Nonpoint source pathways of salinity, Se and B in the Pariette Draw watershed, Utah, USA: Impact of climate and land use

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The Pariette Draw watershed in northeastern Utah is an arid landscape where trace elements such as selenium (Se) and boron (B), which are released during weathering, can become concentrated in salt phases (predominantly sodium sulfate) that form in soils. Disturbance of soil and local hydrology by natural processes and anthropogenic activities (farming, mining, oil/gas development and urban growth) can result in dissolution of these salts and mobilization to surface and ground water. Diverted irrigation water in the upper watershed makes Pariette Draw Creek perennial and sustains a BLM-managed wetland near the watershed outlet. Water in the draw is in violation of state and federal water quality criteria for total dissolved solids, Se and B. This study provides a geochemical context to understand source, mobility, transport and storage of contaminants in the watershed and seeks to predict how changes in land use may alter the fate and flux of these soluble contaminants.

The likely source of sulfur, Se, and B is ash layers in the now eroded Upper Uinta Formation. We hypothesize that these elements were transported into the Lower Uinta Formation sandstone aquifers during weathering and were immobilized by reduction and sorption. Modern weathering of the Lower Uinta Formation releases sulfate and selenate via oxidation and B via desorption from clays.

Irrigation in the upper watershed transports salt, Se and B to the streams resulting in the exceedance of water quality standards, however, over time this has decreased extractable amounts in the agricultural soils. In the wetlands, significant amounts of sulfate and Se are removed to the sediment through reduction and B by sorption. Therefore, land use change that results in the irrigation of new fields or oxidation of wetland sediment would result in additional mobilization of contaminants in the watershed.