



# How Low Will They Go?

## Trends in Summer Low Flows in King County Rivers and Streams

WLRD Science Seminar  
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# Human Impacts on Water Cycle

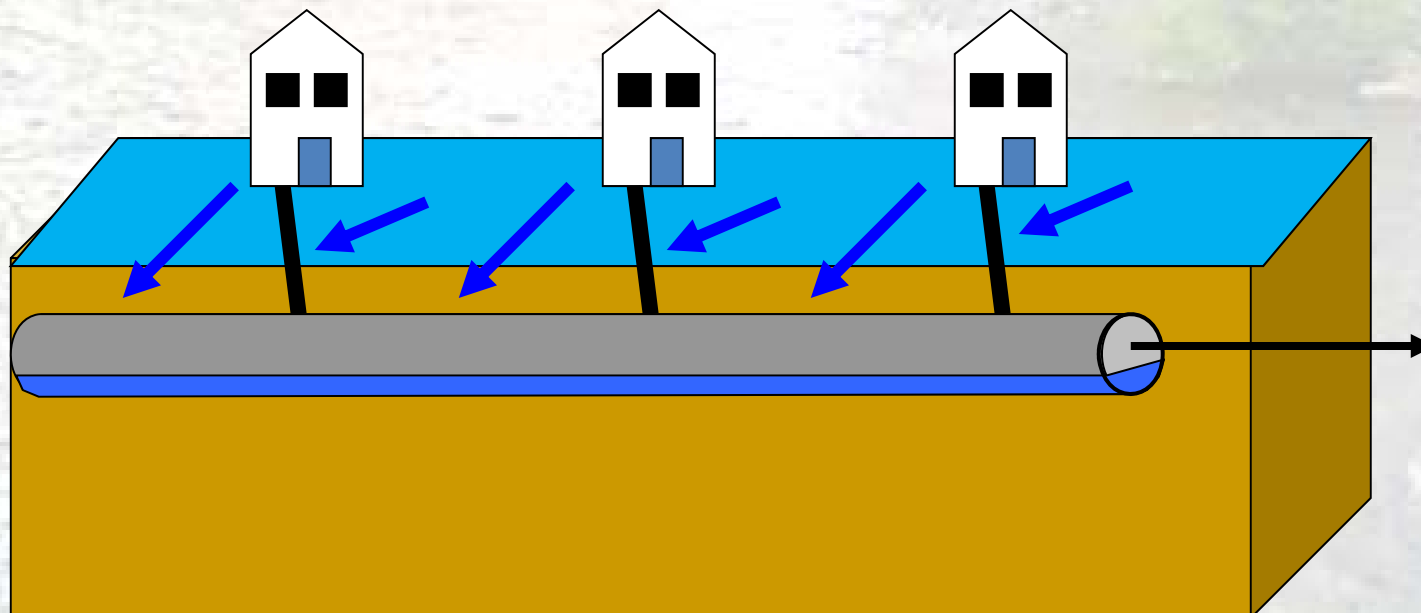
- Land cover change
  - Forest clearing/Development



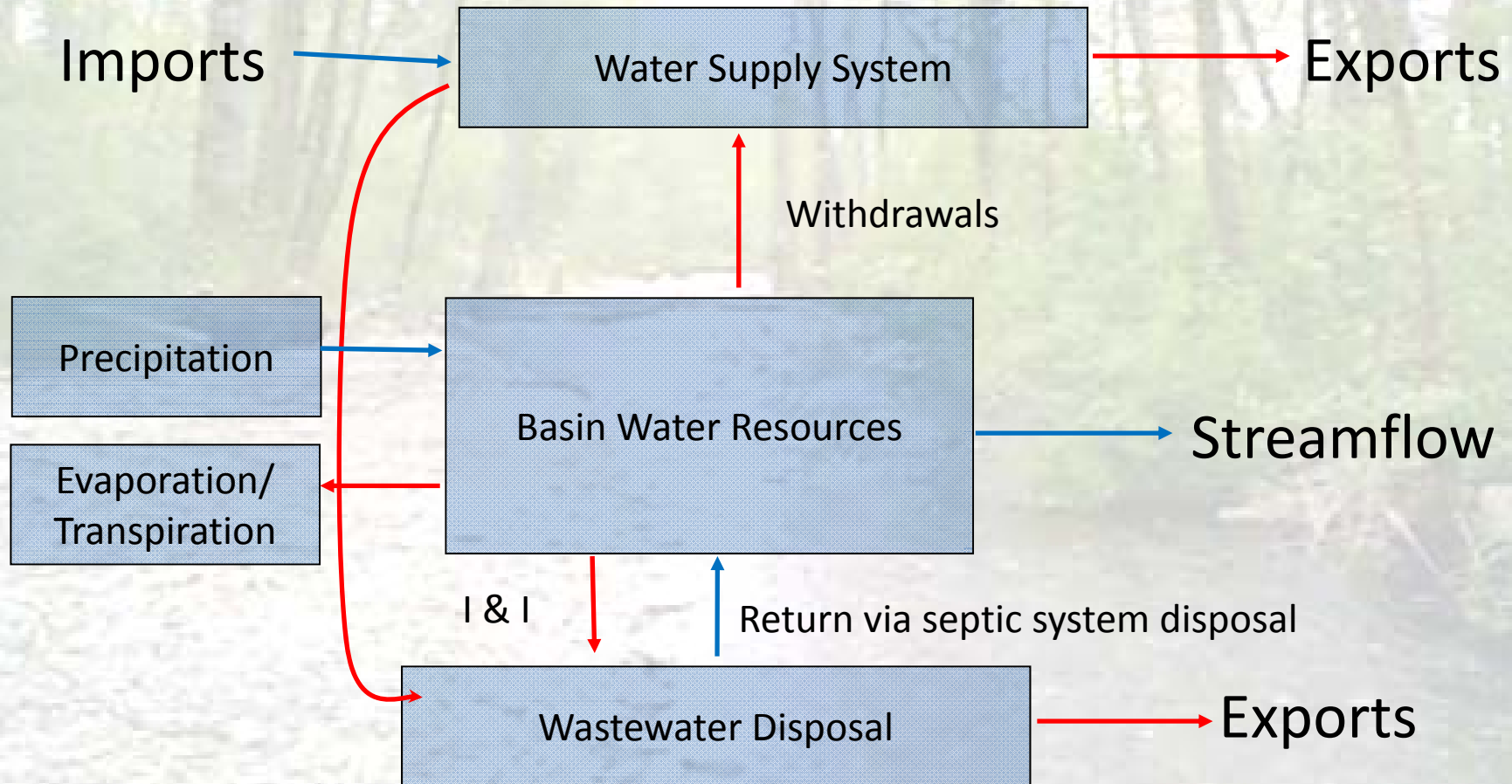
# Human Impacts on Water Cycle

## Water management

- Surface water and groundwater extraction
- Consumptive uses (Irrigation)
- Septic vs Wastewater conveyance
- Pipeline infiltration/exfiltration



