

# Developing hydroclimatic reconstructions for water resources management in the Pacific Northwest

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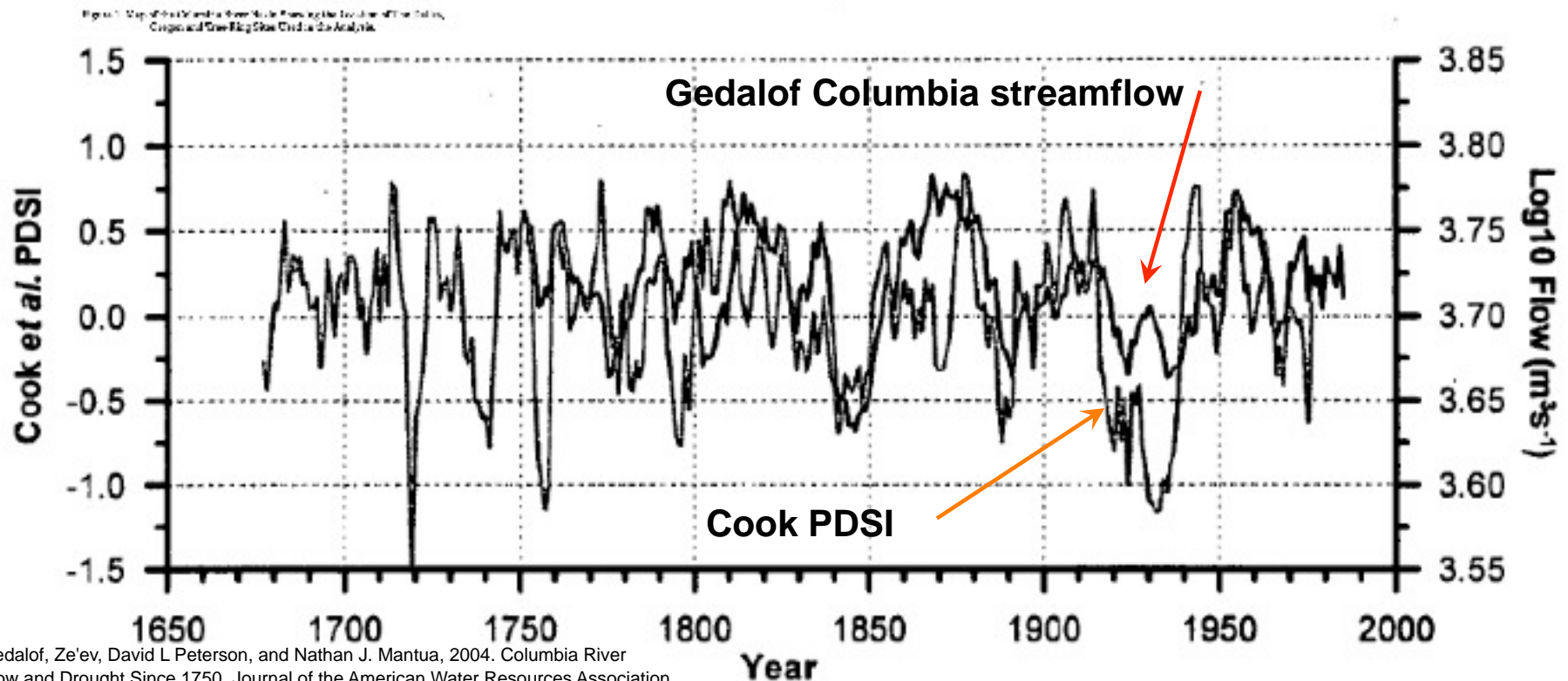
# NOAA CPO SARP project goals

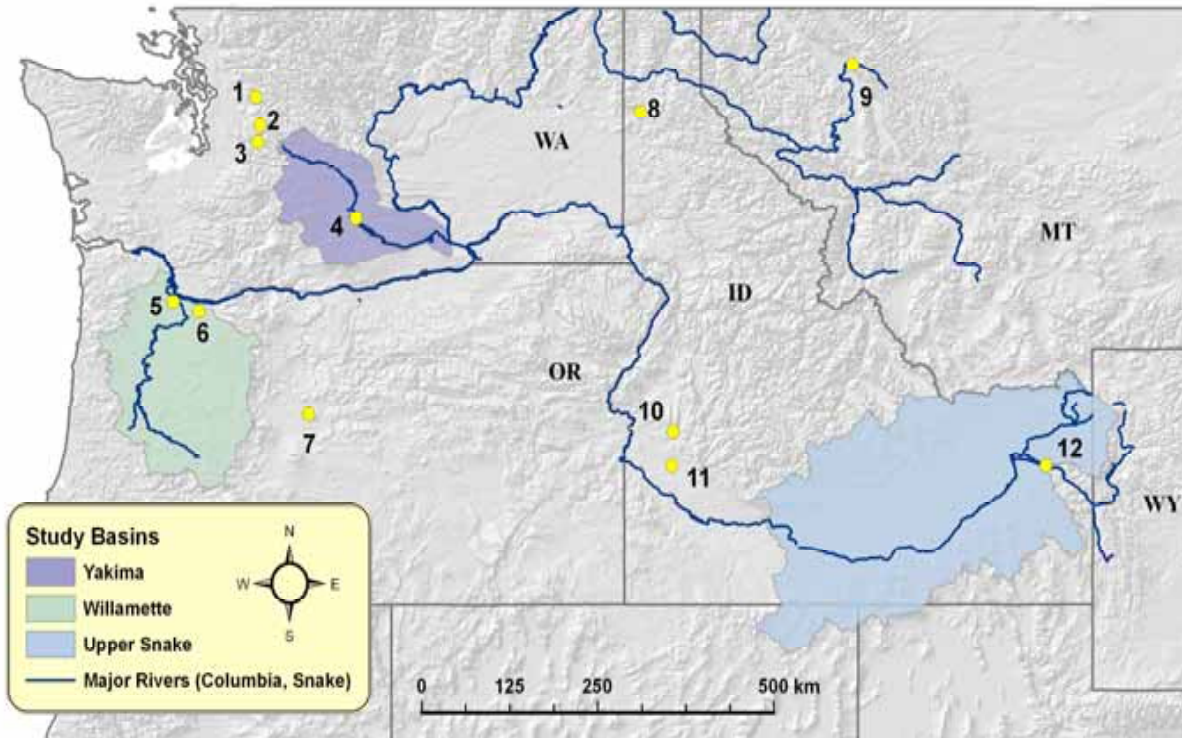
- **Develop new sub-regional hydroclimate reconstructions** that consider:
  - Winter vs. summer drought, decadal variability, nature of 20<sup>th</sup> century droughts (warmer)
- **Use reconstructions to inform hydrologic models and develop future scenarios given extended range of “natural” conditions**
- Host two workshops:
  - **First workshop:** further developing our understanding of the regional needs for climate information by water managers and planners
  - **Second workshop:**
    - results of reconstructions and modeling products from goals one and two
    - identifying and breaking barriers to adaptive capacity associated with uncertainty about the nature of future drought
    - Mutually identifying decision support tools useful for water managers



## Gedalof et al. Columbia reconstruction

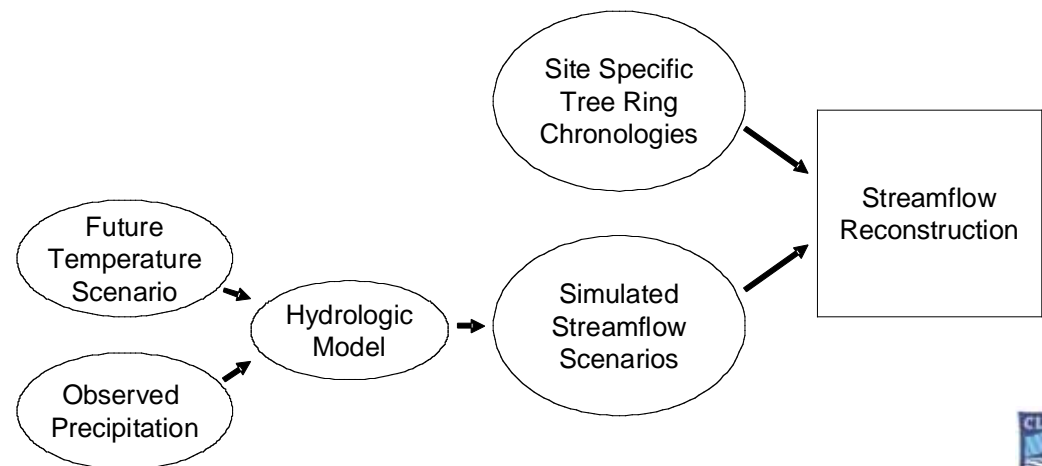
- Possible to do reconstruction in the PNW
- Low flows in 1840s less than 1930s (?)
- Single to multi-year droughts earlier in record
- Contribution from high and low elevation trees
- Contribution from trees that “see” PDO
- Unsatisfying geographical representation
- Unsatisfying variance explained





