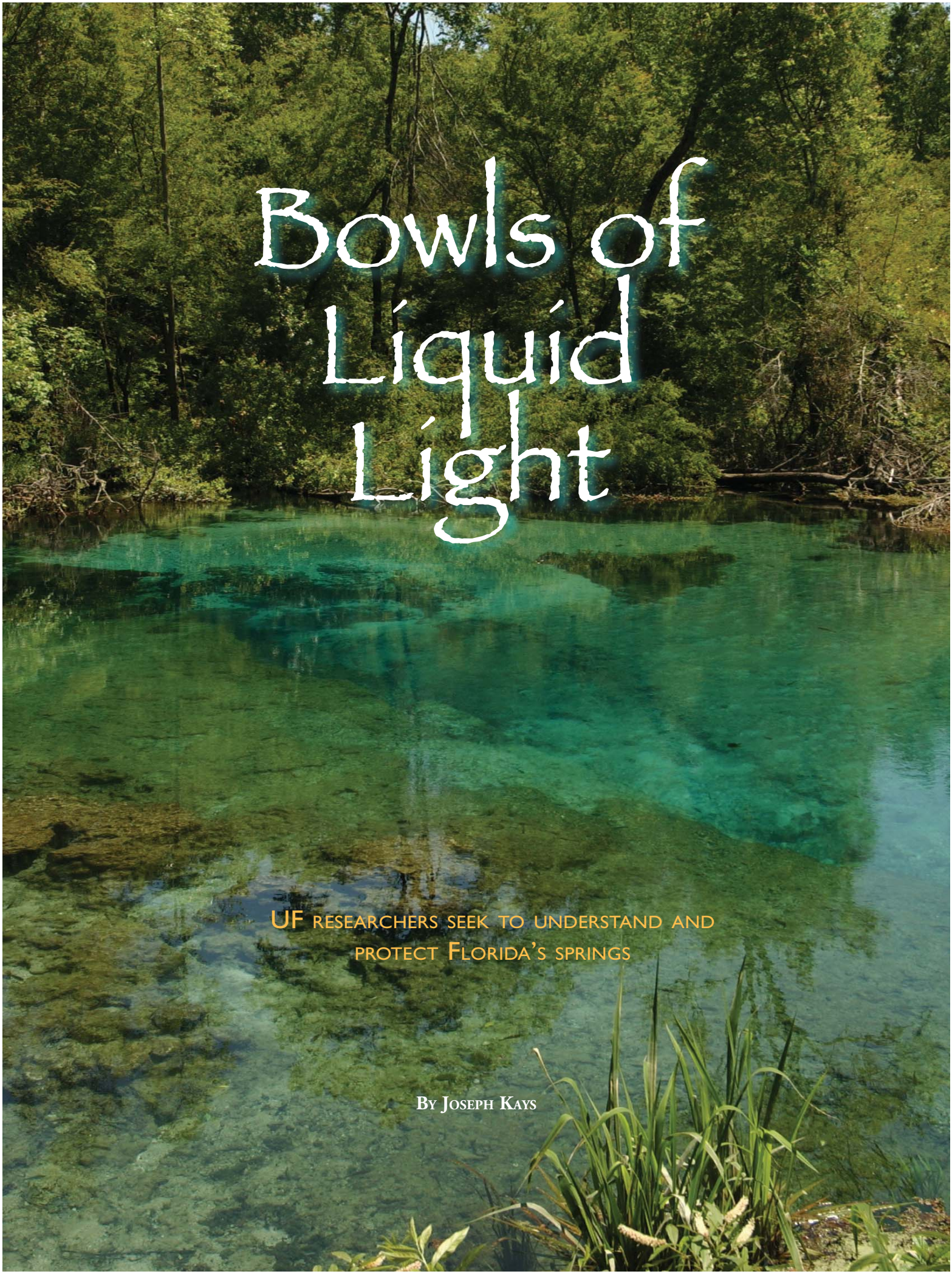


Bowls of Liquid Light

UF researchers seek to understand and protect Florida's springs

By Joseph Kays

Florida's Springs.

Renowned University of Florida naturalist Archie Carr called them "little ecologic jewels" and "the singular blessing of the Florida landscape." Environmentalist Marjorie Stoneman Douglas called them "bowls of liquid light," and 18th-century explorer William Bartram called them "enchanting and amazing crystal fountains."

Geologically, Florida's 700 springs are windows into the Floridan Aquifer — 100,000 square miles of permeable limestone saturated with water like a giant sponge that underlies all of Florida and parts of Georgia, South Carolina and Alabama.

