Zion Klos - Field Handout - Reynolds Creek

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Influence of contrasting aspect, lithology, and vegetation on saprolite genesis in complex terrain: Reynolds Creek Critical Zone Observatory

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AGU 2014 Abstract

This study employs a variety of geophysical, biological, hydrological, and pedological methods to expand on the understanding of how contrasting aspects, lithologies, and vegetation influence critical zone structure and evolution. We performed shallow seismic refraction (SSR) and time-lapse electrical resistivity tomography (ERT) surveys across two geologically distinct valleys within the Reynolds Creek Critical Zone Observatory in southwestern Idaho. We also quantified vegetation density, soil pH, and subsurface stratigraphy (by manual sampling) across opposing north-facing (forested) and south-facing (unforested) aspects to better understand the relationship between lithology, vegetation, seasonal moisture dynamics, and saprolite genesis within the critical zone. The first study sub-site, Upper Johnston Draw, resides on late Cretaceous granitic bedrock associated with the Idaho Batholith. The second study sub-site, Upper Sheep Creek, resides on Miocene basaltic bedrock. In the granitic Upper Johnston Draw there is a sharp contrast in depth to unweathered bedrock (regolith thickness) between the north-facing aspect (average depth of 18.6 m) and the south-facing aspect (average depth of 8.2 m). In the basaltic Upper Sheep Creek there is only a marginal contrast in depth to unweathered bedrock between the north-facing aspect (average depth of 14.4 m) and the south-facing aspect (average depth of 12.0 m). These observed relationships between the contrasting lithologies of Upper Johnston Draw and Upper Sheep Creek, coupled with our time-lapse ERT surveys, vegetation density tests, soil pH tests, and subsurface augering data, provide new understanding about the causes of symmetry or asymmetry in saprolite development on north-facing and south-facing slopes. Specifically, these findings suggest that abiotic chemical weathering via hydrolysis may be the dominant control creating the symmetrical pattern of saprolite genesis (north vs. south aspects) observed within the basalt-parented site. While conversely, within the critical zone of the paired granitic site, ecohydrologically-influenced chemical weathering via oxidation and organic acidification may instead be the dominant control creating the distinct asymmetrical pattern of saprolite genesis observed

Extent of the rain-snow transition zone in the western U.S. under historic and projected climate

P. Zion Klos, Timothy E. Link, and John T. Abatzaglou

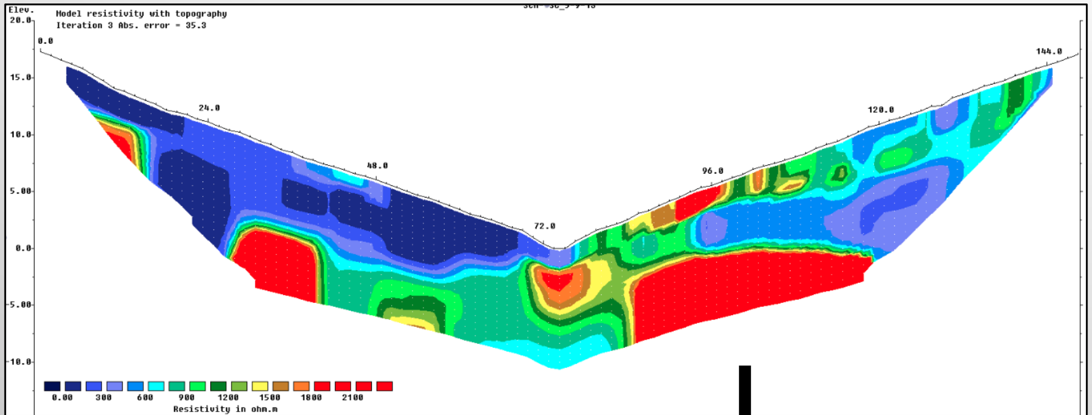
2014, *Geophysical Research Letters* (41) Abstract

