

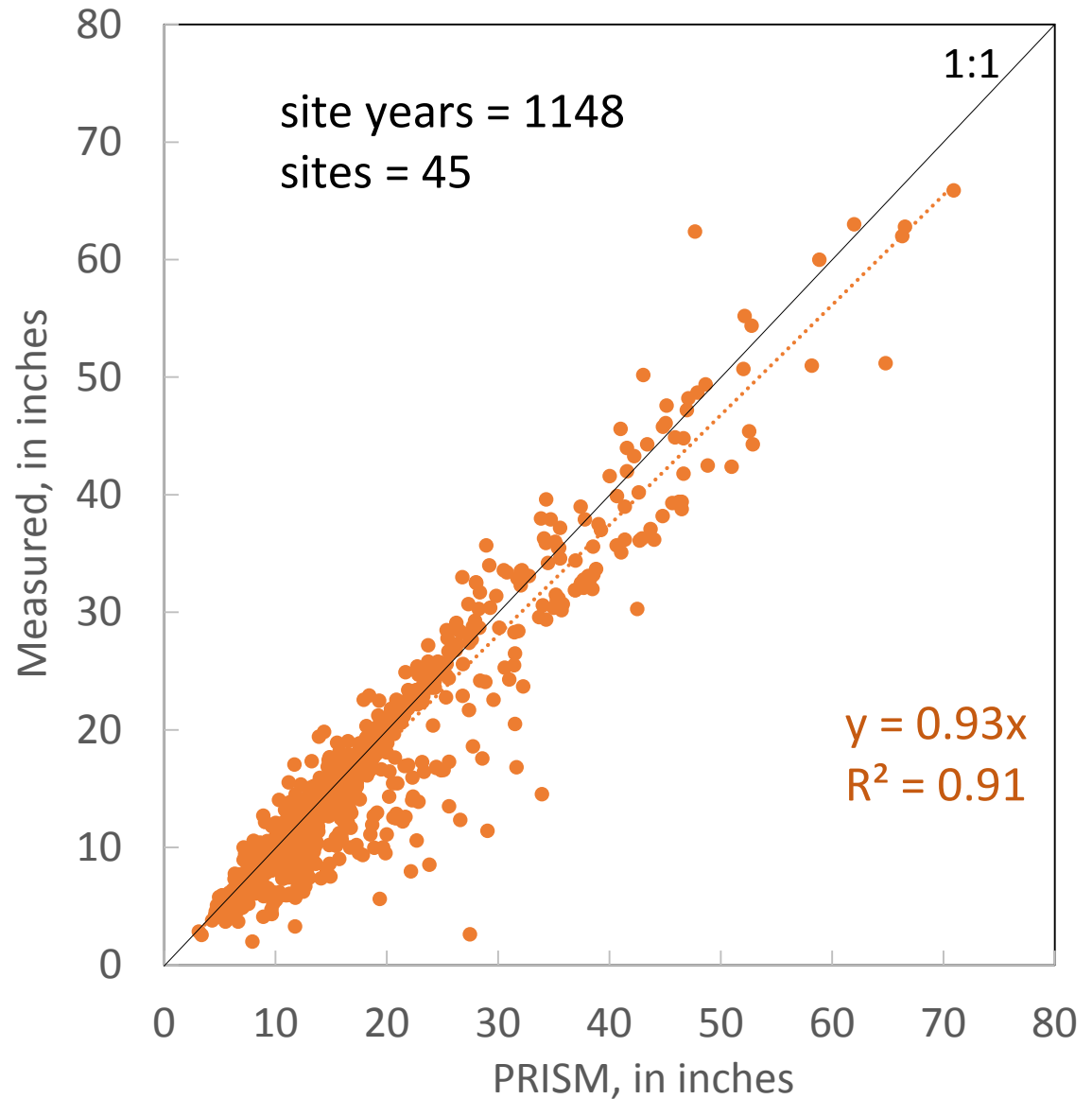
Precipitation Patterns and Plant-Water Sourcing with Stable Isotopes

Amanda Garcia, Stephen Gingerich, and Hank Johnson

How well does gridded PRISM and
GRIDMET data represent field
measurements?

Annual Precipitation 1900-2016

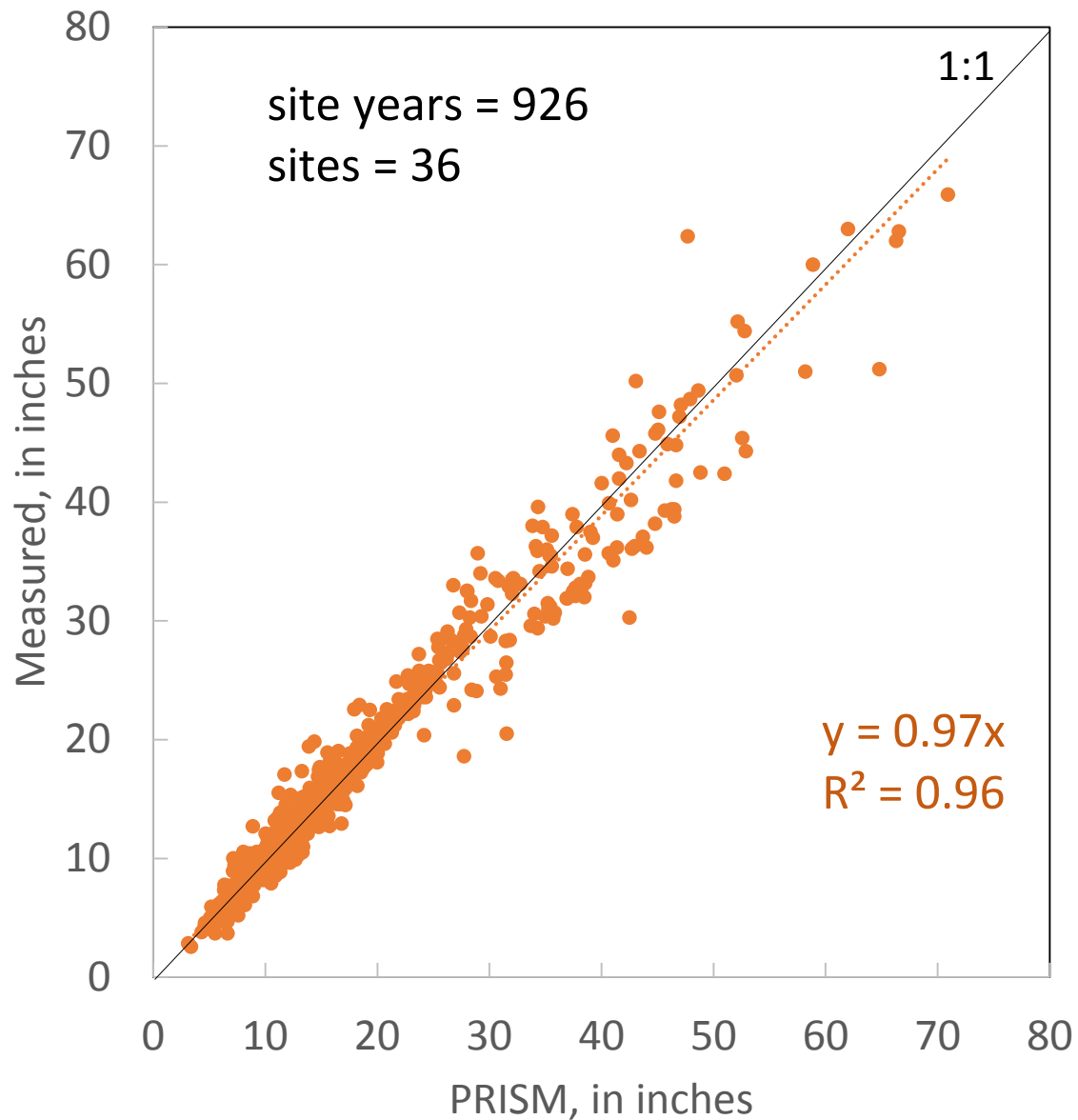
All sites:
COOP
SNOTEL
WBAN
RAWS



Annual Precipitation 1900-2016

Sites:
COOP
SNOTEL
WBAN

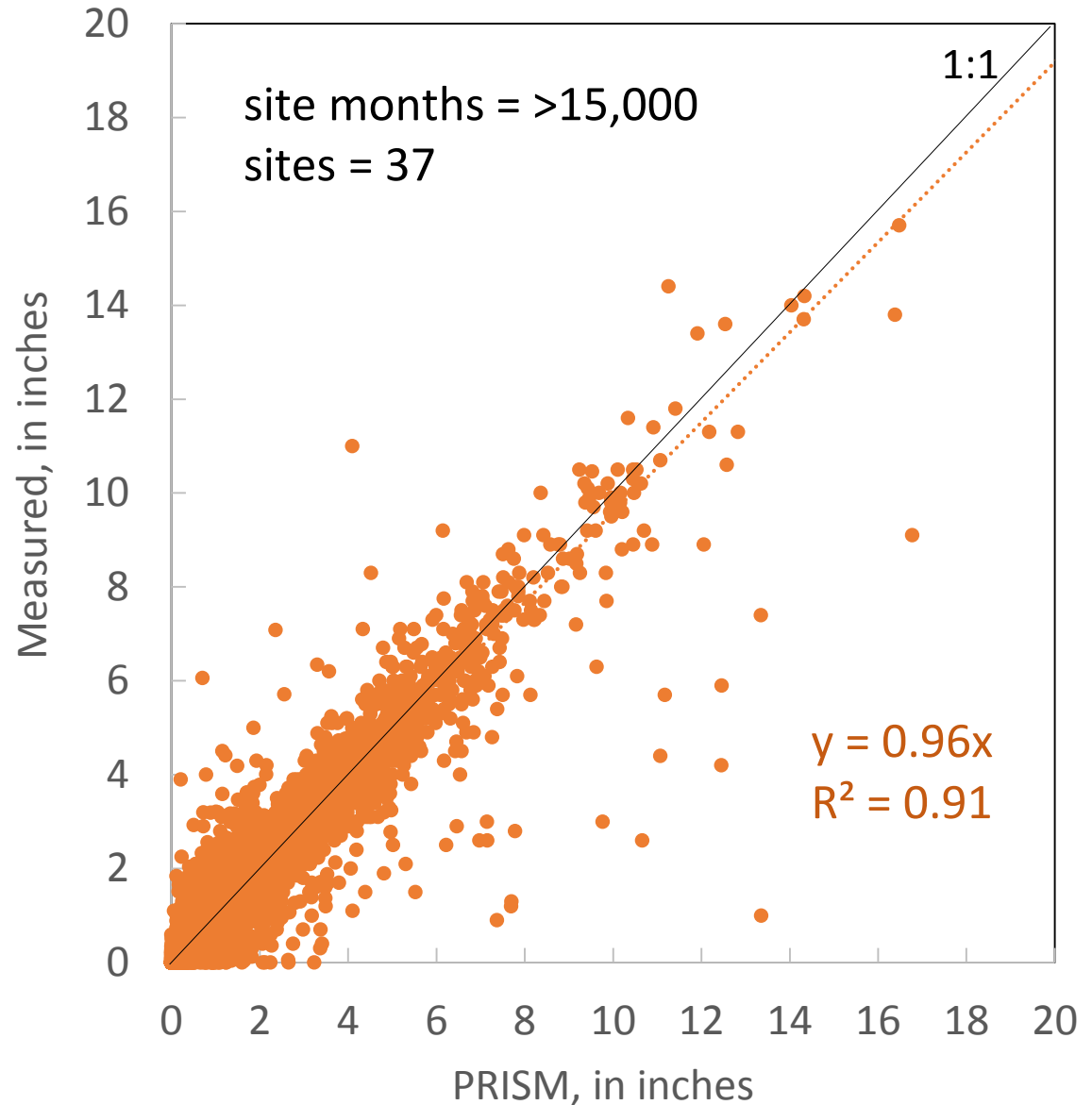
No RAWS



Monthly Precipitation 1900-2016

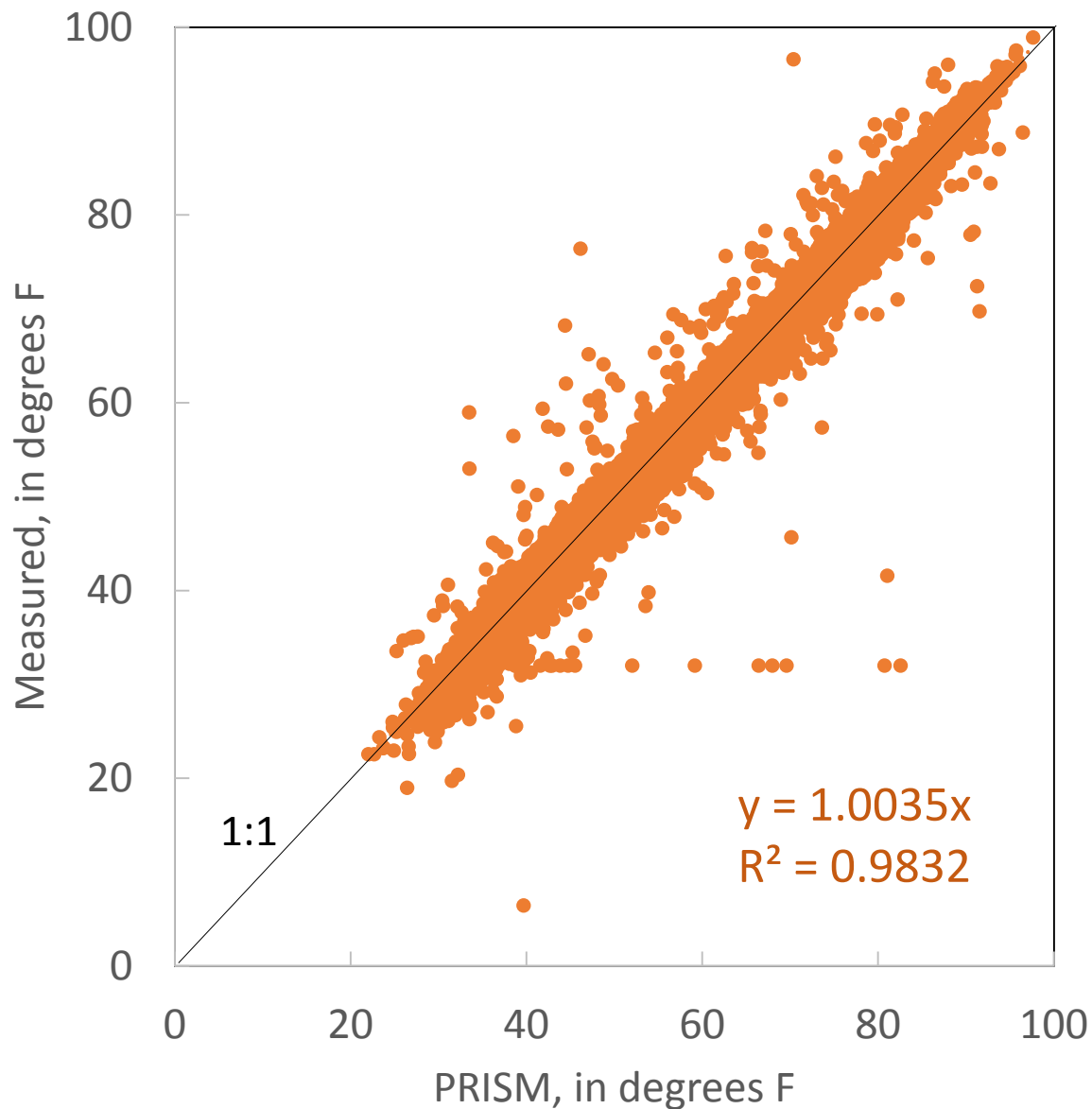
Sites:
COOP
SNOTEL
WBAN

No RAWS



Monthly Maximum Temperature 1900-2016

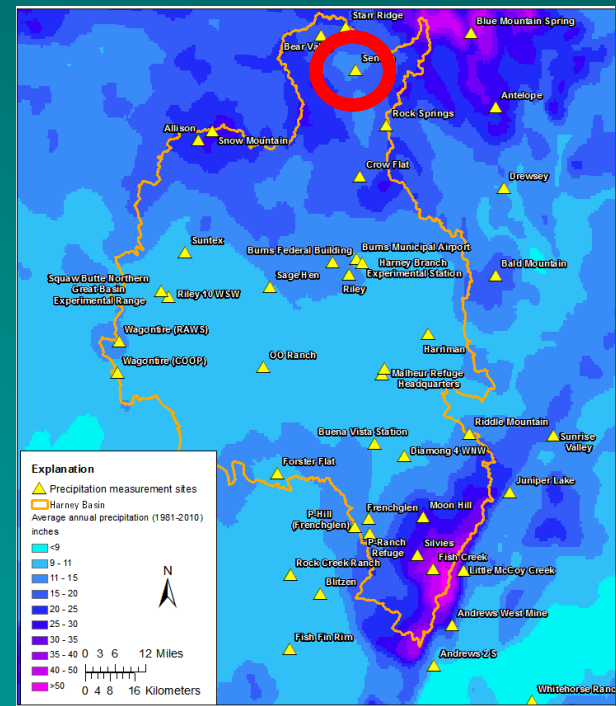
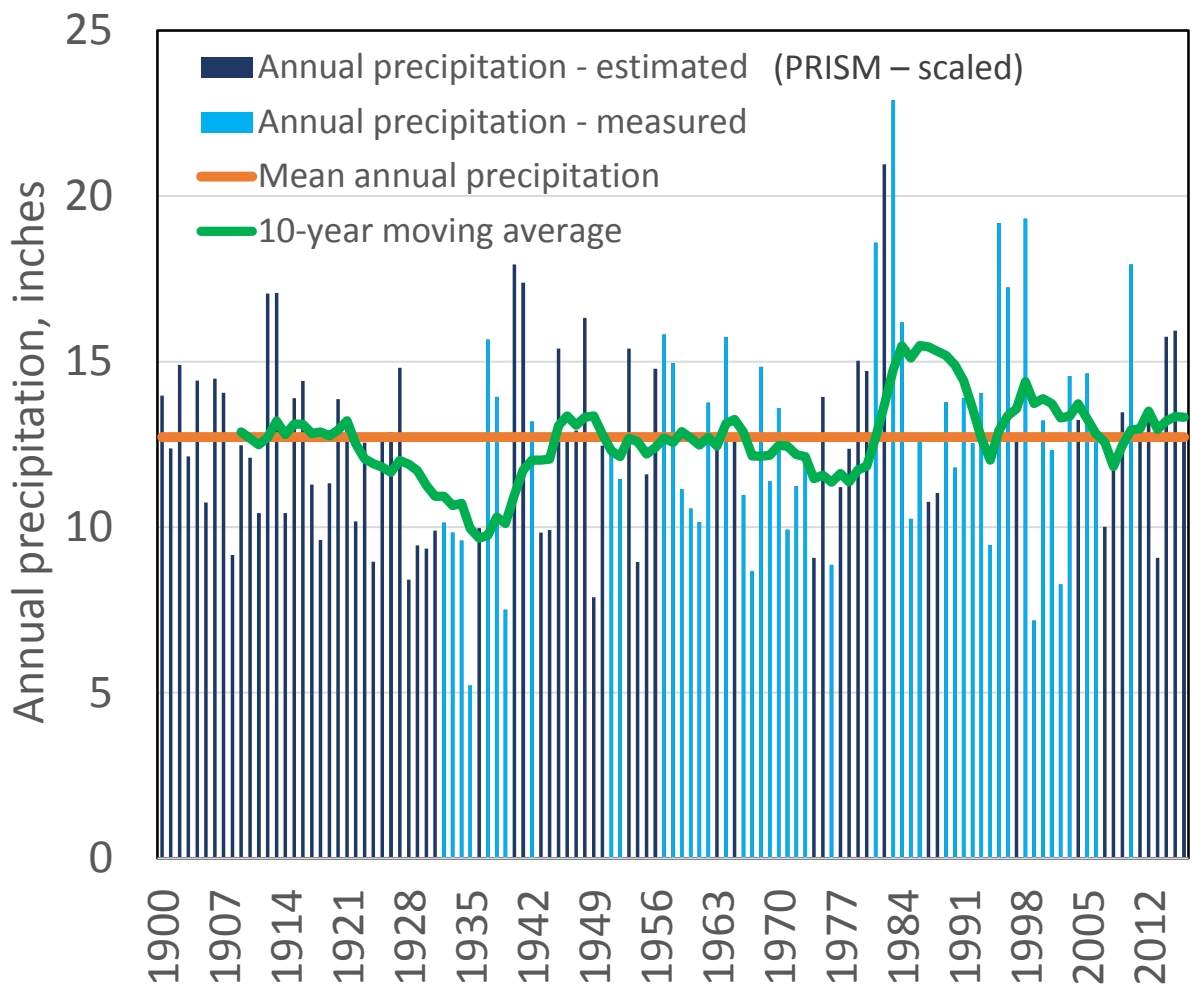
All sites:
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RAWS



