairs. A coalition of leaders is making safety and mobility improvements to the sidewalks and to the general streetscape along North Wenatchee Avenue (SR 285), an urban street corridor (City of Wenatchee, 2025). These improvements include tree plantings, which have the benefit of providing shade and contributing to improved mental health outcomes. In addition to City-led efforts, the organization Sustainable Northcentral Washington (SNCW) is launching a bike repair co-op with classes and refurbished bike giveaways to also increase the number and safety of bike riders.

Chelan and Douglas County residents also see greater connectivity to the rest of the state and to larger metropolitan areas such as Seattle, Everett and Spokane through bus services and once a day Amtrak Empire Builder service (Rail Passengers Association, 2023). See Table 15.

Table 15: Population served within 25- and 50-mile distances of Amtrak Empire Builder stops (Rail Passengers Association, 2023)

Population served by Amtrak	Wenatchee	Leavenworth
Within 25 miles	110,226	87,317
Within 50 miles	209,308	179,328

Housing, Food and Other Services

Several organizations in Chelan and Douglas County aim to address the housing crisis and enhance community well-being. The Chelan Valley Housing Trust builds attainable homes for individuals earning 80% to 120% of the area median income, improving housing stability and affordability for those who have faced housing discrimination (Chelan Valley Housing Trust, 2023). Similarly, the Housing Authority of Chelan County and the City of Wenatchee offers multifamily housing for low-income residents, seniors, disabled individuals, veterans, and agricultural workers (Housing Authority of Chelan County & the City of Wenatchee, 2024). Additionally, homeless shelters and services in cities like Wenatchee, Cashmere, East Wenatchee, and Palisades provide critical support to those in need, further strengthening community well-being. We were unable to verify the energy efficiency and climate resilience of these buildings.

Other community-based and non-profit organizations located throughout Chelan and Douglas Counties play a critical role in supporting residents facing food insecurity (Chelan-Douglas Community Action Council, 2024). For example, Lake Chelan Food Bank, which offers services in English and Spanish, reports serving 120 families weekly with about 10,000 pounds of food. This assistance can provide assistance if extreme events disrupts food supply chains that affect food insecurity.

Some of the service providers in the region that help build adaptive capacity are noted below:

SELECT SERVICE PROVIDERS IN CHELAN COUNTY

- Cashmere Food Pantry
- Chelan-Douglas Community Action Council-Community Market
- Upper Valley MEND's Community Cupboard
- Dryden Community Church
- Entiat Valley Community Services
- Lake Chelan Food Bank
- Lighthouse Christian Ministries
- The Plain Pantry
- SAGE
- Salvation Army
- YWCA
- Wenatchee Rescue Mission

SELECT SERVICE PROVIDERS IN DOUGLAS COUNTY

- Columbia Valley Community Health
- Mansfield Food Pantry
- Rock Island Food Pantry
- Waterville Food Pantry

Programs like the Chelan County Behavioral Health Unit, which collaborates with law enforcement to respond to crises, have built a strong reputation for serving Chelan and Douglas Counties. Since its inception in 2021, the program has secured over $1 million in grant funding, supporting its mission to enhance community well-being and provide critical services during times of need (Taylor, 2023).

Conclusion: Informing and Inspiring Action

Action Resources and Ideas

One goal of this CVA is to inform and spur actions by a wide range of actors, including businesses and industries, emergency managers, governments, health departments, health care providers, and social service organizations.

In Figure 56, the column on the far right identifies some of the common interventions and strategies governmental, non-profit, and other actors can take to address the health impacts from climate change in the region. These include early warning and preparedness, prevention or reduction of disease, illness and injury, community engagement, education and awareness raising, and adoption and integration (National Institute of Environmental Health Sciences, n.d.).

Figure 56: Interventions and strategies to address health impacts from climate change (National Institute of Environmental Health Sciences)

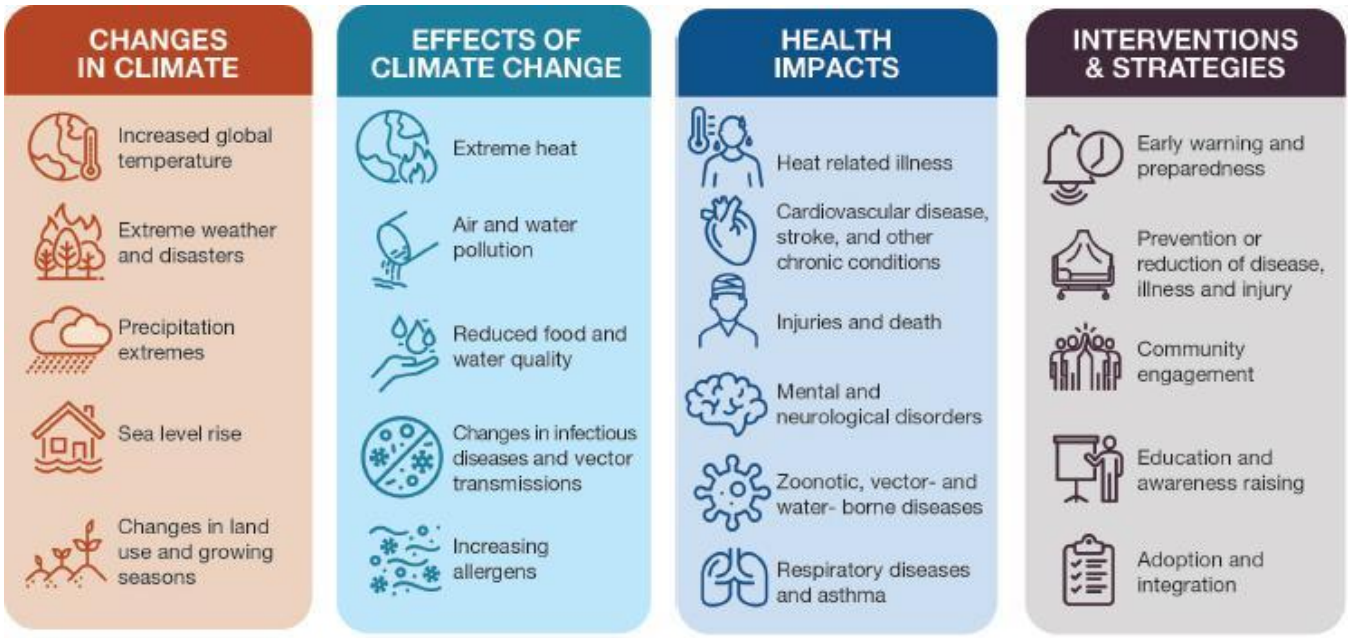


Table 16 identifies an example action or more for each of the four health focus areas addressed in this CVA. In addition, a local example in each focus area is highlighted, and discussed in more detail on the pages that follow. The intent is that the example actions may serve as inspirations to health actors and other leaders in Chelan and Douglas Counties.[17] The highlighted local actions offer some insight into positive adaptive capacity measures underway in region, which can be strengthened and expanded.

[17] See additional example actions and case studies for climate change adaptation from the American Public Health Association, Adaptation in Action (2018) and the U.S. Environmental Protection Agency: Searchable Case Studies for Climate Change Adaptation | US EPA.

Table 16: Example actions by health focus areas

Focus area	Example action
Public Health and Safety	Educate and support small forest property owners to adopt land management practices that reduce wildfire risk. Encourage or require defensible space and resilient structures. Restrict new development in high risk wildfire areas. (USDA and USFS, Fire Adapted Communities) Detect and communicate heat wave risks by using heat wave warning systems, use advisories to communicate where people can go to cool off, open cooling centers for the public to gather for relief from the heat, and provide easy access to public drinking fountains and swimming pools. (American Public Health Association, Adaptation in Action, 2018) Assess air quality, conduct surveillance and gather data on chronic diseases with particular attention to vulnerable populations, engage with local officials and planners on long-term community design solutions that mitigate air pollution, and partner with local organizations and agencies to educate residents about air quality. (American Public Health Association, Adaptation in Action, 2018) *Local action: Wildfire risk reduction (Chumstick Wildfire Stewardship Coalition)*
Physical Health	Collaborate with health insurers to provide in-home asthma education and home health and energy efficiency retrofits, including the installation of air filters, for households with high asthma rates and hospital visits. (Green and Healthy Homes Initiative's Asthma Program) *Local action: Addressing pediatric asthma Emergency Room visits (Confluence Health in Wenatchee)*
Economic Health	Support programs to help low-income residents adopt energy efficiency measures. Support climate-impacted business, such as tourism and agriculture, and workers in developing adaptation strategies and alternative income streams. *Local action: Energy and weatherization assistance programs (Chelan-Douglas Community Action Council and partners)*
Mental Health & Community Well-Being	Collaborate with transportation, planning, parks and recreation agencies and schools to increase opportunities for safe active transportation, especially for children and youth, including Safe Routes to School, walking and bicycling programs, Complete Streets, traffic calming and speed reduction measures like speed bumps, and signage, lighting and shading on sidewalks and bike paths. (Environmental Protection Agency, Climate Adaptation) Collaborate with parks, planning, and community-based organizations to expand tree canopy, urban greening, and park access and programming, especially for youth and children. (Environmental Protection Agency, Climate Adaptation) *Local action: Wenatchee Valley College Tree Planting and Maintenance*

EXAMPLE PUBLIC HEALTH & SAFETY ACTION

Wildfire Risk Reduction (Chumstick Wildfire Stewardship Coalition)

The Chumstick Wildfire Stewardship Coalition has been integral to the fire risk management and adaptation process in the greater Leavenworth, Washington area for the past twelve years. The vision of the Coalition is "a resilient community living with wildfire." The CWSC engages in collaboration, education and outreach, particularly to small private forest owners (50-300 acres) to help them actively manage their lands. Their efforts help reduce wildfire risk to everyone in the region.

The Coalition's main strategies are:

1. **Accelerate the pace and scale of treatments,** with a special emphasis on working with residents and landowners in Chelan County Fire District 3.
2. **Protect communities and values at high risk from wildfire**, via educational workshops and town meetings, along with home and landscape assessments for fire risk.
3. **Promote rural economic development and use of restoration by-products**, by collaborating with foresters, fuels removal contractors, and industry on on alternative uses for forest products.

