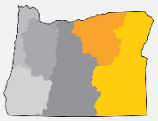

EASTERN & COLUMBIA BASIN

REGIONS 5 & 6

Observed & Projected Climate Changes

Air & Water Temperature

Observed

Annual Air

- Mean annual temperatures have increased by about 0.06°C (0.1°F)/decade between 1895-2013.
- In Oregon, the past 20 years (2000-2019), except 2011, were warmer than the 20th century (1900-1999) average.

Extreme Heat

- Increasing number of days >90°F (32°C) (e.g., +8 days/yr in Pendleton)
- Relative to 1981-2010, the average number of hours of exposure to heat indexes >80°F (27°C) or 90°F (32°C) has increased.

Streams

- Across the Pacific Northwest, stream temperature increases have occurred during summer, fall, and winter, with the highest rates of warming in the summer (0.2°C (0.4°F)/decade).

Projected by 2100

Annual Air

- +1.1°C (2°F) to +4.7°C (8.5°F) compared to 1970-99.

Seasonal Air

- Increased summer air temperature (+5.4°C/9.7°F by 2080s), with smaller increases during other seasons.
- Summer (mean maximum daily temperature):
  - La Grande: 29°C (85°F) in 2020s; 31.2°C (89°F) by 2050s.
  - Burns: 29°C (85°F) in 2020s; 30.1°C (87°F) by 2050s.
- Winter (mean maximum daily temperature):
  - La Grande: 5.6°C (42°F) in 2020s; 6.7°C (44°F) by 2050s.
  - Burns: 10°C (50°F) in 2020s; 11.1°C (52°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 (+17 to +33 days) compared to 1971-2000.
- Increased frequency and magnitude of days with an extreme heat index (temperature + humidity
  - Hermiston, Rome, and Ontario are projected to have the greatest increases in the number of extreme heat index days by the late 21st century.

Streams

- Temperature in low-elevation, warmer streams (less shade, less cool water groundwater inputs) will likely increase the most in the future.
- +2°C (3.6°F) for mean August stream temperature.

Precipitation & Drought

Observed

Annual

- No significant trend in annual precipitation in the region, although the last 30 years have generally been drier than the 20th century average.

Snowpack

- From 1982-2017, peak snow-water equivalent (SWE) declined in the Steens Mountains, Trout Creek Mountains, and Wallowa Mountains.

	• Complete melting of snowpack has occurred slightly earlier (2-10 days earlier per decade) in the southern and northern Blue Mountains, Steens Mountains, and along the lower elevations of the Wallowa Mountains.
Drought	• Persistent and severe droughts have occurred in Oregon since 2000.
Projected by 2100	
Annual	• Projections range from wetter to drier.
Seasonal	• Decreased summer precipitation and slight increases during other seasons.
Extreme Precipitation	• 60% increase in number of extreme rainfall events in Burns from the 1990s to 2050s. • Increase in frequency and intensity of floods due to stronger storms and a shift from snow to rain. • Increased risk of flash floods. • Increased intensity of atmospheric rivers and possible penetration further inland.
Snowpack	• Declines in snowpack persistence and April 1 SWE, with largest declines in mid-elevation and wetter locations. • In the Blue Mountains, large areas could lose all or significant portions of April 1 SWE by mid-century. • Watersheds historically classified as mixed rain and snow will become rain-dominant. • Annual mean snowfall in Union County projected to decline from 5 ft (1.5 m) in 1981-2010 to 3 ft (0.9 m) in 2025-2049.

Drought	• Increased severity and duration of droughts.
	• Annual number of dry days:
	  ○ Union County: 157 days in 1990s; 163 days by 2050.
	  ○ Burns: 133 days in 1990s; 140 days by 2050.

Hydrology

Observed	
Streamflows	• In the Western U.S., increased temperatures have led to earlier runoff timing in snowmelt-dominated and mixed rain-and-snow watersheds; spring, early summer, and late-summer flows have been decreasing and more of the annual flow has been occurring earlier in the water year. • In the Blue Mountains, summer flows decreased 21-28% in the period from 1949-2010.
Projected by 2100	
Streamflows	• Flood magnitude likely to increase in the Wallowa Mountains, Hells Canyon Wilderness Area, and northeastern portion of the Wallowa-Whitman National Forest, with mid-elevation areas the most vulnerable to rain-on-snow events. • Locations with the greatest change in flood magnitude also show substantial changes in the frequency of largest flows in winter (i.e., these areas likely to have more frequent high flows). • No change in frequency of mid-winter flood events. • Runoff timing of streams projected to occur 9-23 days earlier in the year. • Projections of future low flows show relatively minor decreases (<10%) in summer streamflow for 47% of perennial streams across the Blue Mountains region however, some portions (e.g., Wallowas, Greenhorn Mtns., Wenaha-Tucannon Wilderness) show greater decreases (>30%).

Disturbances

Observed	
Wildfire	• In the northwestern U.S., large forest fires have become near-annual. • Annual area of shrubland burned has increased. • In the Blue Mountains, wildfires have moved upslope (i.e., spread into higher elevations that were previously cool and moist enough to deter fire expansion) at a rate of 12 m (39 ft)/yr from 1984-2017.

Projected by 2100

Wildfire

- Increased number of wildfires in national forests in the Pacific Northwest.
- Increased area with high fire danger in the summer.
- Increased number of high fire danger days in summer and fall.
  - LaGrande: 14 days in 2020s; 20 days by 2050s.
  - Burns: 13 days in 2020s; 19 days by 2050s.

Information from the following references and the citations therein:

1. Halofsky, J.E. and D.L. Peterson, eds. 2017. Climate change vulnerability and adaptation in the Blue Mountains. Gen. Tech. Rep. PNW-GTR-939. U.S. Dept of Ag., Forest Service, Pacific Northwest Research Station. 331 p.
2. Dalton, M. and E. Fleishman, eds. 2021. Fifth Oregon Climate Assessment. Oregon Climate Change Research Institute, Oregon State University. 183 p.
3. Fleishman, E., ed. 2023. Sixth Oregon Climate Assessment. Oregon Climate Change Research Institute, Oregon State University. 248 p.
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