Hydrology of Upper Johnson Creek

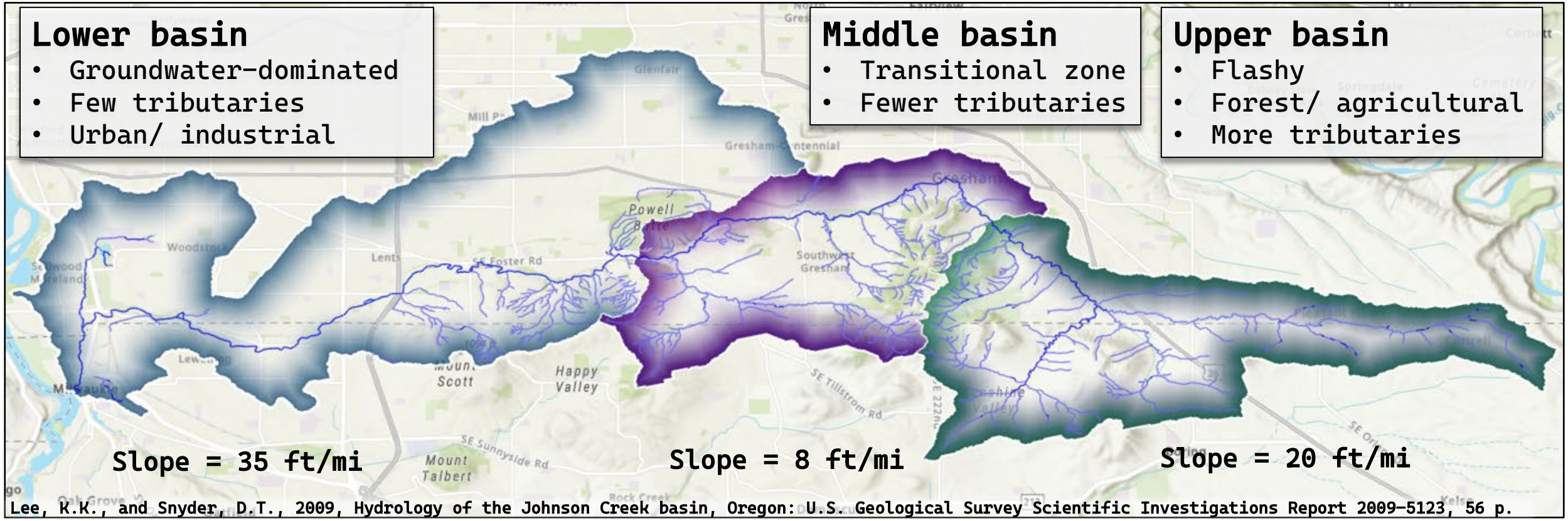
Johnson Creek Science Symposium

October 20, 2026

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USGS Oregon Water Science Center

This information is preliminary and is subject to revision. It is being provided to meet the need for timely best science. The information is provided on the condition that neither the U.S. Geological Survey nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the information.

