



---

# Choices & Change:

What does global climate change mean  
for the Pacific Northwest &  
How can we best prepare?

---

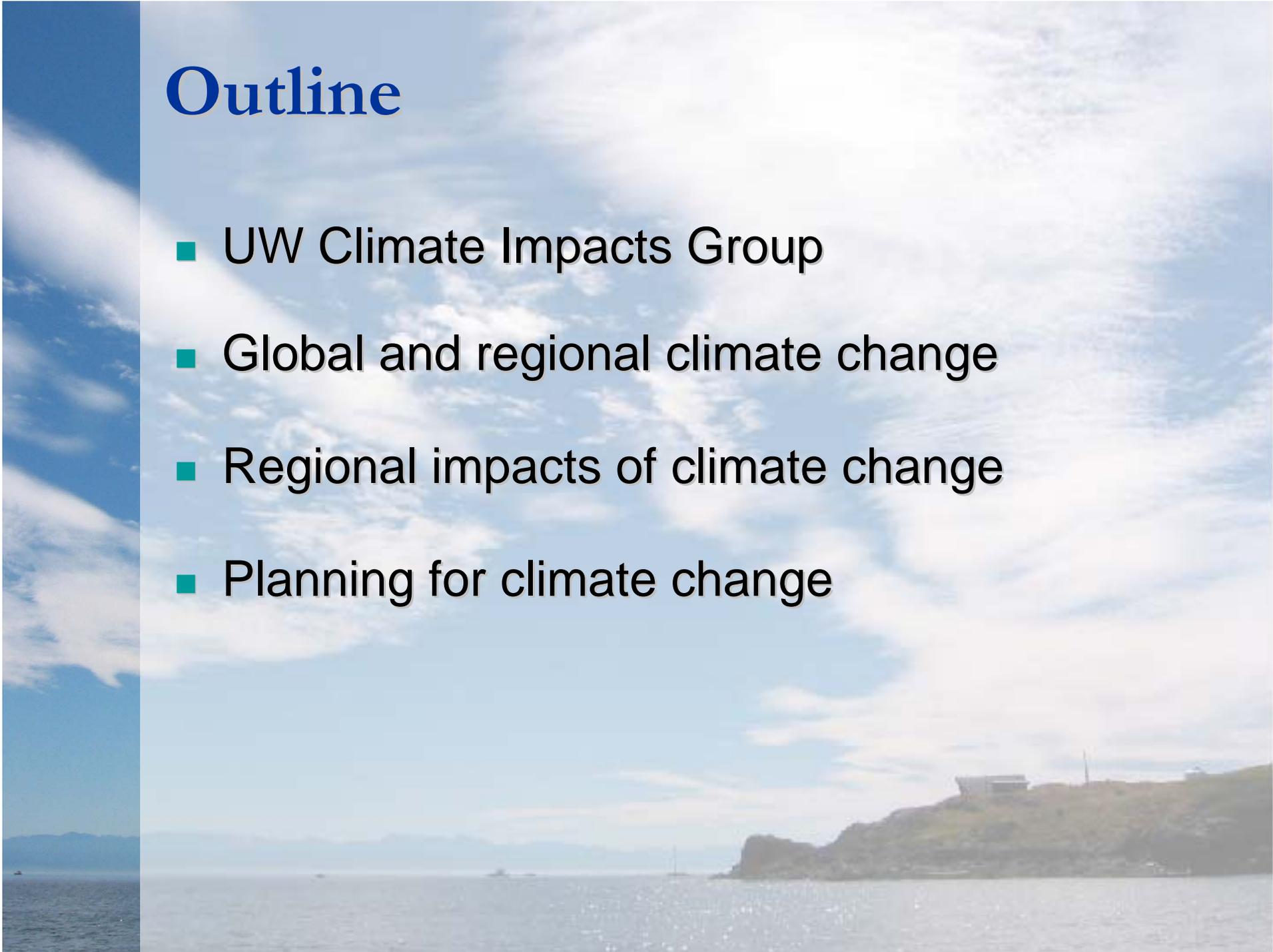
**Amy Snover, PhD**  
UW Climate Impacts Group



*November 29, 2005 • King County Science Seminar*

# Outline

- UW Climate Impacts Group
- Global and regional climate change
- Regional impacts of climate change
- Planning for climate change



# Climate Impacts Group

- One of 8 U.S. regional integrated assessment teams based at the University of Washington
- Evaluating the impacts of climate variability *and* climate change on the PNW environment and its social systems
- Primary research areas:  
climate dynamics, water, salmon, forests, coasts
- Outreach & decision support – a regional planning resource
- ***Ultimate goal:*** to help the region become more resilient to natural climate variability and human-caused climate change



# Facts about global climate change

- There is a natural greenhouse effect
- Humans are increasing the greenhouse effect by adding greenhouse gases to the atmosphere
- There is considerable evidence that Earth has warmed in the last 100 years
- Without drastic changes in current emissions trends, greenhouse gas concentrations will increase dramatically over the next century and beyond

*Source:* The Intergovernmental Panel on Climate Change (IPCC), [www.ipcc.ch](http://www.ipcc.ch)