About image: Fire District #3 Tree Chipping in Icicle Canyon near Leavenworth. From https://www.chumstickcoalition.org/

EXAMPLE PHYSICAL HEALTH ACTION

Addressing Pediatric Asthma Emergency Room Visits (Confluence Health Hospital in Wenatchee)

Staff members at Confluence Health Hospital in Wenatchee, including Dr. Bindu Nayak, have been analyzing asthma rates and promoting action to address disparities in wildfire smoke impacts. As discussed in the Physical Health section, Confluence Health Hospital researchers found that children with asthma who have Medicaid as their medical coverage are the most impacted by wildfire smoke, and are most likely to go to the Emergency Room during smoke events. This is true despite their higher-than-average participation in asthma care plans.

Currently, Medicaid does not cover the costs of air purifiers. Thus, Confluence Health Hospital researchers are advocating for Medicaid to cover the cost of air purifiers for individuals with asthma. They have presented to the Department of Ecology at a Listening Session and proposed a resolution for the Washington State Medical Association to support Medicaid coverage for in-home visits for patients with asthma and any durable medical equipment interventions, such as air purifiers.

EXAMPLE ECONOMIC HEALTH ACTION

Energy Assistance and Weatherization Programs (Chelan-Douglas Community Action Council and partners)

The Chelan-Douglas Community Action Council or CDCAC (partnering with Chelan County PUD, Douglas County PUD, Cascade Natural Gas, Washington State Department of Energy, Washington State Department of Commerce and other essential organizations) manages programs that assist low-income and other eligible residents (e.g. those with disabilities) with the economic hardships of heating and cooling their homes in a changing climate.

- The **Energy Assistance Program** maintains power and heat for households by helping them pay their heating bills, whether it's electricity, gas, oil, propane, wood, or wood pellets.
- The **Weatherization** program helps residents to add insulation to the attic, heating ducts, crawl spaces, sidewalls, repair or replace the furnace and/or water heater, repair damaged windows and doors, add weather stripping, and more. Weatherization reduces energy consumption and lowers utility bills while keeping homes warmer in the winter and cooler in the summer.
- CDCAC also provides **air conditioners or air purifiers** to eligible residents.

About Chelan-Douglas Community Action Council: *Front Page - CDCAC*

Source of image: Washington Department of Commerce, https://www.commerce.wa.gov/weatherization/

EXAMPLE MENTAL HEALTH & COMMUNITY WELL-BEING ACTION

Tree Planting and Maintenance (Wenatchee Valley College)

Tree canopy provides a wide range of mental health and community benefits as well as positive environmental impacts. As a local leader in tree planting and maintenance, Wenatchee Valley College (WVC) has the goal of attaining and maintaining Tree Campus USA recognition. On the WVC Wenatchee campus alone, there are over 460 trees. Over the last 7 years, WVC has done tree planting, tree dedications, campus tree tours, poetry readings, carbon measurement workshops, and collecting Ginkgo leaves as part of a community science event.

As of 2025, WVC students are in the process of measuring the pounds of carbon sequestered in each tree using forester tape and clinometers. The former Sustainability Coordinator, Joan Qazi, notes that "our trees on campus help us adapt to a changing climate in several ways, including giving us shade on those extreme heat days, providing a cooling affect. They help filter rainwater in flood events to protect our stormwater management. We continue to focus on goals of mitigating for and recovering from drought periods and water stress in our trees."

There are also educational benefits, as studies show improvements in student focus and creative performance after spending time with trees or in green spaces (Wolf & Flora, 2010).

Image https://www.wvc.edu/about/wenatchee-campus/

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Appendix A: Climate Impacts Summary

This summary examines past trends and future projections to outline how climate and associated hazards will impact Douglas and Chelan Counties presently and in the future. The purpose of the climate impacts summary is to identify historical and projected climate impacts to support the findings of the NCWA health-focused vulnerability assessment. By considering future climate changes, the assessment will be better equipped to analyze the region's vulnerability to these impacts. Without substantial reductions in greenhouse gas emissions regionally and globally, the two counties are expected to face the following impacts, highlighted in brief below and discussed in detail on the following pages.

Icon	Climate Impacts – 2050 and beyond
	**Extreme heat:** Warmer year-round temperatures, including higher maximum summer temperatures and more frequent severe heat waves.
	**Drought:** Decrease in summertime rainfall, with associated impacts to farming/food production and natural resources.
	**Heavy winter rainfall (and less snow):** Winter rainfall is projected to increase in frequency and intensity, increasing the risk of flooding in certain places. This is accompanied by a projected decrease in snowpack.
	**Streamflow change**: Precipitation changes will lead to heavier winter flow and reduced summer flow. Increased streamflow temperatures are also expected. These changes will impact fish and water supply for humans.
	**Wildfires and Smoke:** Higher risks of wildfires and increased wildfire smoke.

Climate Change Trends and Projections in Douglas and Chelan Counties

Douglas County and Chelan County, located in North Central Washington state, are already experiencing significant impacts from climate change. These impacts are expected to intensify in the coming years, under the Representative Concentration Pathway (RCP) 8.5 scenario. Key impacts, which will be detailed in subsequent sections, are summarized below.

- Douglas and Chelan Counties have warmed up by approximately 2.5°F and 2.3°F, respectively, from 1895 to 2024. Projected average daily maximum temperatures are expected to increase by 9.2°F and 9.5°F, respectively, by 2090 (U.S. Climate Resilience Toolkit Climate Explorer, 2023).

- East of the Cascades, winter rainfall is expected to increase by 6.3% by 2050, and 9.9% by 2080, increasing the risk of landslides (Rogers & Mauger, 2021).
- Summer rainfall east of the Cascades is projected to decline by 10.3% by 2050 and 13.7% by 2080 (U.S. Climate Resilience Toolkit Climate Explorer, 2023). These drier summers, combined with reduced snowpack, will likely increase drought levels and alter streamflow and river temperatures.
- An increase in wildfire risk and wildfire smoke, with a projected increase of 10 high fire danger days (Abatzoglou & Brown, 2012).

Climate Variability

The climate of Washington state, including Chelan and Douglas Counties, is shaped by natural cycles such as El Niño, La Niña, and the Pacific Decadal Oscillation. These cycles can strongly influence the annual climates of the counties. For example, during an El Niño year, winters tend to be warmer and drier, whereas La Niña years typically bring cooler and wetter winters.

Understanding human-caused climate change within the context of these natural cycles is crucial. Year-to-year weather patterns can be unpredictable, influenced by both natural variability and human activities. Despite these natural fluctuations, there are clear signs that the region's climate is undergoing significant changes in various aspects.

Climate Scenarios and Models

This climate vulnerability assessment relies on climate change scenarios known as Representative Concentration Pathways (RCPs), which depict a range of greenhouse gas (GHG) concentration trajectories. These pathways cover a broad spectrum of potential futures, influenced by factors such as land use, technological advancements, economic activities, energy sources, and human behaviors.

For this assessment, we utilize the RCP8.5 scenario (“business as usual”). This scenario represents a high-emission trajectory, closely aligning with historical trends in GHG emissions. By using RCP8.5, we ensure that informed adaptation policies are robust enough to prepare for the severe potential impacts of climate change. This approach will help the county effectively protect its communities, infrastructure, and natural resources against the most extreme climate risks. Moreover, the approach follows that of other assessments in Washington state.

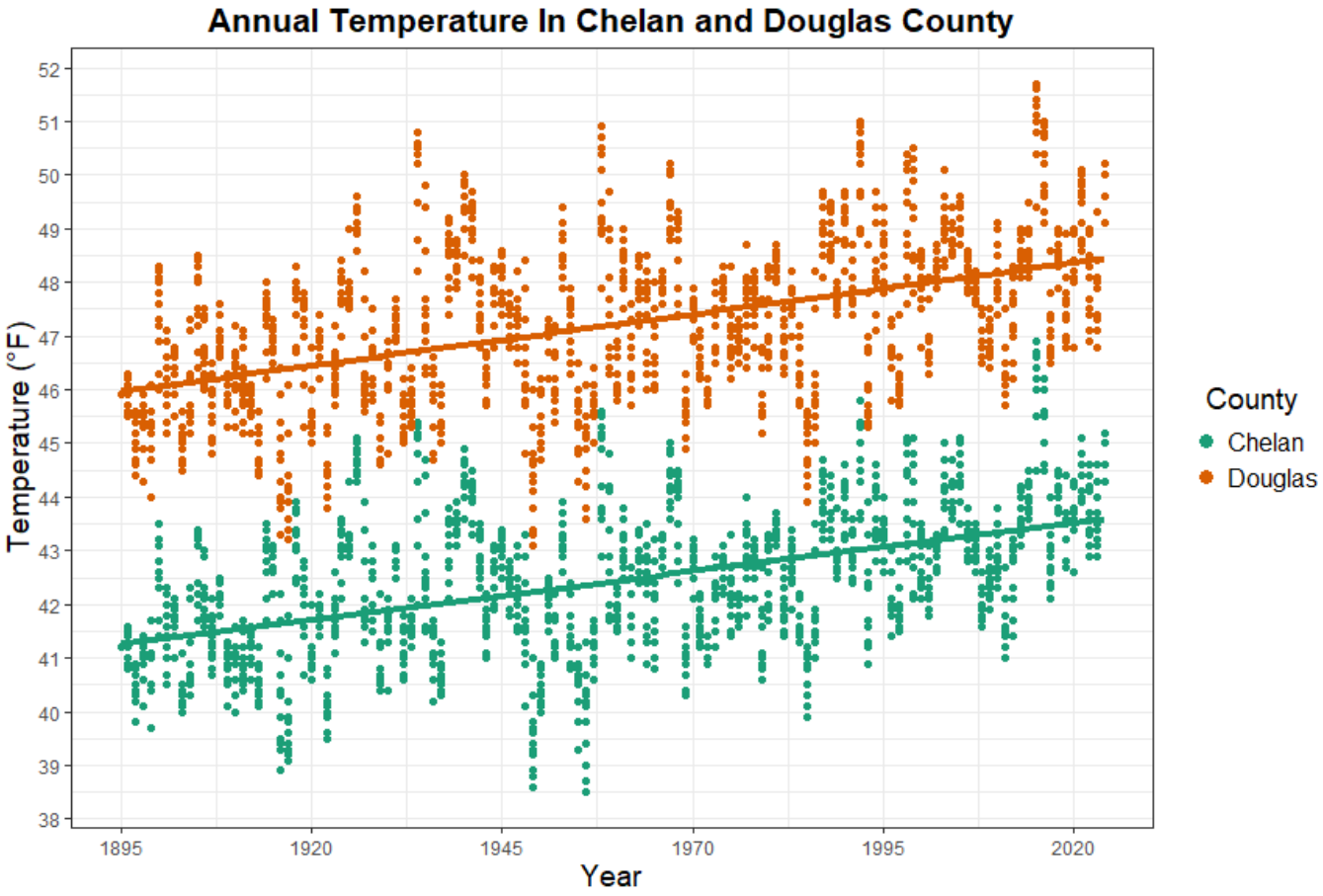
Climate Trends and Projections

The sections below provide an overview of historical climate trends and future projections.

