

## **High Cascades Water Farm: Buffering Climate Change Effects?**

### ***Abstract***

Summer streamflow in the High Cascades of central and western Oregon and northern California is due almost exclusively to the vast amount of ground water in storage in the porous and permeable Cascades volcanic rock aquifers. Some people have even suggested that this huge reserve of water could serve as a source, not only for the Pacific Northwest (PNW), but also for other regions in the West. This subsurface water has all but been neglected in discussions of climate change effects on hydrology in the PNW, as most of the emphasis has been placed on the effects on snowpack.

Much work has been done on the hydrogeology of these aquifers, including estimates of transit times and total water in storage. Key Person Gordon Grant and his OSU/U.S. Forest Service (USFS) colleagues and OSU graduate students have conducted much of this work. Their research suggests that large amounts of water in storage exist. These efforts, however, have assumed steady-state flow; there has been no simulation of the transient (time-dependent) behavior of these systems, either in the short or long term. Estimation of time-dependent behavior of these systems is essential to calculate the amount of *recoverable water* in storage and the effects of withdrawals on hydro-ecosystems. Current approaches to simulate transient behavior in volcanic rock aquifers assume models appropriate only for granular porous medium systems.

We propose to: 1) develop new subsurface flow routing models to treat transient behavior in volcanic rock aquifers; 2) collect environmental isotopic and hydrologic data to verify these models; 3) downscale climate models (predictors of temperature and precipitation) to provide estimates of the input forcing functions for the models developed in (1); and 4) estimate the effects of out-of-basin water transfers on Cascades hydro-ecological systems.

### ***Key Personnel*** (contact **M. Campana: aquadoc@oregonstate.edu**)

**Michael E. Campana, PhD** – Director, Institute for Water & Watersheds (IWW) at Oregon State University (OSU). Thirty-five years of professional hydrogeological experience. Developer of compartment models for aquifer analysis and water dating.

**Gordon Grant, PhD**– OSU Professor/USFS Hydrologist. Foremost expert on Cascades ground water systems.

**Jeffrey McDonnell, PhD** – OSU Professor, College of Forestry. World-renowned forest hydrologist/modeler who has worked extensively in the Cascades.

**W. Todd Jarvis, PhD** – Associate Director, IWW. Twenty-five years of professional hydrogeological experience, including work in fractured rock/volcanic aquifers.

### ***Justification for Foundation Support***

The proposed work is high-risk from both the technical and political vantage points. It will require the development of new, and refinement of existing, routing models and collection of data to verify such models, with linkage to climate models. The work is highly politically sensitive, as the mere suggestion that a system has enough water to allow for out-of-region export is unpopular, especially in the PNW.

### ***Estimated Budget - \$2,750,000***

Personnel: \$1,250,000; Equipment: \$750,000; Supplies & Services : \$750,000