Apr 4th, 2:00 PM - 2:15 PM

Estimating river flows across basins using water isotopes

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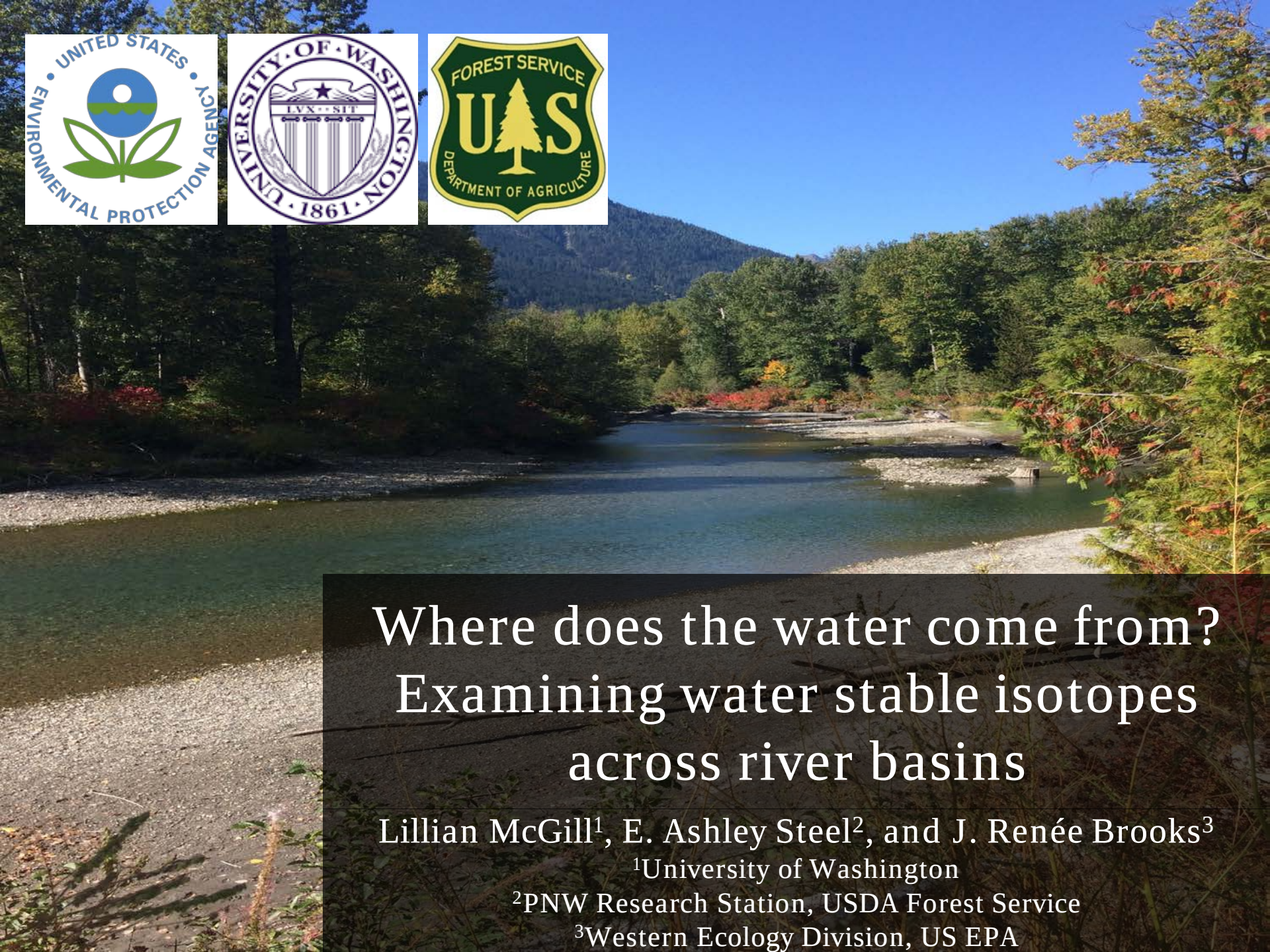
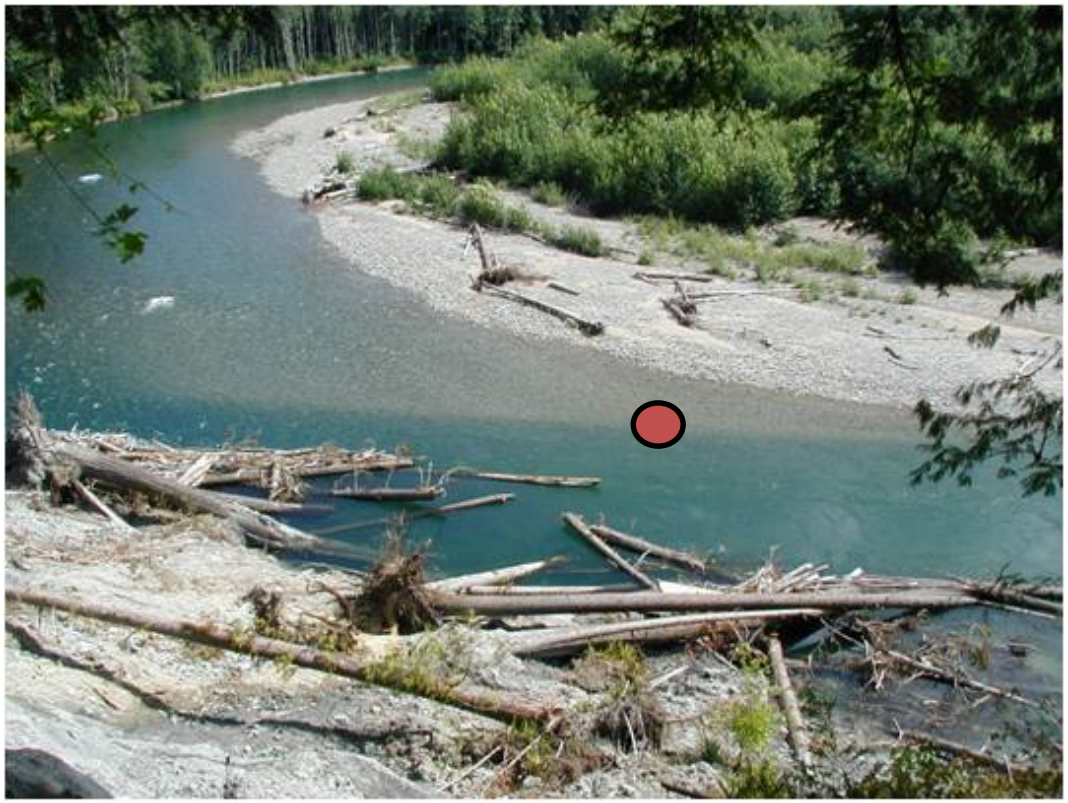
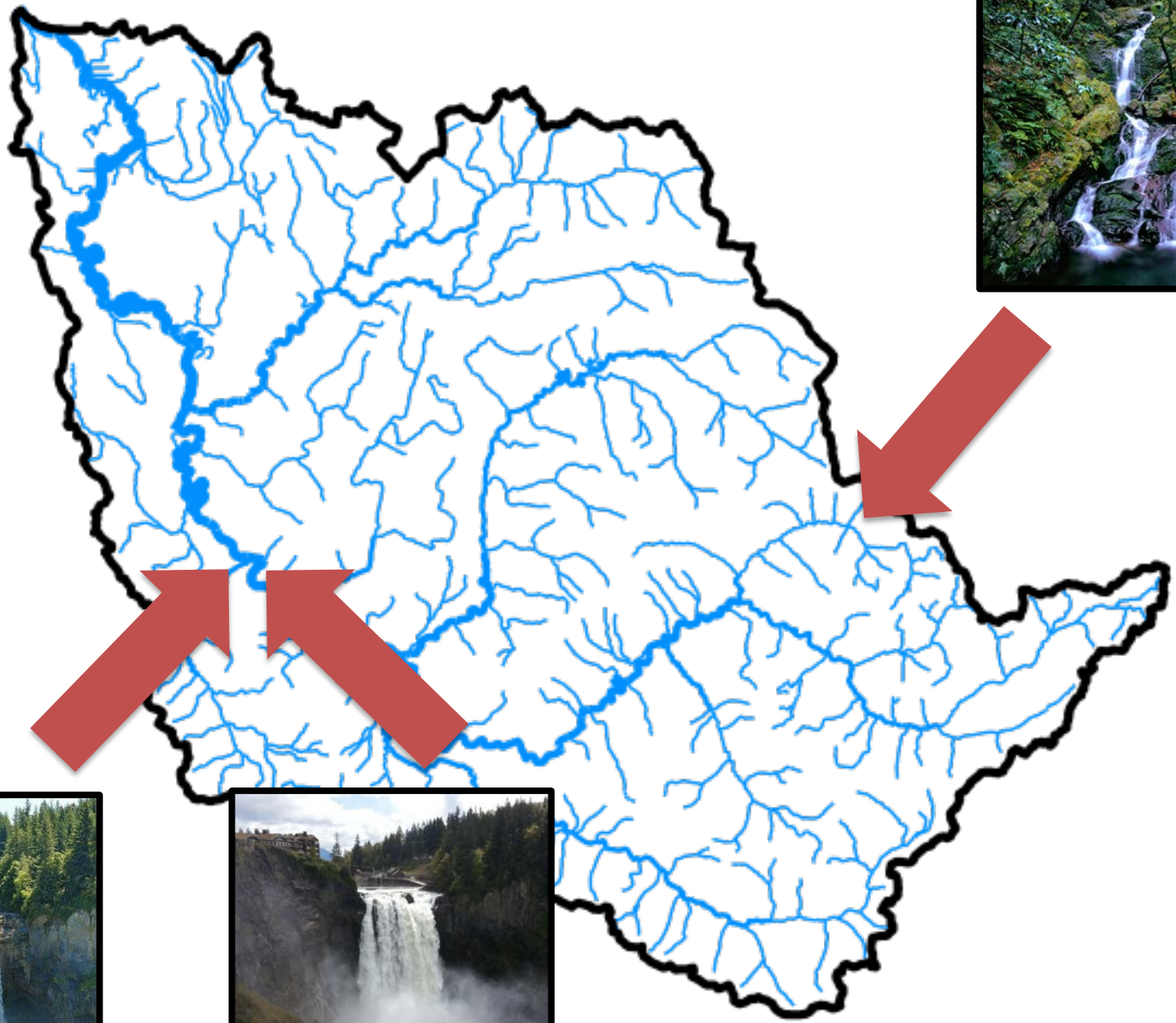