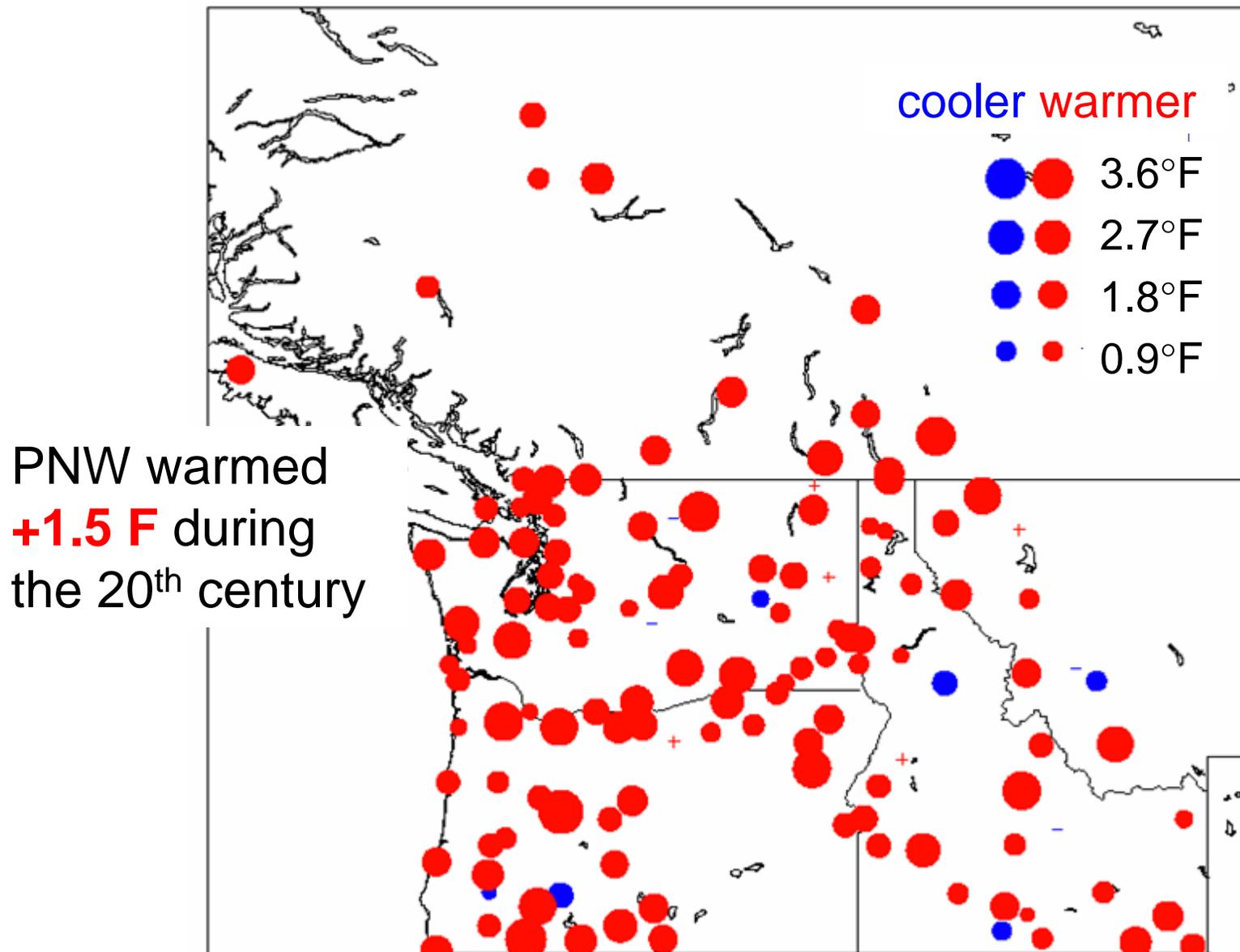


---

*Change in Motion?*  
**Trends in 20<sup>th</sup> Century PNW  
Climate**

---

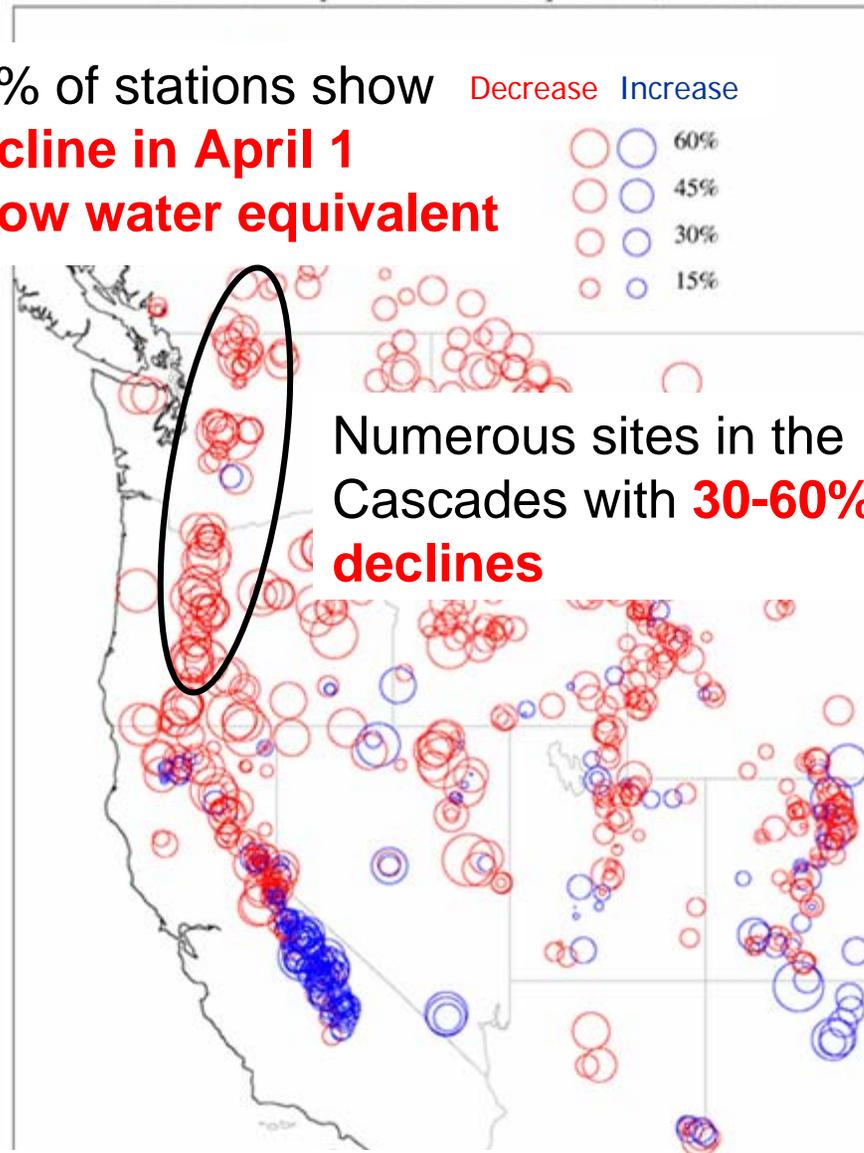
# Temperature trends (°F per century) since 1920



