Modeling ecohydrological impacts of land management and water use in the Silver Creek Basin, Idaho - DTU Orbit (22/12/2018)

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A number of anthropogenic stressors, including land use change and intensive water use, have caused stream habitat deterioration in arid and semiarid climates throughout the western U.S. These often contribute to high stream temperatures, a widespread water quality problem. Stream temperature is an important indicator of stream ecosystem health and is affected by catchment-scale climate and hydrological processes, morphology, and riparian vegetation. To properly manage affected systems and achieve ecosystem sustainability, it is important to understand the relative impact of these factors. In this study, we predict relative impacts of different stressors using an integrated catchment-scale ecohydrological model that simulates hydrological processes, stream temperature, and fish growth. This type of model offers a suitable measure of ecosystem services because it provides information about the reproductive capability of fish under different conditions. We applied the model to Silver Creek, Idaho, a stream highly valued for its world-renowned trout fishery. The simulations indicated that intensive water use by agriculture and climate change are both major contributors to habitat degradation in the study area. Agricultural practices that increase water use efficiency and mitigate drainage runoff are feasible and can have positive impacts on the ecosystem. All of the mitigation strategies simulated reduced stream temperatures to varying degrees; however, not all resulted in increases in fish growth. The results indicate that temperature dynamics, rather than point statistics, determine optimal growth conditions for fish. Temperature dynamics are influenced by surface water-groundwater interactions. Combined restoration strategies that can achieve ecosystem stability under climate change should be further explored. ©2014. American Geophysical Union. All Rights Reserved.

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