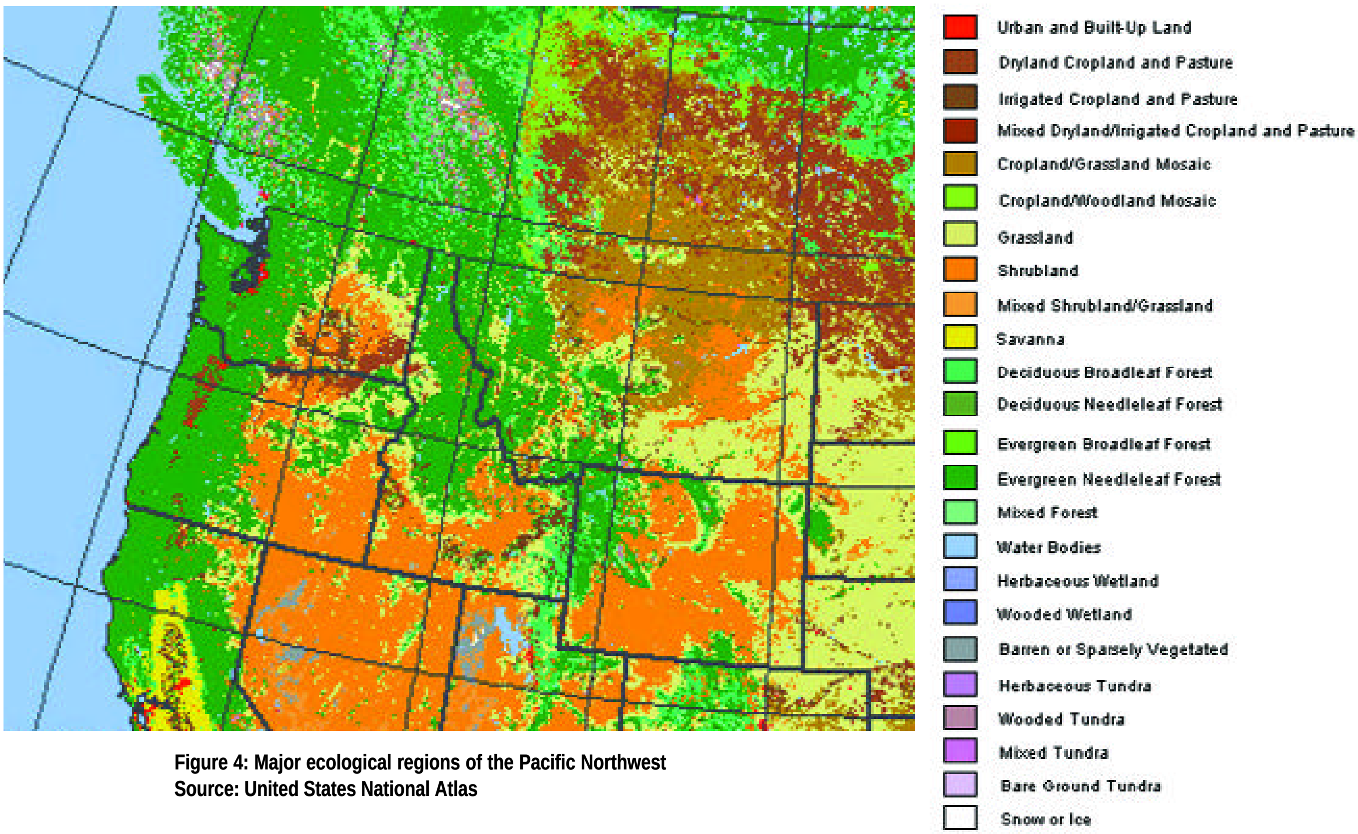


Figure 4: Major ecological regions of the Pacific Northwest
Source: United States National Atlas