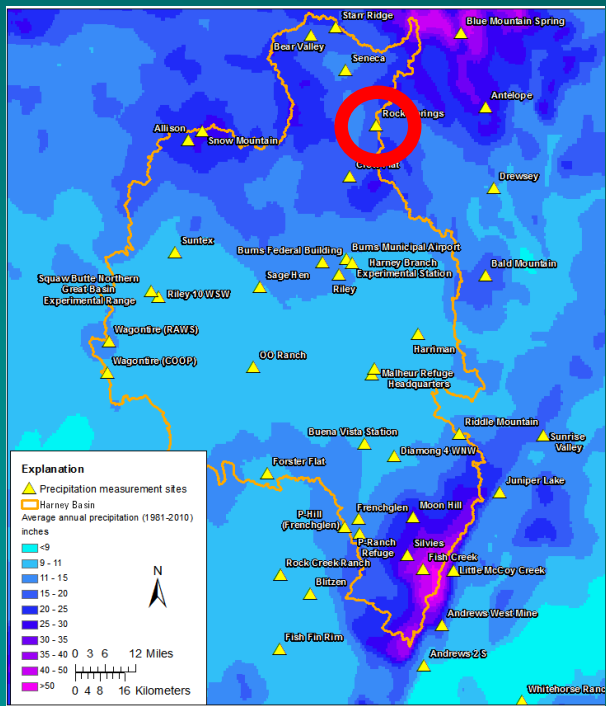
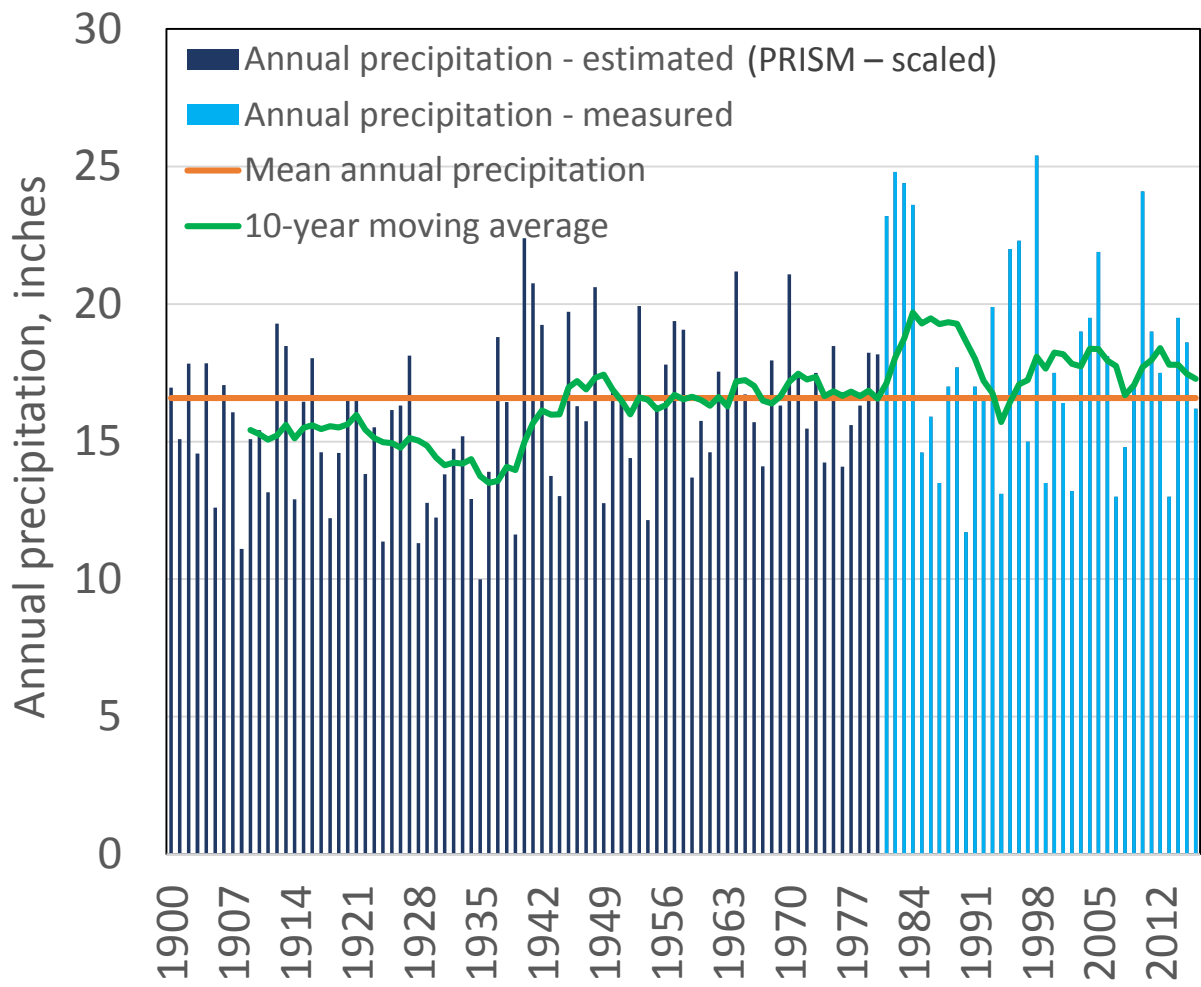
Long-Term Annual Precipitation

Provides a basis for understanding hydrologic conditions observed today and over the last 100 years

Annual Precipitation 1900-2016, Seneca COOP

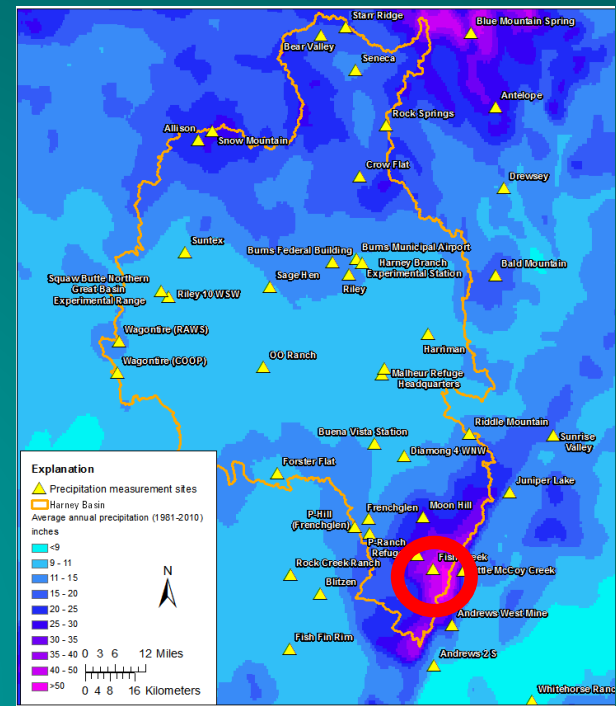
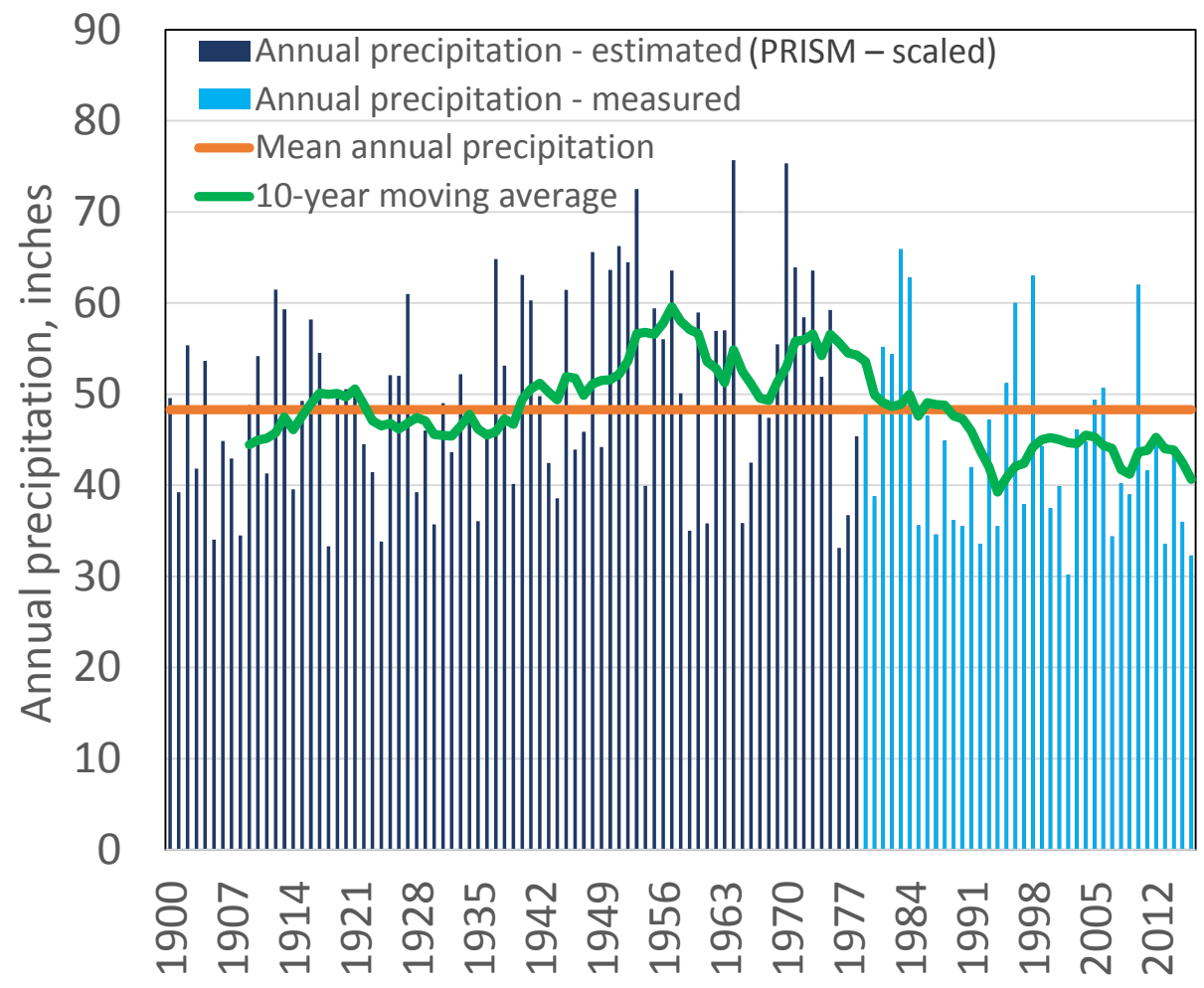


Annual Precipitation 1900-2016, Rock Springs SNOTEL

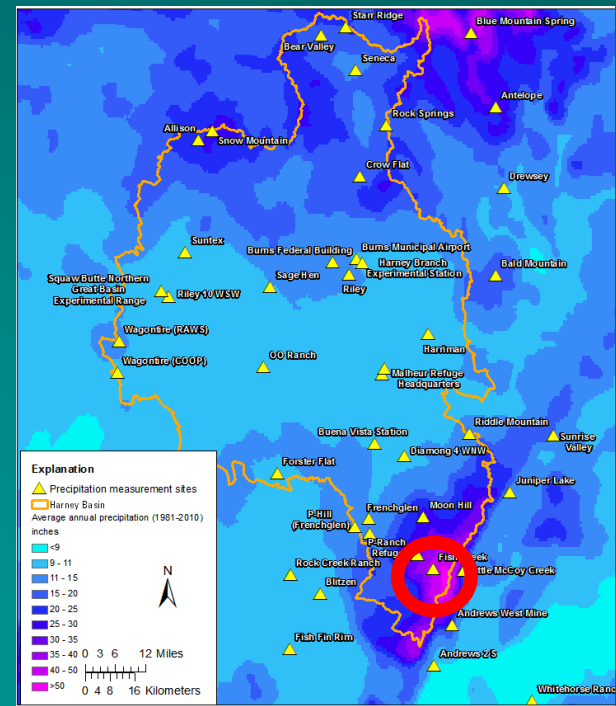
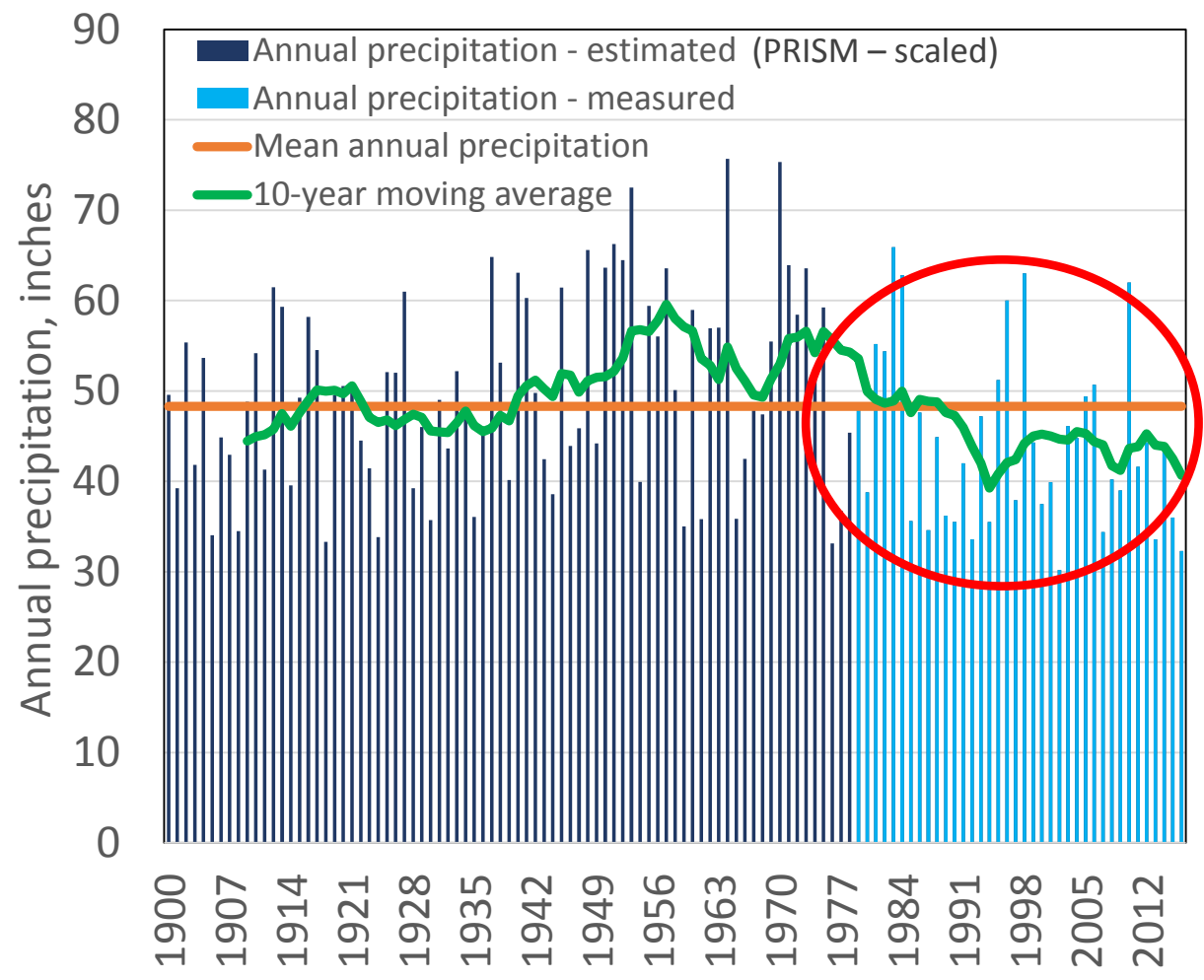


*Same trend as Seneca COOP provides confidence in estimates over the long-term record

