

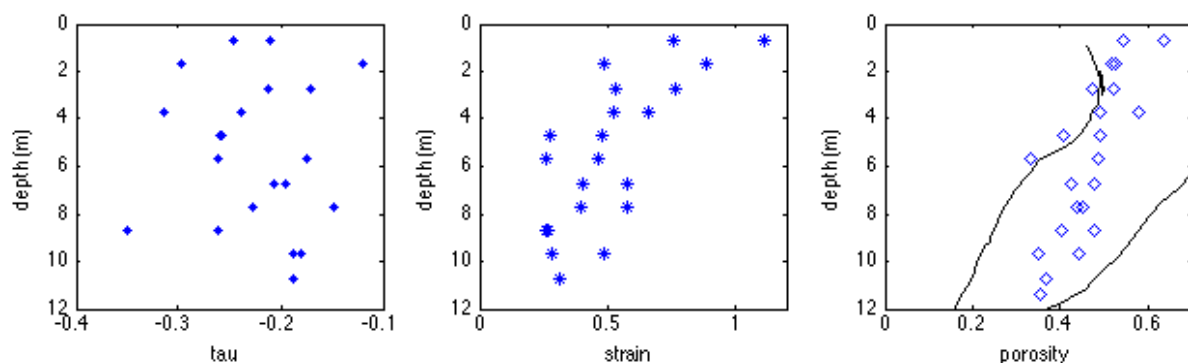


Figure 1. Variation in mass-transfer coefficient or "tau" (left), volumetric strain (middle) and porosity (right) versus depth beneath the surface for saprolite cored from the top of catchment P301. Tau, a measure of chemical weathering (ranging from -1 for complete chemical loss to 0 for no chemical loss), varies by roughly a factor of two but shows no trend with depth. Conversely, volumetric strain and porosity both increase with decreasing depth, possibly due to the influence of biotic processes near the surface. In right panel, points are from lab-based estimates of density, and lines encompass ranges estimated from a geophysical model of measured P-wave velocities in the subsurface. Together, these data suggest that water-holding capacity of the regolith is influenced by physical, chemical and biological processes that generate strain, contrary to our working hypothesis, which was that dissolution of minerals in the saprolite would be primarily responsible for generating porosity and thus subsurface water-holding capacity.

