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SLIDES: Balancing Drought and Flood in the Pacific Northwest: The Challenge of Climate Change

Doug McChesney

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BALANCING DROUGHT AND FLOOD IN THE PACIFIC NORTHWEST: THE CHALLENGE OF CLIMATE CHANGE

Doug McChesney*

ABSTRACT: The Pacific Northwest has a reputation for having abundant water resources, but this is only partly the case. Some parts of the Northwest actually receive relatively small amounts of precipitation, particularly the interior regions. Still, the climate of the region is generally one of heavy precipitation in the late fall and winter, followed by relatively dry late spring and summer months. Much winter precipitation comes in the form of snow, with the snowpack functioning as a large region-wide reservoir. The melting snowpack provides water for irrigation, public water supplies, hydropower, and instream flows for the region's valuable fishery resources.

But the climate of the Pacific Northwest may be undergoing a major shift. The region has become warmer and wetter in the past century. There is also compelling evidence that the Northwest's snowpack has declined in the last fifty years, dramatically in some locations. If the projections made by global climate models prove correct, the changes that have already occurred could be but a precursor of things to come. Higher winter precipitation, much of it falling as rain, plus the potential for more rain-on-snow events would create an increased risk of river flooding. Higher winter precipitation could also increase groundwater levels, leading to groundwater flooding in lowland regions. Conversely, earlier and lower peak spring flows will mean lower summer streamflows and less water to meet summer agricultural and municipal water demand. Regional susceptibility to drought would also increase as a result of the changes to streamflow conditions.

Regional decision-makers may be faced with difficult choices about how to adapt to the altered conditions brought on by climate change. Northwestern states have begun to address these potential changes, but more will eventually need to be done. Because many political leaders remain skeptical about climate change, no state in the region has a dedicated climate change program. Nonetheless, agencies across the region continue to cooperate in monitoring climate conditions and even to cooperate in climate research. They also use other programs, such as drought planning and energy planning, to address issues similar to those that would accompany climate change.

Even without specifically addressing climate change, Northwestern states continue to explore means to augment water supplies. This includes investigating possibilities for new on-channel and off-channel surface water storage. The states are also investigating more innovative means of extending water supplies, including aquifer storage and recovery projects and the reclamation and reuse of wastewater. States are also investigating different water management options, some of which could be applied to climate change scenarios. These include changes to reservoir operations, such as different flood rule curves or altered release schedules, and expanded conservation and the creation of watershed planning processes.

For example, Washington State has embraced locally-based watershed planning as the preferred means to address water resources-related issues. Watershed planning units are not required to address climate change, but many have elected to learn more about possible effects of climate change and begun to investigate potential approaches. The planning groups face many challenges, and only a couple have produced plans to date, but they still provide a promising, and innovative, opportunity to involve a broader range of water user interests in addressing vexing water resources issues, including those posed by climate change.

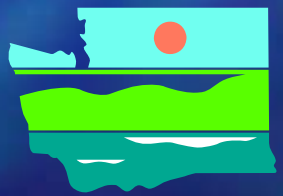
Even absent a specific mandate, states can promote further work on climate change in other ways. In addition to traditional roles such as conducting education and outreach activities, monitoring climate conditions, establishing policies and procedures, states can collaborate on climate change activities. The value of such collaborations would be in making more efficient use of resources, recognizing commonalities, obtaining different perspectives, and supporting policy discussions at a level that an individual state could not do. Northeastern governors and eastern Canadian premiers have already concluded a collaborative agreement on climate protection. Similarly, Washington State has entered into a limited collaboration with the Province of British Columbia on a series of environmental issues, including climate change. Those efforts could provide a promising framework for future collaborations on climate research and policy development in the Pacific Northwest.

* Manager, Policy and Planning Section, Washington Department of Ecology, PO Box 47600, Olympia, WA, 90504-7600, Phone: (360) 407-6647, Fax: (360) 407-7162, E-Mail: dmcc461@ecy.wa.gov.

Balancing Drought and Flood in the Pacific Northwest:

The Challenge of Climate Change

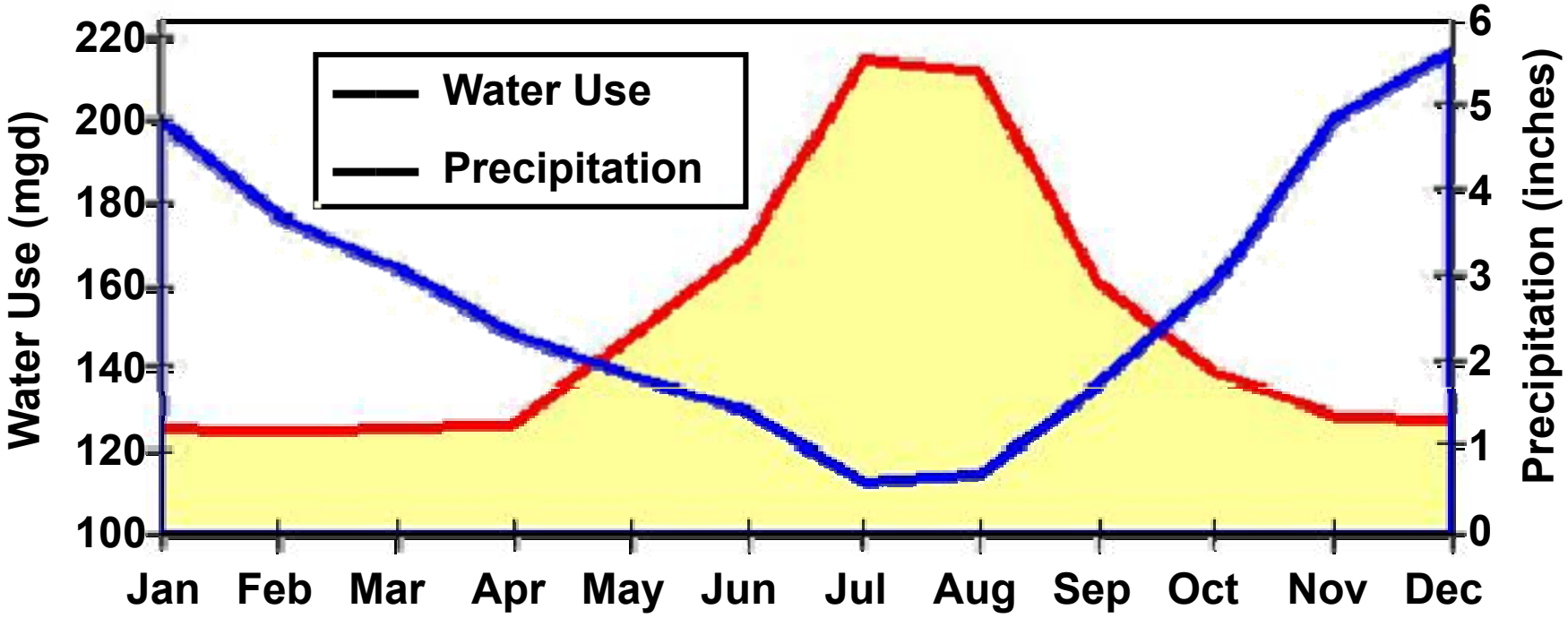
Doug McChesney
Water Resources Program
Washington Department of Ecology
June 12, 2003