Annual Precipitation 1900-2016, Fish Creek SNOTEL



Annual Precipitation 1900-2016, Fish Creek SNOTEL

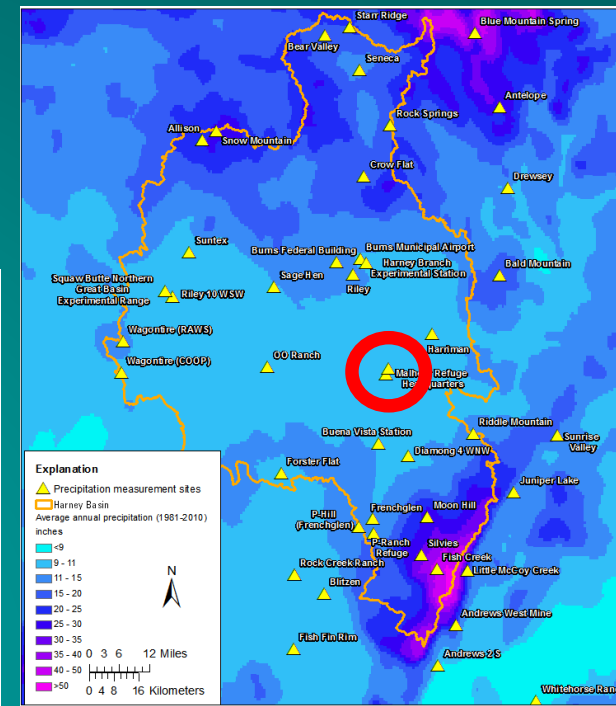
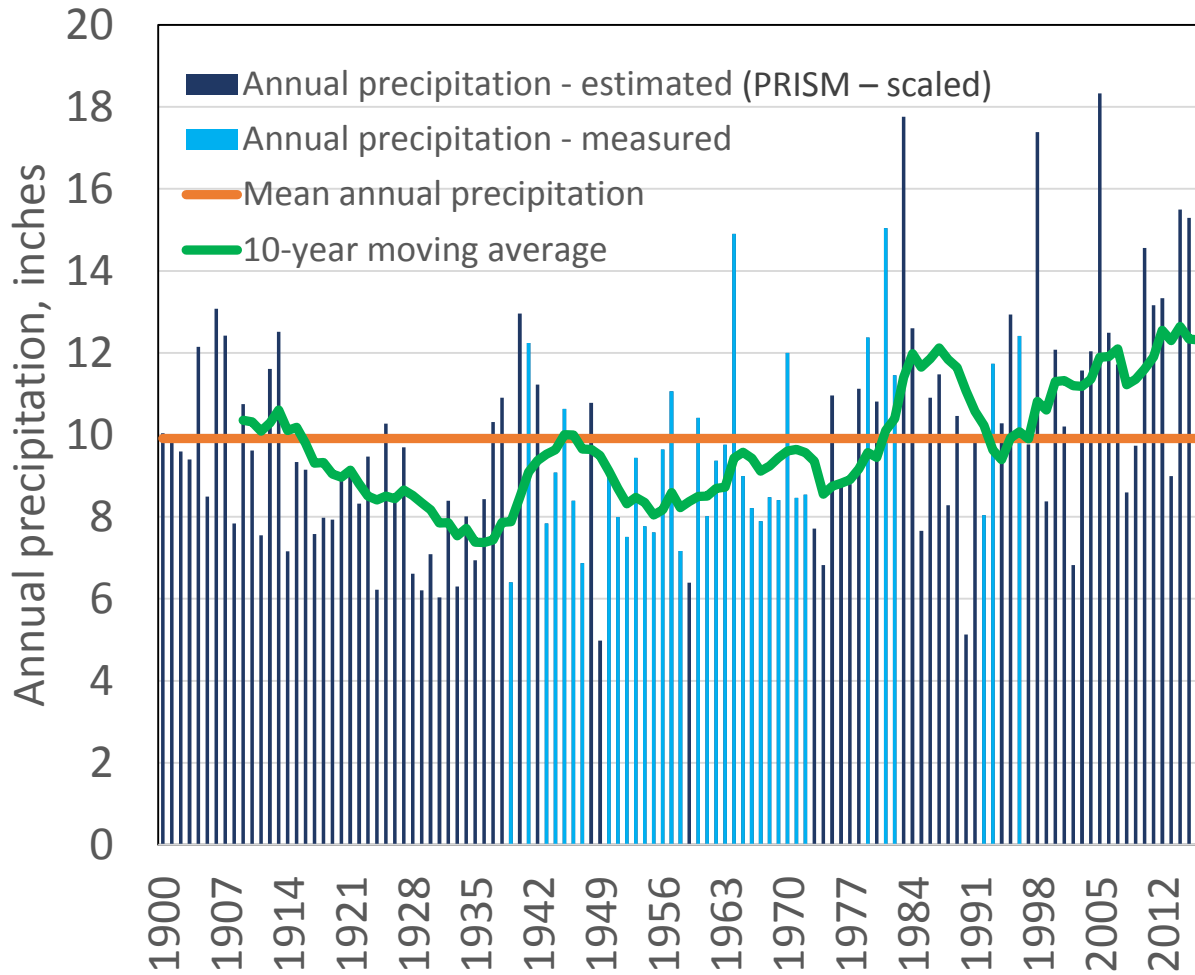


* High altitude Steens precipitation declining since the 1980s

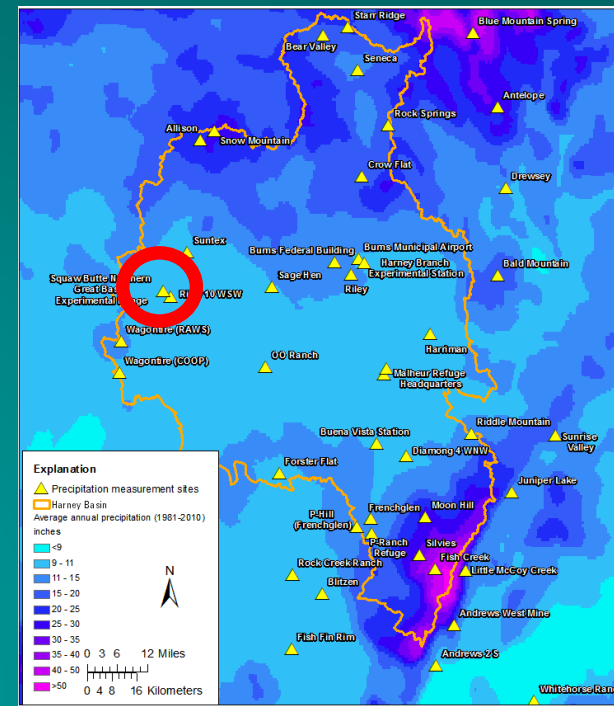
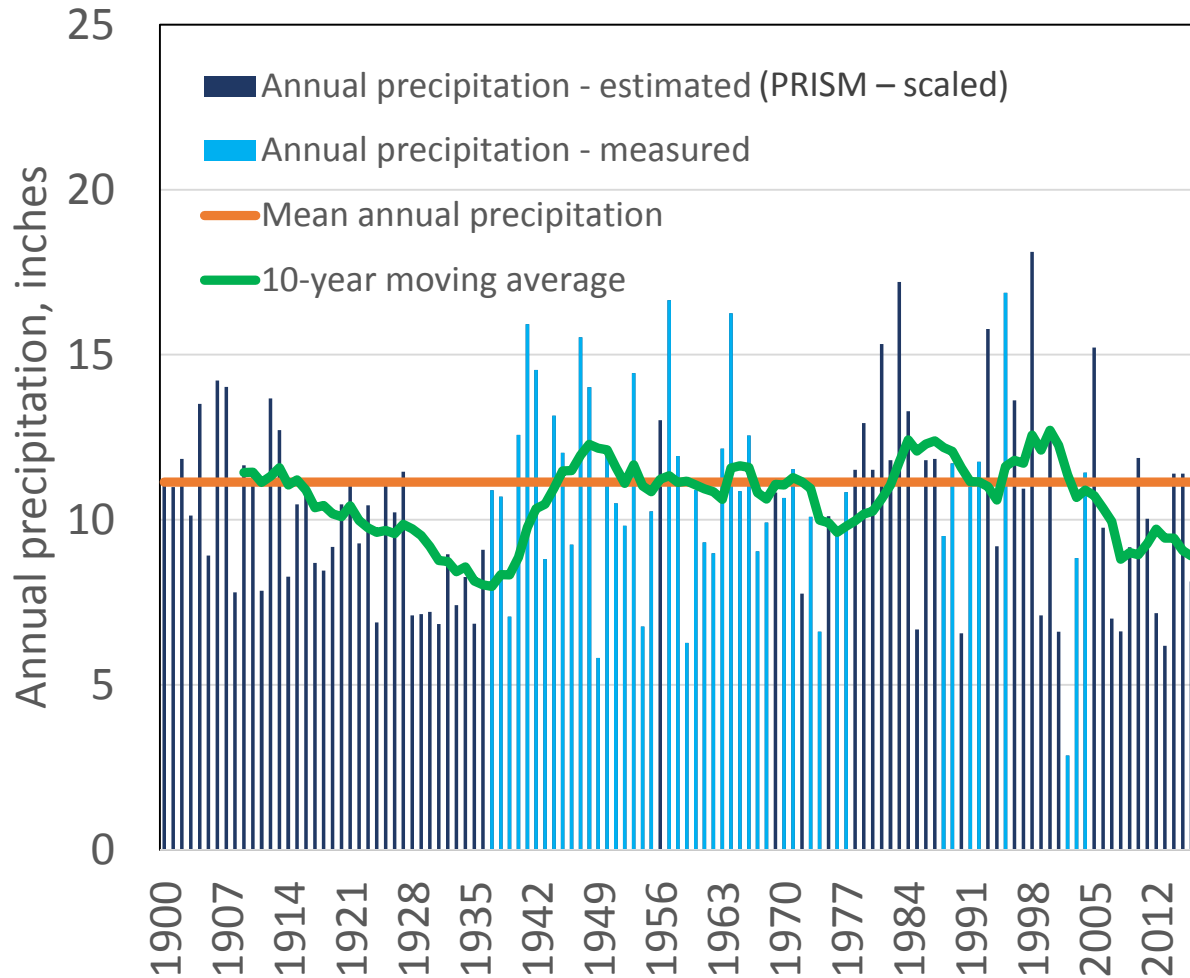


Preliminary results, do not cite.

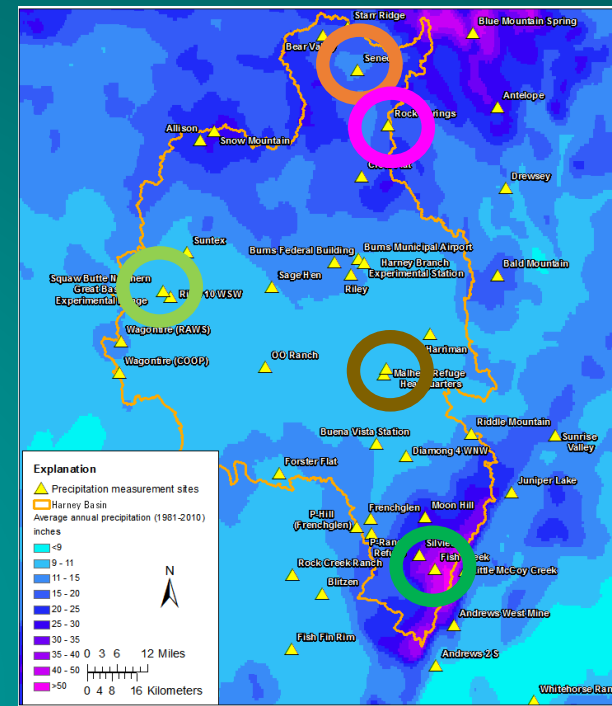
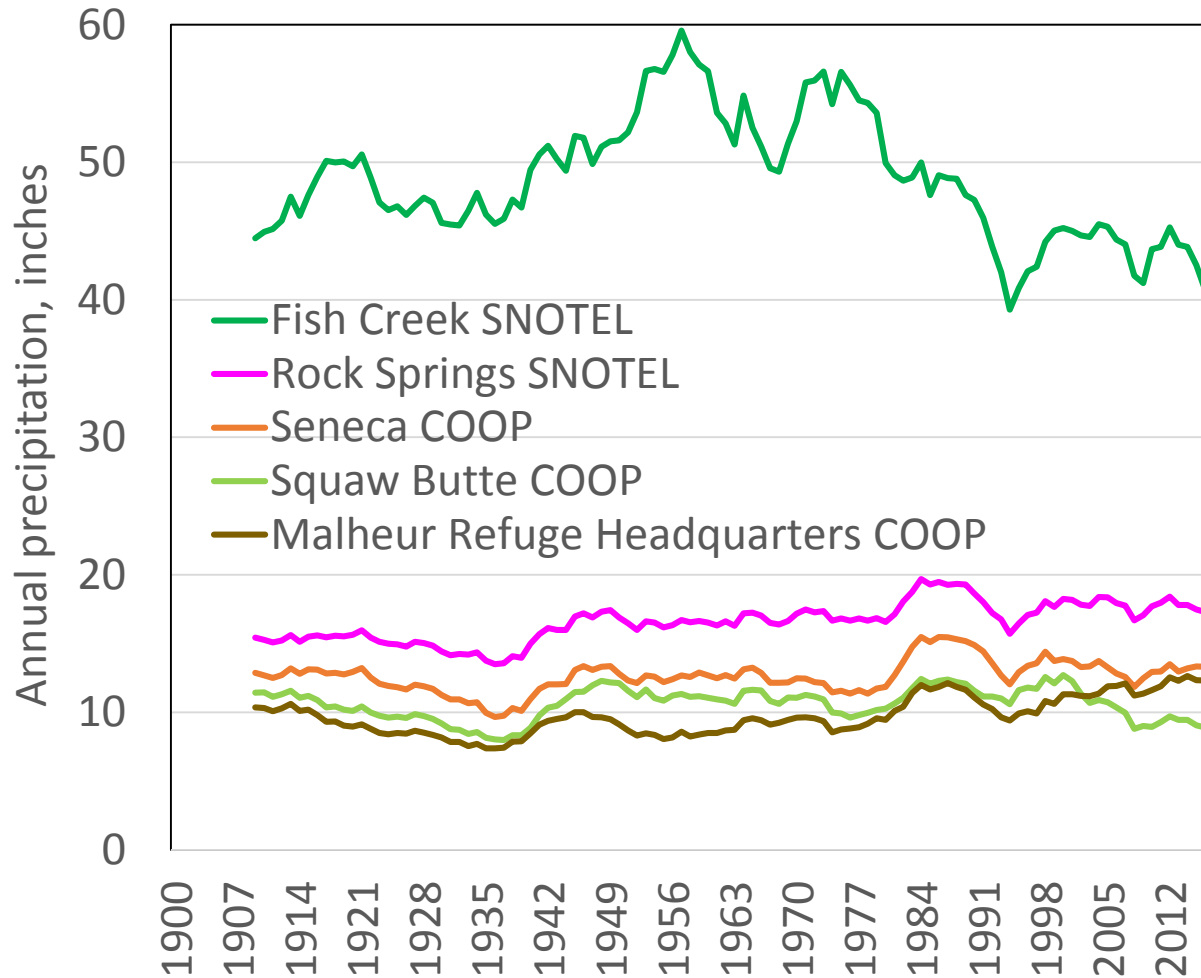
Annual Precipitation 1900-2016, Malheur Refuge Headquarters COOP



Annual Precipitation 1900-2016, Squaw Butte COOP



Annual Precipitation 1900-2016, 10-year Moving Average



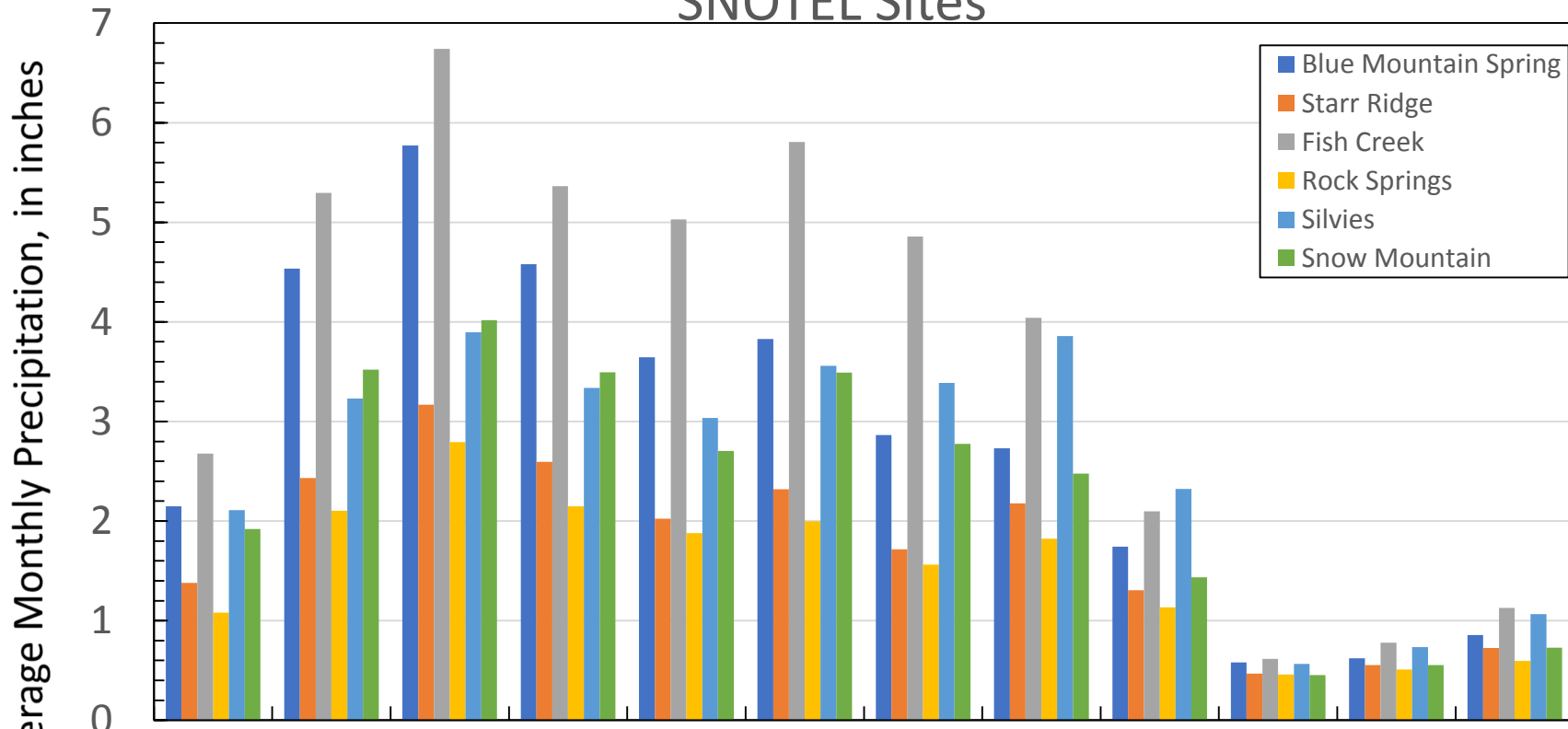
*Variability at Fish Creek site impacts regional hydrology