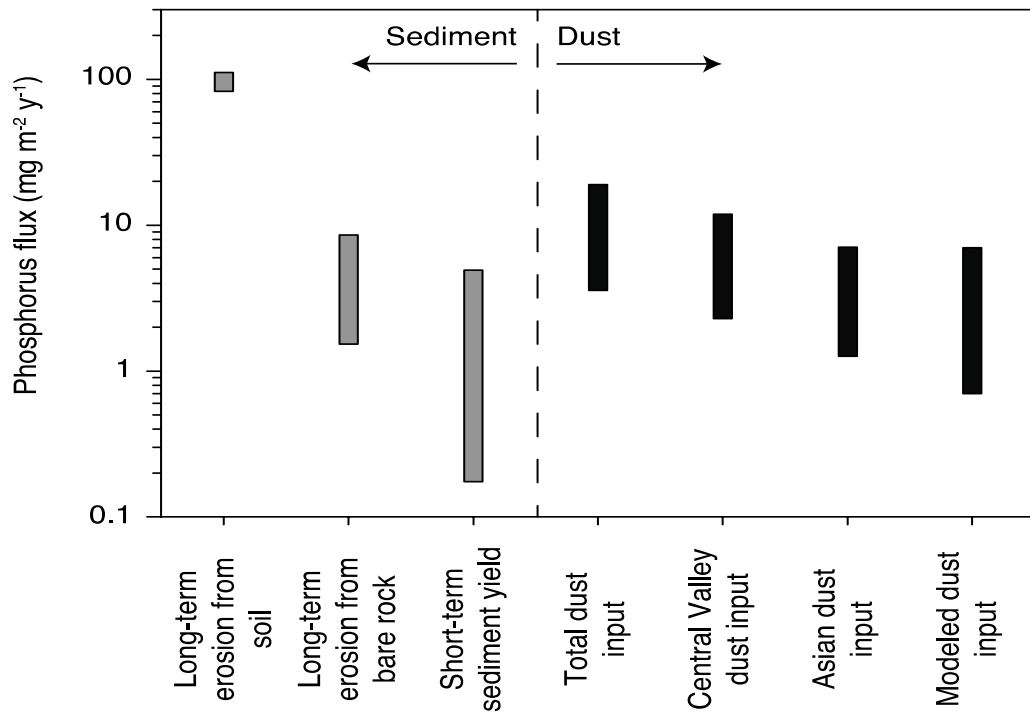


Figure 2. Fluxes of the plant-essential macronutrient phosphorus at the Providence Creek study site due to erosion (gray bars) and aeolian deposition (black bars). Bars span ranges in fluxes from multiple measurements. Total dust flux is the sum of fluxes from Asian and Central Valley sources. On soil-mantled slopes, the total input of P from dust accounts for 10 to 20% of the supply of bedrock P implied by coupling long-term erosion rates with concentrations of P in bedrock. On bare rock slopes, the estimated supply of bedrock P is much lower and commensurate with the fluxes from the Asian and Central Valley dust sources, due to slower erosion and lower concentrations of P in bedrock. The fluxes of P implied by catchment-wide sediment yields averaged over a recent seven-year interval are generally slower than the estimated dust fluxes, implying that the ecosystem is strongly influenced by the day-to-day contributions of dust from Asia and the Central Valley.

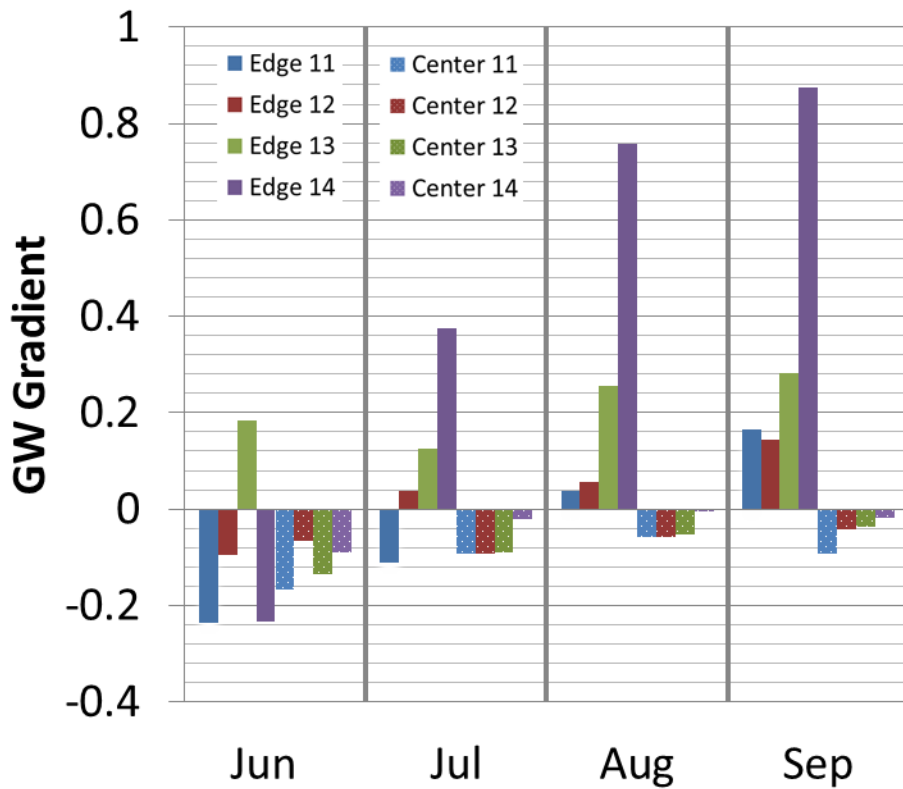


Figure 3. Vertical hydraulic gradient at the meadow edge and meadow center for the relatively wet water year (WY 2011) and three subsequent very dry years (WY2012-2014). Vertical gradient at the meadow edge is consistently positive—indicative of groundwater recharge—in the late summer and fall; while vertical gradient at the meadow center is persistently negative—indicative of groundwater discharge—even after two very dry years

