

Climate Change in Your Backyard

A summary of Northwest climate change impacts
from the 2014 National Climate Assessment



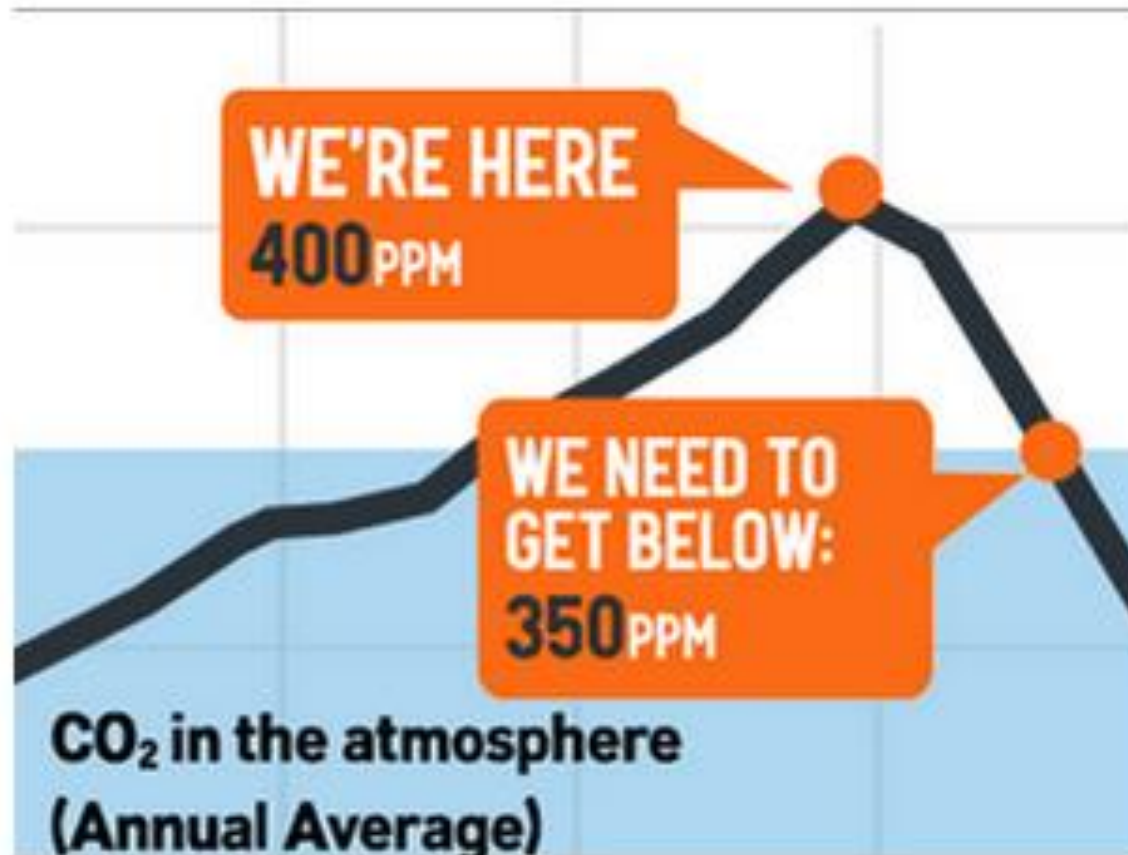
Columbia Gorge Climate
Action Network

November 17, 2014

Eric Strid