Johnson Creek Overview

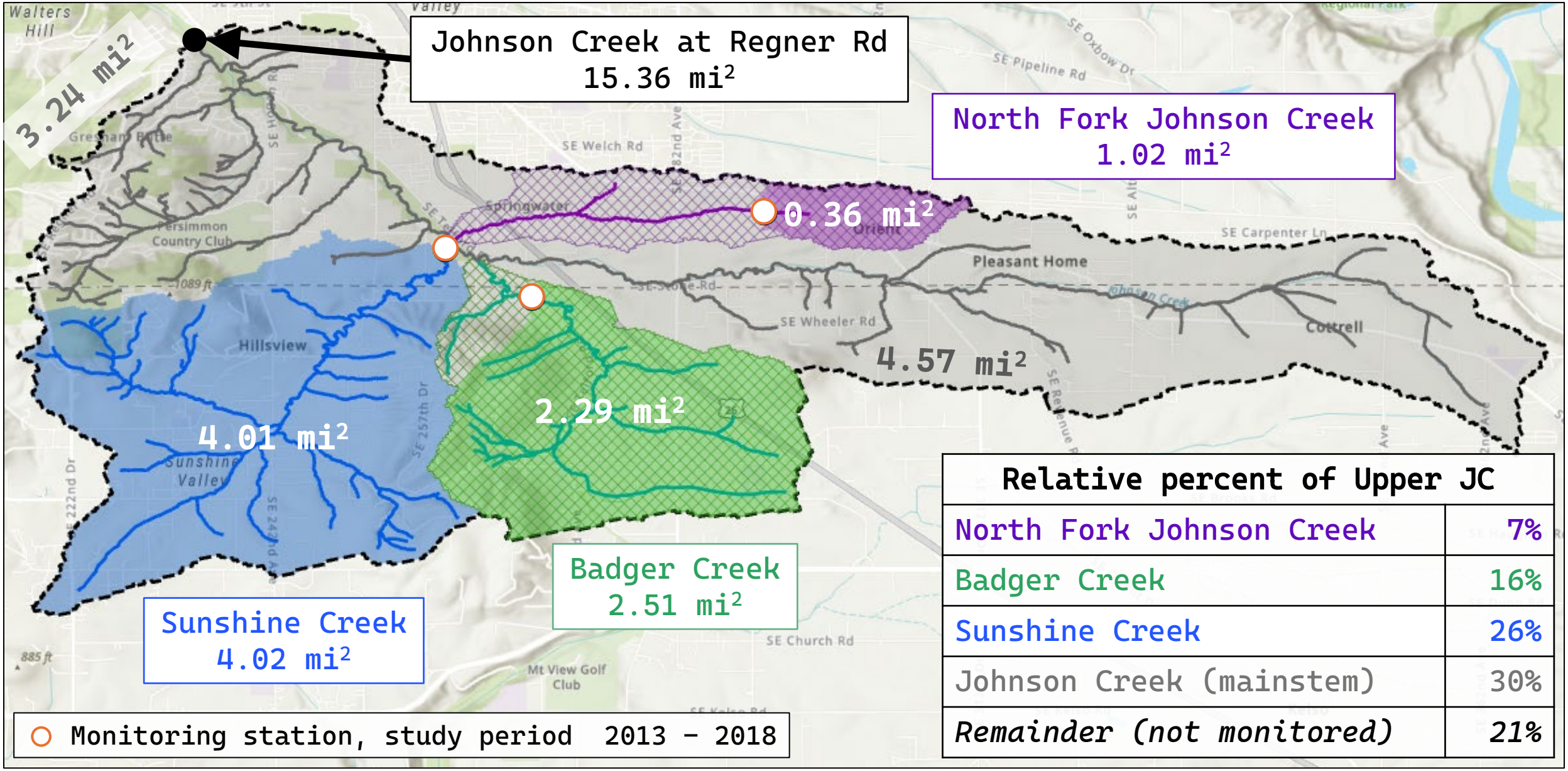


- How do hydrologic trends of the upper watershed affect the middle and lower basins?
  - Which tributaries contribute the most flow within the upper basin?
  - Intermittent vs permanent flow?

- Basin-wide trends in flow (base, median, maximum):
  - Variation over time
  - Variation with respect to location

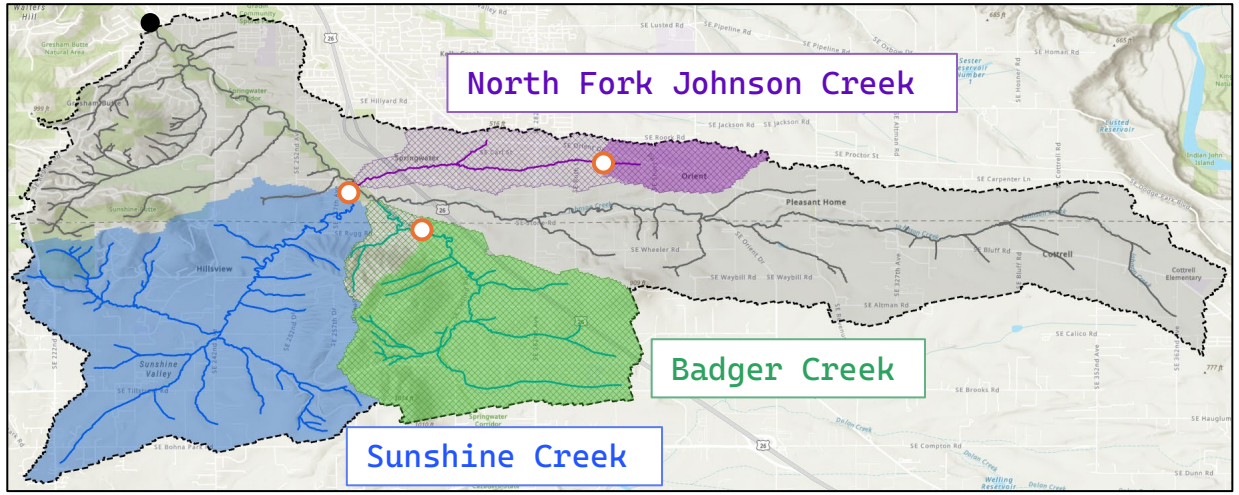
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Upper Johnson Creek



Relative percent of Upper JC	
North Fork Johnson Creek	7%
Badger Creek	16%
Sunshine Creek	26%
Johnson Creek (mainstem)	30%
Remainder (not monitored)	*21%*

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North Fork Johnson Creek, October 2020