Temperature

From 1895 to 2024, average annual temperatures in Douglas and Chelan Counties have increased by about 2.5°F and 2.3°F, respectively (Figure 1; NOAA, National Centers for Environmental Information).

Figure 1. Average monthly temperature between 1899-2024 in Douglas and Chelan Counties, WA.



Data from NOAA's National Centers for Environmental Information. Accessed 20 June 2024. Graph created by Cascadia Consulting Group.

While year-to-year temperature variability is influenced by natural climate cycles such as ENSO and PDO, significant warming trends are evident. Additionally, maximum August temperatures, which indicate potential summer heat stress, have increased from 1895 to 2023 (Table 1; U.S. Climate Resilience Toolkit Climate Explorer, 2022).

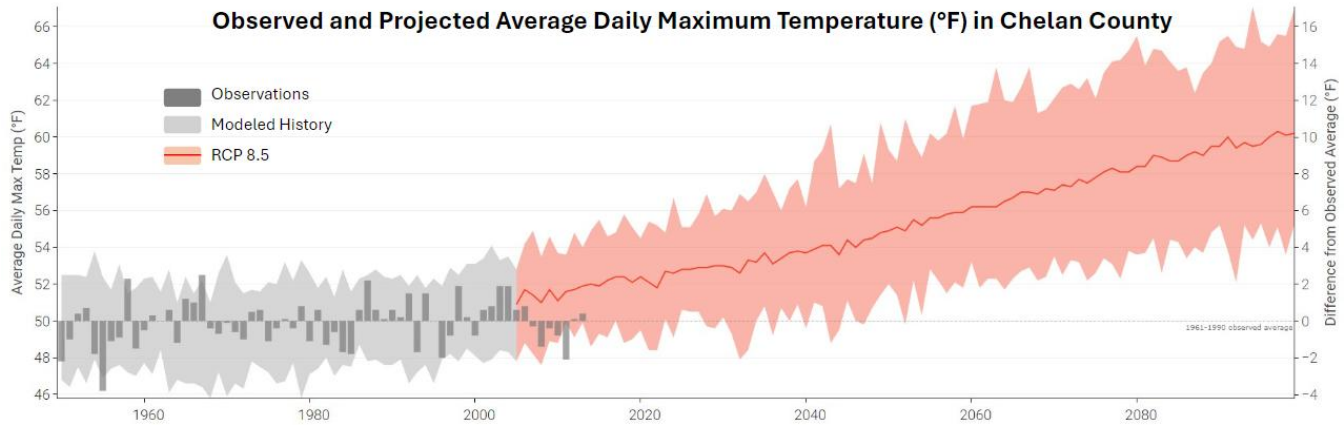
Table 1: Average maximum August temperature trends in Chelan and Douglas Counties.

County	Max August temp (1895)	Max August temp (2023)
Douglas	82.1°F	85.3°F
Chelan	72.5°F	75.5°F

Data from NOAA's National Centers for Environmental Information. Accessed 1 July 2024.

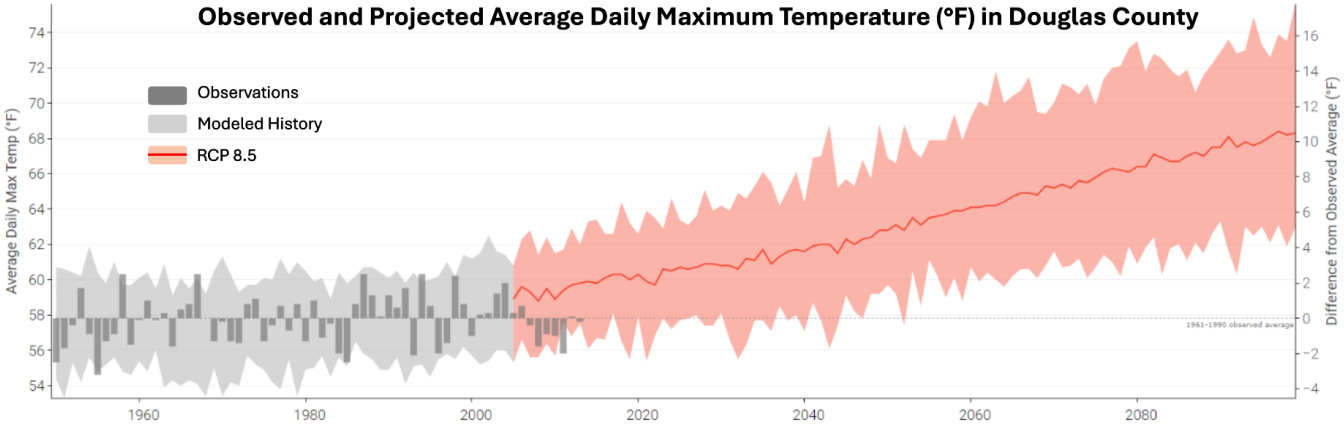
Relative to the 1952-2004 baseline, the average daily maximum temperature in Chelan and Douglas Counties is projected to rise by an additional 9.5°F (Figure 2) and 9.2°F (Figure 3), respectively, by 2099 under the RCP8.5 scenario (U.S. Climate Resilience Toolkit Climate Explorer, 2023).

Figure 2: Chelan County projected average daily maximum temperature (F°) under RCP8.5, relative to 1952-2004.



Data from the U.S. Climate Resilient Toolkit Climate Explorer, version 3.1. Accessed 20 June 2024. Climate projections and graphics were produced by the National Environmental Modeling and Analysis Center (NEMAC) at the University of North Carolina Asheville.

Figure 3: Douglas County projected average daily maximum temperature (F°) under RCP8.5, relative to 1952-2004.



Data from the U.S. Climate Resilient Toolkit Climate Explorer, version 3.1. Accessed 20 June 2024. Climate projections and graphics were produced by the National Environmental Modeling and Analysis Center (NEMAC) at the University of North Carolina Asheville.

This warming trend is projected to lead to more frequent and intense heatwaves, along with an increase in extreme heat days. By 2099, it is anticipated that there will be an additional 54 days annually in Douglas County and 28.2 days in Chelan County where the maximum humidex (how hot the weather feels to an average person) exceeds 90°F, compared to the baseline period of 1952-2004 (Abatzoglou & Brown, 2012). More hot days will pose additional risks to the counties' agricultural workers, due to their exposure and the demanding nature of their job. Additionally, days that reach below 32°F will become less frequent as the projected number of annual freeze-free days (days with minimum temperatures above 32°) in the Wenatchee River Basin, will increase by over 90 days compared to the 1971-2000 historical baseline (Krosby, et al., 2018).

Precipitation

Precipitation projections under the RCP 8.5 scenario indicate significant changes by the end of the century. Specifically, summer precipitation east of the Cascades is expected to decrease, while fall, winter, and spring precipitation are projected to increase relative to the period of 1950-1999 (Table 1; Rogers & Mauger, 2021).

Table 2: Projected change in average precipitation (%) for the region east of the Cascades relative to 1950-1999 (RCP8.5).

Season	2050	2080
Winter	8.6 % Increase	14.6 % Increase
Spring	10.3 % Increase	13.7% Increase
Summer	6.3 % Decrease	9.9 % Decrease
Fall	2.3% Increase	6.1 % Increase

