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Public Health as a National Weather Service Deep Core Partner

Reid Wolcott, National, National Weather Service, Seattle

Marnie Boardman, Washington State Department of Health

Erika Estrada, Washington State Department of Health

Addison Houston, Public Health Seattle & King County

Jillian Edge, Public Health Seattle & King County

Brendon Haggerty, Multnomah County Health Department



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Background

- Improving support to populations disproportionately impacted by weather hazards has been a priority for NWS Seattle for years.
- More recently, the new NWS Director's Priorities (People, Infrastructure, & Future) includes a focus on service equity.



- But where are the gaps and how do we create sustainable service equity?
- June 2021 Pacific Northwest "Heat Dome" event provided an ideal lens upon which to view service gaps.



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Supporting Disproportionately Impacted Populations

NWS Seattle Extreme Heat Workshop

- March 22-23, 2022
 - Identified 4 primary focus areas to increase reach & service to disproportionately impacted populations
1. Developing New & Enhanced Partnerships
 2. Providing Targeted Messaging & Resources
 3. Integrating into Core Partner Planning & Response
 4. Supporting Data Needs in a Changing Climate

Final Report: NWS Seattle Extreme Heat Workshop
March 22-23, 2022

Executive Summary

On March 22 and 23, 2022 the National Weather Service Forecast Office in Seattle hosted a virtual Extreme Heat Workshop via GoToWebinar. The workshop was broken into nine sections with each section having one or more discussion sections meant to tie the material to emergency management processes. The first day saw 120 attendees, while day two saw 165 attendees. Over the course of the two days, core partners engaged in conversations about extreme heat and the unique challenges brought on by this evolving hazard in the Pacific Northwest. Of particular note was the discussion on vulnerable populations, which alone accounted for two hours and resulted in numerous potential action items for the NWS and core partners.

Whole Community Engagement Model

Feedback on the workshop was overwhelmingly positive with 95% of the post-workshop surveys indicating a positive response to the overall quality and content of the workshop. Despite the workshop being scheduled to run for 8 hours (it was ultimately 6.5 hours in duration), over 85% of the respondents indicated that the workshop was a valuable use of their time and would attend a similar workshop on other weather-related hazards.

It is the goal of NWS Seattle to host similar workshops on other weather hazards in the Pacific Northwest, with minor changes made to the format and execution based on partner input.

A summary of the workshop sections is described below:

Day 1

- **Hazard Climatology**
The Hazard Climatology section focused on introducing the hazards of extreme heat, how extreme heat events develop, the local factors that make extreme heat dangerous in the Pacific Northwest, extreme heat records in western Washington, and a look at how extreme heat events are expected to be impacted by continuing climate change. Finally, this section provided core partners with resources for hazard mitigation planning.
- **Forecast Tools & Situational Awareness**
The Forecast Tools & Situational Awareness section began with a focus on what makes probabilistic forecasts, specifically those from the NBM, valuable and how these forecasts can be used in decision making. This was

The background image shows a collage of workshop slides including topics like 'Vulnerable Populations', 'Who is vulnerable?', 'Population Identification', 'Vulnerable Populations', 'Monitoring', 'New Migration Strategies', 'Other Migration Strategies', and various charts and maps.



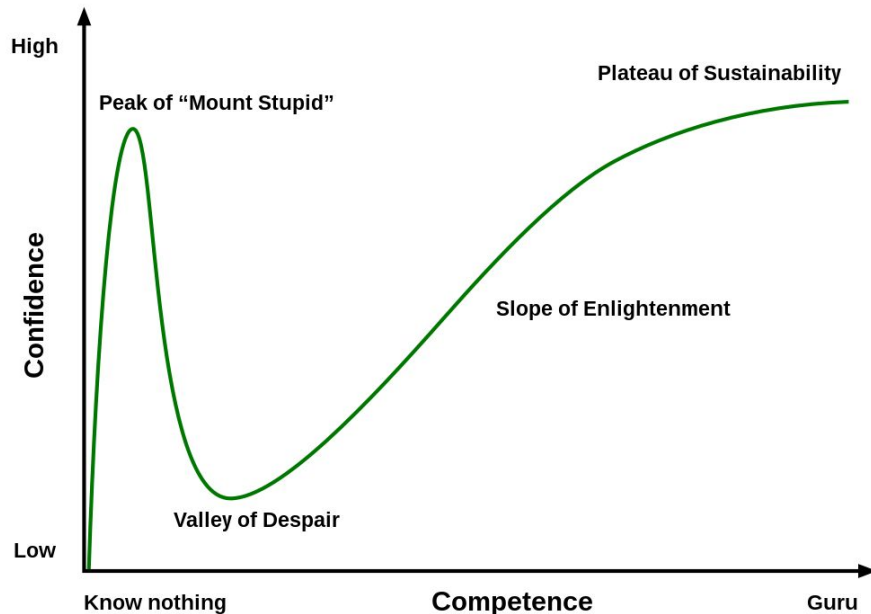
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Importance of Expertise

