

Threats to Food-Energy-Water Security for a Colorado River Basin Provisioning Watershed

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Water is critical to society, including water for food, energy, industry and human use. Currently, water infrastructure and management in the United States is optimized for historic mean supplies and is designed to be resilient to past natural and societal extremes. However, the past is no longer an analog for the future. Temperature, precipitation, natural ecosystems, irrigation, energy technology and society regimes are all undergoing changes, which, cumulatively, will likely affect the security of our food-energy-water systems. Here, we examine the impact of these pressures on a provisioning headwater system, the San Juan River basin, a key source area for food, energy and water in the southwestern U.S., and a critical watershed to both the Colorado River and the Rio Grande basins. We consider coupled disturbances on water resources, including changes in climate, vegetation and water use regimes. If these disturbances were to be realized, impacts would be felt not only in the San Juan River basin, but also the downstream reaches of the Colorado River and the Rio Grande. We present a multi-model framework examining scenarios of both climate and water use futures in the local basin and the adjacent basins and consider the impacts on water stress metrics, including reservoir storage, water shortages, instream flows, and water transfers. Impacts range from improved conditions to significantly disrupted water deliveries, which exceed manageable thresholds. These results raise important questions regarding the resiliency of food, energy, and water resources in watersheds across the West under future disturbance and demand scenarios.