*Variability at lowland sites impacts local hydrology

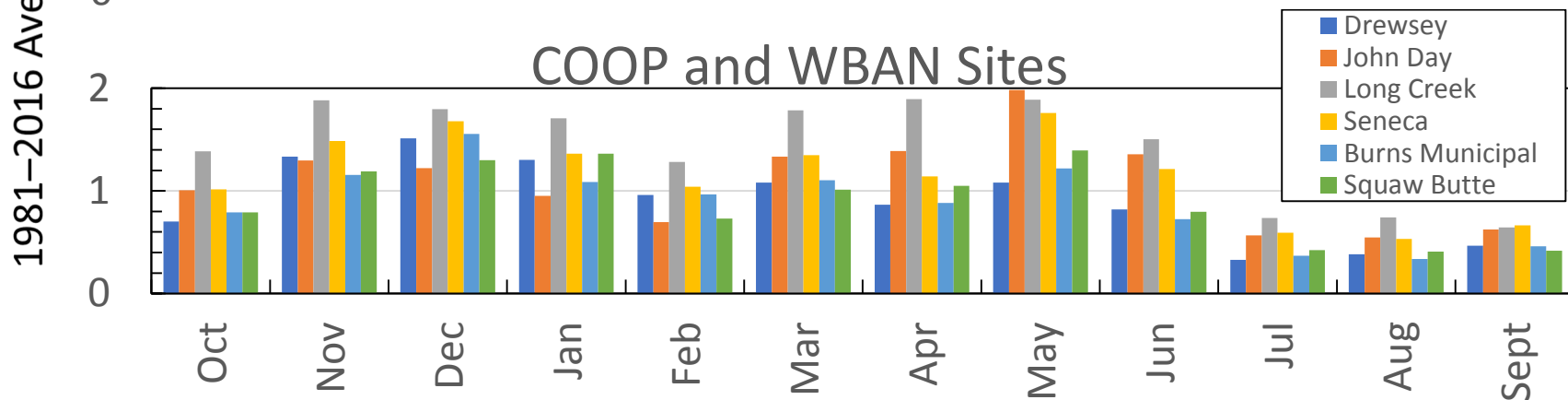
Average Monthly Precipitation

Provides a basis for understanding seasonal changes in hydrologic conditions over the recent past

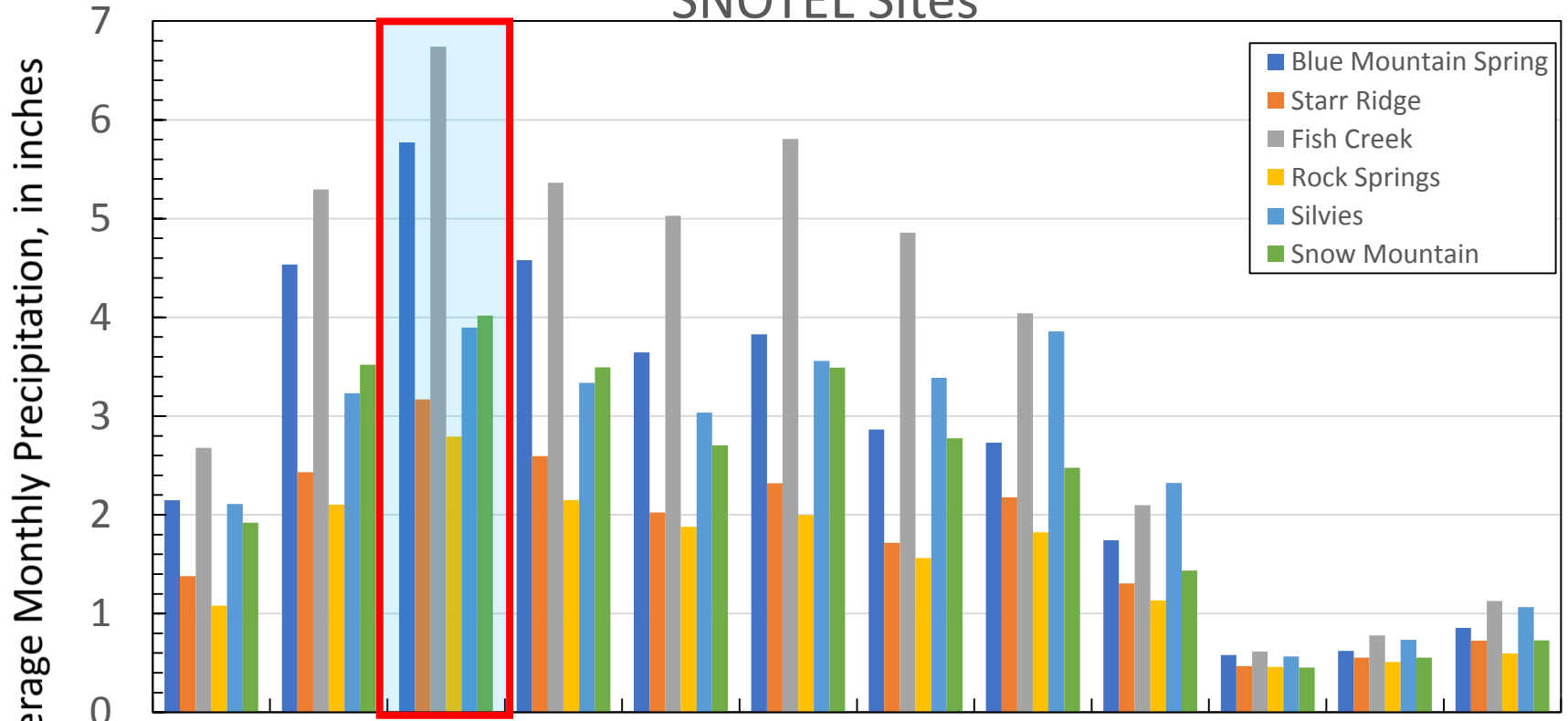
SNOTEL Sites



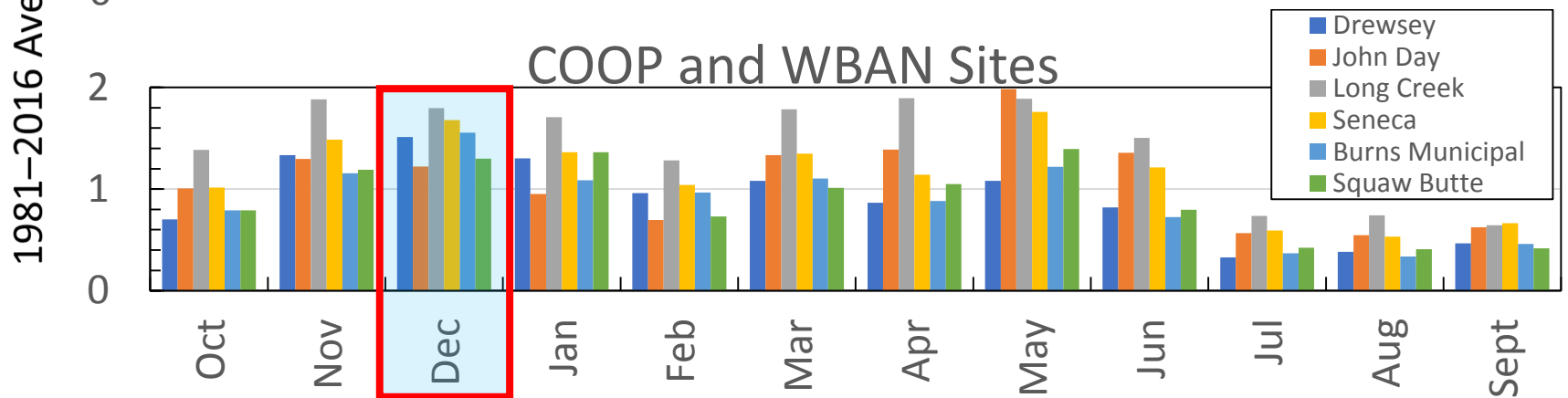
COOP and WBAN Sites



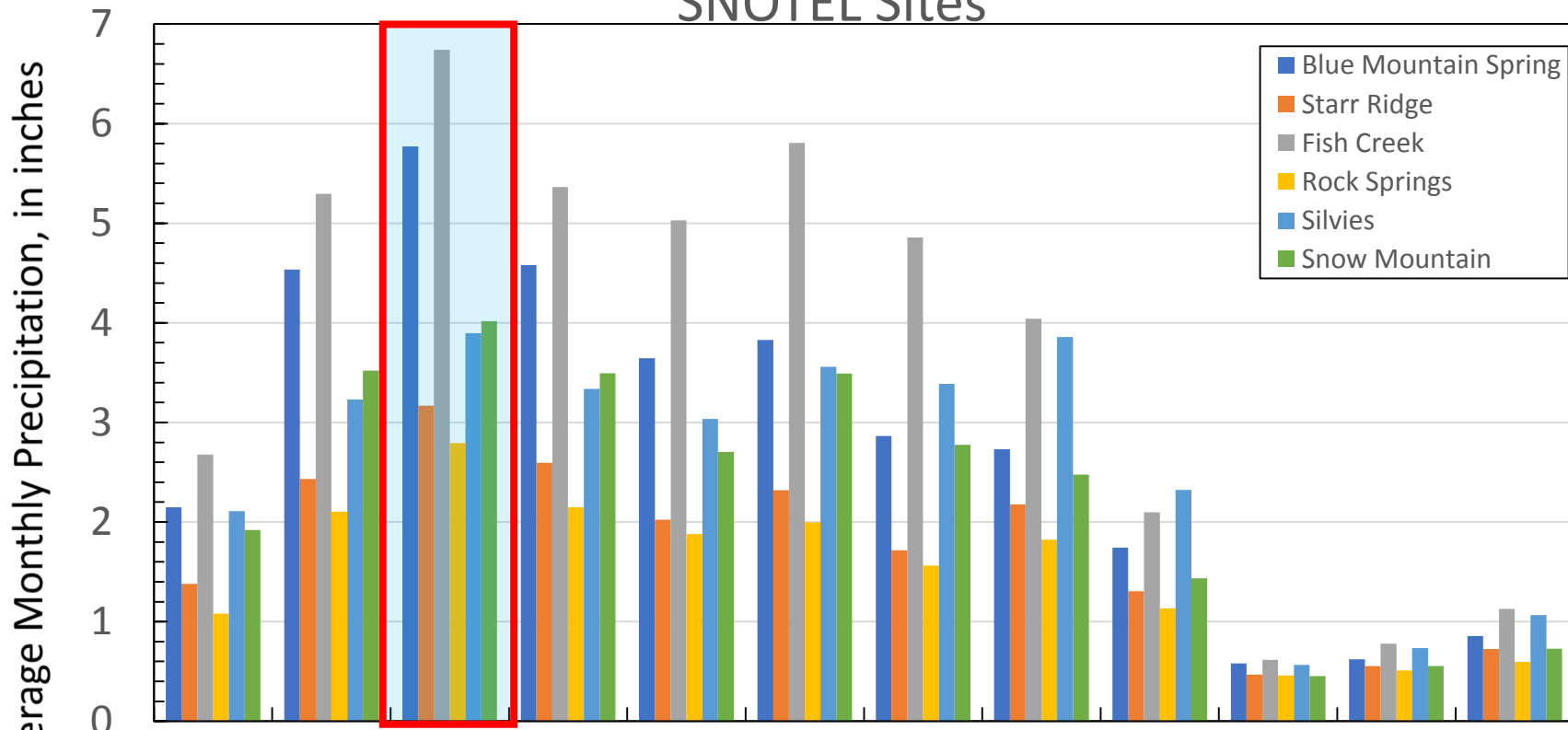
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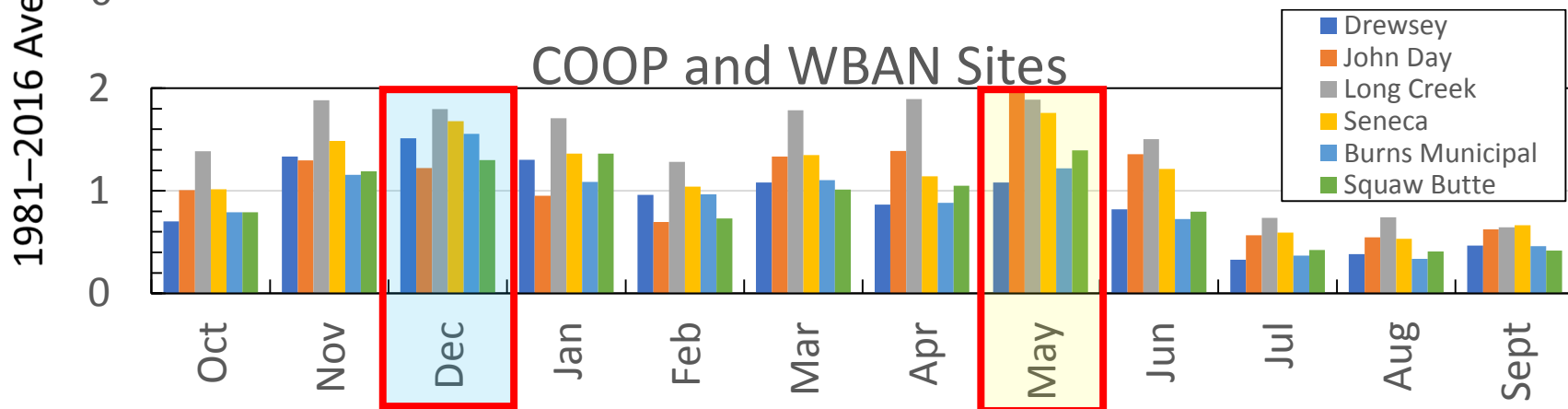
COOP and WBAN Sites



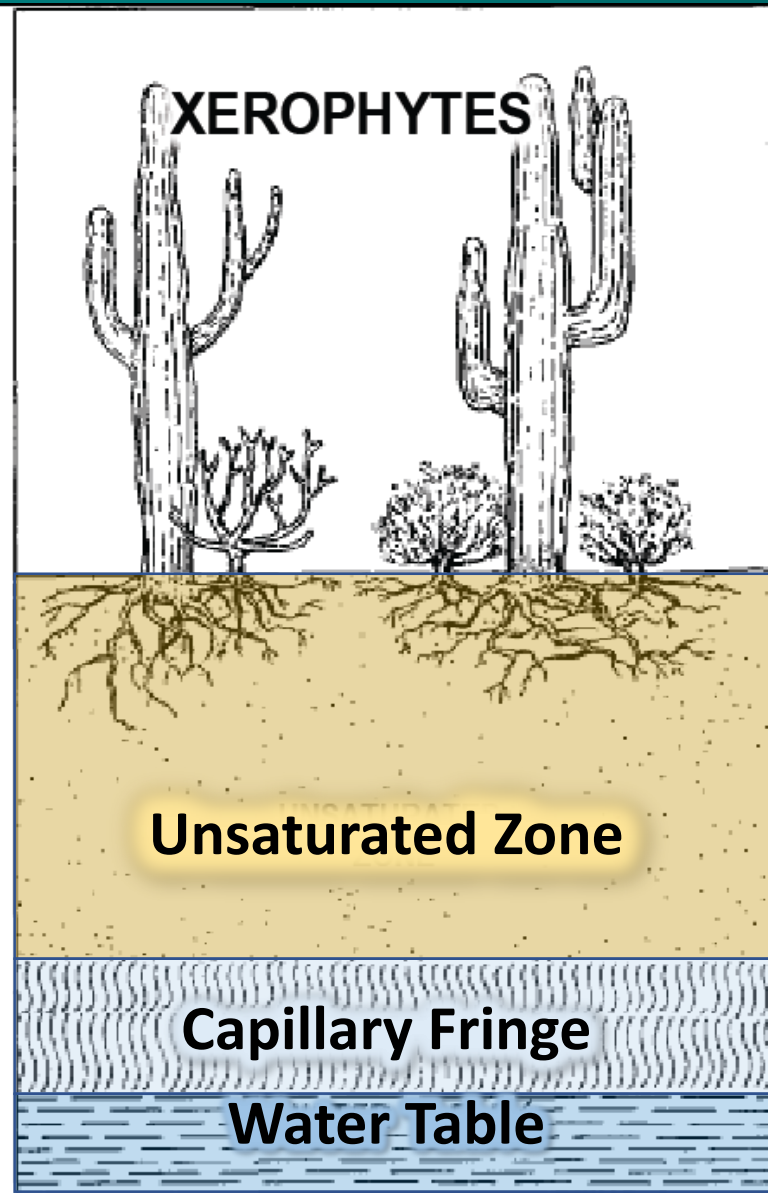
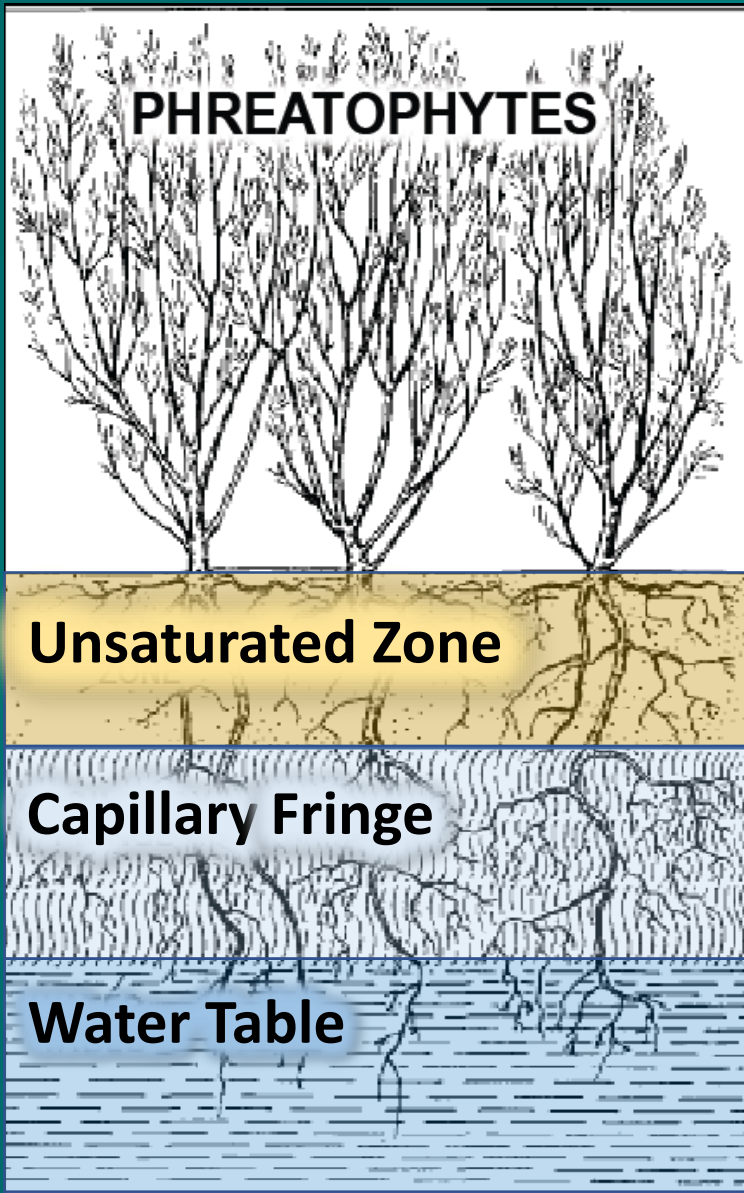
SNOTEL Sites