*In contrast: No clear 20<sup>th</sup> century trend in precipitation ...*

# Snow water equivalent trends, 1950-2000

73% of stations show **decline in April 1 snow water equivalent**



Trends in April 1 SWE, 1950-2000

*Mote 2003(b)*

---

# Climate change is more than just averages

- frost days decreasing
  - snowfall decreasing
  - precipitation intensity...
-



---

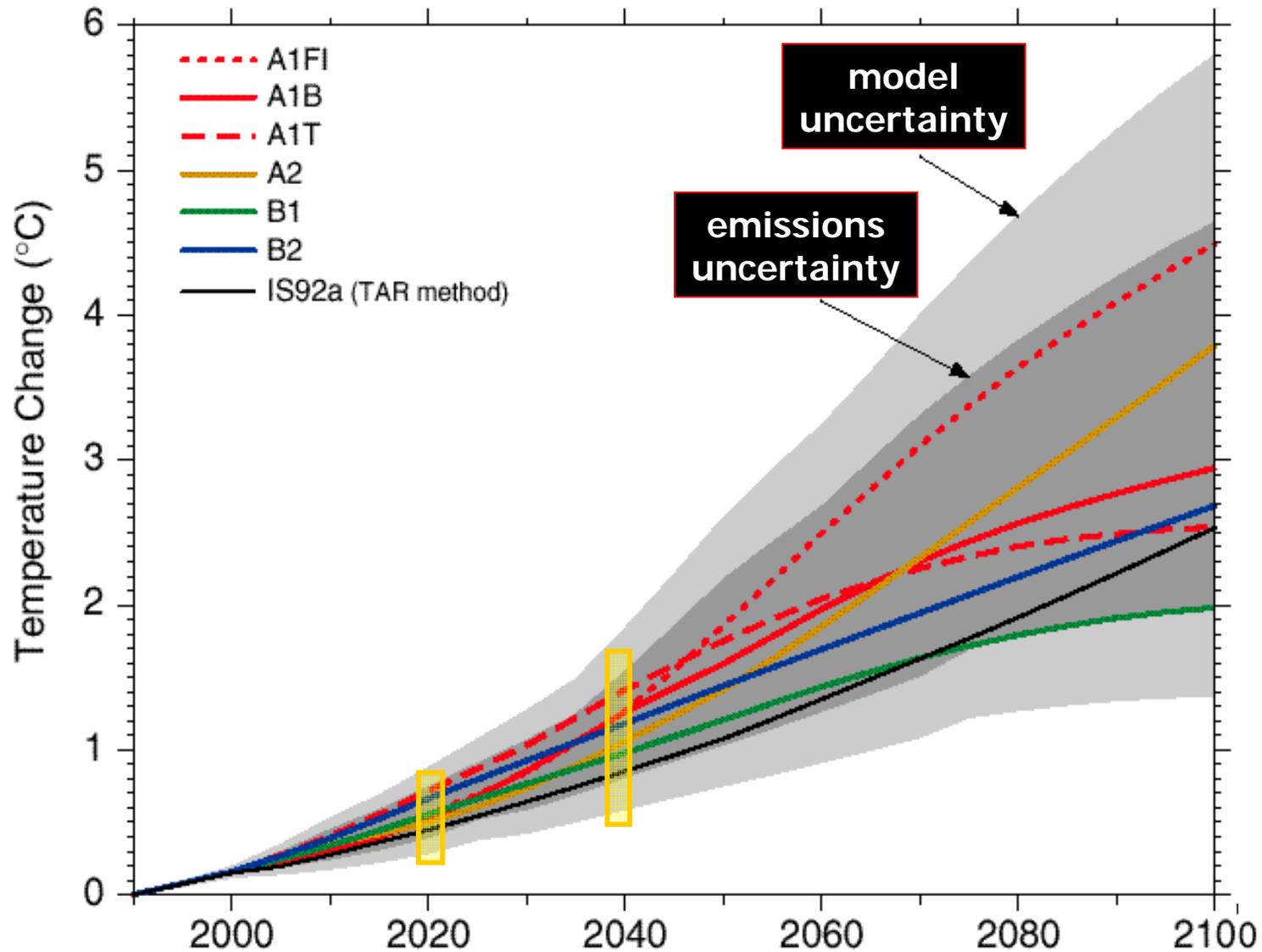
*Where Are We Headed?*  
**21<sup>st</sup> Century Climate Change  
Projections**

*“Human influences will continue to change atmospheric composition throughout the 21<sup>st</sup> century.”*