- Easy to get to the first peak where someone “knows enough to be dangerous”
- It takes a career to climb the slope of enlightenment
- When addressing complex issues, it’s absolutely critical to bring in expertise to avoid perishing at the peak of “Mount Stupid”

Dunning–Kruger Effect



Source: Wikimedia Commons



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**Who can the NWS partner with
within those focus areas?**



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Visions, Missions, & Goals

Equity and optimal health for all [...] works with others to protect and improve the health of all people...

Protect and improve the health and well-being of all people [...] Whenever possible, employ strategies, policies and interventions to reduce health disparities.

We work with communities to advance health equity, protect the most vulnerable, and promote health and wellness for everyone.

Provide weather, water and climate data, forecasts, warnings, and impact-based decision support services for the protection of life and property and enhancement of the national economy.



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Visions, Missions, & Goals

Washington State Department of Health

Equity and optimal health for all [...] works with others to protect and improve the health of all people...

Public Health Seattle & King County

Protect and improve the health and well-being of all people [...] Whenever possible, employ strategies, policies and interventions to reduce health disparities.

Multnomah County Health Department

We work with communities to advance health equity, protect the most vulnerable, and promote health and wellness for everyone.

National Weather Service

Provide weather, water and climate data, forecasts, warnings, and impact-based decision support services for the protection of life and property and enhancement of the national economy.



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Public Health Engagement



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Step 1: Connecting the Dots

- **#1 Tip from Public Health Partners: Go in and LISTEN**
- **NWS & Public structures may not be well aligned. The first step is getting the right subject matter experts to the table.**
- **In Washington, the priority weather-health overlap areas are**
 - Extreme Heat
 - Extreme Cold
 - Wildfire Smoke & Air Quality
 - However, Public Health is involved in every type of disaster
- **Engage as Weather-Ready Nation Ambassadors**
- **Schedule regular (e.g. quarterly) meetings with public health partners**



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Step 2: Find the Opportunities

- Operations & Response
- Planning, Recommendations, & Public Information
- Research, Development, & Feedback
- Training



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Operations & Response

- **Situational awareness is key, in both directions!**
 - Public Health should be included on the distribution of significant weather briefings as that information is utilized for operational decisions & messaging. Examples:
 - Multnomah County Health Department uses probability-focused weather forecasts with a focus on the reasonable worst-case scenario in recognition that it is far easier to stand down a response than to stand one up
 - [Washington SAFER Dashboard](#)
 - NWS needs to maintain awareness of ongoing event impacts to the population
- **Health Data Surveillance & Reporting**
 - NWS collects impact data for use in services assessments, event reviews, verification, science studies, and FEMA major disaster declarations.
 - NWS has specific data needs to meet reporting requirements that should be coordinated with Public Health.



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Daily Weather Brief

April 27, 2023

NWS Regional Offices Forecasts

NW Quadrant

4/27/2023

Increased chance of mountain snow. Increasing breezy to gusty winds

NE Quadrant

4/27/2023

Morning snow/scattered rain/snow showers

SW Quadrant

4/27/2023

Rain

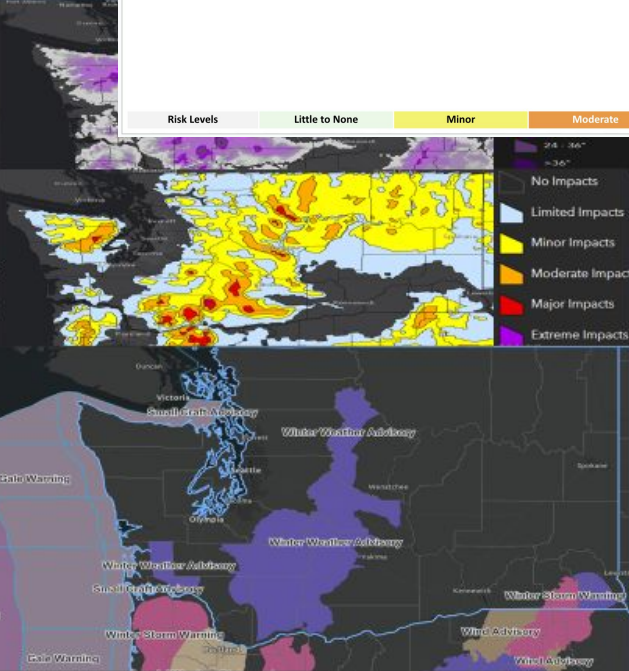
SE Quadrant

4/27/2023

Mountain snow, breezy to windy

Risk Levels Little to None Minor Moderate Major Extreme

National Weather Service 72 Hour Snowfall Forecast National Weather Service Winter Storm Severity Index