Average Annual Precipitation, Pacific Northwest, 1961-1990

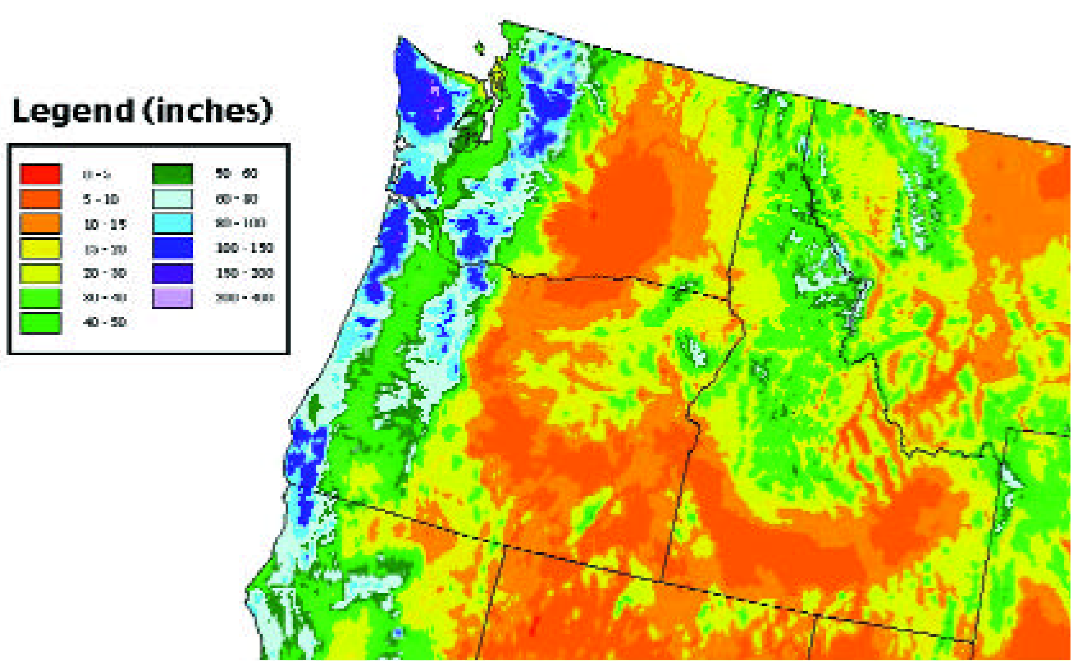


Figure 5: The Cascade mountains divide the wetter west from the drier east. Source: Mapping by C. Daly, graphic by G. Taylor and J. Aiken, copyright © 2000, Oregon State University.

Northwest Average Temperature, Observed and Modeled

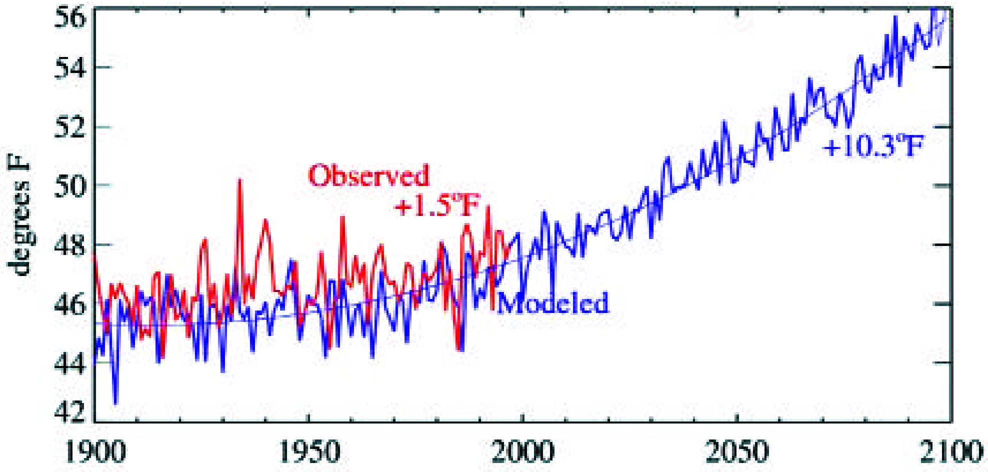


Figure 7: The red line shows annual-average temperature in the Northwest in the 20th century, observed from 113 weather stations with long records. The blue line shows the historical Northwest average temperature calculated by the Canadian model from 1900 to 2000, and projected forward to 2100. Source: Mote et al (1999), Summary (p. 6).