Targets: urban and agricultural water supplies in the PNW, gages managers use (e.g., SPU, PWB, USBR, IDWR)

## Combined tree ring and hydrologic model approach



# A case for better reconstructions: scientific progress and new applications

- **Ecological/dendrochron**

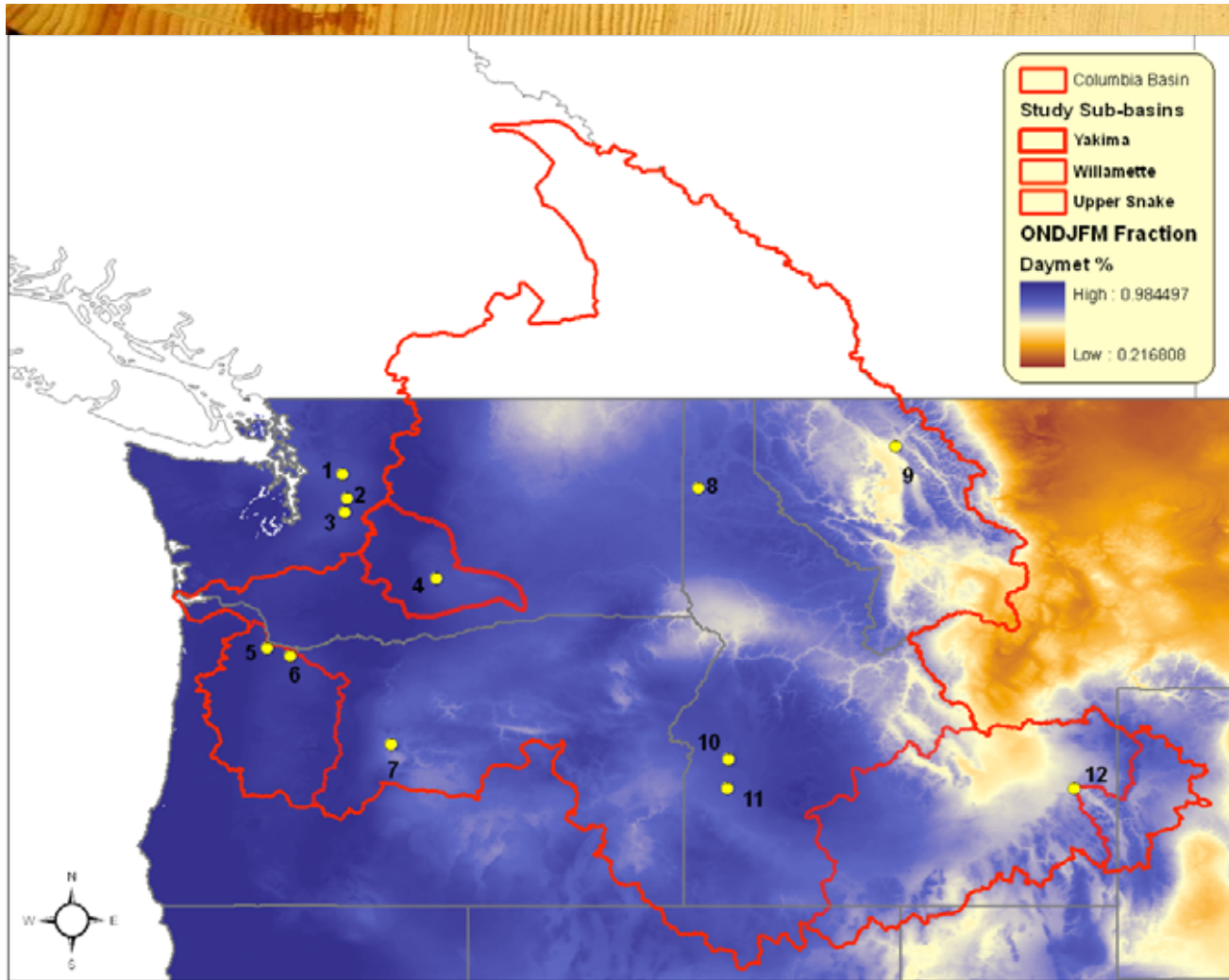
- Locating sensitive trees:
  - Within landscapes
  - Within climate space
- Understanding limiting (and multiple limiting) factors
- History of sampling - networks

- **Climatological**

- Better attribution of variability in growth to specific climate
- Diagnosing and fixing statistical “error” (esp. extreme events)
- Targeting watersheds based on timing of hydrograph
- Climate change and climate variability

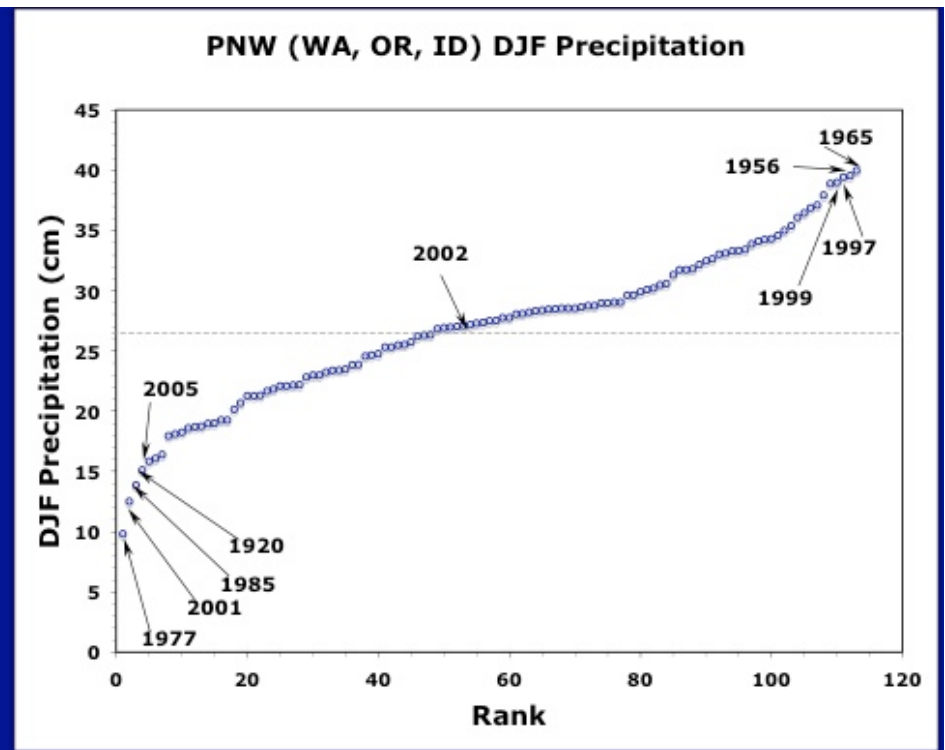
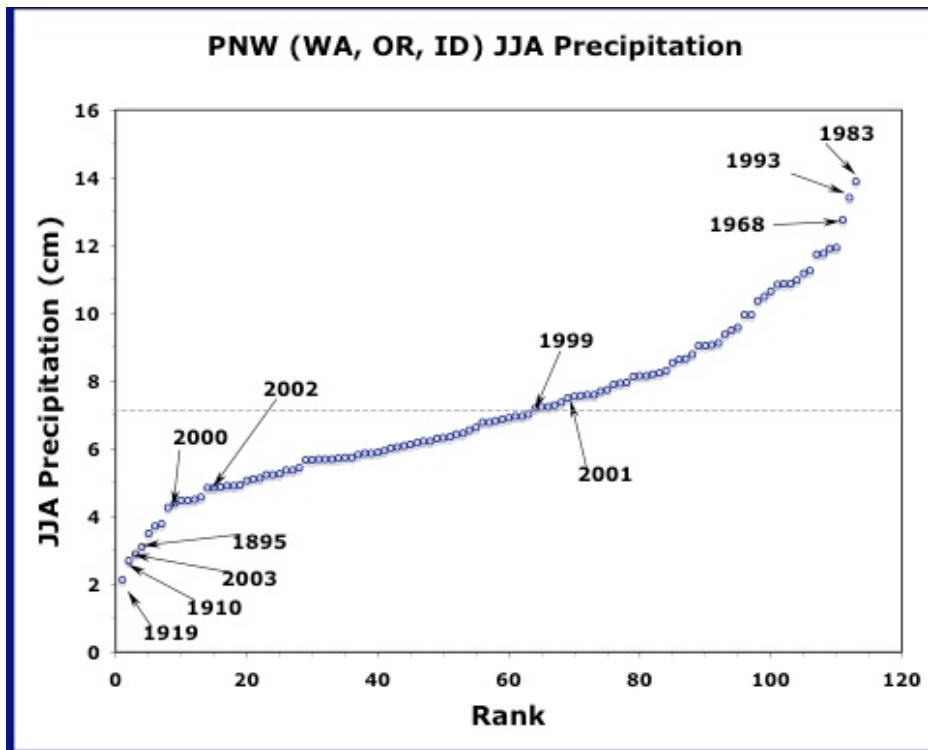
- **Application: workshops, resource basis, manager input**