North Fork Johnson Creek, December 2020



Sunshine Creek, October 2018



Sunshine Creek, December 2018





Badger Creek, 2015

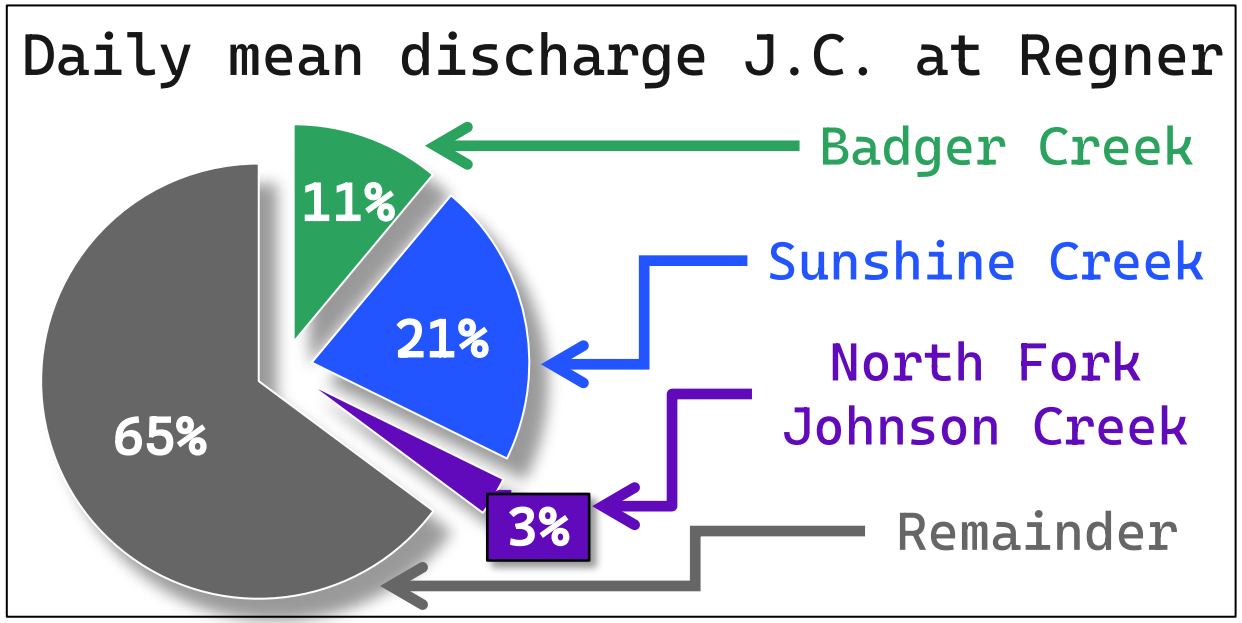


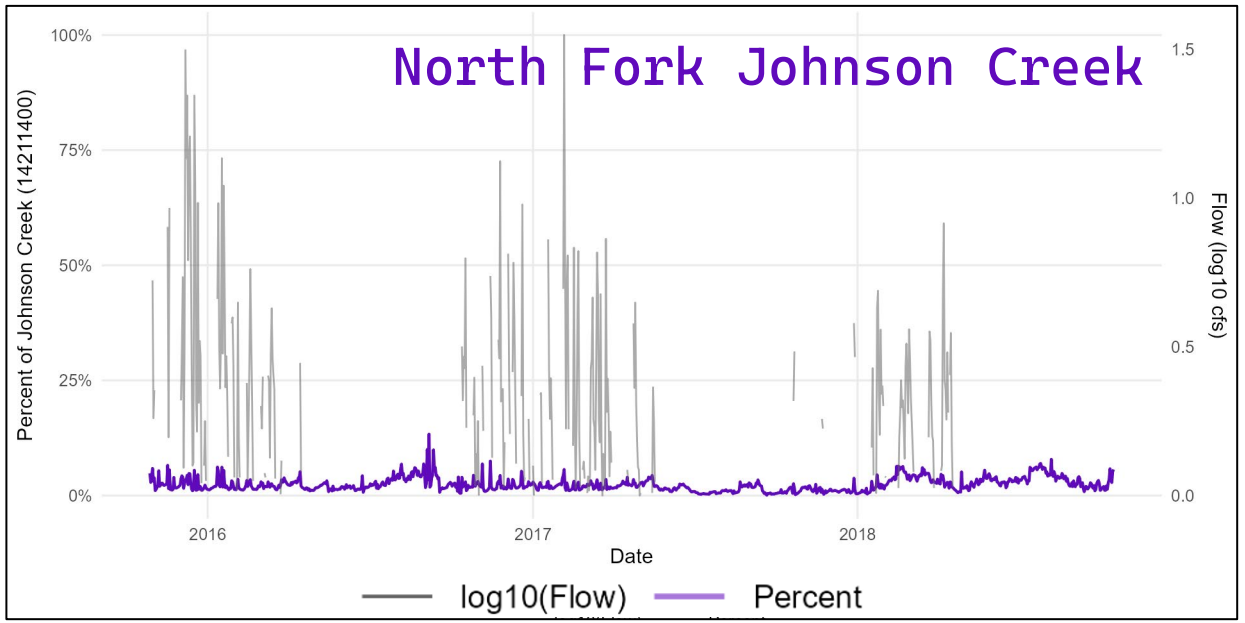
Badger Creek, 2019

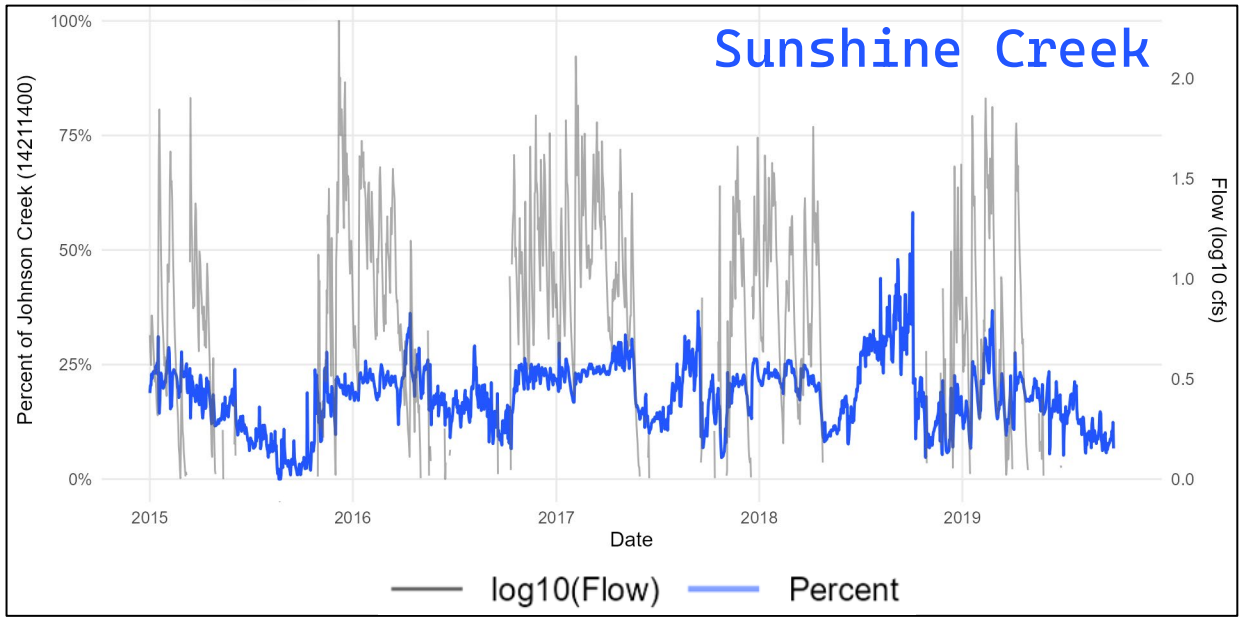
Photo credits (all): USGS/ Matt Yates

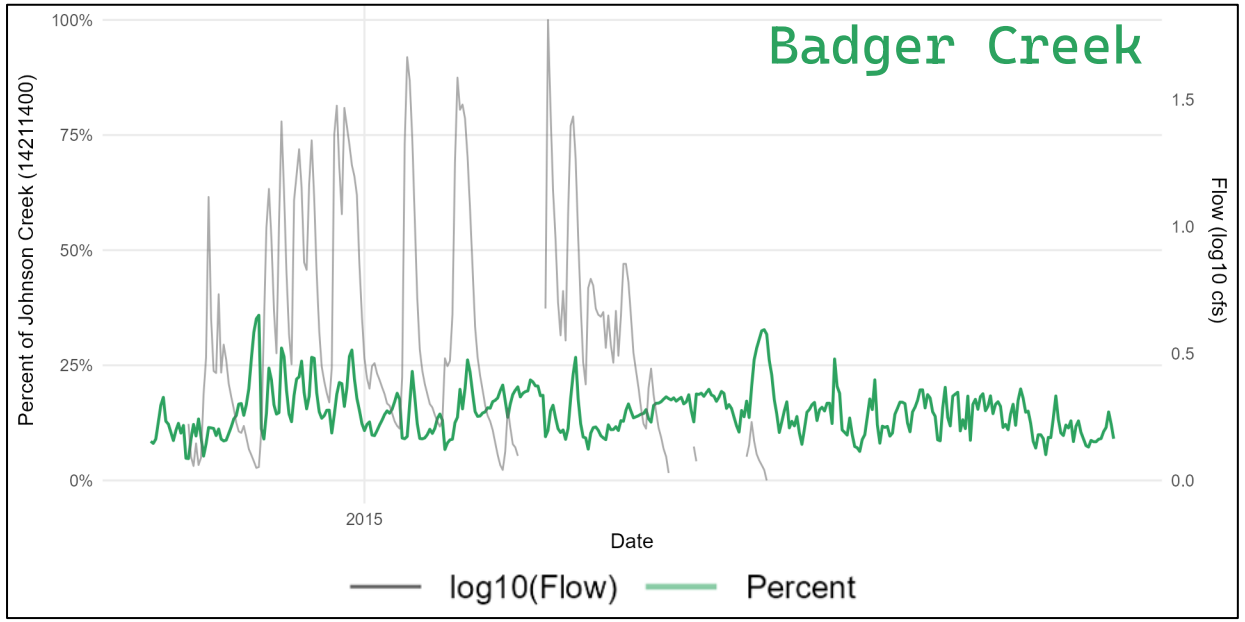
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Upper tributary flow contribution



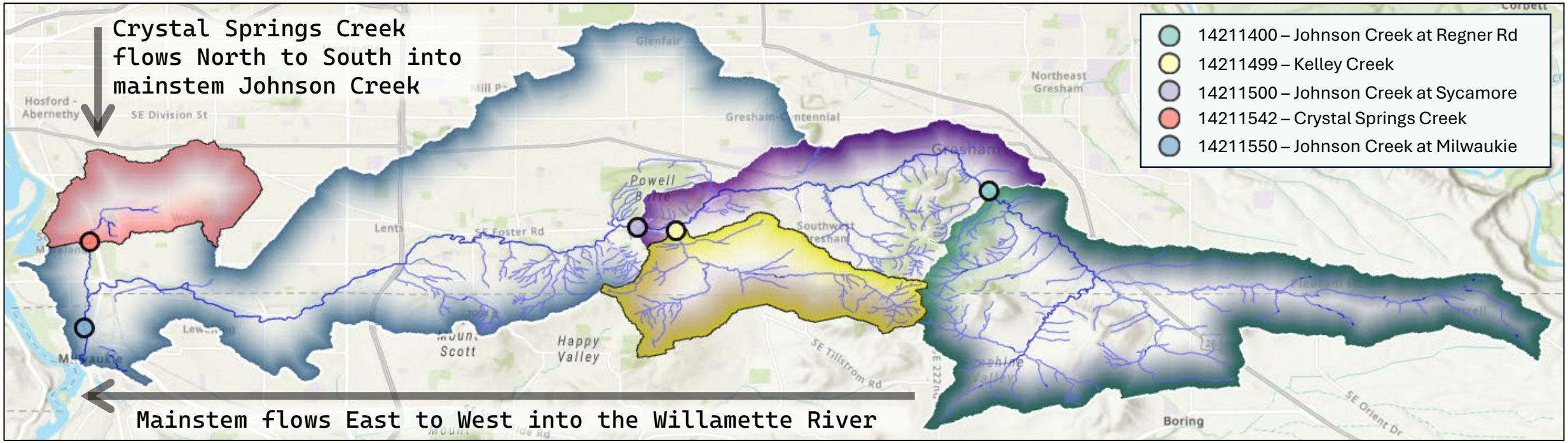