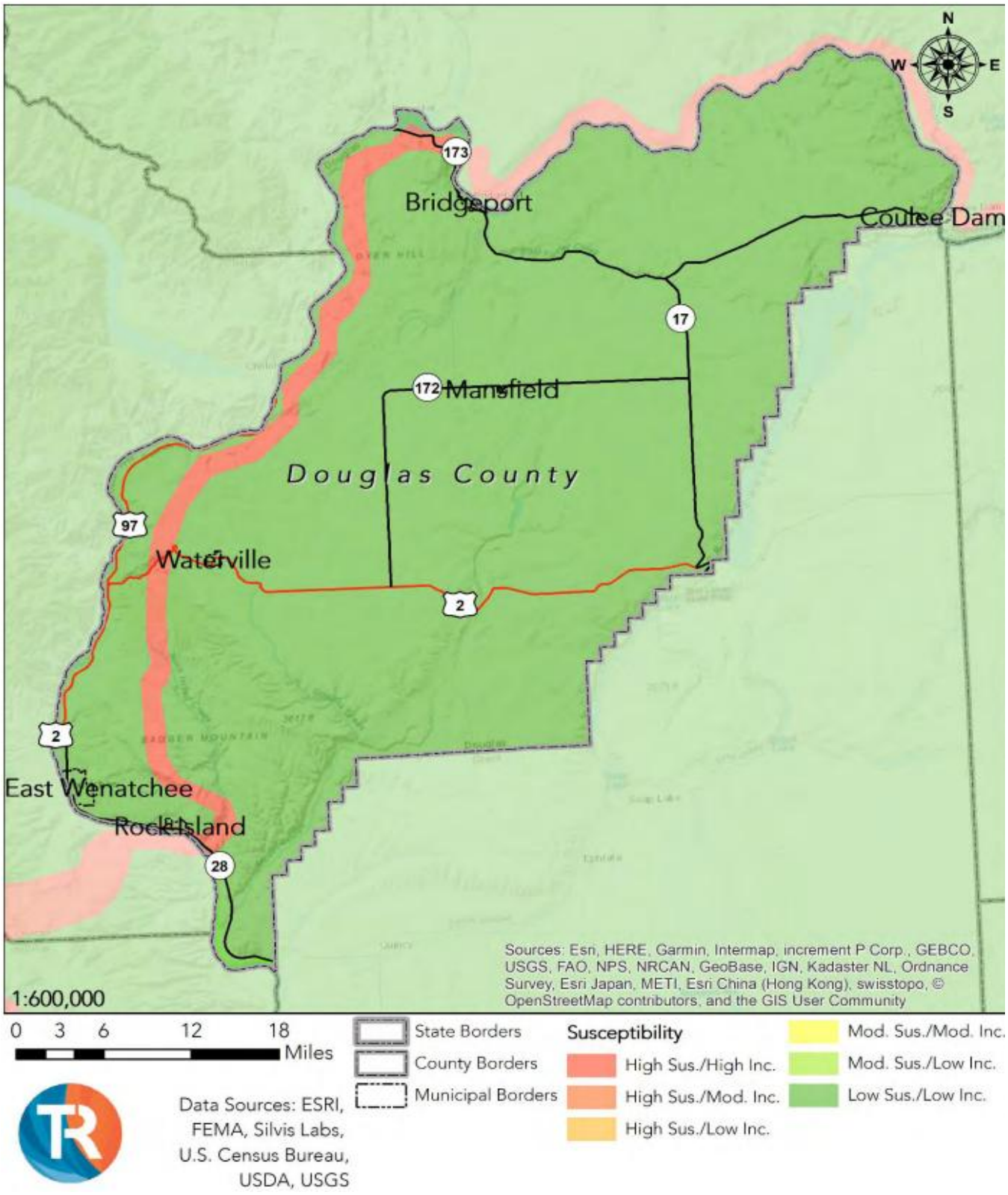
Data from Climate Mapping for a Resilient Washington. Prepared by the Climate Impacts Group, University of Washington, Seattle and Research Data & Computing Services, University of Idaho, Moscow. Accessed 22 June 2024.

Additionally, extreme precipitation events are expected to become more intense and frequent. By the end of the century (2070-2099), the magnitude of extreme precipitation events (25-year storm) in Douglas and Chelan Counties are projected to increase by an average of 15% and 16%, respectively, compared to the 1980-2009 baseline (Salathé, Leung, Qian, & Zhang, 2010).

Precipitation trends also pose additional risks, as the projected increases in the frequency and intensity of rainfall, along with decreases in snowpack, will lead to higher soil water content. This will reduce the strength of slopes, making them more susceptible to landslides (Washington Geological Survey, 2017).

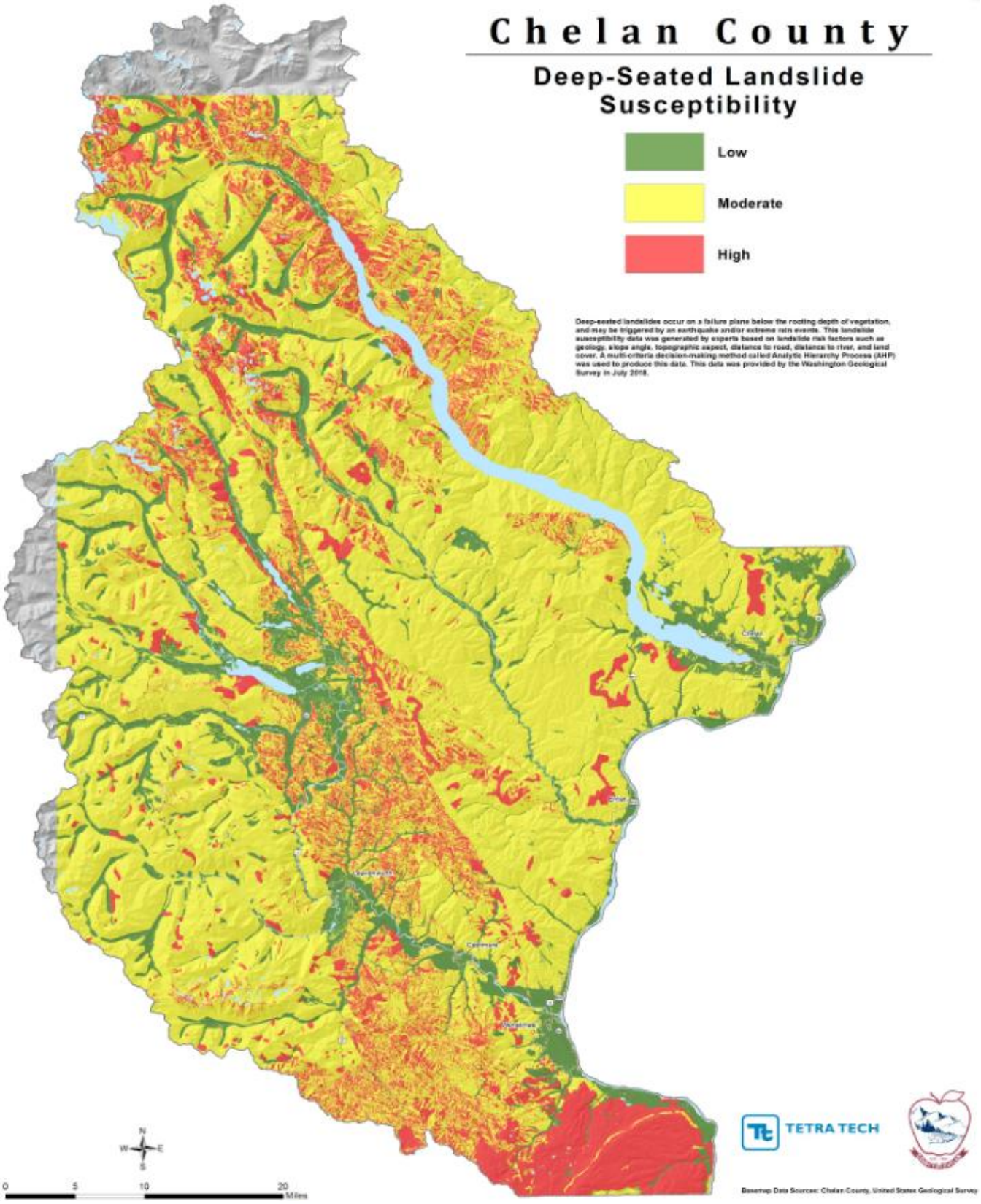
Although overall landslide risk in Douglas County is limited, there are some higher risk areas on the western edge of the County and near Rock Island (Figure 4; Douglas County, 2019). Additionally, landslides have been reported along Highway 2 just west of Waterville. Much of Chelan County has moderate to high susceptibility to landslides (Figure 5; Chelan County Natural Resources Department, 2019). The City of Wenatchee Hazard Mitigation Annex (2024) notes that businesses adjacent to Crescent Street and Snohomish Street in South Wenatchee have experienced multiple flooding issues during rain events in the past. A 100-year flood event would impact approximately 799 structures and over 2,100 people. The Annex notes there are limited evacuation routes.

Figure 4: Landslide susceptibility in Douglas County.



Data from Douglas County 2019 Hazard Mitigation Plan. Accessed 12 July 2024.

Figure 5: Susceptibility to landslides in Chelan County.



Data from Chelan County Natural Resources Department. Accessed 12 July 2024.

Drought and Snowpack

Currently, about 86% of Douglas County's land mass is classified as being in moderate drought, with another 12% in severe drought (National Integrated Drought Information System, n.d.). In Chelan County, 35% of the area is classified as being in moderate drought, and another 61% is labeled as severe drought (National Integrated Drought Information System, n.d.).

Under the RCP 8.5 scenario, total summer (July through September) precipitation is projected to decrease by an average of 9% in Chelan County and 16% in Douglas County by the end of the century (Salathé, Leung, Qian, & Zhang, 2010). The water supply in these counties will likely be further strained by changes to the region's snowpack. Rising temperatures will result in more precipitation falling as rain instead of snow, thereby reducing snowpack storage (Frankson et al., 2022).

Table 3 illustrates the likelihood of April 1 snowpack being below 75% of the 1980-2009 average over the next century for the two counties. April 1 snowpack is a crucial indicator of the amount of water available during the melt season, with decreases suggesting less water for streams, soil, and reservoirs (Chegwidden, et al., 2017).