A Little Background . . .

- The Northwest is not always wet
- Wet winters and dry summers
- Development linked to water
  - Agriculture
  - Hydropower
  - Fisheries
  - Forestry
  - Urban growth
- Water supplies already stressed

Where's the Water?



Source: Seattle Public Utilities

Climate Change is Not New

Past Northwest climate was quite different

- **Geologically recent time scale**
- **Glaciers covered Puget Sound region**

What happened?

- **Systems adjusted**
- **Species migrated or went extinct**

What's different now?

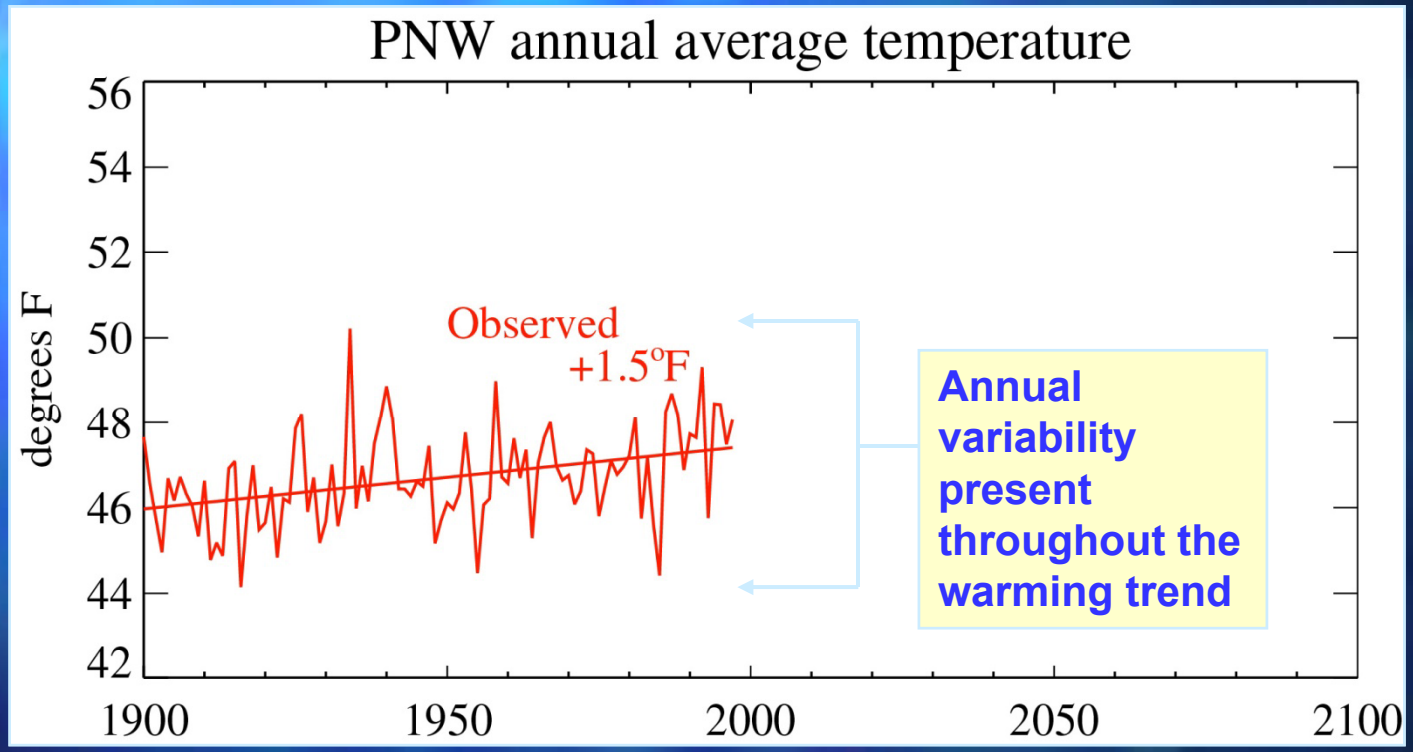
CO_2 concentration levels appear to be higher than any time in past ~23 million years

The effect on human systems:

- Based on expectations of certain climate conditions
- Ability to tolerate change limited

