



Eyes Over Puget Sound

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Special Report:

Expected drought effects and a warmer Puget Sound

March 24, 2015

[Return to Eyes over Puget Sound](#)

[EOPS](#)

Up-to-date observations of visible water quality conditions in Puget Sound and the Strait of Juan de Fuca

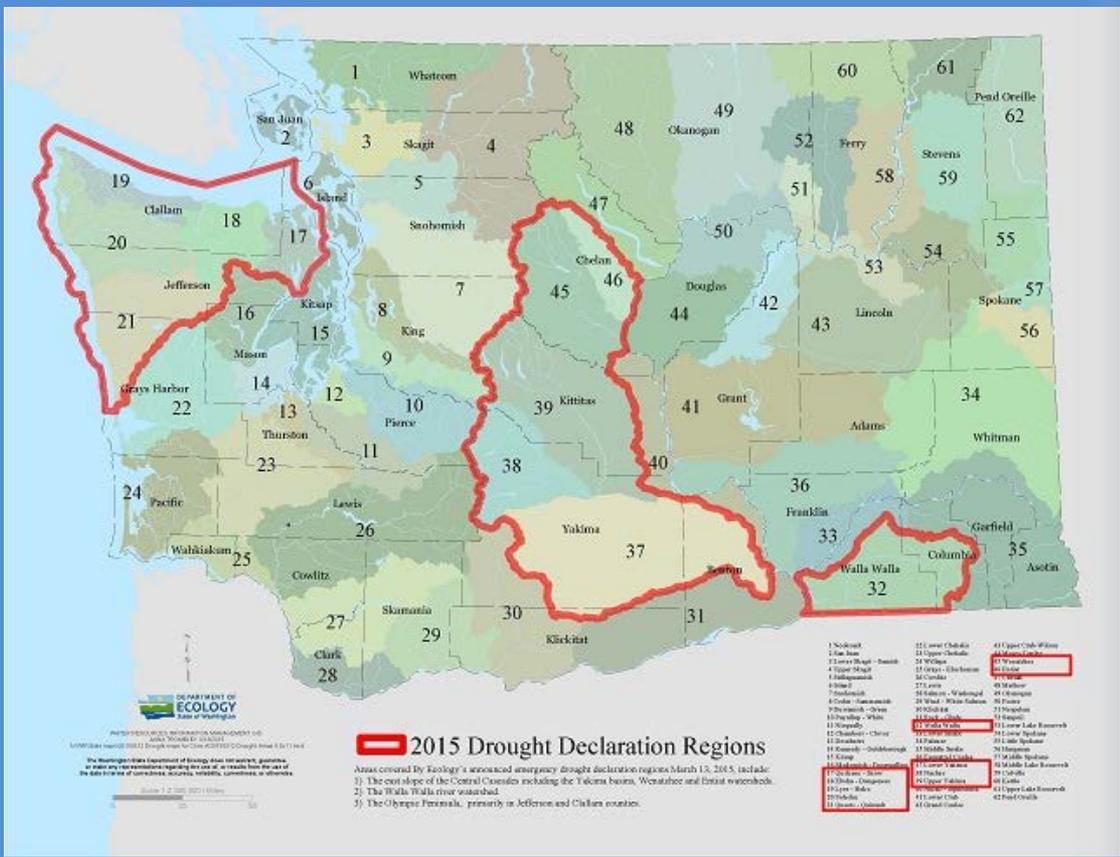
Extreme low snowpack has triggered a drought

Governor Jay Inslee declared a drought on March 13 in three regions of Washington state. State law allows Ecology to declare a drought emergency if we determine that all or part of a geographical area is suffering from drought conditions.

Snowpack is like a frozen reservoir for river basins, usually collecting over the winter and then slowly melting, providing a water supply for rivers and streams.

Currently snowpack statewide is 26 percent of normal, with little to no snowfall predicted into the spring, and warmer-than-normal temperatures through the summer.