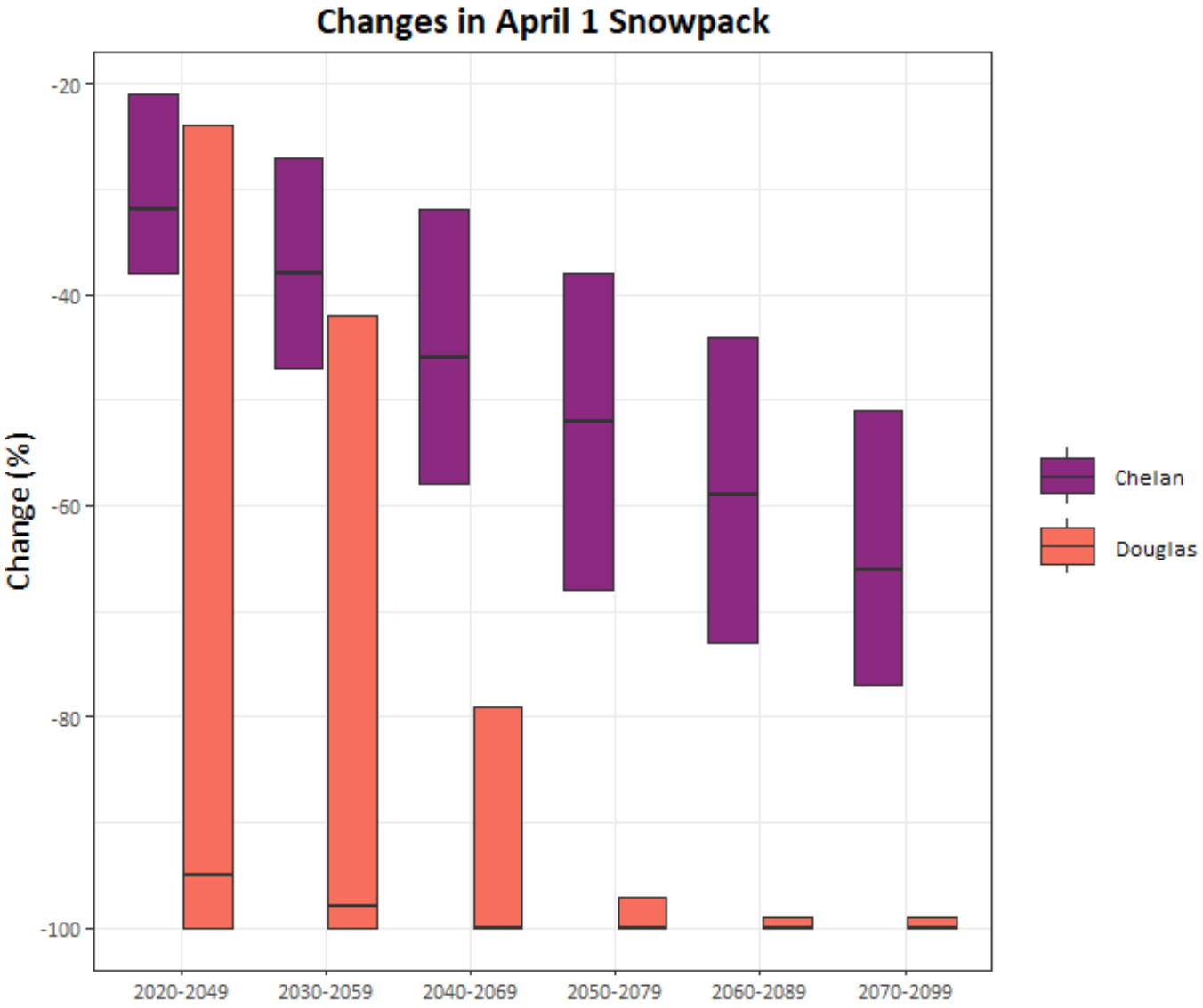
Table 3: Likelihood, or chance, that any given year has an April 1st snowpack below 75% of the normal or the 1980-2009 average snowpack.

County	Likelihood of April 1st snowpack below 75% of the normal
Chelan	41%
Douglas	100%

Data from Climate Mapping for a Resilient Washington. Prepared by the Climate Impacts Group, University of Washington, Seattle, and Research Data & Computing Services, University of Idaho, Moscow. Accessed 22 June 2024.

In addition to affecting drinking water supplies, the projected decreases in snowpack relative to the 1980 to 2009 baseline (Figure 6) are expected to significantly reduce opportunities and shorten the seasons for outdoor winter recreation, which will impact the local economies (Chegwidden, et al., 2017).

Figure 6: Projected changes in April 1 Snowpack (%) relative to the 1980 to 2009 average.



Data from Climate Mapping for a Resilient Washington. Prepared by the Climate Impacts Group, University of Washington, Seattle, and Research Data & Computing Services, University of Idaho, Moscow. Accessed 17 July 2024.

Streamflow

In Washington state, shifts in precipitation trends and declining snowpack are already impacting streams and rivers. Due to earlier spring snowmelt, the timing of streamflow is peaking earlier in the year for many rivers that rely on snowmelt (Cayan, Dettinger, & Stewart, 2005) A study of 43 stream gauges across the Pacific Northwest found that, from 1948 to 2006, 72% of stations showed a significant decrease in the 25th percentile annual flow (Luce & Holden, 2009). Several stations with the highest levels of decline are located in north central Washington (Figure 6), indicating that these trends may also be evident in Chelan and Douglas County.

Figure 7: Changes to the 25th percentile annual flow from 1948 to 2006.

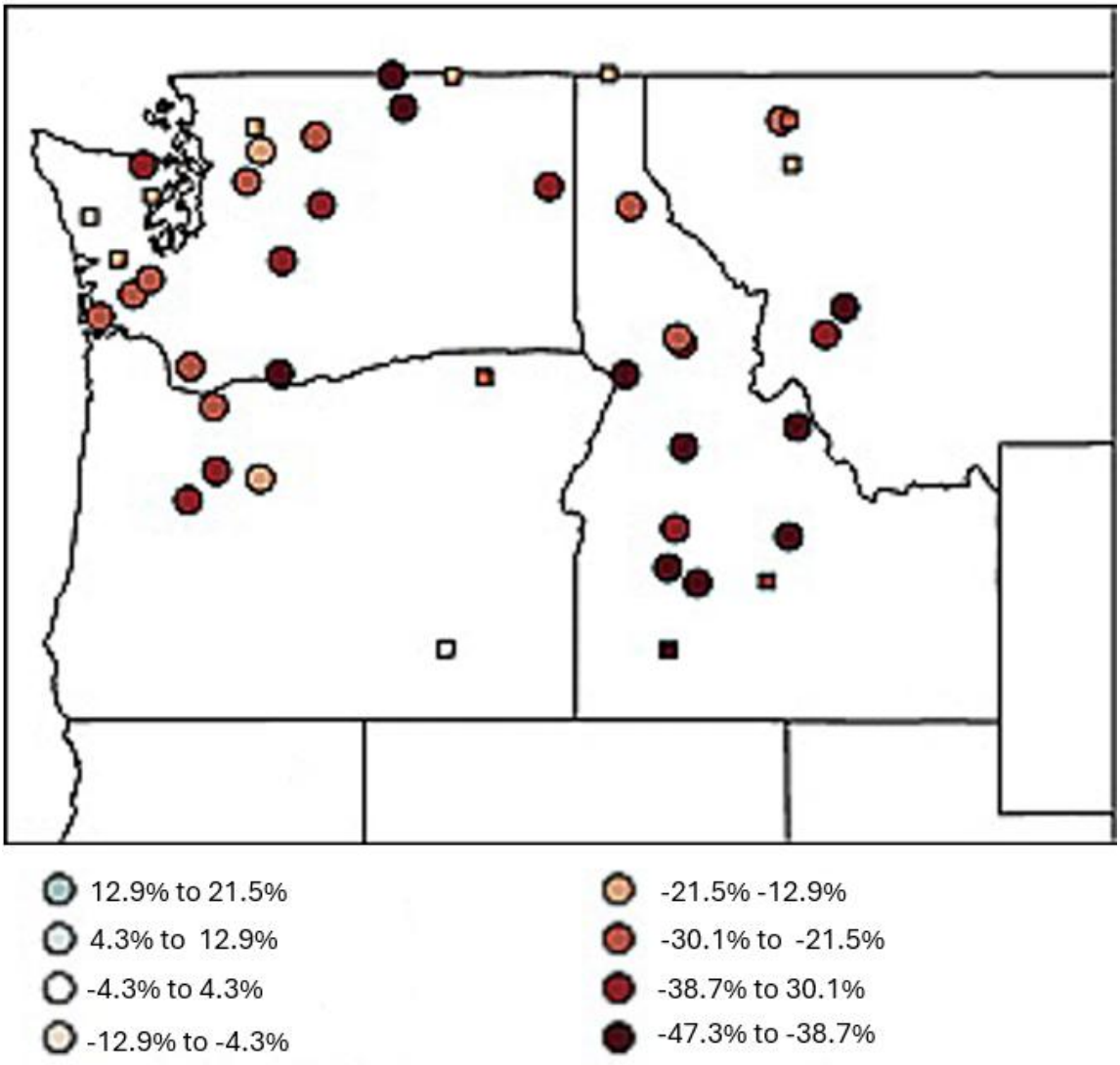


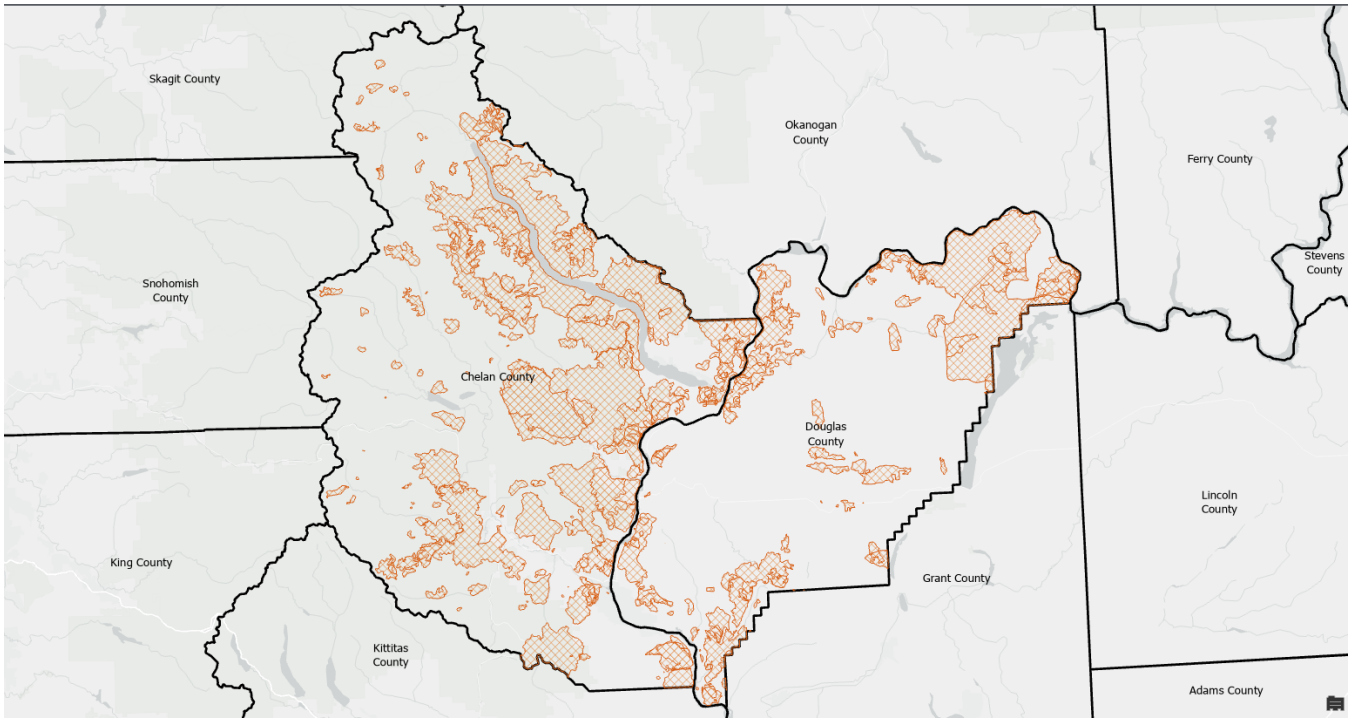
Figure from Geophysical Research Letters, volume 36, issue 16. Accessed 11 July 2024.

