MODELING WATER AVAILABILITY AND ITS RESPONSE TO CLIMATIC CHANGE FOR THE SPOKANE RIVER WATERSHED

Abstract

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Water availability at global, national, and regional scales is under threat as never before. Consequently, an important yet challenging issue facing researchers is how to adequately estimate water availability at a basin scale and to predict its response to future climatic change. This doctoral research addressed this need by developing a monthly water availability model to estimate the current water availability at a watershed scale, and by developing a monthly water balance model to simulate and analyze the impacts of future climatic change on water availability.

The applications of these two models upon the Spokane River watershed, which was ranked sixth on the most endangered rivers in American in 2004 due to "too little water, too much pollution, and an uncertain future", produced four important results: (1) The monthly average water availability in the Spokane River watershed was 5,255 cfs, of which 5,094 cfs, or 96.9%, was from surface water, and 753cfs, or 14.3%, was from ground water. However, 592 cfs, or 11.2%, was due to the surface- and ground- water interaction and was double counted; (2) For 16% of the time (123 out of 768 months), mostly in August and September, there was no surface water availability; (3) Water availability within the watershed will be more critical in the future because of potential climatic change, especially for the summer months. Under a climatic scenario when

precipitation remains constant and temperature increases by 2°C, the model predicts a 0.4% decrease in annual streamflow, but a 20–25% decrease in streamflow during July–September; (4) Based on General Circulation Model (GCM) results, the annual streamflow in the Spokane River watershed is likely to increase by 8.6% and 4.8% under the 2020s and 2040s scenarios, respectively, while the streamflow for July–September will decrease by 4.9–7.0% and 14.4–24.6% in the two scenarios, respectively.

The water availability model and the monthly water balance model developed in this study can be applied in other watersheds for estimation of water availability and potential responses to climatic changes. The research results can help managers make more informed decisions in water resource management.