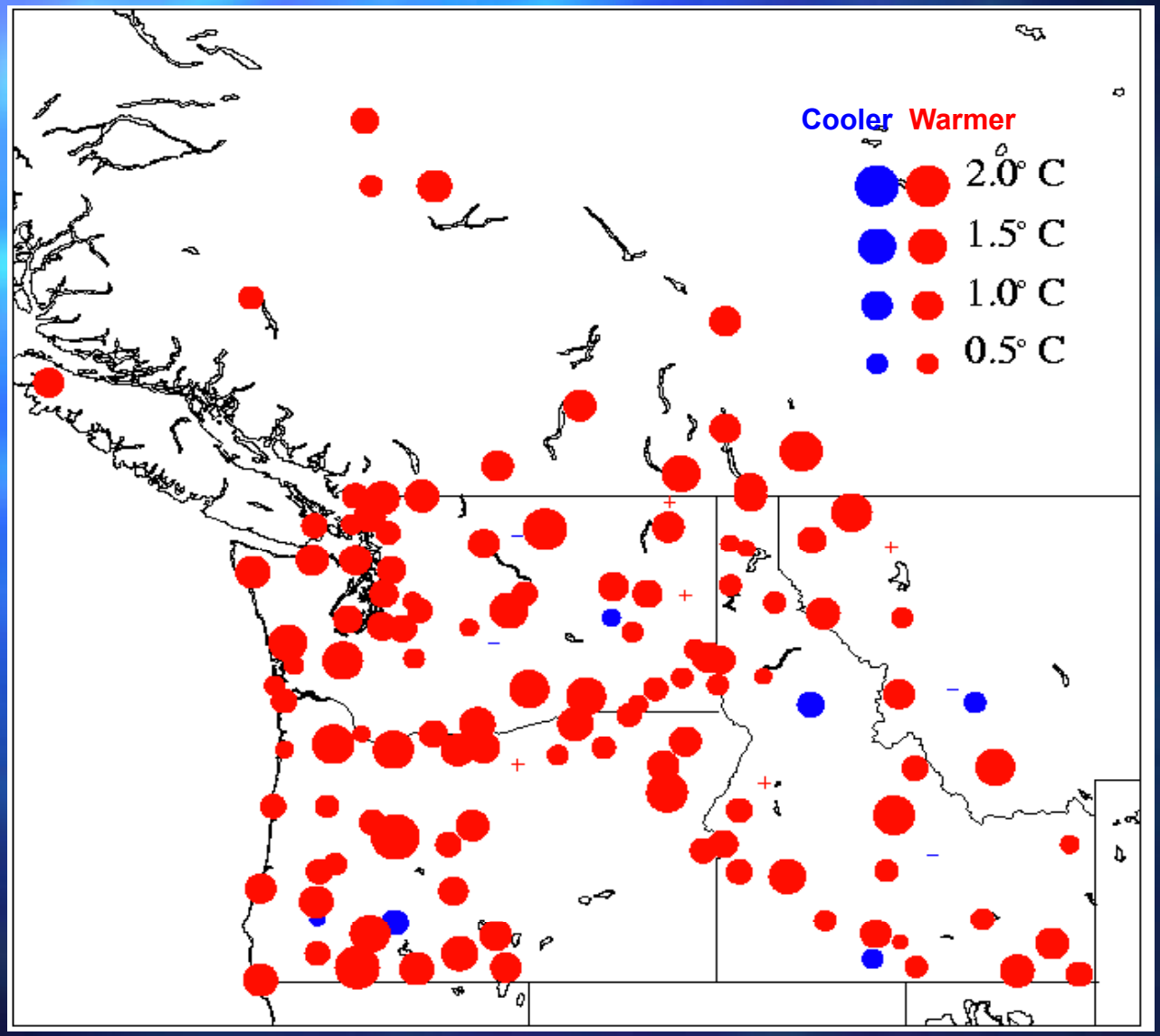
In the Past Century:

The Pacific Northwest has gotten warmer and wetter



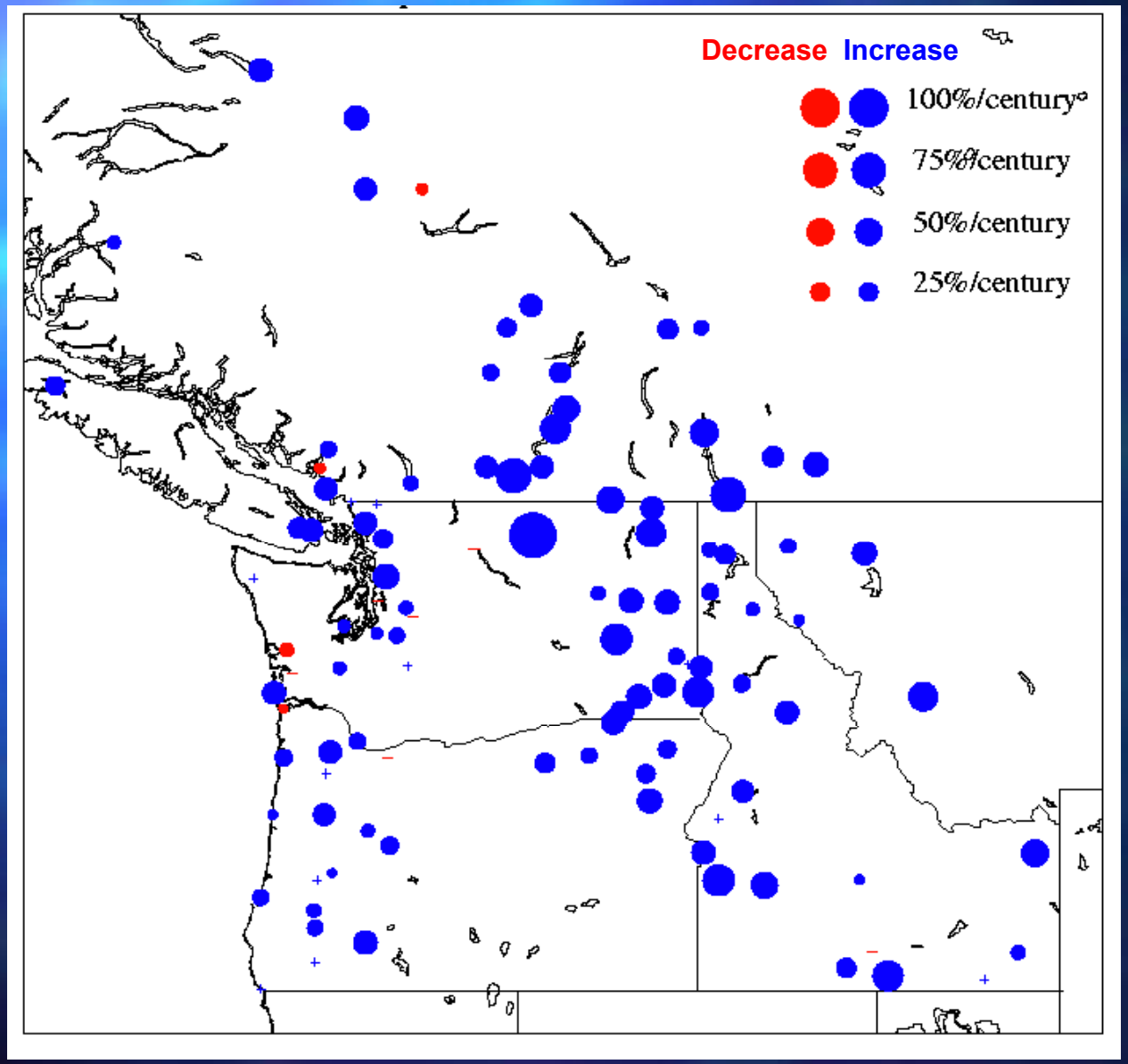
From 1900 to 2000, the average annual temperature increased 1.5°F