- Nature of information needs and questions
- Feedback on use of future projections and reconstructions



- Annual precipitation varies substantially within the CRB, but.....
- Most of it arrives in winter, frequently as snow in mountainous areas where much of the basin's summer water supply originates

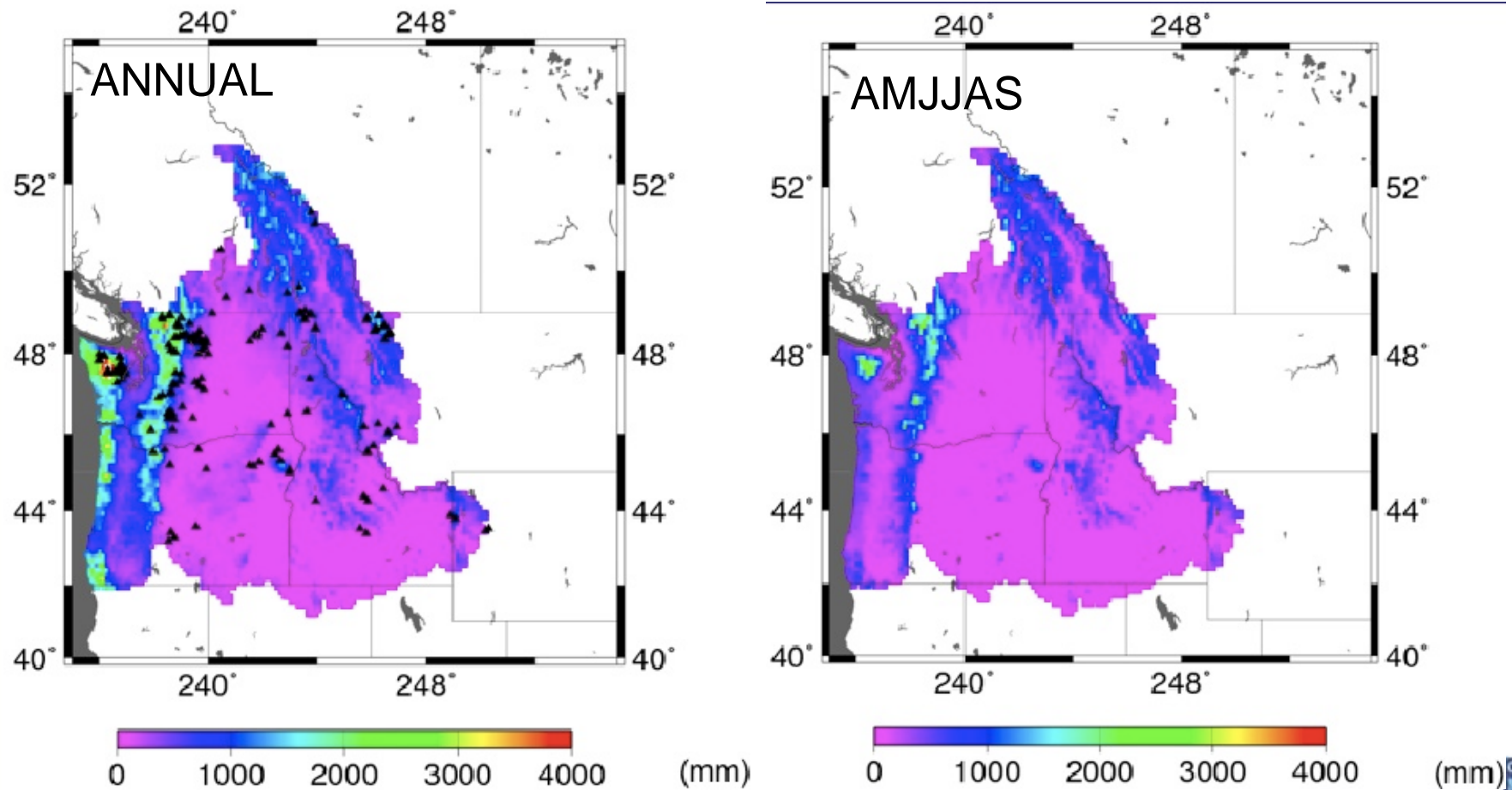




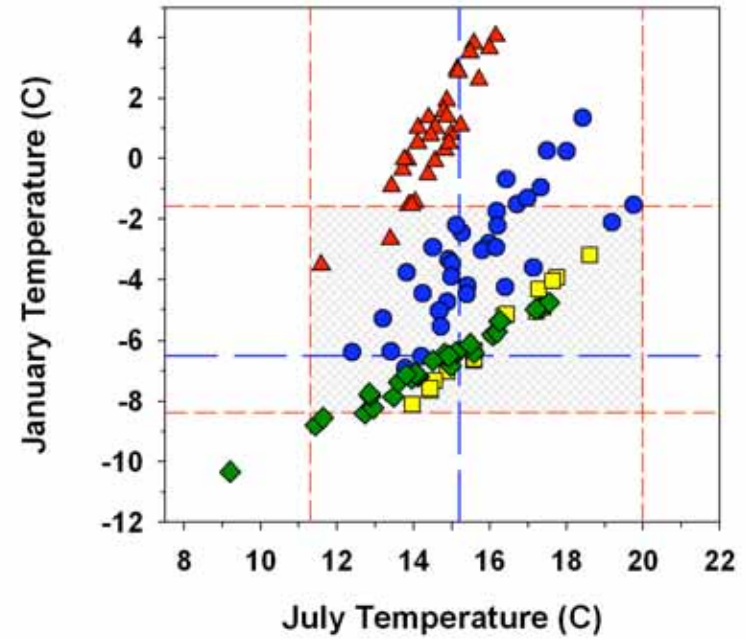
In the Pacific Northwest, summer and winter droughts tend not to occur in the same year Examples:

- 2003: Dry summer affected rivers west of Cascades, east side fire risk
- 2005: Low snow owing to warm spell in January, dry February led to problems with irrigated agriculture (mostly east side)
- for this flavor of drought, analysis and prediction may lead to more nuanced drought declaration

Runoff in summer mostly from high elevation portions of Columbia Basin, and from snowmelt. This also has implications for reconstructions because summer precipitation and summer drought are not the only important climatic factors for summer water supply.