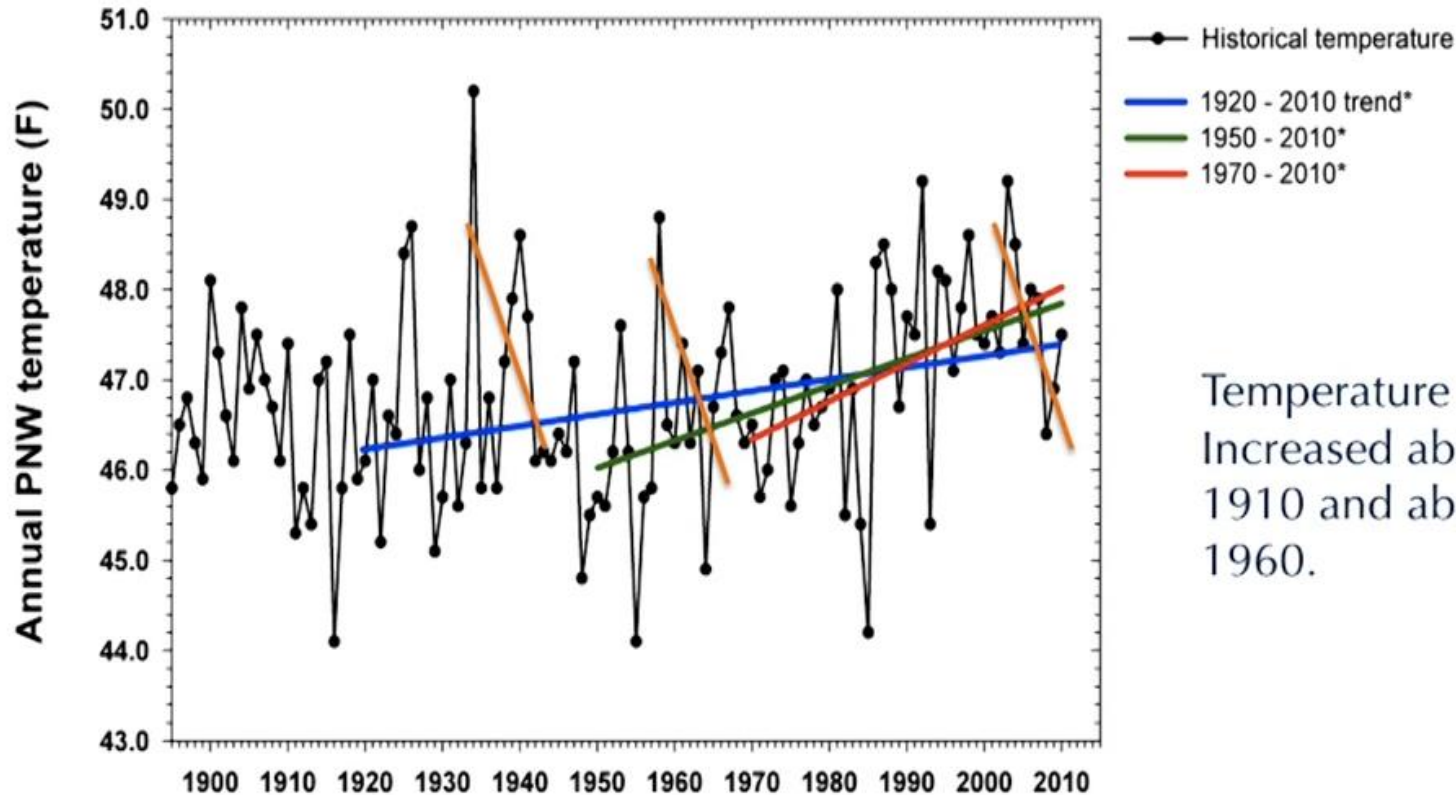
We've Got a Problem

A complex, severe, and urgent problem...



What's expected to happen to climate in the Northwest?

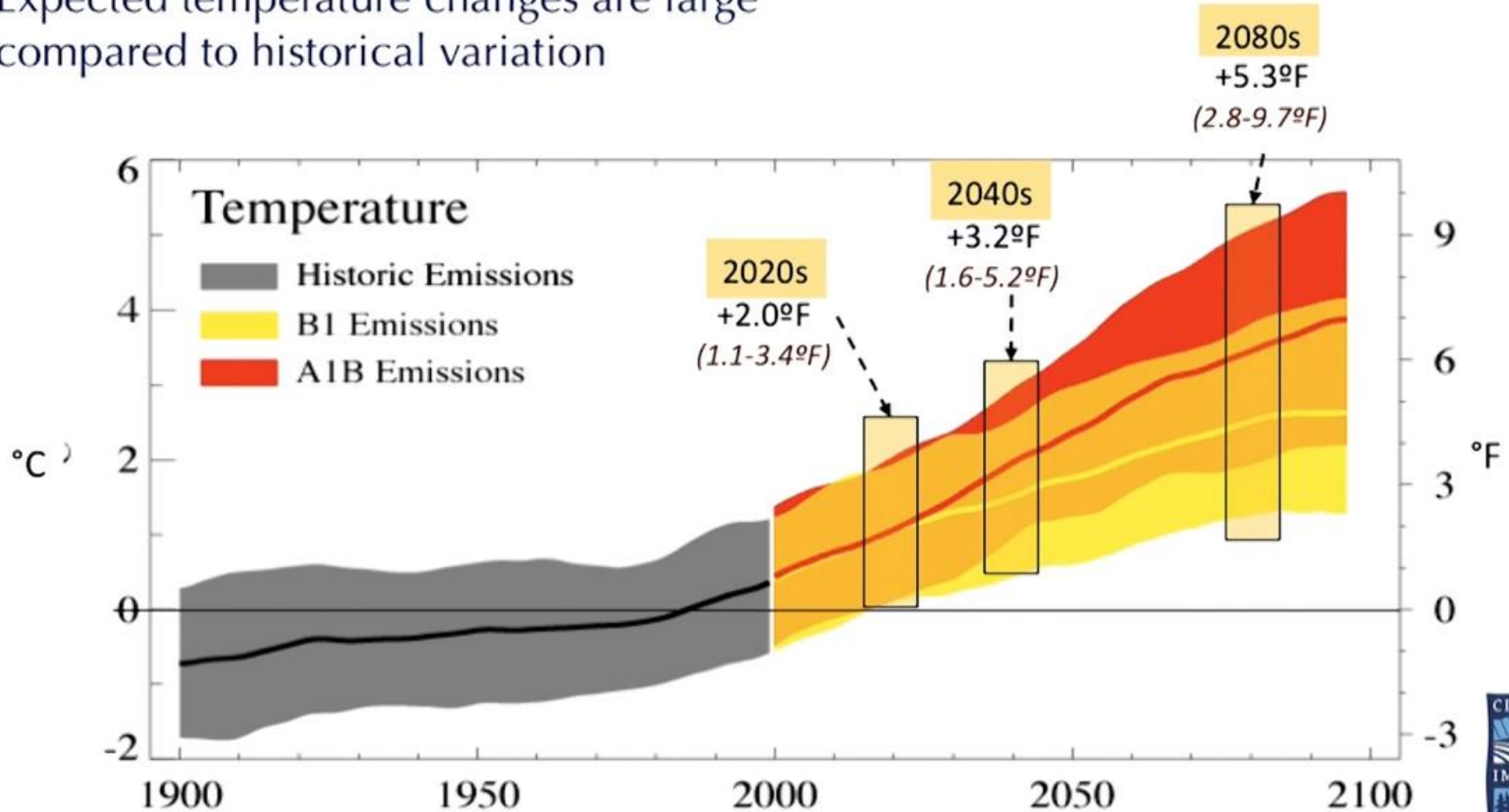
Climate is warming, globally and regionally