For eons, rainwater has trickled from the surface down to the aquifer, only to reappear days, months or years later from the springs, to form rivers like the Ichetucknee and the Silver, evaporate and fall again as rain in a never-ending cycle.

For much of history, human impact on the springs and the aquifer has been minimal. Although archaeological evidence indicates humans have lived around the springs and along the rivers they feed for thousands of years, it is only in the last century, as Florida's population has mushroomed, that humans have begun to negatively impact the state's fresh water supply.

Beginning in the 1880s, Jacksonville, Fla. and Brunswick, Ga. became the first municipalities to punch wells into the Floridan Aquifer to provide drinking water for their growing populations. Today, Floridians use more than 7 billion gallons of water a day, more than 60 percent of it groundwater.

At the same time that more water is being withdrawn from the aquifer, nitrates and other pollutants from septic tanks, treatment plants and stormwater and agricultural runoff are contaminating the surface water that replaces it.

The springs are suffering "death by a thousands wounds," says Jim Stevenson of the state's Springs Task Force and the Ichetucknee Springs Basin Working Group

"Between 1950 and 1990, Florida's human population more than quadrupled, and our population continues to increase," a November 2000 report from the task force said. "Since the 1970s, scientists have documented a decline in water quality in most Florida springs, particularly in regard to nutrients such as nitrate."

Over the past 30 years, typical nitrate levels in Florida springs have risen from 0.02 milligrams per liter to 1.0 milligrams per liter, according to the report.

During a recent day-long tour of the Ichetucknee Springs basin, Stevenson illustrated the many ways development is impacting, and being impacted by, the springs.

He starts in Lake City at Alligator Lake, which regularly flushes its water into a sinkhole that ultimately leads 12

Photos by Kristen Bartlett

Alligator Lake in Lake City

miles south to Ichetucknee Springs. Lake City used to pump its treated sewage into the lake. Now, the city sprays the effluent over some 350 acres of hay field just a stone's throw from the Ichetucknee Trace, the historic path of the Ichetucknee River, now mostly underground.

As the tour follows the current and historic path of the river south, Stevenson points out gas stations almost on top of sinkholes feeding the springs, and mobile homes being swallowed by sinkholes in an area that was once the riverbed. Canoeing down the Ichetucknee River from the headwaters, Stevenson then points out the ecological implications of the pollution. Mats of algae float past the canoes, algae covers the eelgrass that grows along the river bottom and water lettuce threatens to clog some of the seven springs that feed the river.

Excessive nutrients promote invasive plant growth.

For Richard Hamann, an environmental law expert in the UF College of Law's Center for Governmental Responsibility (CGR), it was a tour like this that opened his eyes to the extent of the springs pollution problem.