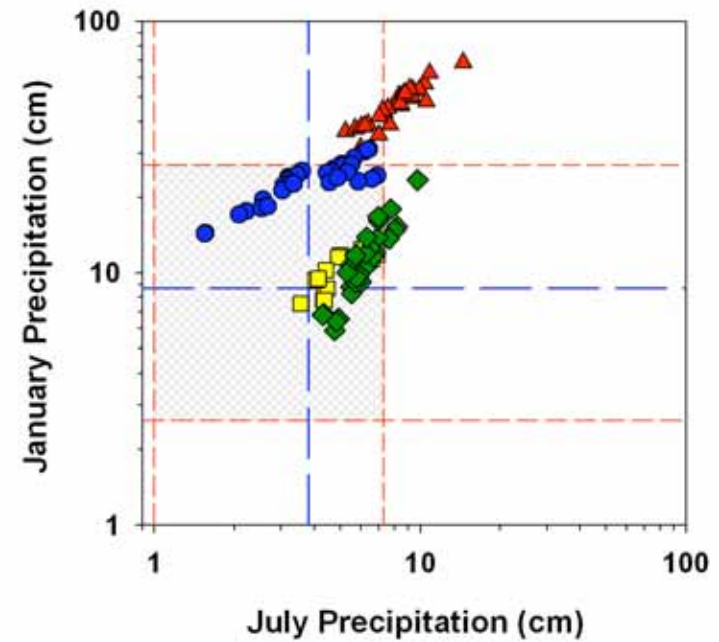


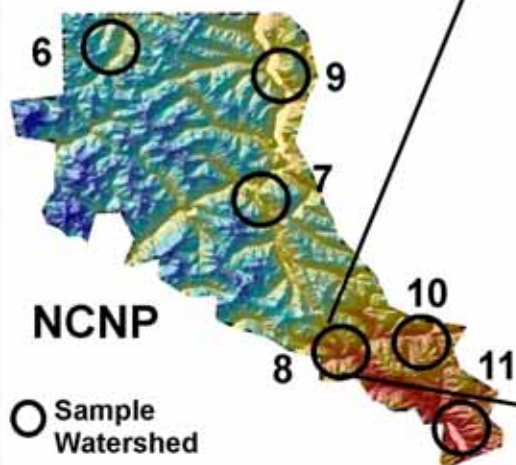
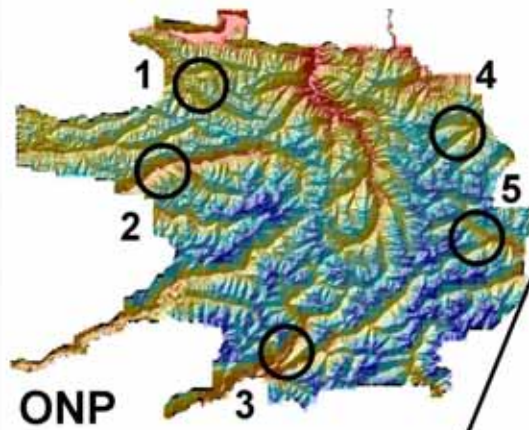
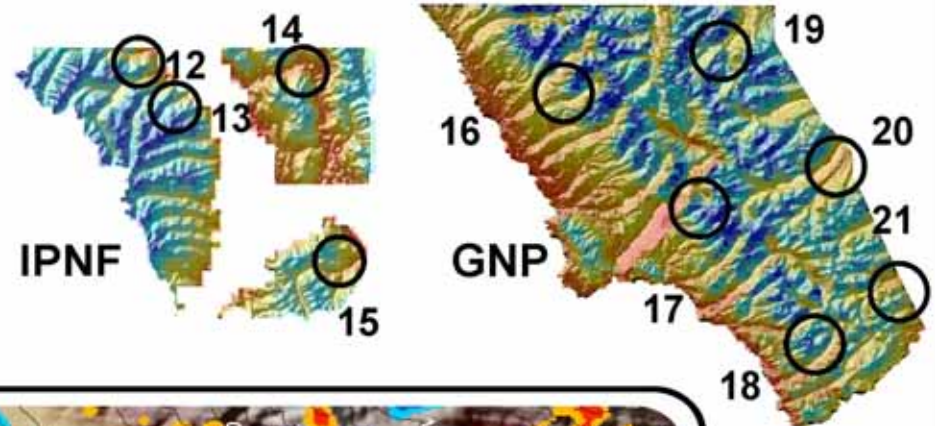


Quinault North (ONP)

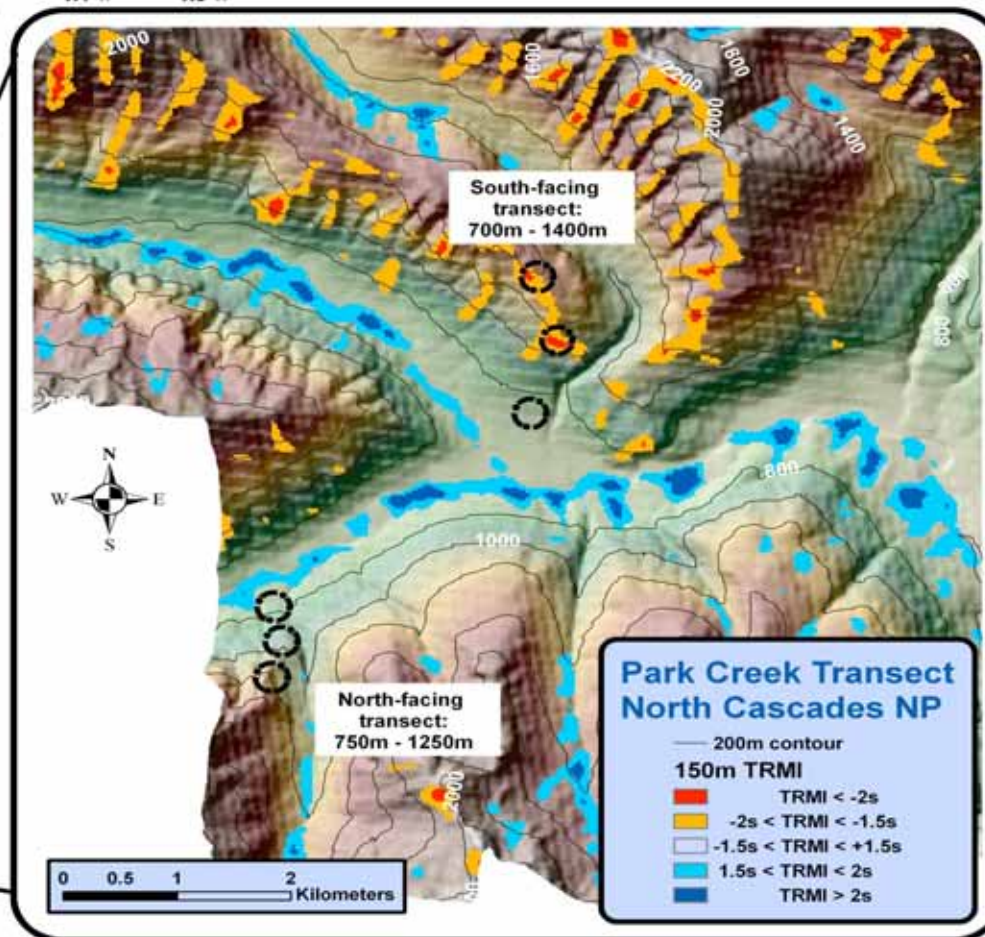


Robinson South (IPNF)

