



Climate Change in Puget Sound

from the snowcaps to the whitecaps

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NIDIS Drought Early Warning System Kick-off

February 3, 2016



*Climate Science in the
Public Interest*

A few thoughts for the DEWS...

- We have a lot of information about future climate and vulnerability
- We are good at making information accessible to researchers and for condensing it for a general audience...***is there a middle ground?***
- Do we have a system/strategy for organizing information about ***socioeconomic impacts and responses?***



State of Knowledge: Climate change in Puget Sound

Climate impacts & risk reduction activities

Synthesis of peer-reviewed literature, agency reports, published datasets

Place-based, locally-specific, designed for ease-of-use

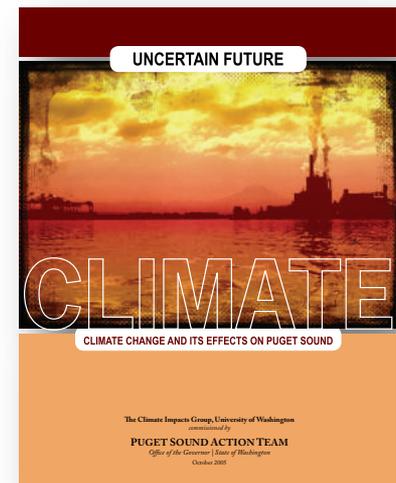
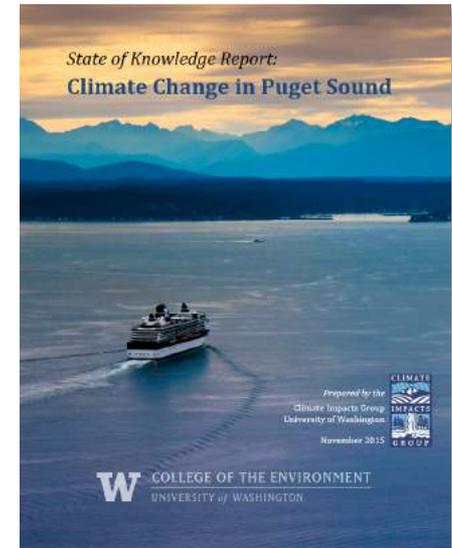
First update since 2005

Sponsored by Puget Sound Institute, NOAA, WA state

9 authors, 29 contributors & reviewers

Released in November, 2015

<https://cig.uw.edu/resources/special-reports/ps-sok/>



An aerial photograph of the Puget Sound region in Washington state. The image shows a large body of water in the foreground with a white boat leaving a wake. The surrounding land is densely forested with evergreen trees. In the distance, a range of mountains with snow-capped peaks is visible under a clear blue sky. The text is overlaid in the center of the image.

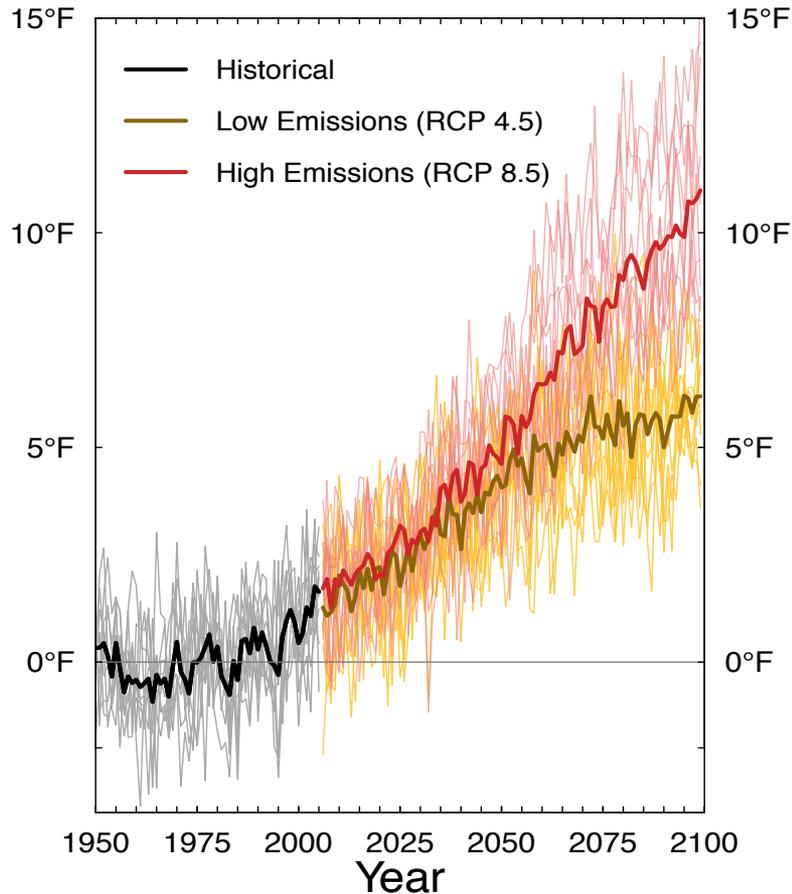
Changes in freshwater and marine systems represent the dominant pathways for climate impacts in the Puget Sound region.