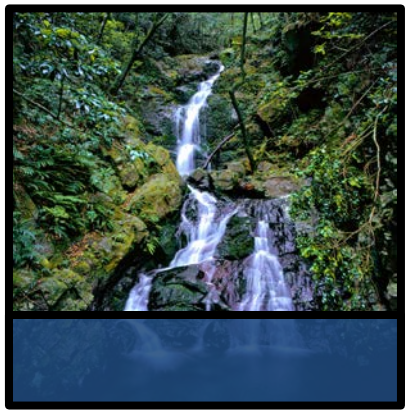
Where does the water come from? Examining water stable isotopes across river basins

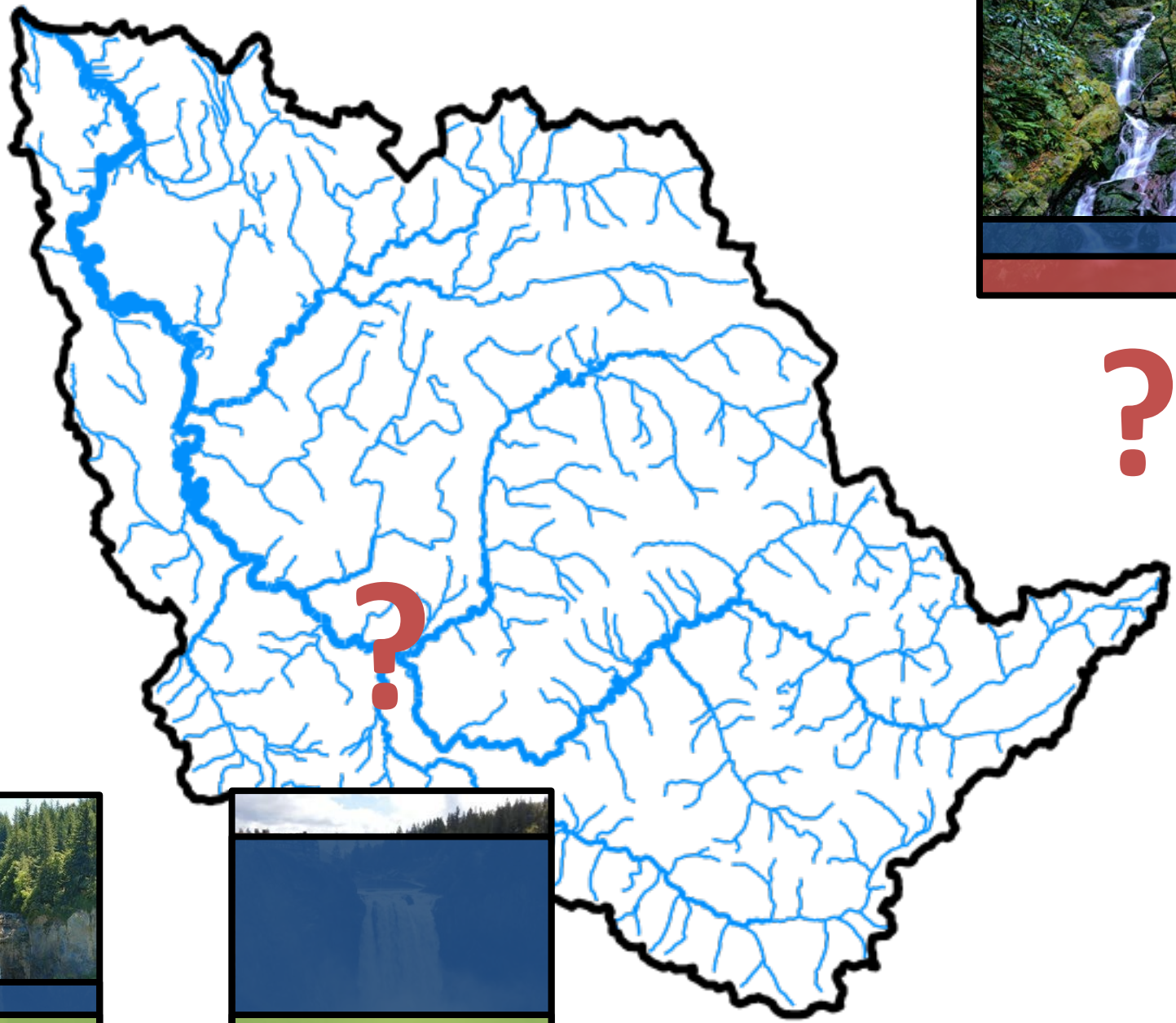
Lillian McGill[1], E. Ashley Steel[2], and J. Renée Brooks[3]
[1]University of Washington
[2]PNW Research Station, USDA Forest Service
[3]Western Ecology Division, US EPA

What can we learn from a water sample?

