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Climate change impacts on water for energy development in the US Mountain West.

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Unconventional fuels, primarily oil shale and coal-to-liquid conversions, are under consideration as solutions to our dependence on foreign fuels. However, they are energy intensive, have a higher carbon footprint than conventional fossil fuels and present significant demands on water resources in the Rocky Mountain West. We are applying the Watershed Analysis Risk Management Framework (WARMF) basin-scale hydrologic model to address the impacts of climate change and variability on water resources within the context of energy and fuel development in the upper Colorado River basin. WARMF performs physics based energy and water balances on a sub-watershed basis and routes flow through soils and a network of streams, lakes and reservoirs to a watershed outlet. A climate change module has been developed to modify historical meterological data in order to examine the impacts of climate change scenarios in the basin. The model is parameterized and calibrated for the White, Upper Colorado and Gunnison Rivers in Colorado from their headwaters to the Utah border. These rivers are the most likely to be impacted by new extractions of water for oil shale development in the Piceance Basin in Western Colorado. The model predicts that a three degree Celsius change in temperature could result in an average annual reduction in stream flow by 15 to 20 percent and a shift toward earlier snowmelt runoff. In addition, model output is used within a systems dynamics modeling framework to examine water resource management strategies for a range of energy production growth scenarios and the interdependencies between water use, energy production, carbon management, population growth, infrastructure, and economics in western basins.