Temperature Trends by Station



Mote, 2003

Precipitation Trends by Station



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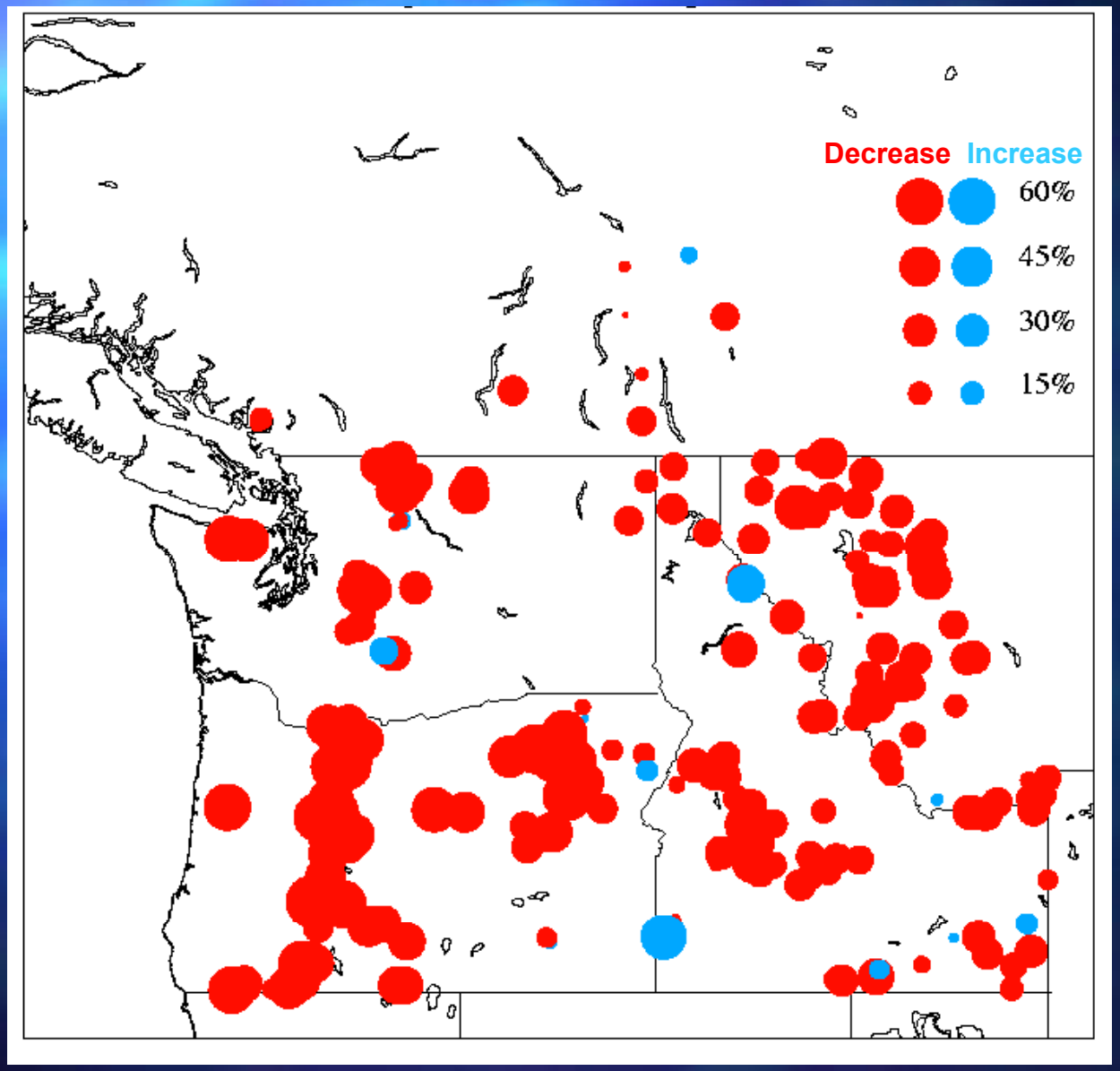
Snow Water Equivalent Trends