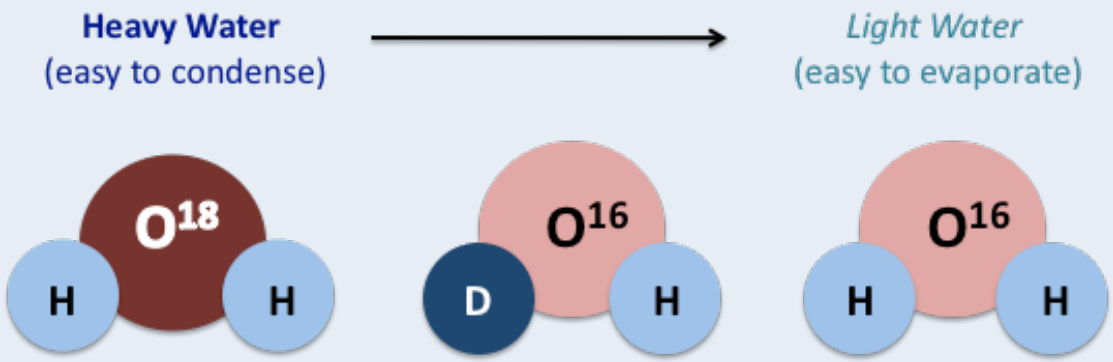






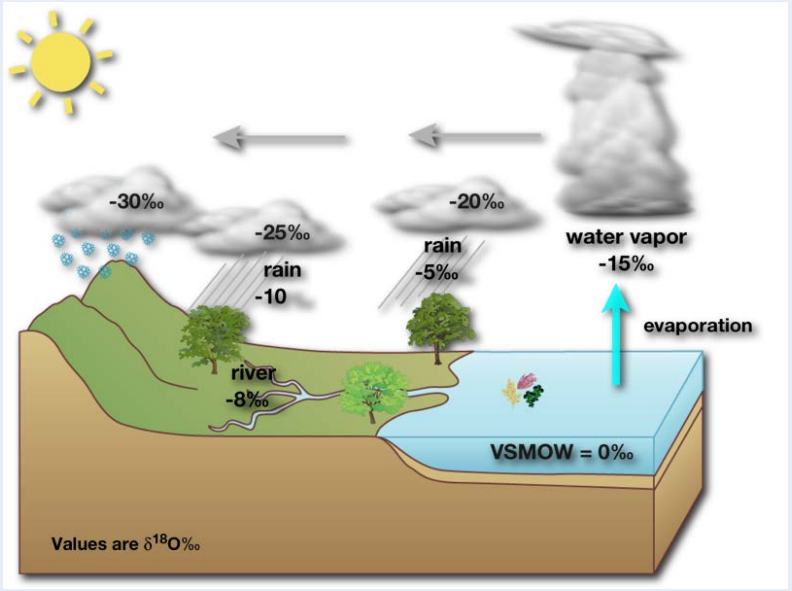


Water isotopes are naturally occurring, and partitioned by hydrologic fluxes

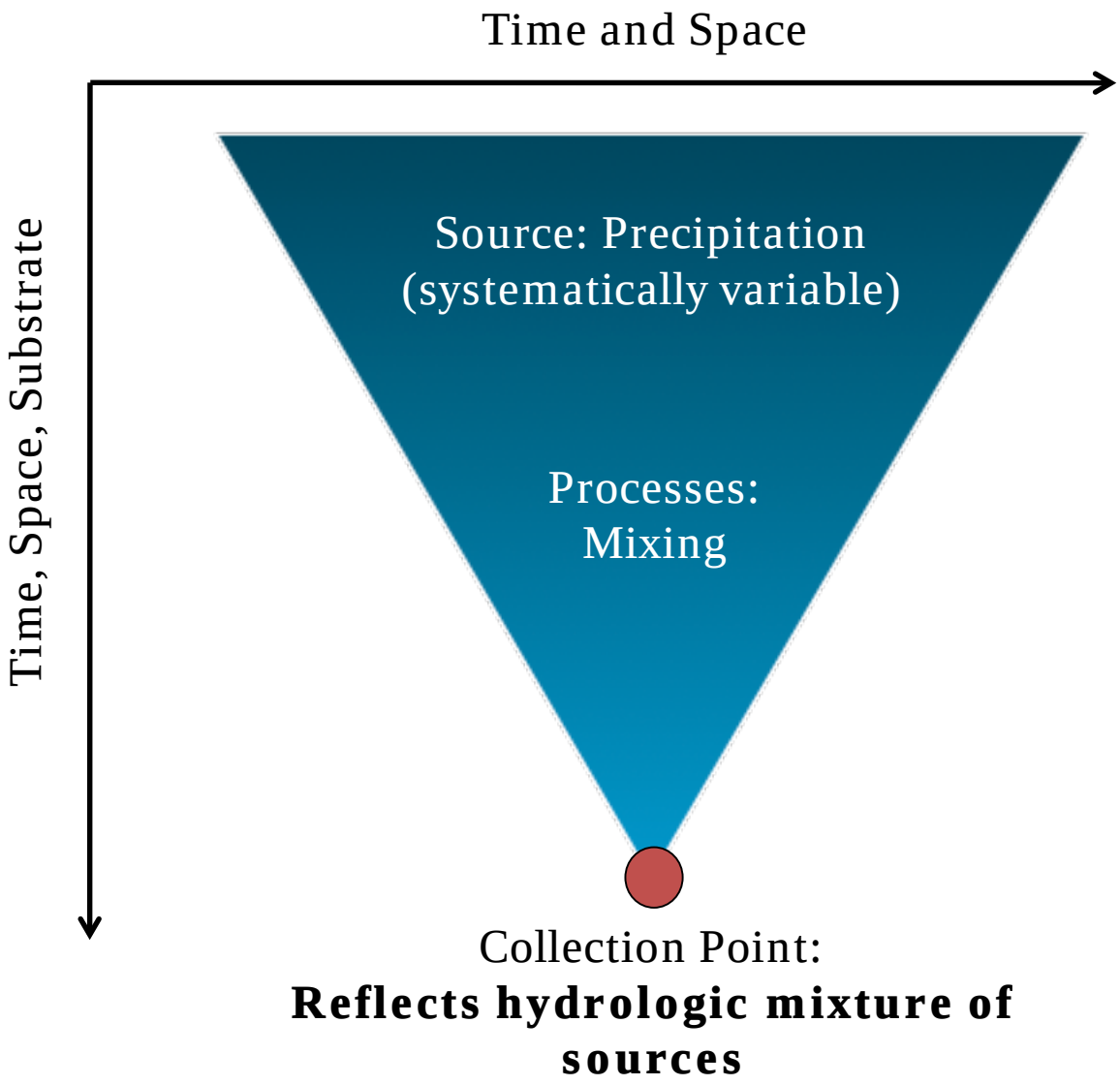


- Isotopes have different weights.
- This causes fractionation due to phase changes.

- Fractionation causes spatial variation in the isotope composition of precipitation.
- As you move inland from the coast and up in elevation, the isotopic signature becomes more negative.



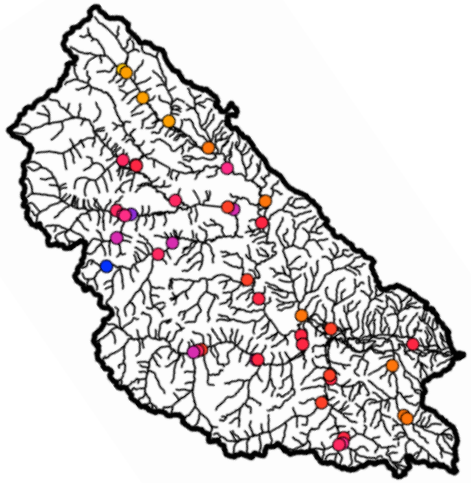
Streams integrate the isotopic signal of precipitation



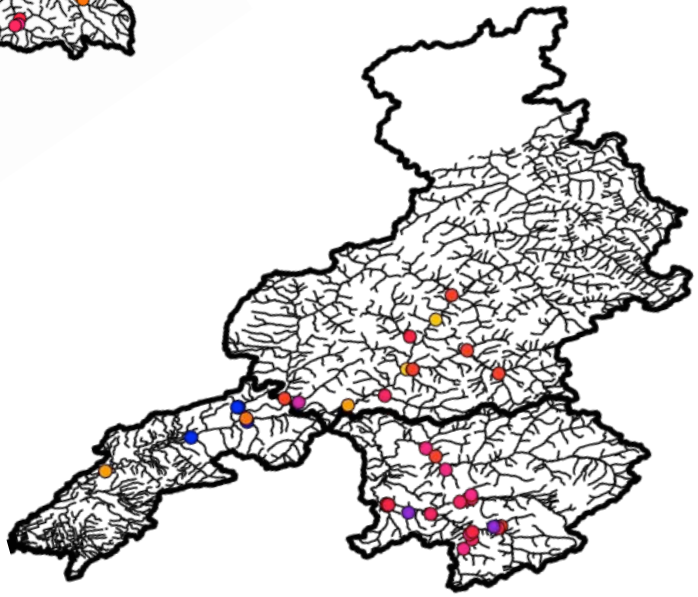
WHERE can we use water isotopes to understand water sources across rivers?

Samples collected in four river basins within Washington

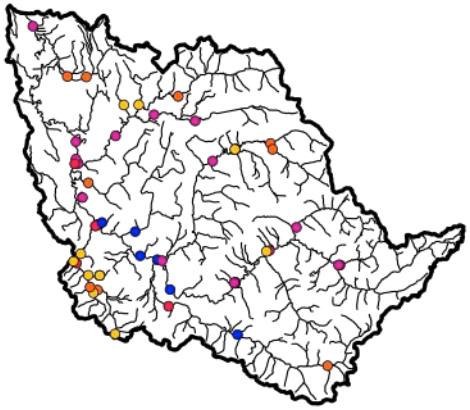
Wenatchee



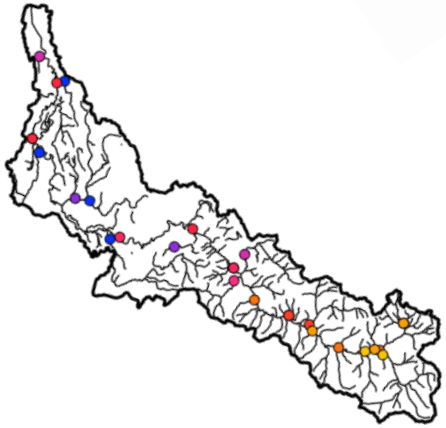
Skagit



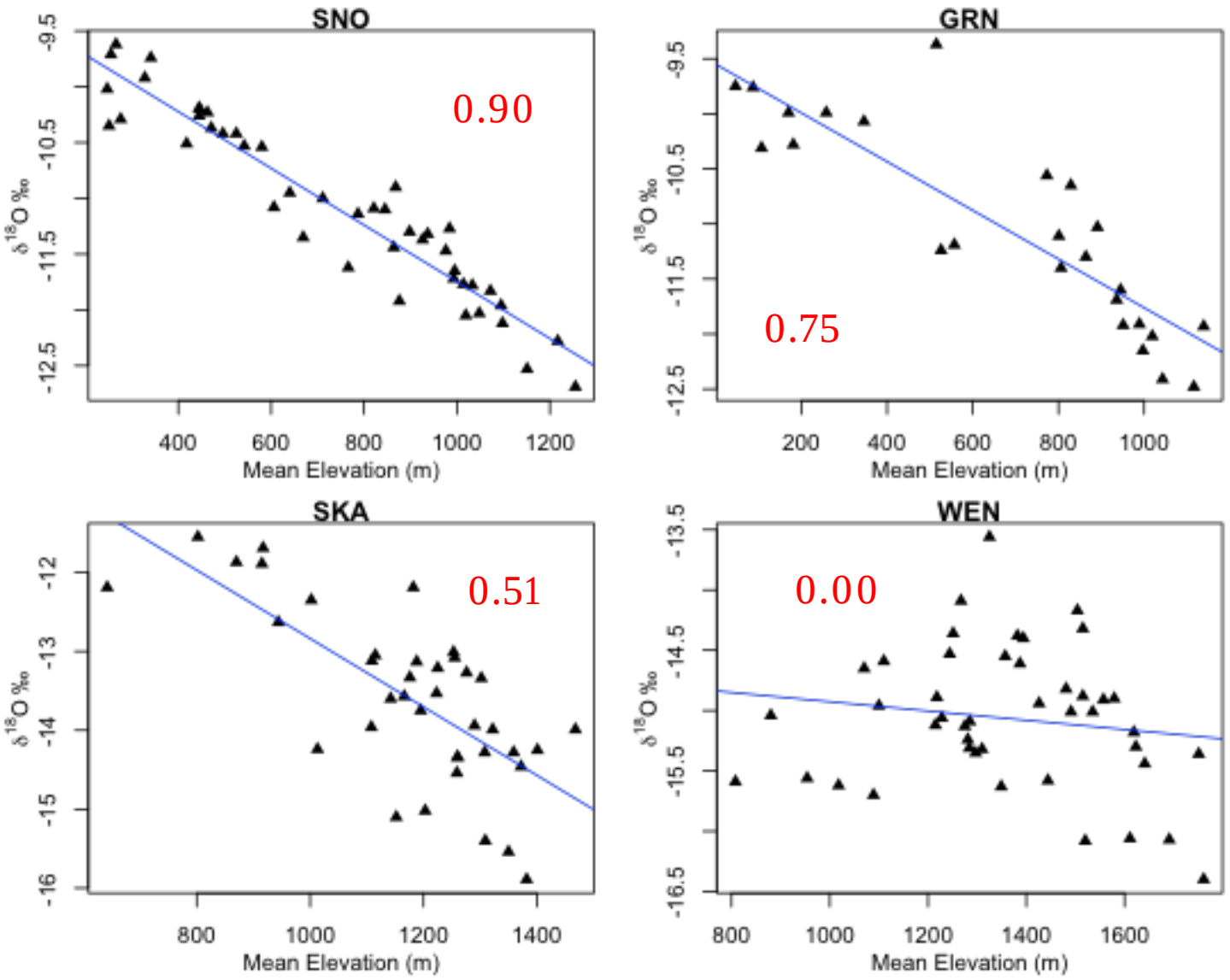
Snoqualmie



Green

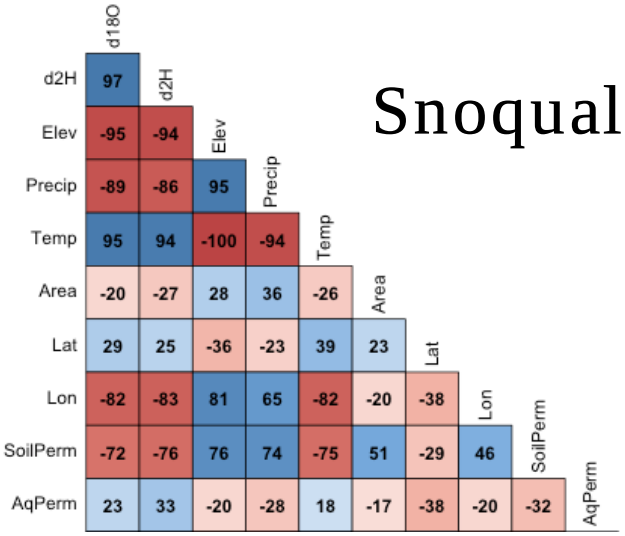


Westside basins display strong relationships with elevation, the Wenatchee does not