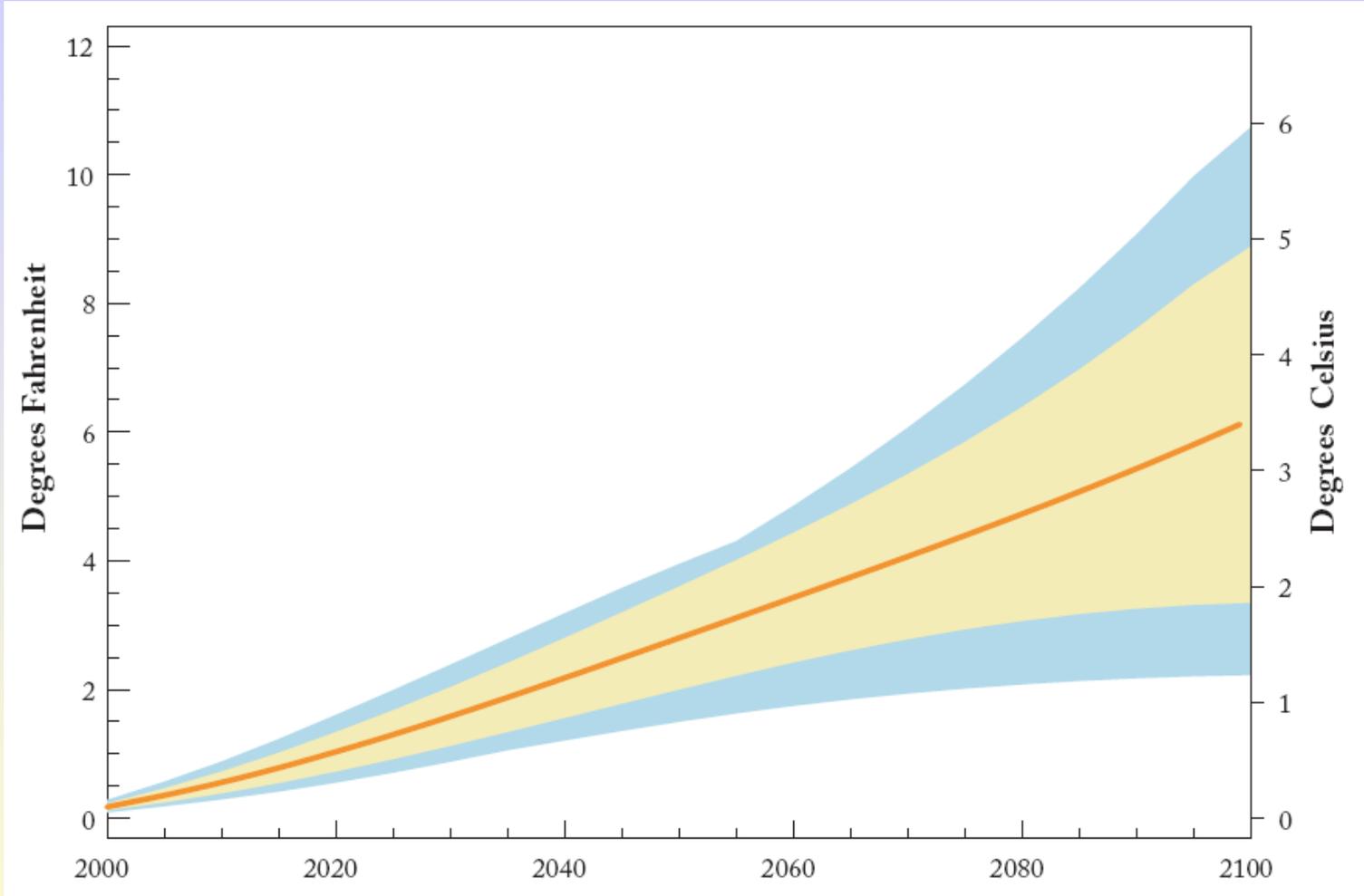
---

*IPCC 2001*

# Global climate change



# Projected PNW Climate Change



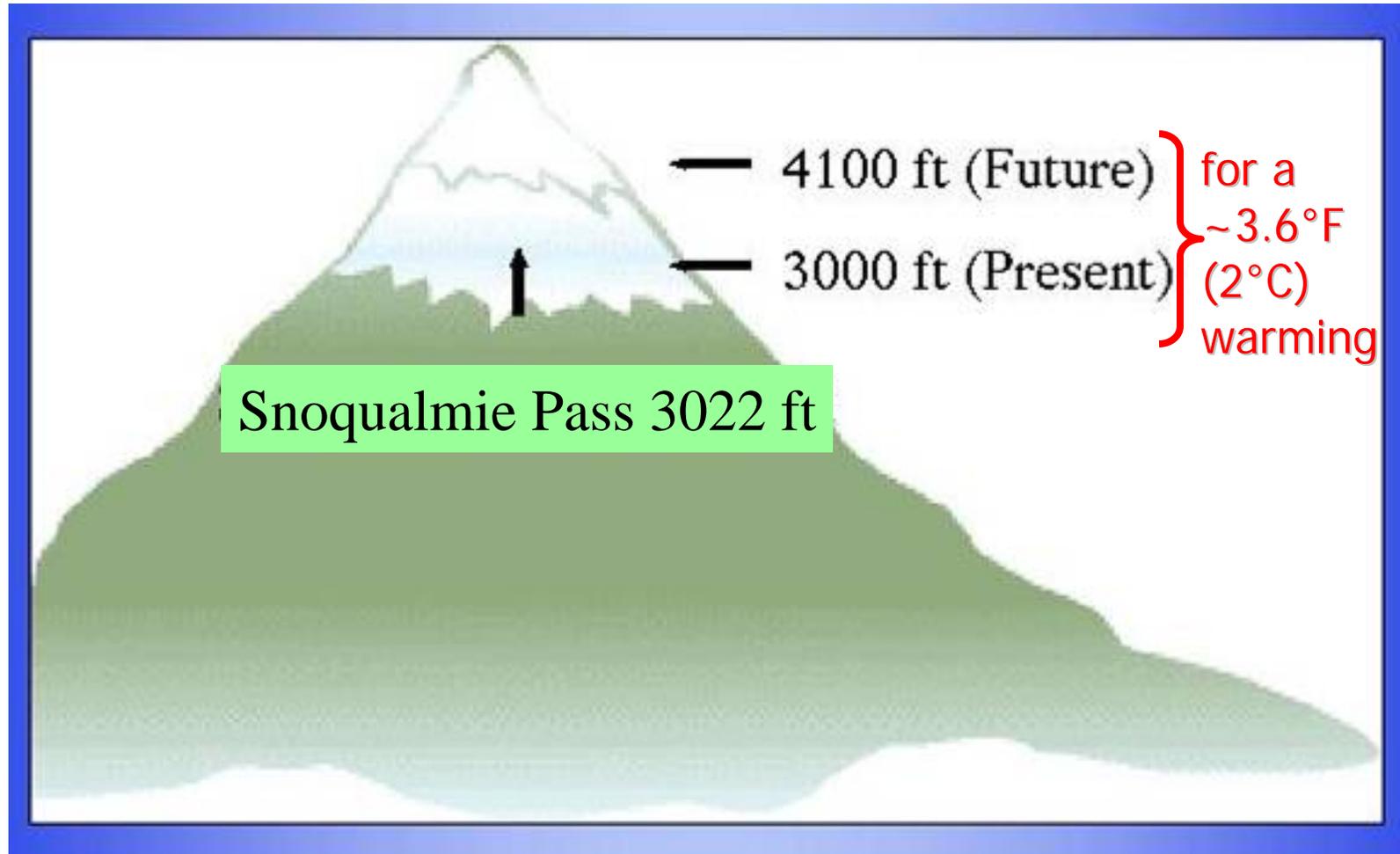
**Warmer** conditions year 'round

# Regional Impacts

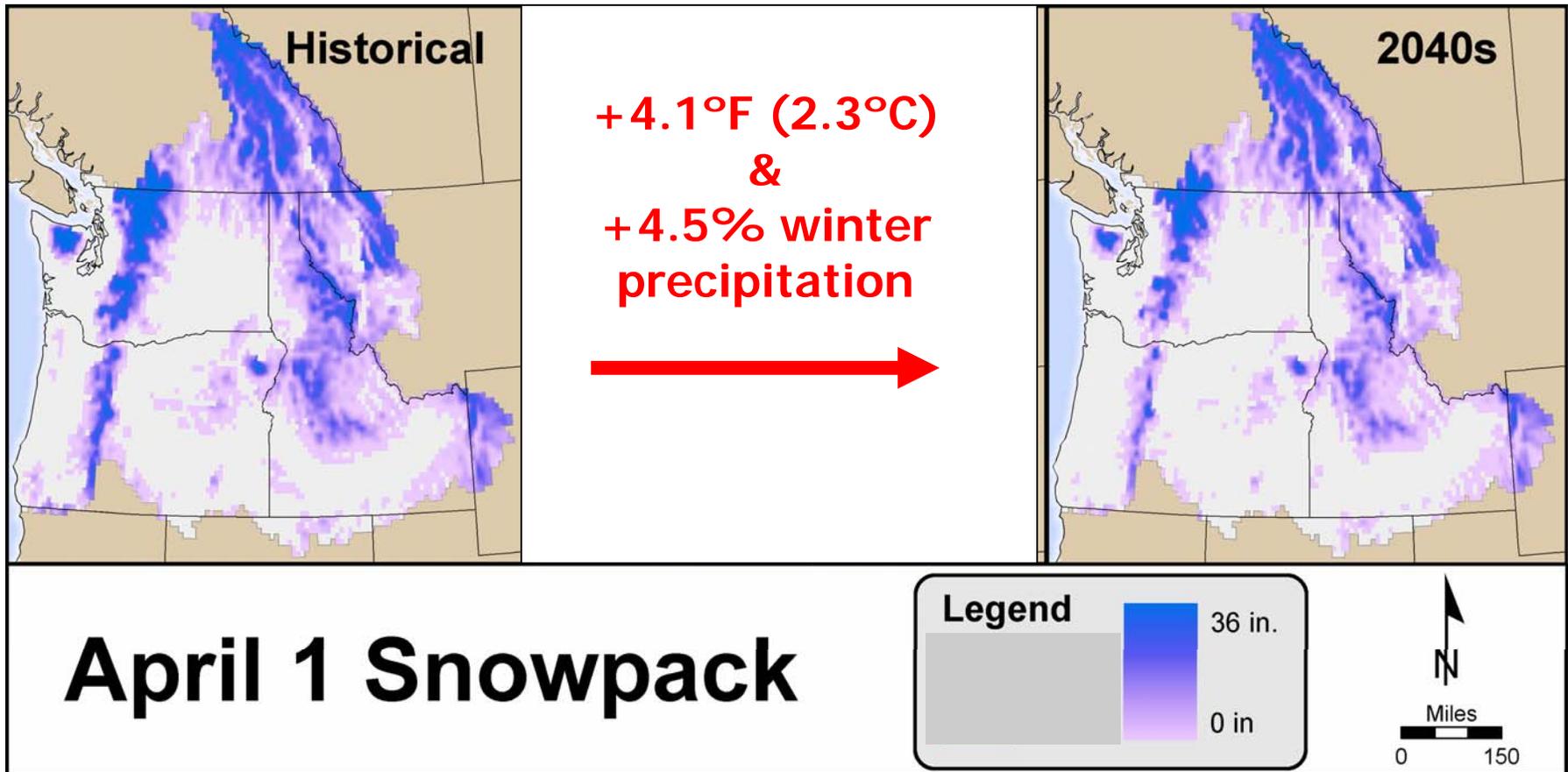


*Washington's economy and natural resources are sensitive to climate changes ...*