Mote, 2003

Projected PNW Climate Change

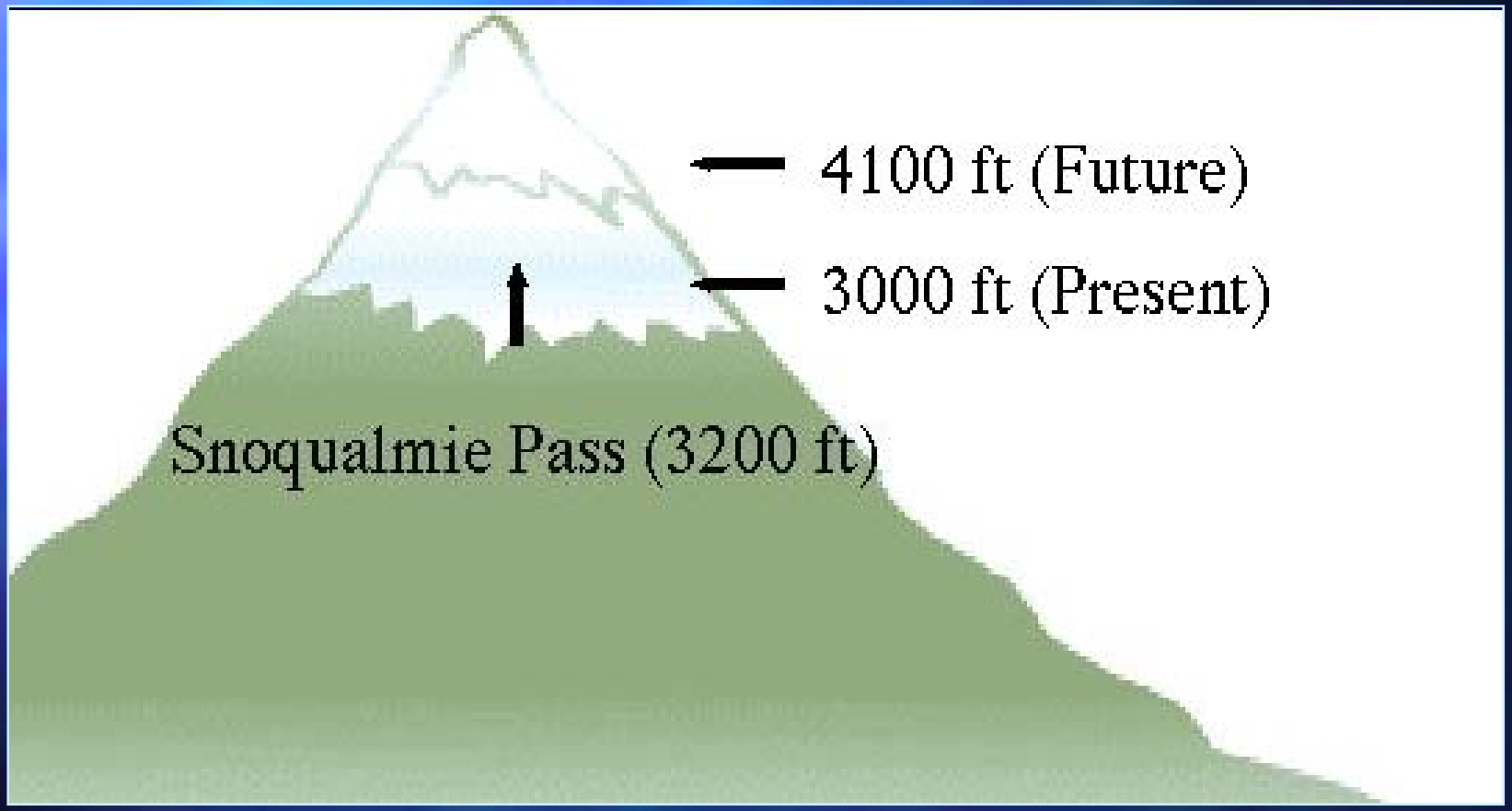
Projected changes in average annual temperature and precipitation for the 2020s and 2040s

2020s	Temperature	Precipitation
Low	+ 0.8 °F	+ 1.5 %
Mean	**+ 2.7 °F**	**+ 6.9%**
High	+ 4.6 °F	+ 14.4 %

2040s	Temperature	Precipitation
Low	+ 2.7 °F	- 3.3 %
Mean	**+ 4.1 °F**	**+ 7%**
High	+ 5.7 °F	+ 13.7 %

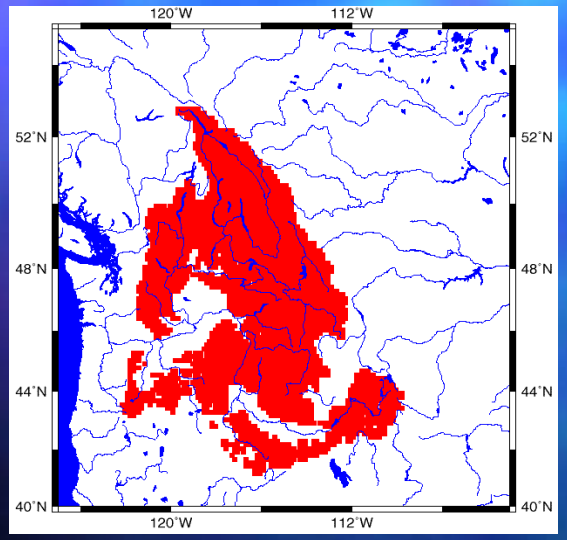
Based on an increase in equivalent CO_2 of 1% per year. Benchmarked to the decade of the 1990s.