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Johnson Creek – Long term sites

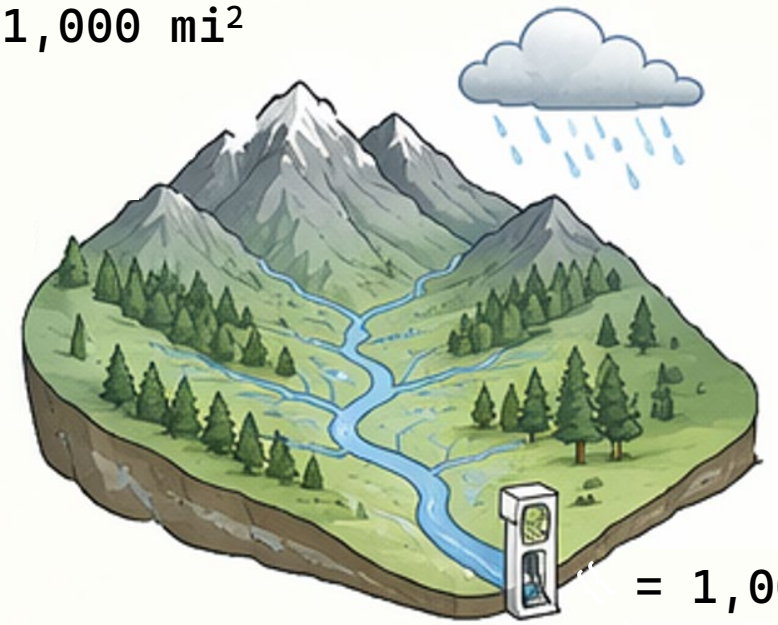


USGS Site No.	Station name	Drainage area (mi²)	Discharge period begins
14211400	Johnson Creek at Regner Road, at Gresham, OR	15.36	Feb 26, 1998
14211499	Kelley Creek at SE 159th Drive at Portland, OR	4.69	Mar 11, 2000
14211500	Johnson Creek at Sycamore, OR	26.8	Oct 1, 1941
14211542	Crystal Springs Creek at Bybee St, Portland, OR	3.08	Oct 1, 2019
14211550	Johnson Creek at Milwaukie, OR	53.17	Apr 22, 1989