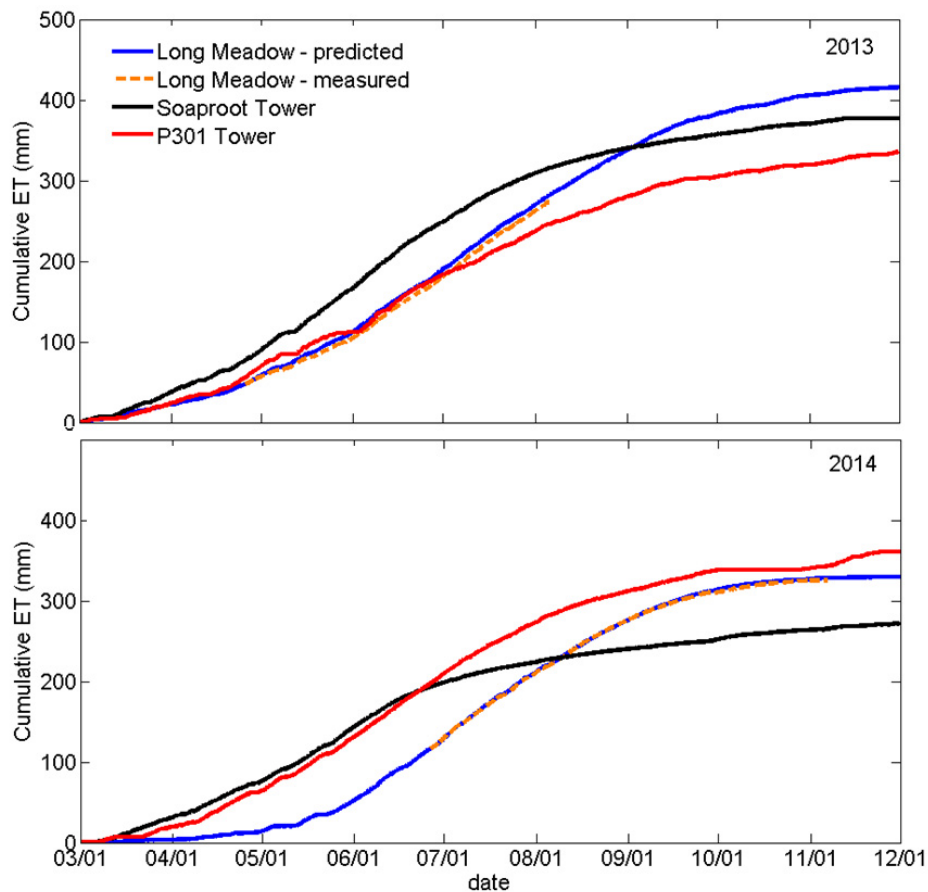


Figure 4. Cumulative ET from March 1 to December 1 for 2013 (top) and 2014 (bottom) as measured at the P301 and Soaproot Saddle eddy flux towers and modeled in Long Meadow. Dashed orange line is measured ET at the Long Meadow eddy flux station overlain on the modeled ET for comparison.