[Read the story on Ecology's website](#)



Record high winter temperatures mean rain, not snow

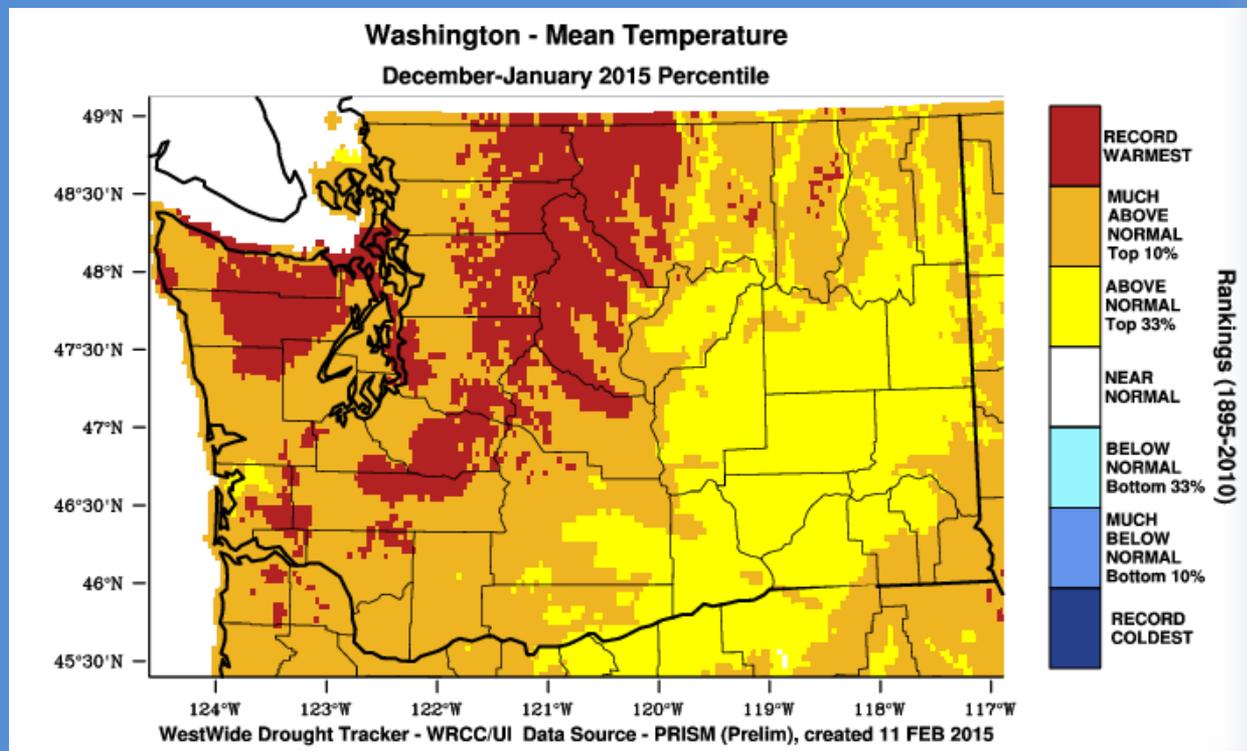
Although we've had plentiful precipitation, warm temperatures have pushed the snow line to high elevations and reduced the snowpack in most areas. Some areas that are relatively cold, like the North Cascades, have avoided this problem.

This year's warm temperatures follow a long-term trend in warming.

[Trends in PNW Climate](#)