Projected Changes in Temperature and Precipitation

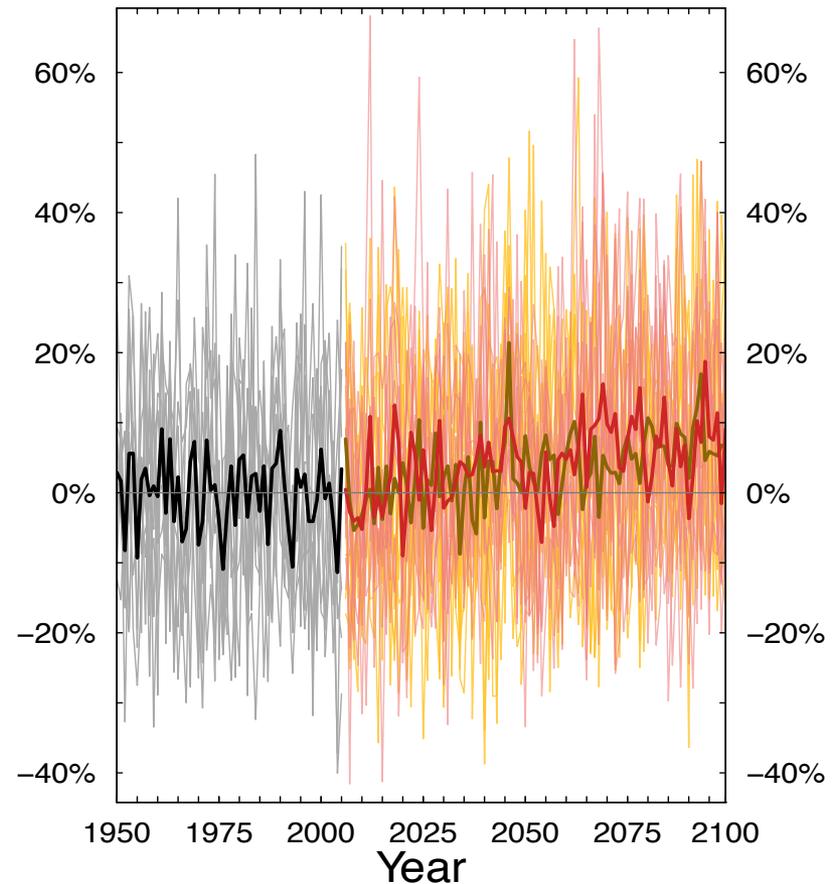
Temperature Difference

(Relative to 1950–1999 average)



Precipitation Change

(Relative to 1950–1999 average)