This study investigates the extent of the rain-snow transition zone across the complex terrain of the western United States for both late 20th century climate and projected changes in climate by the mid-21st century. Observed and projected temperature and precipitation data at 4 km resolution were used with an empirical probabilistic precipitation phase model to estimate and map the likelihood of snow versus rain occurrence. This approach identifies areas most likely to undergo precipitation phase change over the next half century. At broad scales, these projections indicate an average 30% decrease in areal extent of winter wet-day temperatures conducive to snowfall over the western United States. At higher resolution scales, this approach identifies existing and potential experimental sites best suited for research investigating the mechanisms linking precipitation phase change to a broad array of processes, such as shifts in rain-on-snow flood risk, timing of water resource availability, and ecosystem dynamics.

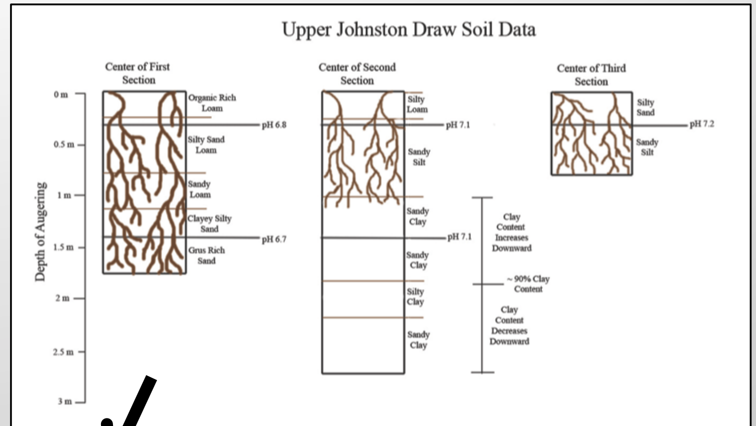
WESTERN SNOWPACK COULD PLUMMET THIS CENTURY

June 26, 2014 | Conservation This Week | 0 Comments

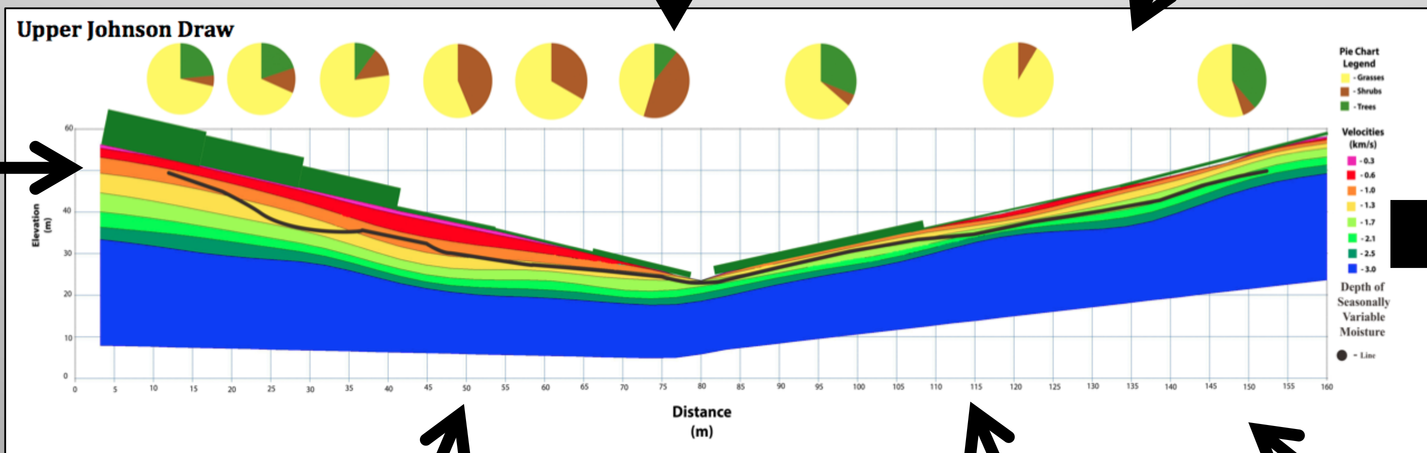
Time-Lapse Resistivity Data (~water content)