- These are temperatures from the Pacific Northwest
- Long-term trend lines show accelerating temperature trends
- Short-term trend lines (orange) can show anything you want and aren't meaningful

Climate will almost certainly keep warming

Expected temperature changes are large compared to historical variation



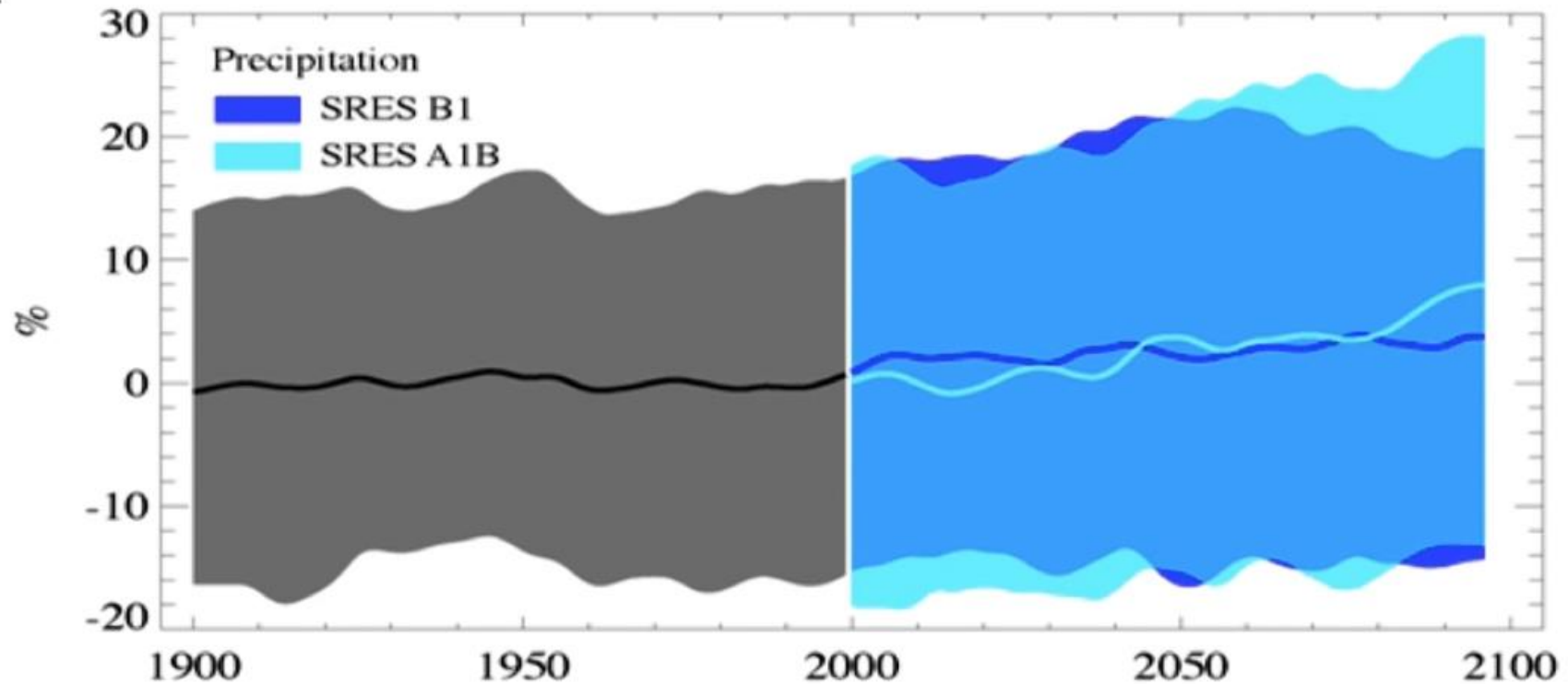
Mote and Salathé, 2010

* Compared with 1970-1999 average



- Beyond ~2040, warming driven by greenhouse gas (GHG) emissions *now*
- A1B emissions scenario: Mostly business-as-usual but with some improvements
- B1 emissions scenario: More integrated and reduced material intensity