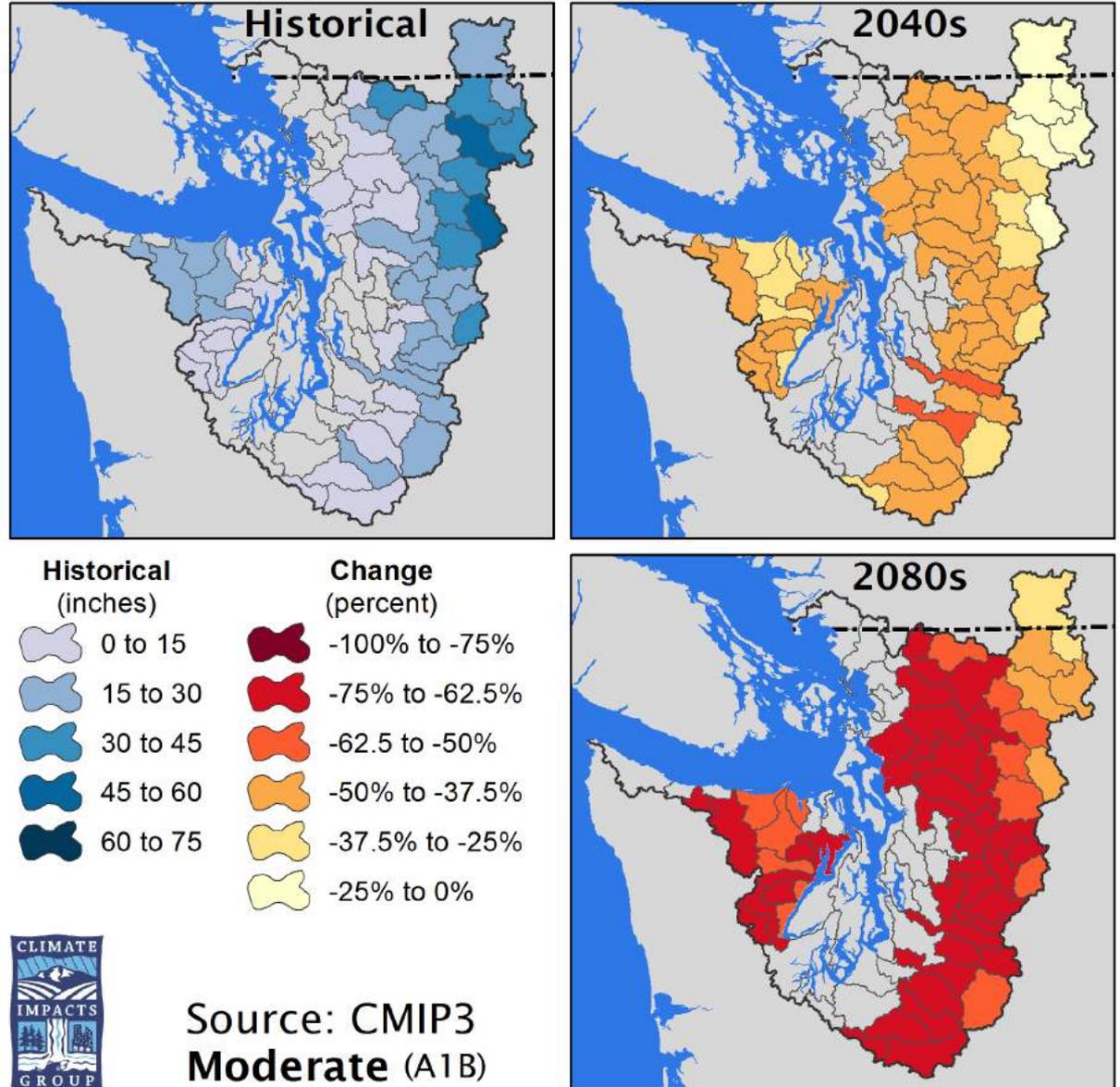


All Scenarios Indicate Less Snow

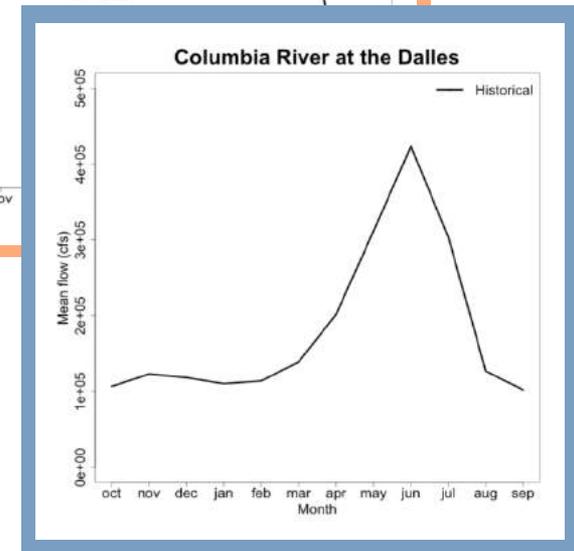
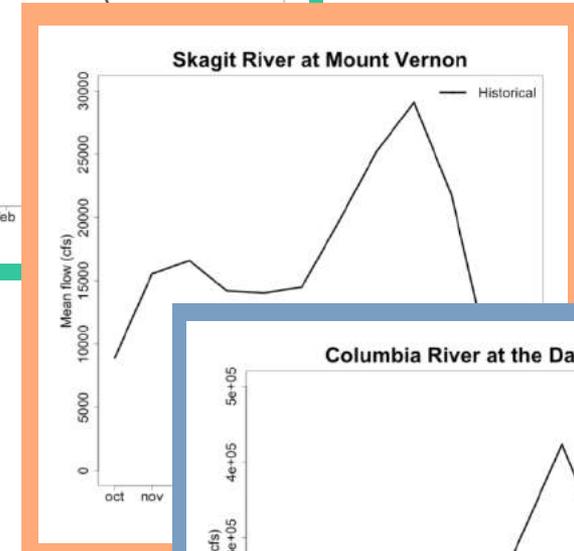
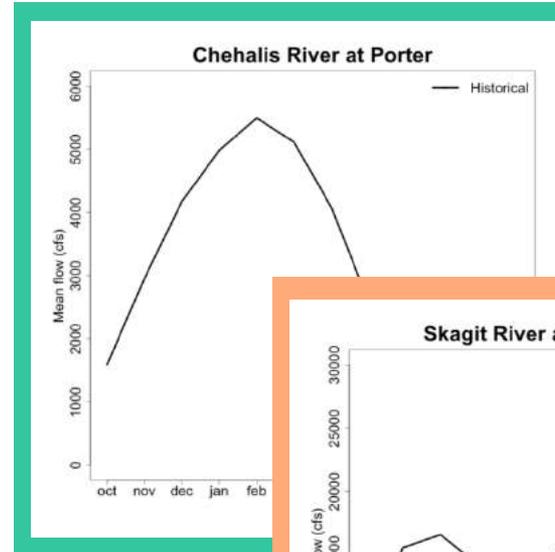
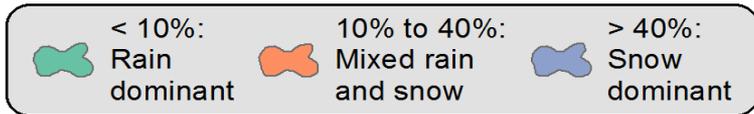
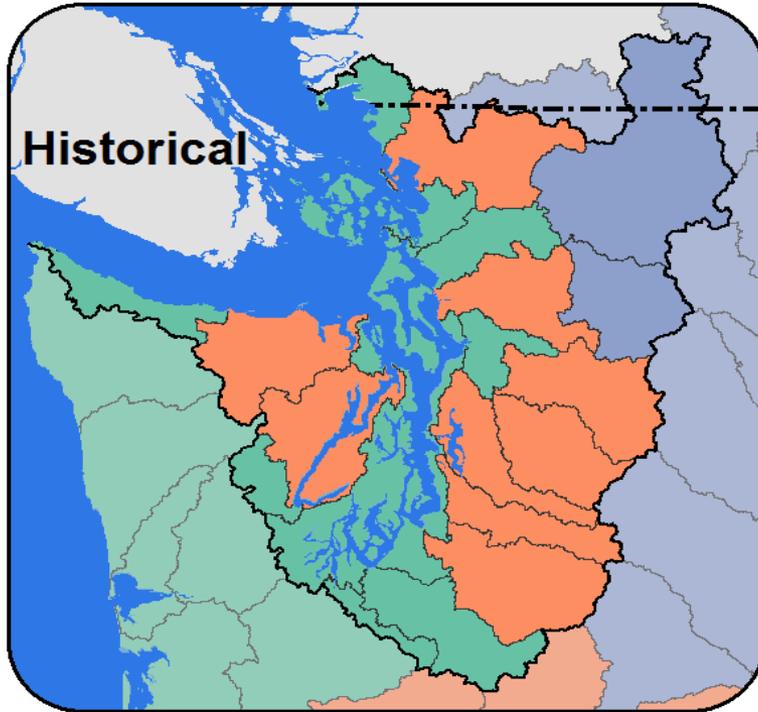
Puget Sound, 2040s:
-29%