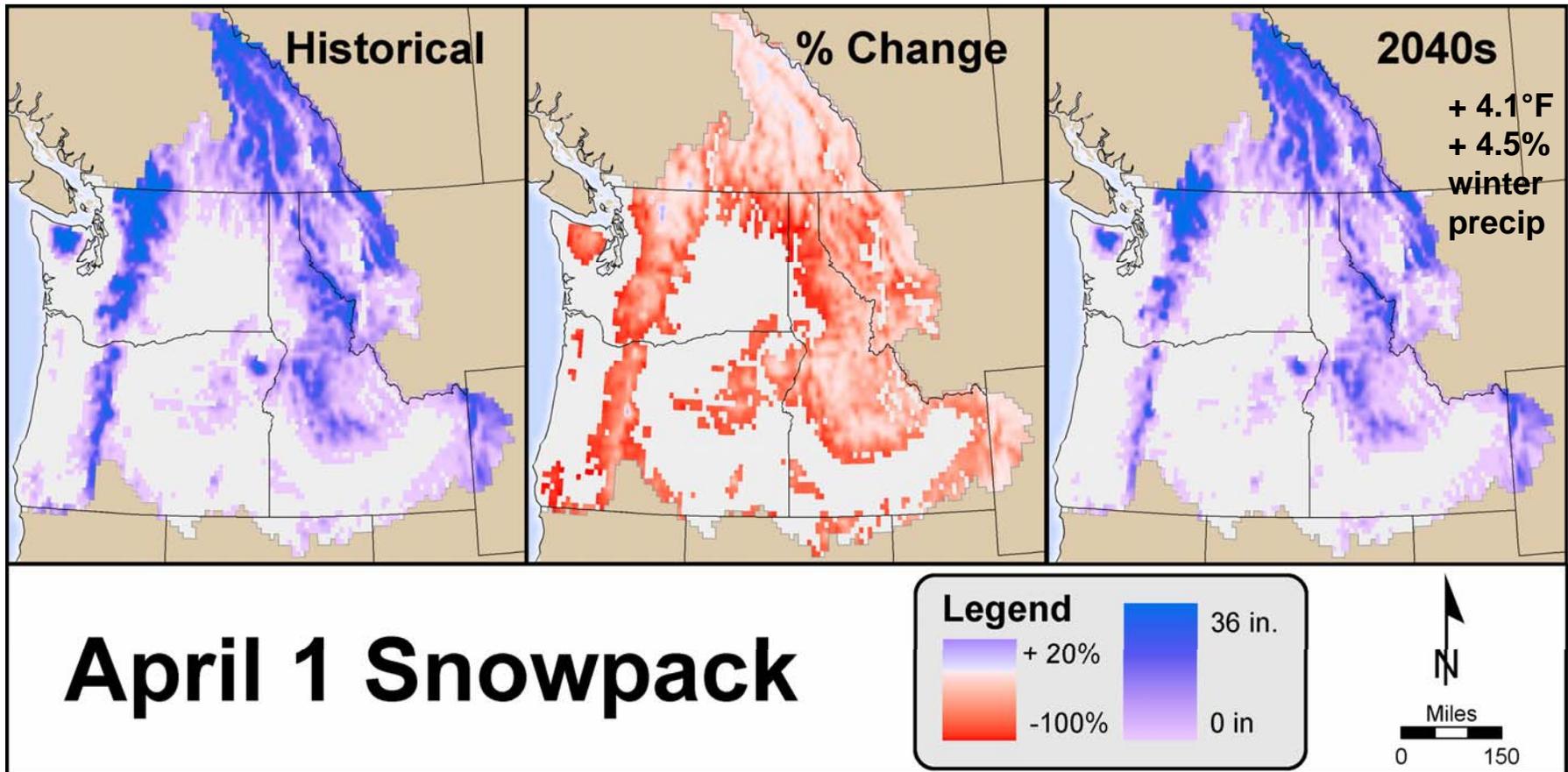
# The main impact of a warmer climate: **LESS SNOW**



# Springtime snowpack will decline, especially at the warmest locations



# The coldest locations are less sensitive to warming



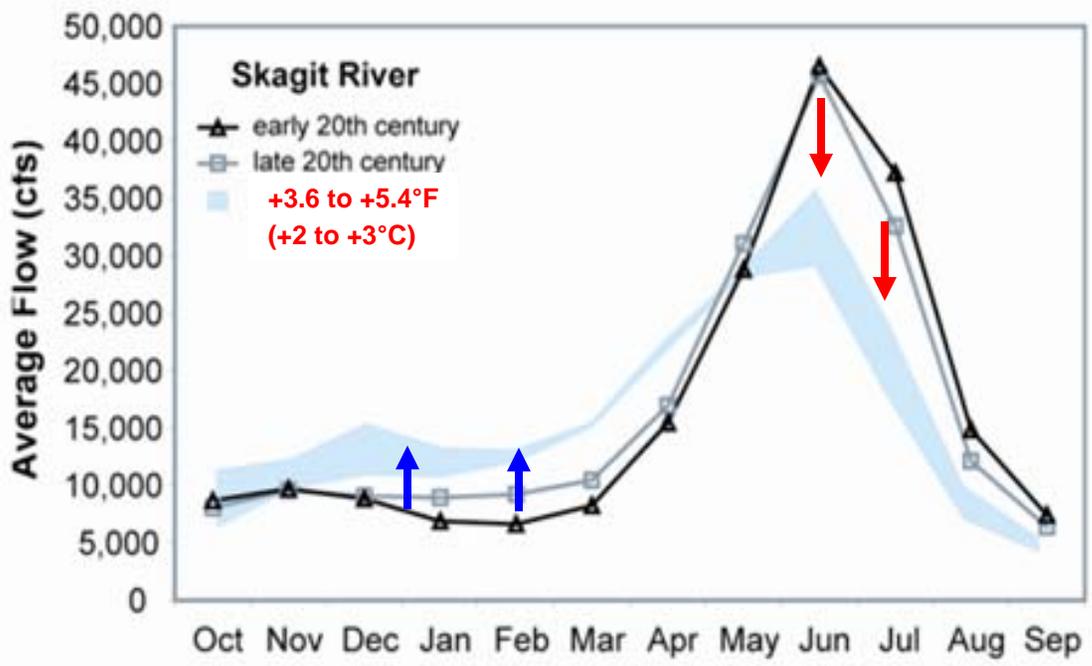


# Hydrologic Changes

*Washington's water =  
extraordinarily  
dependent on snowpack*

Less snow, earlier melt:

- ☁ More water in winter
- ☀ Less water in summer



# Climate change impacts on Washington's forests

- **CO<sub>2</sub> fertilization**
  - a transient impact
- **Longer dry season**
  - increased vulnerability to fires & pests; reduced regeneration and growth at low-dry sites; some benefit at higher elevations
- **Shifts in species ranges**
- **Forest fires will accelerate change**
  - climate has played a key role in recent increases in area burned
  - average annual area burned in Washington could increase 2-5x by 2100