Projected changes in annual precipitation



Changes in annual precipitation are small compared to historical variation, but some models show seasonal changes, especially **wetter autumns and winters** and **drier summers**.

Mote and Salathé, 2010

* Compared with 1970-1999 average



- Wetter and warmer when it rains; possibly drier summers

Four “Key Messages”

- **Water-related challenges**

Changes in the timing of streamflow related to changing snowmelt have been observed and will continue, reducing the supply of water for many competing demands and causing far-reaching ecological and socioeconomic consequences.

- **Coastal Vulnerabilities**

In the coastal zone, the effects of sea level rise, erosion, inundation, threats to infrastructure and habitat, and increasing ocean acidity collectively pose a major threat to the region.

- **Impacts on Forests**

The combined impacts of increasing wildfire, insect outbreaks, and tree diseases are already causing widespread tree die-off and are virtually certain to cause additional forest mortality by the 2040s and long-term transformation of forest landscapes. Under higher emissions scenarios, extensive conversion of subalpine forests to other forest types is projected by the 2080s.

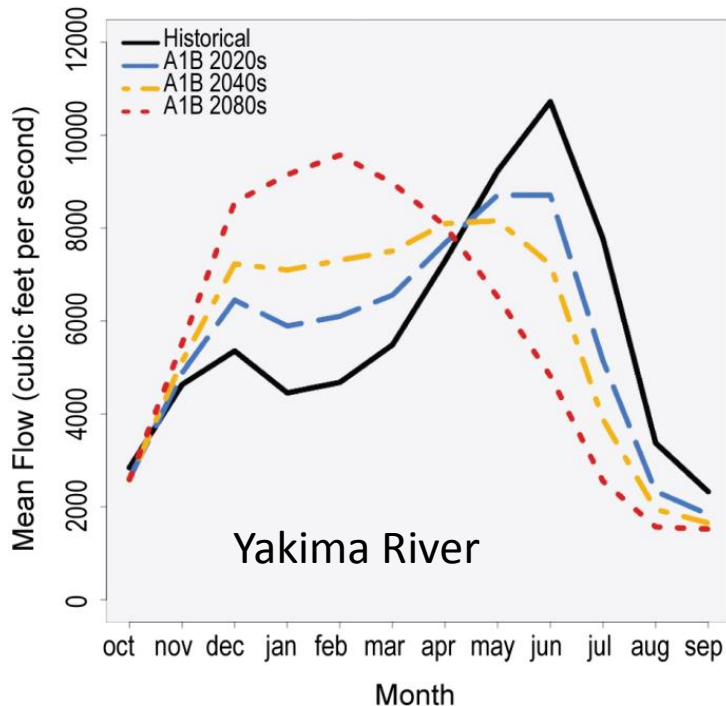
- **Adapting Agriculture**

While the agriculture sector’s technical ability to adapt to changing conditions can offset some adverse impacts of a changing climate, there remain critical concerns for agriculture with respect to costs of adaptation, development of more climate resilient technologies and management, and availability and timing of water.

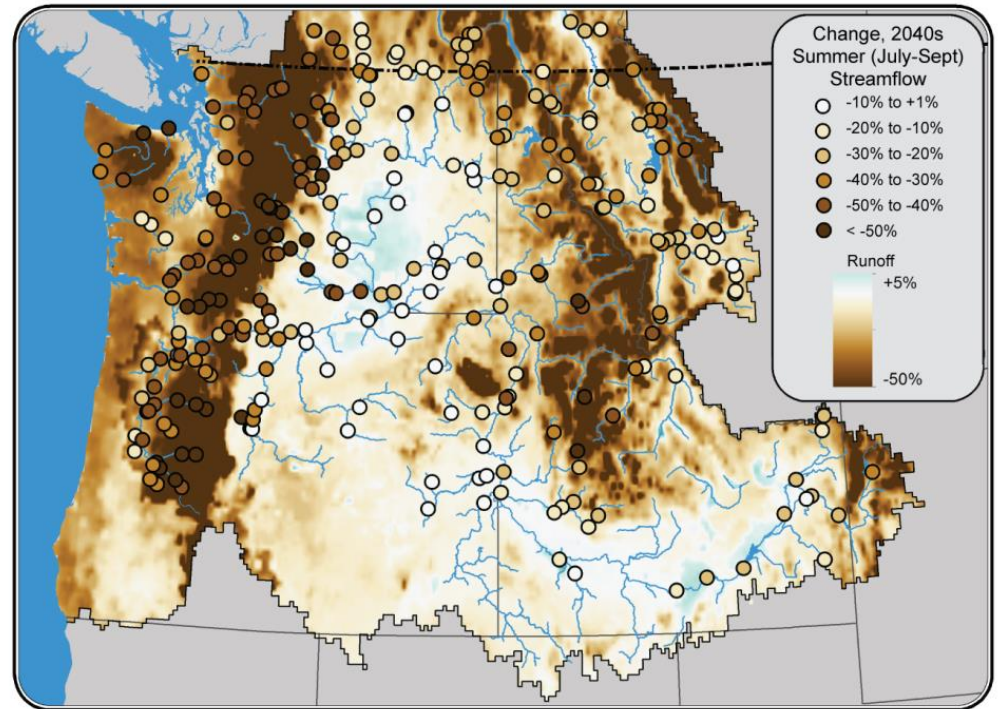
<http://nca2014.globalchange.gov/report/regions/northwest>