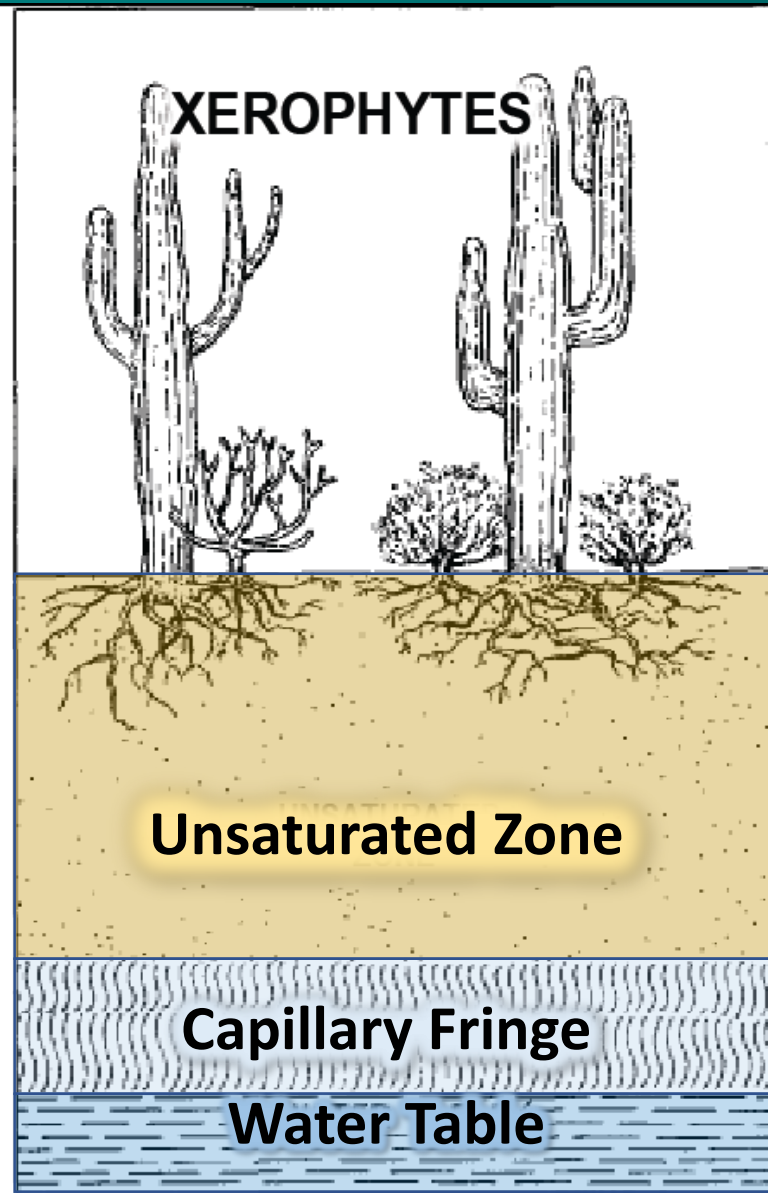
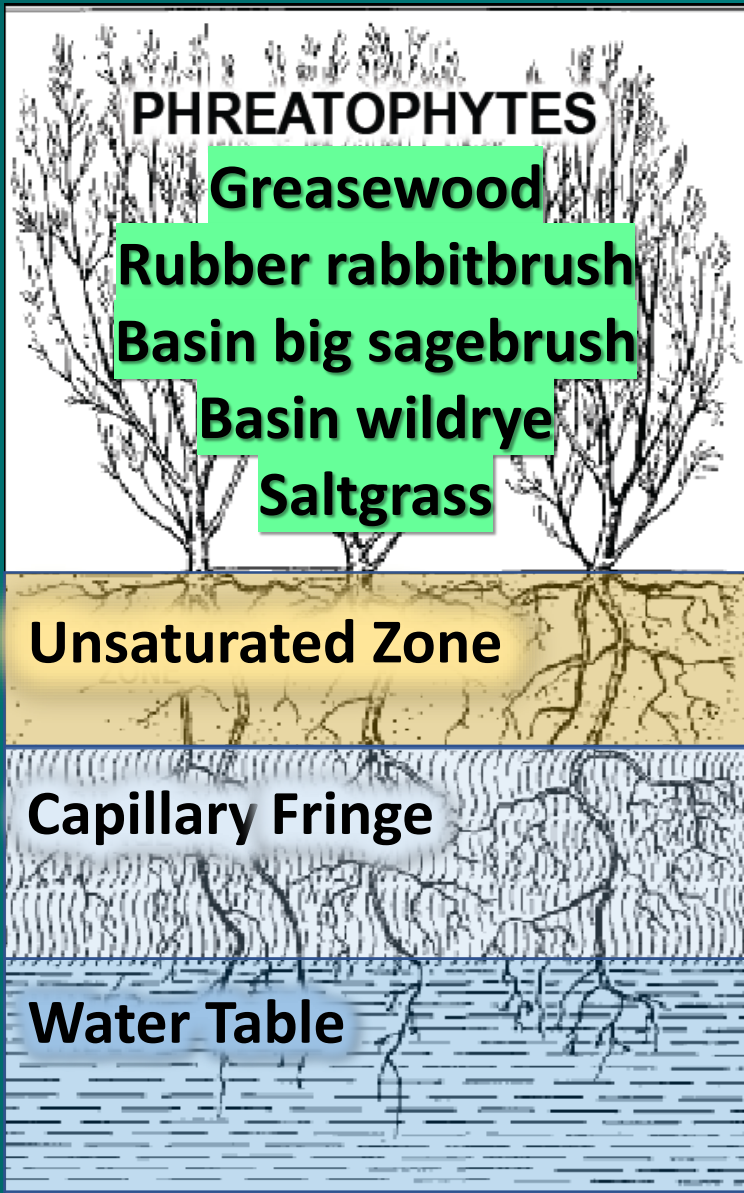
COOP and WBAN Sites



Plant-Water Sourcing with Stable Isotopes

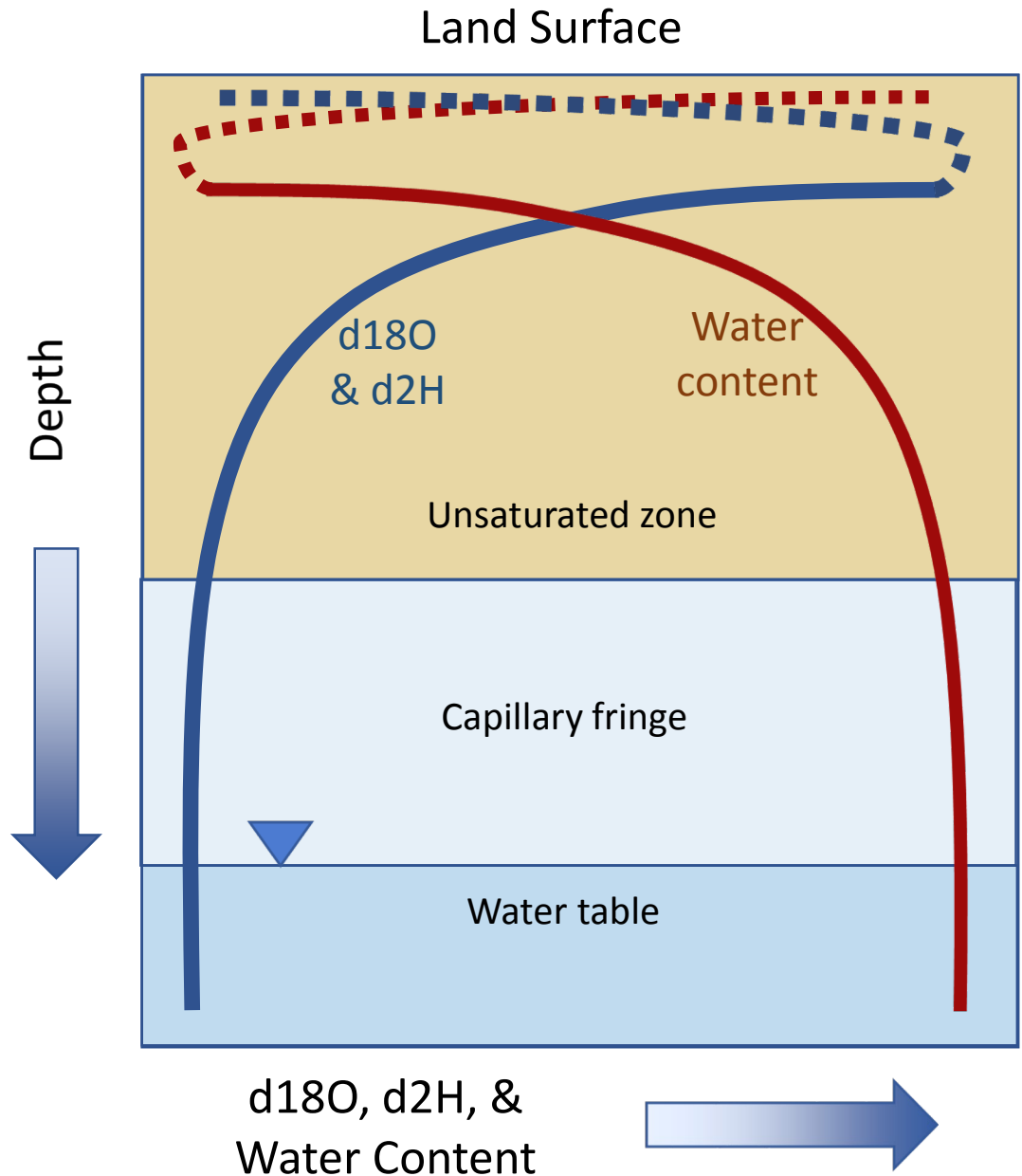


Robinson (1958)

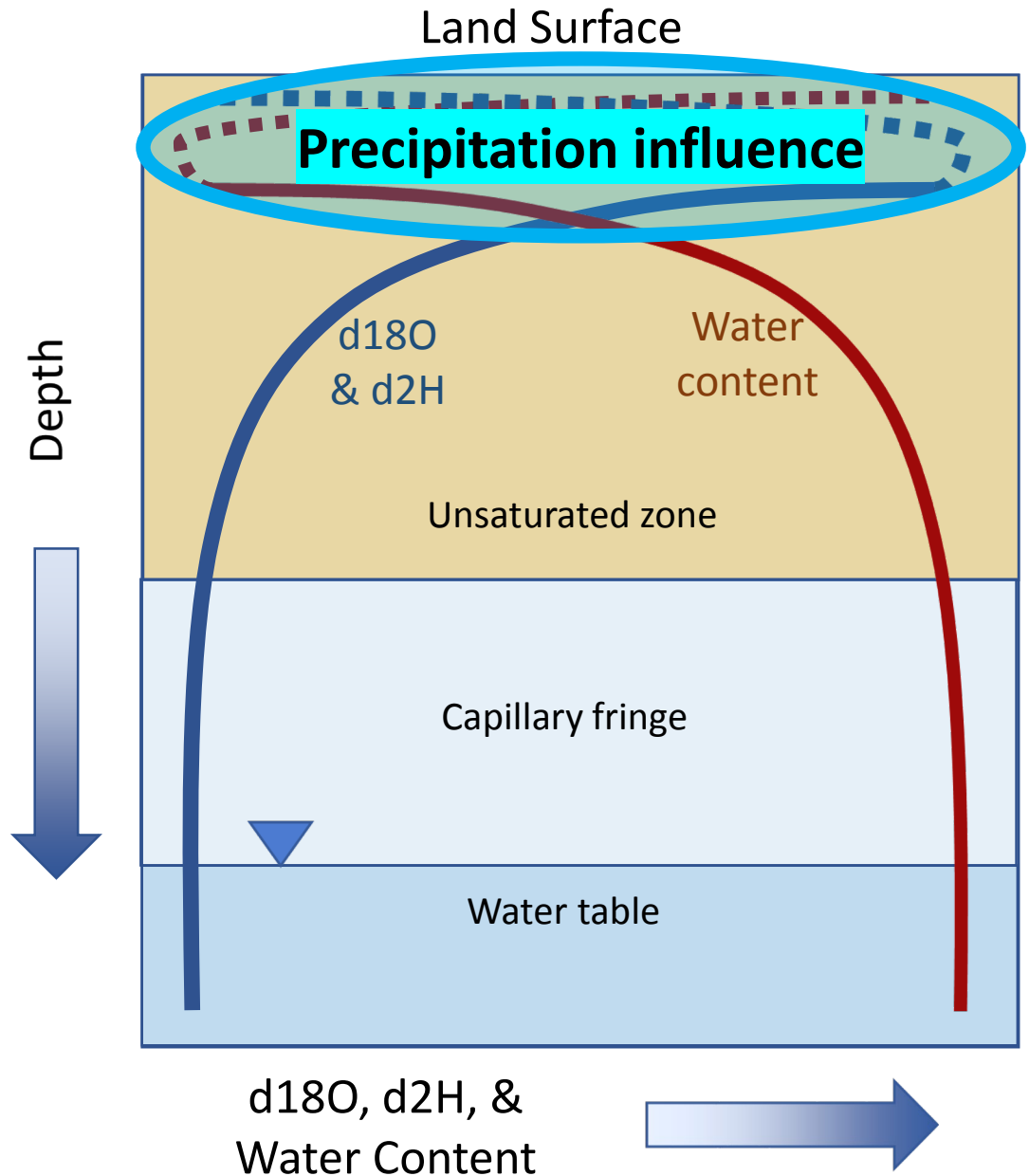


Robinson (1958)

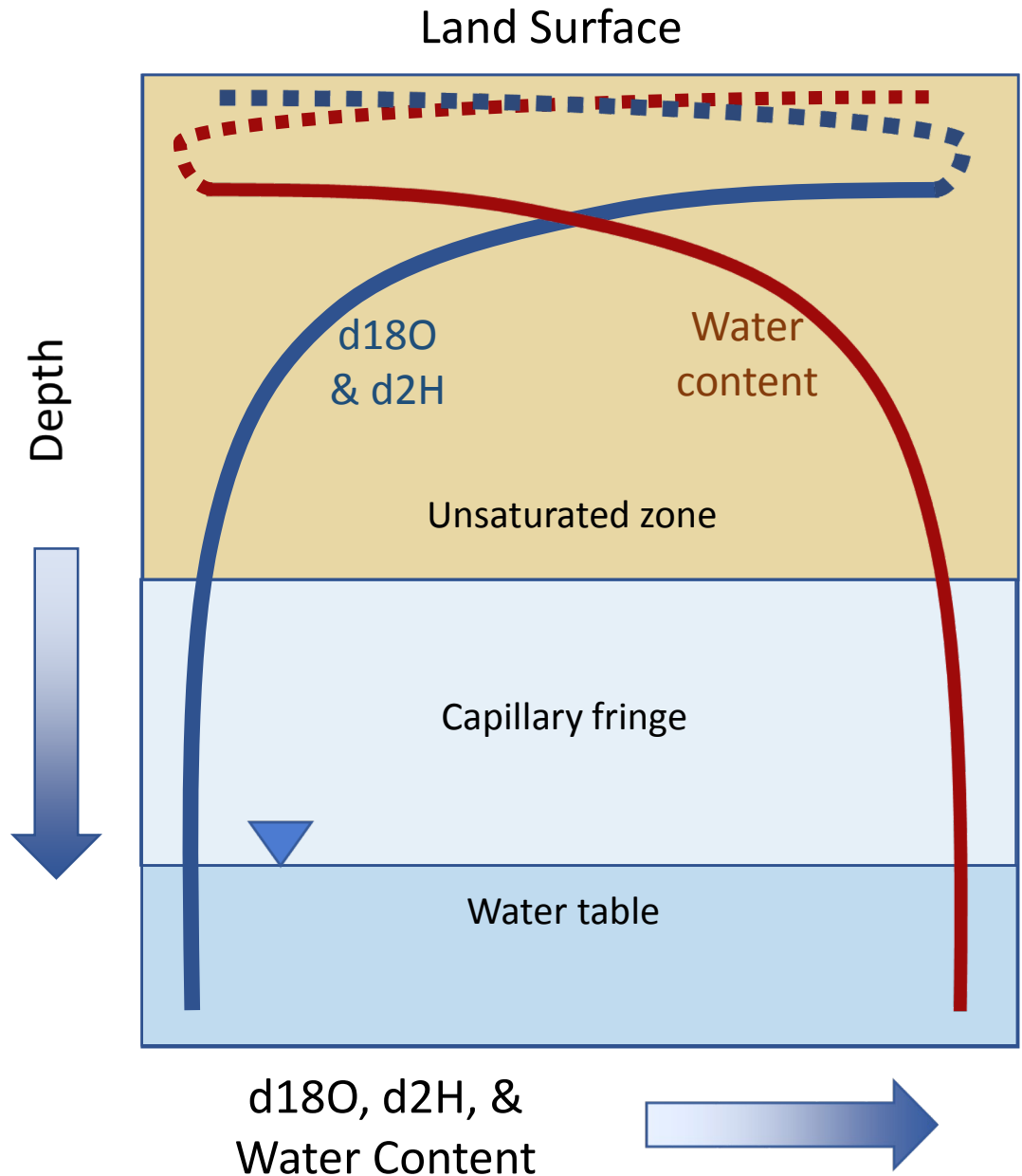
Isotopic composition with depth-below land surface