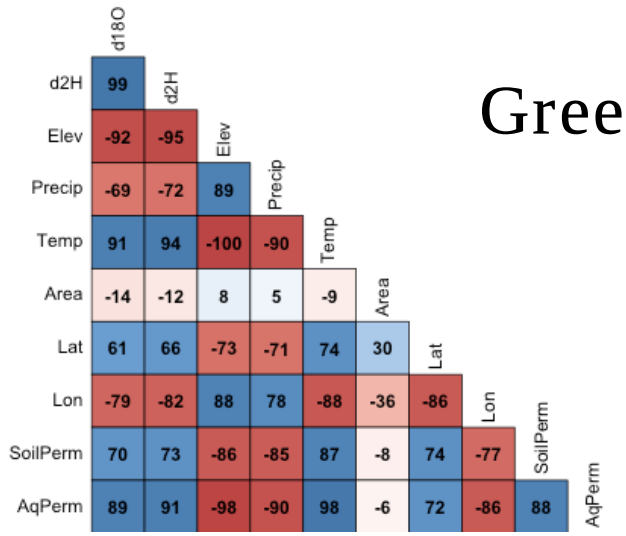


River basins have many landscape features that influence our ability to use the rainout effect as a tool for tracing water source.

Snoqualmie



Green



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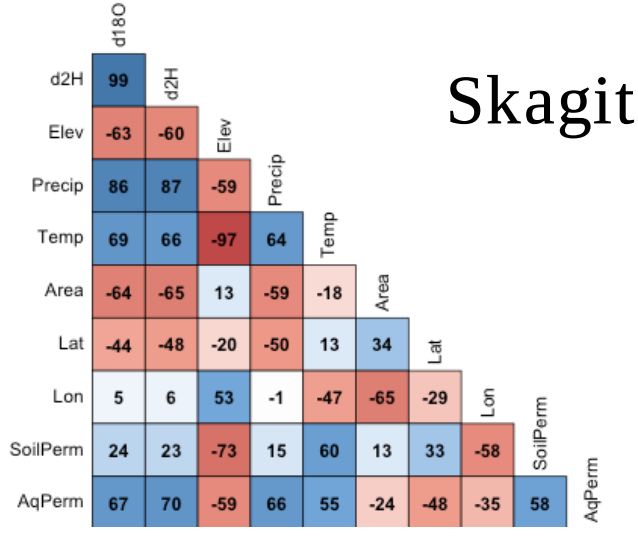
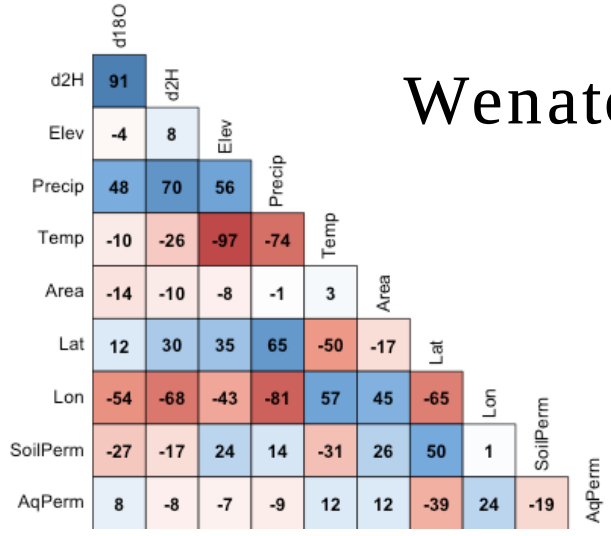
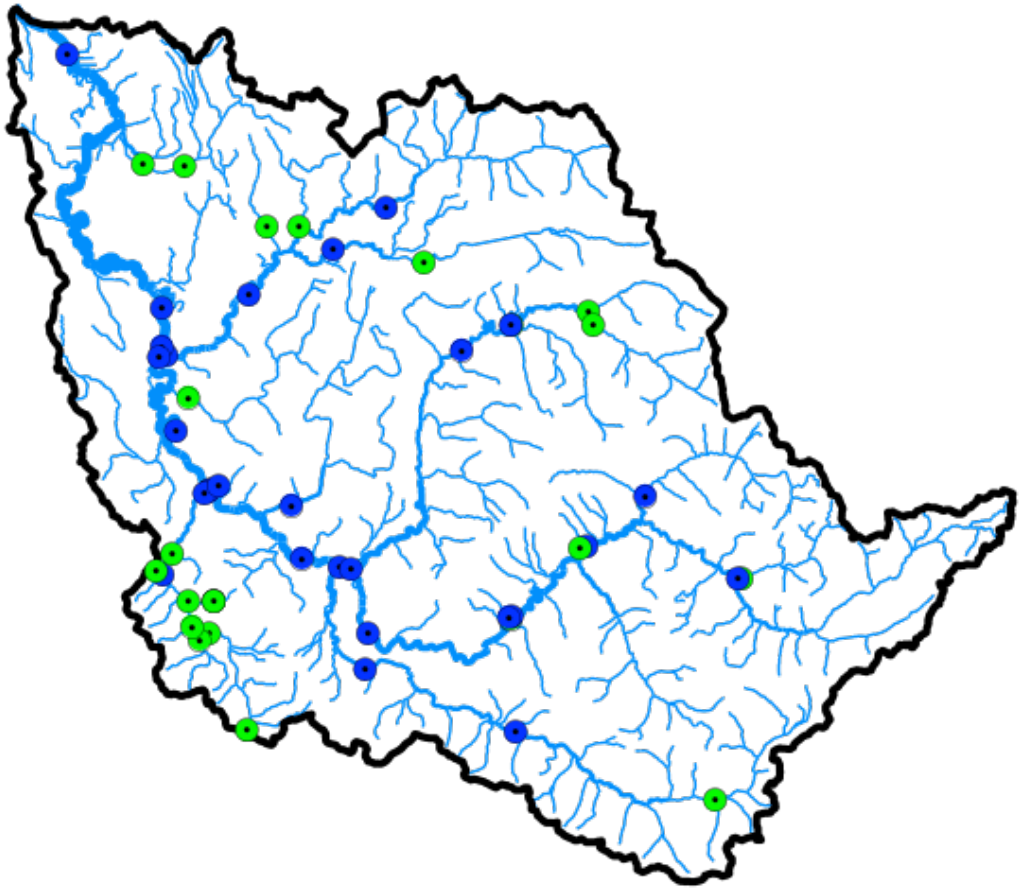


Wenatchee

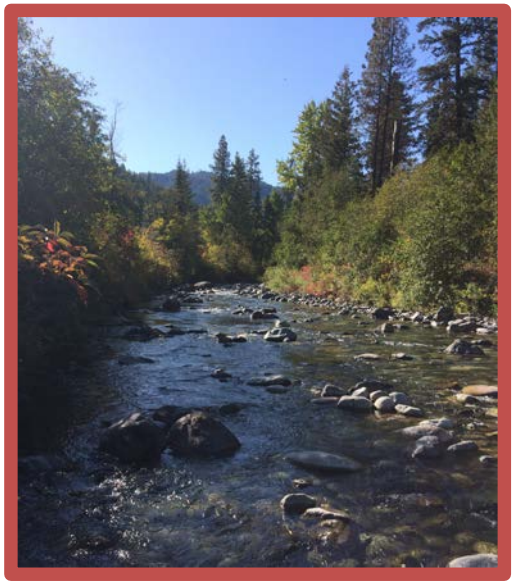


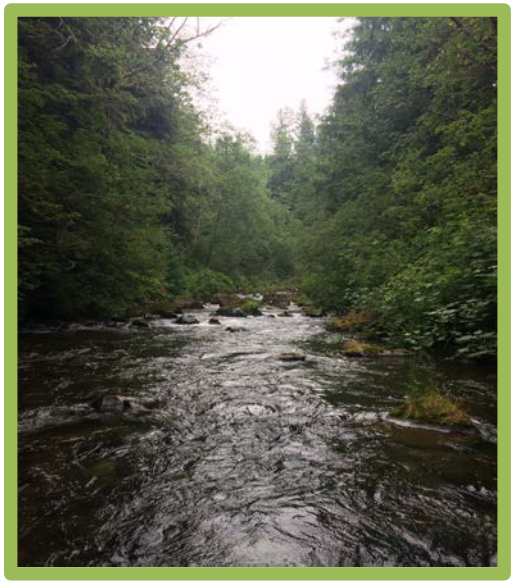
HOW can we use water isotopes to understand water sources across rivers?