Soil Texture, Rooting Depth, pH Data

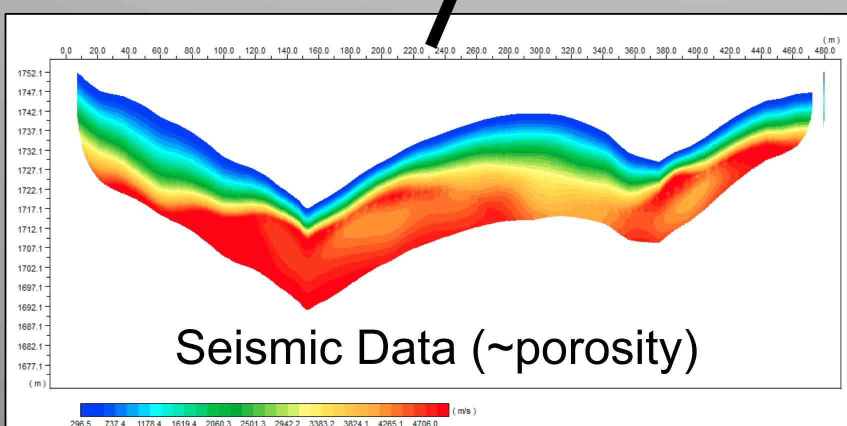


Lithology: Granite

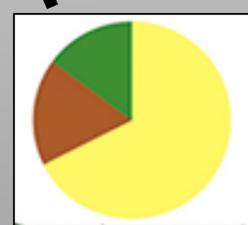


Johnson Draw Take-Aways

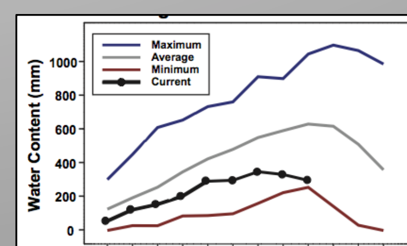
- saprolite thickness is deeper on N-facing slopes than S-facing
- biologically-influenced chemical weathering via oxidation and organic acids is dominant control (over hydrolysis)



Seismic Data (~porosity)