# Water Management

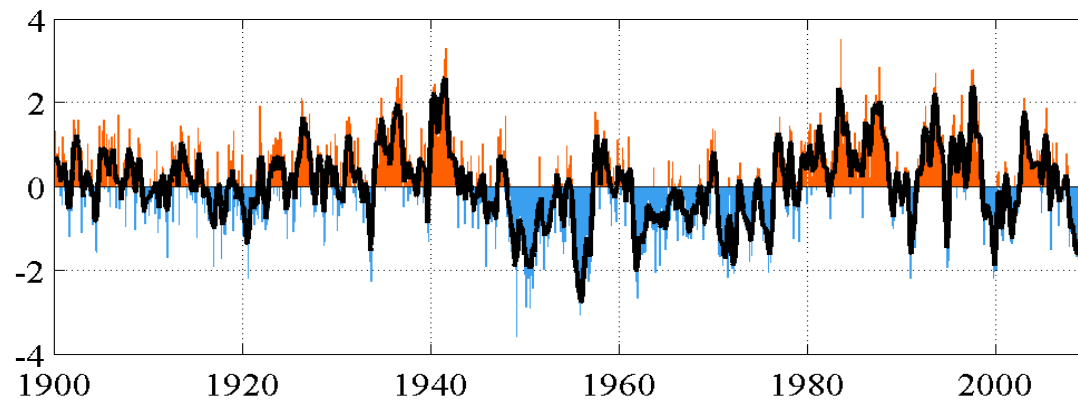


# Climate Change

- Natural Seasonal and Decadal Variability
- Human-induced trends or shifts

## Pacific Decadal Oscillation (PDO)

monthly values for the PDO index: 1900-September 2009



Source: National Institute for the Study of the Atmosphere and Ocean (JISAO)

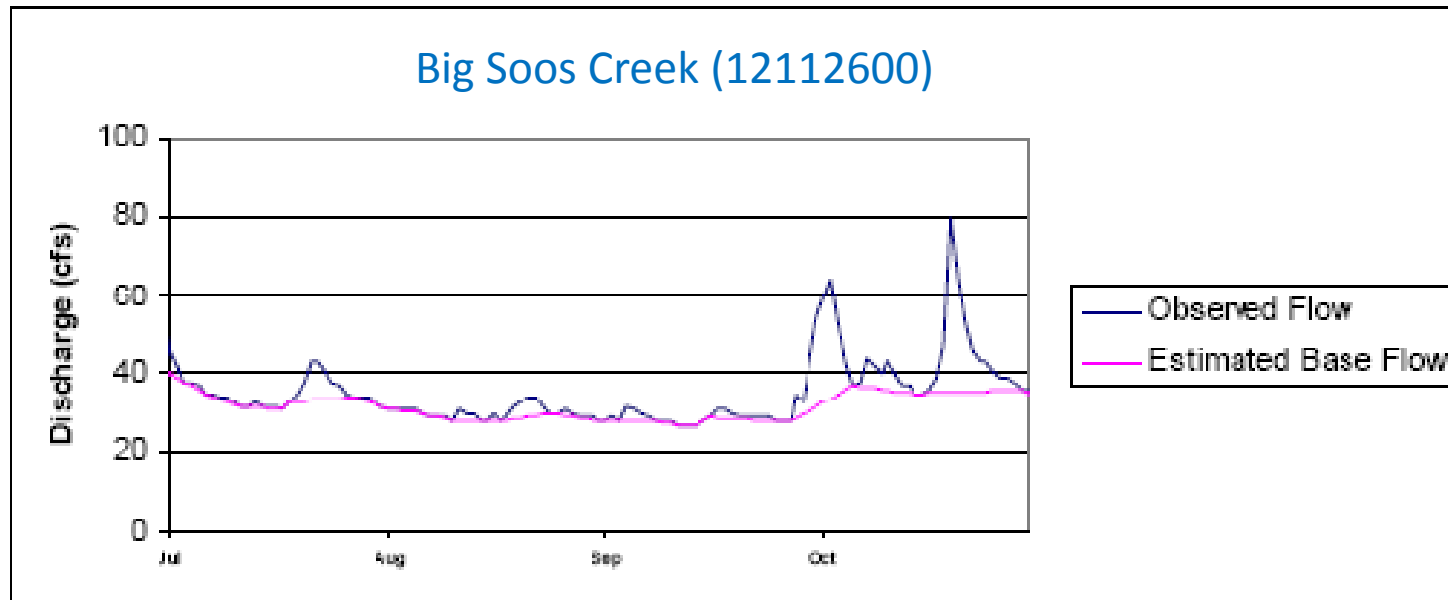
# How Do We Detect Changes in Low Flow?

- Relies heavily on long term flow gauging
- Typically look at trends in low flow metrics
  - Annual daily minimum flow
  - Annual 7-day low flow
- Unclear which low flow metrics are most ecologically relevant

# We've Detected a Change

- How do we identify the cause(s)?
  - Land cover change data
  - Basin scale water management data
  - Historical climate data
  - Develop hydrologic models that synthesize this information