Puget Sound, 2080s:
-55%

Annual Maximum Snow Water Equivalent



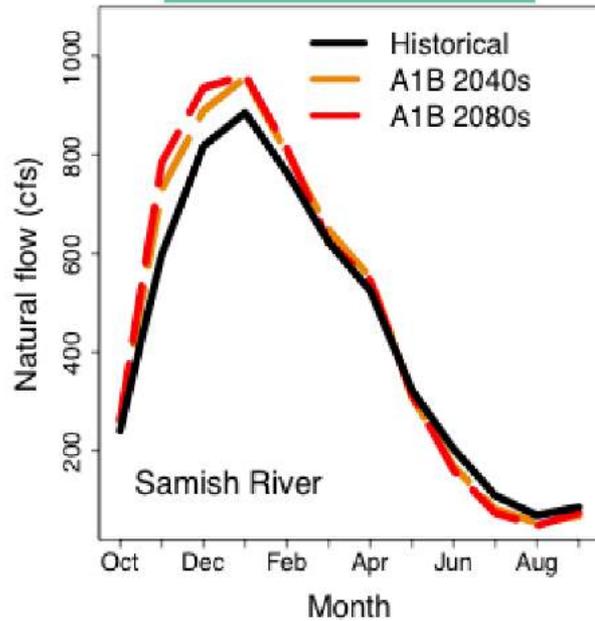
Basin Transformations: Shifting from Snow to Rain



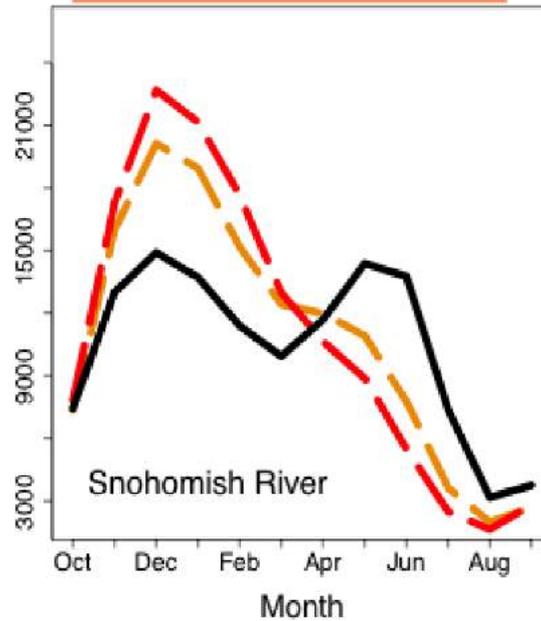


Hydrology is most affected in basins that historically accumulated snow

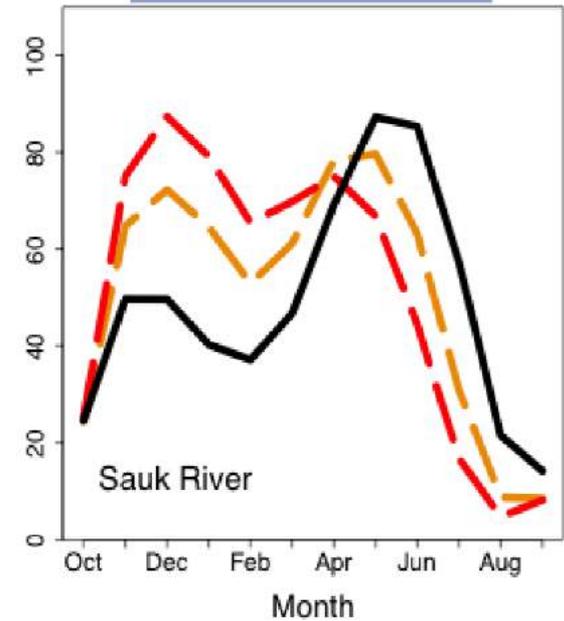
Rain dominant (Green)



Mixed rain and snow (Red)