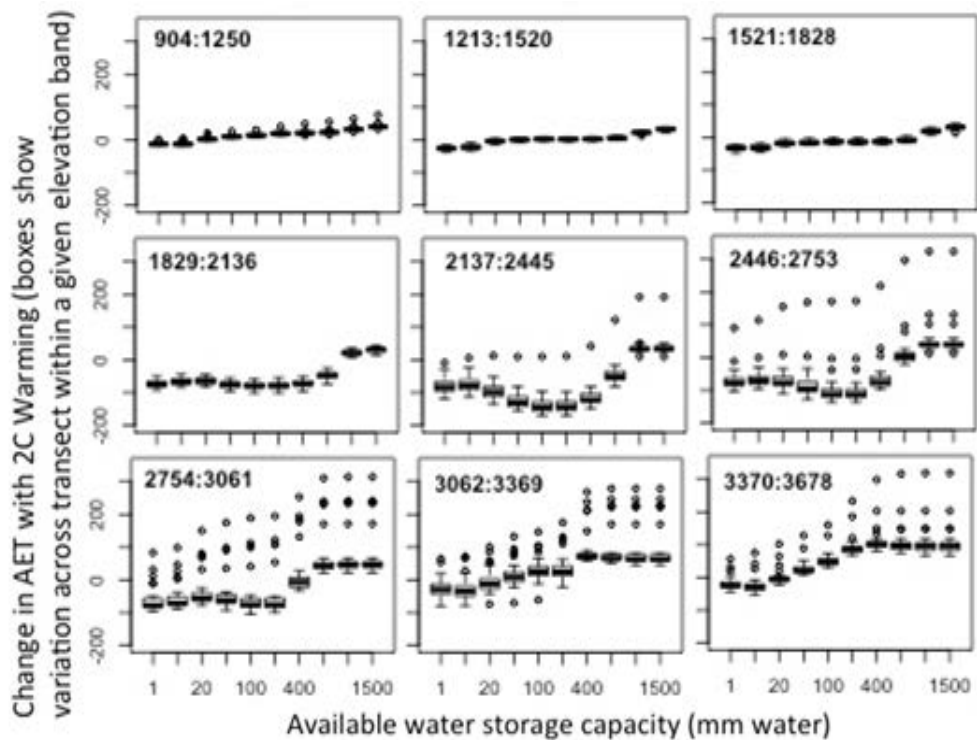


Figure 5. RHESSys results on simulated change in forest water use (actual evapotranspiration, AET) over 30 years for different elevations. Each graph shows mean annual change in Forest AET with warming for a given elevation range (plot subtitle), as a function of available water storage capacity (rooting depth times field capacity).

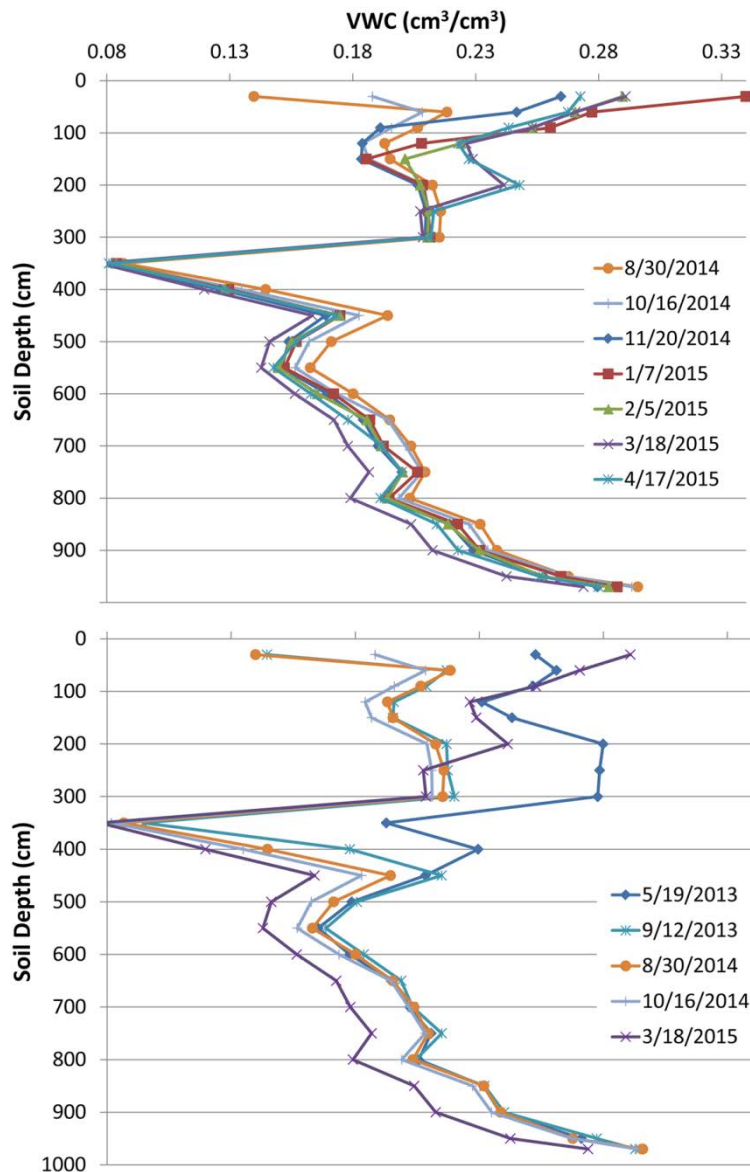


Figure 6. Neutron-probe readings in the deep saprock adjacent to the critical zone tree in P301. There has been significant drying in the deep saprock in P301 during WY2015. Precipitation was far below the mean this year and comes on top of 3 previous years of drought. Previous years have shown significant drying in the top several meters of the soil profile, especially in the late summer, but spring drying, especially deep in the profile, is unique and appears to be a shift in water depletion in the profile from shallower than 3m into the deeper profile. Continued monthly measurement throughout the summer will track this evolving water source.