# Another Low Flow Metric?

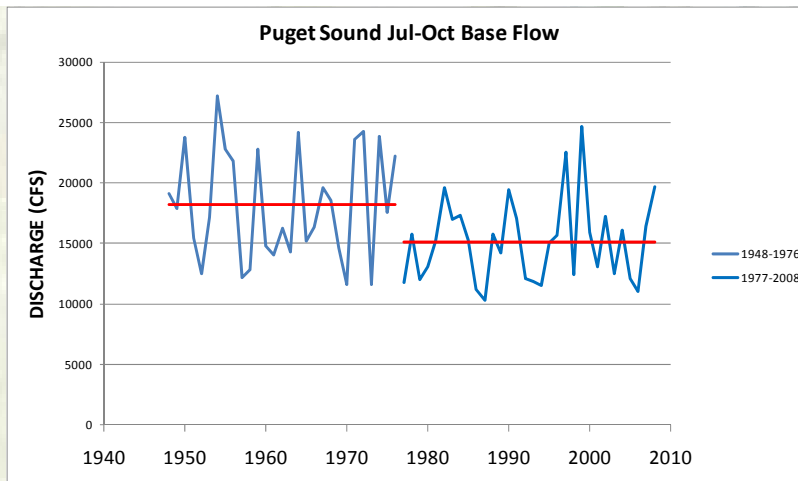


July – October 2007

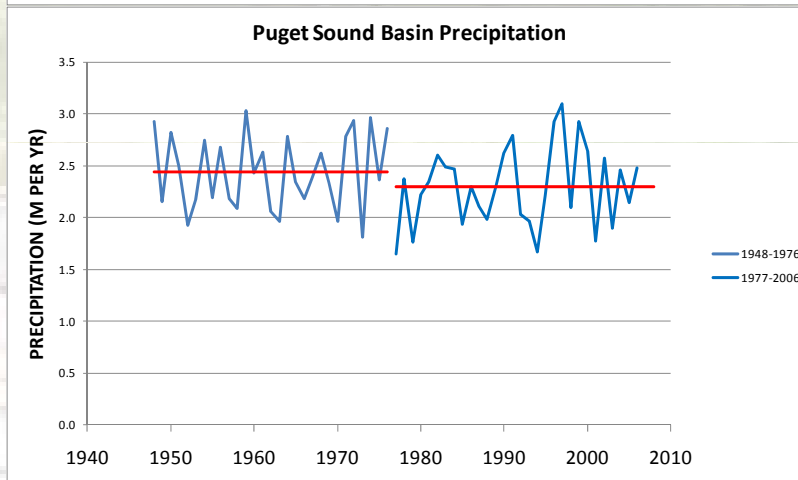
July – October Base Flow



# Puget Sound Jul-Oct Base Flow



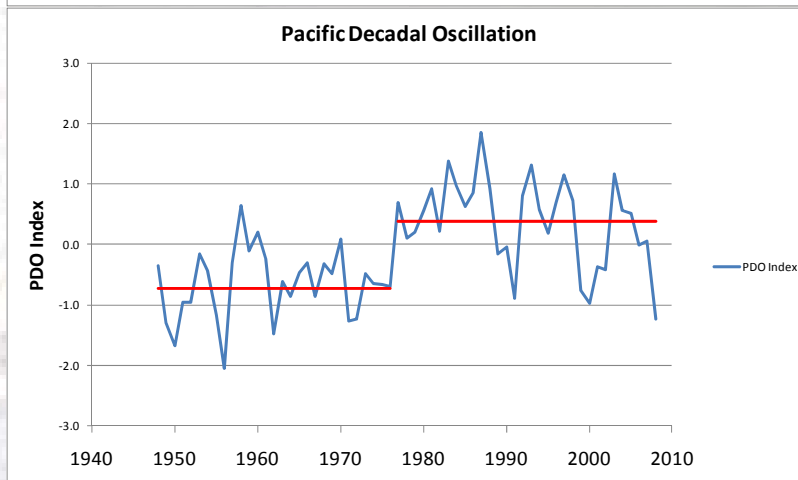
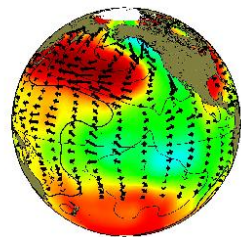
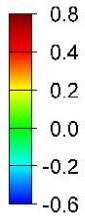
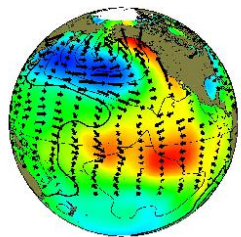
Jul-Oct Base Flow



Annual Precip

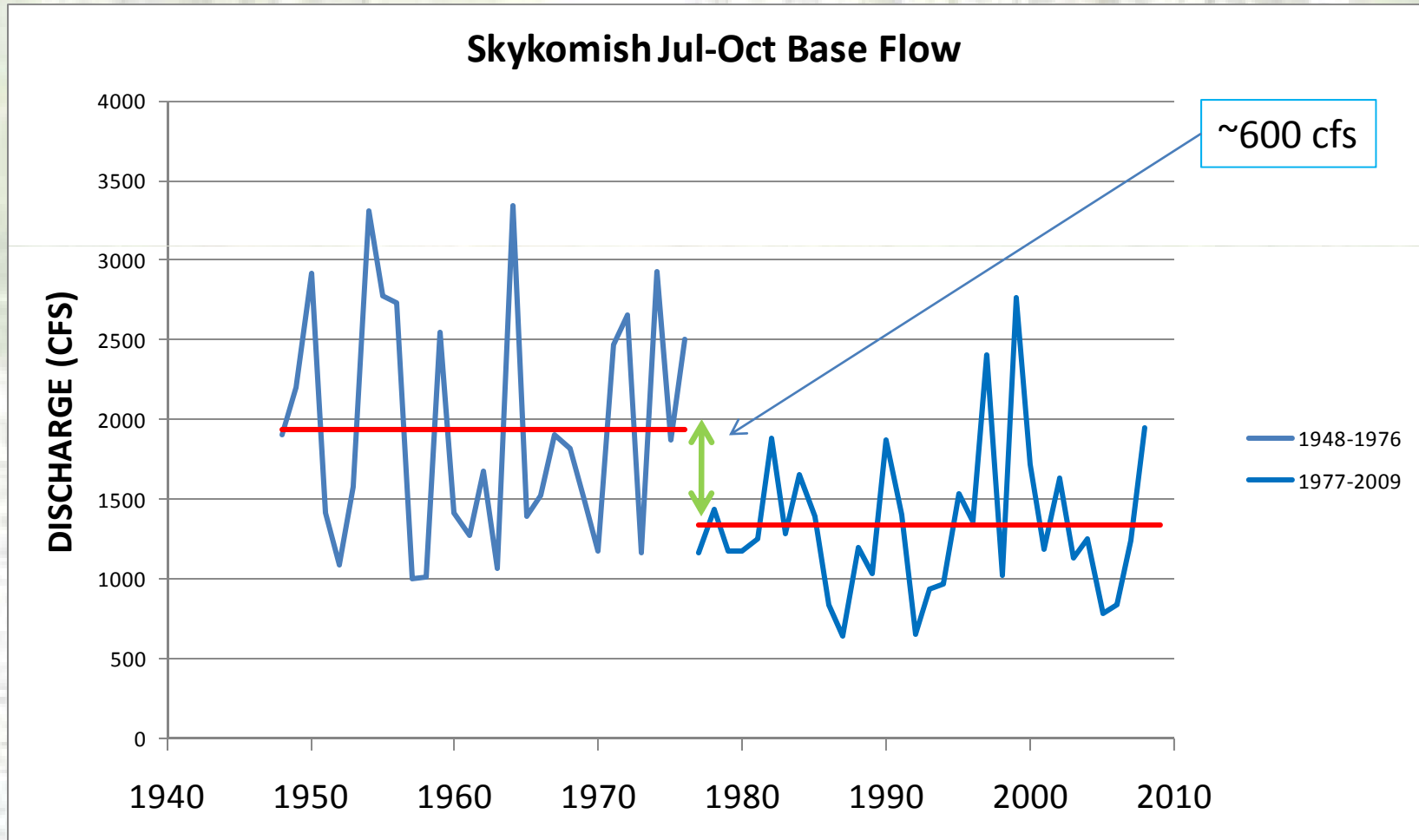
Warm (+PDO)

