

16th Biennial Scientific Conference on the Greater Yellowstone Ecosystem

Advancing Conservation in the GYE

Title: Water Budget Analysis for a Rapidly Developing Headwaters Community

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Abstract:

A water budget analysis was conducted for the West Fork Gallatin River watershed to enhance the Big Sky community's understanding of water availability in a changing climate and enable wise stewardship of water resources as population and visitation continues to grow. A water budget is a tool that quantifies where water comes from and where it goes within a watershed on an annual basis. This analysis was produced using a combination of climatic models, regional SNOTEL precipitation data, measured stream stage data, water use data, and assumptions based on norms from watersheds in similar climates. The analysis is considered an "open" water balance since inputs and outputs don't necessarily add up to 100% based on available data, highlighting gaps in data availability and annual and geographic variability. In this high elevation watershed, primary water inputs include precipitation in the form of snow and rain, with a snowmelt dominated spring runoff that shapes channel morphology and provides fresh surfaces for the growth of riparian vegetation. Water outputs include shallow groundwater infiltration that supports late-season baseflows, along with water that leaves the watershed through evaporation, sublimation and deep aquifer infiltration. This water budget characterizes seasonal and spatial trends in snow-water storage with applications for maintaining productive fisheries and enhance ecosystem resiliency in the face of lower and warmer late-season flows. Management recommendations include expanded monitoring networks and restoration actions that maximize precipitation capture and slow the flow of water through the system, along with development practices that mimic natural processes to infiltrate water and reuse actions to cycle water back into the hydrologic system.