Water-Related Challenge: Timing of Stream Flows

Future Shift in Timing of Stream Flows

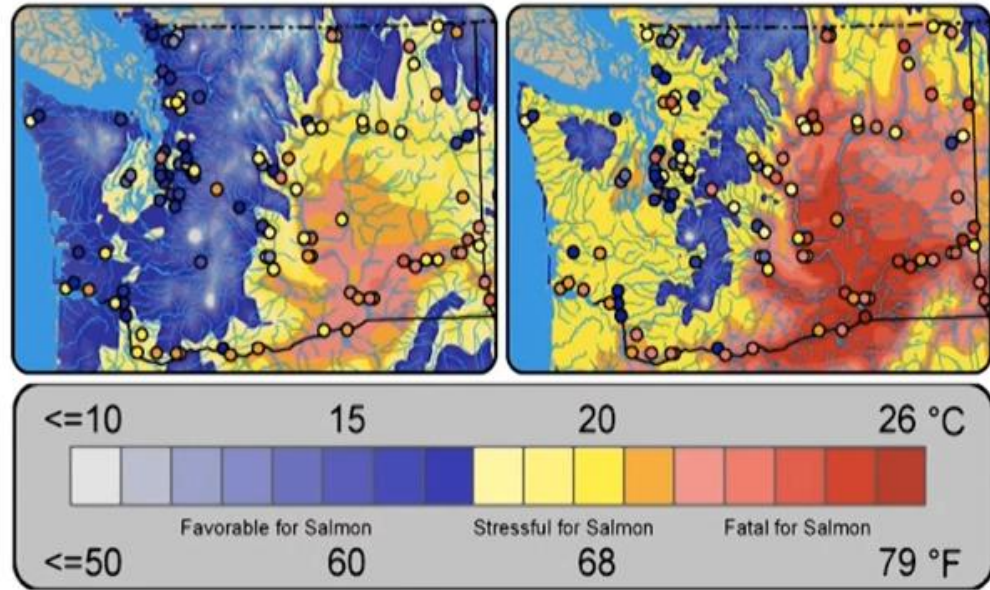


Reduced Summer Flows



- April 1 snowpack is projected to decline 37-44% on average in WA by the 2040s
- Yakima R. is typical of snow melt flow that happens earlier in the year
- Coastal rivers mostly unchanged
- Columbia R. a blend of the cases, *dropping summer flows 20-50% by 2080*
- Less summer water for irrigation, fish, and hydro power

Water-Related Challenge: Fisheries



Increases in air temperature affect stream temperature too. Lower summer flow can limit migration and spawning success. Changes in river flow timing affect different species differently. Mostly, these spell increased stress for salmon.