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Relative unit-area streamflow

Basin A
1,000 mi^2



= 1,000 ft^3/s

Larger basins tend to generate more flow

Direct comparisons of flow can be misleading

Basin B
100 mi^2

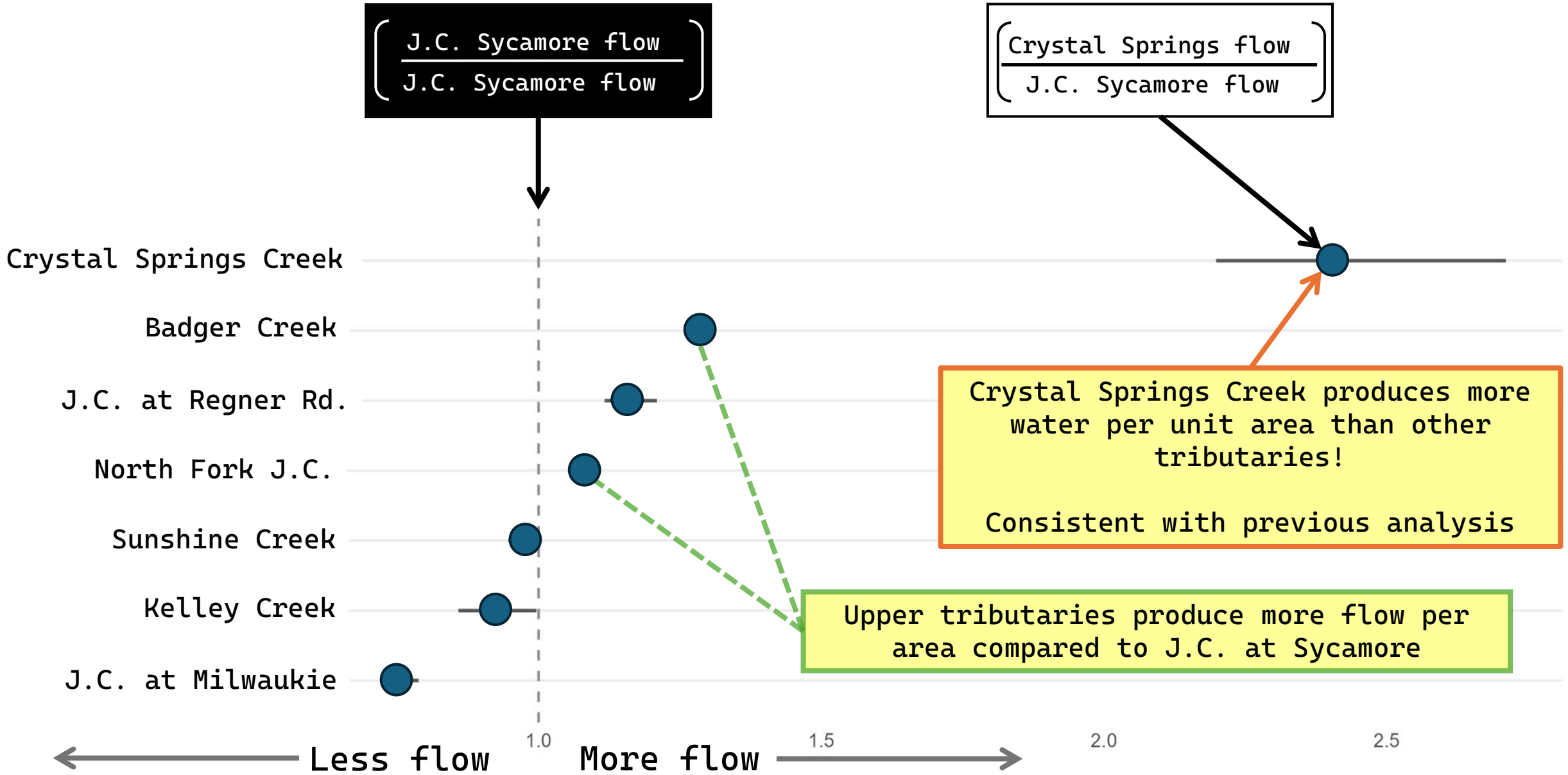


= 100 ft^3/s

$$\frac{1{,}000\ ft^3/s}{1{,}000\ mi^2} = 1.0\ ft^3/s/mi^2 \quad \Longleftrightarrow \quad \frac{100\ ft^3/s}{100\ mi^2} = 1.0\ ft^3/s/mi^2$$

