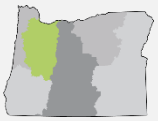

WILLAMETTE

REGION 3

Observed & Projected Climate Changes

Air & Water Temperature

Observed

Annual Air

- Average temperature in Oregon was warmer than normal in 18 of the last 23 water years (as of 2022).
- Mean annual temperatures have increased by about 1.2-1.5°C (2.2-2.7°F) since 1895.

Seasonal Air

- Summer, fall, and winter temperatures have each increased by about 1.4°C (2.5°F) since 1895; spring temperatures have increased by about 0.7°C (1.3°F).

Extreme Heat

- Increasing number of extremely warm days (e.g., Salem: 17.1 days >90°F (32°C) from 1951-2020; 37 days from 2021-2022).
- Increasing number of extremely warm nights in Portland; no significant change for Salem, Eugene.

Streams

- Long-term temperature monitoring sites in the McKenzie River basin (downstream of large dams and reservoirs) show little evidence of warming trends during late summer months in comparison to nearby free-flowing reaches.

Projected by 2100

Annual Air

- +2°C (3.6°F) to +6.0°C (10.8°F).

Seasonal Air

- Largest temperature increase is projected during summer (+6°C/10.8°F), followed by fall (+5°C/9°F), and then spring and winter (+4°C/7.2°F).
- Portland's Dec/Jan temperature patterns are projected to be similar to those currently experienced in Mar.
- Projected increases in summer mean maximum daily temperature - Eugene: 28°C (82°F) in 2020s; 31.3°C (88°F) by 2050s.
- Projected increases in winter mean maximum daily temperature - Eugene: 10°C (50°F) in 2020s; 12.2°C (54°F) by 2050s.

Extreme Heat

- Longer, more frequent, and more intense extreme heat events.
- Increase in the annual number of days >90°F (32°C) by mid-century (+13 to +21 days) compared to 1971-2000.
  - Eugene: 19 days in 2020s; 38 days by 2050s.
  - Portland: 14 days in 2020s; 31 days by 2050s.
- Increased frequency & magnitude of days with an extreme heat index (temperature + humidity).

Streams

- Outside of regulated reaches, temperature increases are projected to be relatively uniform except for small increases in streams at the highest elevations.
- +2.2°C (4°F) for mean August stream temperature.

Precipitation & Drought

Observed

Annual	• Overall, Oregon's precipitation is below average in 17 of the last 23 water years (as of 2022). • No long-term trend in annual precipitation within the region.
Seasonal	• Spring precipitation has increased in the past century.
Snowpack	• No significant change in April 1 snow-water equivalent (SWE) since 1980. • Annual peak SWE has decreased significantly with a simultaneous increase in rain-on-snow events.
Drought	• Persistent and severe droughts have occurred in Oregon since 2000. • Increased drought severity from 1987-2013 compared to 1960-1986.

Projected by 2100

Annual	• Generally, no change or minimal increase.
Seasonal	• Slight increase in winter precipitation (Dec-Feb) and less precipitation during the growing season (Apr-Oct).
Extreme Precipitation	• Increased intensity of atmospheric rivers. • Increased number of days with an atmospheric river present.
Snowpack	• Complete loss of snowpack in the lower and mid-elevations; significant declines at higher elevations. • Average snow residence time is expected to decline by about 8-10 weeks relative to current conditions.

Drought	• Increased frequency and duration of drought.
	• Increased probability of more extreme droughts than those observed in the past century.
	• Annual number of dry days:
	  ○ Eugene: 133 days in 1990s; 140 days by 2050.
	  ○ Portland: 135 days in 1990s; 141 days by 2050.
	• Climatic water deficit (CWD; a measure of drought stress) is projected to increase, with the largest percentage change above 1,500 m (4,921 ft).

Hydrology & Sea Level Rise

Observed

Streamflows	• Across the Pacific Northwest, a higher fraction of the total annual flow occurs earlier in the year, and summer flows have been decreasing.

Projected by 2100

Streamflows	• Lower elevation catchments (rain-dominant) will be less affected than higher elevation catchments; smaller streams in lower elevations do not show major peak-flow increases. • Peak flow increases projected in mid to higher elevations and in main tributaries with the expansion of rain-on-snow events and greater contribution of winter rain to floods. • Increased frequency and magnitude of floods due to more intense rainfall and shifts from snow to rain. • In areas where snow is not a large contributor to streamflow, small decreases in low flows are expected. • Greatest declines in low flows occur in High Cascade streams and some of the larger tributary rivers (e.g., Sandy River, Middle Fork Willamette River, Santiam River). • Summer flows are projected to decline by 38-58%. • Overall, summer water availability indicates less streamflow for extended periods.

Disturbances

Projected by 2100

Wildfire	• Increased suitability for large wildfires for the western Cascades; highest suitability in the southeastern part of the region (Willamette National Forest).
	• Increased fire activity and frequency.
	• Uncertainty regarding fire severity; some studies suggest an increase in burn severity while others project either no change or potential reductions in fire severity.
	• Increased number of high fire danger days in summer and fall.
	  ○ Eugene: 12 days in 2020s; 16 days by 2050s.
	  ○ Portland: 15 days in 2020s; 20 days by 2050s.

Insects & Pathogens	• Increased pathogen activity in areas with drought-stressed host species. • Altitudinal and latitudinal range expansion of some forest pathogens. • Warmer winters and hotter droughts may enable some insects to increase reproductive rates and move into previously unsuitable habitat. • Increased tree mortality from insects and pathogens as trees are exposed to more stress associated with growing-season drought.
Invasive Plants	• Altered distribution and spread of nonnative plant species. • Warm, dry sites with increased topographic exposure may be particularly susceptible to nonnative species.

Information from the following references and the citations therein:

1. Halofsky, J.E., D.L. Peterson, and R.A. Gravenmier, eds. 2022. Climate change vulnerability and adaptation in the Columbia River Gorge National Scenic Area, Mount Hood National Forest, and Willamette National Forest. Gen. Tech. Rep. PNW-GTR-1001. U.S. Dept of Ag., Forest Service, Pacific Northwest Research Station. 469 p.
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4. Department of Land Conservation and Development. 2023. Climate Change Vulnerability Assessment Workshops, Regional Climate Change Projections Fact Sheets. https://www.oregon.gov/lcd/CL/Pages/Vulnerability-Assessment.aspx