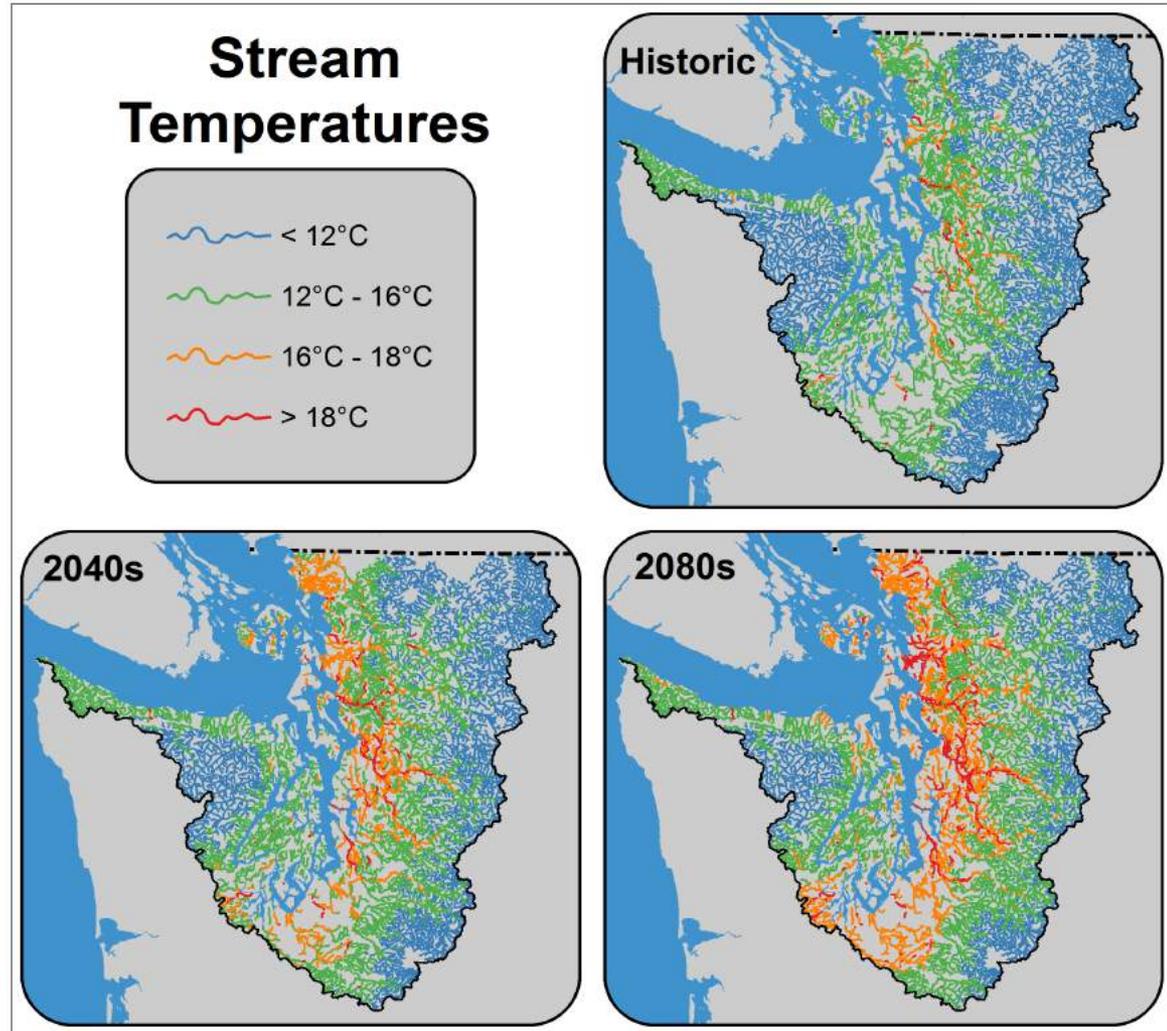
Snow dominant (Blue)



Warming Streams

By the 2080s, in Puget Sound:

- Stream temperatures, on average, are projected to increase by +4.0°F to +4.5°F by the 2080s.
- Number of river miles exceeding thermal tolerances are projected to increase by >1,000 mi. for salmon, and >2,800 mi. for char





More Intense Heavy Rains

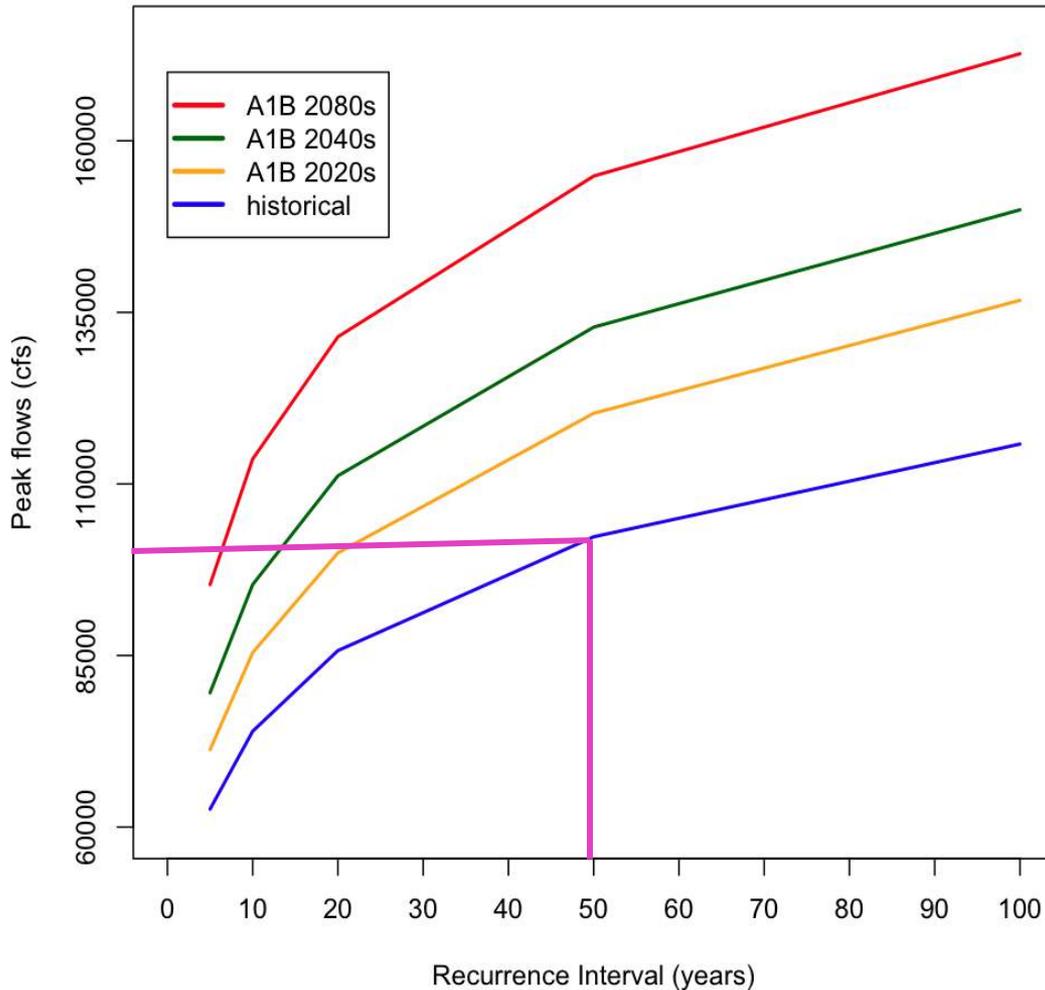
Heaviest rain events are projected to become **+22% more intense** (*range: +5 to +34%*) by the 2080s.