Projected decreases in summertime rainfall, shifts in snowpack, and increased temperatures will likely intensify the existing trends in streamflow and stream temperature in the area. Changes in streamflow, including reduced flow in summer, will affect the supply of drinking water and the amount of water available for irrigating crops, generating electricity, and other human needs (U.S. Environmental Protection Agency, 2024). In addition, plants and animals - including salmon, a keystone species - will be affected by lower streamflow.

Wildfires and Smoke

Since 1900 the frequency and impacted area of large wildfires have been steadily increasing in Douglas and Chelan Counties (Figure 7; Welty & Jeffries, 2020). Moreover, wildfires have been very prevalent in the north central region of Washington state, and the area has historically seen some of the largest wildfires within the state (Washington State Department of Natural Resources, 2016).

Figure 8: Burn areas of wildfires in Douglas and Chelan Counties between 1900-2019.



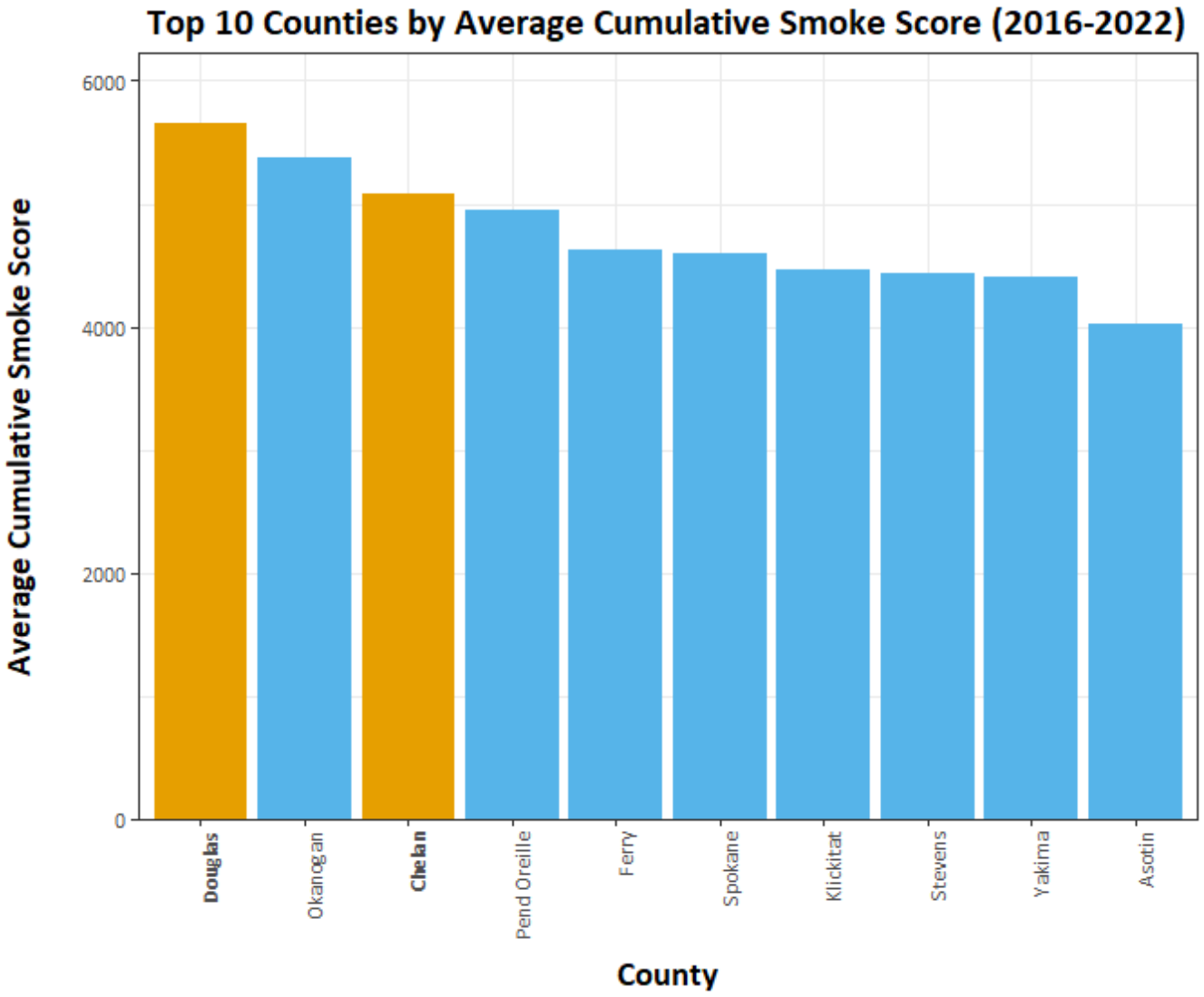
Wildfire burn areas in Douglas and Chelan County from 1900 to 2019 (Welty & Jeffries, 2020). Figure created by Cascadia Consulting Group. Accessed 19 July 2024.

The region is already experiencing increases in wildfire frequency, size, and intensity (North Central Wildfires Project, 2022). Higher temperatures and reduced precipitation will likely continue to increase vegetation dryness, inducing more favorable conditions for wildfire ignition and spread. Historically (from 1971-2000), Chelan and Doulas experienced 53 and 55 high fire danger days. By 2050, both Douglas and Chelan County are expected to see an increase of 10 high fire danger days each (Abatzoglou & Brown, 2012). An increase in high fire danger days indicates greater potential for wildfire danger to damage infrastructure, interrupt businesses, and affect public health and well-being.

Wildfires not only cause severe destruction within their immediate burn areas but also lead to episodes of regional smoke and degraded air quality, which have substantial health and economic repercussions for Chelan and Douglas Counties. The smoke generated by wildfires is closely linked to a rise in hospital admissions and a surge in new or aggravated respiratory and cardiac conditions (Wilgus & Merchant, 2024).

Douglas and Chelan Counties are already experiencing significant impacts from wildfire smoke. Both counties have some of the highest wildfire smoke scores in Washington state, reflecting elevated particulate matter concentrations on days affected by wildfire smoke. (Washington State Department of Health, 2023).

Figure 9: Washington state counties ranked by average cumulative smoke score (2016-2022).



Data from Washington Tracking Network, Washington State Department of Health. Figure created by Cascadia Consulting Group. Accessed 19 July 2024.

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Appendix B: Community Workshop Summary

Community Workshop Summary

Chelan and Douglas Counties Health-Focused Climate Vulnerability Assessment

October 24, 2024 | 9:30am-12:00pm | Confluence Technology Center – Wenatchee, WA

Background

Douglas and Chelan Counties (North Central WA) are developing a Health-Focused Climate Vulnerability Assessment. The Vulnerability Assessment will examine climate impacts across key components of public, community, and economic health, paying particular attention to overburdened and vulnerable communities. It will also identify opportunities for city and county staff, the health sector, community-based organizations, and other partners to take action.

The Community Workshop brought together stakeholders from local jurisdictions and CBOs across North Central WA. The Community Workshop included an overview of the Vulnerability Assessment, a review of climate impacts in Chelan and Douglas Counties, two main discussion rounds, a presentation on a local example, and a final round robin of action steps. The first main discussion round focused on the four focus areas of the Vulnerability Assessment, and while the latter on vulnerable and overburdened communities.

Workshop Goals

- Introduce the health-focused climate vulnerability assessment effort.
- Learn more about attendees' experience with health-related climate change risks and climate vulnerabilities to overburdened and health sensitive communities.
- Identify opportunities to connect the climate vulnerability assessment to other initiatives.

Attendees

Facilitators

Name	Organization
Steve Maher	Our Valley Our Future
Liz Walker	Smoke Ready Solutions
Meg Horst	Cascadia Consulting Group
Jana Fischback	Sustainable NCW

Participants

Name	Organization
Stan Smoke	Chelan County Emergency Management
Elle Robinson	Chelan County Natural Resource Dept.
Jenny Ezpileta	Chelan-Douglas Health District
Kristen Hosey	Chelan-Douglas Health District
Eric Torres	Chelan-Douglas Health District
John Ajax	City of Chelan
Curtis Lillquist	City of East Wenatchee
Maggie Boles	City of Leavenworth
Mia Bretz	City of Wenatchee
Jerri Barkley	Visit Chelan County
Gerardo Perez	Community Health Plan of WA
Bindu Nayak	Confluence Health
Teresa Bendito	Parque Padrinos / Rural People's Voice
Marlene Farrell	Sustainable NCW
Rick Edwards	Sustainable NCW
Sara Bates	Thriving Together NCW
Maria I. Morales-Sanchez	Wenatchee CAFÉ
Teddy Garcia	Wenatchee Valley Chamber
Chad Kruger	WSU

Facilitated Discussion

Climate Impacts in Chelan and Douglas Counties

After a presentation on climate impacts, attendees participated in a group discussion about what climate impacts were missing and if attendees had experiences or information to add.

ARE THERE ANY MISSING CLIMATE IMPACTS OR HAZARDS?

- Attention to secondary impacts, e.g. rising costs of agricultural products, particularly fruits and vegetables.