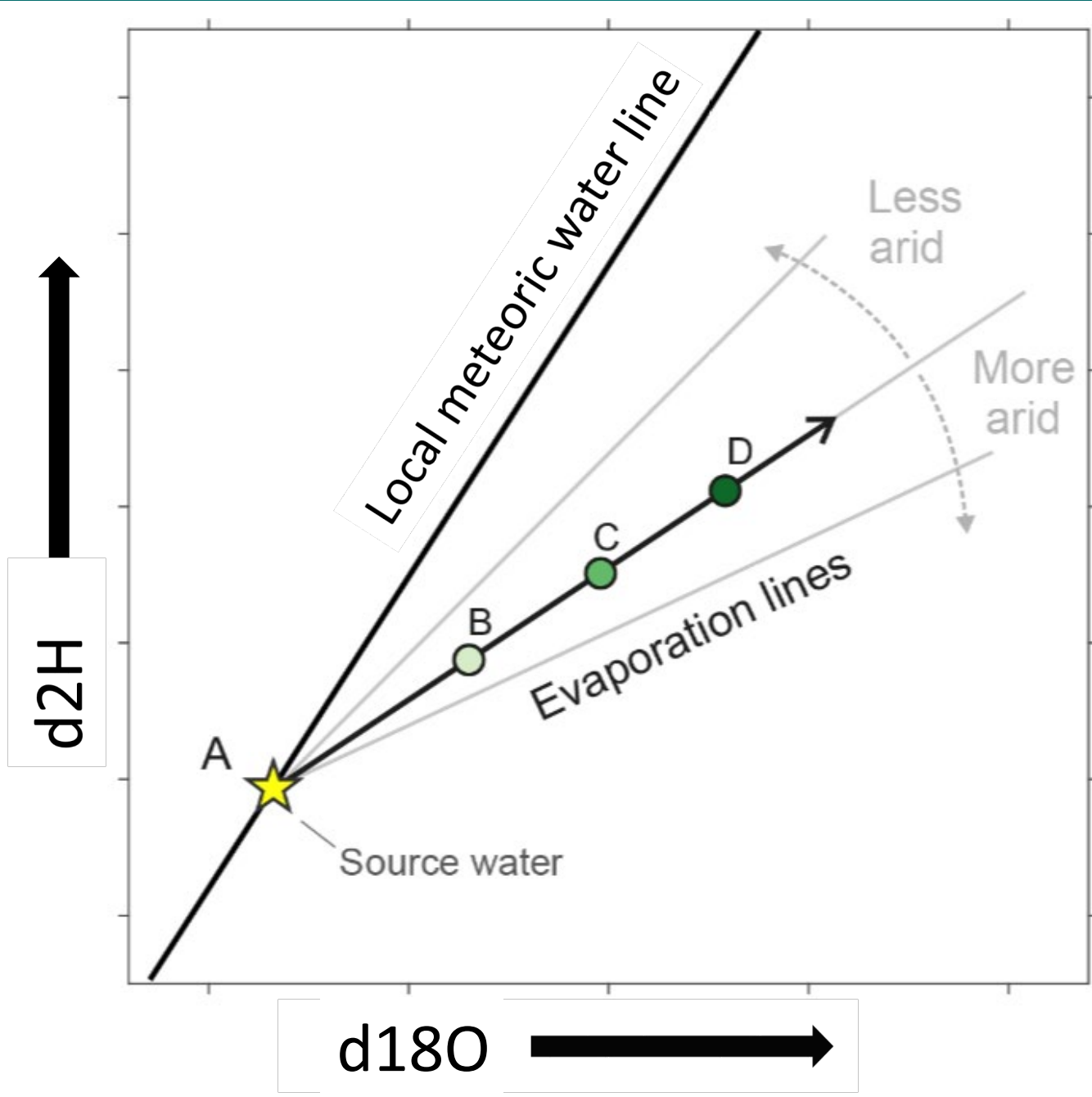


Isotopic composition with depth-below land surface

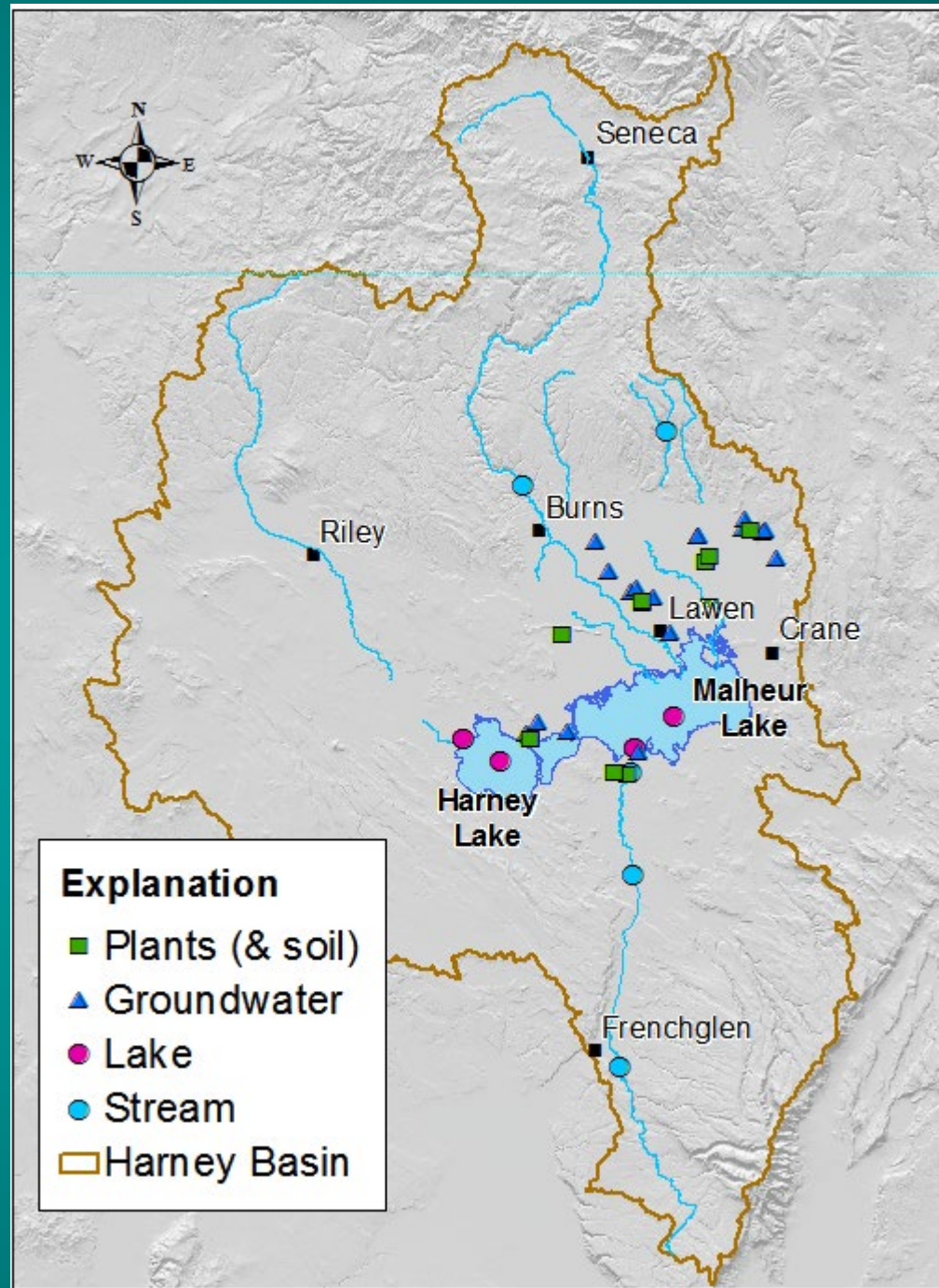


Isotopic composition with depth-below land surface

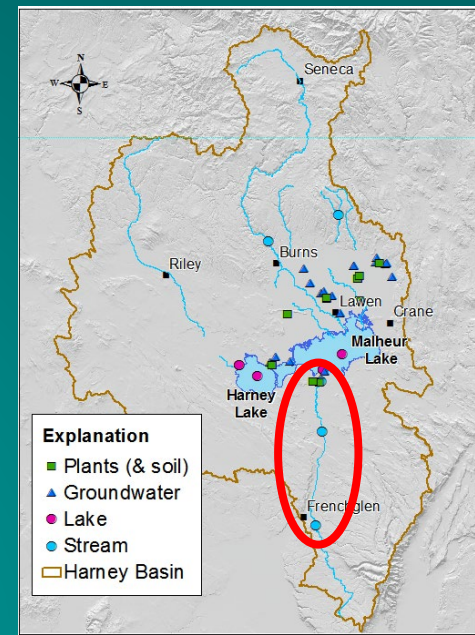
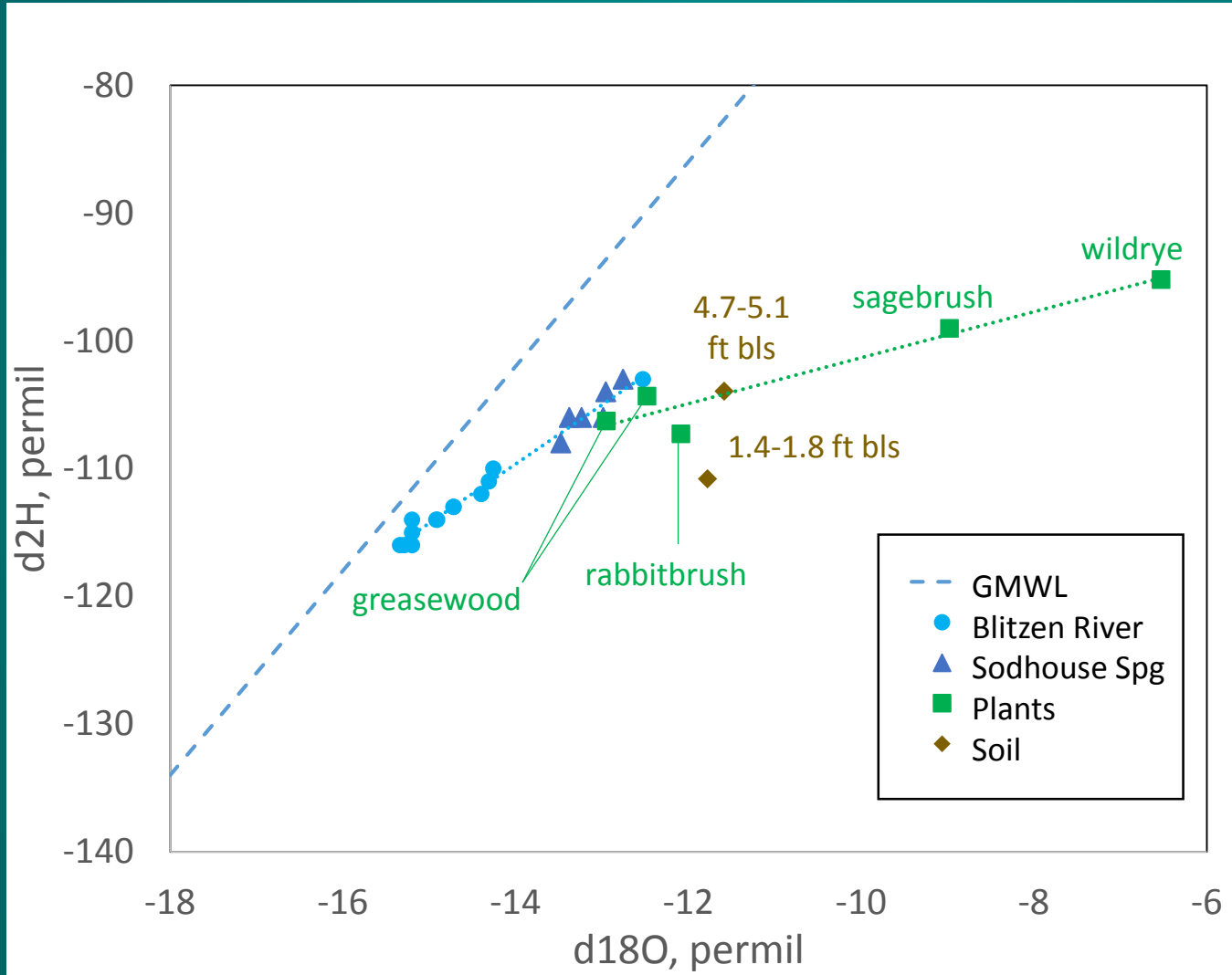




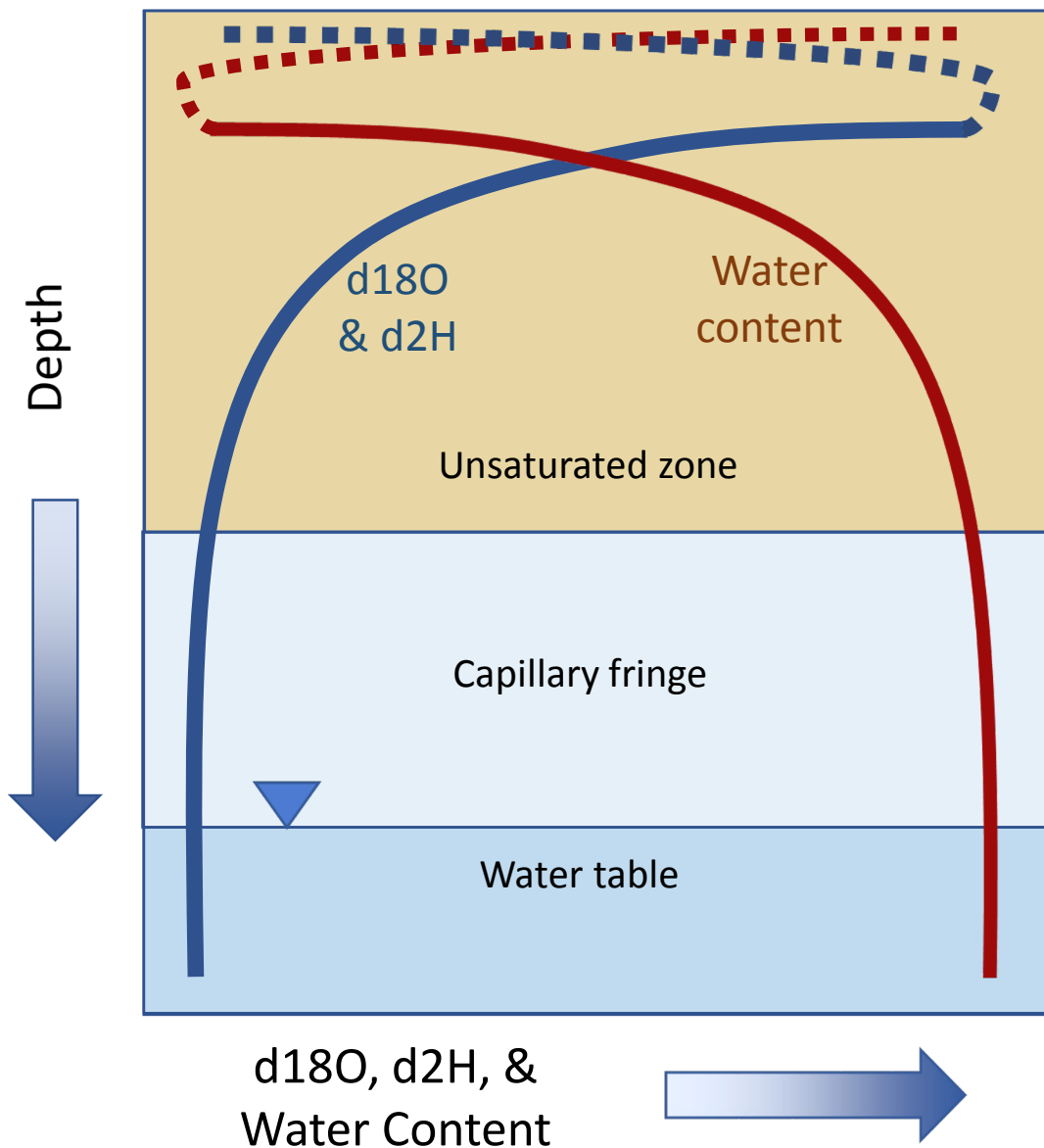
Sample locations



Malheur Field Station



Land Surface

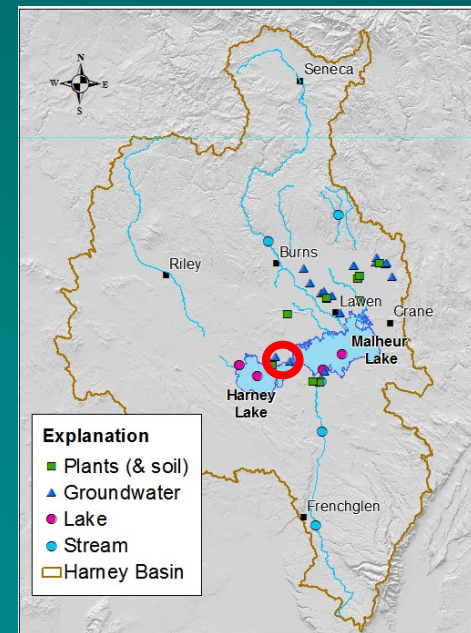
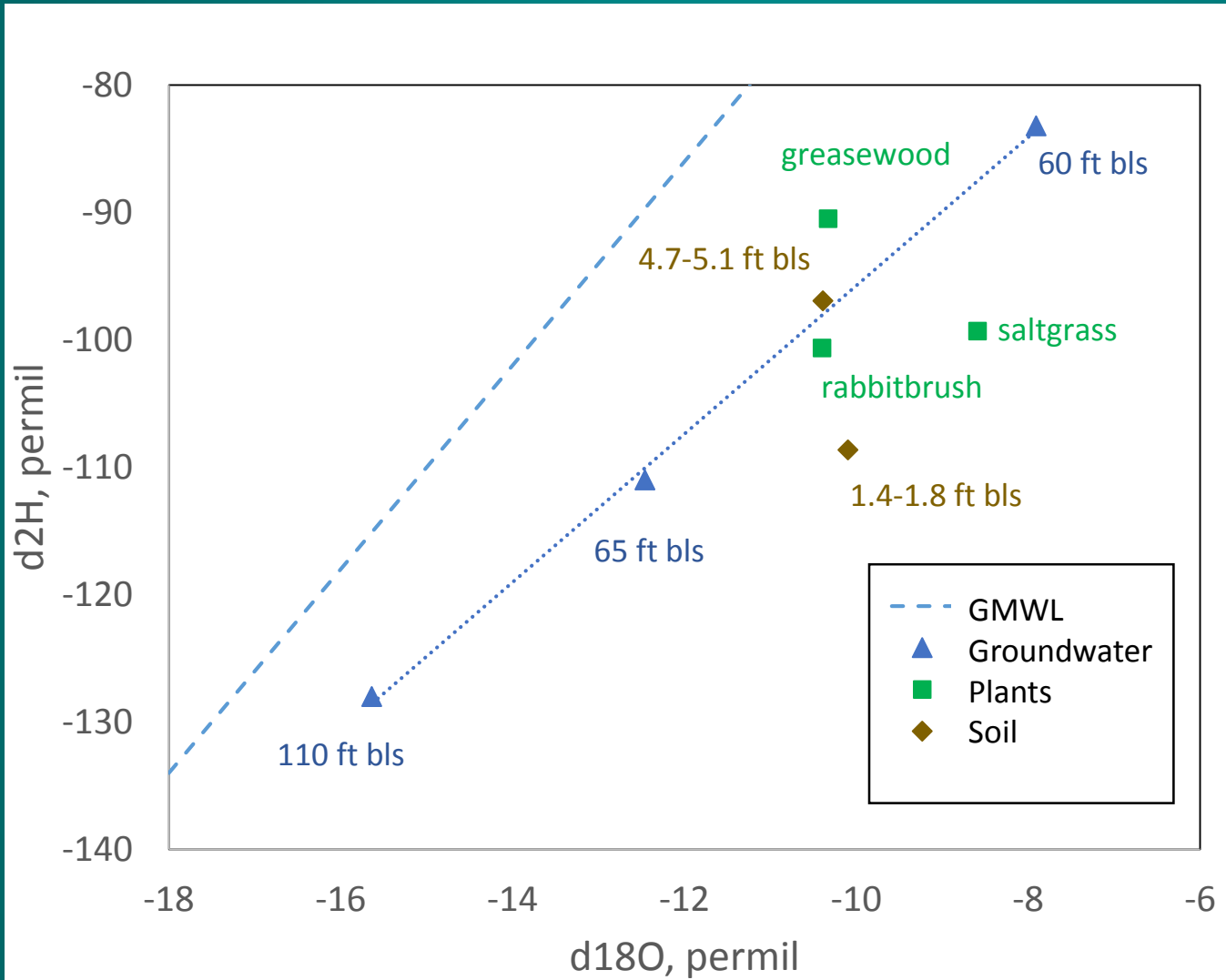