Samples collected at 46 monitoring sites within the Snoqualmie River Basin

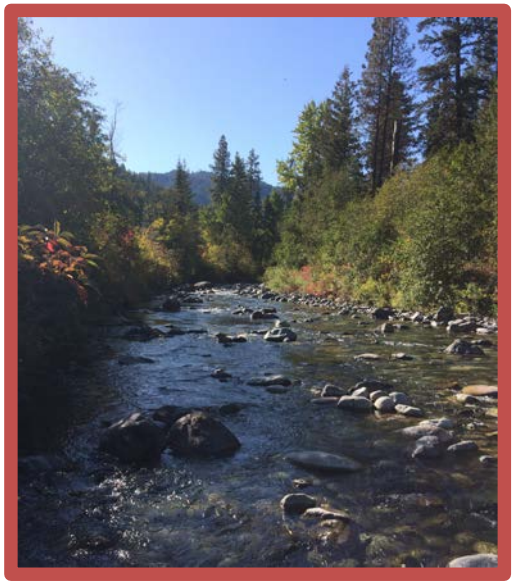


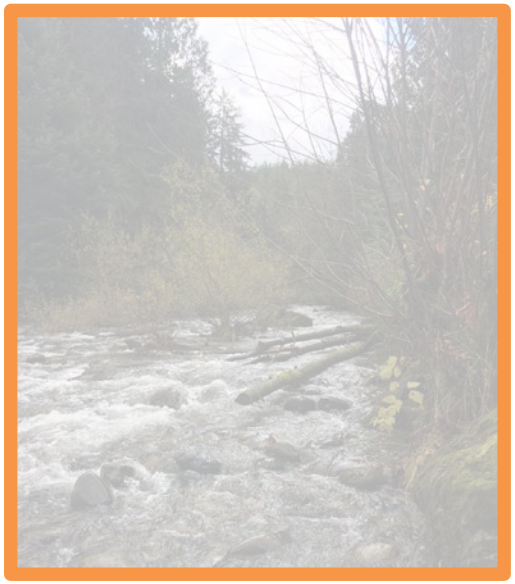
Samples collected across five hydrologic periods

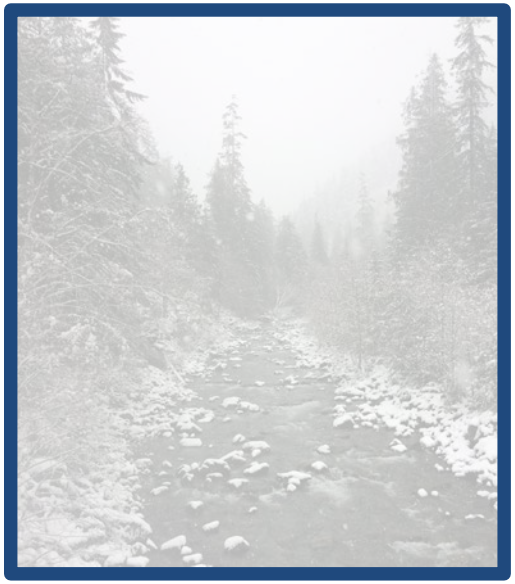


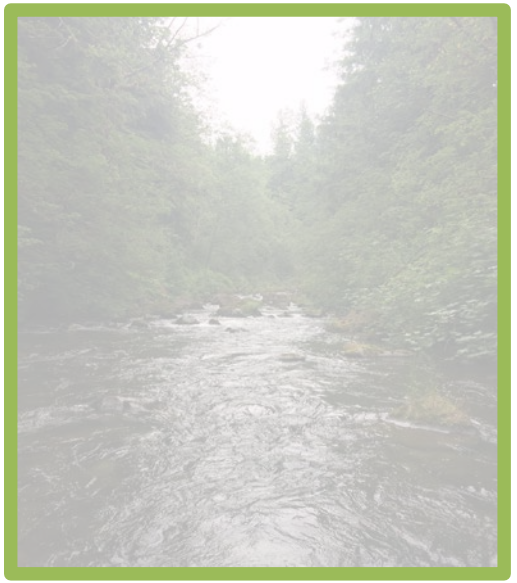


Samples collected across five hydrologic periods: Early and late summer analyzed

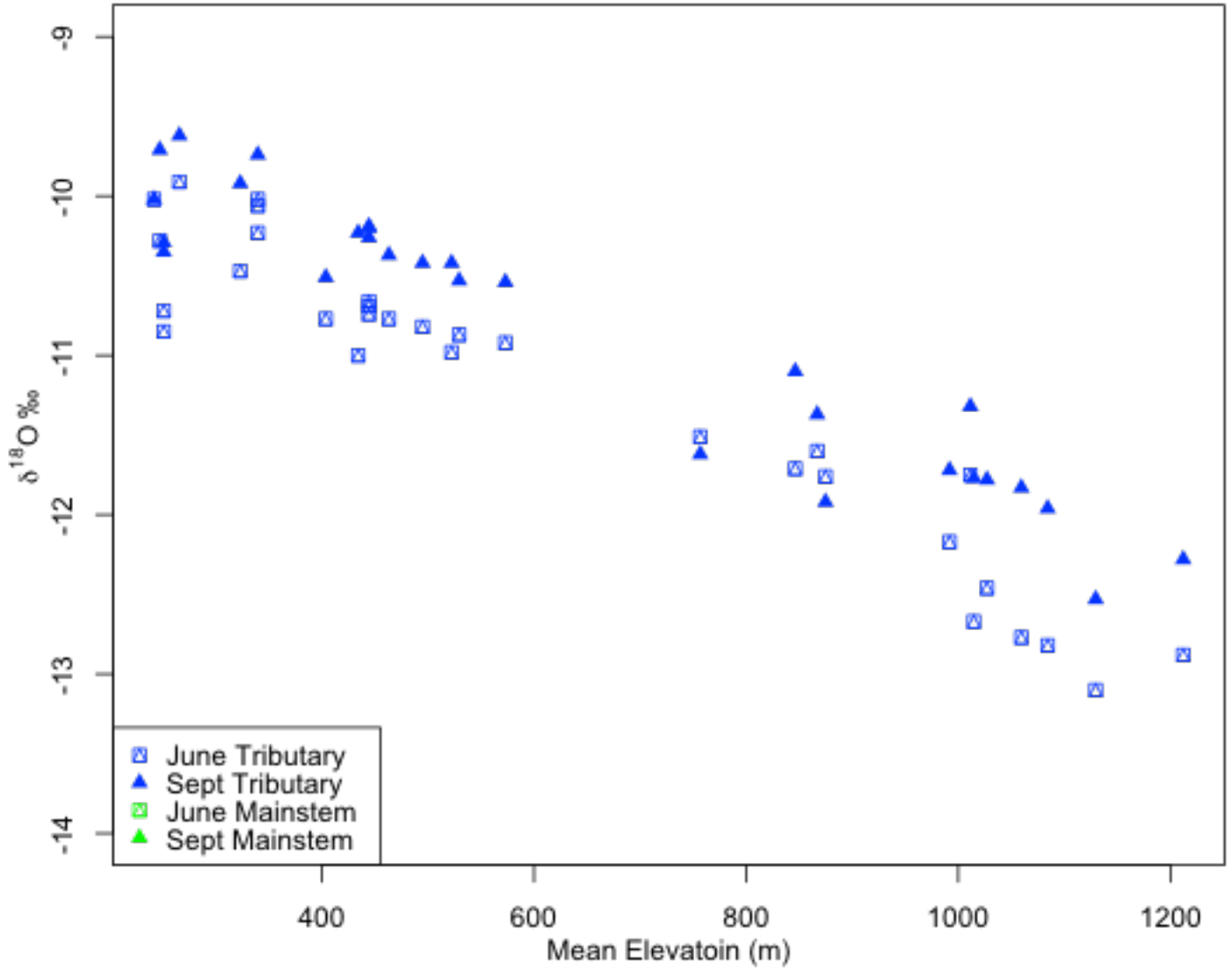








Elevation drives isotopic signature. Tributaries have fairly stable isotopic signatures through time.