Cool (-PDO)

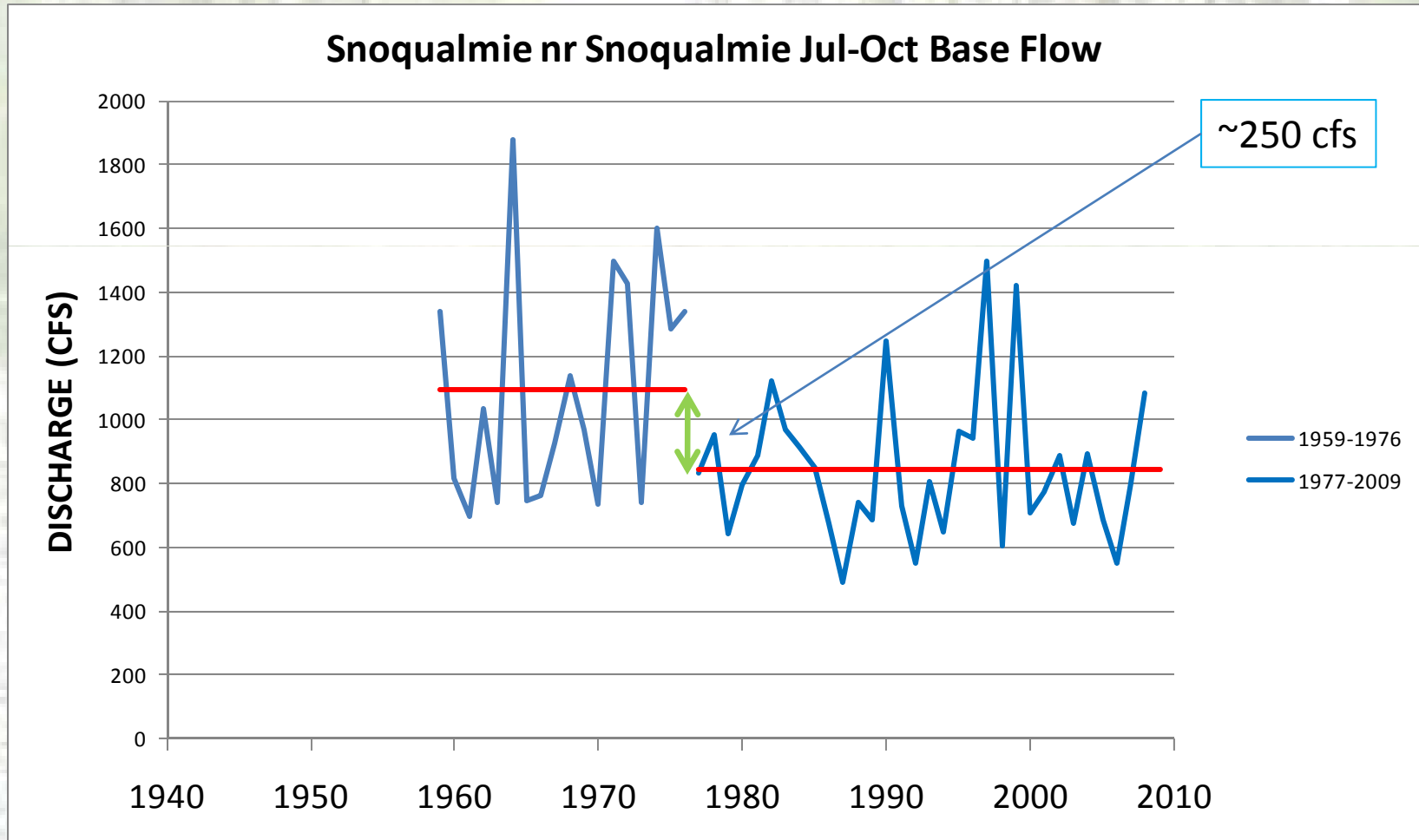


PDO

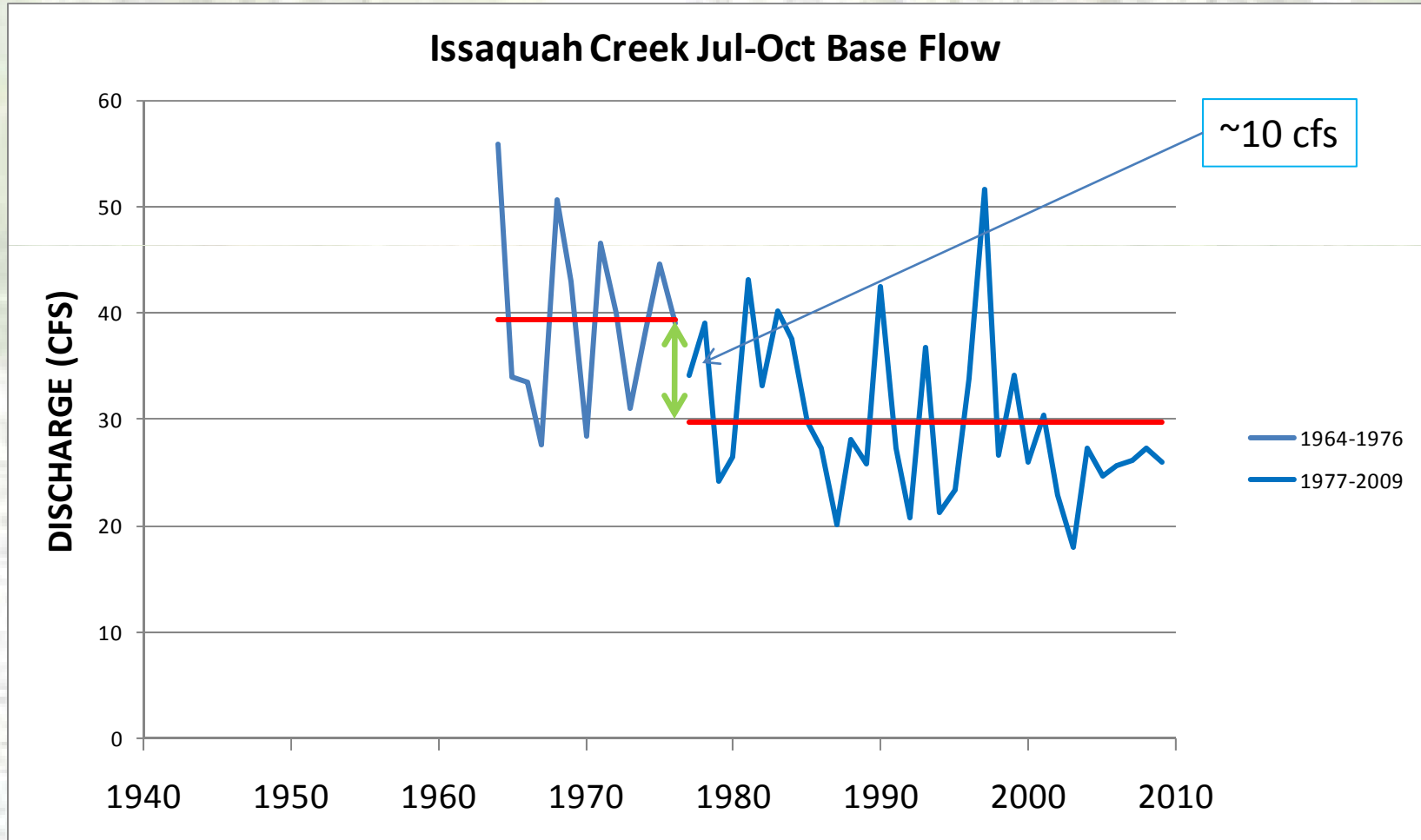
# Skykomish near Gold