Instream Water Rights/Ecological Flows: The Science Perspective (Newsletter)*

December 18, 2017

Instream water rights are (or should be) based on ecological flows. Several western states (including Oregon, Alaska, California, Colorado, and Montana) have statutory requirements for these flows, and the US Geological Survey's Fort Collins Science Center hosts an ecological flows research center. Incorporating effects of changes in climate, human population size and distribution patterns, and other variables makes it difficult for policy makers to allocate a scarce and varying resource among competing vested interests. Each user interest has legitimate economic and societal justification for their claims. Policy makers and lawyers are challenged to optimally adjudicate competing claims. There is a valuable role for environmental science and data analyses to inform these decisions.

As the Fort Collins Science Center web page explains, "The science of ecological flows is interdisciplinary, transdisciplinary, and integrative. The assessment and prescription of ecological flows requires water resource managers and researchers to access and analyze several different types of data and select appropriate tools and approaches from a wide variety of established methodologies." The environmental variables include basin characteristics (natural features and human influences), watershed and aquatic ecology, hydrology, hydraulics, topography, and fluvial geomorphology.

In Oregon, ecological flows and instream water rights date from at least 63 years ago. In 1955 the State Water Resources Board was created to provide a single entity responsible for water resources. In 1972 Ken Thompson described how to determine flows for fish life in his presentation at a Pacific Northwest River Basin Commission meeting. Oregon adopted the Instream Water Rights Act in 1987 which continues to direct actions of the Water Resources Department. In 2007 E. George Robison, Oregon Department of Fish and Wildlife instream flow specialist, prepared a guidance document for the agency entitled, "Calculating channel maintenance/elevated instream flows when evaluating water right applications for out of stream and storage water rights." The need for science in these decisions is at least as strong today as it was in the past.

There are abundant environmental data available from federal and state agency web sites and other sources. These data are at different spatial and temporal scales but can be integrated into a comprehensive description of areas of interest.

One robust approach for analyzing and interpreting complex environmental data sets such as those for instream water rights is that of spatio-temporal modeling. This combines point (e.g., stream discharge, point of withdrawal) and areal (e.g., land use/cover, fish habitat and presence) spatial data with values collected over a period of time. It extends the familiar 2D and 3D views of a landscape to the 4D view of that landscape over time. Viewing changes over time in a river system helps to understand its dynamics. Quantifying those changes using point and areal statistical models better inform decisions because various water allotment scenarios can be compared for their effects on competing uses. A less temporally dynamic approach applies the mathematical techniques of linear algebra to quantitatively optimize a limited resource among various uses; an approach commonly applied to operational research. Decision makers are not bound by these results but have objective, quantitative comparisons of the available choices.

While spatio-temporal analyses and optimization models of comprehensive environmental data provide insights into the changing dynamics of streams, rivers, and the fish and other animals that live in them it does not address the complex issues of water right seniority. That is not an environmental science question but a legal one. However, quantifying the data can assist making decisions on instream water rights/ecological flows.

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