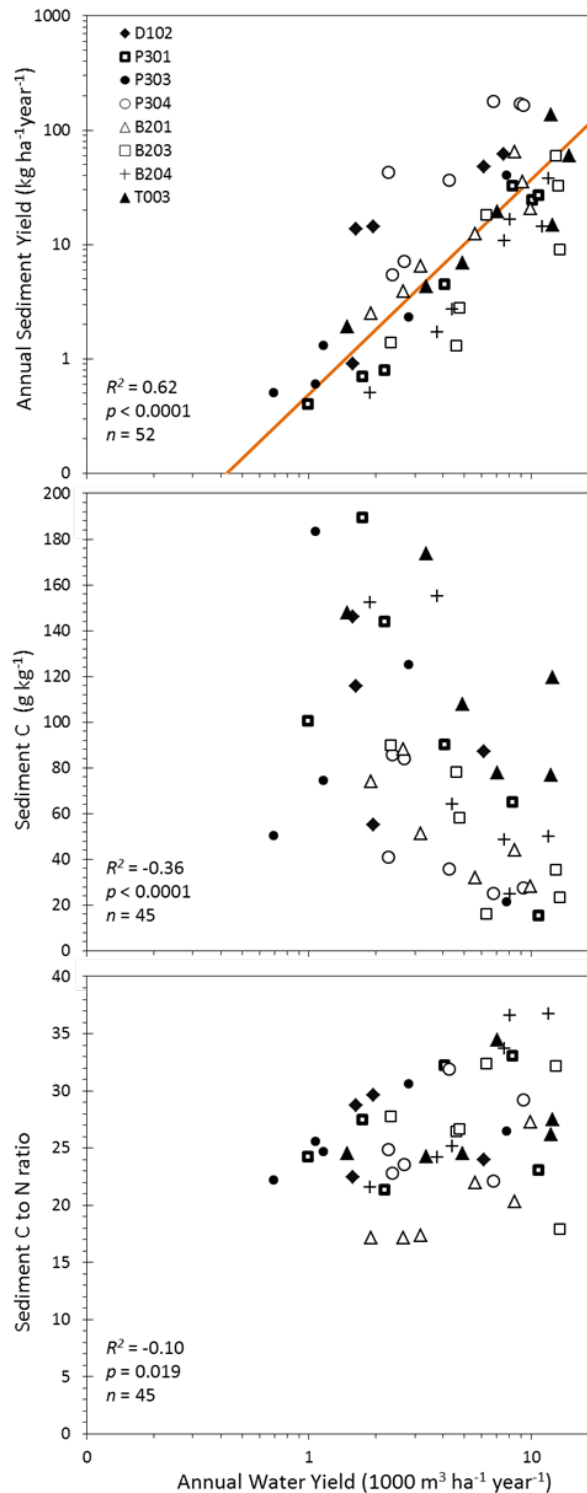


Figure 7. (Top) Annual sediment yield (including mineral, coarse and fine organics) is directly correlated with annual water yield. **(Middle)** Sediment carbon (C) and nitrogen (N; (not shown) concentrations in years have an inverse relationship to water yield. **(Bottom)** The C to N mass ratio C:N relationship is weakly correlated with water yield. Data presented for WY 2005, and 2007-2011 (Sediment basins constructed over the period 2002-2004, samples were not preserved for analysis in WY 2006). From Stacy et al. (2015a)