Weather Risk Outlook

Weather Forecast Office
Seattle, WA
Tuesday, March 21

	Tuesday, Mar 21	Wednesday, Mar 22	Thursday, Mar 23	Friday, Mar 24	Saturday, Mar 25	Sunday, Mar 26	Monday, Mar 27
Northwest Washington <i>NWS Seattle Forecast Area Briefing</i>							
Southwest Washington <i>NWS Portland Forecast Area Briefing</i>							
Northeast Washington <i>NWS Spokane Forecast Area</i>							
Southeast Washington <i>NWS Pendleton Forecast Area</i>							

Risk Levels Little to None Minor Moderate Major Extreme



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Planning, Recommendations, & Public Information

NWS & Public Health have the same goal during significant events
→ to save lives.

- **Align & share impact and call-to-action statements**
 - Public Health may have resources to assist in the translation of these statements for those with limited English proficiency
- **Explore Alignment of Public Health & NWS Recommendation Strategies**
 - Example: Public Health Seattle & King County Heat Recommendations

Public Health Seattle & King County



Public Health Seattle - King County External Extreme Heat Response Document

Table 1. Overview of Heat Risk Values:

Numerical Value	Meaning	Who/What is at Risk?	How Common is the Heat in King County?
1	Level of heat poses little to no risk. Most of this type is tolerated by most, however, there is a low risk for sensitive groups to experience health effects.	No elevated risk. Primarily those who are extremely sensitive to heat.	Very common
2	Moderate risk for members of heat sensitive groups to experience health effects. Some risk for the general population who are exposed to the sun and are active.	Primarily heat sensitive groups, especially those without effective cooling or hydration. Some transportation and utility workers.	Fairly common for most locations
3	High risk for much of the population who are exposed to the sun and are active, or 2 are in a heat sensitive group. Dangerous to anyone without proper hydration or adequate cooling. Power outages may occur as electrical demand increases for cooling.	Much of the population, especially those who are heat sensitive and anyone without effective cooling or hydration. Most transportation and utility workers.	Uncommon for most locations
4	Very high risk for entire population. Very dangerous to anyone without proper hydration or adequate cooling. This is a multi-day extreme heat event. Increased health impacts to anyone not prepared. Power outages are increasingly likely as demand for cooling may reach critical levels.	Entire population is at risk. For heat sensitive groups, especially people without effective cooling, this level of heat can be deadly. Most transportation and utility workers.	Rare in most locations

The following table provides recommended actions to take when heat risk levels reach orange, red, and magenta categories.

Public Health Seattle - King County External Extreme Heat Response Document

Public Health Recommendations

INITIATE EARLY WARNING, PUBLIC MESSAGING, AND RESPONSE ACTIVITIES

- Recommended sharing information about available cooling locations where general population can go to access air conditioning or cooling before sun or water recreation facilities or other public places
- Recommended dissemination of key public health heat safety messaging and risk communications to at-risk populations, including those experiencing homelessness, older adults, children, and outdoor workers
- Recommended reductions in strenuous outdoor activities
- Consider cancellation and/or rescheduling of outdoor children's activities, day camps, athletic practice, and games or moving them indoors where temperatures are cooler during the hottest periods of the day
- Consider distribution of water and other cooling supplies to at-risk communities and populations
- Consider activation of daytime cooling centers for unsheltered individuals
- Consider understanding power sector activities required to meet recommendations of higher heat levels, if forecast indicates increase in risk and temperatures
- Monitor local weather forecast and alert until forecast conditions become more favorable (e.g., HeatRisk value of 1 - yellow - or lower)

RECOMMEND ACTIVATION OF COOLING CENTERS & REDUCTION IN OUTDOOR ACTIVITIES

- Continue outreach efforts to reach at-risk populations with risk communications, cooling supplies, and water resources
- Recommended activation of daytime cooling centers for unsheltered individuals
- Recommended activation of daytime cooling centers for general population
- Recommended temporary suspension of strenuous outdoor activities during hottest times of the day
- Recommended cancellation and/or rescheduling of outdoor children's activities, day camps, athletic practice, and games
- Consider expanding hours of operation for cooling centers for unsheltered individuals to accommodate overnight use

RECOMMEND CANCELLATION OF OUTDOOR EVENTS AND ACTIVITIES

- Recommended expanding hours of operation for cooling centers to accommodate overnight use
- Recommended cancellation of outdoor activities and events during hottest times of the day
- Emphasize cancellation and/or rescheduling of outdoor children's activities, day camps, athletic practice, and games
- If critical in essence, consider rescheduling of events to postpone under indoor air temperatures. Public Health will recommend closure if indoor temperatures cannot be maintained reasonably free of excessive heat (WAC § 240-260-080)