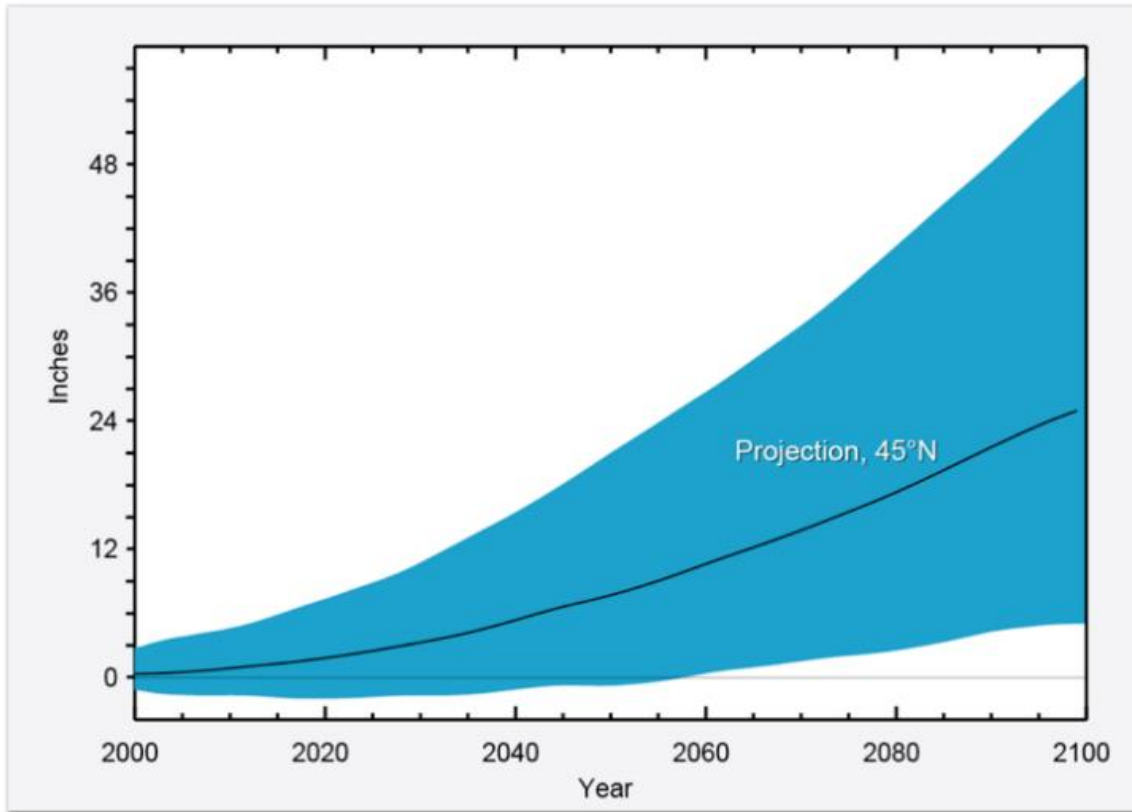
Mantua et al, 2010



- By the 2080s, suitable habitat for the four trout species of the interior western U.S. is projected to decline 47% on average

Left map is historical temps; right is B1 case in 2080. Area shading is surface temp and dots are stream temps.

Projected Northwest Sea Level Rise

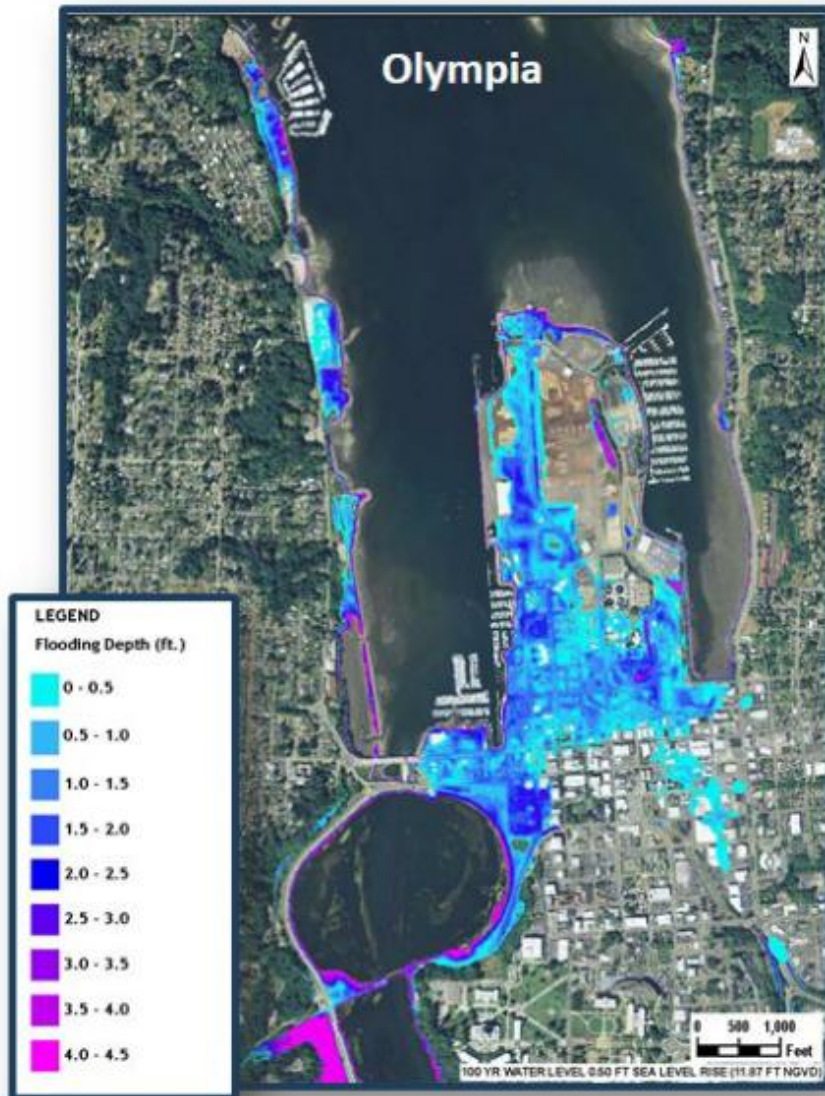


NCA Figure 21.3

- El Nino can change sea level by 4-12"
- Uncertainty range is due to range of emission scenarios and model uncertainties

Consider also: local vertical land movement, shorter term variability (El Niño) and a Cascadia subduction zone earthquake.

