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"Valles Caldera National Preserve Participates in Study of Earth's Critical Zone"

The zone from the treetops to the bottom of the groundwater table has been dubbed the "Critical Zone" because of its key role in processing and cycling water, carbon and nutrients necessary for life.

Now an interdisciplinary team of researchers will establish a "Critical Zone Observatory" in the Southwest with the help of a five-year, \$4.35 million grant to The University of Arizona from the National Science Foundation.

"We think of the critical zone as being a living filter for the hydrological cycle," said principal investigator Jon Chorover, a UA professor of soil, water and environmental sciences.

"We know a lot about geology and rocks, and we know a lot about communities of plants that exist in different climatic zones, and we know a lot about fertility of soil. However, we don't understand how the components all interact to create this filter at the surface of the earth that helps to clean and store our water," Chorover said.

To figure out how the ecological, geological and hydrological components of the critical zone interact, he and his colleagues will study two different mountain-and-basin areas in the desert Southwest -- the Santa Catalina Mountains outside Tucson, Ariz., and the Valles Caldera National Preserve near Los Alamos, N.M.

"In the arid Southwest, a lot of the water we all depend on is derived from relatively local high-rainfall environments," he said. "Mountains in the Southwest are areas that suck water out of the sky and bring it down into our basin aquifers."

The UA-led effort is called the Jemez River Basin-Santa Catalina Mountains Critical Zone Observatory. The Valles Caldera drains into the Jemez River basin. The NSF has funded four such CZOs in different climatic zones throughout the U.S.

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Comparing the same processes in different climates will help scientists figure out how the critical zone's properties will change under climate change, said co-principal investigator Peter Troch, a UA professor of hydrology and water resources.

The scientists have already begun research at the Valles Caldera and in Marshall Gulch at the top of the Santa Catalinas.

By monitoring water in the soil, stream water and rainwater in the Catalinas, the team has found that even within a relatively small area, the bedrock geology affects water in the soil enough to dictate what vegetation grows there. The UA's Water Sustainability Program provided a Technology and Research Initiative Fund seed grant for the pilot project.

Troch said the research at the Valles Caldera will build upon previous studies of snowpack and the hydrologic cycle conducted there as part of the UA's Sustainability of Semi-Arid Hydrology and Riparian Areas (SAHRA) program.

Robert Parmenter, Valles Caldera's Director of Science and Education, said, "This large NSF CZO grant provides yet another example of the scientific value of the Valles Caldera as an outdoor laboratory and classroom.

"The scientists and students who will work here from across the country, along with their arrays of high-tech instrumentation, will provide benefits to society at local, regional and national scales -- particularly through educational programs for public school students and teachers, as well as university undergraduates, graduate students and faculty."

In addition, findings from CZO research will complement those from the new experiment at UA's Biosphere 2. A team of scientists, including some from the CZO team, are using Biosphere 2 as a gigantic controlled-environment laboratory to test how water moves through a variety of artificial hill slopes.

Chorover said, "A lot of exciting science occurs at the interface between disciplines." He added that having a research team that combines the outlooks and skills of hydrologists, ecologists, geomorphologists and geochemists is crucial for figuring out how the critical zone works.

Karl W. Flessa, director of UA's new School of Earth and Environmental Sciences, said the CZO project capitalizes on the school's strengths.

"It's a bold and imaginative effort," Flessa wrote in an e-mail. "This project is a great example of how the new School can bring together a great interdisciplinary team to tackle important problems in the earth and environmental sciences."

Chorover, a member of the new school, said, "We would be hard-pressed to find another university in the entire country that has the human resources to do truly integrated Critical Zone Observatory science at the scale that we're going to do it."

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Related Web sites

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<http://www.hwr.arizona.edu/~surface/index.html>

Valles Caldera National Preserve
<http://www.vallescaldera.gov/>

Biosphere 2
<http://www.b2science.org/>

UA School of Earth and Environmental Sciences
http://cos.arizona.edu/sci_interdisciplinary/earth_environmental_sci.asp