May 2022



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Human Health Impacts

- **#1 Cause of Weather-Related Fatalities**
- Heat Cramps
- Heat Exhaustion
- Heat Stroke
- Reduced Air Quality

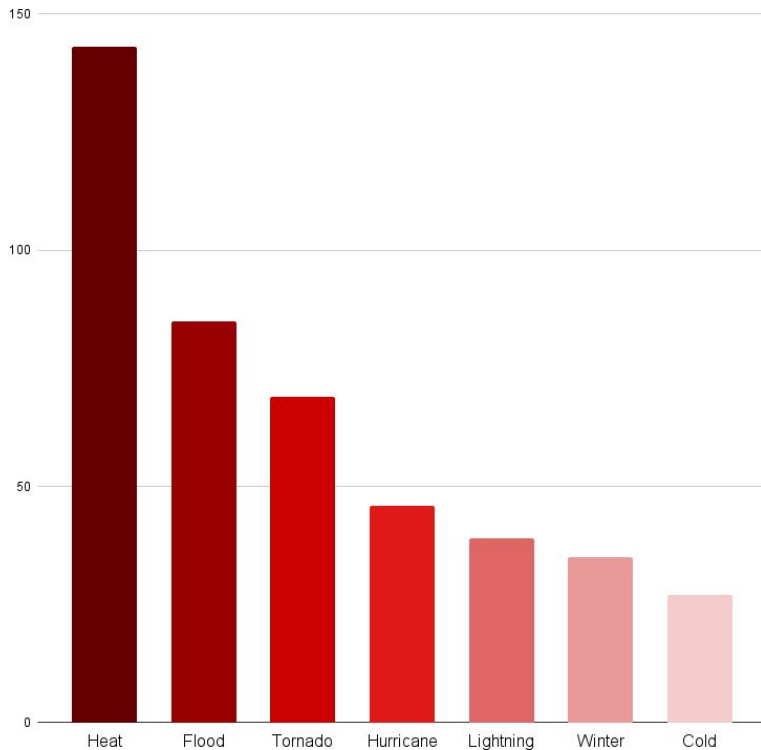
Infrastructure & Other Impacts

- Damage to roads, bridges, railways, power & telecommunications lines
- Strain on power systems
- Rapid increase in wildfire danger
- Agriculture/Aquaculture impacts

Urban Heat Island

- Significant warming due to urbanization & human activities
- Effect most noticeable overnight

U.S. Weather Fatalities (30-Year Average: 1991-2020)





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Heat Decision Metrics:

- Ambient Temperature
- **Heat Index***
- **Wet-Bulb Globe Temperature***
- **HeatRisk***
- Kalkstein & Other Systems

***Most frequently used by the National Weather Service**

	WBGT	HEAT INDEX
Measured in the sun	●	●
Measured in the shade	●	●
Uses temperature	●	●
Uses relative humidity	●	●
Uses wind	●	●
Uses cloud cover	●	●
Uses sun angle	●	●

Heat Index

Traditional measure of what the temperatures feels like to the human body when humidity is combined with air temperature.

However, there is a limited humidity climatology, particularly in the western US. Most heat index approaches do not consider overnight temperatures.

Wet Bulb Globe Temperature (WBGT)

Parameter that estimates the effect of temperature, humidity, wind, and solar radiation on humans.

This hyper-local index is a particularly useful measure for acclimatized, healthy, & physically active people including the military, outdoor workers, athletes/marching bands, etc. However, it is not a universal measure for the risk posed by heat. WBGT can be difficult to predict on the local scale, however NWS does provide WBGT forecasts.