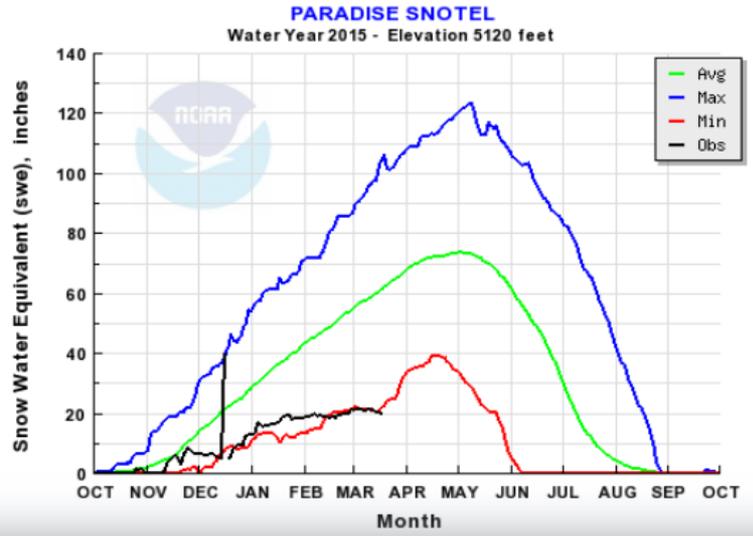
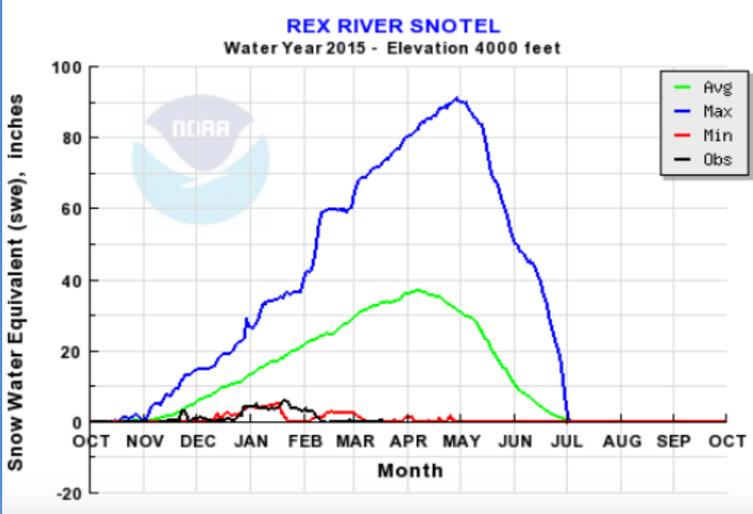
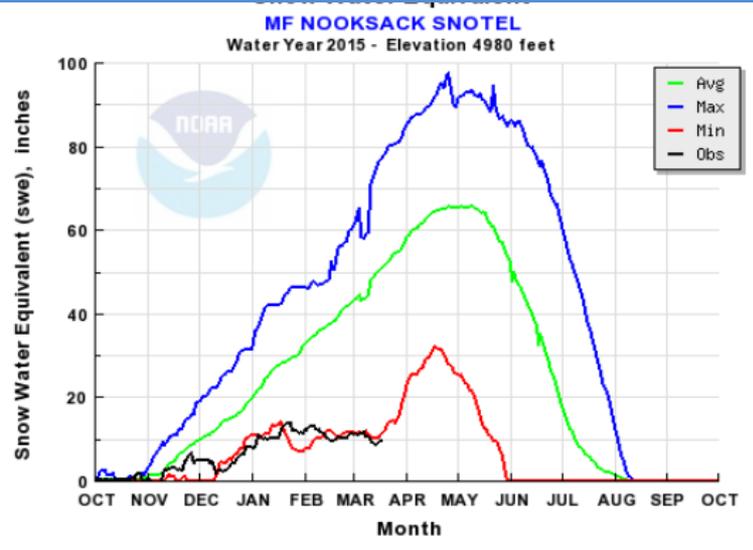
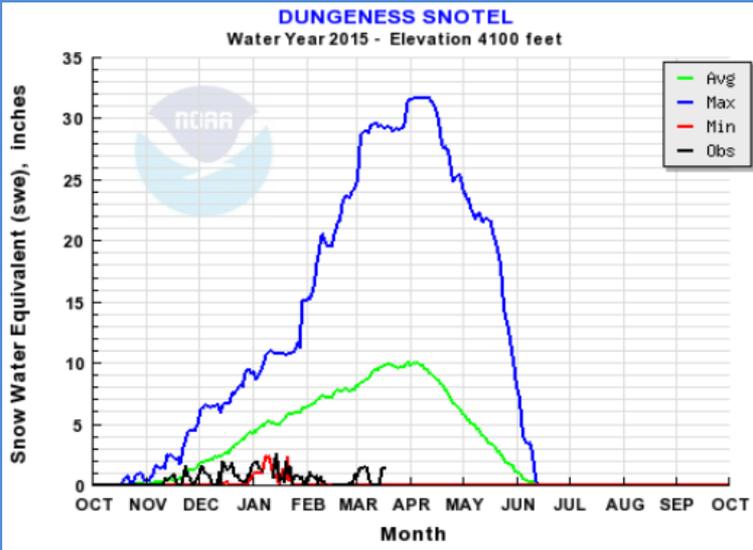
Climate change modeling suggests that this winter's weather conditions, although extreme compared to the historical record, will become more common in the future.