Changes in Winter Atmospheric Rivers along the North American West Coast in CMIP5 Climate Models

Warner, Mass, Salathé, J Hydromet, 2014

Increasing Winter Flood Risk

Change in Flood Magnitudes
Skagit River at Mount Vernon



The current 50 year (2%) flood event in the Skagit becomes (approx):

2020s: a 1-in-20 year (5%) event

2040s: a 1-in-10 year (10%) event

2080s: a 1-in-5 year (20%) event

Landslides and Sediment

- *New topic:* No previous report has synthesized the research linking climate and landslide risk in the region.
- Currently no projections for changing landslide risk, but climate change will likely lead to an increased risk in winter, decrease in summer
- Sediment: nearly **2.5 times larger** by 2080s in the Skagit

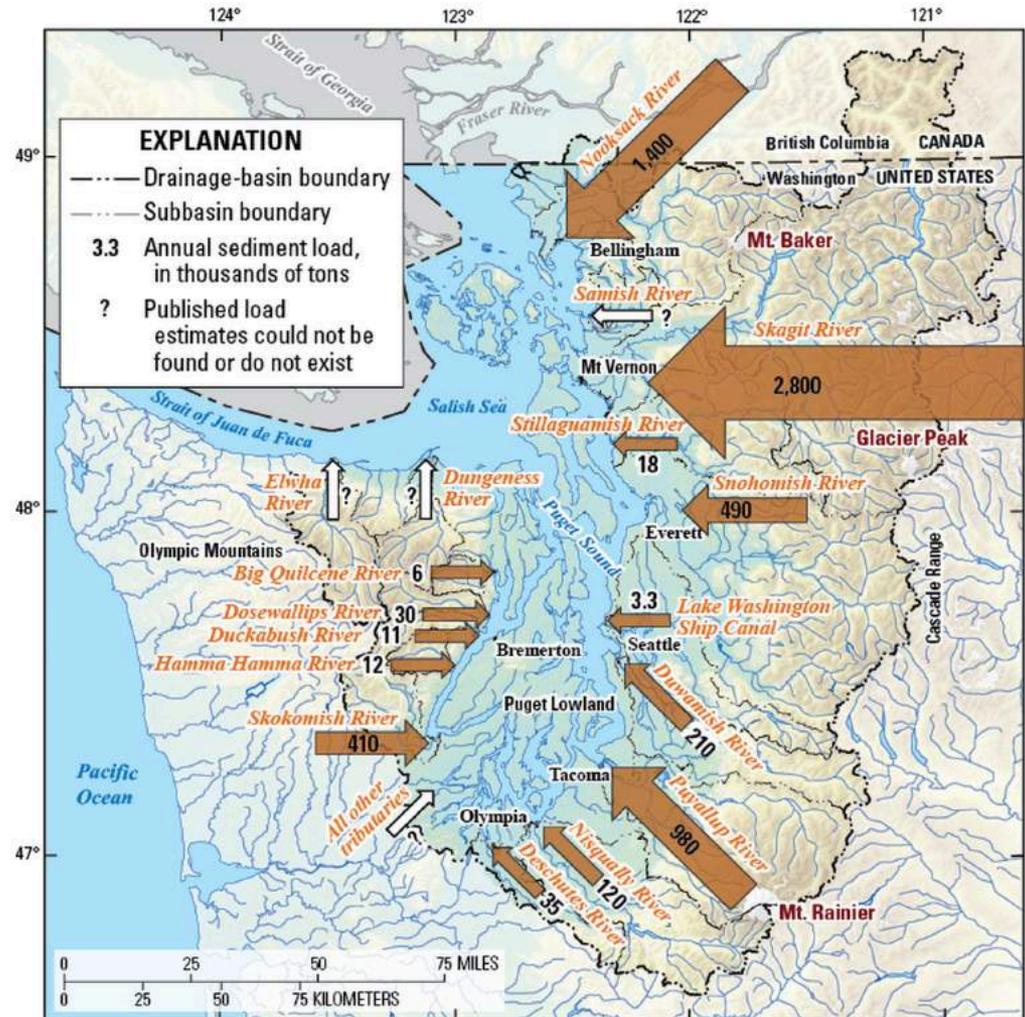


Figure Source: USGS; Czuba et al. 2011

Sea Level Rise

- Sea level rose **+8.6 in.** from 1900 to 2008.
- By 2100, sea level in the region is projected to rise an additional **+4 to +56 in.**
- Local rates of rise vary; research is beginning to quantify local variations.