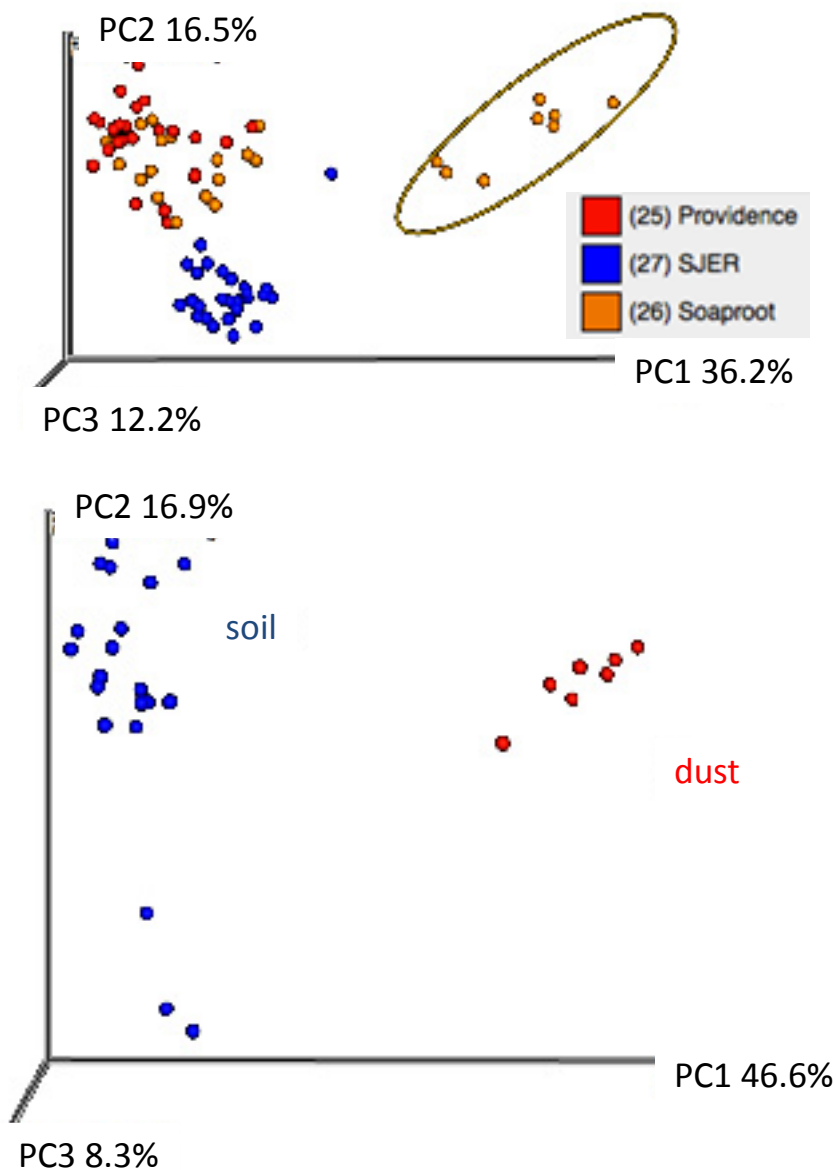


Figure 8. Microbial communities at three of the SSCZO climosequence sites as assessed using metagenomic analyses of 16S rRNA sequences and the Illumina platform. (Upper panel) Principal component analyses show clear differences in the soil microbial communities at the SJER and the higher elevation Soaproot and Providence sites taken within the eddy covariance tower “footprint.” However, in an adjacent opening within a few hundred meters of the Soaproot tower, intra-site differences were also observed (“by dust collectors”). (Lower panel) Comparison of microbial communities in dust collected in passive collectors placed 2-m above ground at the three lower SSCZO sites compared to communities in A horizon soil samples collected from these same sites. The soil communities differed from the dust communities at all sites. Data points represent individual replicate samples collected in July, 2014 (soils) or over the April – July period (Dust).