# Ecosystem thresholds: The case of the Mountain Pine Beetle

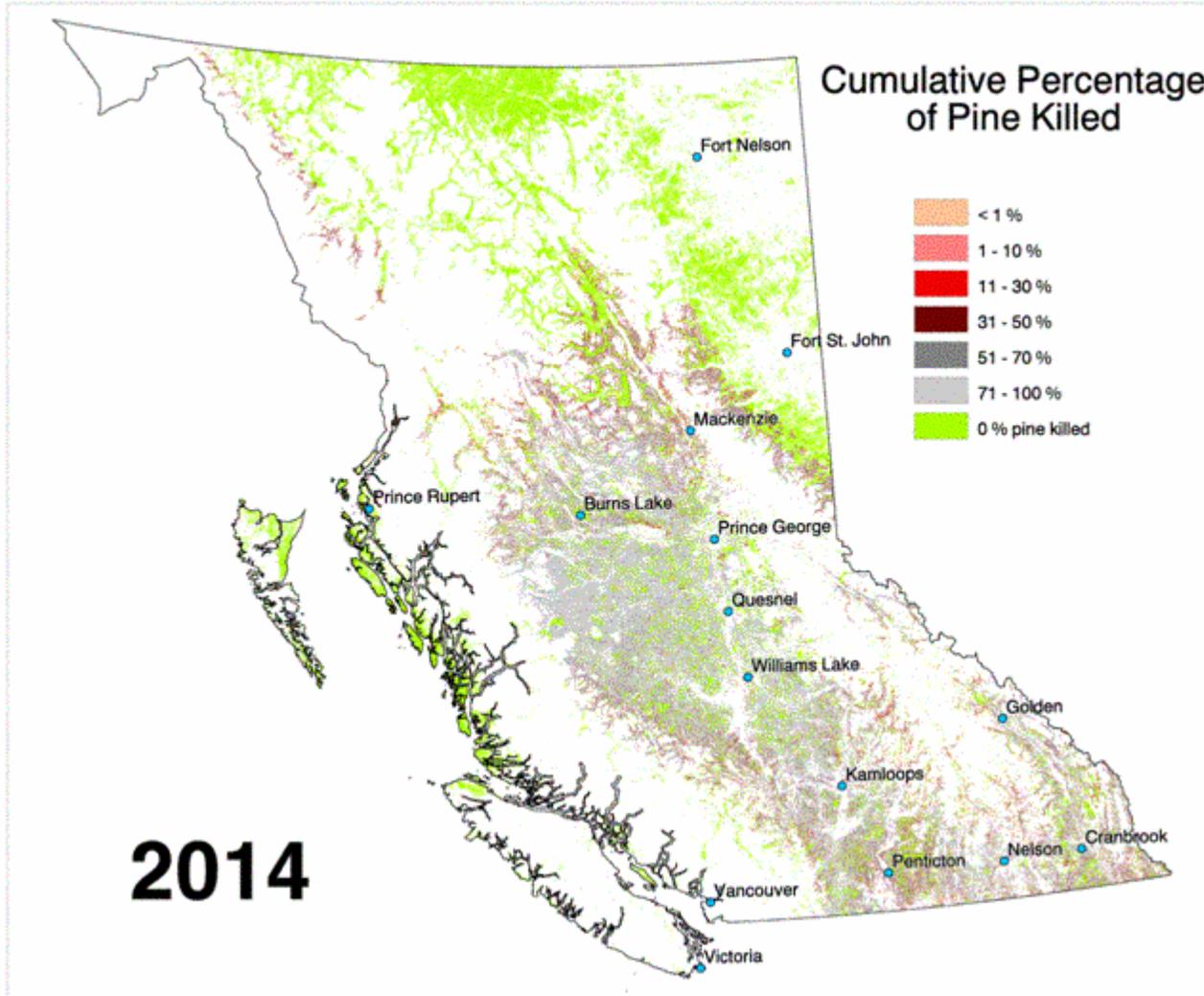
- A massive outbreak of the mountain pine beetle in BC has killed 100 billion board feet (approx. 9 years of harvest)
- Low temperatures ( $< -10^{\circ}\text{F}$ ) limit beetle activity

a recent lack of extreme cold (killing) temperatures has allowed the beetle to thrive in epidemic numbers