Converting flow to a unit of area enables a more direct comparison

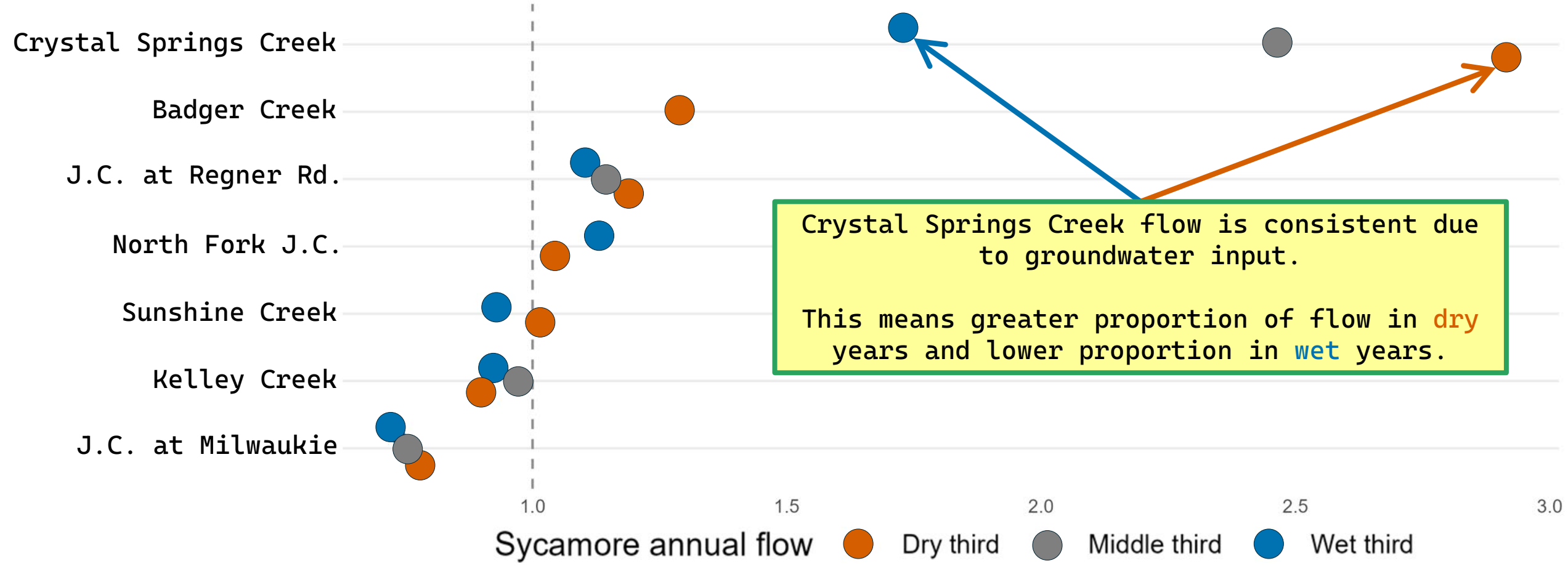
Relative unit-area streamflow



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Unit-area streamflow distribution

Annual median streamflow per unit area at J.C. Sycamore are separated into wet, middle, and dry categories for each water year. Corresponding values at other sites are plotted relative to the J.C. Sycamore wet, middle, and dry water year values.