Bar Jul-Oct Base Flow



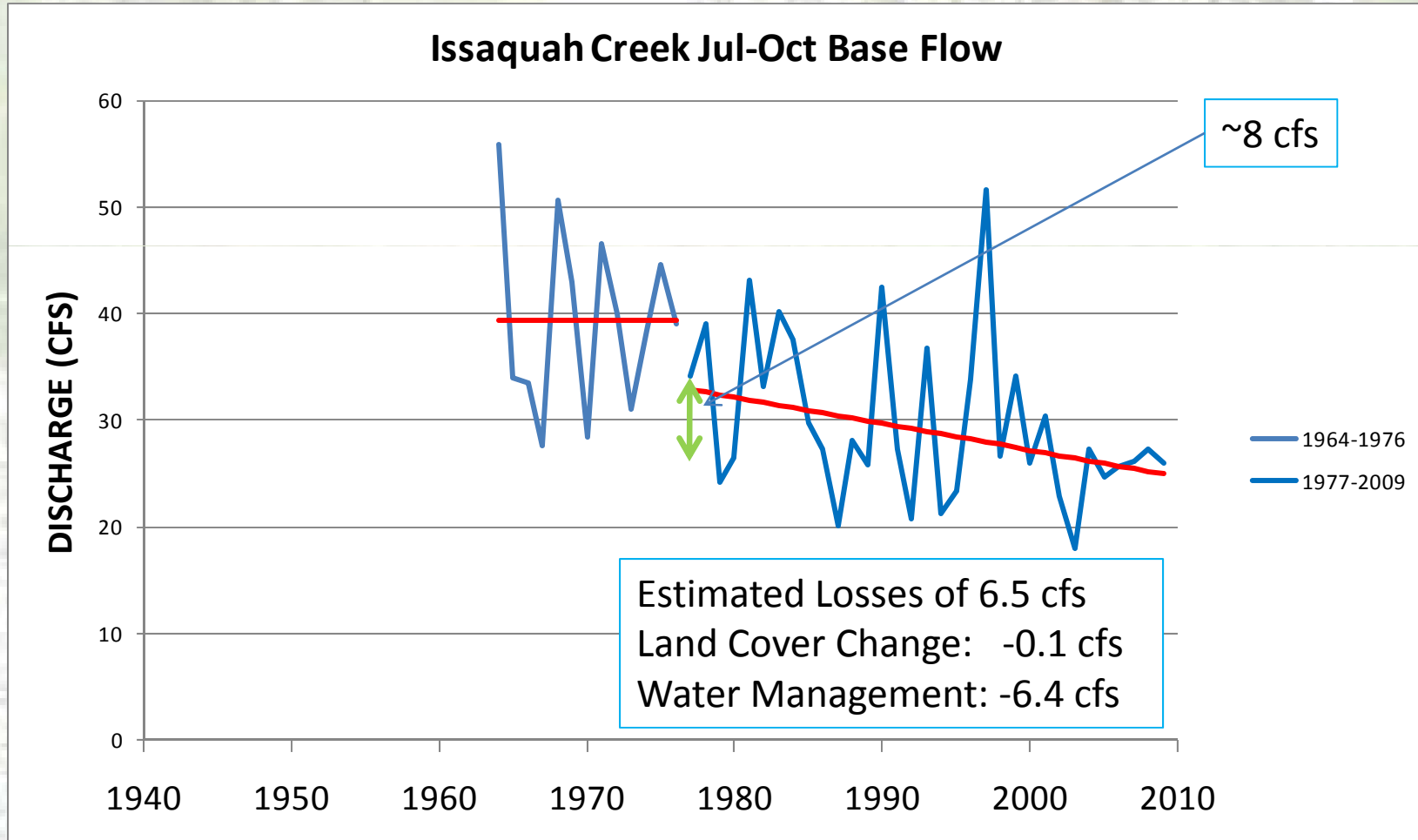
# Snoqualmie near Snoqualmie Falls Jul-Oct Base Flow