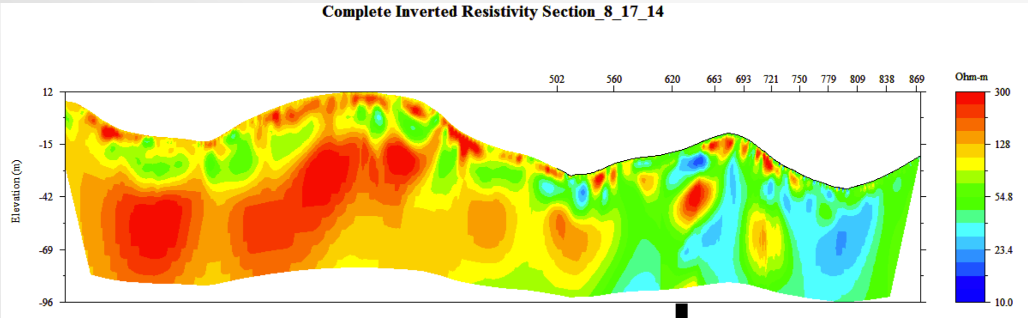


Vegetation Data

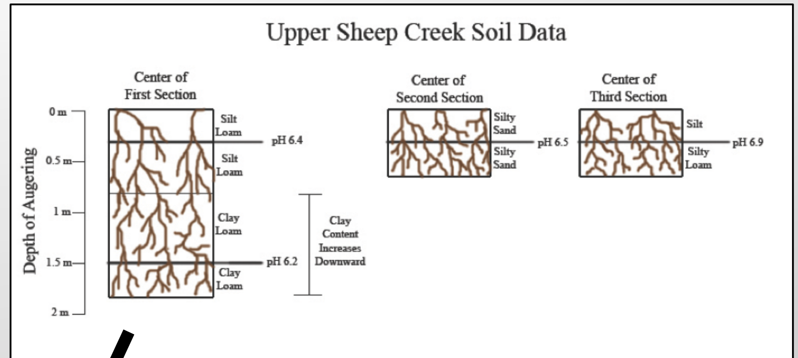


Surface Snow and Hydrology Data

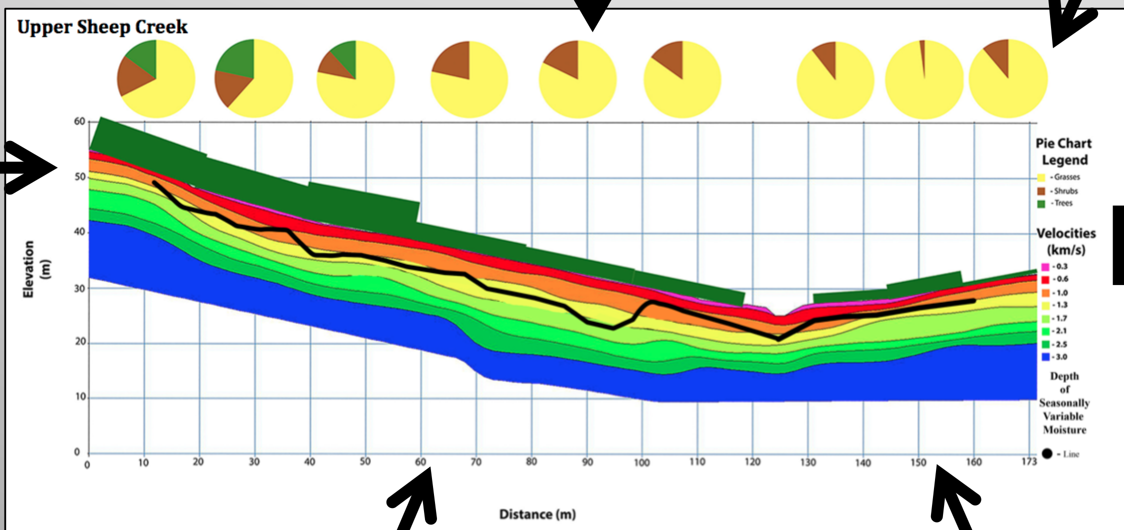
Time-Lapse Resistivity Data (~water content)