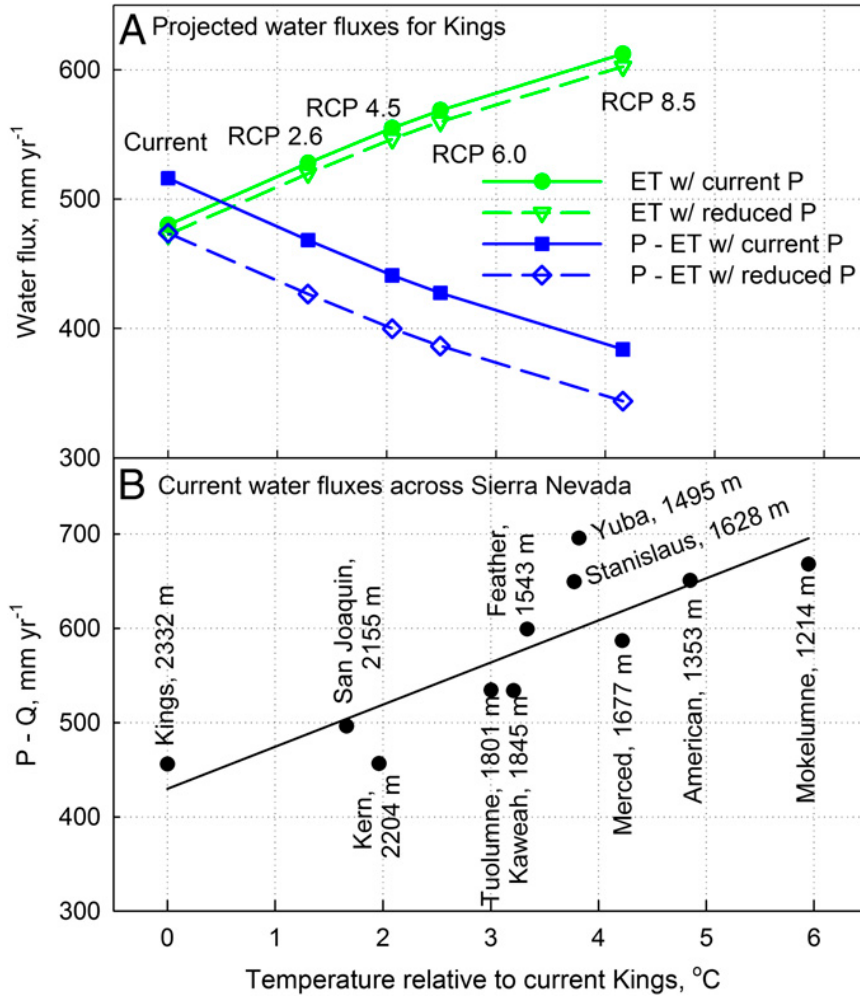


Figure 9. (A) Effect of warming and P reduction on Kings River basin-average ET (mm yr⁻¹; lines connect green circles and inverted triangles) and P-ET (mm yr⁻¹; lines connect blue squares and diamonds). Basin-wide ET was calculated for all combinations of current conditions (1981–2010 PRISM normals), 2085–2100 elevation-dependent warming with the four RCP, and 5% P reduction. The ET sensitivity to warming under current P was 31.8 mm °C⁻¹. (B) The observed 1981–2010 relationship between basinwide mean T and P - Q across 11 large river basins on the western Sierra Nevada slope. The P - Q sensitivity to temperature was 44.6 mm °C⁻¹ [$P - Q \text{ (mm yr}^{-1}) = 44.64 \times \Delta T \text{ (}^{\circ}\text{C)} + 430.0$; $R^2 = 0.716$].