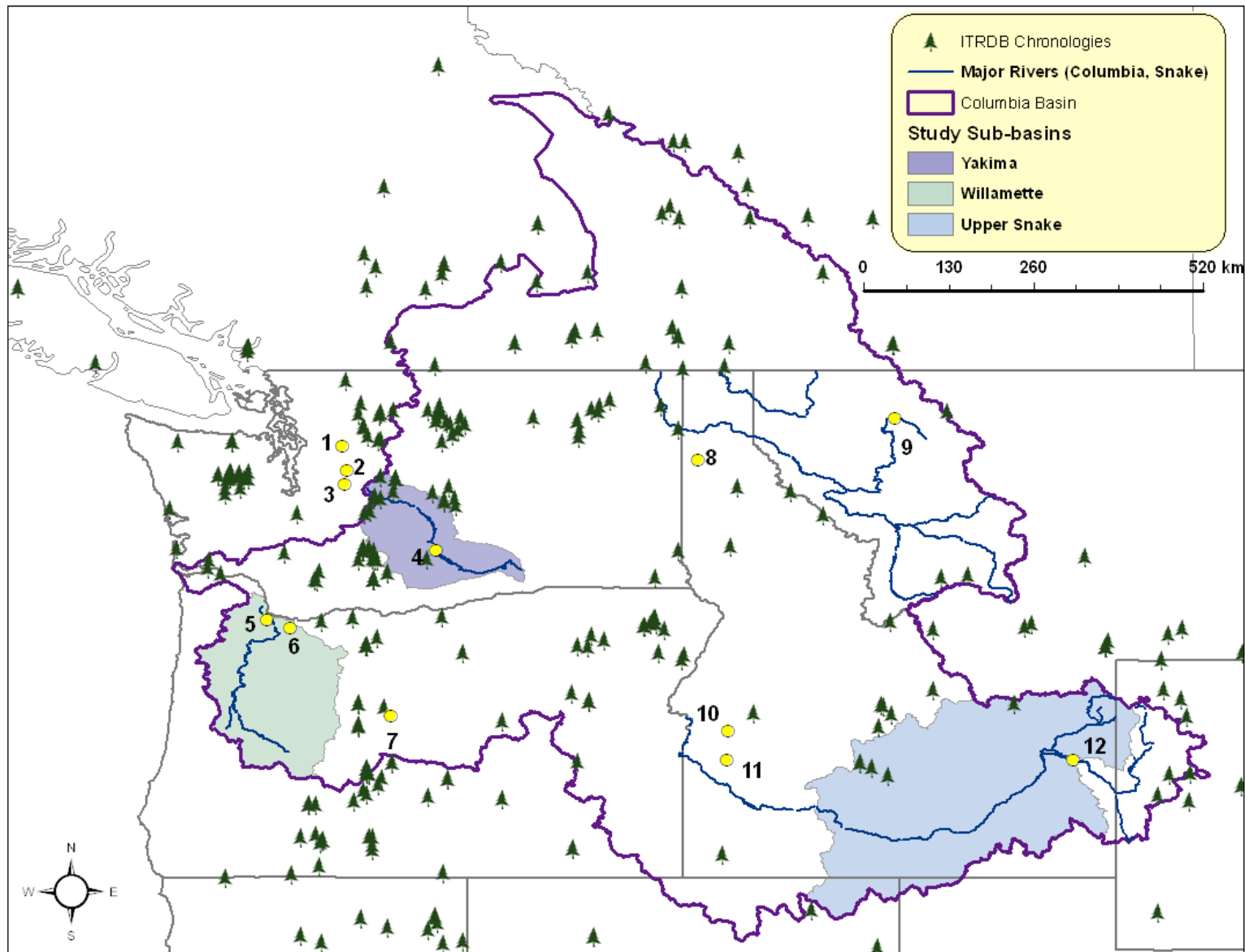




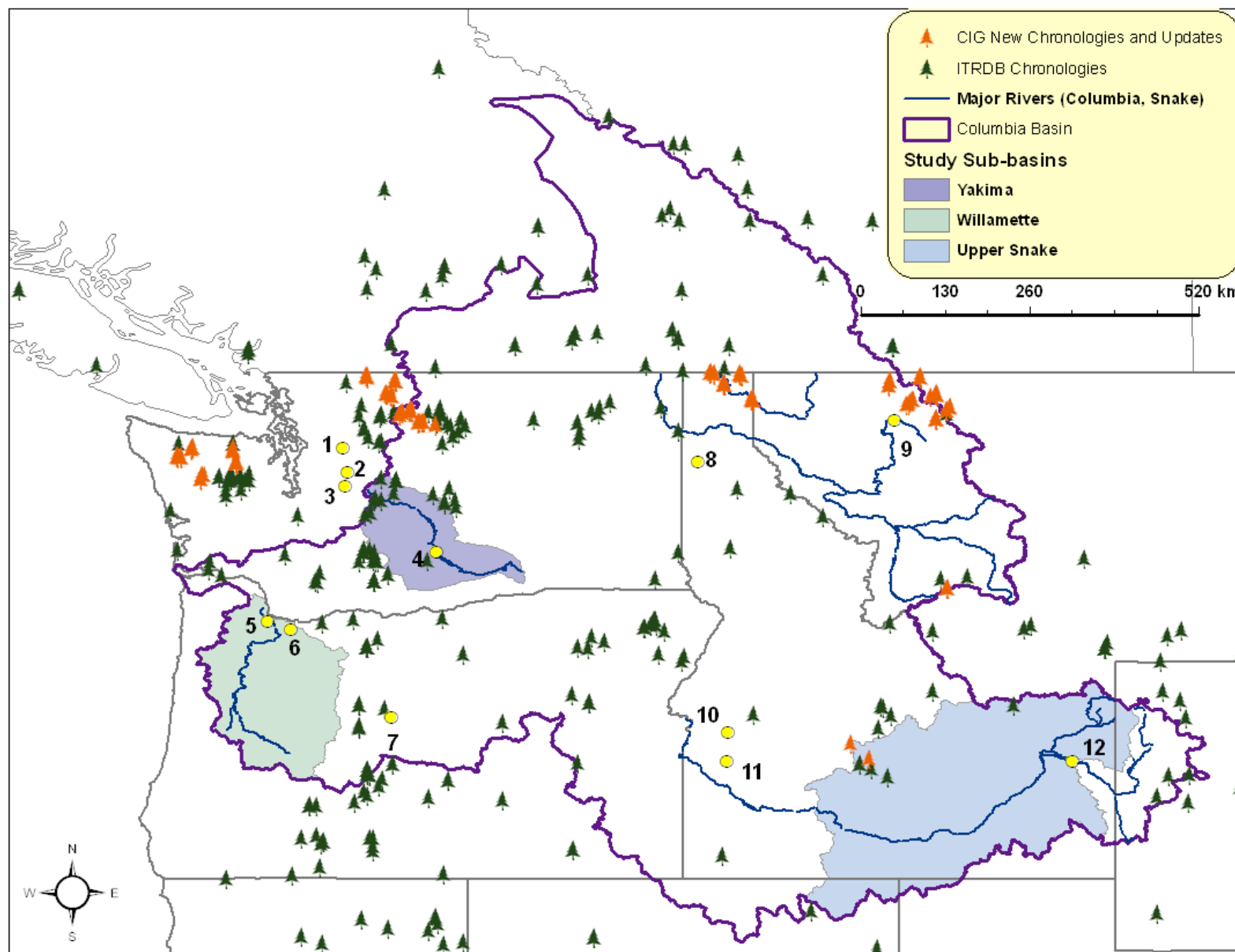
○ Sample Watershed



# 200+ ITRDB tree-ring chronologies



# PSME, updates, and new SARP chronologies: +130





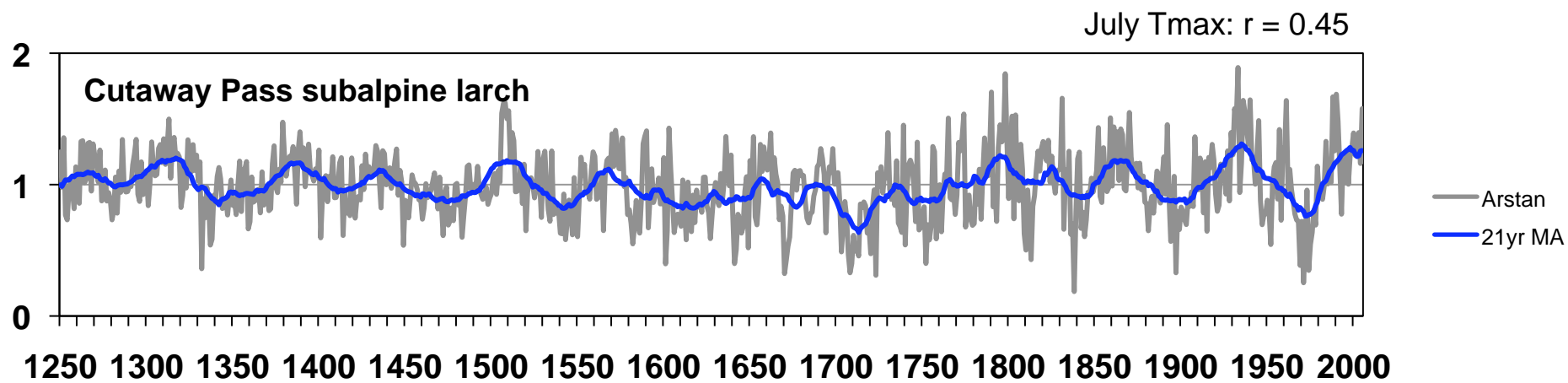
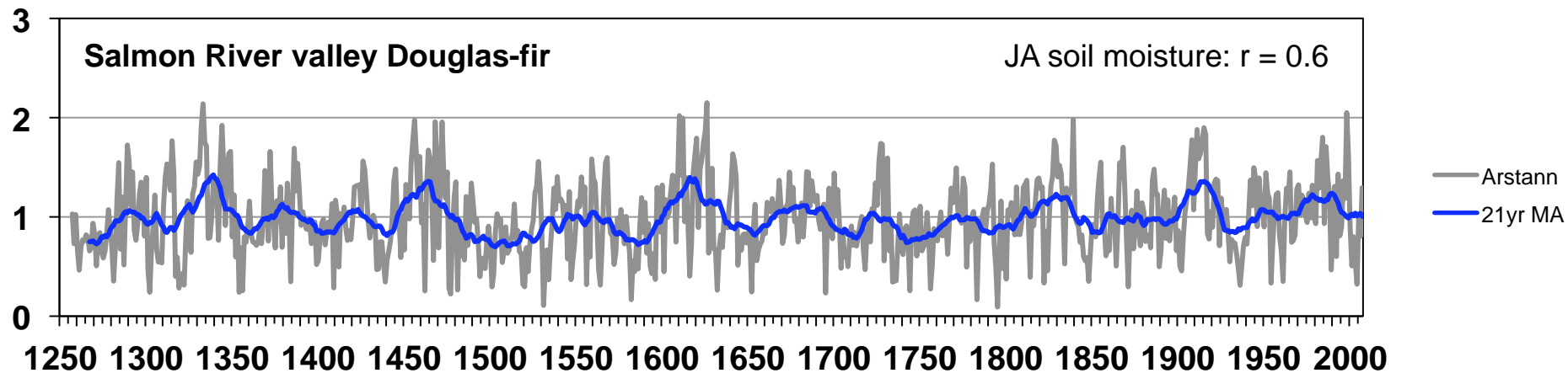
