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UC Merced Connect: Better water management in forecast

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In a remarkable outdoor laboratory in the Sierra, a team of researchers led by UC Merced hydrologist Roger Bales is using sensors to gather a mother lode of data to greatly improve ecological measurement and hydrologic forecasting.

What winter brings to the Sierra Nevada determines, more than anything, how much water can be tapped in summer by California's communities and businesses, including the state's $35 billion agricultural industry. About 60 percent of the water used in California comes from melting Sierra snow.

Water managers always have faced a difficult task trying to allocate the state's most precious resource. They need to know how much water to store in reservoirs and how much to send downstream, and when. But estimates of the amount of Sierra water the reservoirs will receive sometimes are off by as much as 20 percent to 30 percent. At rates of $100 to $600 per acre-foot delivered to metropolitan areas, a 20 percent error could translate into a more than $150 million shortage or excess of water needed downstream. (An acre-foot is about 326,000 gallons).

Historically, the amount of water held in the Sierra winter snowpack has been estimated by intrepid snow surveyors who ski and helicopter in to selected mountain sites to measure snow depth monthly with steel tubes shoved into the snow. The obvious solution seems to be wiring up the Sierra with sensors, but the physical constraints of laying wires throughout remote regions would still limit coverage, not to mention the unavoidable hazards of bears plowing through the wires and rodents chewing them up.

The solution lies in matching remote measurements from satellites with wireless ground monitoring. A specially designed new generation of wireless sensors, developed by UC Berkeley professor Steven Glaser, are now being deployed and tested in Bales' ambitious pilot project.

The matchbook-sized sensors communicate using wireless microprocessors known as motes to measure soil moisture, snow depth and other features critical to predicting spring and summer water availability. The system is designed to transmit the real-time measurements to researchers and water managers.

"What we are deploying right now in this small watershed lays the foundation for new information systems to greatly improve ecological measurement and hydrologic forecasting," said Bales, director of UC Merced's Sierra Nevada Research Institute. "At the same time, it is advancing sensor technology and provides insights about basic Earth-atmosphere interactions."

The prototype grid is being established on a 2.5-square kilometer site in the Sierra, but Bales has his eye on a much larger effort. He has proposed creating a wireless sensor grid to monitor the entire snow-covered region of the American River basin -- more than 3,000 square

kilometers.

"When we can measure these features at the large watershed scale, we can really make a major contribution to the state's water management," Bales said. "Such a grid, along with satellite data, advanced hydrologic models and supporting cyber-infrastructure will form the core of a new water information system for California."

UC Merced Connect is a collection of news items written by the university's Office of Communications. To contact the communications team, e-mail communications@ucmerced.edu.