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15. CLIMATE: Warmer weather poses threat to Western aquifers *(12/11/2007)*

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SAN FRANCISCO – Many geologists fear climate change will impair the ability of groundwater aquifers in the West to recharge as a result of diminished snowpack in the region, according to new research presented here at the American Geophysical Union's fall meeting.

Even if a warming climate does not lead to appreciable changes in the amount of precipitation experienced in a particular watershed or bioregion, dramatic effects are possible for the availability of water from aquifers and other subsurface water systems, the research said.

Sam Earman, of the Desert Research Institute in Reno, Nev., said some scientists wrongly think groundwater represents an "unwavering reservoir" that will help stabilize supplies even if surface water is adversely affected through increased evaporation or altered runoff patterns. But the thrust of new studies presented at the AGU meeting is that warming has the potential to alter groundwater recharge patterns for the foreseeable future.

That is because melting snow is essential for recharging groundwater, Earman explained yesterday.

"Even basin-filled aquifers in the western U.S. will have originated as water that fell on mountains as snow," he said, adding that snowpack acts as a bank account to store up precipitation and the amount of runoff allows deeper penetration, thus adding to groundwater systems. Snow is a very efficient recharge agent when compared to rain, and it can be responsible for between 40 and 70 percent of the water that recharges a given aquifer, he said.

Groundwater is a major source of drinking and irrigation water in the United States, representing about 30 percent of all water supplies but 40 percent of the public water supplies. As temperatures rise, there will be less snow collected in the mountains, even if the total amount of precipitation does not change. This "snow to rain shift" greatly reduces recharge efficiency, Earman said.

Small changes in groundwater systems could also drive relatively large shifts in stream flows and above surface water systems, he added.

Alan Flint, a researcher with the U.S. Geological Survey in Sacramento, reported yesterday on hydrologic surveys and projections covering some 20 streams in Northern California and surrounding states, finding in some cases that a 3 degree Celsius increase in average surface temperatures could result in a 45 percent to 70 percent reduction in snowpack in the Sierra Nevada Mountains and the Klamath River Basin of southern Oregon, respectively. This in turn could lead to about a 20 percent reduction in annual runoff and a 17 percent decrease in the recharge of aquifers, he said.

A separate study indicated even more pronounced effects in the Cuatro Cienegas Basin of Mexico, where a 10 percent change in temperatures led to a near 40 percent reduction in groundwater recharge. A somewhat higher temperature change of 5.8 degrees Celsius could bring about a "worst case scenario" characterized by a near total depletion of groundwater recharging, according to Brad Wolaver, of the Jackson School of Geosciences at the University of Texas.

The long-term effects could be decreased availability of water for irrigation in an area known for cattle and alfalfa production.

For the most part, these researchers tested the various effects of temperature while holding total precipitation levels constant, in keeping with observations that there is little change in precipitation as temperatures rise. But such changes would lead to less snow, earlier melting and less total runoff, the scientists found.

The AGU conference continues through Friday.