Soil Texture, Rooting Depth, pH Data

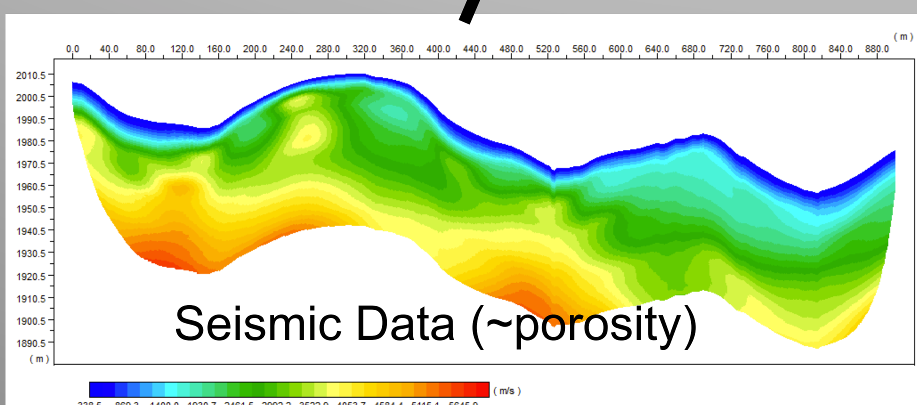


Lithology: **Basalt**

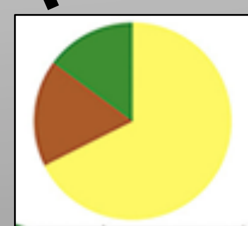


Upper Sheep Creek Take-Aways

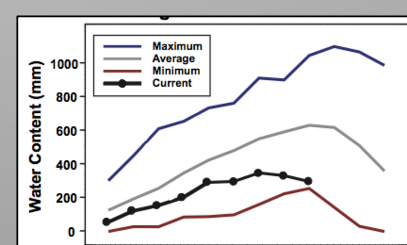
- saprolite thickness is homogenous by aspect
- abiotic chemical weathering via hydrolysis is dominant control
  - background hydrolysis is faster in basalt than granite >> dominant over biologically-influenced chemical weathering (oxidation, organic acids)



Seismic Data (~porosity)