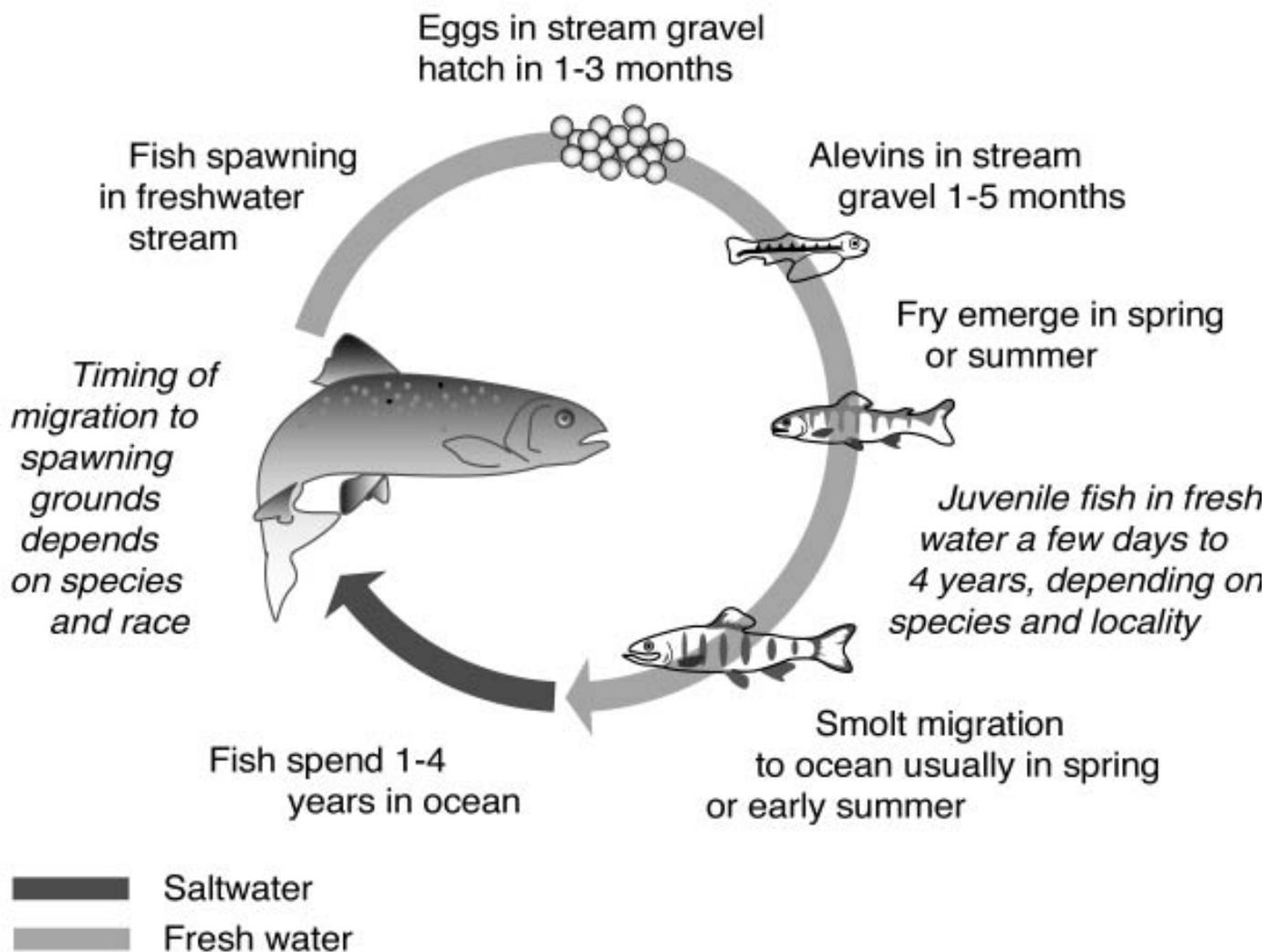


beetle killed pines in BC

Photos from <http://www.for.gov.bc.ca>

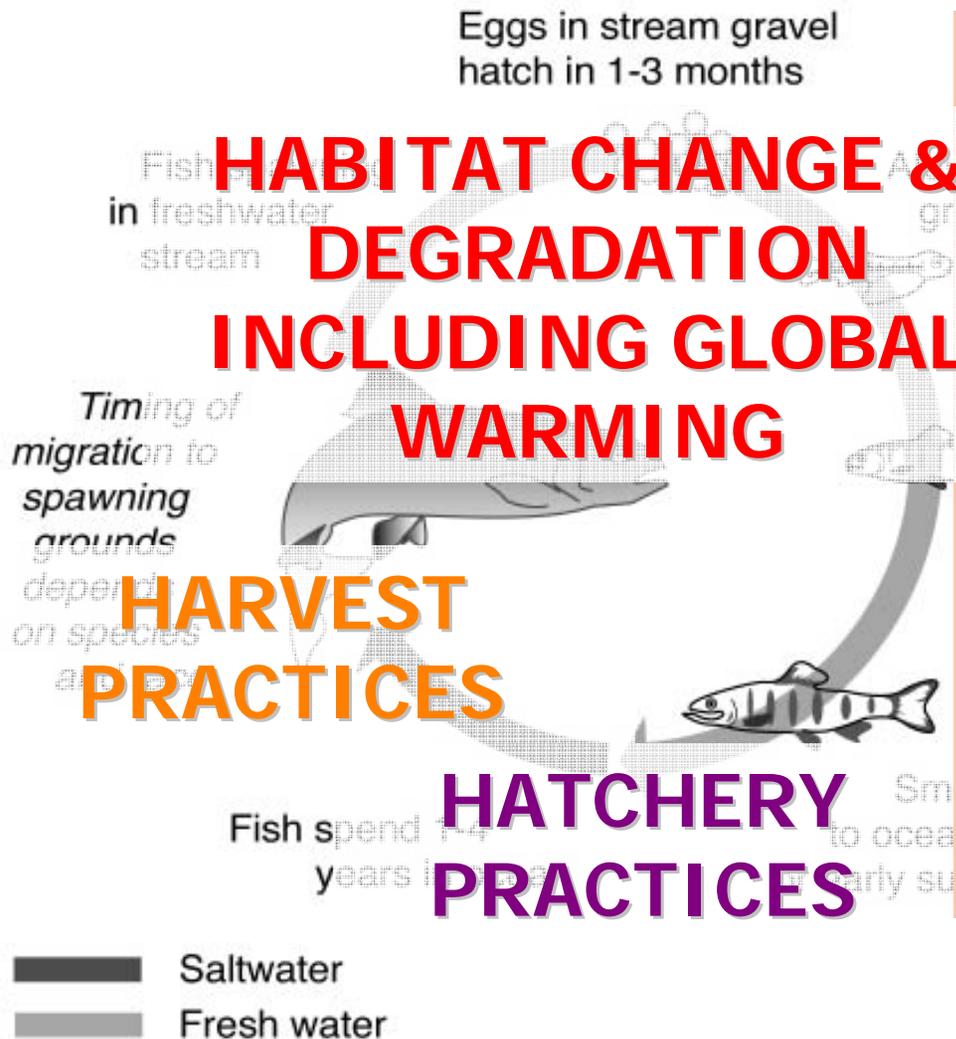


# Climate impacts on salmon must be added to existing stresses across their full life-cycle



# Impacts are cumulative ...

## Salmon Life Cycle

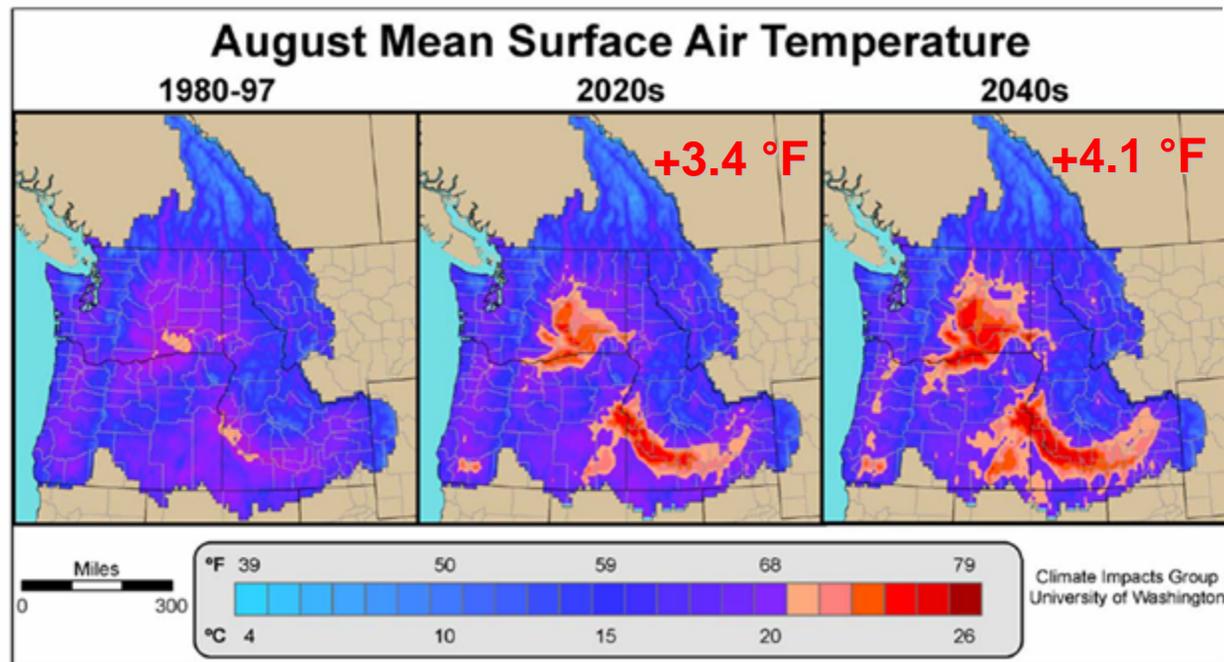


- Increased stress in the freshwater environment
  - Winter: floods
  - Summer/Fall: low flows & high temperatures
  - Impaired water/habitat quality
- Uncertain changes in coastal & ocean habitat

