Combining tree-ring records, in-situ instrumentation, and baseline ecology in the Walker River Basin, California-Nevada

**Background:** Tree-ring data are often used for millennial-length reconstruction of discrete climatic variables such as seasonal temperature or precipitation. The numerical definition of the response relationship is usually based on comparison with only 50-100 years of overlap with instrumental data sources not co-located with the trees themselves. In addition, tree-ring sampling for these purposes is usually performed irrespective of topographic exposure or homogeneity.

As a result, an integrated signal over multiple micro-site conditions is usually present in the final chronology, resulting in increased uncertainty regarding the seasonal stationarity of the targeted response variable. Addressing uncertainty, particularly in the decadal to centennial frequencies, is arguably critical when performing reconstructions of absolute values as opposed to relative variability measures or indices. Changes in synoptic-scale circulation that result in localized shifts of precipitation and spring thaw/summer runoff timing can have a significant effect on the annual hydrologic cycle of typical semi-arid watersheds. Runoff, recharge, and PET would change in seasonality as well as yearly totals.

The resulting differences in vegetative growing seasons, soil moisture persistence, and extreme events (e.g. frost), while still within the genetic operating envelopes of present species, can encourage up-, down-, or cross-slope movement of populations. More importantly, such shifts would be undetectable using conventional ring-width tree-ring analysis from old-growth stands which persist through such time periods, several of which have arguably occurred within the last 1,500 years in western North America.

**Study Design: Instrumentation**

To aid evaluation of spatial and topographic variability of temperature and snow persistence, distributed temperature loggers (button) are placed on topographically-homogeneous tree-ring sites using standardized gill shielding. Temperature is monitored at 2 m and ground level at hourly intervals. In order to provide a point of comparison, a full-service climate station is placed within the watershed at a central location at mid-elevation (see map, top left). The station site is chosen so as to minimize local topographic influence and instead more generally represent conditions within the watershed.

These data will help quantify the local accuracy of historic station, regional, and modeled (e.g. PRISM) data used for climate reconstructions from tree rings, and aid in evaluation of response variable stationarity.

**Summary & Acknowledgements**

Evaluating the current seasonal climatic responses of topographically discrete tree-ring chronologies (reinforced by instrumentation and ecological surveys) will aid in development of hypotheses concerning how and when specific climate variables have shifted across the physical and temporal landscape at the watershed scale.

These hypotheses may go a long way in explaining the mounting evidence of recent (<2ky), significant climatic shifts, aiding modelers and managers of infrastructure by providing seasonality scenarios that can be aligned with known atmospheric circulation mechanisms.

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We also thank the following who are helping with field, lab, and intellectual collaboration: Mackenzie Kilpatrick, Brad Lyles, Greg McCurdy, Chris Ryan, Rob Tausch, Bob Westfall, and Wally Woolfenden.

**Study Design: Ecology**

Vegetation species assemblages are an indicator of dominant seasonality of temperature and precipitation. Survey of these assemblages on each tree-ring study site will give an additional view into differences across sites, as well as with comparisons to similarly-surveyed locations elsewhere in the Great Basin.

Surveys are accomplished using plots centered on each local conifer population as well as on the extreme upper and lower boundaries of the stands. Species presence and abundance are recorded using standardized methodology, together with macro and landscape photographs.

**Study Design: Dendrochronology**

Sites for tree-ring chronology development are identified by specific topographic aspect, species, and elevation (see map above). Only sites likely to cover 1000 years or more are considered.

By exploring the inter-chronology changes in growth response over time (across elevations, species, and aspects), modes and timeframes of similarity and dissimilarity will emerge.

**Study Design: Topoclimatic Dendrochronology**

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