Coastal Change: Loss of Land to Rising Seas



Courtesy City of Olympia



Courtesy City of Seattle (NCA Fig 21.3)

Coastal Change: Human consequences



Erosion, inundation, and flooding will threaten

- public and private property along the coast
- infrastructure, including wastewater treatment plants
- stormwater outfalls
- ferry terminals
- coastal road and rail transportation, especially in Puget Sound

Coastal Change: Ecological consequences



Altered ranges, types & distribution of marine species

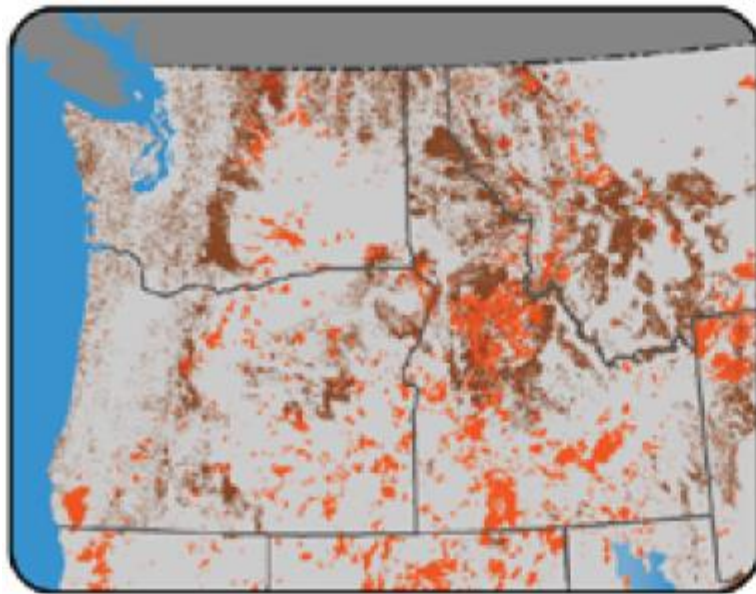
Higher incidence / increased toxicity of harmful algae blooms linked to paralytic shellfish poisoning

Decline in coastal wetlands

Ocean acidification threatens culturally and commercially significant marine species like oysters and Pacific salmon

- Already seeing subtropical species due to higher coastal sea temperatures

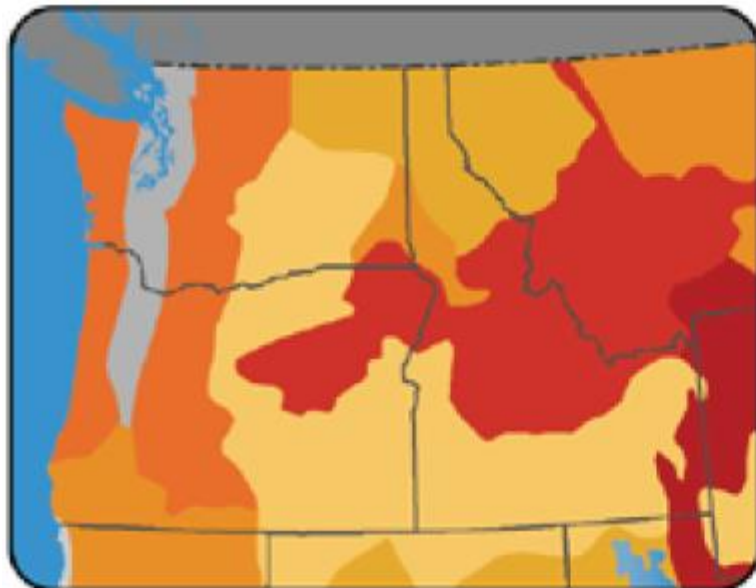
Forest Impacts: Fires, Insects, Diseases



Recent Disturbance



- Burn data 1984-2008
- Insect/disease data 1997-2008
- Pine beetles spread, then temps too hot!!