Temperature Change 20th and 21st Centuries

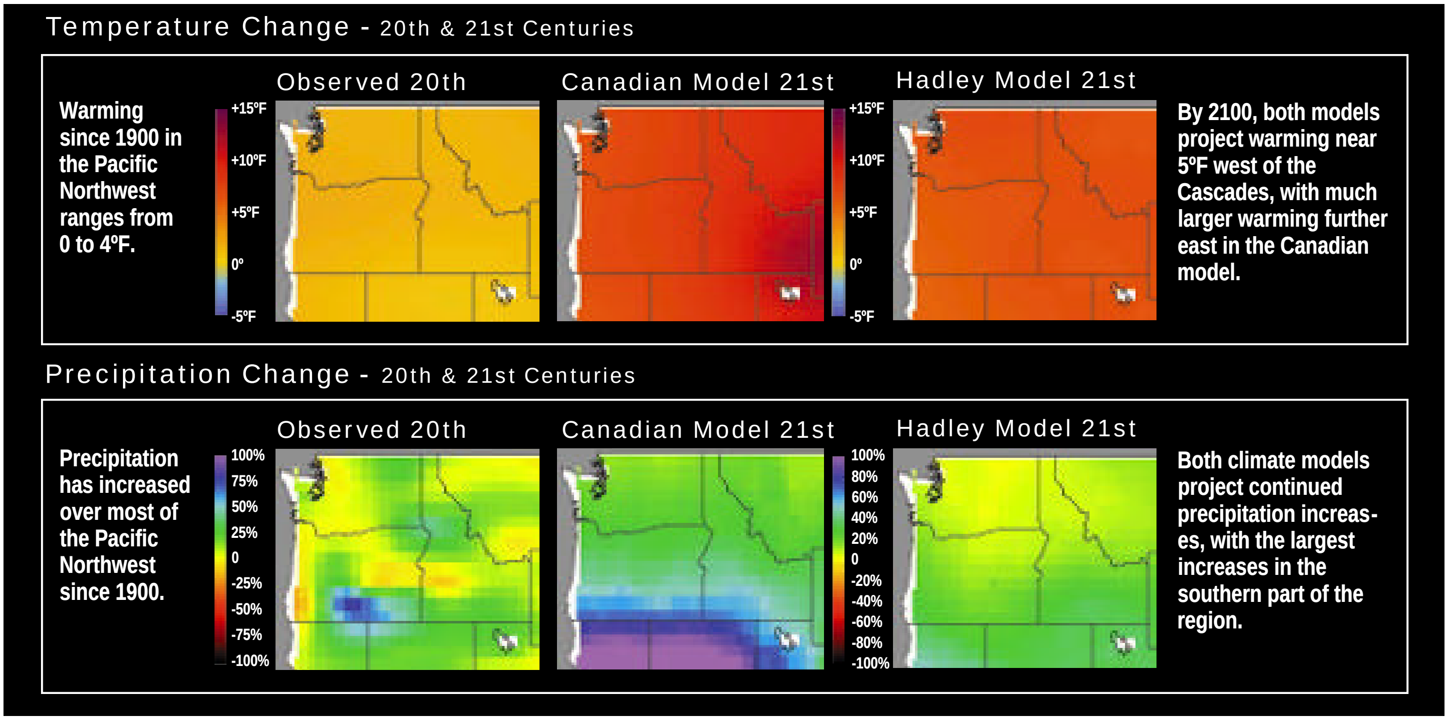


Figure 8: Temperature change observed in the 20th and projected for the 21st centuries.