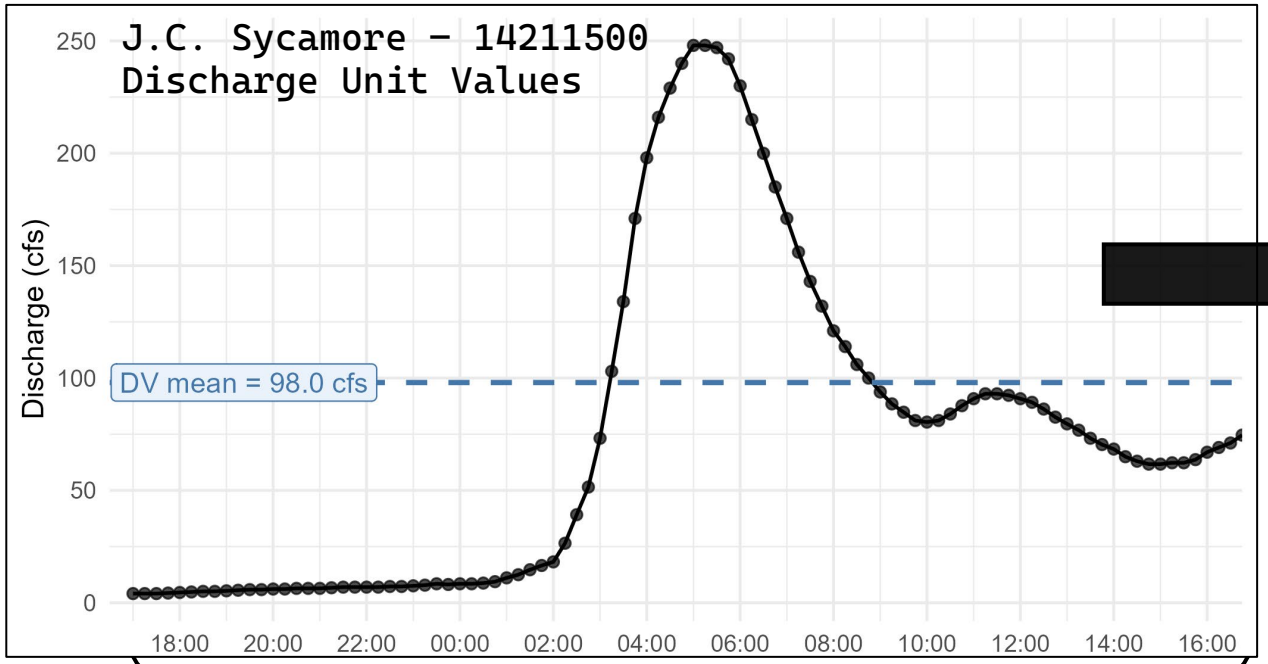


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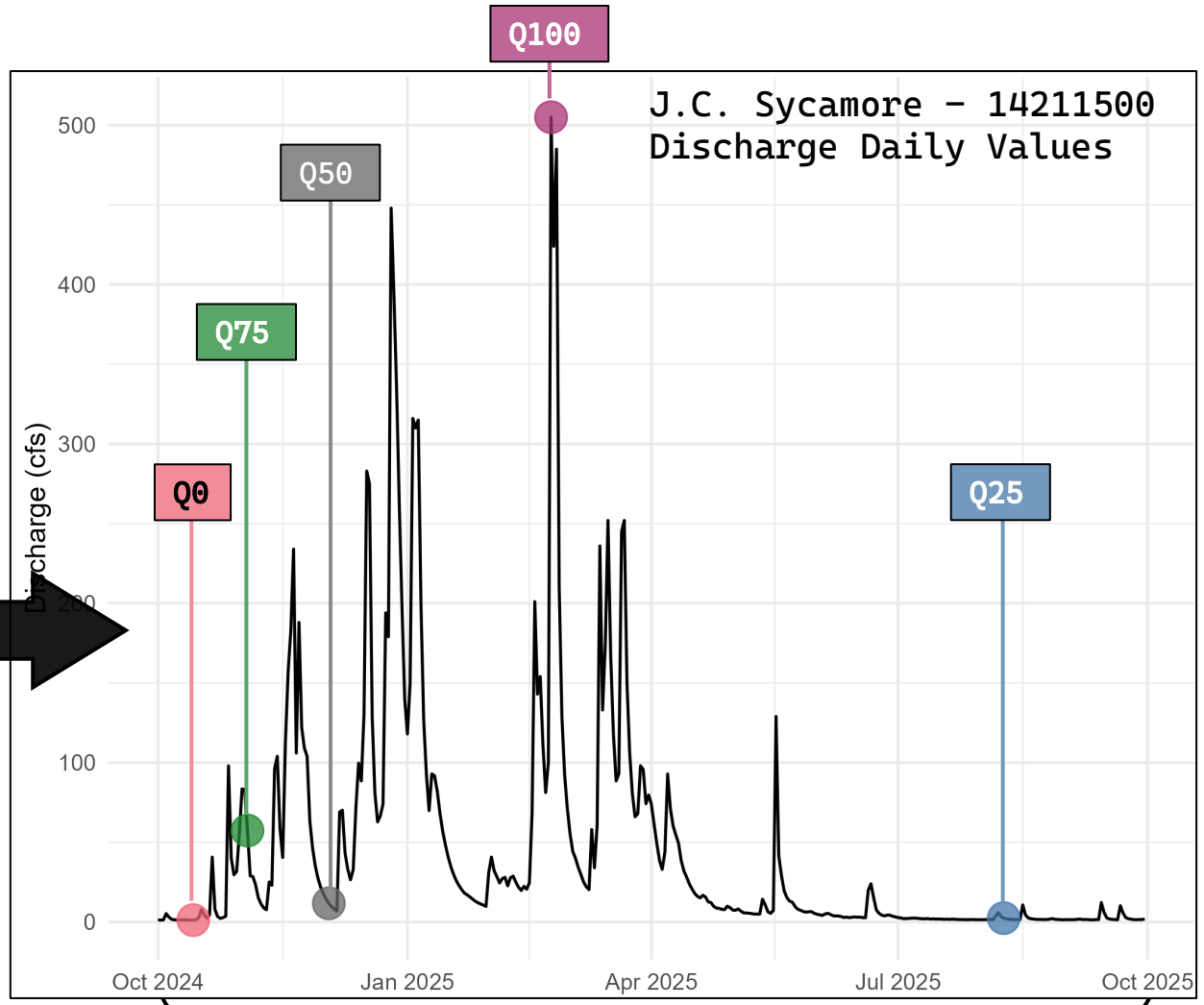
Intro to streamflow stats

Different ranges of flow are analyzed separately so that trends in low, typical, and high flows can be seen independently.

For example – peak flow trends may inform flood-risk planning.



One day (24 hours)



One year (365 days)

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Non-stationarity

How do we determine trends?

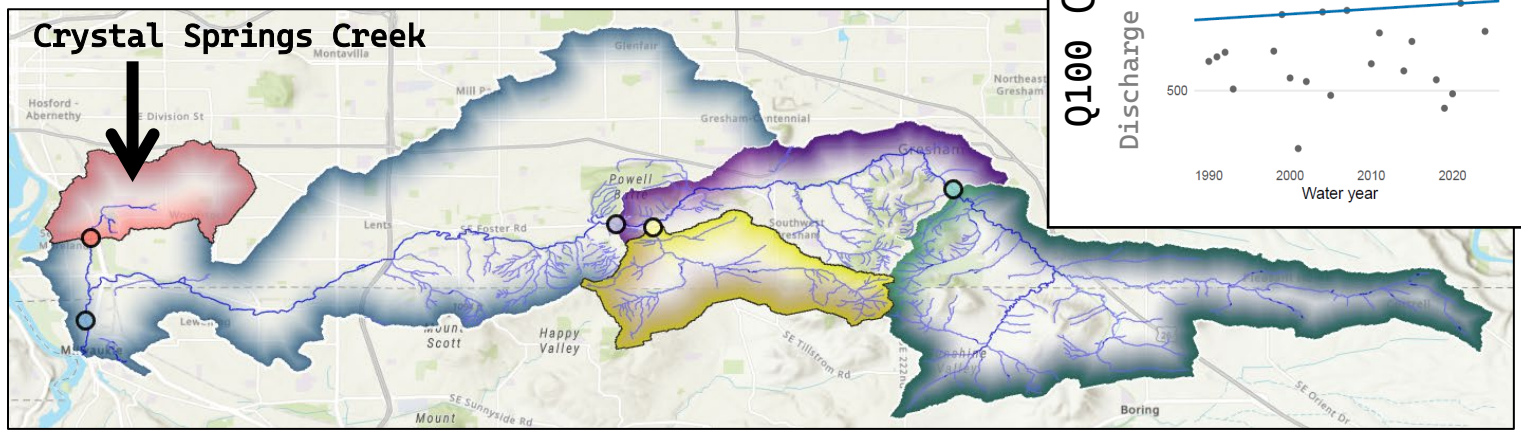
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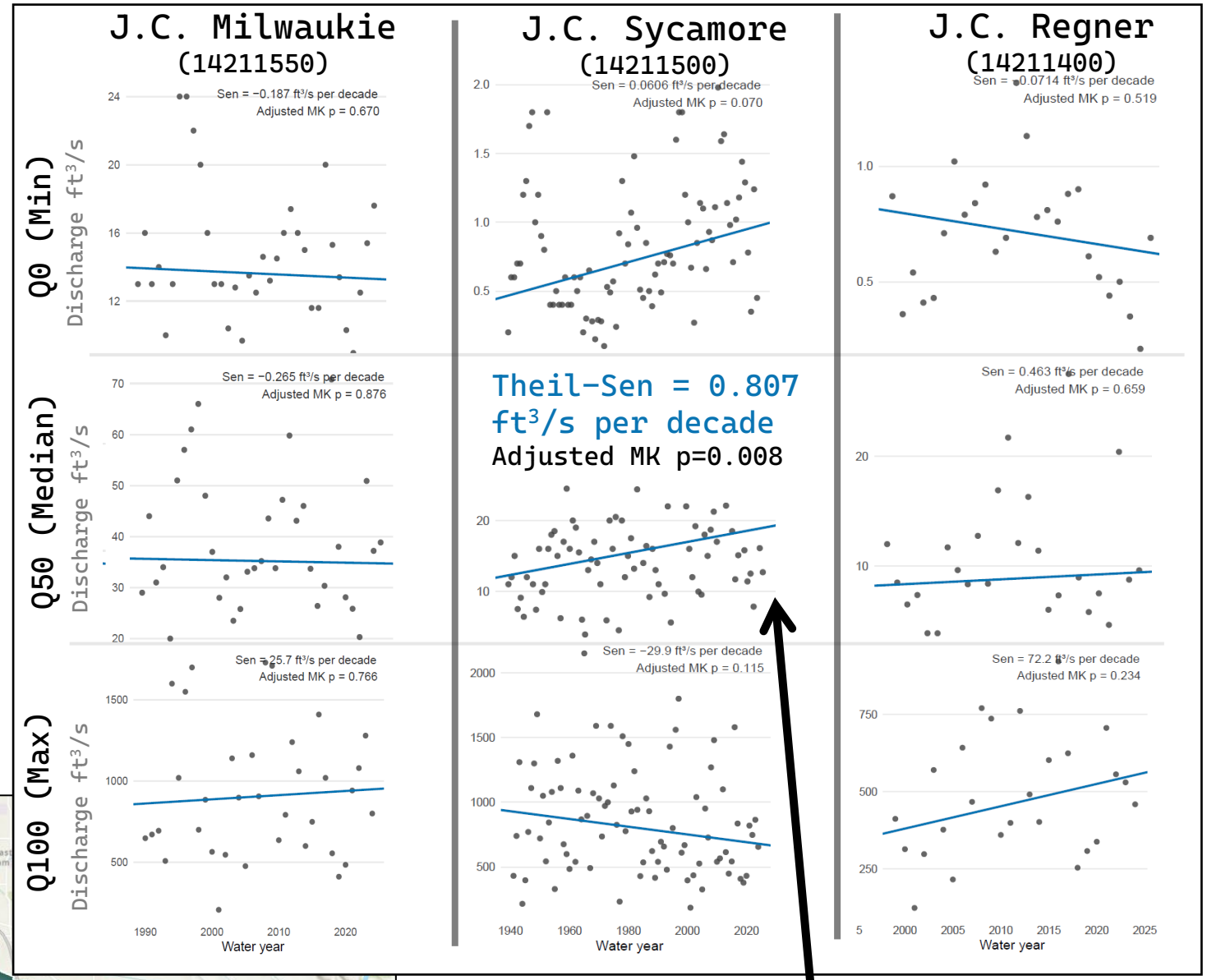
The slope between all possible pairs, e.g.: 1941-1942, 1941-1943, 1941-1944, etc.