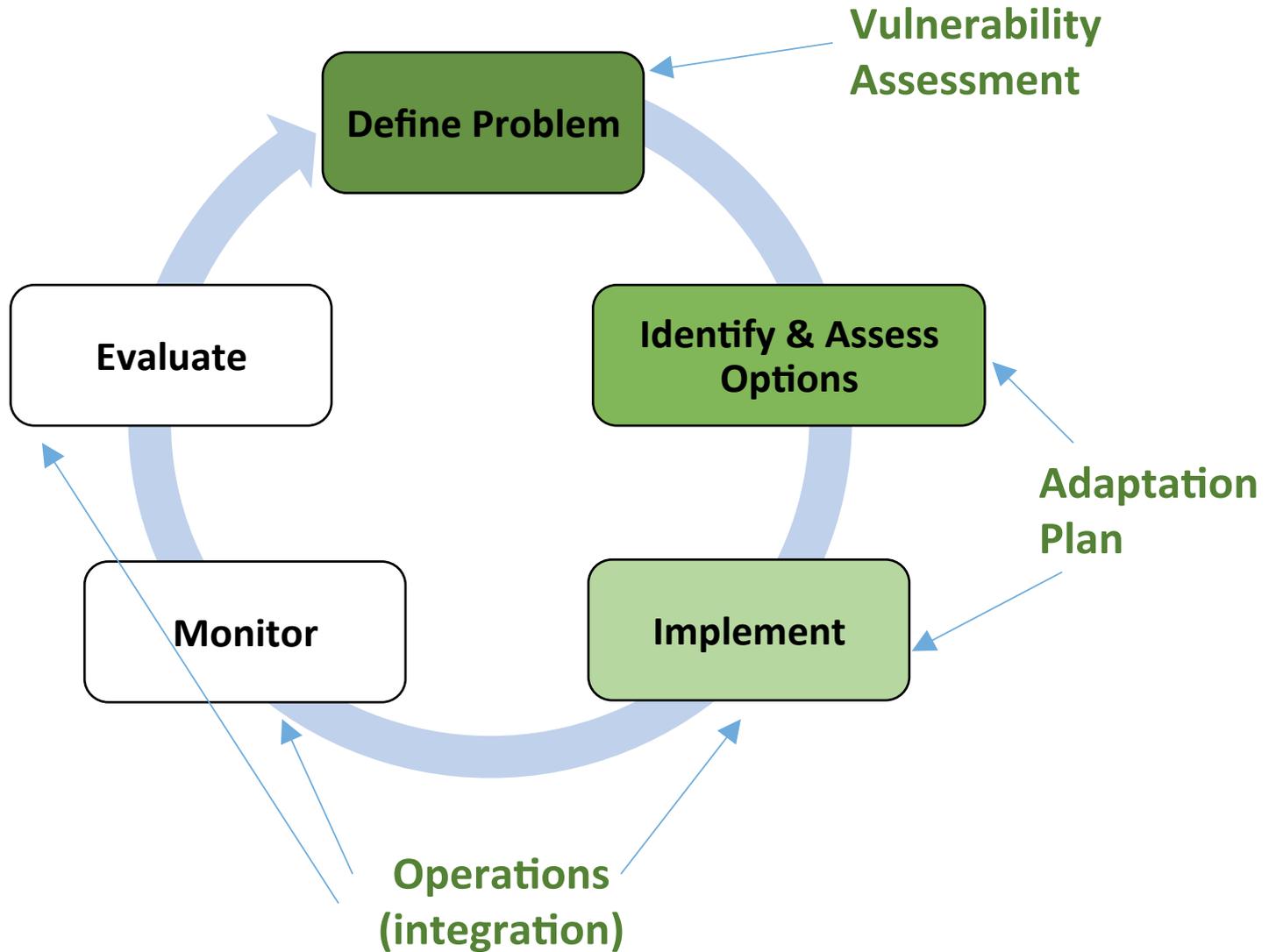
Alki Beach, West Seattle, January 21, 2010
Photo by Hugh Shipman, WA Dept. of Ecology

Ecosystem impacts





Climate Risk Reduction



A few thoughts for the DEWS...

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The Climate Impacts Group
www.cses.washington.edu/cig