- Increased flood and flashflood risks due to intensified rainfall. The Chelan County Hazard Mitigation Plan (HMP) discusses flooding and has several data sources. Specific to events within the City of Wenatchee, the City Annex document discusses specific events within the city limits.
- The risks and vulnerabilities associated with flooding. Flooding can be caused by what's left after a wildfire and caused by heavier periods of rain and by runoff from warming weather. In any case, flooding is an issue when you have the geography that NCW has — mountains, rivers, valleys, populations of people. Chelan County Natural Resources Department has been working in this area and likely has data, including on the most vulnerable areas. Others may include the Chelan County PUD, Cascadia Conservation District, Chelan County Emergency Management, and state and federal agencies.
- Potential for waterborne diseases and harmful algae blooms from changes in precipitation.
- Compounded urban air quality issues exacerbated by wildfire smoke.
- Evacuation concerns in areas with narrow, single-road canyons or limited evacuation routes, especially for wildfire and earthquake events.
- Leavenworth is ranked #1 of 50 communities in Washington with greatest cumulative housing-unit exposure to wildfire due to Chumstick's area's dense population, long fire-free interval, and limited evacuation options.
    - *https://pyrologix.com/wp-content/uploads/2019/11/RiskToCommunities_OR-WA_BriefingPaper.pdf*
    - *https://www.yoursourceone.com/columbia_basin/usfs-report-ranks-ncw-communities-by-wildfire-risk/article_e9d1b7d2-e8f5-11e8-8af2-af15c0720333.html*
- Additional resources:
    - https://www.dnr.wa.gov/publications/rp_burn_cwpp_leavenworth.pdf
    - https://wildfirerisk.org/
    - https://www.usgs.gov/fire-danger-forecast
    - https://www.blueforest.org/our-impact/insights-news-resources/innovative-conservation-finance-partnership-aims-to-mitigate-wildfire-risk-in-washington/
    - https://www.fs.usda.gov/detailfull/okawen/home/?cid=FSEPRD1068006

DO YOU HAVE ANY SPECIFIC EXPERIENCES OR INFORMATION TO ADD?

- Importance of regulating the physical environment to support community health, such as landscaping in residential and commercial areas, separating industry from residential zones, and improving transportation systems.
- Observed differences in climate change awareness across generations within families, with younger members being more informed due to education in school and college.
- Potential for the Community Health Plan of Washington to provide current data on climate change impacts on health. CHPW could introduce billing codes to improve tracking—though this can be challenging.
- The Community Health Plan of Washington's Equity Department hosted a Town Hall on Climate Change as a Social Driver of Health. They may have relevant data for further insight.
- Hazard Mitigation Plan- recommendation to refer to wildfire sections for identifying high-risk areas

- US Geological Survey may have information on historical and predicted risk for forest fires, forest management
- High concern around evacuation capabilities and readiness within the community.

Discussion Round 1: Focus Areas

Following a presentation on the Vulnerability Assessment and review of climate impacts in Chelan and Douglas Counties, participants split into four small groups, one for each focus area—Public Health, Physical Health, Economic Health, and Mental Health & Wellbeing. Participants were asked to discuss what was missing from the climate risks and vulnerability assessment.

PUBLIC HEALTH & SAFETY

What is missing from our assessment of climate risks and vulnerability? What resources could help fill these gaps?

- Need for widespread education on individual risks related to climate impacts.
- Strengthening disease surveillance, particularly for wildfire smoke (WFS)-related health impacts, collect data on hospitalizations to better assess human health risks.
- Tap into local smoke knowledge, and institutional memory to enhance understanding of climate vulnerabilities.
- Explore engaging healthcare providers as advocates for climate-related health risks.
- Utilize surveys, like the one CDHD is developing, to gauge wildfire smoke literacy and awareness in the community.
- Lack of fire evacuation routes, particularly for communities (Malaga, Manson, and parts of Leavenworth) that only have one way out now, is a major threat to human life. Local officials don't want to talk about this much because of the cost of adding more roads.
- Resources:
    - Hazard Mitigation Plans
    - Emergency Response Plans
    - Leavenworth Wildland Urban Interface Code
    - Firewise Home Assessment Program, though note limits of program too. Firewise, etc., are good programs but so much more needs to be done. Overall, I would say this work has been a failure so far. The Central Washington Initiative has gotten off to a slow start, apparently due to difficulty finding workers. I believe it received about $300 million to treat the national forest but local officials have told me that it will take 10 times that amount to really make a dent in forest health.

Have we missed anything in terms of adaptive capacity? How do you/your community adapt to climate impacts? What current programs, policies, and initiatives are being currently employed (and by who) to help with these impacts?

- The HMP lists programs for preparedness - Stan is compiling the list.
- WUI code adoption

- Fire retrofit programs, like City of Leavenworth's, provide funding for low-income individuals
- CDHD education program
- PUD home adaptation programs
- FD3 Firewise Assessment
- Chumstick Coalition
- Ongoing health monitoring and disease reporting by local health organizations.
- CDHD - assist with hazardous waste removal and pollution prevention for small businesses
- City of Wenatchee Resilience Planning: Efforts to enhance climate resilience through urban planning initiatives, including increased shade and vegetation.
- CDHD EPA EJ program supporting air quality and wildfire smoke
- Strong connections across organizations, though this continuity is at risk due to retirements and staff turnover.
- Communities are asking for support to do vegetation management. Jurisdictions are moving towards a mandate/providing support.

What additional questions, comments or input for this or other focus areas do you have?

- Balancing tree canopy with fire safety: How to manage tree canopy goals alongside Wildland Urban Interface (WUI) regulations and home hardening.
- How does the health of our rivers impact human health?
- Consider alternative data boundaries beyond census tracts, such as city limits, Urban Growth Areas (UGAs).
- Acknowledging potential political barriers to implementing new climate programs and initiatives.

PHYSICAL HEALTH

What is missing from our assessment of climate risks and vulnerability? What resources could help fill these gaps?

- City + County Comprehensive Plans – may not have much data, but the lack of information may inform vulnerability
- What is the source of health issues?
- HIPPA is an issue—makes it hard to identify problems leading to health issues
- How to attribute a heat wave to ER visits/actual deaths—how is this tracked?
- Where are the cooling centers? Are they effective? Why are they not used? Who uses them? Problem with them closing early?
- Unhoused living in the open and in cars—their stories are not well captured---how are they affected?
- May not be focusing on most important index relative to extreme heat impacts
- Cumulative impact of working during the day in extreme HIGHs and then being exposed to elevated nighttime temps

- Need more focus on preventive care
- Noted the impact of needing to have windows open at night, with high levels of wildfire smoke, compounding effect.
- Air filters are not currently covered by Medicaid

Have we missed anything in terms of adaptive capacity? How do you/your community adapt to climate impacts? What current programs, policies, and initiatives are being currently employed (and by who) to help with these impacts?

- Need indices to measure success of adaptive strategies. Data probably exists, but is it accessible? Need more data sharing.
- The lack of information and education is listed under the above question as a gap. One example of how to reach certain groups with targeted messaging is the Columbia Valley Community Health (CVCH) mobile unit. This mobile unit visits migrant camps and other places where farmworkers and their families congregate.
- There is a lack of adequate air quality sensors in schools, public places, and other vulnerable facilities
- There is a Air Quality station in Wenatchee on 4th Street
- Implementation of the State's Dept of Health air quality sampling rules is very difficult, especially if you have people/employees in many locations; the current situation is not intuitive.
    - It's hard to know exactly what conditions you are experiencing
    - Need more stations and the ability to push a refresh button to get the most current conditions, quick AQ updates for your location.
    - Need cell phone access to actual AQ data in order to adapt your actions in the field.

What additional questions, comments or input for this or other focus areas do you have?

- CDHD collects a lot of data; may be useful. Health Data
- Confluence Research Department is interested in doing more smoke impact research.

ECONOMIC HEALTH

What is missing from our assessment of climate risks and vulnerability? What resources could help fill these gaps?

- Think about the umbrella of ecosystem services provided in county
- A way to measure what the dollar cost impact is on fruit growers and packing sheds (like Stemilt or McDougall).
- The cost of more wildfire smoke days, and how that will impact local residents, visitors, businesses and communities. What resources are available to residents, visitors, businesses and communities. Do they know how to access those resources? What kind of savings can be realized if upstream actions are taken now or very soon?
- Best practices. There seems to be a lack of information on innovative steps that organizations, people and communities can take to "build resiliency." The big fruit growers have adopted more

sustainable irrigation practices but few know about that outside the farm industry. Could those practices be scaled down?

- One sector that will be impacted is seasonal tourism (especially when we consider Leavenworth and the classic snow covered village). Tourism is essentially the second most important economic driver in the region (behind agriculture). Extreme heat, wildfires and smoke, and less snowpack have and will continue to negatively impact tourism. Which businesses, workers, residents, and communities will be impacted most? And to what degree? Chelan County is about to embark on a large tourism study and is negotiating with BERK to conduct the study. Could these questions be answered in that study?
- Mission Ridge Ski Area, on the other hand, likely doesn't want to talk about climate change as they are trying to expand the area and build and sell homes there.
- Pear season was really bad in 2024- many employees only worked a minimal schedule; this has economic and other mental health impacts
- We are missing a lot of data. We need data. How much of a crop loss are we experiencing due to climate change? Or the number of hospitality industry employees in Chelan County?
- In Washington state, the kind of grapes you can plant and harvest has changed due to climate change. As a result, grape growers have changed what kinds of grapes they grow. This area needs more research.
- There is competition for water resources. People here don't comprehend that because the big old Columbia River rolls by with all this water and residents consciously or subconsciously conclude it will always be there.
- The Census of Ag is a good place for data on H2A workers

Have we missed anything in terms of adaptive capacity? How do you/your community adapt to climate impacts? What current programs, policies, and initiatives are being currently employed (and by who) to help with these impacts?

- Hispanic and Latino small business owners, they are very cost sensitive. Ideally, modern business practices should consider sustainability but I think if we are to have widespread adoption in the Wenatchee, there needs to be affordable options (which I imagine is easier said than done).
- What about creating greater capacity for social services for people who are losing their jobs (or will lose their jobs) due to climate change?
- When it comes to adaptive capacity, maybe we need to focus on just what we can control locally? We can't control how much water is flowing by in the Columbia, for example.
- We need the big players in the region — the ag industry, the PUDs — who are all mitigating for climate change to be forthcoming about what they are doing as a way to inform the overall community that climate change is real. The large fruit companies, such as Stemilt, have adopted sustainable irrigation practices but they don't talk about it. Very few people are aware of the practices they have adopted.
- How do you prime your economy to prepare for further climate change in the years to come? Maybe restore agricultural lands to natural environment by retiring the agricultural lands and planting sage.
- We need a major fire base here. We need major forest health here and the money to finish the job.