Main Impact: Less Snow Overall

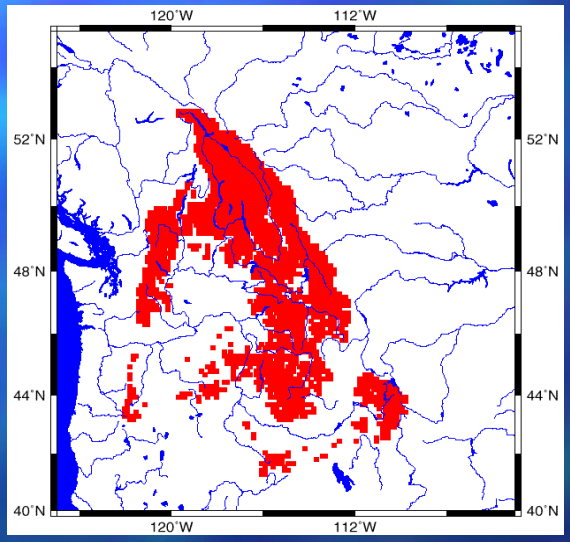


Snow Extent for the Columbia River Basin
April 1

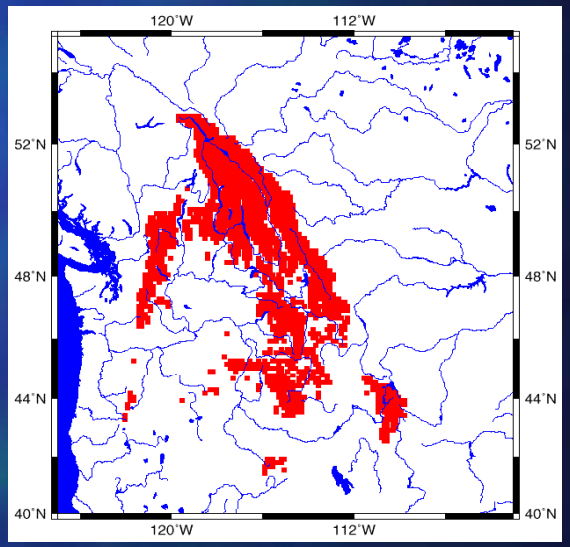
Current



2020s



2040s



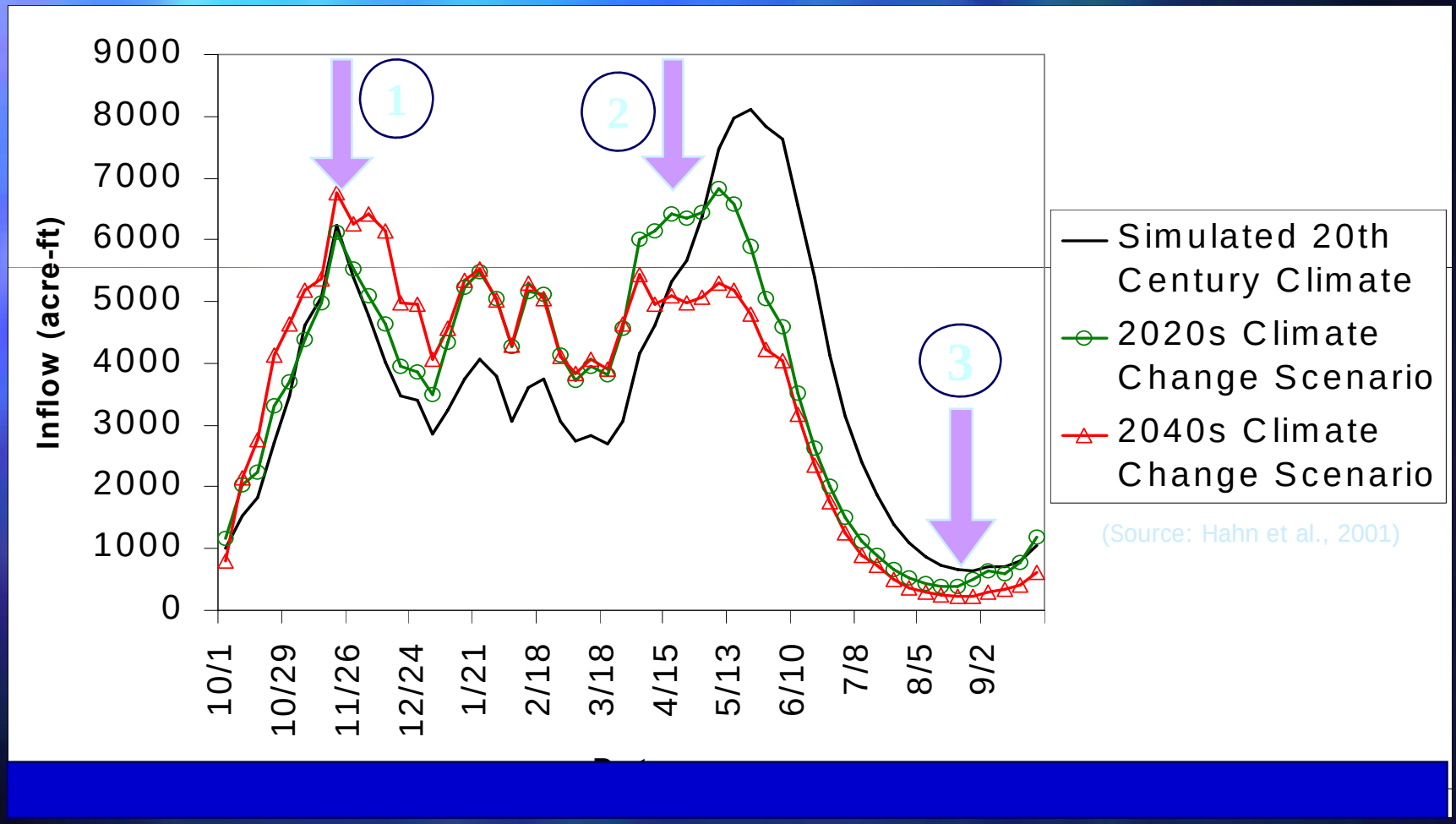
This Will Contribute to:

- **Higher winter flows: Increased winter flood risk**
- **Earlier and lower peak flows: Longer dry season, less water for salmon**
- **Lower summer flows: Higher water temperatures**

Changes to Winter Water Conditions:

- More winter precipitation
- More precipitation falls as rain
- More rain-on-snow events
- Increased risk of river flooding
- Increased groundwater levels
- Aggravated lowland flooding

Earlier Streamflow peaks:



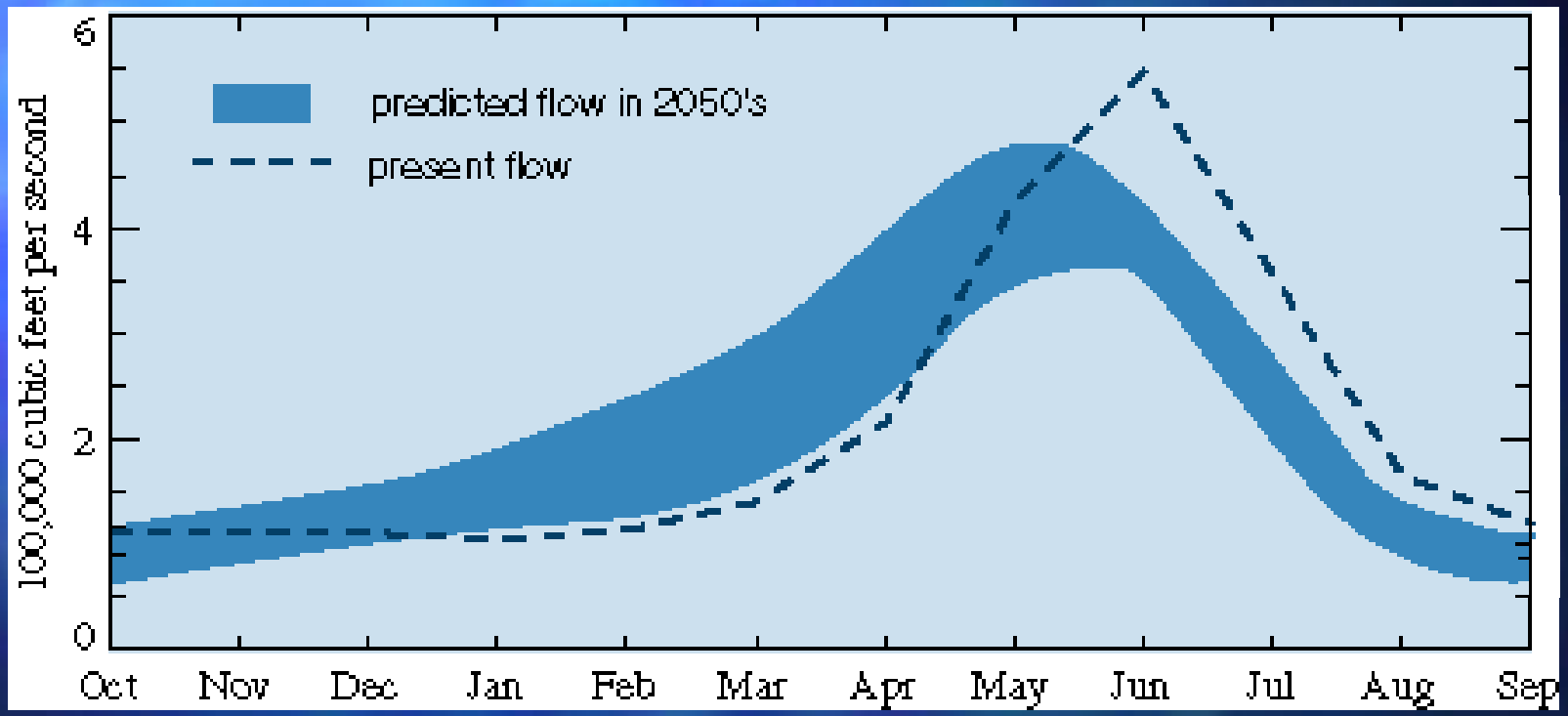
(Source: Hahn et al., 2001)

Projected Climate Change Impacts on Chester Morse reservoir, Cedar River, WA

Changes to Summer Water Conditions:

- Earlier and lower peak spring flows
- Increased M&I water demand
- Increased agricultural water demand
- Increased evapotranspiration
- Potential for lower summer flows
- Increased vulnerability to drought

Potential Impacts of Climate Change on Columbia River Streamflows



Natural flow at The Dalles, OR

P. Mote

What does this Mean for the Pacific Northwest?

The past may not be a good indicator of the future

Why Should We Care?

Climate change could affect:

- Regional economic viability
  - Agriculture
  - Forest resources
  - Hydropower generation
  - Fisheries resources

Why Should We Care?

Climate change could also affect:

- Resource Management
  - Water allocation
  - Fish & wildlife survival
  - Land management policies

Why Should We Care?

Climate change could also affect:

- Frequency of Disasters
  - Drought
  - Flooding
  - Landslides
  - Erosion

The Problem:

- Water users want certainty
- Water supply conditions likely to become more variable
- Will require choices to adapt to changed circumstances

Adaptation:

"…adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts."

IPCC, 2001

What Constitutes Adaptation?

- Individual change
- Institutional response (planning)
- Protection of investments
- Acceptance of new conditions

Why Adaptation?

