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Ground-Water Resources Program

Ground-Water Availability Assessment for the Columbia Plateau Regional Aquifer System, Washington, Oregon, and Idaho

Part of a National Effort to Assess Ground-Water Availability

The U.S. Geological Survey (USGS) is assessing the availability and use of the Nation's water resources to gain a clearer understanding of the status of our water resources and the land-use, water-use, and climatic trends that affect them. The goal of the National assessment is to improve our ability to forecast water availability for future economic and environmental uses. Assessments will be completed for regional aquifer systems across the Nation to help characterize how much water we have now, how water availability is changing, and how much water we can expect to have in the future (Reilly and others, 2008).

Water availability is a function of many factors, including the quantity and quality of water, and the laws, regulations, economics, and environmental factors that control its use. The focus of the Columbia Plateau regional ground-water availability assessment is to improve fundamental knowledge of the ground-water balance of the region, including the flows, storage, and ground-water use by humans. An improved quantitative understanding of the region's water balance not only provides key information about water quantity, but also can serve as a fundamental basis for many analyses of water quality and ecosystem health.

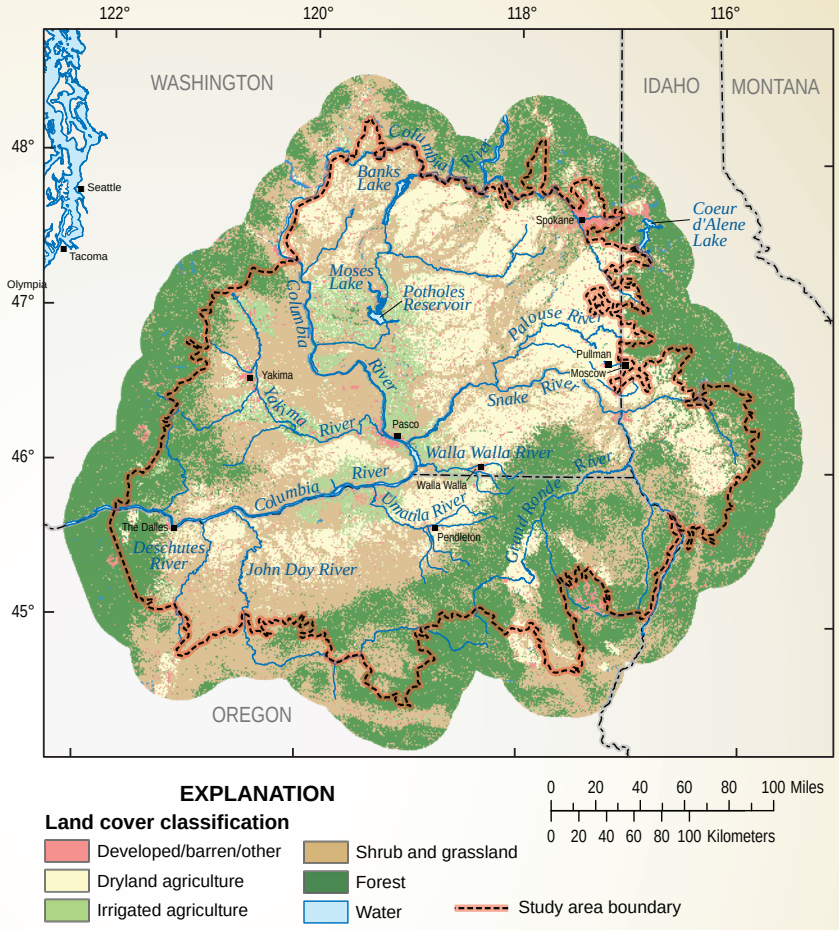

Figure 1. Land use and cover in the Columbia Plateau study area.

Ground Water is a Critical Resource in the Region

The Columbia Plateau covers more than 60,000 square miles within the Columbia River Basin in Washington, Oregon, and Idaho (fig. 1). More than 10 million acres support a $5 billion per year agricultural industry, among the most productive in the Nation. Water supplied from the Columbia River system and the basalt and overlying unconsolidated aquifers is essential to nearly 2 million acres of irrigated land (fig. 1). Water also is important for growing rural and urban populations and ecological needs, and ground-water availability is a primary consideration for balancing the conjunctive use of surface-water and ground-water supplies throughout the region.

Agriculture in the Quincy Valley (Photograph taken by David Putnam, July 2006.)