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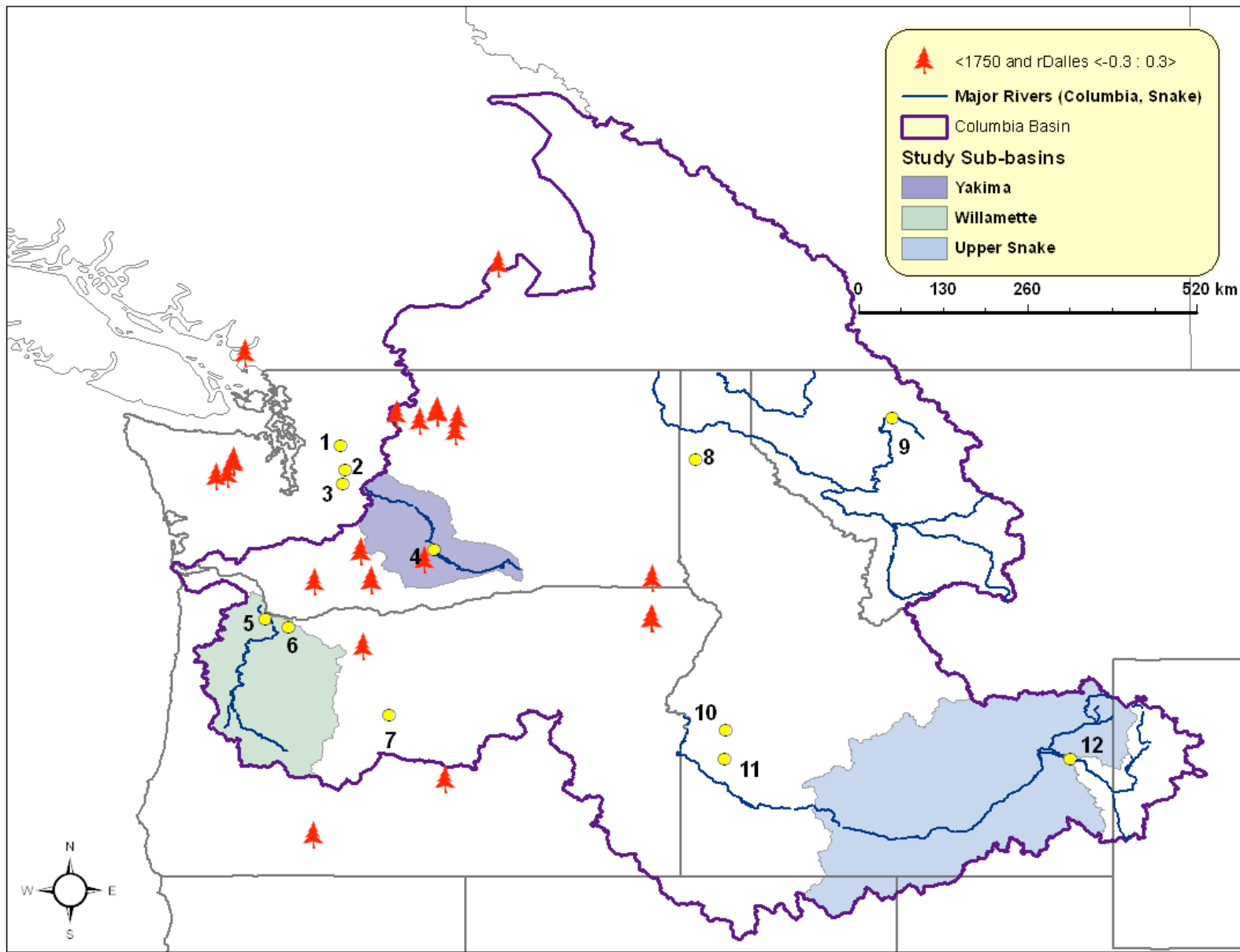


Littell, Hamlet, Mantua, Woodhouse NOAA SARP project

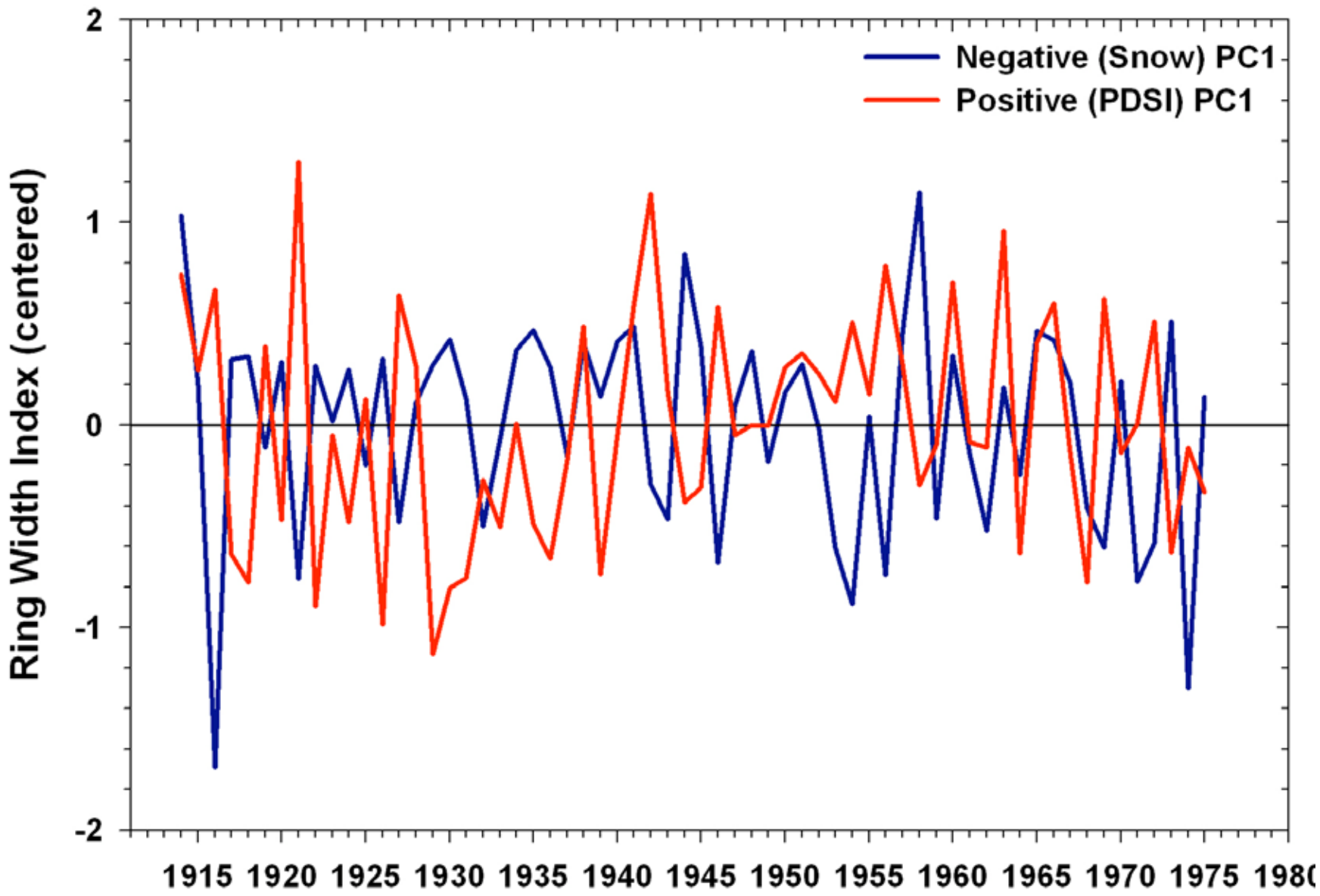
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# 29 Best: earlier than 1750 and $r_{\text{Dalles}} \leq \pm 0.3$ with Dalles flow