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NWS HeatRisk

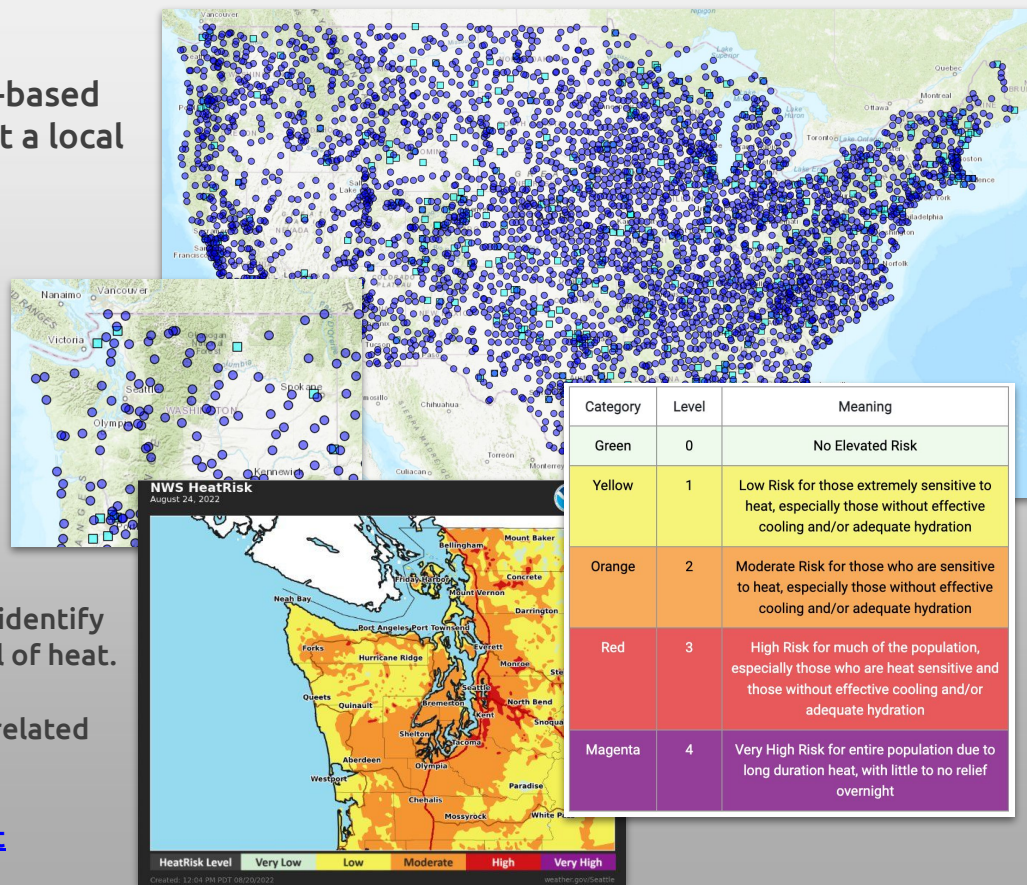
Puts heat into an actionable, impacts-based context to support decision-making at a local level.

HeatRisk takes into account:

- **Local Climatology**
 - Location
 - Time of Year
- **Forecast**
 - Forecast High Temperature
 - Forecast Low Temperature
 - Event Duration
- **Impacts**
 - Uses CDC heat health data to identify at-risk groups for a given level of heat.

HeatRisk is the primary driver of NWS heat-related Watch, Warning, & Advisory products

[HeatRisk Forecast](#) | [Historical Data](#) | [About](#)



National Weather Service HeatRisk Tool Anticipates Risks to Health

NWS HeatRisk Prototype

Identifying Potential Heat Risks in the Seven Day Forecast

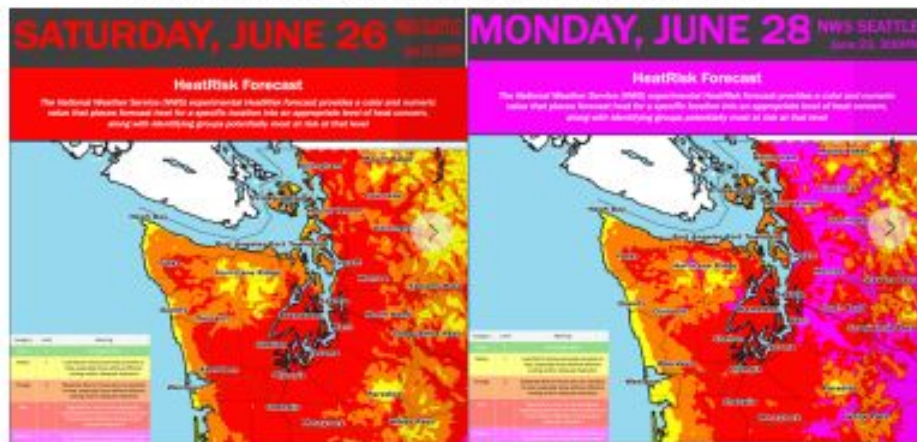
Thu 4/27	Fri 4/28	Sat 4/29	Sun 4/30	Mon 5/1	Tue 5/2	Wed 5/3
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Click map for potential heat risks and NWS forecast for a location.

