

Changes to Stream Flow in the Boise River and Their Context in the Pacific Northwest

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The effects of climate change on the water cycle have important implications for water management as well as aquatic and terrestrial ecology. Previous studies of stream flow in the Pacific Northwest have found little or no change in the mean stream flow during recent decades; they have, however, found earlier runoff timing from snowmelt dominated systems. Unfortunately, tests for trends in the mean using least squares fitting underestimate the significance of trends for heteroscedastic data. Quantile regression is a tool that can be used to examine trends in distributions and is robust to trends in variance. We analyzed annual runoff data from 43 stations in the Pacific Northwest covering the years 1948 to 2006. About half of the stations had significant ($\alpha=0.10$) declines in median stream flow, and a large majority (72%) of the stations had significant declines in the 25th percentile of annual stream flow. In other words, dry years have been getting drier. Because many aspects of managed and natural systems operate without impairment within some range of the mean, trends in extremes of the distribution may hold more consequences than trends in the mean. The decreasing trends in the lowest quartile, in particular, represent increasing challenges for land and water managers who must cope with water scarcity and its ecological consequences on more frequent and acute basis. Although historical trends in runoff may not reflect future climates the observed trends in stream flow have important implications for other studies of trends in the last half-century. The Boise River is experiencing among the largest trends in stream flow, which has been reflected in a recent history of large wildfires, which, themselves affect the flow. An important finding from the Boise River is the relative response of the stream flow directly to climate change and to vegetation changes over time. This information can greatly improve our understanding of alternative adaptation responses to the changes locally.