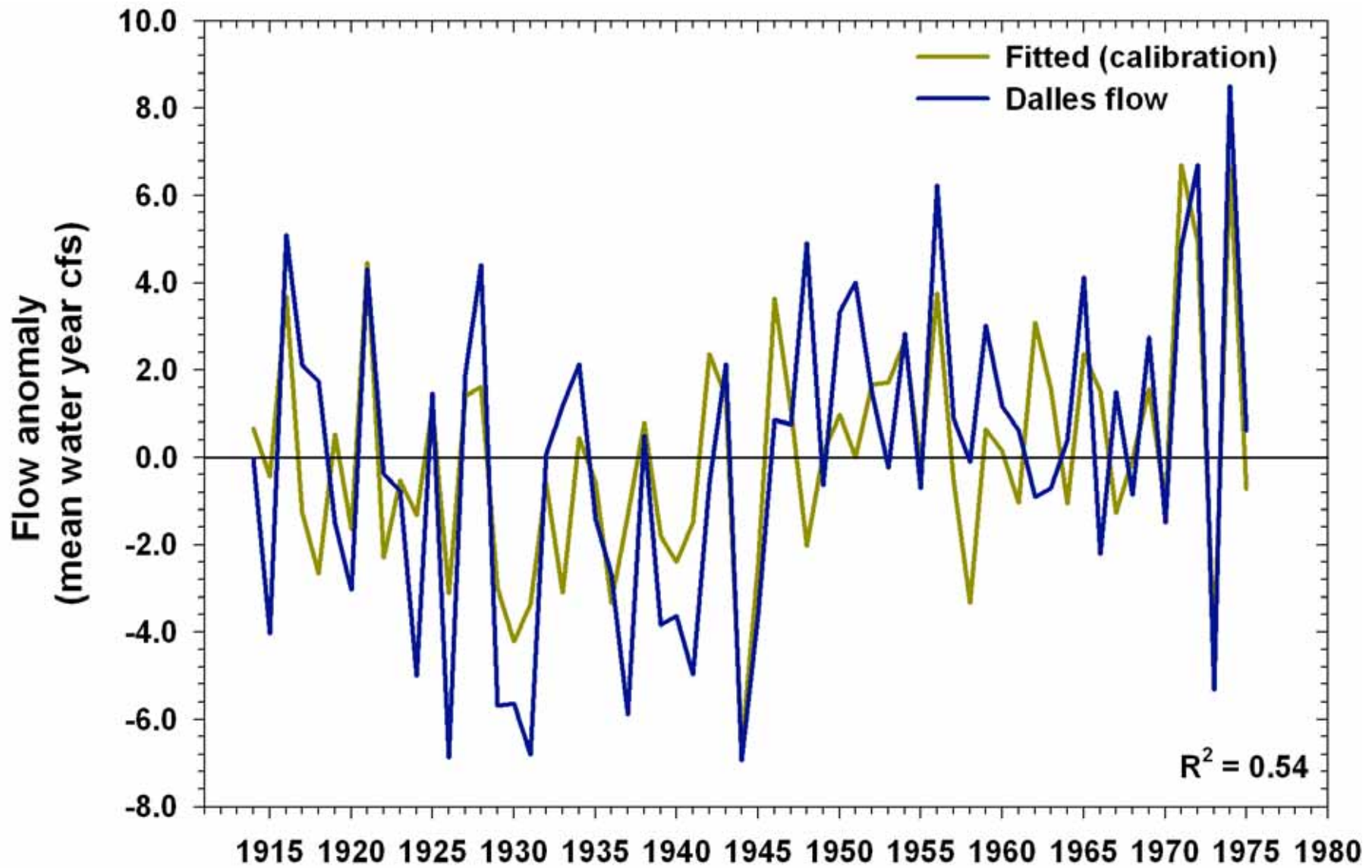






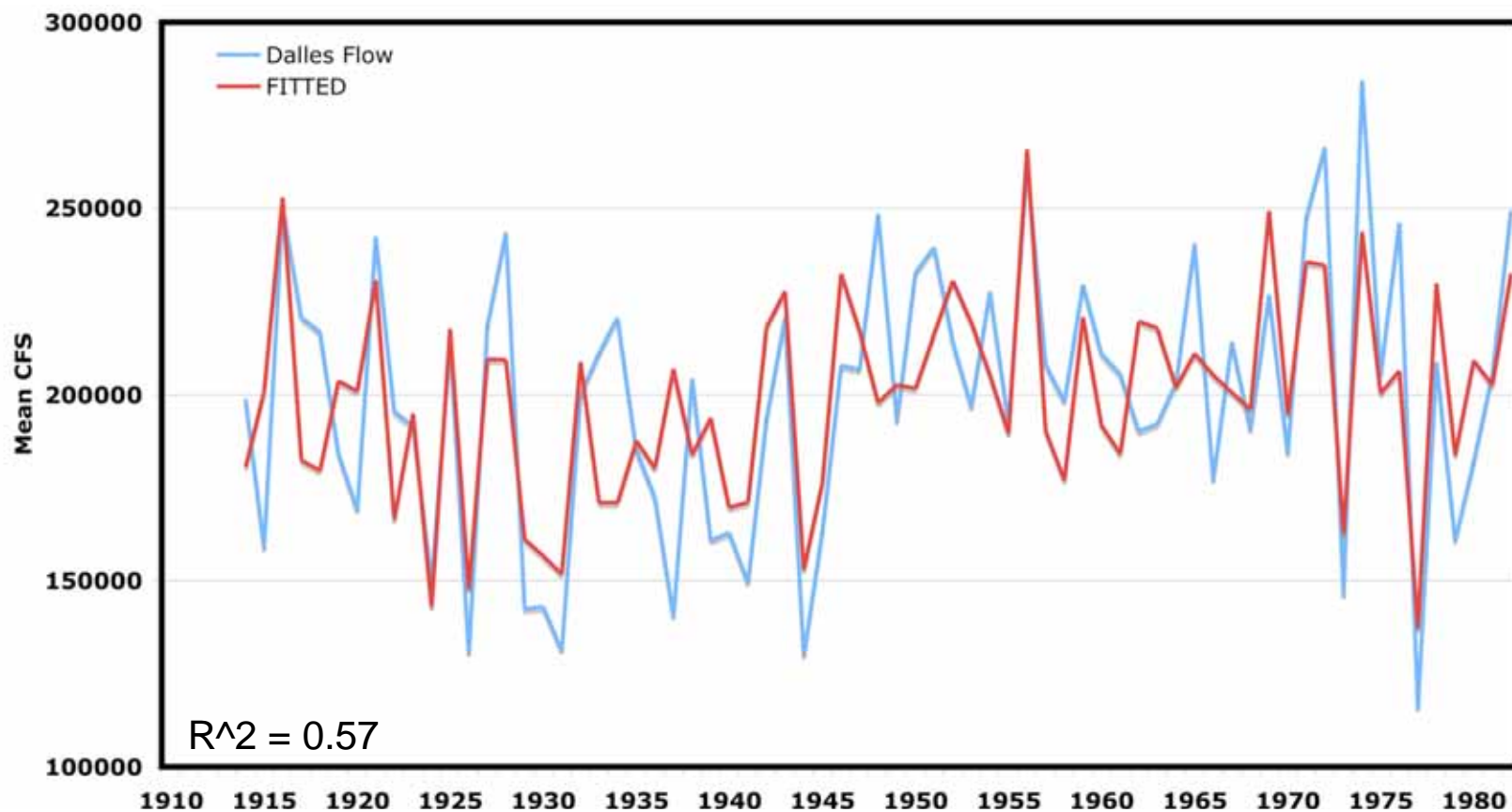
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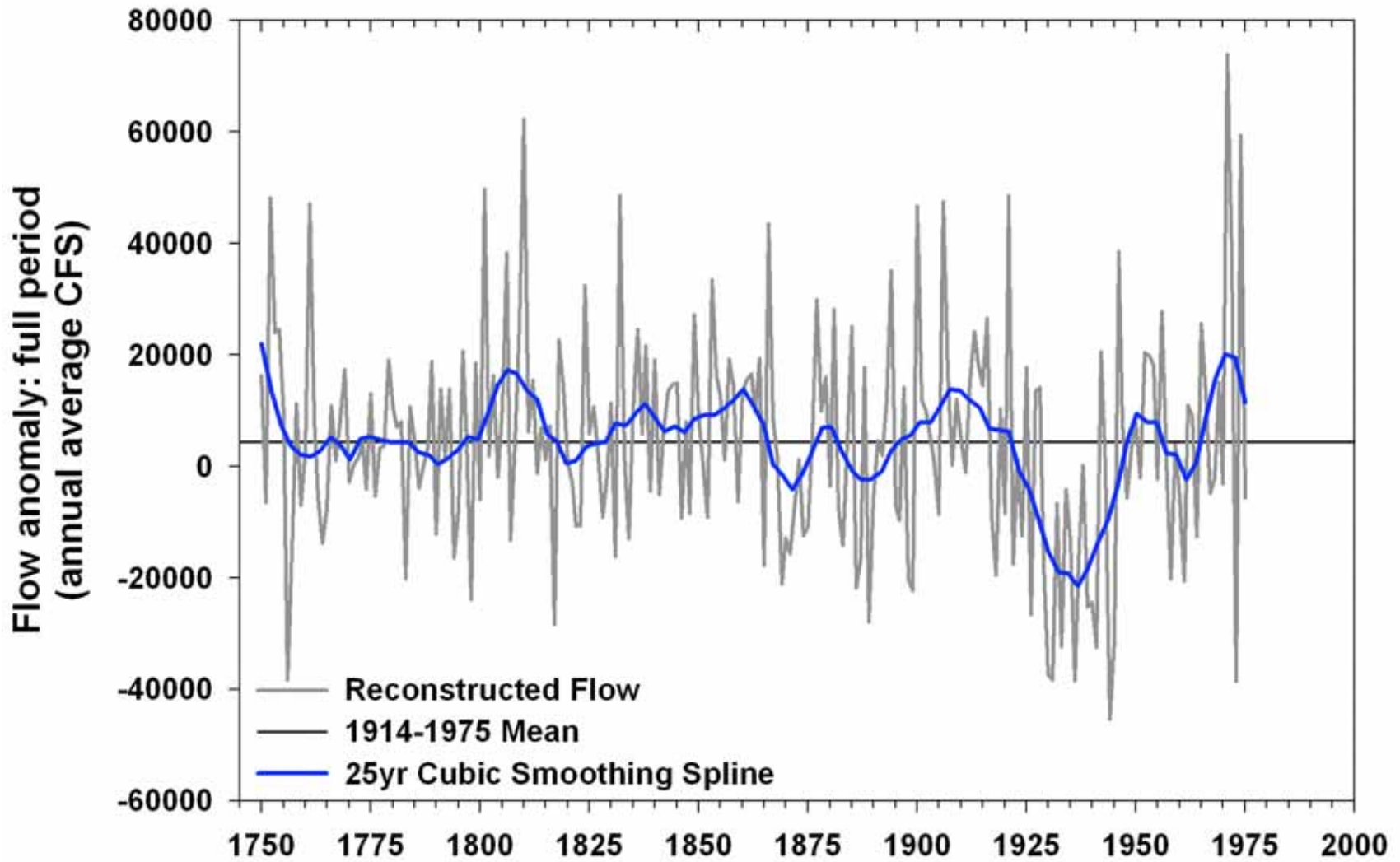