Category	Level	Meaning
Green	0	No Elevated Risk
Yellow	1	Low Risk for those extremely sensitive to heat, especially those without effective cooling and/or adequate hydration
Orange	2	Moderate Risk for those who are sensitive to heat, especially those without effective cooling and/or adequate hydration
Red	3	High Risk for much of the population, especially those who are heat sensitive and those without effective cooling and/or adequate hydration
Magenta	4	Very High Risk for entire population due to long duration heat, with little to no relief overnight



HeatRisk Tool forecasts for May 3, 2023



HeatRisk Tool forecasts posted June 23, 2021

NWS HeatRisk Values	Public Health Recommendations
<p>2 Moderate</p>	<p>INITIATE EARLY WARNING, PUBLIC MESSAGING, AND RESPONSE ACTIVITIES</p> <ul style="list-style-type: none"> • Recommend sharing information about available cooling locations where general population can go to access air conditioning or cooling features such as water recreation facilities or other public places • Recommend dissemination of key public health heat safety messaging and risk communications to at-risk populations, including those experiencing homelessness, older adults, children, and outdoor workers • Consider limiting strenuous outdoor activities during the hottest period of the day • Consider cancelation and/or rescheduling of outdoor children's activities, day-camps, athletic practice, and games taking place during the hottest period of the day or consider moving them indoors where temperatures are cooler • Consider distribution of water and other cooling supplies for at-risk communities and populations • Consider activation of daytime cooling centers for unsheltered individuals • Consider undertaking preparation activities required to meet recommendations of higher HeatRisk levels, if forecast indicates increase in risk and temperatures • Monitor NWS HeatRisk forecast and alerts until forecast conditions become more favorable (e.g., HeatRisk Value of 1 - yellow - or lower)
<p>3 High</p>	<p>RECOMMEND ACTIVATION OF COOLING CENTERS & REDUCTION IN OUTDOOR ACTIVITIES</p> <ul style="list-style-type: none"> • Continue outreach efforts to reach at-risk populations with risk communications, cooling supplies, and water resources • Recommend activation of daytime cooling centers for unsheltered individuals • Recommend activation of daytime cooling centers for general population • Recommend temporary suspension of strenuous outdoor activities during hottest times of the day • Recommend cancelation and/or rescheduling of outdoor children's activities, day-camps, athletic practice, and games • Recommend conducting wellness checks on elders and people living with disabilities to ensure access to air conditioning or cooling centers • Consider expanding hours of operation for cooling centers for unsheltered individuals to accommodate overnight use • If school is in session, consider capabilities of schools to maintain cooler indoor air temperatures; Public Health will recommend closure if indoor temperatures cannot be maintained reasonably free of excessive heat (WAC § 246-366-080)
<p>4 Very High to Extreme</p>	<p>RECOMMEND CANCELATION OF OUTDOOR EVENTS AND ACTIVITIES</p> <ul style="list-style-type: none"> • Recommend expanding hours of operation for cooling centers to accommodate overnight use • Recommend cancelation of outdoor activities and events during hottest times of the day



Air Quality Coordination & Alerting

High Resolution Rapid Refresh (HRRR) Smoke Guidance

HRRR Smoke - Smoke Visualizer

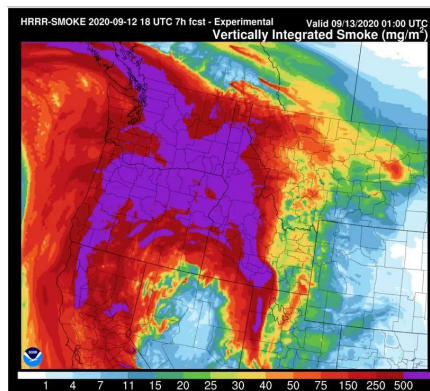
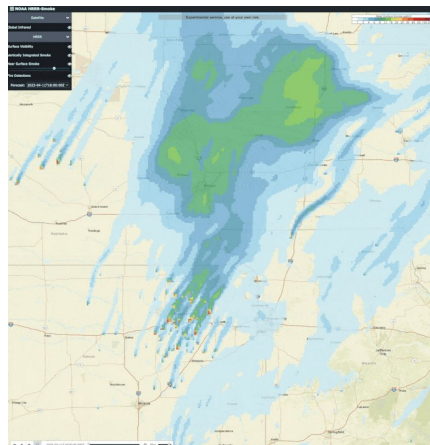
Provides hourly guidance for

- Surface Visibility
- Vertically Integrated Smoke
- Near Surface Smoke

HRRR Smoke - Model Graphics

Provides hourly guidance for

- Surface Visibility
- Vertically Integrated Smoke
- Near Surface Smoke
- Hourly Wildfire Potential
- Fire Radiative Power
- & More!

