

UC SANTA BARBARA

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## **GROUNDWATER PUMPING MODEL DEVELOPED BY UC SANTA BARBARA PROFESSOR**

Underground water or aquifers are continuous, but the land above them is usually carved up among different owners. A professor at the University of California, Santa Barbara has designed a tool for landowners to determine how much water they can pump without depleting the aquifer they share.

Hugo A. Loaiciga, a professor of geography at UC Santa Barbara, will present his mathematical model at the annual meeting of the Geological Society of America, in Denver at the end of October.

Loaiciga has spent a decade refining his model. He studied two aquifers, the small Santa Barbara aquifer in Santa Barbara, Calif., and the large Edwards aquifer in Texas, which spans an area between Austin, San Marcos and San Antonio.

He is interested in how to maintain long-term sustainability of a resource that is renewable.

The model looks at the number of individuals pumping water out of an aquifer and shows how much each can take out without causing the aquifer or springs to dry up. The model also includes the expected financial return for the water and the amount of water available.

Loaiciga shows that the competition for shared ground water can be framed as a problem of game theory whose outcome depends on whether or not there is cooperation among ground water pumpers. Climate variability and future human pressure for groundwater are taken into account by the ground water model.

Eventually Loaiciga expects to package and market the mathematical software.

He said that two individuals influenced his thinking on this problem. They are emeriti professors John Nash of Princeton University and Garrett Hardin of UC Santa Barbara. Nash, whose story was told in the movie "A Beautiful Mind," did mathematical studies of how businesses compete for a share of the market. "The math is different, but the idea of competition is the same," said Loaiciga. Hardin wrote "The Tragedy of the Commons," which tells the story of how natural resources held in common are often decimated by overuse.

In California, the groundwater is very scarce and valuable, according to Loaiciga. "Many people are after it," he said. "And the statutes that govern the extraction of groundwater are less developed than they are for rivers and lakes."

Articles by Loaiciga describing the model are in press with two journals, The Journal of Hydrology and the International Geology Review.

NOTE:

Before the conference Loaiciga can be reached at (805) 893-8053 or [Hugo@geog.ucsb.edu](mailto:Hugo@geog.ucsb.edu)

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## **About UC Santa Barbara**

The University of California, Santa Barbara is a leading research institution that also provides a comprehensive liberal arts learning experience. Our academic community of faculty, students, and staff is characterized by a culture of interdisciplinary collaboration that is responsive to the needs of our multicultural and global society. All of this takes place within a living and learning environment like no other, as we draw inspiration from the beauty and resources of our extraordinary location at the edge of the Pacific Ocean.