WALTER SCOTT, JR. COLLEGE OF ENGINEERING
COLORADO STATE UNIVERSITY

Hydrology Days
March 27 – 29, 2019

Effects of snow persistence on soil moisture and soil water nitrogen along the Colorado Front Range

Alyssa Anenberg, Stephanie Kampf, Jill Baron
Department of Ecosystem Sciences and Sustainability, Colorado State University

Abstract. In the western US mountains, the timing and magnitude of snowmelt is an important control on soil water and nutrient availability at high elevations. While prior research relating snow to soil water nitrogen has focused on areas with persistent winter snow, the snow and soil water dynamics in lower elevation areas with intermittent snowpack are not as well documented. The broad goal of this study is to understand how the duration of snow persistence affects soil moisture and soil water nitrogen concentrations. The specific objectives are to (1) manipulate snow depths within the intermittent snow zone at a semi-arid study site in the Colorado Front Range, and (2) use the results to examine how snow accumulation and melt affect soil moisture and soil water nitrogen. A total of nine plots were selected within the study site, avoiding areas with steep slopes that would potentially contribute lateral flows. Three plots were designated as controls, where snow was not altered. Snow chambers, made of PVC and either black or white canvas, were constructed on the remaining six plots to manipulate snow depths. After each snowfall, we shoveled snow from the black (low snow) chambers into the white (high snow) chambers. Each chamber was instrumented with temperature and soil moisture sensors as well as lysimeters and ion exchange resin probes to quantify soil water nitrogen. Temperature and soil moisture were recorded at 15-minute intervals. Resin probes were exchanged monthly, and lysimeters were sampled following snowmelt or large rain events. This site experienced mid-winter melt, in which snow accumulated and rapidly melted, releasing pulses of snowmelt throughout the winter and spring. These pulses gradually increased the overall soil moisture, with peak soil moisture values occurring in late April, coinciding with the highest levels of nitrogen supply from the resin probes. Initial results from the lysimeter soil water samples showed elevated nitrogen concentrations in the manipulated plots, compared to control plots. This suggests that soil water nitrogen is limited by the amount of soil water available, and that scenarios in which snow depth is altered can directly correlate to changes in nitrogen levels.