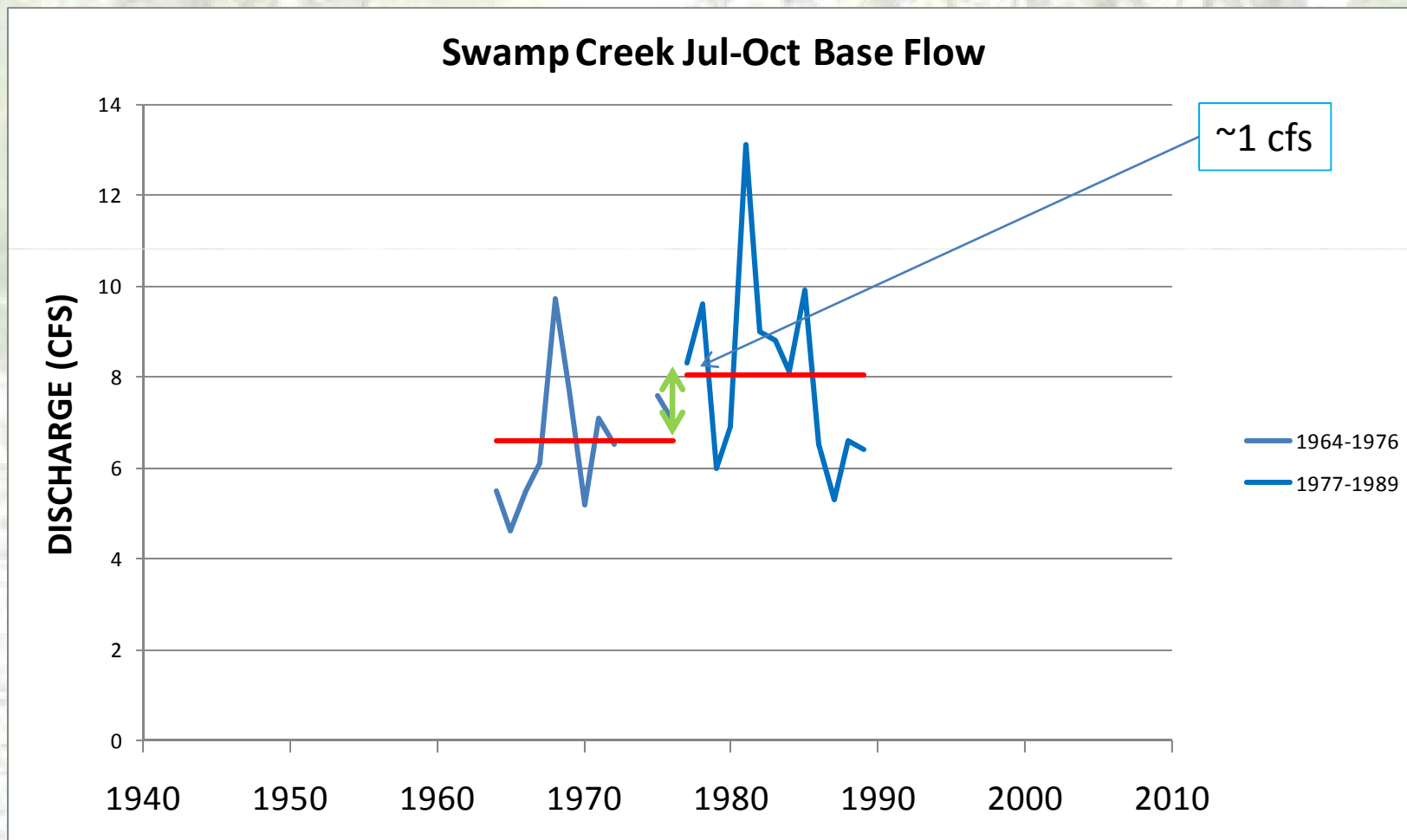
# Issaquah Creek near mouth Jul-Oct Base Flow



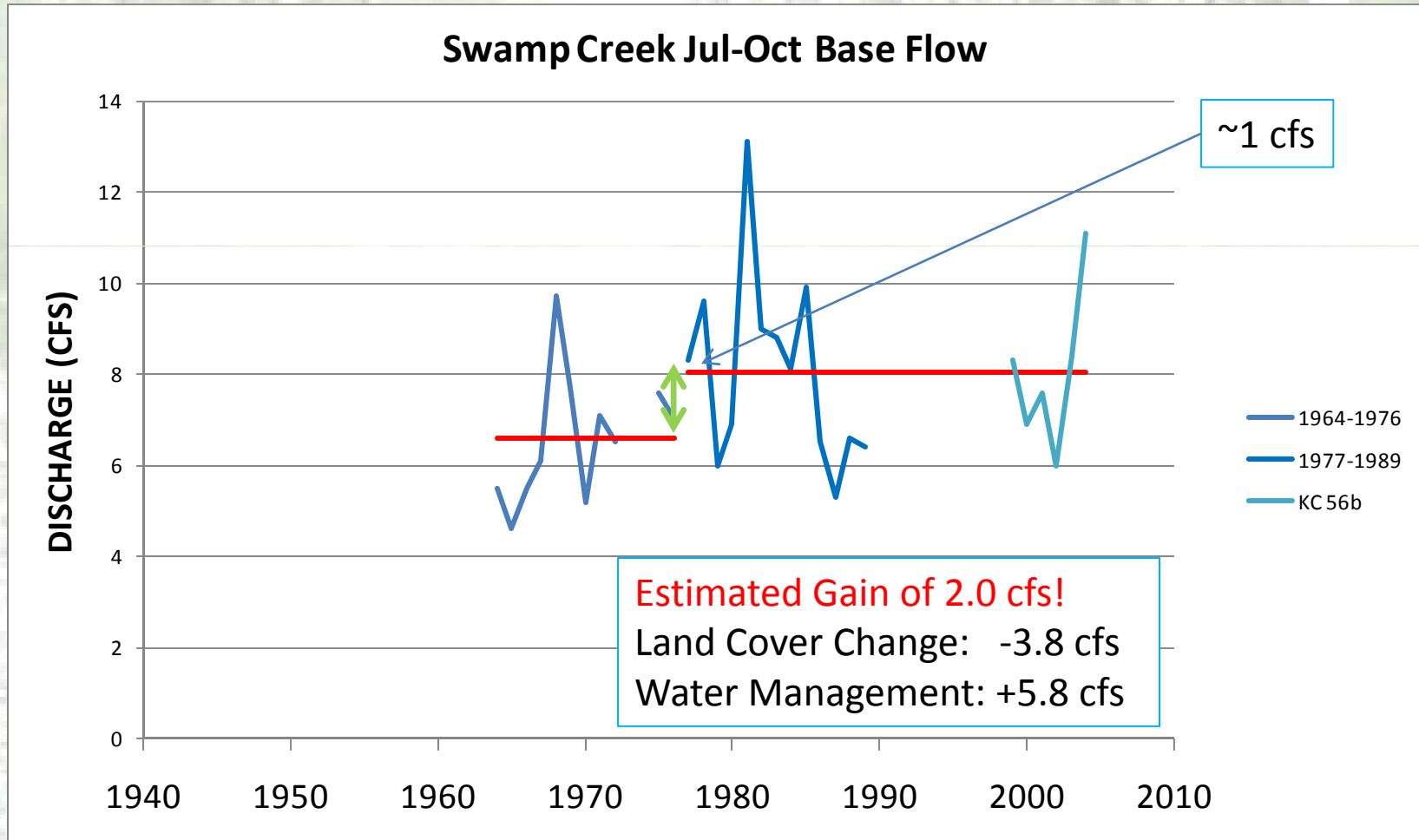
# Issaquah Creek near mouth Jul-Oct Base Flow



