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 \textit{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

- \textbf{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
Change in Motion?
Trends in 20th Century PNW Climate
Temperature trends (°F per century) since 1920

In contrast: No clear 20th century trend in precipitation ...

PNW warmed +1.5 F during the 20th century
Snow water equivalent trends, 1950-2000

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

Numerous sites in the Cascades with 30-60% declines

Mote 2003(b)
Climate change is more than just averages

- frost days decreasing
- snowfall decreasing
- precipitation intensity...
Where Are We Headed?  
21st Century Climate Change Projections

“Human influences will continue to change atmospheric composition throughout the 21st century.”

IPCC 2001
Global climate change

- Temperature Change (°C)
- Emissions uncertainty
- Model uncertainty

- A1FI
- A1B
- A1T
- A2
- B1
- B2
- IS92a (TAR method)

IPCC 2001
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

Snoqualmie Pass 3022 ft

for a ~3.6°F (2°C) warming

www.cses.washington.edu/cig/
Springtime snowpack will decline, especially at the warmest locations

+4.1°F (2.3°C)
&
+4.5% winter precipitation

April 1 Snowpack
The coldest locations are less sensitive to warming

Historical

% Change

2040s

+ 4.1°F
+ 4.5% winter precip

April 1 Snowpack

Legend

+ 20%
-100%
36 in.
0 in

www.cses.washington.edu/cig/
Less snow, earlier melt:
- More water in winter
- Less water in summer

Washington’s water = extraordinarily dependent on snowpack

---

Hydrologic Changes

Olympic Peninsula, WA

Washington’s water = extraordinarily dependent on snowpack

+3.6 to +5.4°F (+2 to +3°C)
Climate change impacts on Washington’s forests

- **CO$_2$ 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

www.cses.washington.edu/cig/
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°F) limit beetle activity
  - A recent lack of extreme cold (killing) temperatures has allowed the beetle to thrive in epidemic numbers

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 …

- 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
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.
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
www.cses.washington.edu/cig