[Future Northwest Climate](#)

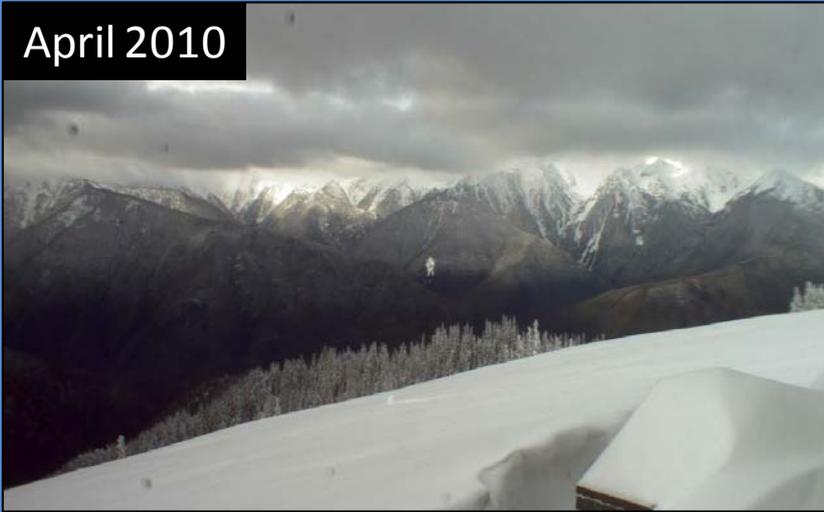




Four examples: snowpack tracking lowest on record



April 2010



March 2015



Photo by Bill Baccus, Olympic National Park

Feb 2013



Hurricane Ridge:
winter snow is gone.
Low snow has only occurred
twice since 1960
(1977 & 2005).

Low snowpack means low flows

Many of the major rivers draining to Puget Sound are considered snowmelt-dominated. In these systems, melting snowpack in the upper elevations maintains streamflows well into the summer and recharges groundwater. Snowpack below normal means that low summer flows will begin earlier and continue to drop below normal into the fall.

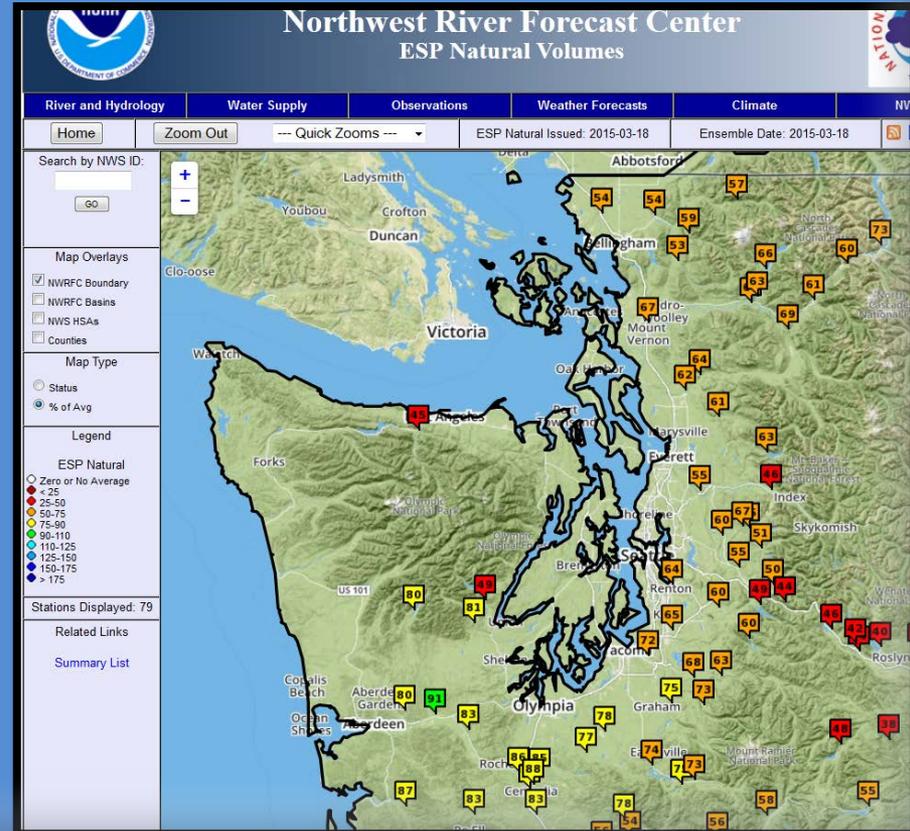
[Encyclopedia of Puget Sound:
Section 5. Seven-Day Low Flow](#)

Basins most strongly affected have high elevation headwaters and no reservoirs.