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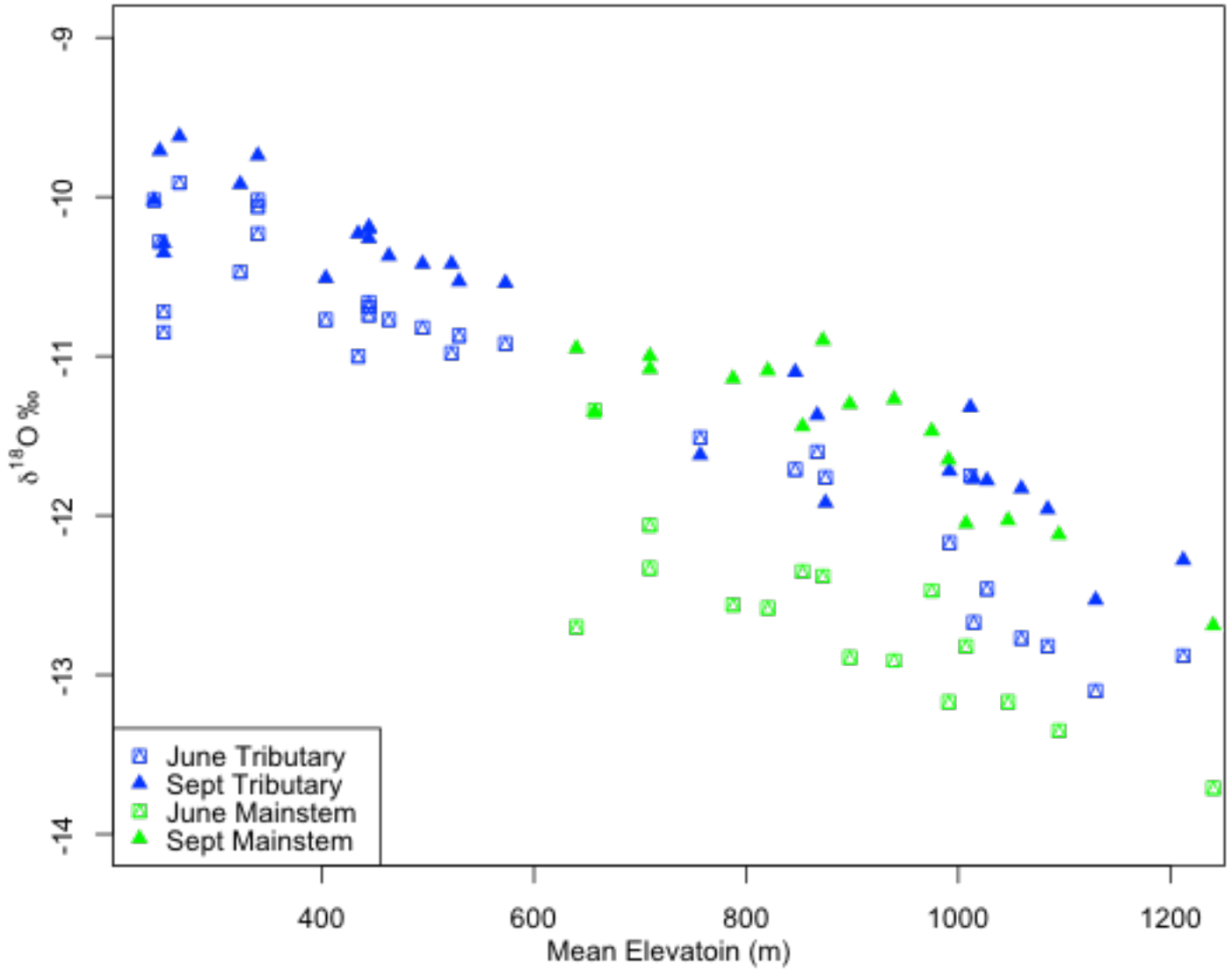
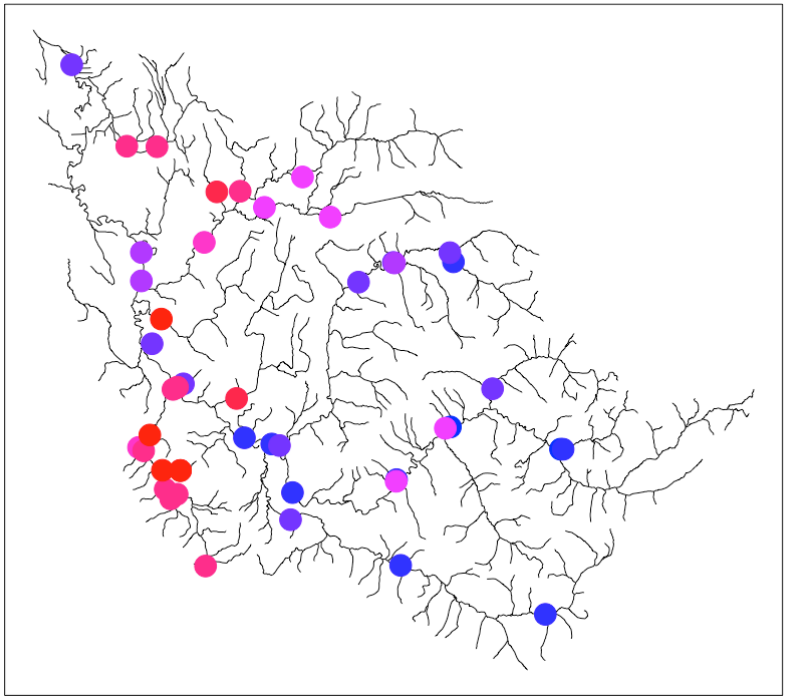
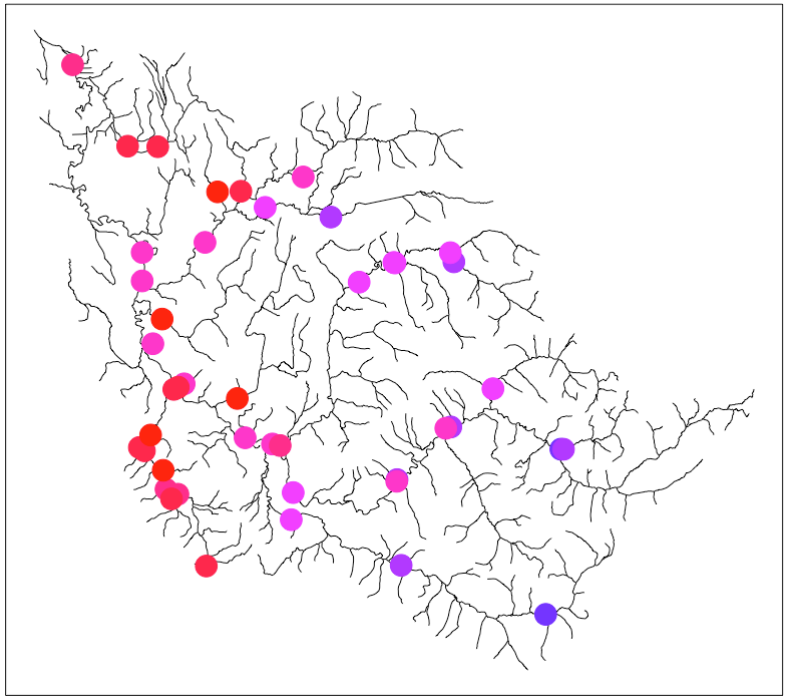


Lower $\delta^{18}O$ values in June indicate higher elevation source water, presumably from residual snowmelt

$\delta^{18}O$ June



$\delta^{18}O$ September



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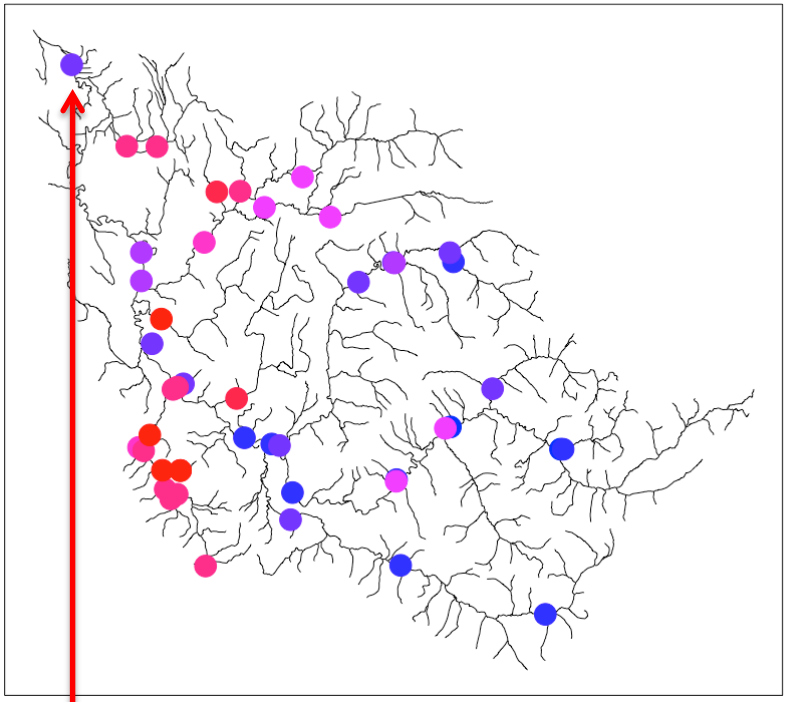
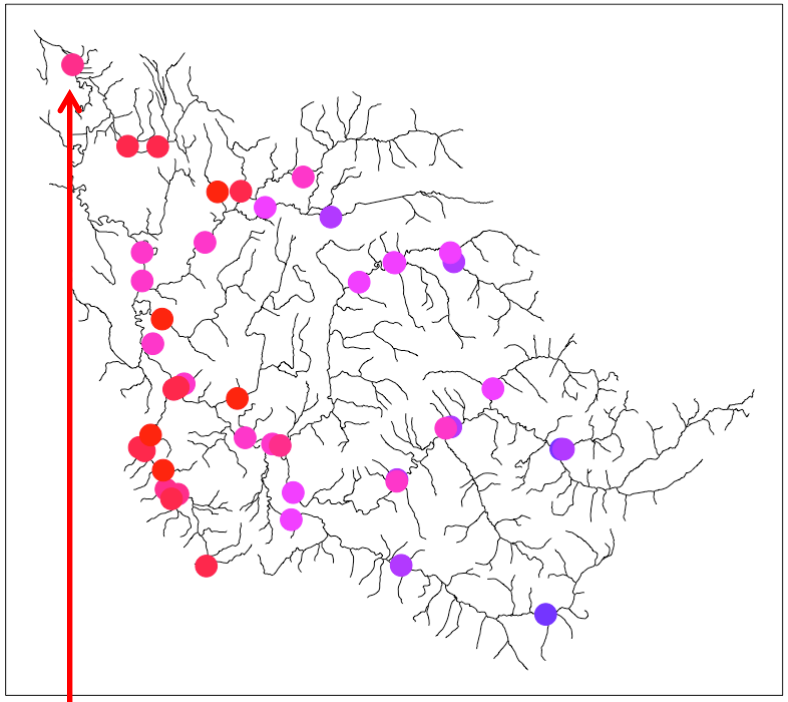


Outlet $\delta^{18}O$: -12.70
Avg. elevation: 8306 m

$\delta^{18}O$ September



Outlet $\delta^{18}O$: -10.95
Avg. elevation: 7648 m

Next Steps

- Continue to monitor and analyze Snoqualmie River stable isotopes
- Use a mixing model framework to predict how much water derives from the snow zone, rain-on-snow zone, and rain zone.
- Integrate water source estimates with climate projections for the basin to determine how future flows may shift.