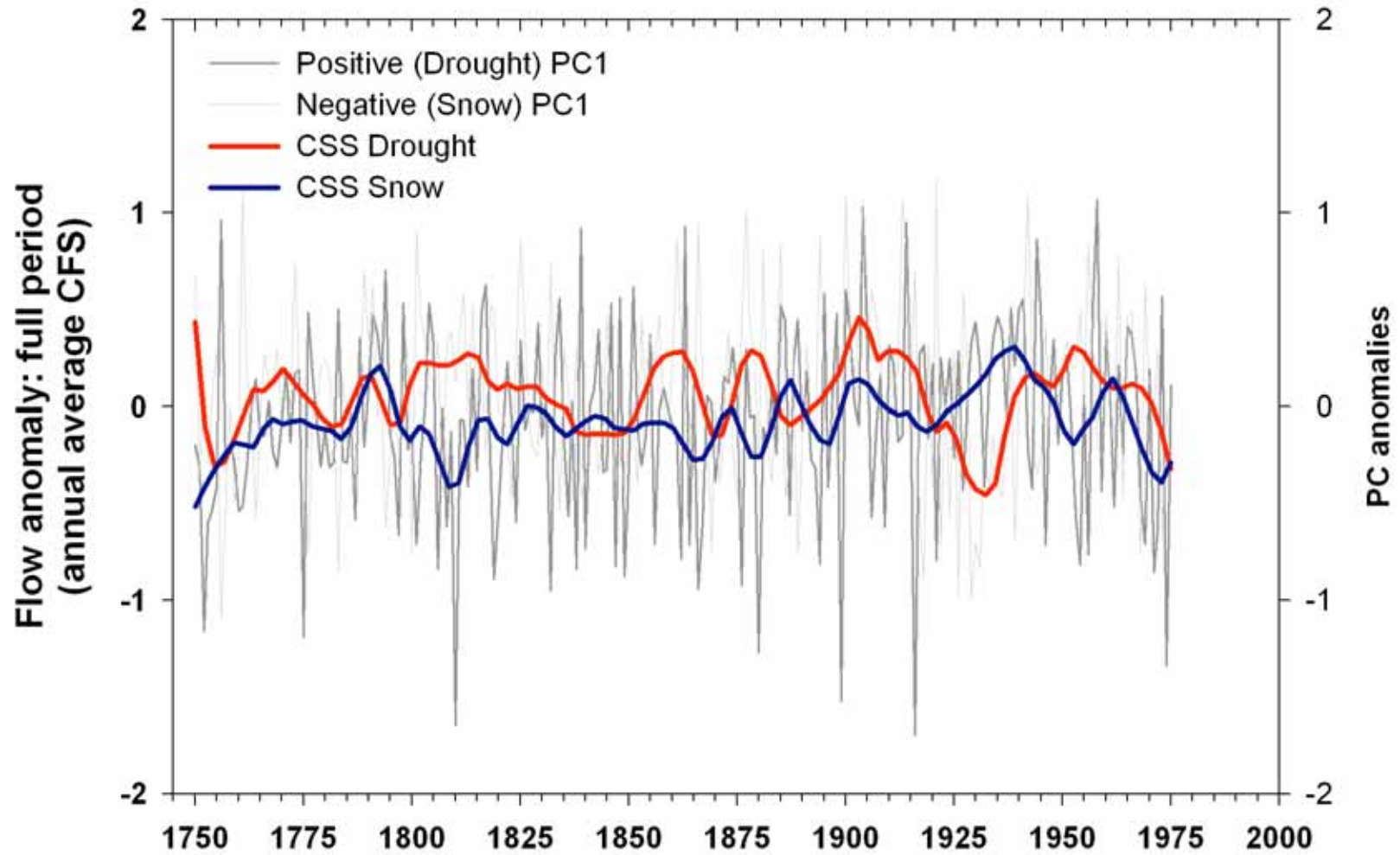


# Ten new chronologies + ten from International Tree Ring Data Bank

Chronology	Location	Species	Span
Pintler LALY 1	SW MT	LALY	835 - 2006
Pintler LALY 2	SW MT	LALY	1168 - 2006
North Cascades LALY	WA Cascades	LALY	1369 - 2006
Salmon River, ID Update	Central ID	PSME	1177 - 2008
Galena Pass, ID Update	Central ID	PCEN	1300 - 2008
Warm Springs, ID Update	Central ID	PSME	1607 - 2008
SolDuc South High	WA Olympics	PSME	1759 - 2005
Dosewallips River South High	WA Olympics	PSME	1703 - 2005
Round Prairie South Low	ID Selkirks	PSME	1754 - 2005
Leonia Knob Sough Low	ID Selkirks	PSME	1803 - 2005







## Woodhouse et al. model for workshops and science / manager interaction

- Work with water resource managers to identify the gages and hydrologic metrics most useful in water resource planning and management, as candidates for reconstruction.
- Develop reconstructions of annual streamflow, and associated products and analyses, for the gages of interest to water managers. Work with data users to ensure that the products and presentations are meaningful and useful.

## Research model, continued

- Use the reconstructions to evaluate droughts and wet periods and climate characteristics over the past 300 to 800 years in comparison with 20th and 21st century.
- Investigate linkages between drought in the Columbia River basin with other parts of the western U.S. to identify possible relationships between regional drought and atmospheric circulation.
- Use the reconstructions to assess the ability of climate model runs to simulate characteristics of the reconstructions.

For more information about the CIG NOAA SARP project,  
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Funding: NOAA-SARP

More information on Columbia basin and PNW climate  
impacts and planning for climate change is available from:

**The Climate Impacts Group**  
[www.cses.washington.edu/cig](http://www.cses.washington.edu/cig)



*Mountain hemlock (Tsuga mertensiana) above the Chilliwack River, NCNP*