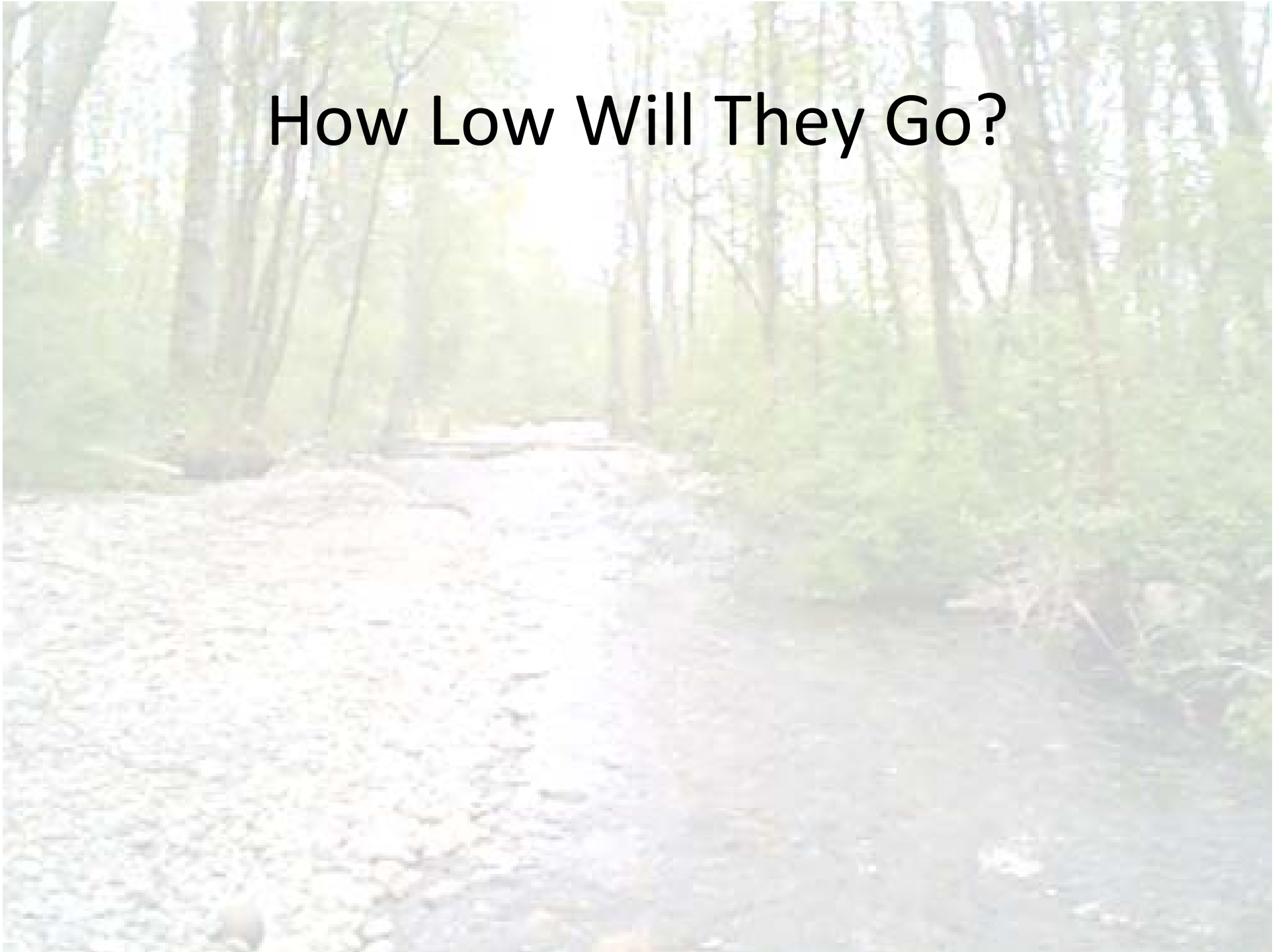
# Swamp Creek at Kenmore Jul-Oct Base Flow