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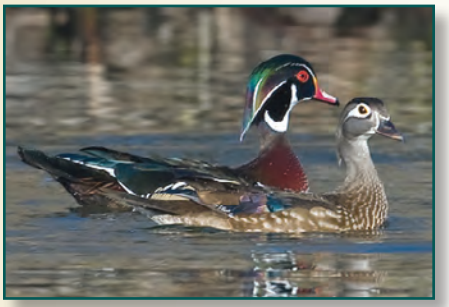
Ground-water pumping has removed water from storage in the basalt aquifers and resulted in maximum water-level declines of 300 feet and declines of more than 100 feet over extensive areas (fig. 2), placing important agricultural sectors at risk. Streamflow in many subbasins currently is inadequate for certain fish listed under the Endangered Species Act and ground-water depletion has contributed to adverse environmental effects. Declining ground-water levels have measurably reduced streamflows and have contributed to loss of wetlands and degradation of aquatic habitat.



Wood duck pair at McNary Wildlife Refuge, Washington (Photograph taken by Janet Barrett, January 2008.)

Developing Tools and Understanding to Support Resource Management Decisions

Several questions must be answered to adequately assess water availability within the Columbia Plateau regional aquifer system:

What is the hydrologic budget (inflows, outflows, and change in storage) for the regional aquifer system and how have its components changed over time?

The study will estimate key components of the ground-water budget (recharge, pumping, exchange with surface water) and evaluate how changes over time have affected ground-water storage and availability.

How have indicators such as ground-water levels and streamflow responded to changes in hydrologic stresses, such as pumping, irrigation return flow, and climate?

Ground-water level data collected from hundreds of wells monitored by State, Federal, local agencies, Tribes, and the USGS will be compiled and analyzed to define the current status of storage in the ground-water system and evaluate temporal and spatial trends that can be correlated with changes in pumping and recharge to the system.

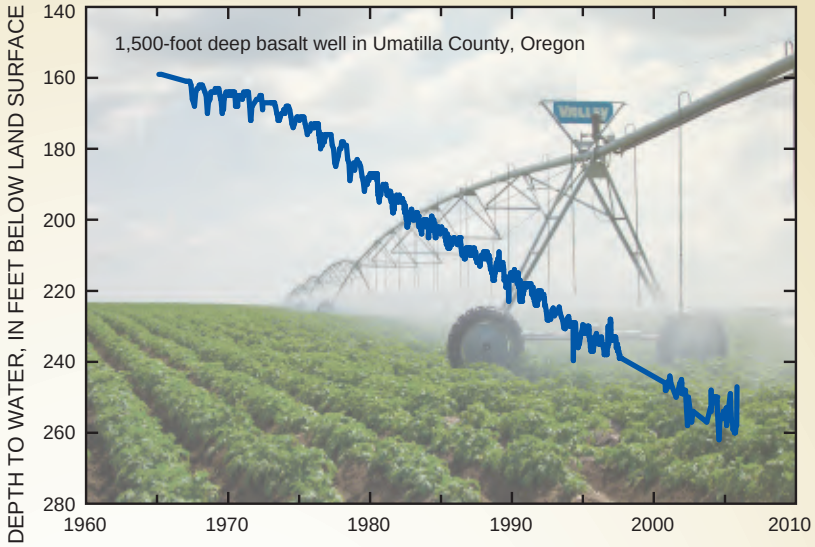


Figure 2. Pumping has removed water from storage in basalt aquifers and caused declines in many areas of the Columbia Plateau.

What are the depths, thicknesses, extents, and characteristics of the major aquifer units?

Most ground water used in the Columbia Plateau comes from layers of basalt collectively known as the Columbia River Basalt Group, a complex aquifer system made up hundreds of individual basalt flows. As part of this study, maps depicting the regional extent and geometry of the major basalt aquifers will be updated using geologic data from a wide variety of sources. The resulting three-dimensional "geomodel" will integrate data and interpretations from recent studies in many parts of the Columbia Plateau and will serve as the framework for a simulation model of the ground-water flow system.

Ground-Water Modeling: A Tool for Assessing Water Availability

Ground-water models attempt to simulate the behavior of a ground-water system using a mathematical counterpart. Models typically are used to evaluate changes to the water budget of an aquifer caused by pumping, land-use changes, and climate, and how these changes affect ground-water storage, streamflow, lake levels, and other environmental variables.

The ground-water model developed during this study will be used to answer questions about how the ground-water system works, and to forecast the effects of regional water management alternatives and effects of drought and climate change. The regional model will also serve as a starting point for more refined local models that can be developed within the boundaries of the regional model, saving time and resources.

Working with Partners

Many State, Federal, and non-governmental agencies, as well as Tribal organizations, have responsibilities or interests in water resource management in the Columbia Plateau. The USGS is collaborating with many of these agencies and organizations to build a better understanding of the region's water resources, expand existing monitoring and data collection networks, and develop tools that will better inform resource management decisions.

Reference Cited:

Reilly, T.E., Dennehy, K.F., Alley, W.M., and Cunningham, W.L., 2008, Ground-water availability in the United States: U.S. Geological Survey Circular 1323, 70 p. http://pubs.usgs.gov/circ/1323/

Banner photograph taken by David Putnam, July 2006.

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