wildrye & sagebrush

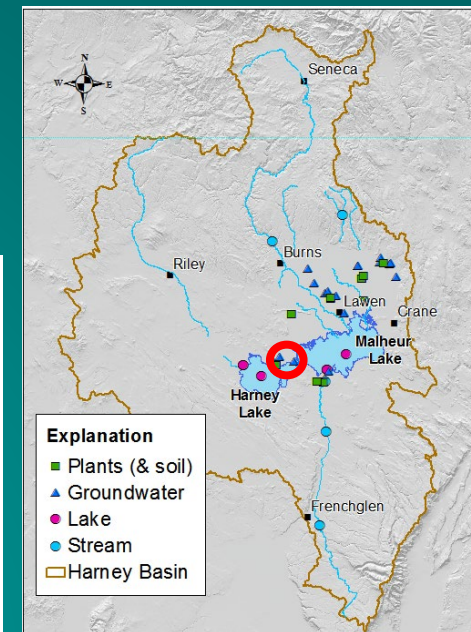
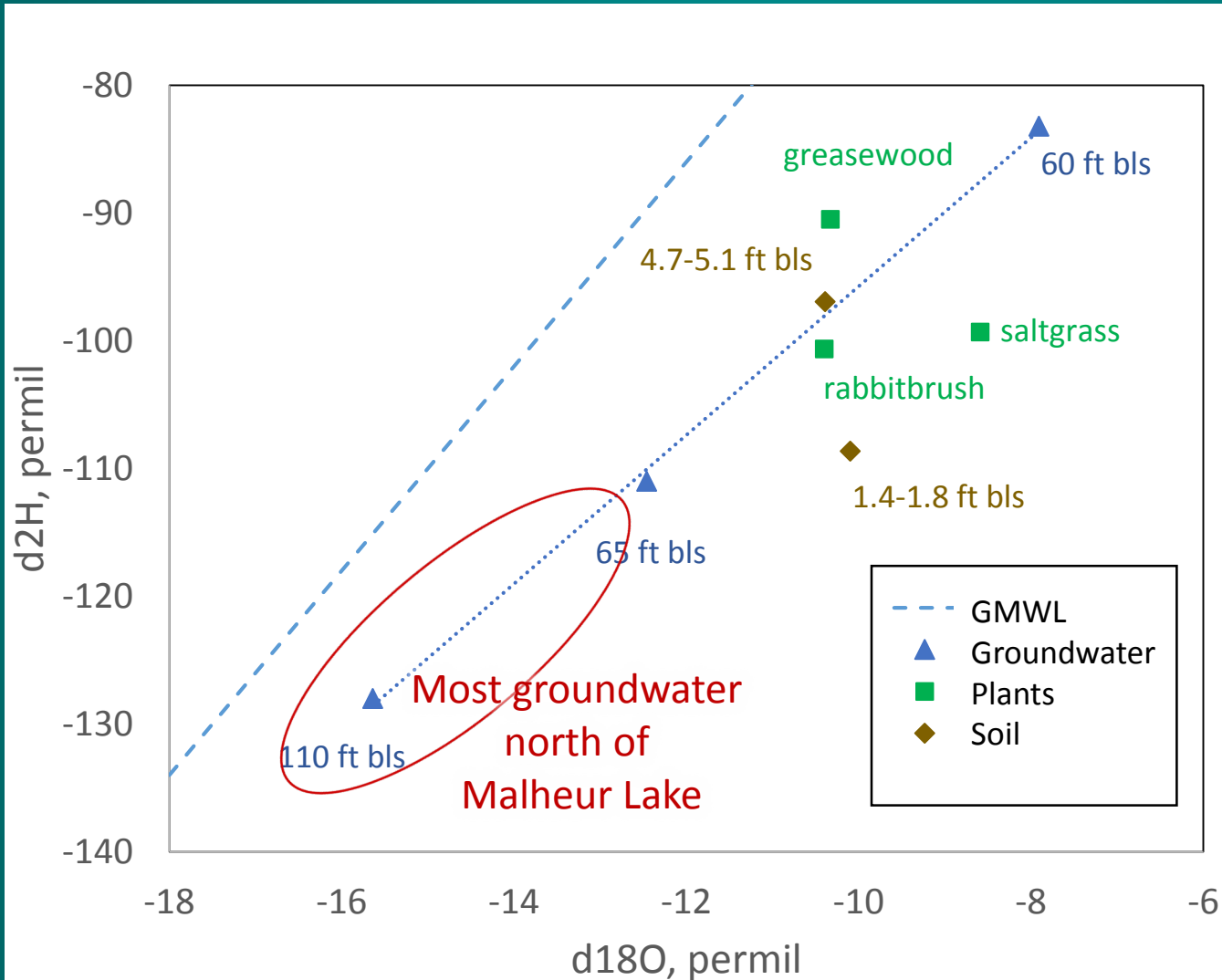


rabbitbrush & greasewood

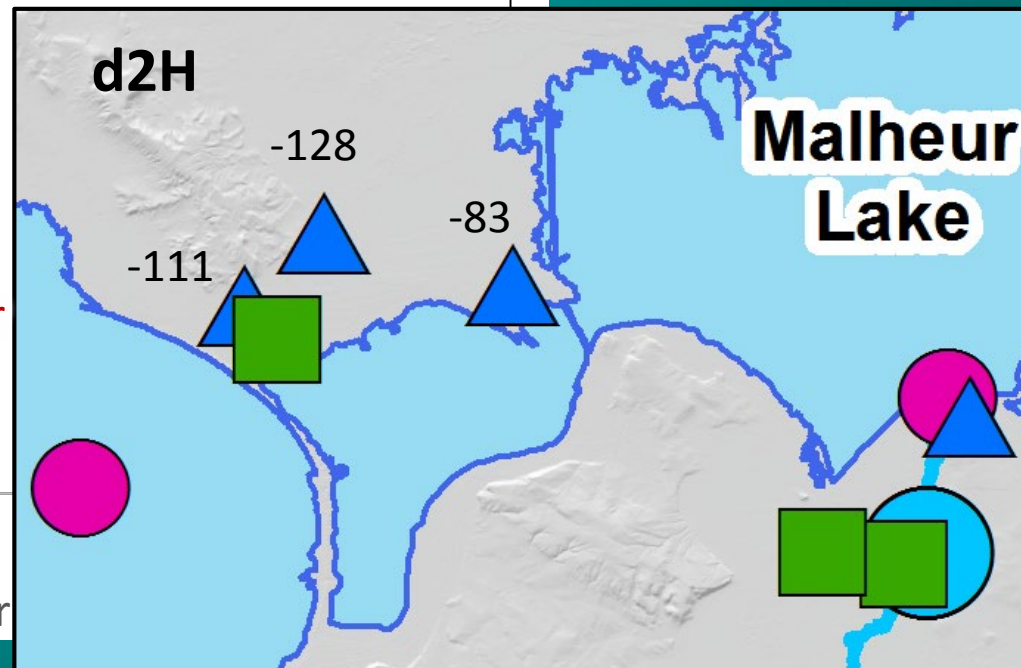
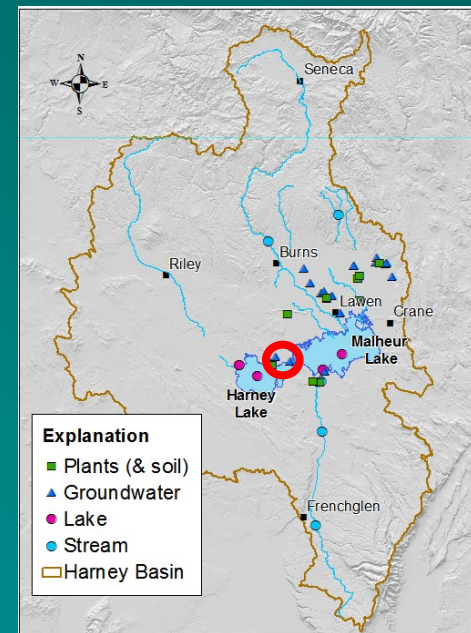
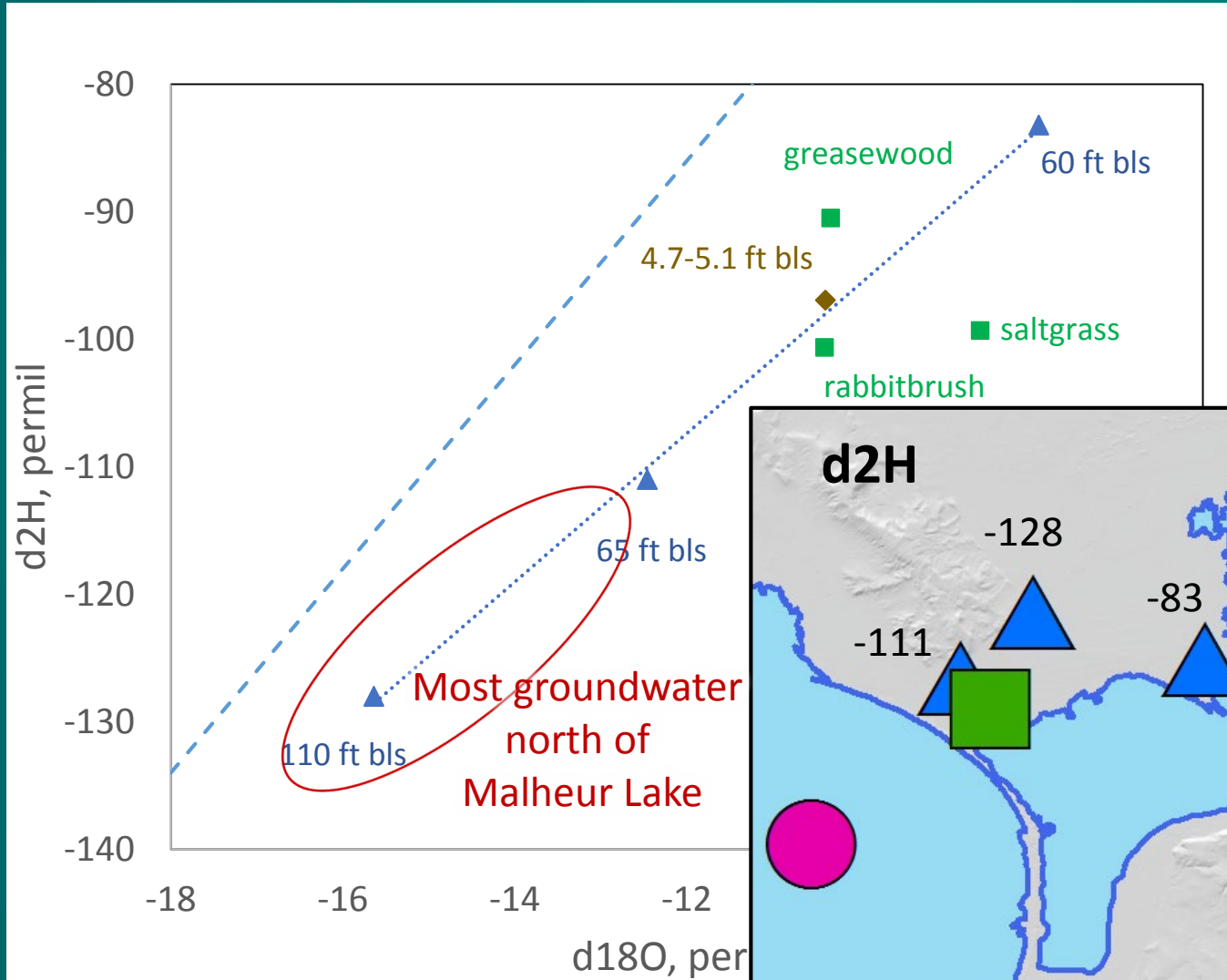
Near Mud Lake



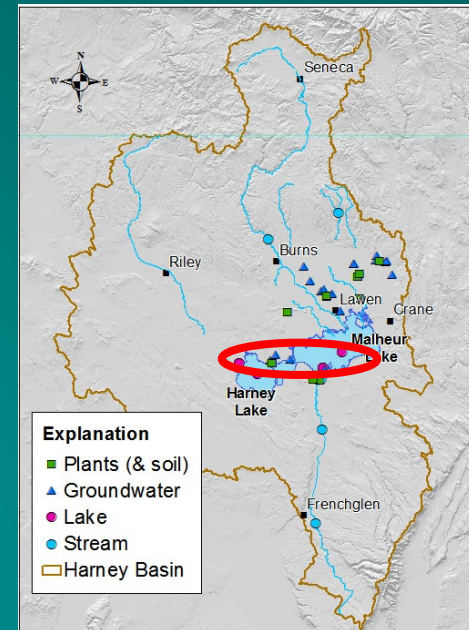
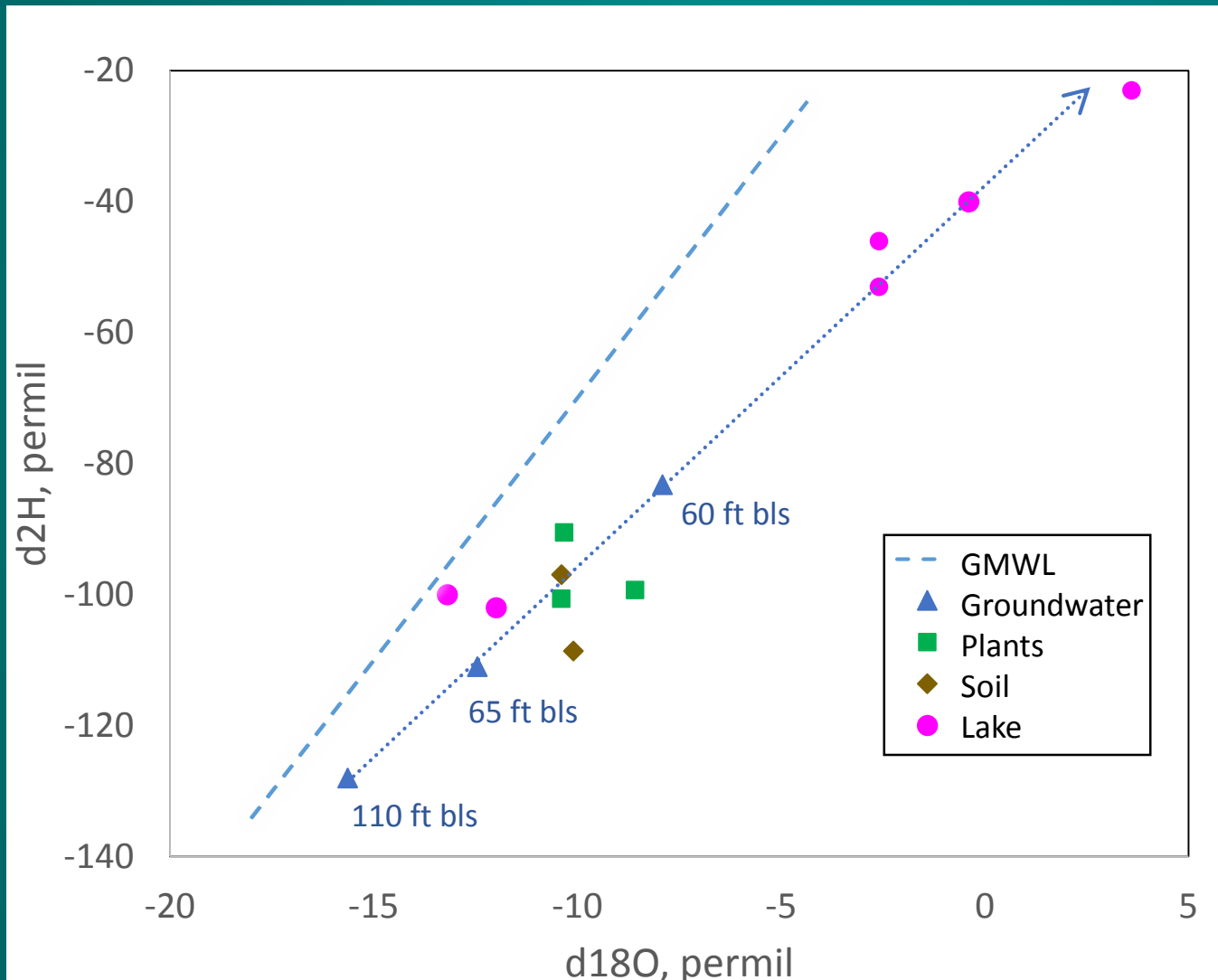
Near Mud Lake