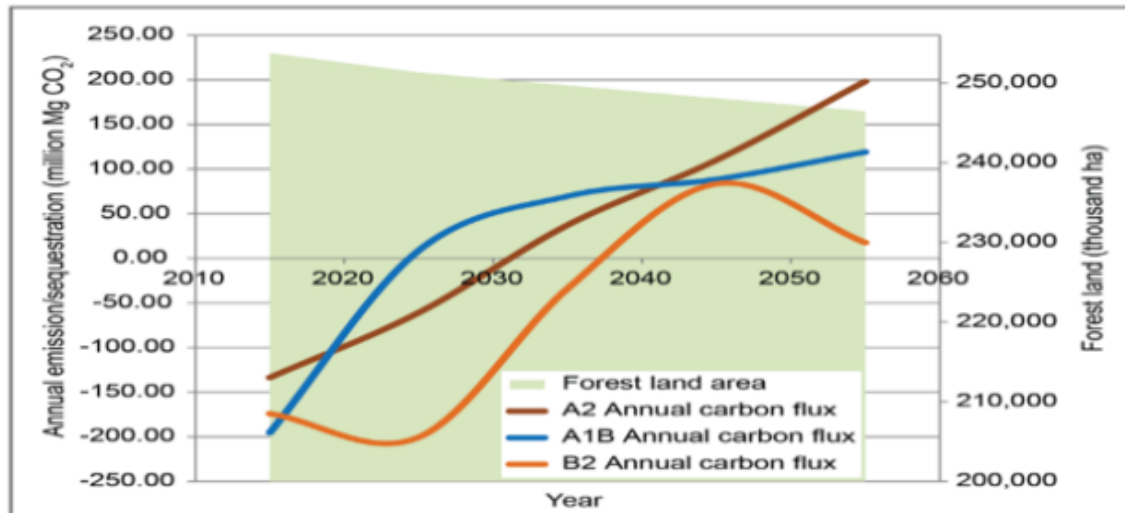
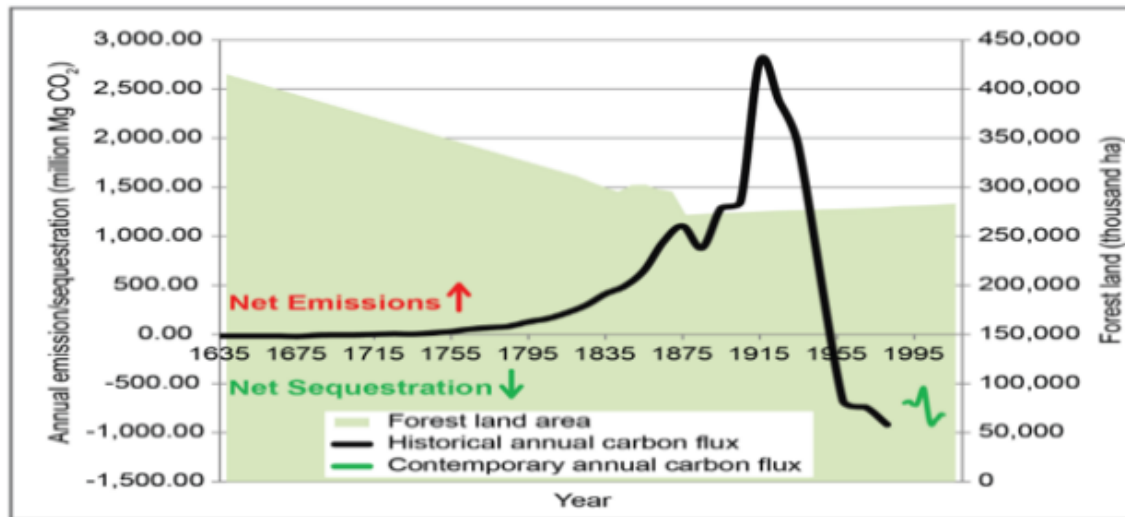


Projected Increase in Area Burned



- Projected at 2.2°F global warming
- Thinning can help in some forests, notably the drier eastern Cascades

Forests Can Be a Carbon Source or Sink



- Pre-1950 a source of CO₂ emissions due to deforestation
- US forests now sink 16% of CO₂ emissions from fossil fuels in US
- Projected to be a source again by 2100 due to forest deteriorations

Agricultural Impacts

- About ¼ of the land is agricultural
- Changes:
 - Less irrigation water
 - +/- Higher temperatures
 - +/- Changes in growing seasons
- Net impacts are complex
 - Heat and drought stress can affect yields
 - + Warmer, drier winters can be beneficial for some crops, especially dry-land winter wheat

Northwest Agriculture

Well-positioned for adaptation

Inherent flexibility and responsiveness to changing conditions indicate potential for a significant amount of autonomous adjustments.

With potential limitations

The potential for agricultural adaptation is constrained by the availability of resources, including water, fertilizer, machinery, processing infrastructure, capital, knowledge, and management expertise, and by the rate of change



Photo: WA DNR

Where Are We Now?

- Planning for adaptation and mitigation is becoming more widespread
- “But current implementation efforts are insufficient to avoid increasingly negative social, environmental, and economic consequences.”

What are we willing to do to make a difference?

- Personally
- In your family
- In your community
- In your state