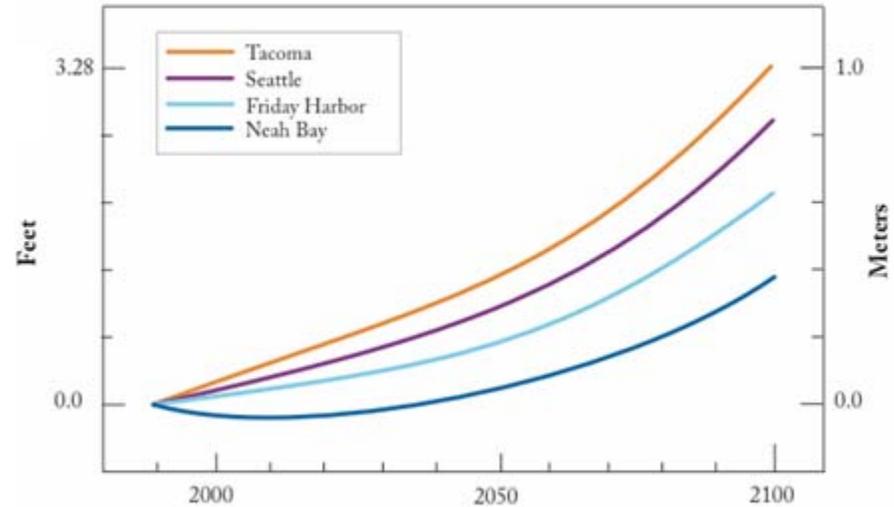
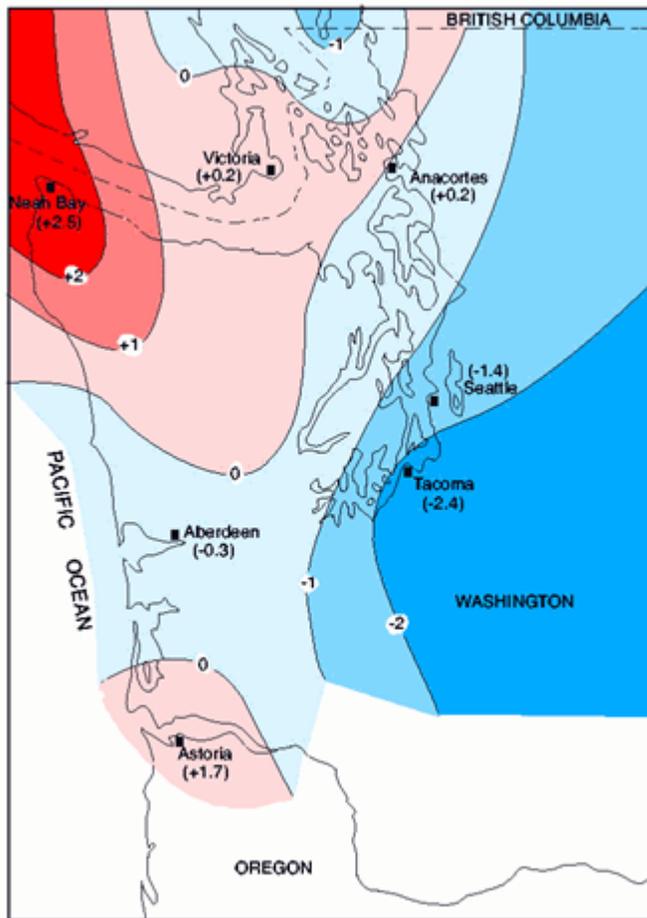
# Temperature thresholds for coldwater fish in freshwater

- **Warming temperatures will increasingly stress coldwater fish in the warmest parts of our region**

A monthly average temperature of 68°F (20°C) has been used as an upper limit for resident cold water fish habitat, and is known to stress Pacific salmon during periods of freshwater migration, spawning, and rearing.



# Sea Level Rise scenarios depend on regional tectonics



- this means that relative sea level rise will be greatest in South Puget Sound (~3.3ft by 2100), and least near Neah Bay (~1.3ft by 2100)

*So what do we do about it?....*

# Planning for Climate Change



Climate change will force resource managers and planners to deal with increasingly complex trade-offs between different management objectives.



---

# Choices and change

- Climate changes projected for the next few decades are largely unavoidable
- Today's choices will shape tomorrow's impacts
- Planning should begin now

# Guiding Principles for Planning

- Take actions to maintain or increase the resilience of regional ecosystems



Log weirs placed in a small coastal Washington stream to create pools and habitat for coho salmon. NWFSC.

# Guiding Principles for Planning

- Take actions to maintain or increase the resilience of regional ecosystems
- Monitor regional climate and resources for ongoing change



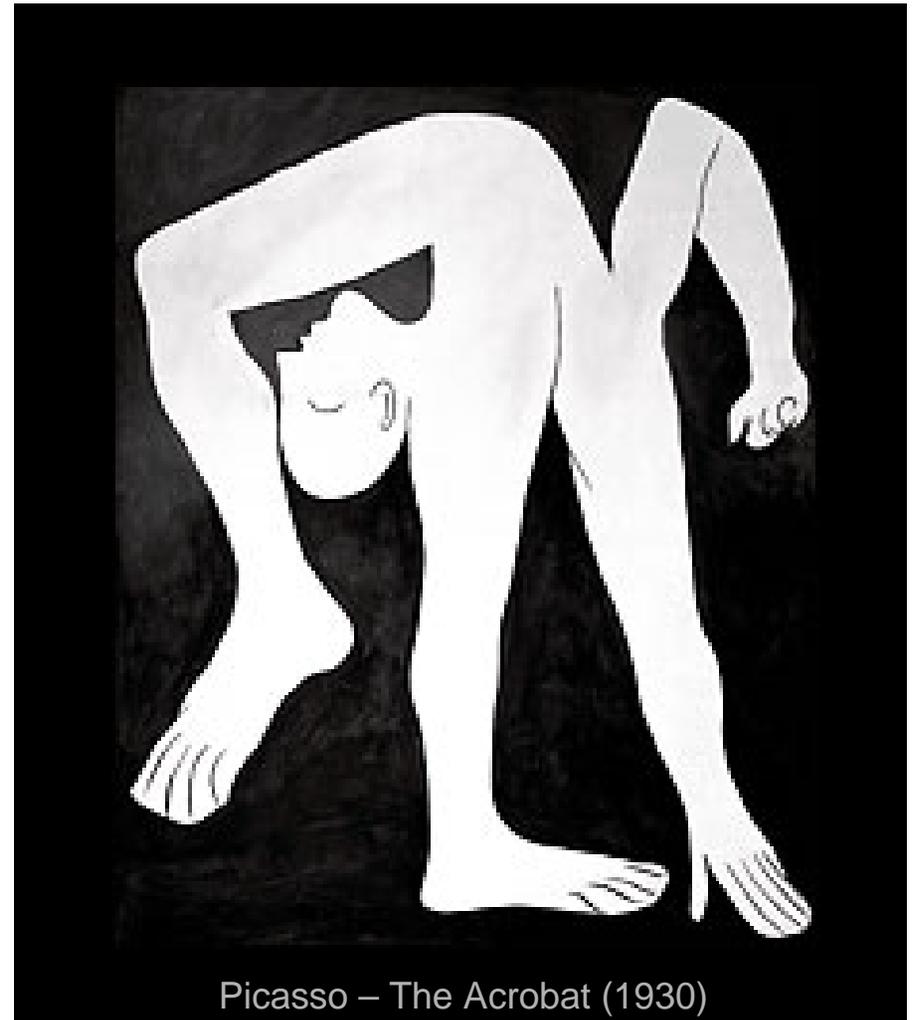
October 27, 2005

[www.cses.washington.edu/cig/](http://www.cses.washington.edu/cig/)



# Guiding Principles for Planning

- Take actions to maintain or increase the resilience of regional ecosystems
- Monitor regional climate and resources for ongoing change
- Design for surprises. Policies & management practices should be flexible.



[www.georgetown.edu](http://www.georgetown.edu)

---

By starting now to plan for a changing climate, we can build the ecological, political and socioeconomic capacity required to cope with climate change in Washington state.



# For More Information ...

Amy Snover

UW Climate Impacts Group

206-221-2997

[aksnover@u.washington.edu](mailto:aksnover@u.washington.edu)

[www.cses.washington.edu/cig](http://www.cses.washington.edu/cig)



*Climate Science in the  
Public Interest*