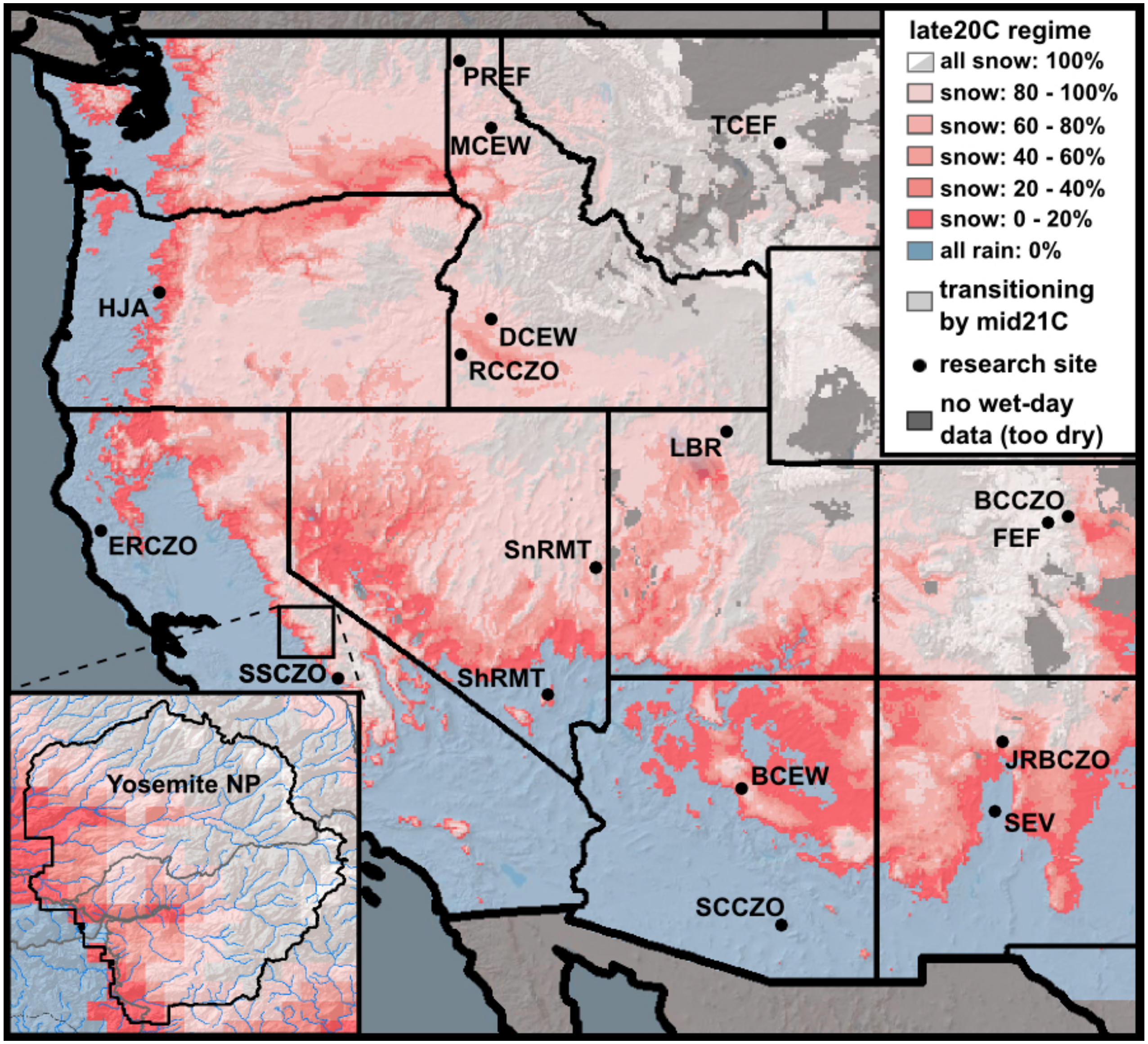


Vegetation Data



Surface Snow and Hydrology Data

Extent of the rain-snow transition zone in the western U.S. under historic and projected climate



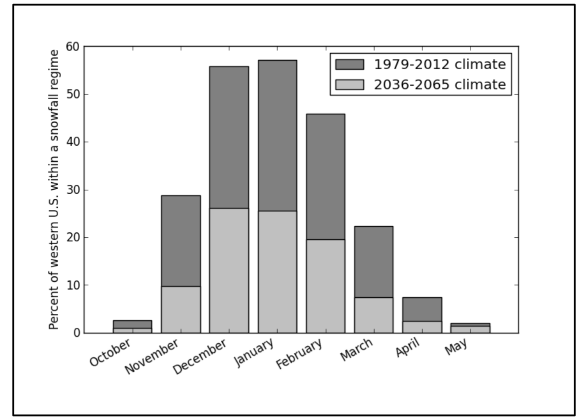


Table 1. Changes in Wintertime Precipitation Phase by Region[a]

Region	Strongly Snow-dominated Extent in Late20c (%)	Change in Strongly Snow-dominated Extent by Mid21c (%)	Strongly Extent
	U.S. EPA Level-III Ecoregions		
15 NORTHERN ROCKIES	56	−56	
77 NORTH CASCADES	48	−48	
11 BLUE MOUNTAINS	27	−27	
80 NORTHERN BASIN AND RANGE	18	−18	
20 COLORADO PLATEAUS	18	−18	
04 CASCADES	6	−6	
13 CENTRAL BASIN AND RANGE	6	−6	
09 EASTERN CASCADES SLOPES AND FOOTHILLS	5	−5	
10 COLUMBIA PLATEAU	3	−3	
23 ARIZONA/NEW MEXICO MOUNTAINS	1	−1	
12 SNAKE RIVER PLAIN	44	−42	
16 IDAHO BATHOLITH	88	−79	
19 WASATCH AND UINTA MOUNTAINS	68	−60	
18 WYOMING BASIN	44	−37	
05 SIERRA NEVADA	19	−14	
41 CANADIAN ROCKIES	100	−67	
22 ARIZONA/NEW MEXICO PLATEAU	3	−2	
17 MIDDLE ROCKIES	82	−46	
21 SOUTHERN ROCKIES	69	−34	
08 SOUTHERN CALIFORNIA MOUNTAINS	0	0	
14 MOJAVE BASIN AND RANGE	0	0	
01 COAST RANGE	0	0	
02 PUGET LOWLAND	0	0	
03 WILLAMETTE VALLEY	0	0	
06 SOUTHERN AND CENTRAL CALIFORNIA CHAPARRAL AND OAK WOODLANDS	0	0	
07 CENTRAL CALIFORNIA VALLEY	0	0	
78 KLAMATH MOUNTAINS	0	0	
79 MADREAN ARCHIPELAGO	0	0	
81 SONORAN BASIN AND RANGE	0	0	

Citation: Klos, P. Z., T. E. Link, and J. T. Abatzoglou (2014), Extent of the rain-snow transition zone in the western U.S. under historic and projected climate, Geophys. Res. Lett., 41, doi:10.1002/2014GL060500.