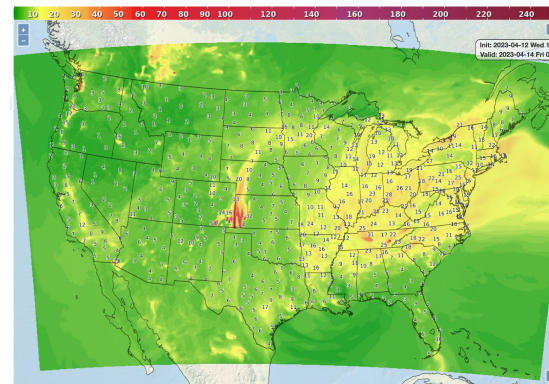


NWS/EPA Air Quality Forecast Guidance

The NOAA National Weather Service's (NWS) website (weather.gov) provides weather forecasts and hourly Air Quality forecast guidance for ozone, smoke, and dust in the form of interactive national maps.

NWS, in partnership with the Environmental Protection Agency (EPA), issues hourly air quality forecast guidance twice daily as part of a national Air Quality Forecasting Capability.

- [Operational Guidance Viewer](#)
- [Prototype Guidance Viewer](#)

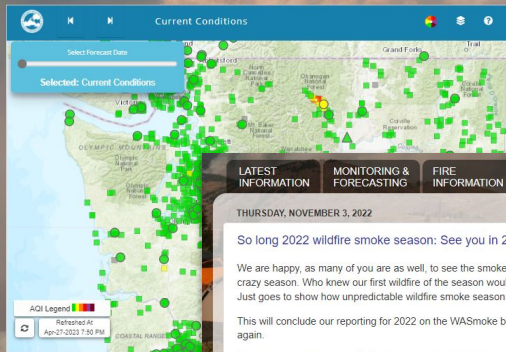




Air Quality Public Resources

Washington Smoke Information

Welcome to the Washington Smoke blog, a partnership between state, county, and federal agencies, and Tribes. We coordinate to collectively share info for Washington communities affected by wildfire smoke. If the air monitoring map doesn't display here, links to additional monitoring maps can be found under the 'Monitoring & Forecasting' tab.



THURSDAY, NOVEMBER 3, 2022

So long 2022 wildfire smoke season: See you in 2023!

We are happy, as many of you are as well, to see the smoke finally dissipate from Washington and close out this year's crazy season. Who knew our first wildfire of the season would start in mid-July and continue to burn into November? Just goes to show how unpredictable wildfire smoke season can be.

This will conclude our reporting for 2022 on the WASmoke blog. We'll return in 2023 when wildfire season kicks off again.

Recommendations during the off-season:

The map at the top of this page remains active throughout the year. During the off-season, you can still find information here on:

- Monitoring & Forecasting
- Contact information
- NWS Weather Alerts
- Health recommendations

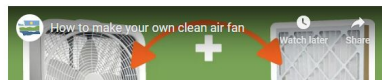
Winter Air Quality burn bans:

Colder weather is upon us, which means an uptick in wintertime wood smoke.

Air quality burn bans typically occur in the winter when wood smoke pollutes the air. They are called by Ecology, local clean air agencies, and Tribes to protect people's health. A burn ban limits wood stove use and outdoor burning.

See if there is Air Quality burn ban in effect before firing up your wood stove or fireplace. Air quality burn bans do not apply if it is your ONLY source of heat.

If you do burn wood to heat your home, those clean air fans are still useful to help keep your indoor air clean!



71822 The Stayman Plate Wofire
Photo courtesy of WA DNR

QUESTIONS OR COMMENTS?

We're happy to help answer questions and comments. We monitor this site during business hours, Monday through Friday, 8 a.m. to 5 p.m. Click on the word "comments" at the end of a post under the Latest Information tab. We moderate all comments to prevent spam. Your comment will publish upon review.

We are unable to provide site-specific forecasts for smoke. To learn about smoke events in your area, review the Local Smoke Outlooks tab for a general forecast, or consult local weather conditions, and check local air monitors under the Monitoring & Forecasting tab. For personal health advice, please consult your physician.

If your question is urgent, review the Contact Information tab for additional resources.

For emergencies, call 911.

NATIONAL WEATHER SERVICE WATCHES, WARNINGS & ADVISORIES



BURN BANS

Washington Burn Bans

FREQUENTLY ASKED QUESTIONS

WA Dept of Health FAQs

PARTICIPATING AGENCIES

Washington Smoke Blog

wasmoke.blogspot.com

Oregon Smoke Blog

oregonsmoke.org

Idaho Smoke Blog

idsmoke.blogspot.com

California Smoke Blog

californiasmokeinfo.blogspot.com



Air Quality Products & Services

Partner-Driven

Air Quality Alert (AQA)

To relay non-routine air quality alerts and information compiled by state and local air quality agencies.

→ **The NWS is *not* the lead agency for AQA issuance**

The function of initiating and issuing air quality messages is performed by state and local air quality forecasters. The NWS' primary function in this process is providing, on request, a means of disseminating these state and locally issued air quality messages.

Processes & players vary by state.