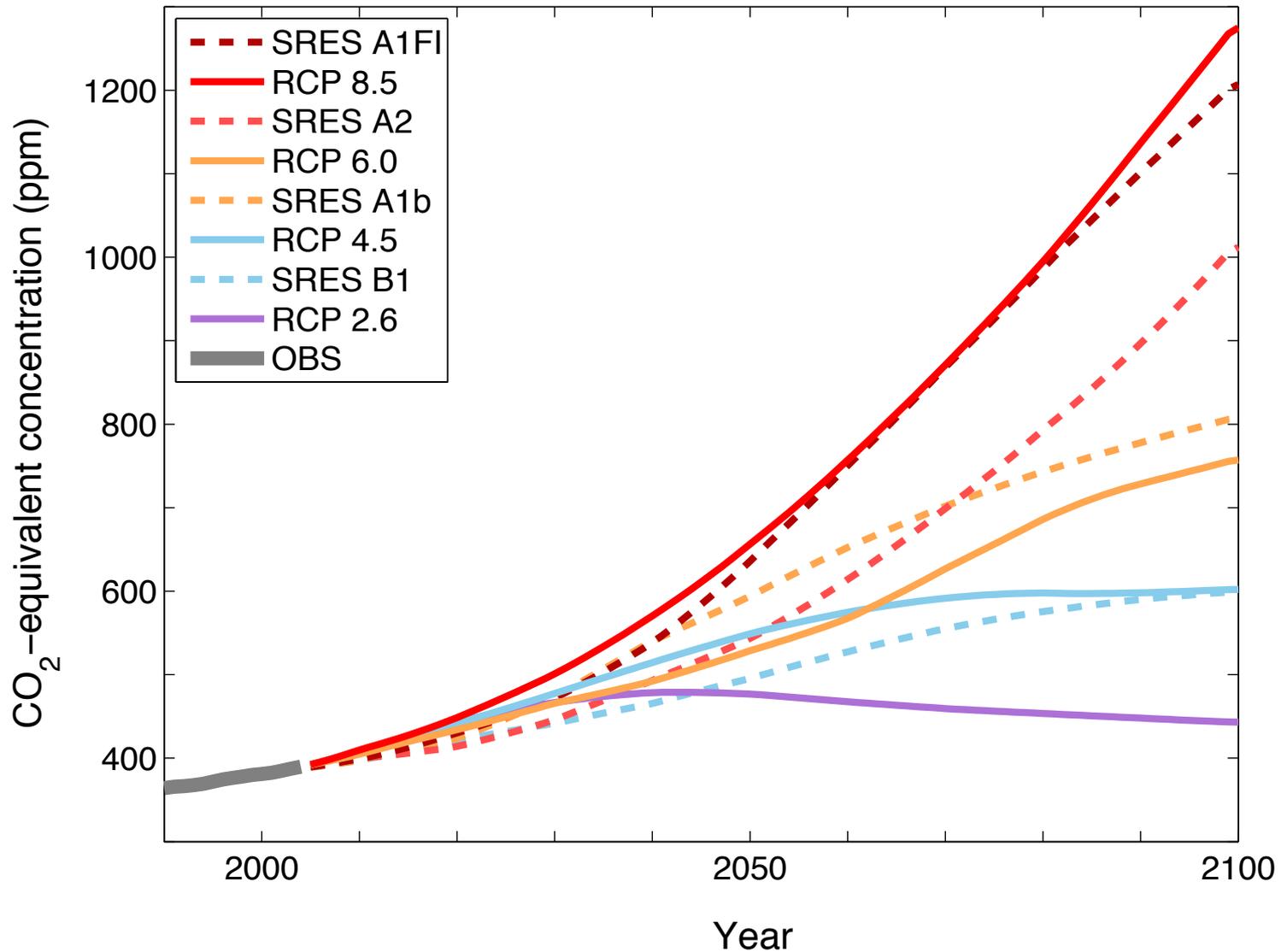
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COLLEGE OF THE ENVIRONMENT

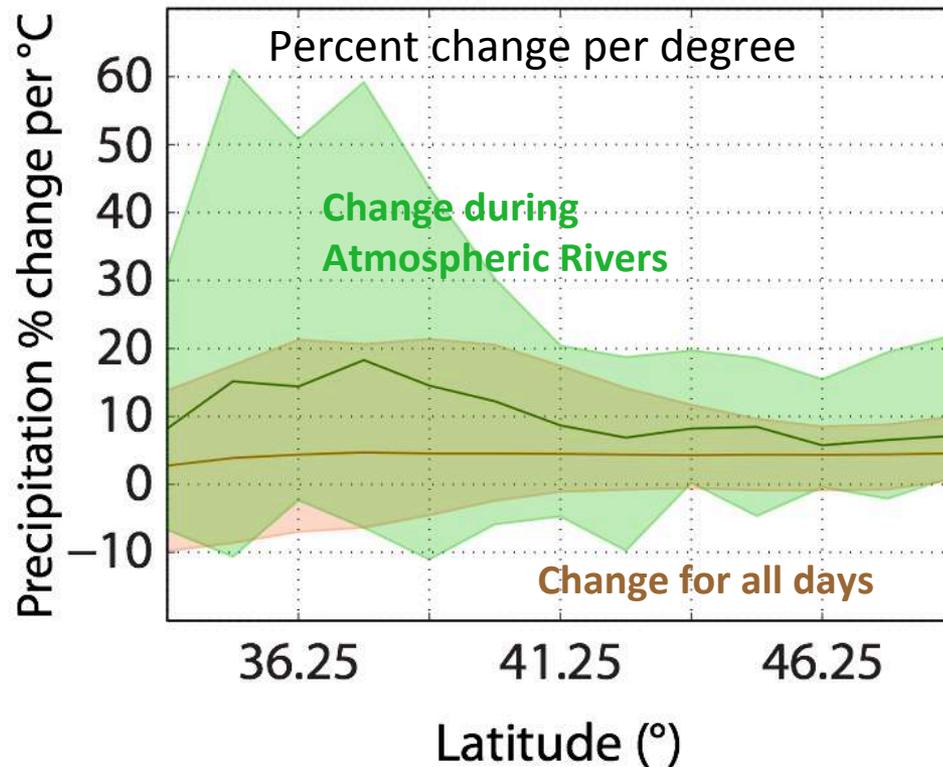
UNIVERSITY *of* WASHINGTON

Greenhouse gas “scenarios” are best guesses about future emissions



Heavier Peak Rain Events

Atmospheric rivers are more sensitive to warming



- Changes in normal precipitation:
1.5-3.5% per degree
- Changes in extreme precipitation:
5-12% per degree