The **median** of all these slopes is used to interpret the overall trend. This method is resistant to outliers such as very wet years, or very dry years.

Adjusted Mann-Kendall

Significance test which evaluates if the trend is strong enough to stand out from year-to-year variability. [p-value < 0.05]

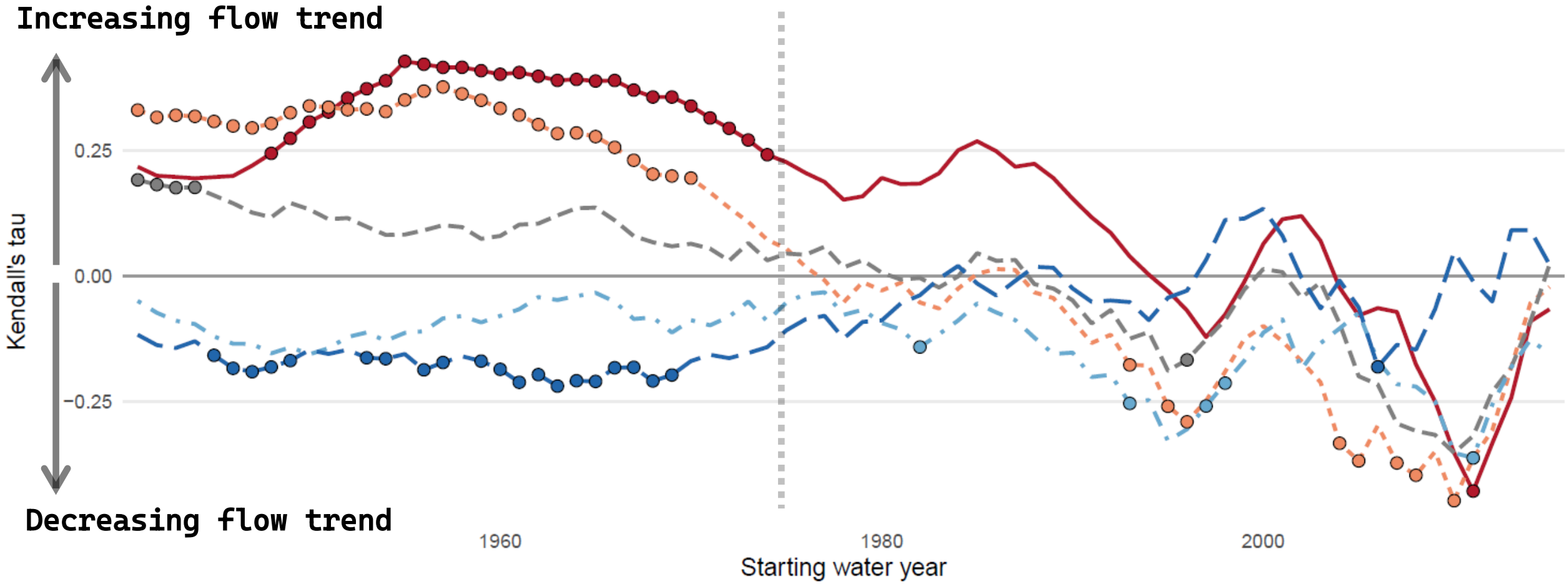




Increasing median flows at JC Sycamore is the only significant trend displayed

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Non-stationarity – rolling start



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Johnson Creek flow is not uniform!

- Sunshine Creek and mainstem Johnson Creek produce most of the flow observed at the Regner Road gage (with high inter-annual variability)
- Crystal Springs contributes stable baseflow for the lower basin due to groundwater discharge
- Stationarity varies across the basin and over time
- Increasing median flows at J.C. Sycamore (14211500)

Next steps?

- Secondary analysis – normalize period of record being analyzed (reduce temporal variance)