Examples include:

- Dungeness River
- Nooksack River
- Snohomish River

Northwest River Forecast Center
Flow Volume Projections
as percent of normal



Low flows can harm salmon

Hal Beecher of Washington Dept. of Fish and Wildlife:

Low snowpack and consequent summer low flow have a variety of negative effects on salmon and trout in rivers flowing to Puget Sound:

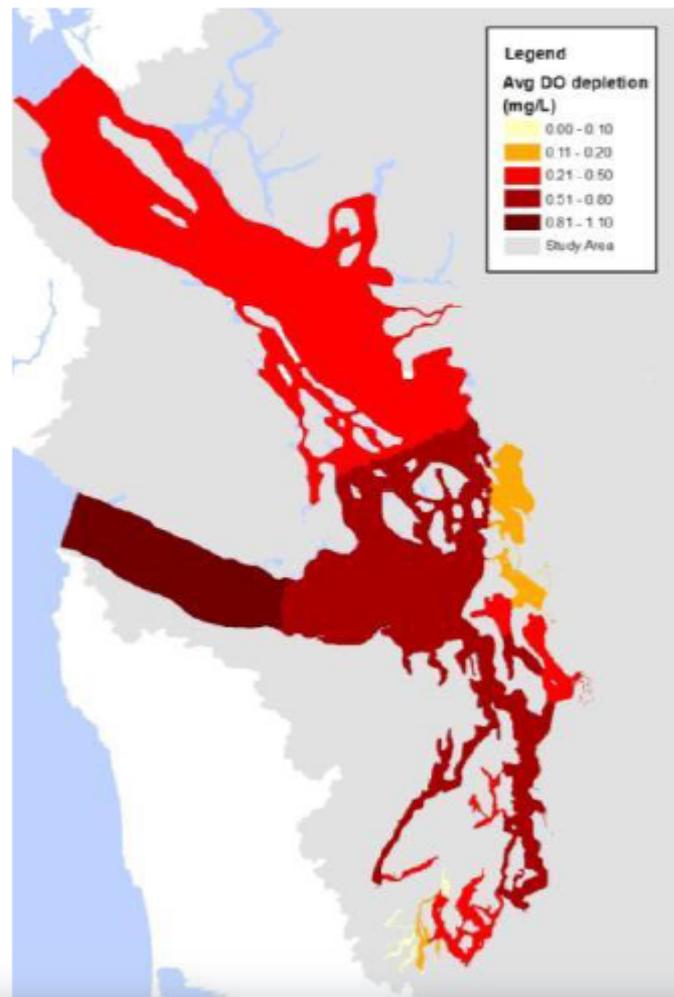
- Many species spend at least a year growing in upland water bodies before going to sea. Lower flows mean less space to live in and higher temperatures, so that fewer young fish go to the ocean following a dry summer, and fewer return as adults.*
- When low flows extend into the upstream migration season, shallow water may prevent fish from reaching their home spawning grounds. High temperatures may have the additional impact of low oxygen levels and the spread of disease.*
- Low flows may force salmon to spawn nearer the middle of the river channel, so that subsequent winter storm and high flows may scour redds and kill eggs.*
- Several species spawn in the spring. If low flow comes earlier than normal, some eggs may be left high and dry before the young can emerge to swim away.*
- Most ocean-going salmon and trout migrate downstream in spring. Higher flows from spring snowmelt usually help move those fish. Low spring flows from low snowpack means they move more slowly, putting them at greater risk of predation.*



Low inflows affect Puget Sound circulation and quality

- Modeling shows that lower summer inflows change circulation and reduce net outflows.
- Slower summer circulation can decrease oxygen levels in the Sound to lower than normal levels.
- Climate change modeling demonstrates the effect of reduced inflows on the Sound. By 2070, circulation changes from low flows will significantly reduce oxygen. These reductions may be as large as reductions from doubling the population in the Puget Sound watershed.
- [Ecology Report: Puget Sound and the Straits Dissolved Oxygen Assessment - Impacts of Current and Future Nitrogen Sources and Climate Change through 2070](#)

Conditions – Average regional depletion with future circulation (Run 34)



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