Acknowledgements

E. Ashley Steel, USDA Forest Service
J. Renée Brooks, US Environmental Protection Agency
Aimee Fullerton, National Oceanic and Atmospheric Administration

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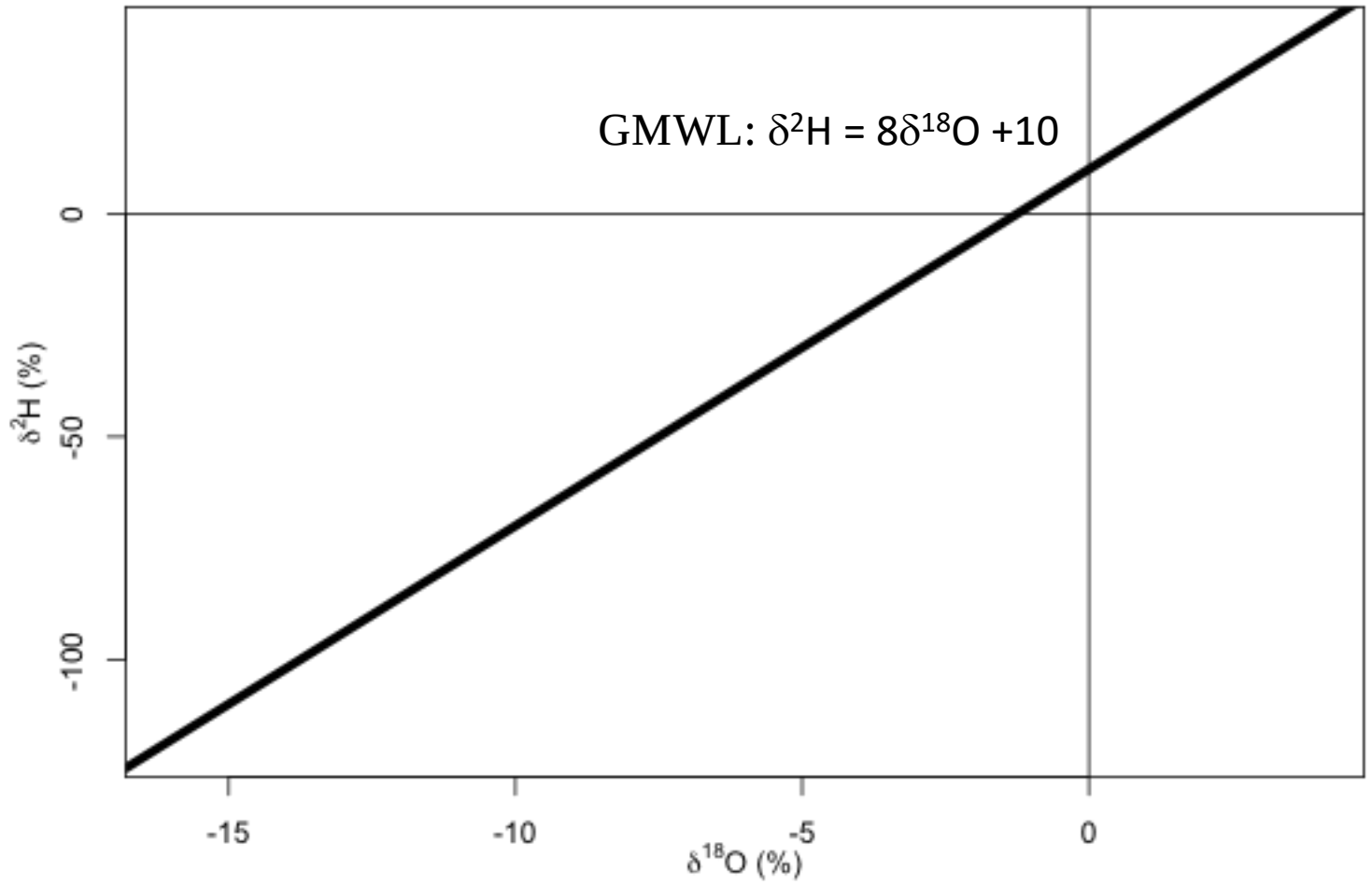
US DOI's Northwest Climate Adaptation Science Center
USDA Forest Service's Pacific Northwest Research Station
US Environmental Protection Agency's Western Ecology Division
NOAA's Northwest Fisheries Science Center

Water isotopes are naturally occurring, and partitioned by hydrologic fluxes



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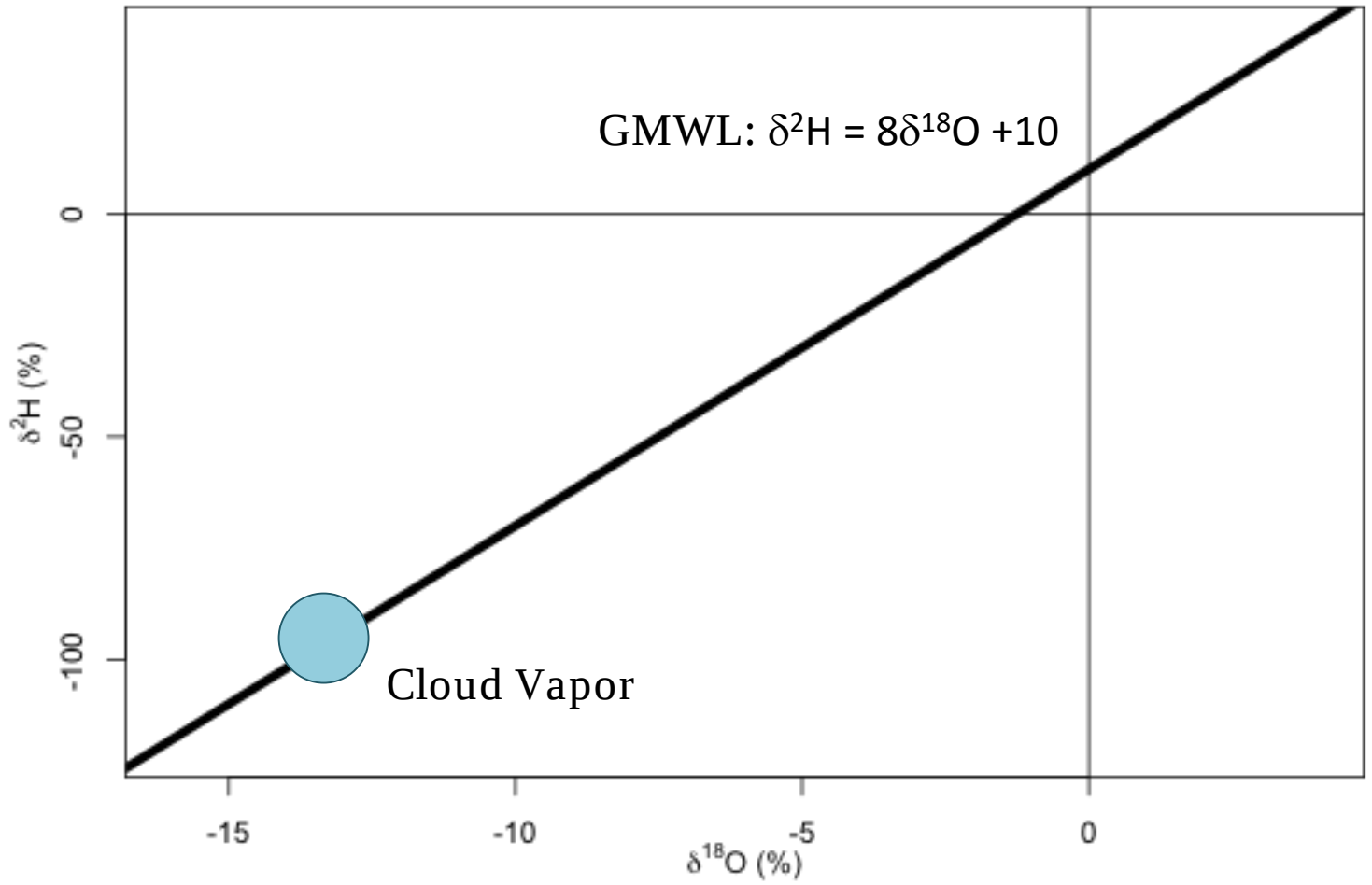