- More sustainable to-go containers. Businesses voting with their wallets may be a barrier. If it's cheap to not use sustainable to-go containers, they will go that route. How do you have sustainable businesses practices? In 2030, if there is a requirement by then to use sustainable practices, then you are going to need composting sites, too. What if we had a city composting site?
- The PUD does a good job in providing incentive programs. But their motive is to save power so they can sell it on the open market and make more money, and not to mitigate for climate change.

What additional questions, comments or input for this or other focus areas do you have?

- If there was a small business owner toolkit in Spanish that is culturally relevant, we may see success in adopting more sustainable business practices
- I've served on the county Tourism Committee for several years, and many of the hoteliers have told us that it is difficult to land conventions during the summer months and fall months anymore because of the perception that Chelan County is full of smoke. I would assume the annual smoke season has had a negative impact on individual and family travel as well.
- On the other hand… tourism related businesses often do not want to talk about climate impacts like smoke, as it could deter visitors.

MENTAL HEALTH & COMMUNITY WELLBEING

What is missing from our assessment of climate risks and vulnerability? What resources could help fill these gaps?

- Is there data from school districts about the number of days where smoke/air quality has impacted school sport activities?
- The availability of Link Transit buses, look at local transit data from Link Transit.
- Public transportation to front Country parks is good in Chelan County but lacking in Douglas County.
- East Wenatchee has good parks but pedestrian access needs improvement
- 'Belonging in the Outdoors' Report by TREAD, plus their mapping of future pathways and getting residents' perspectives
- Chelan-Douglas Land Trust and Wenatchee Outdoors are helping connect more people to outdoor experiences.
- Mental health assessment- CDHD- Wendy is doing a geospatial study. Can ask Sara Bates. Trying to assess what prevents people from getting help.
- Data from school districts, on the number of days they cancel sports. How does that change each year? What are their policies?
- CDHD and Thriving Together NCW are looking at geographic access to mental health facilities and barriers that prevent people from seeking care.
- Thriving Together NCW also has new data from survey respondents about wellbeing – Sara Bates can provide the data.
- Spanish speaking community may not always feel they belong
- Air quality issues compound mental health challenges

- The rising cost of housing is a big problem! Needs to be noted
- Challenge in pedestrian access to resources (such as parks, food sources, care services). The lack of pedestrian access can create anxiety in relation to safe pedestrian access.
    - Low income, elderly, children are especially impacted

Have we missed anything in terms of adaptive capacity? How do you/your community adapt to climate impacts? What current programs, policies, and initiatives are being currently employed (and by who) to help with these impacts?

- The problem with engaging people about climate change and vulnerable communities is that people are still focused on the impacts from the pandemic and are still suffering from that and aren't ready to move forward.
- TREAD as a resource: Projects — TREAD
- Link Transit- it's pretty good for a rural county! Though better in Chelan than Douglas County. This is more important than Amtrak for local residents.
- Wenatchee Outdoors
- Chelan-Douglas Land Trust- doing some more culturally relevant programming including outreach to Latino community, more Spanish programming
- It may be true there are a lot of parks, but access is uneven.
- In Bend, Oregon, for example, green lawns have been replaced by sage in people's yards. The design standards in NCW are poor. Visit our parks and they are always soggy because they overwater them with sprinklers. We need design standards that the cities and counties sign off on.

What additional questions, comments or input for this or other focus areas do you have?

- Re food deserts- UWMPH students did a windshield survey to verify USDA food desert map- also showed some high prices in remote areas
- Access data from an All Payers Claims Database (APCD) to gain detailed local health information (both for mental and physical health)
- The physical health of asthmatic people is harmed by wildfire smoke. But how does wildfire smoke impact the mental health of asthmatic residents as well as those of other community members? Is this an area that Dr. Bindu Nayak could look into or perhaps UW professor Mary Crocker? Is this an area that most behavioral health counselors even have expertise in?
- Housing is a major, major problem here and is impacting virtually every aspect of community life. Having worked in this area for the past six or seven years, the Housing Authority is a relatively small player.
- As for green spaces and parks, I believe access is quite poor, unless you factor in things like the Foothills trails (which many people can't access due to transportation issues or won't because they can't afford a $2,000 mountain bike). In south Wenatchee, which is heavily Hispanic and low income as you know, the only park within a mile for about 5,000 people is Methow Park, which is quite small.
- Possible resources on housing:

- It only goes to county level but indicates issues of lack of multi-family housing development and rising homelessness in the 2 counties: https://deptofcommerce.app.box.com/s/8pzb9pjrqn1h6stpgglavhz4e32yztsy
- I also appreciate the Housing & Transportation index, since as the name implies, it takes into account transportation costs, which are growing quickly, especially in more rural counties like yours where transit and walking are rarely options. It shows a high burden in both counties.
- Other maps which show the housing crisis:
- Information by Location | Washington Tracking Network (WTN)
- CDC Places: https://experience.arcgis.com/experience/22c7182a162d45788dd52a2362f8ed65 (click on housing cost burden)
- Point in Time Count on homelessness

Discussion Round 2: Vulnerable and Overburdened Communities

After a short presentation on vulnerable and overburdened communities, participants split into small groups again. Participants were asked to assess the list of vulnerable and overburdened communities and provide suggestions for accessing data or stories about climate impacts to vulnerable and frontline groups.

IS THIS THE RIGHT LIST OF GROUPS TO FOCUS ON? WHAT INSIGHT OR NUANCE CAN YOU ADD?

- Folks with disabilities should be on top, called out- big risk during fires
- Connect with Hospitals and School Districts to reach individuals in the community.
- Consider data from trauma programs and free/reduced lunch statistics.
- Air Pollution Impacts: Compare traffic and industrial pollution with smoke impacts.
- Terminology: Replace "elderly" with a more inclusive term.
- Recognize that individuals in multiple risk categories may face higher overall risk.
- Literacy is an additional vulnerable group
- Douglas County is largely rural and isolated, with limited proximity to health care facilities and a lack of pediatric specialists. People in rural areas “get the shaft”
- Many residents have both physical and mental disabilities, but mental health care resources are limited.
- Grad students in this area struggle with access to healthcare, although there is a reimbursable program based out of Pullman
- People engaging with the healthcare system independently for the first time (such as early-career individuals) encounter significant challenges.
- Households with multiple generations may face increased exposure and health risks (e.g., COVID-19).
- Transportation barriers are a significant gap for people with disabilities.

- Differentiate between migrant and local agricultural workers; they often have different housing and resource access.
- Mapping of vulnerable communities is difficult in these rural counties, as it sometimes highlights areas where very few people live and distracts from the more densely populated areas where there is actually higher vulnerabilities (like poverty). Mapping may underrepresent affluent second-home owners
- Emphasize impact across populations per square mile to ensure focus on high-need areas.
- Rural residents face additional barriers due to distance from resources.
- Poor harvests (e.g., pear season) can lead to economic strain and mental health challenges for farmworkers.
- The vulnerable communities slide did not mention the homeless or veterans. There is a homeless task force that included both government entities and nonprofits. It is led by Amber Hallberg at Chelan County. There also is a veterans services group in the community, as well as a VA clinic.

WHAT OR WHO CAN HELP US ACCESS DATA/STORIES ABOUT THE CLIMATE IMPACTS TO VULNERABLE AND FRONTLINE GROUPS?

- Leveraging schools and hospitals as sources to capture data
- Department of Transportation for traffic pollution insights
- Housing nonprofits and religious organizations for local stories
- New studies with air monitors in high-density residential areas
- Health centers collecting more comprehensive data, especially on racial disparities
- Outreach to those not visiting health centers by sharing stories in trusted community spaces (e.g., churches, nonprofits like MEND and CAFÉ)
- Data from pharmacies and retail stores providing medications to track self-treatment trends
- Insights from school nurses and counselors
- Gathering "data stories" that capture personal impacts
- Mobile clinics serving farmworkers to increase access to diagnosis and treatment
- Addressing "digital equity" concerns, such as access to MyChart for health tracking
- Tracking indirect health impacts on parents of children with asthma
- Cultural considerations (e.g., wood stove use in Mexican homes) that affect health perceptions
- Outreach to unhoused populations via housing nonprofits and church groups

Round Robin on Action Steps and Collaboration

After a presentation on wildfire smoke, pediatric asthma and health equity from Bindu Nayak, MD, attendees participated in a group discussion on how the Vulnerability Assessment could be used in their work and what health departments, emergency managers, health care systems, social service organizations, and related stakeholders can do to advance climate action.

HOW COULD THIS ASSESSMENT BE RELEVANT FOR YOUR INTERESTS AND WORK?

- Helpful to understand the impacted, vulnerable areas
- Can contribute to the Climate Resilience component of the Comprehensive Plan (Which don't always address health)
- Identifying specific groups to invite them to participate in planning solutions for themselves
- Confirming specific, place-based hazards for our city

WHAT CAN HEALTH ACTORS AND OTHERS DO TO ADVANCE CLIMATE ACTION?

- Provide data
- Provide education
- Incentives, whether monetary or social, can be powerful tools for encouraging behaviors like recycling. The book Mixed Signals explores the science behind incentives, showing that even non-monetary incentives can be effective. One idea is to create a recycling station with designated bins for common recyclables (paper, cardboard, aluminum, etc.). Keeping items sorted and clean could reduce processing costs for recyclers. Non-monetary rewards—like badges, pins, or a community leaderboard highlighting top recyclers—might further encourage people to recycle more by appealing to social recognition rather than financial gain.
- Example from Dr. Nayak's presentation- use for advocacy (e.g. advocate for Medicaid to cover air filters)

General comments

The lack of information and education is a huge gap. In general, the conservative nature of much of the region has impeded that work. But there also needs to be different kinds of messaging to different groups, such as seniors, younger people, and farmworkers. How do you really get through to different groups when the messaging hasn't been tailored for each? How do you communicate with people who aren't connected to resources?

Photos from event