Projected Northwest Climate Change, Compared to 20th Century Variability

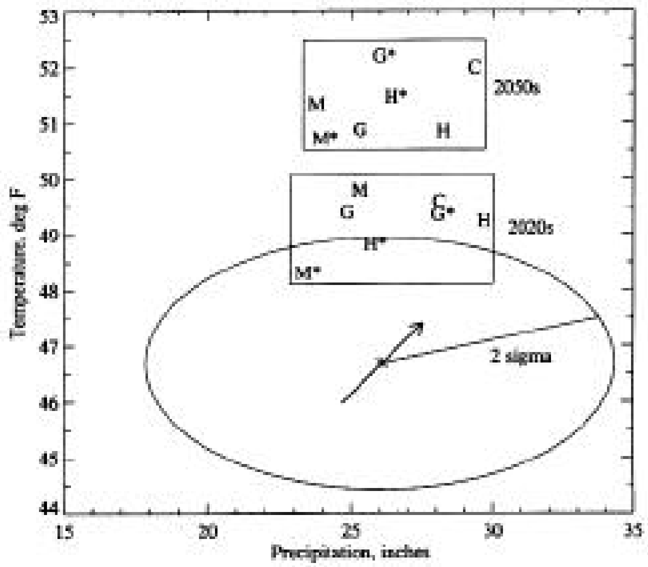


Figure 9: Climate change by the 2020s and 2050s over the Northwest Region from seven climate model scenarios. Any point on the graph shows a particular combination of regional annual-average temperature and total annual precipitation. The asterisk and arrow through it show the average climate over the 20th century and its trend, warming about 1.5°F (0.8°C) with a 2.5" (6 cm) precipitation increase. The oval illustrates how much the region's climate varied over the 20th century, enclosing all combinations of temperature and precipitation that were more than 5% likely to occur. Each letter shows one model's projection of the region's average climate, either in the 2020s or the 2050s. The models project that regional precipitation changes will lie within the range of 20th century variability, but projected temperature changes lie outside it. By the 2050s, all models project a climate so much warmer in the Northwest that it lies well outside the range of 20th century variability (*=1995-vintage model; H=Hadley; M=Max-Planck; G=GFDL; C=Canadian). Source: Regional report, Mote et al. (1999), fig. 12, pg. 19.

Projected Reduction in Columbia Basin Snowpack

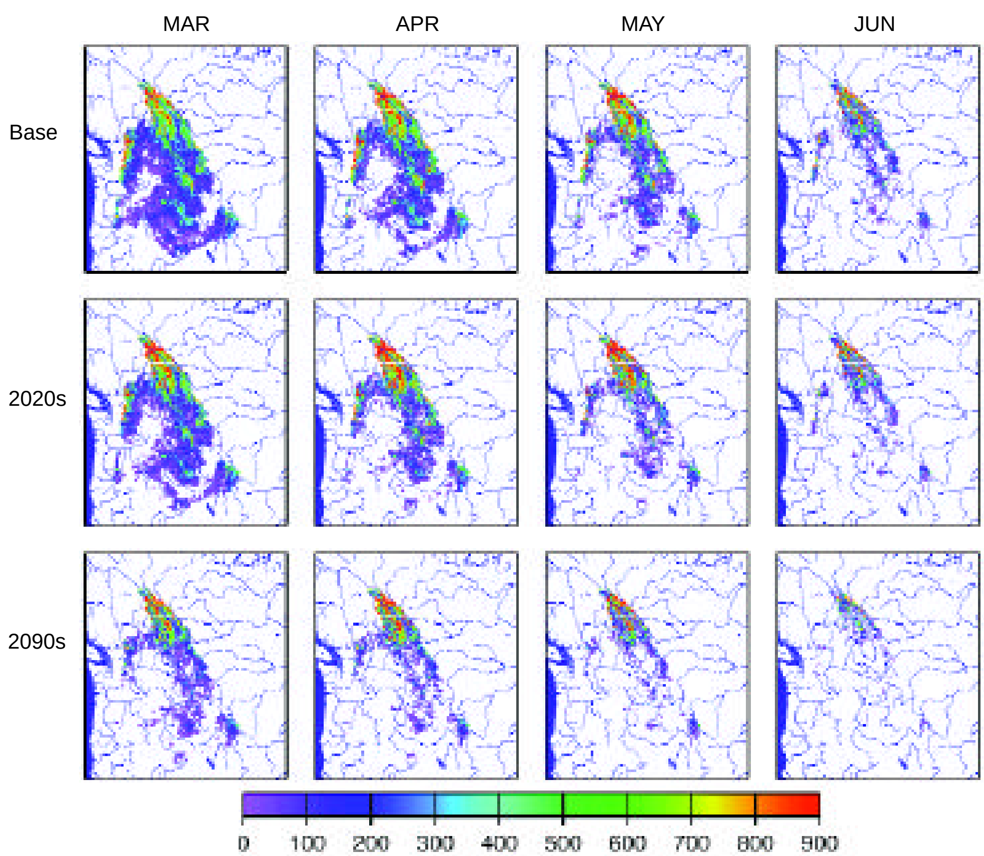


Figure 10: By the 2090s, projected Columbia Basin snowpack on March 1 will be only slightly greater than present snowpack on June 1. Simulations use the VIC hydrology model under the Hadley scenario. Units in millimeters. Source: Hamlet and Lettenmaier, 1999.