- Possibility of climate change presents serious risks to society
- Society needs to understand risks and consider need to adapt

Response of Pacific Northwest States:

- Skepticism (especially politically)
- Monitoring conditions
- Cooperating with research institutions
- Cooperating with other states
- Incorporating into other programs
  - Drought preparedness and response
  - Energy independence

Specific Activities:

- Water storage options
- Changes to water management
- Participation in research projects

Water Storage Options:

- New Storage in Surface Reservoirs
  - On-channel storage
  - Off-channel storage
- Aquifer Storage and Recovery
- Water Reclamation and Reuse

Water Management Options:

- Changes to reservoir operations
  - Different flood rule curves
  - Altered release schedules
- Conservation
- Watershed Planning

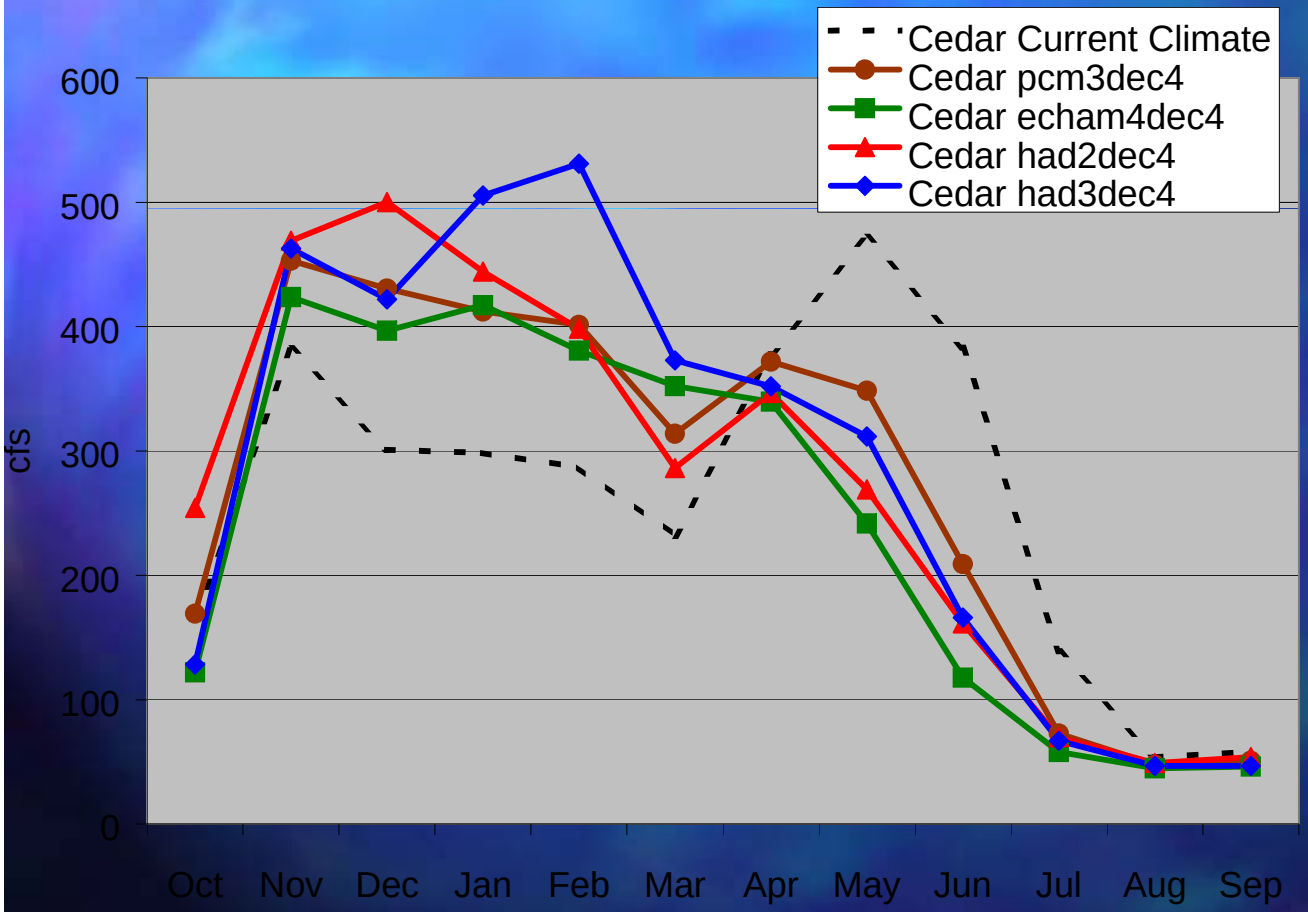
Why Watershed Planning?

- Where actual water use takes place
- Climate change affects same issues
- Broader-based exposure to issues
- Local selection of response options
- Local buy-in for decisions
- Support for political action

Planning at the Watershed Level

- Allows for proactive vs. reactive planning
  - More choices of responses
- The change is already in motion
  - Warming expected to continue through 21st century
- Risk management
  - Lets locals determine tolerance to risk of projected impacts

Climate Change Study for Western WA Rivers



For western Washington rivers (Sultan, Tolt, Cedar, Green):

Winter (2040s): +30 *to* +40%

Summer (2040s): –20 *to* –30%

Challenges to Planning:

- Different spatial scales
- Perfect vs. imperfect information
- Other uncertain variables
- Differing planning horizons
- Resource constraints
- Fatigue

Potential Roles of Government

- Conduct education and outreach
- Conduct case studies
- Monitor conditions
- Share information
- Provide leadership
- Establish policies & programs
- Collaborate with others

Why Collaborate?

- Use resources efficiently
- Recognize commonalities
- Obtain different perspectives
- Support policy discussions

Sustainable Washington Advisory Panel:

"Explore collaboration on climate protection with other Northwest and west coast states and provinces, as the northeastern governors and eastern Canadian premiers have done"

2003