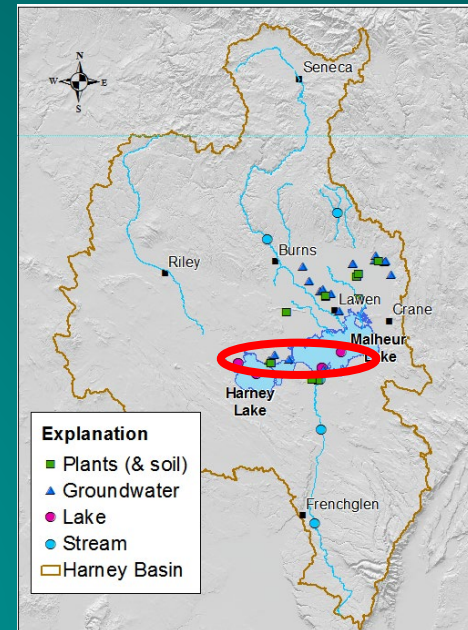
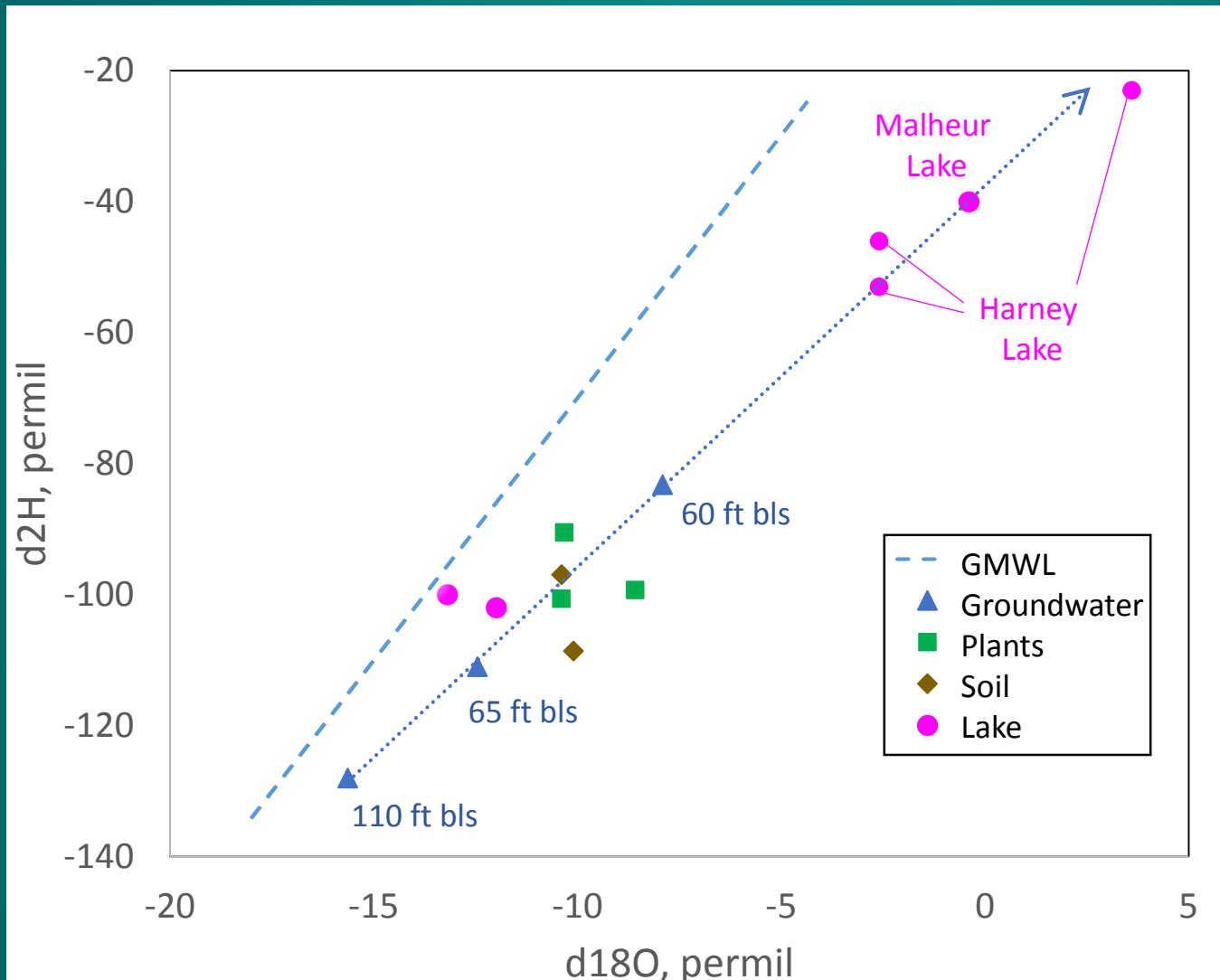
Near Mud Lake



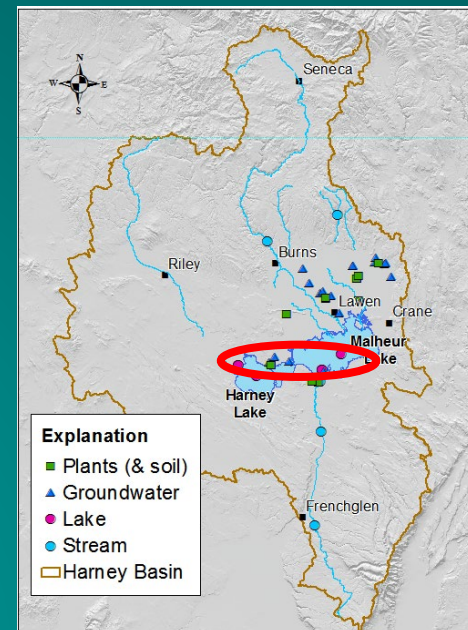
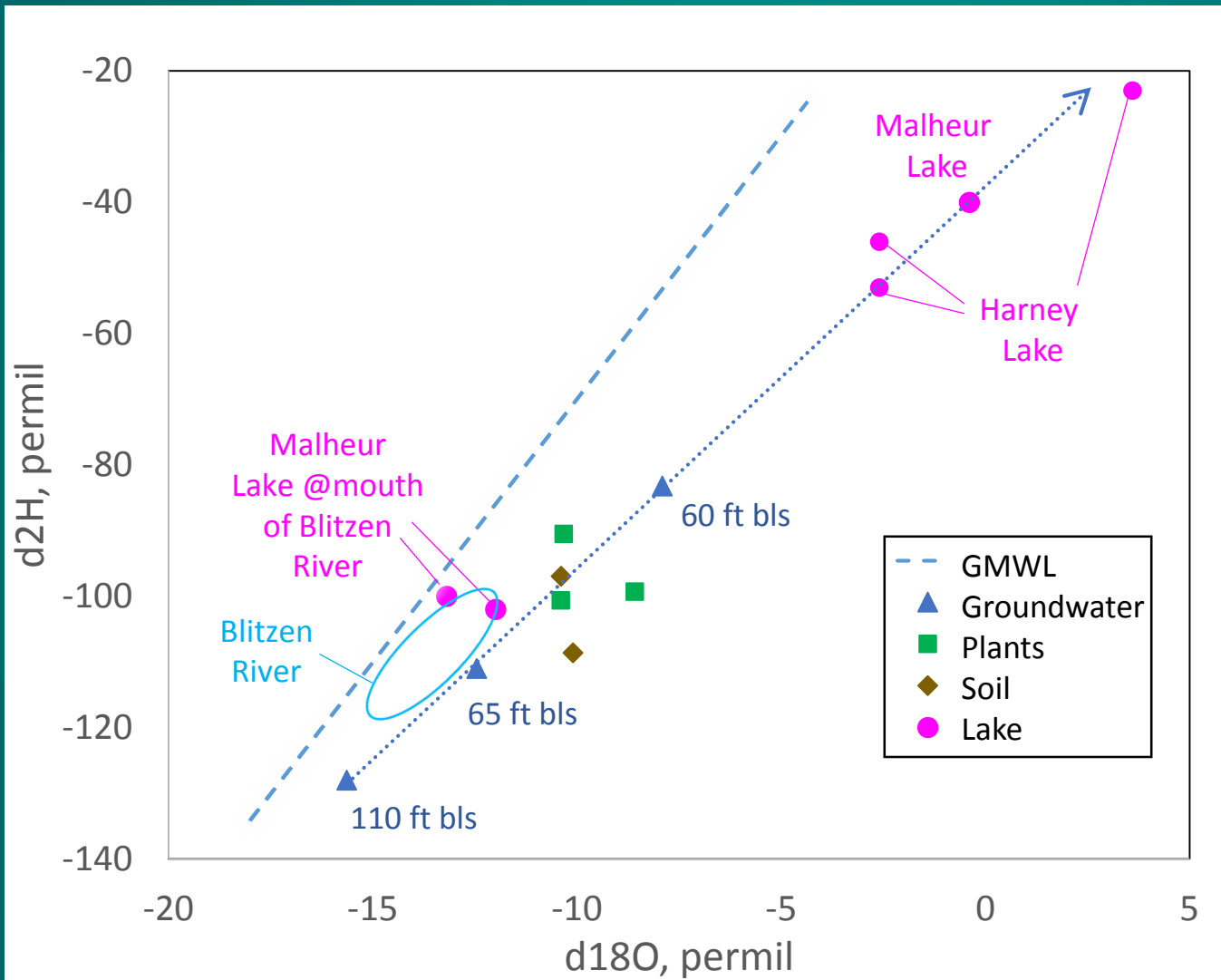
Near Mud, Harney, and Malheur Lakes



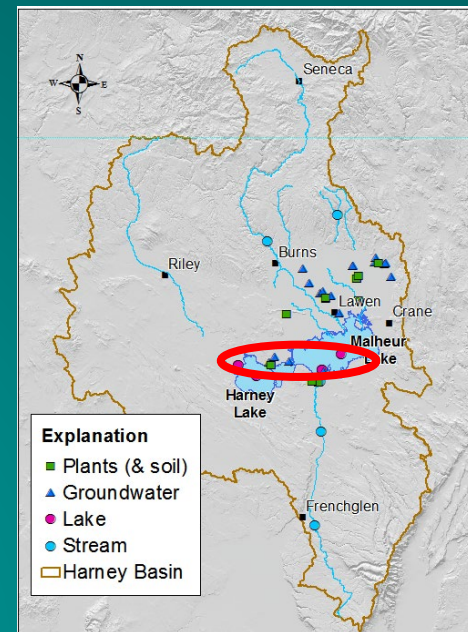
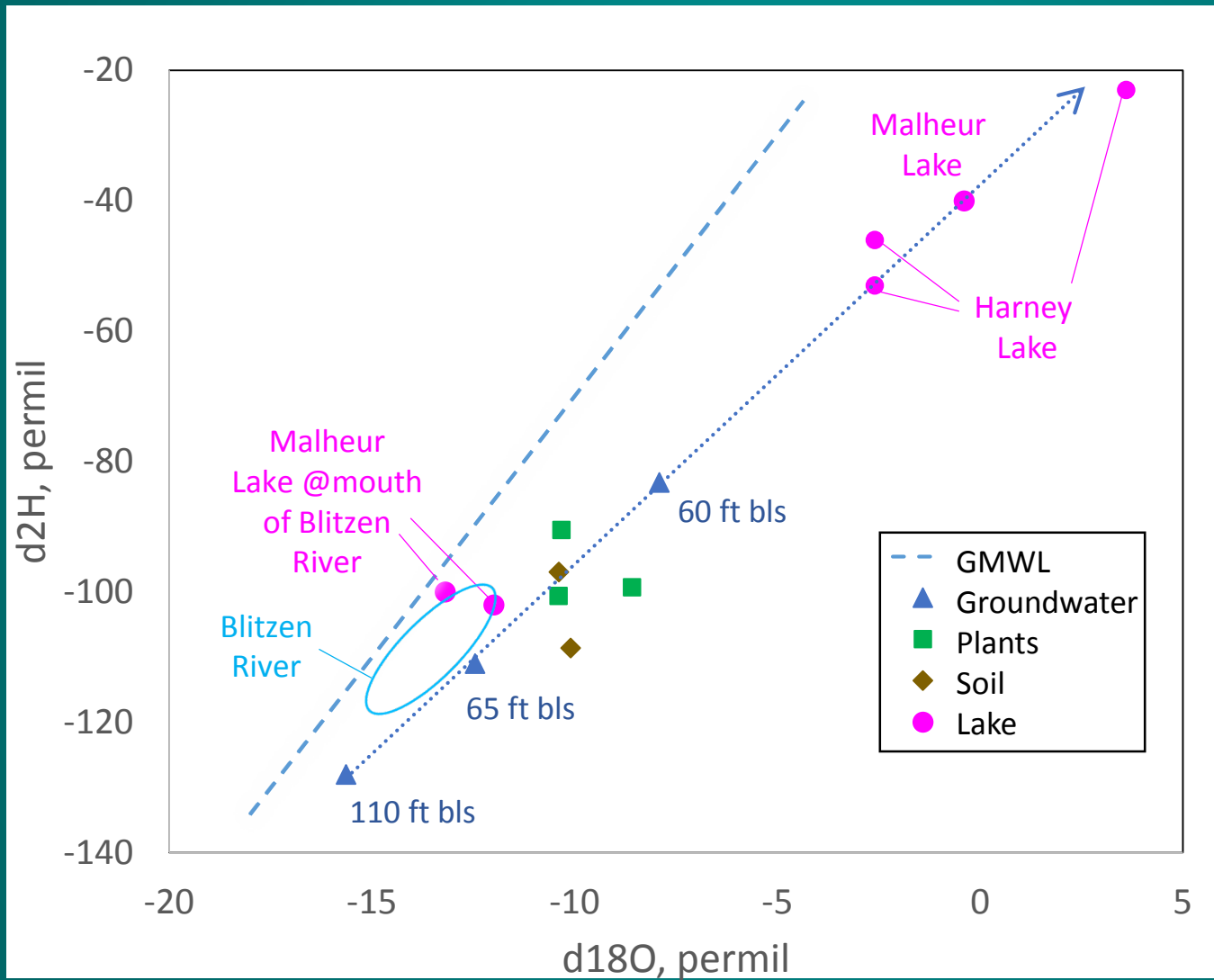
Near Mud, Harney, and Malheur Lakes



Near Mud, Harney, and Malheur Lakes

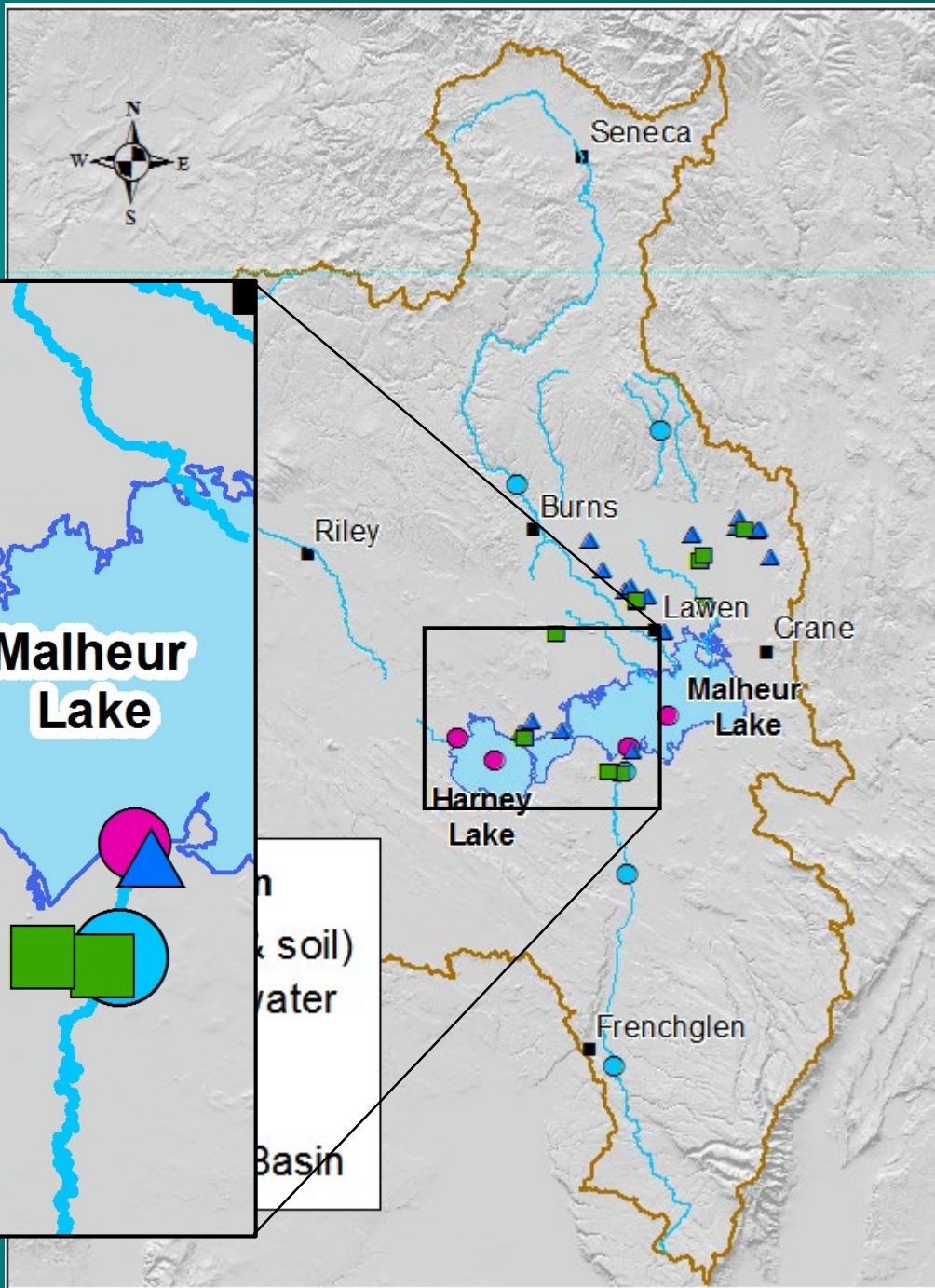


Near Mud, Harney, and Malheur Lakes



*Isotope data supported by groundwater flow direction

Groundwater flowing westward



Summary

- Long-term and seasonal precipitation patterns provide a basis for understanding hydrologic conditions today and over the last 100 years
- Stable isotope data
 - Confirm groundwater discharge by ET in valley lowlands
 - Confirm groundwater-flow paths determined from water-table contour maps

Next Steps

Precipitation patterns

- Evaluate with respect to springflow and streamflow

Plant-water sourcing

- Finalize well-log correlations for DEQ-sampled wells
- Complete water-sourcing interpretations at all sample locations

References

- Benettin, P., Volkmann, T. H. M., von Freyberg, J., Frentress, J., Penna, D., Dawson, T. E., and Kirchner, J. W., 2018, Effects of climatic seasonality on the isotopic composition of evaporating soil waters, *Hydrology and Earth Systems Science*, v. 22, p. 2881-2890, <https://doi.org/10.5194/hess-22-2881-2018>.
- PRISM Climate Group, Oregon State University, <http://prism.oregonstate.edu>, retrieved December 2017.
- Robinson, T.W., 1958, Phreatophytes: U.S. Geological Survey Water Supply Paper 1423, 84 p., <http://pubs.er.usgs.gov/publication/wsp1423>.