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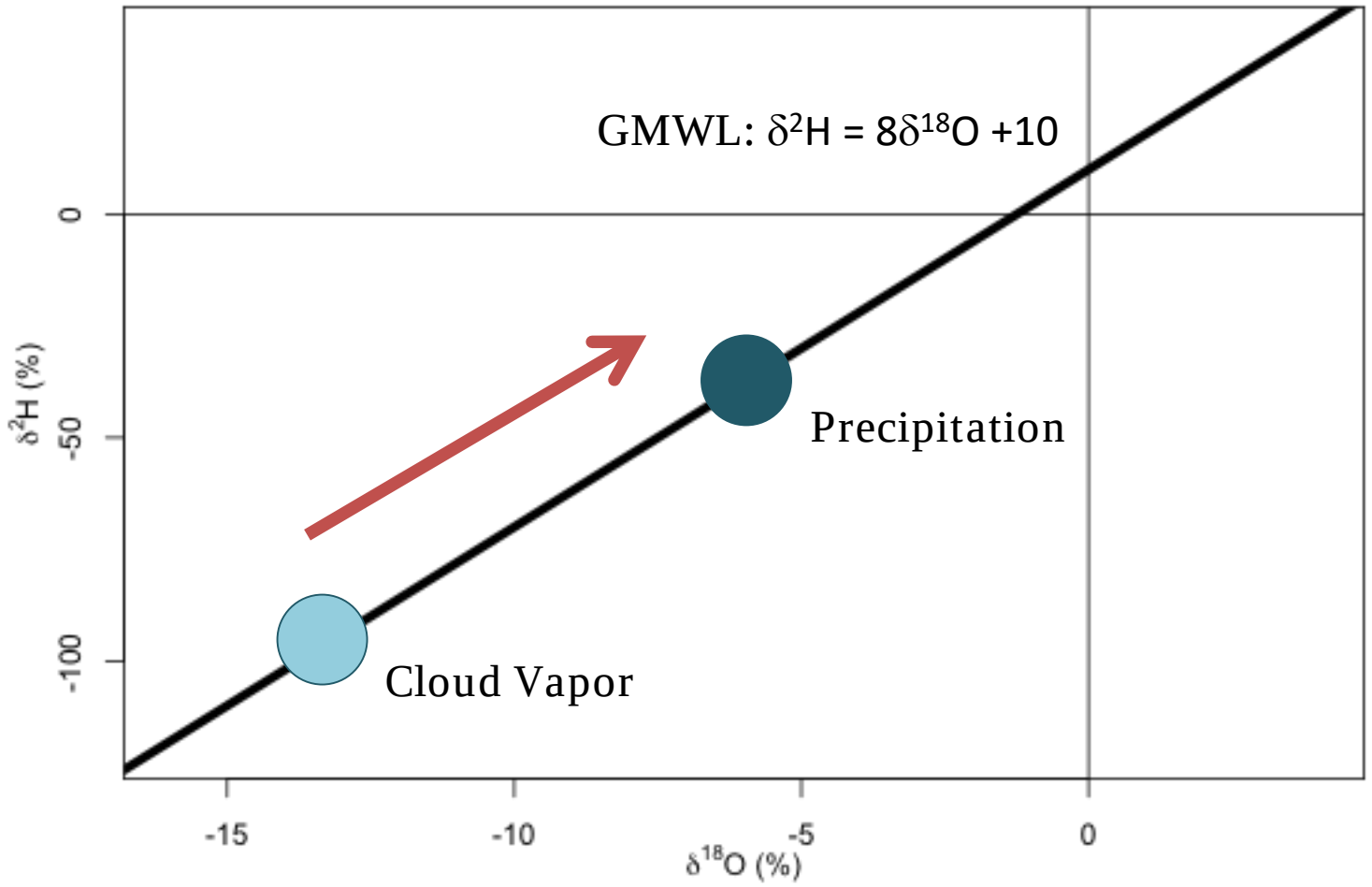

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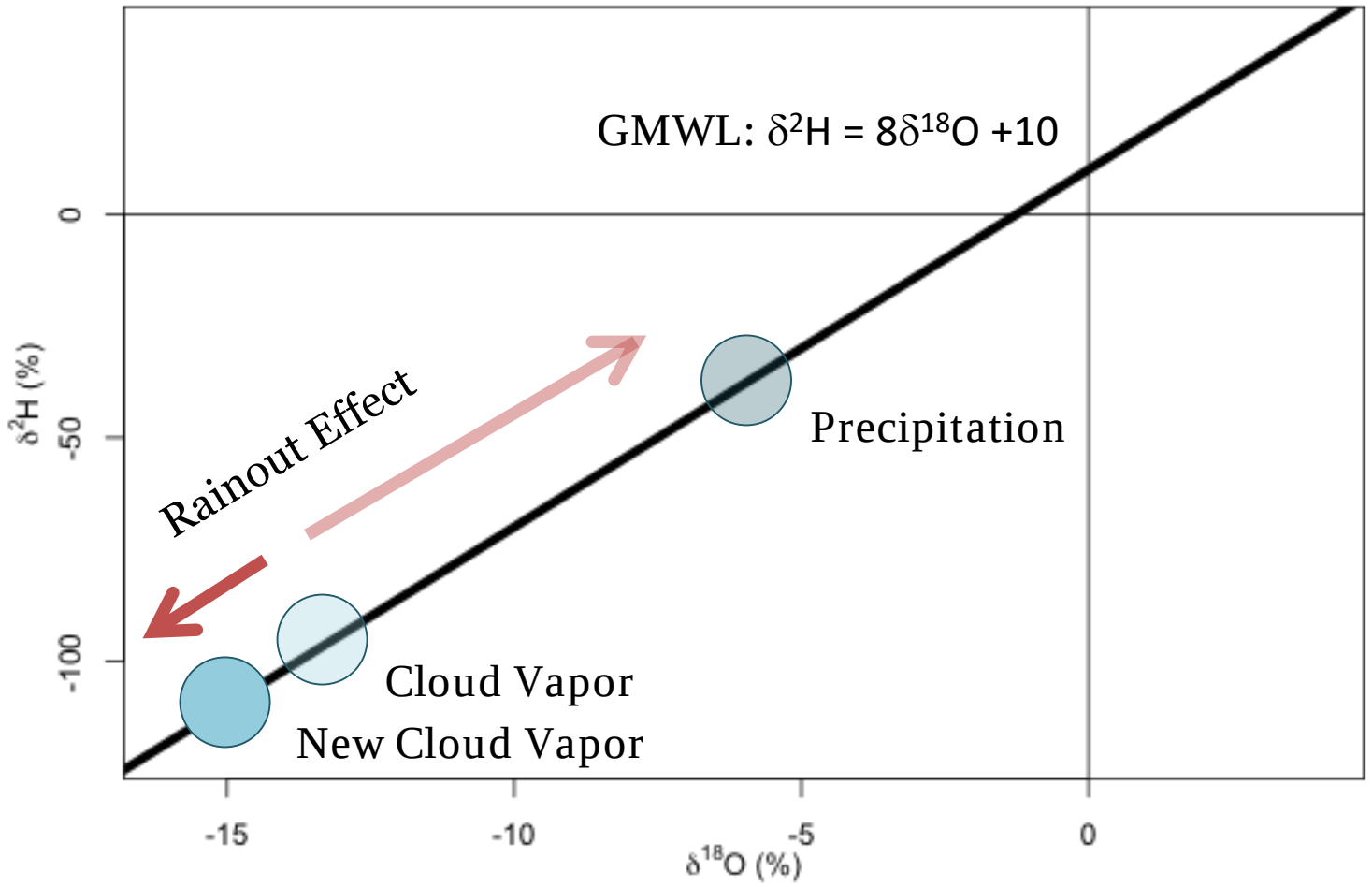

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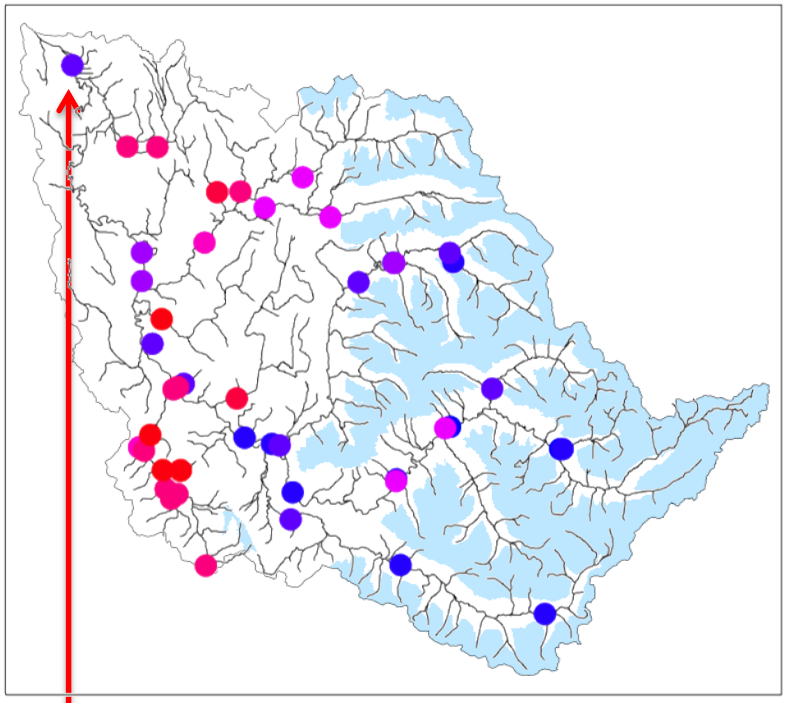

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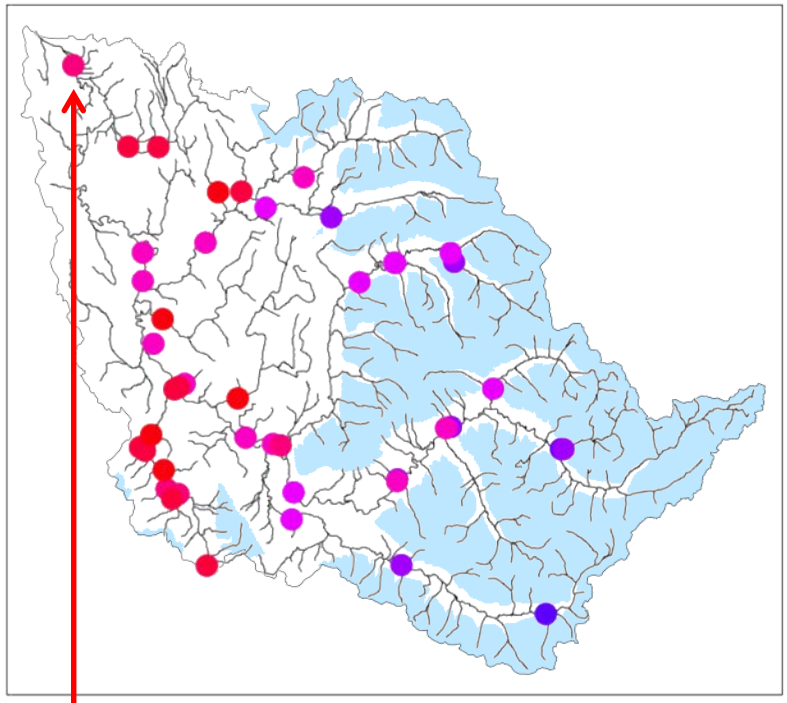

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