Improving Water Resource Resilience For Arid Ranchlands: Modeling Hydrologic Response to Best Management Scenarios In Wyoming's Powder Basin

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Abstract. Water is and will continue to be one of the most critical resource challenges facing communities in the West. Changes in precipitation and temperature regimes will impact timing and quantity of surface discharge and groundwater recharge. Intensification of the water cycle has major implications for farmers and ranchers dependent upon groundwater wells and stream flow for agriculture and ranching. Local land use practices, however, can improve resilience to water stress and increase water storage capacity. By using hydrologic modeling, this project seeks to provide land managers will simulations of how different land management practices impact water quality and surface flow. This project used a semi-distributed, physically-based continuous hydrologic model called the Soil and Water Assessment Tool (SWAT) to create a baseline simulation of hydrologic dynamics in a semi-arid agricultural grassland. The study area is a 21,000 acre watershed nested in the larger Powder River Basin. The site stretches from upper catchments located in the Cloud Peak Wilderness down to the ranchlands of the Clear and Piney creek catchments. The model, calibrated using USGS discharge data, is uniquely based on a fine-scale land use/land cover classification and focused on the relatively small 1,100 acre Ucross ranch. The fine scale of the land use classification allows investigation of hydrologic fluxes in pasture-sized parcels on the ranch. Within the calibrated model, a variety of scenarios have been developed to test how land management practices impact water availability throughout the drier late summer months. Playing with different types and sizes of riparian buffers, initial model results suggest changing ranch management practices could increase late-season water yield by increasing infiltration and decreasing hydrograph flashiness during spring peak run-off.