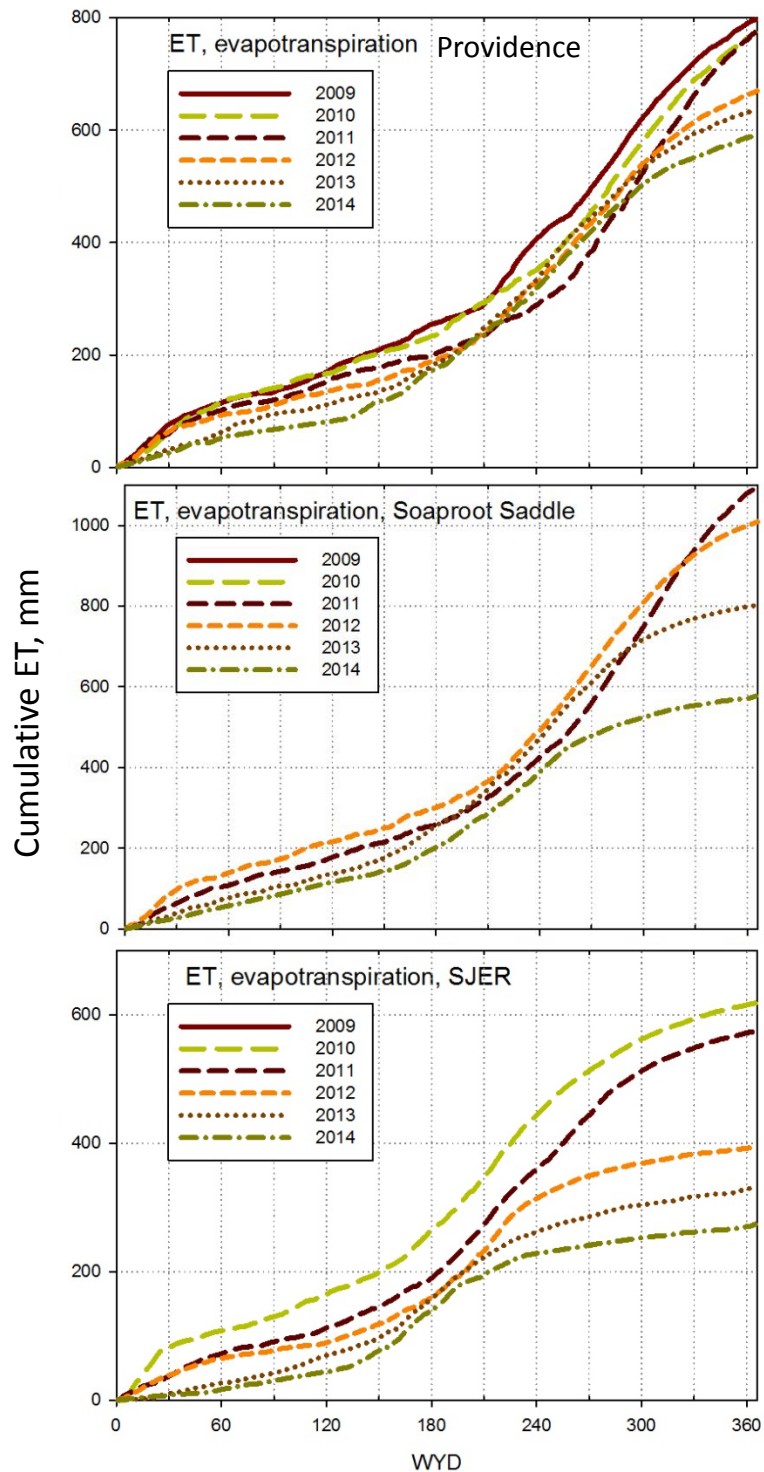


Figure 10. Daily ET at 3 flux towers showing decreased summer-fall ET during 20-2-14 drought years, versus 2011 (wet year) and earlier. Providence is 2000 m, Soaproot is 1100 m, SJER is 400 m). Paper in preparation.

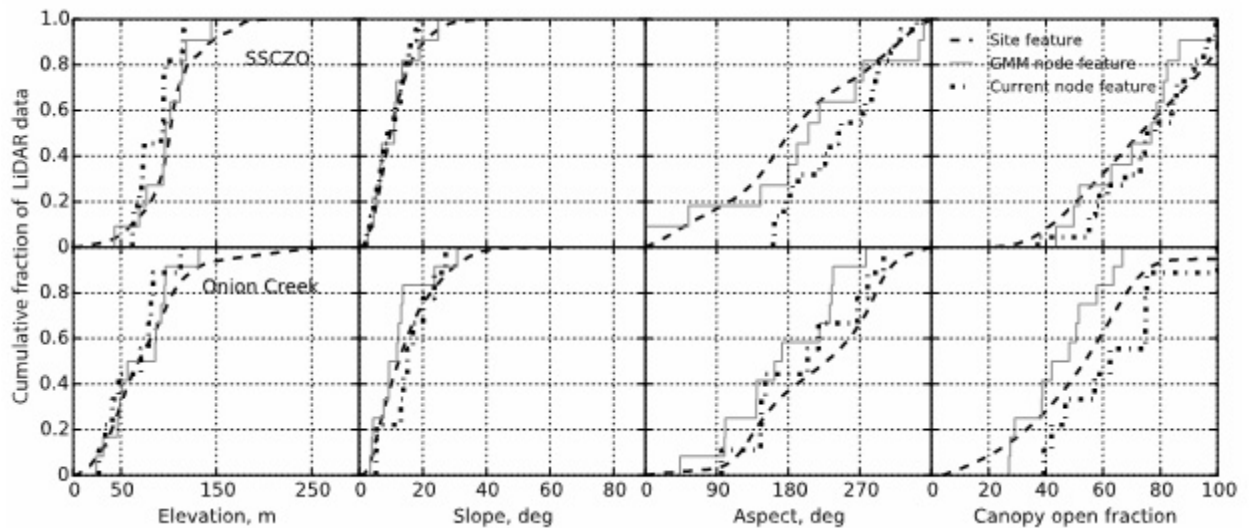


Figure 11. Current node placements (determined using eld surveys) compared to Gaussian mixture model placements at the SSCZO and Onion Creek. At the SSCZO, Gaussian mixture model placements are more representative of site physiographic variables than existing placements. At Onion Creek, placements along the gradients of elevation and slope are comparable. The gradients of aspect and canopy open fraction are poorly sampled by the Gaussian mixture model because sparse LiDAR data limited model convergence. Elevation above 1820 m (Onion), 1900 m (SSCZO).