NWS-Driven

Air Stagnation Advisory

Typically issued in coordination with AQ partners for Atmospheric conditions stable enough to cause air pollutants to accumulate in a given area.

- Stagnant conditions have developed AND
- Are forecast to persist for at least 72 hrs AND
- 24 hour pollution levels are rising over a wide area

Generally a winter-time product.

Who Has The Authority?

Washington

- 8 Agencies & 11 Separate Jurisdictions
- WA Dept of Ecology will lead coordination beginning 2023

Oregon

- Oregon DEQ
- Lane Regional Air Protection Agency (LRAPA)

Idaho

- Idaho DEQ

Tribal Nations





Air Quality Index (AQI)

In Washington State, the WAQA system was retired prior to the summer 2022 wildfire season. The NWS and partnering agencies use the AQI, simplifying messaging across agencies.

Local NWS offices may relay messages from state or local health authorities. →

Washington Air Quality Guide for Particle Pollution

Check current and
forecast conditions at
enviwa.ecology.wa.gov

Vehicle exhaust, woodstove emissions, industrial emissions, wildfire smoke, windblown dust, and other sources contain fine particles with diameters 2.5 micrometers or smaller (PM_{2.5}) that can be dangerous to your health.

The Air Quality Index (AQI) reports the level of air quality and health concern across six categories:

Air Quality Index	What Should I Do?	Know the symptoms!
Good 0–50	It's a great day to be active outside and a good time to make a plan if worse air quality is in the forecast.	Burning eyes Coughing Throat and nose irritation Headaches Fatigue Wheezing and shortness of breath Irregular heartbeat Chest pain
Moderate 51–100	Some people are especially sensitive to lower levels of particle pollution and should reduce exposure. For example, limit time outside and avoid strenuous outdoor activity. All sensitive groups should watch for symptoms.	
Unhealthy for Sensitive Groups 101–150	Sensitive groups should take steps to reduce exposure. Limit time outside, avoid strenuous outdoor activity, and follow tips for cleaner indoor air. Everyone should watch for symptoms as a sign to reduce exposure.	
Unhealthy 151–200	Everyone should reduce exposure. Limit time outside, avoid strenuous outdoor activity, and follow tips for cleaner indoor air.	
Very Unhealthy 201–300	Everyone should reduce exposure. Stay inside and filter indoor air to keep it cleaner. Go elsewhere for cleaner air, if needed.	
Hazardous >300	Everyone should reduce exposure. Stay inside and filter indoor air to keep it cleaner. Go elsewhere for cleaner air, if needed.	

If your symptoms become serious, seek medical attention. High exposure to PM_{2.5} can lead to hospitalizations and increase the risk of death.

See back page for steps to reduce exposure and a list of sensitive groups with increased risk.

For information on wildfire smoke and protecting health, go to doh.wa.gov/smokeyfromfires.

For information on wildfire smoke and outdoor worker safety, see WA State Department of Labor and Industries requirements.

Source
Link



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Research, Development, & Feedback

- **Long Term Planning**
 - Public Health uses historical weather data & long term projections to inform planning & recommendations
- **Local Research**
 - Example: The University of Washington, Public Health Seattle & King County, and NWS Seattle are collaborating on a grant proposal to research the development of a framework for communicating extreme cold risk
- **NWS products & services are constantly evolving.**
 - For instance, the current nationwide effort to determine new Extreme Cold alerting criteria.
- **After Action Reviews (AARs)**
 - NWS Seattle requests AAR input after significant weather events
 - NWS Seattle reviewed & submitted input into the WA DOH 2021 “Heat Dome” AAR
 - NWS Portland & Multnomah County Health Department iteratively revise procedures & thresholds after significant weather events/season.



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Training Collaboration

- **Public Health Partner Training**
 - NWS Portland annual air quality trainings
 - NWS Seattle exploring seasonal public health trainings
- **Conferences, workshops, or training that could further each others missions**
 - NWS-hosted Hazard-Based Training Workshops
 - Emergency Management Conferences
 - Public Health Conferences
 - Tribal Public Health Emergency Preparedness Conference
 - National Environmental Health Association Conference
 - Meteorological Conferences
 - American Meteorological Society
 - Emergency Management Conferences
 - International Association of Emergency Managers (IAEM)



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Thank You

Reid Wolcott	National, National Weather Service, Seattle	reid.wolcott@noaa.gov
Marnie Boardman	Washington State Department of Health	marnie.boardman@doh.wa.gov
Erika Estrada	Washington State Department of Health	erika.estrada@doh.wa.gov
Addison Houston	Public Health Seattle & King County	ahouston@kingcounty.gov
Jillian Edge	Public Health Seattle & King County	jedge@kingcounty.gov
Brendon Haggerty	Multnomah County Health Department	brendon.haggerty@multco.us