Projected Seasonal Shift in Columbia River Flow

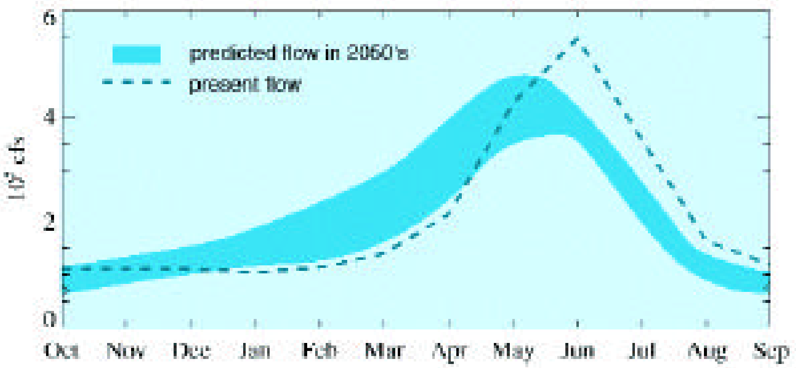


Figure 11: While only small changes are projected in annual Columbia flow, seasonal flow shifts markedly toward larger winter and spring flows, and smaller summer and fall flows. The blue band shows the range of projected monthly flows in the 2050s under the Hadley and Canadian scenarios and the two other 1998-vintage climate models used in the Northwest assessment (MPI and GFDL). Source: Mote et al. (1999), Summary, Figure 7.

Salmon Catches and Inter-decadal Climate Variability

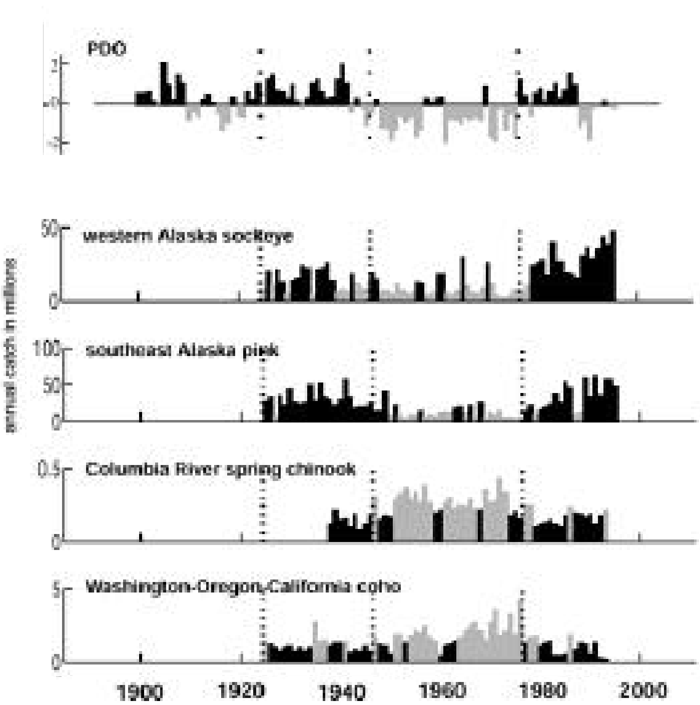


Figure 14: 20th century catches of Northwest and Alaska salmon stocks show clear influence, in opposite directions, of the Pacific Decadal Oscillation. Source: Mote et al (1999), Figure 36, p. 56.

Tree Growth and Inter-Decadal Climate Variability

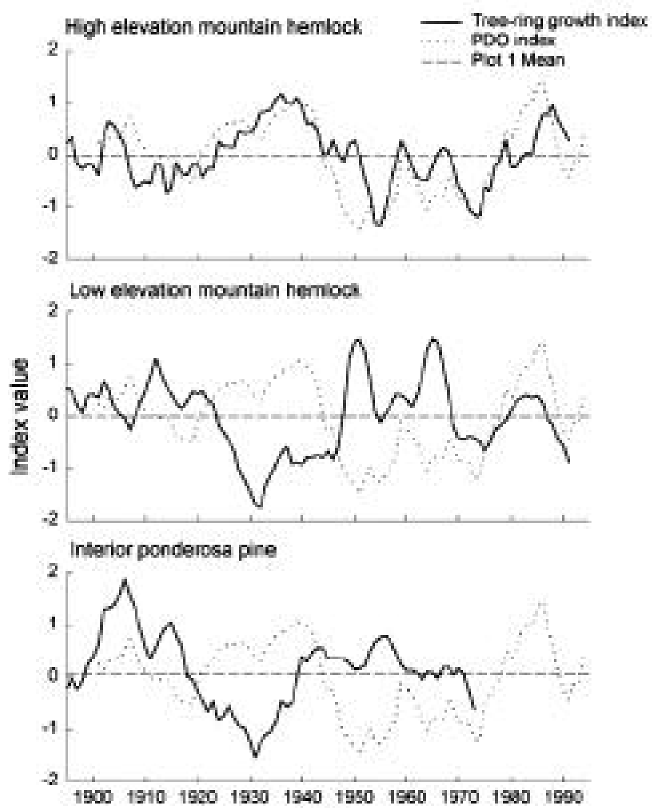


Figure 16: Trees near their climatic limits show strong signals of inter-decadal climate variability. Those near the upper treeline grow best in warm-PDO years because snowpack is lighter, while those near the dry lower treeline grow worst in warm-PDO years, because of summer moisture deficit. Source: Peterson and Peterson, 2000.