# Swamp Creek at Kenmore Jul-Oct Base Flow



**How Low Will They Go?**





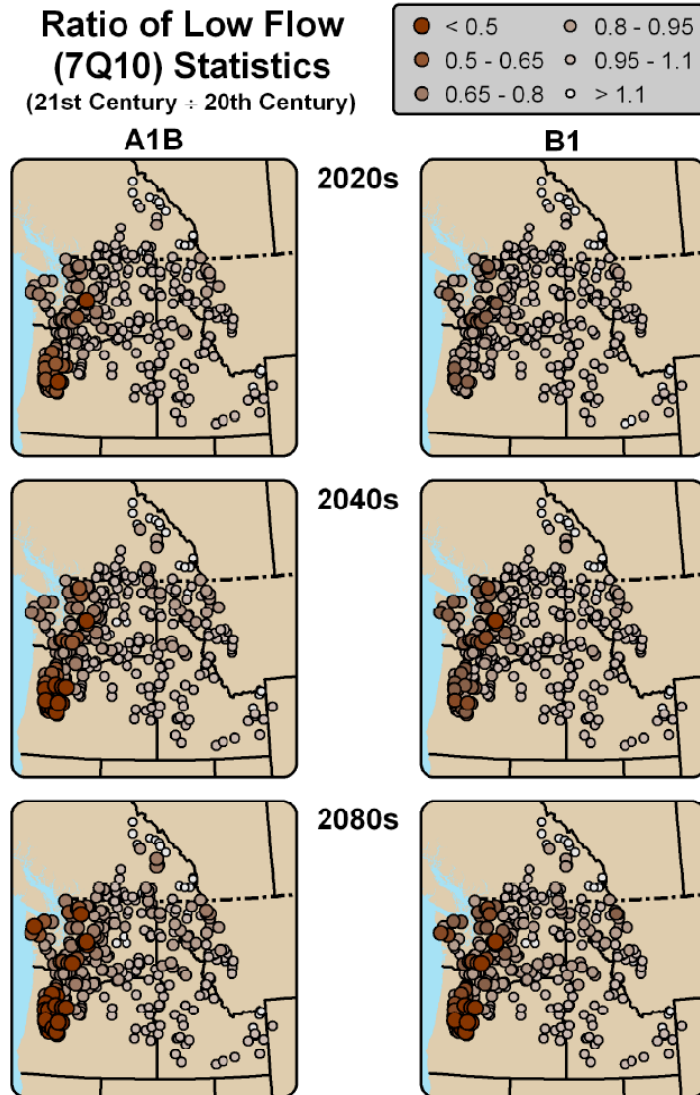
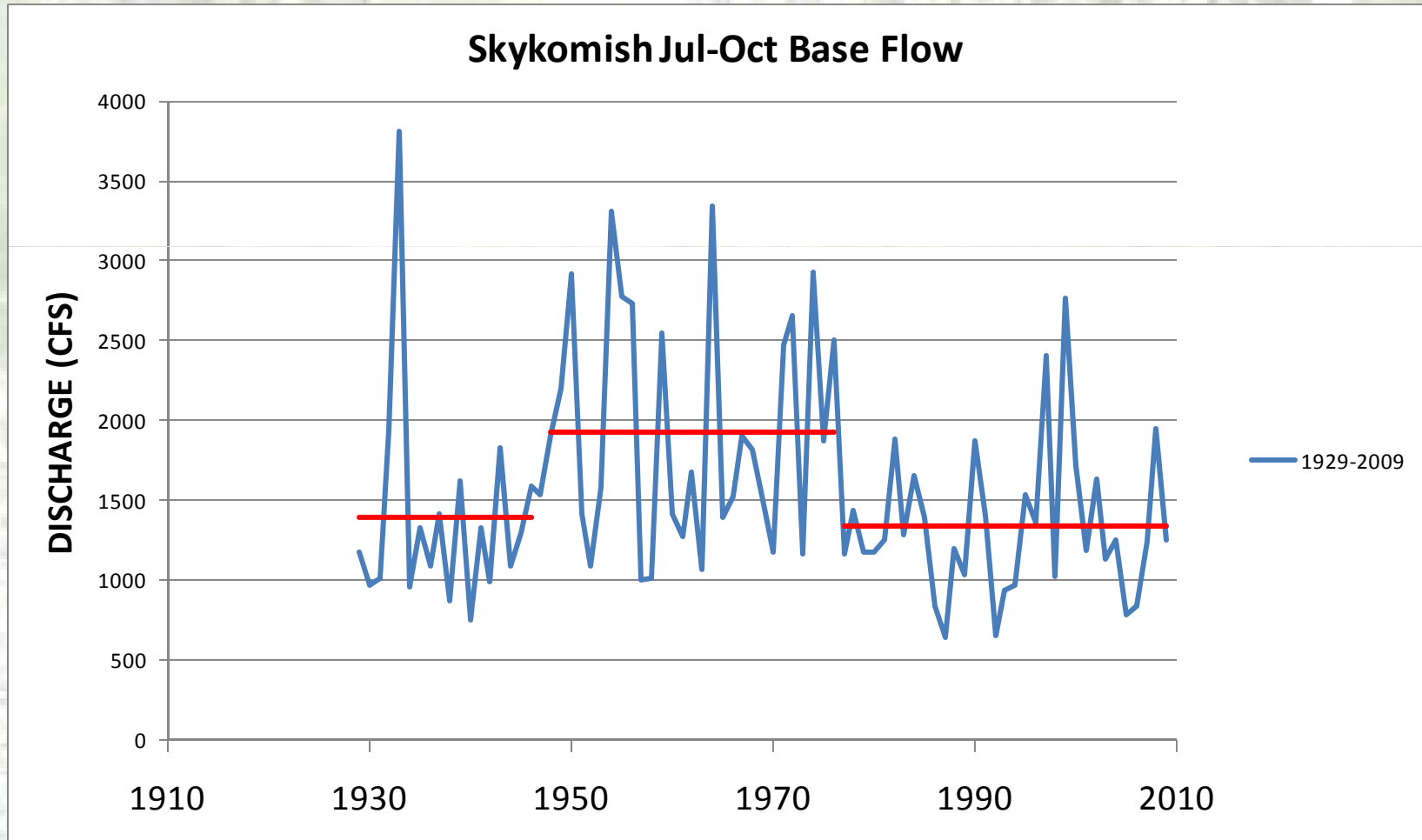


Figure 7: Maps of the ratio of 7Q10 low flow magnitudes (future/historical) for 3 future time intervals, under 2 scenarios. (Lower ratios indicate more intense low flow extremes in the future)

Low flow, 7Q10, values are projected to decrease (i.e. increasing low flow risk) most strongly in rain dominant and transient basins (Figure 7). This pattern is particularly prominent in the lower elevation basins of the eastern Cascades and the mid to lower elevation basins in the western Cascades and in the Olympic Peninsula and the lower elevations on the west slopes of the Rockies. These results support the hypothesis that the intensity of the low flows will rise with increasing temperatures and evapotranspiration, which reduces the soil water moisture and late summer baseflows.

Tohver, I. and A. Hamlet. 2010. Chapter 7: Impacts of 21st century climate change on hydrologic extremes in the Pacific Northwest region of North America. Climate Impacts Group, University of Washington, Seattle, WA. <http://www.hydro.washington.edu/2860/>

# Skykomish near Gold Bar Jul-Oct Base Flow



# Conclusions

- Well designed long-term gauging network
- Compilation and access to up-to-date water management data
- Good models to synthesize information and extrapolate to ungauged basins

“You never miss your water  
till the well runs dry”

