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Groundwater Surface-Water Interaction of First-Order Riparian Drainages impacted by Conifer Encroachment

Willis D. Weight *, Mark Brunson, Clayton Marlow, Kevin Chandler
Montana Tech of the University of Montana
weight@jeffbb.net

Abstract:

A detailed study of the hydrogeology of first order riparian drainages is presented. The study resulted from seeking to understand the response of stream flow and riparian vegetation communities to prescribed fire in the upper portions of the Whitetail Creek watershed in southwestern Montana. Prescribed fire is being evaluated as a possible management tool for encroaching conifers. Four drainages, two burned and two unburned by prescribed fire were evaluated for vegetation response and hydrologic response. The thrust of this presentation is to inform others on the significant dynamics and timing of groundwater and surface water behavior during a given water year.

Preliminary, pre-fire assessments of hydrologic conditions were based upon five rows of piezometers in a near-stream, edge-of-riparian vegetation configuration, driven to a depth of approximately 1 m or less. The general assumption was that post-burned drainages would show more surface water runoff, compared to unburned drainages and that soil moisture supplied by surface water was perhaps the most critical factor for riparian vegetation. Since the percentage of drainage burned was less than hoped for, a more detailed site characterization was conducted gain a better understanding of the hydrologic-riparian system.

The driven piezometers frequently went dry after spring runoff so little was understood about continuing sub-surface groundwater flow through the summer, fall, and winter and how or if riparian vegetation likely derived their water supplies. Many additional deeper hand-augured wells up to 3.5 m were drilled to better understand the geology and changing dynamics of shallow riparian alluvial systems. It was discovered that there is a highly connected surface and groundwater interaction in the upper 1.5 m or so of the alluvial sediments. There are also deeper zones separated by clay and volcanic ash layers that contain groundwater year around. It is in these deeper zones where roots from larger trees extend to sustain themselves during late summer through winter conditions.

Impact Statement:

Dramatic improvement in understanding the surface water and groundwater interactions of first-order streams.

Improved understanding of the quantities of water taken by Douglas fir trees compared to quaking aspen and other riparian vegetation.

Partnerships with Utah State, MSU, and Montana Tech established.

Quantitative values obtained to assist in policy decision making associated with pre-scribed fire.

Category: Watershed Assessment and Restoration
Type of Presentation: Oral Presentation