Projected Northwest Vegetation Changes under two Ecosystem Models, 2100

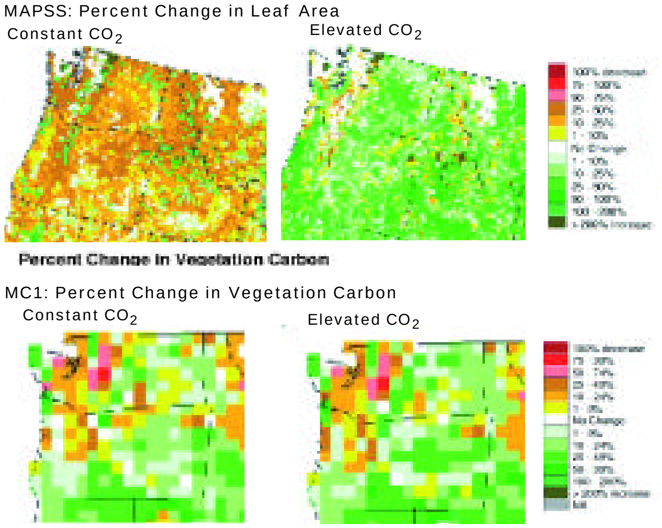
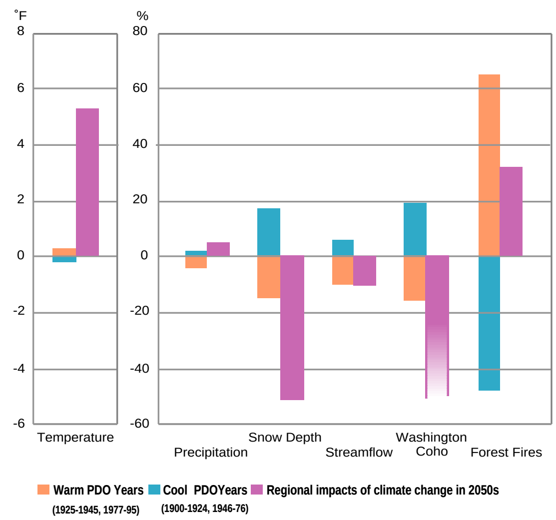


Figure 18: Under the Hadley scenario, the MAPSS (top row) and MC1 (bottom row) models project expansion of forests east of the Cascades and contractions to the west, assuming increased water-use efficiency under elevated atmospheric CO_2 (right column). When no such increase is assumed (left column), projections are nearly unchanged in the MC1 model, but change to a large contraction region-wide in the MAPSS model. Source: Bachelet et al (2000).

Climate Change Projected for 2050 vs Observed 20th Century Variability



Temperature	Change in annual average regional temperature (ºF)
Precipitation	Change in annual average regional precipitation (%)
Snow depth	Change in average winter snow depth at Snoqualmie Pass, WA (%)
Streamflow	Change in annual streamflow at The Dalles on the Columbia River (corrected for changing effects of dams) (%)
Salmon	Change in annual catch of Washington Coho salmon (%)
Forest fires	Change in annual area burned by forest fires in WA and OR (%)

Figure 20: This chart compares possible Northwest impacts from climate change by the 2050s with the effects of natural climate variations during the 20th century. The orange bars show the effects of the warm phase of the Pacific Decadal Oscillation (PDO), relative to average 20th century values. During warm-PDO years, the Northwest is warmer, there is less rain and snow, stream flow and salmon catch are reduced, and forest fires increase. The blue bars show the corresponding effects of cool-phase years of the PDO, during which opposite tendencies occurred.

The pink bars show projected impacts expected by the 2050s, based on the Hadley and Canadian scenarios. Projected regional warming by this time is much larger than variations experienced in the 20th century. This warming is projected to be associated with a small increase in precipitation, a sharp reduction in snowpack, a reduction in streamflow, and an increase in area burned by forest fires. Although quite uncertain, large reductions in salmon abundance ranging from 25 to 50%, are judged to be possible based on projected changes in temperature and streamflow. Source: based on Mote et al., 1999, pg. 27.