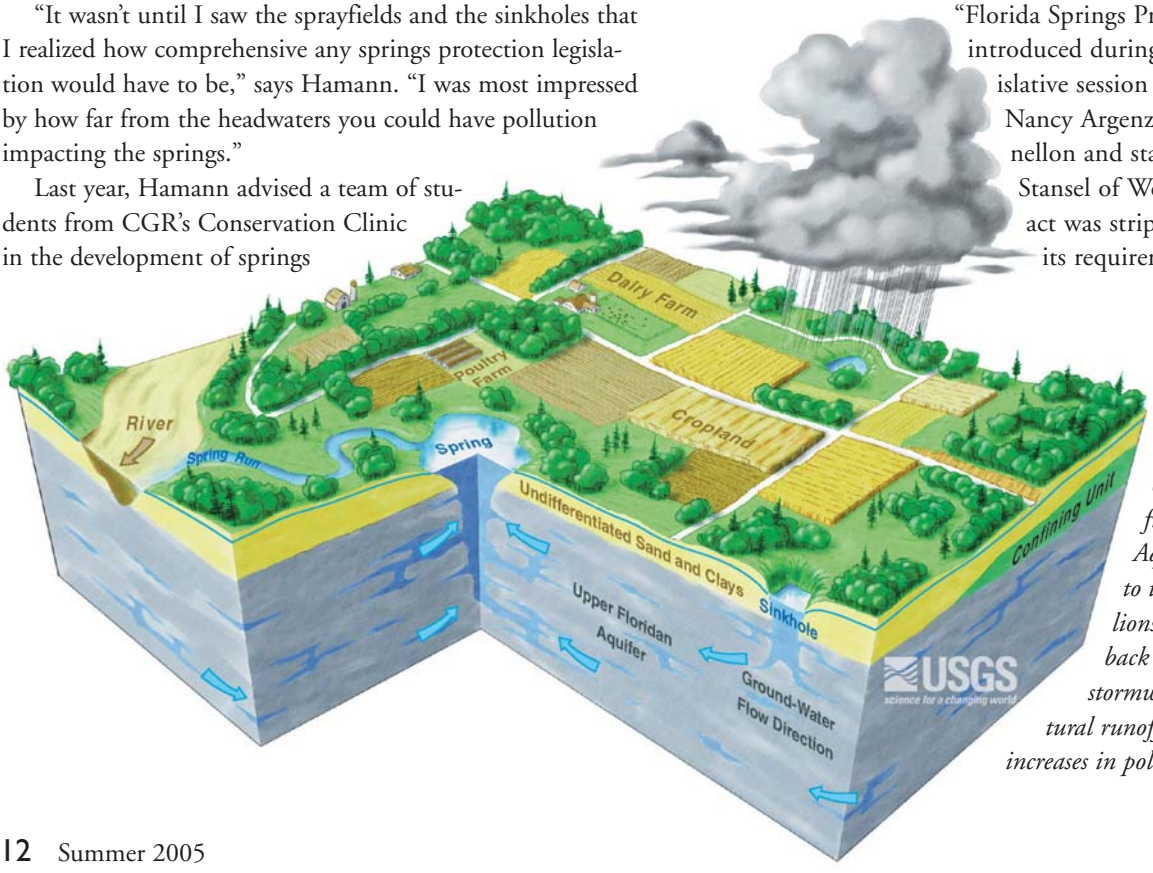
"It wasn't until I saw the sprayfields and the sinkholes that I realized how comprehensive any springs protection legislation would have to be," says Hamann. "I was most impressed by how far from the headwaters you could have pollution impacting the springs."

Last year, Hamann advised a team of students from CGR's Conservation Clinic in the development of springs protection legislation and tools to help local governments implement it.

The model springs protection legislation that law students Matthew Brewer, Matt Clark and Christine Francescani, and interdisciplinary ecology doctoral student Jason Evans drafted at the behest of the Silver Springs Basin Working Group required the state Department of Environmental Protection (DEP) in cooperation with the Florida Geological Survey to delineate springsheds and primary and secondary protection zones for all first- and second-magnitude springs. Flow from first-magnitude springs, the largest, exceeds 64 million gallons a day.

Once this was completed, the law required local governments to review their comprehensive plans to ensure that they addressed any springs in their jurisdiction. The law also required DEP to establish total maximum daily loads of nutrients for all impaired first- and second-magnitude springs and adopt new criteria for determining impairment.

The model legislation ultimately evolved into the "Florida Springs Protection Act" introduced during the 2005 legislative session by state Sen. Nancy Argenziano of Dunnellon and state Rep. Dwight Stansel of Wellborn. The act was stripped of most of its requirements and then



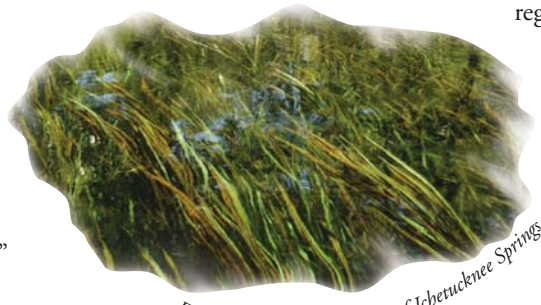
Floridians draw billions of gallons of pure water daily from the Floridan Aquifer, reducing flow to the springs. The billions of gallons they pour back as treated sewage, stormwater and agricultural runoff cause dramatic increases in polluting nitrates.

stalled as the session expired in May, but Hamann says its introduction was an important first step.

"We weren't looking to propose something that was politically possible; we were looking to do something that was needed," Hamann says of the legislation. "This kind of legislation doesn't happen overnight, but the fact that we set in motion serious consideration of the problem and potential solutions is an achievement."

"Getting sponsors and getting it introduced was a big first step," adds Fay Baird, coordinator of the Silver Springs Basin Working Group. "I was very impressed with the quality of the legislation we received from Richard Hamann and the students."

Margaret Carr, a UF landscape architecture associate professor, says "this legislation is part of the building momentum to tie land use to groundwater protection. What initially seems like a radical idea eventually becomes possible."

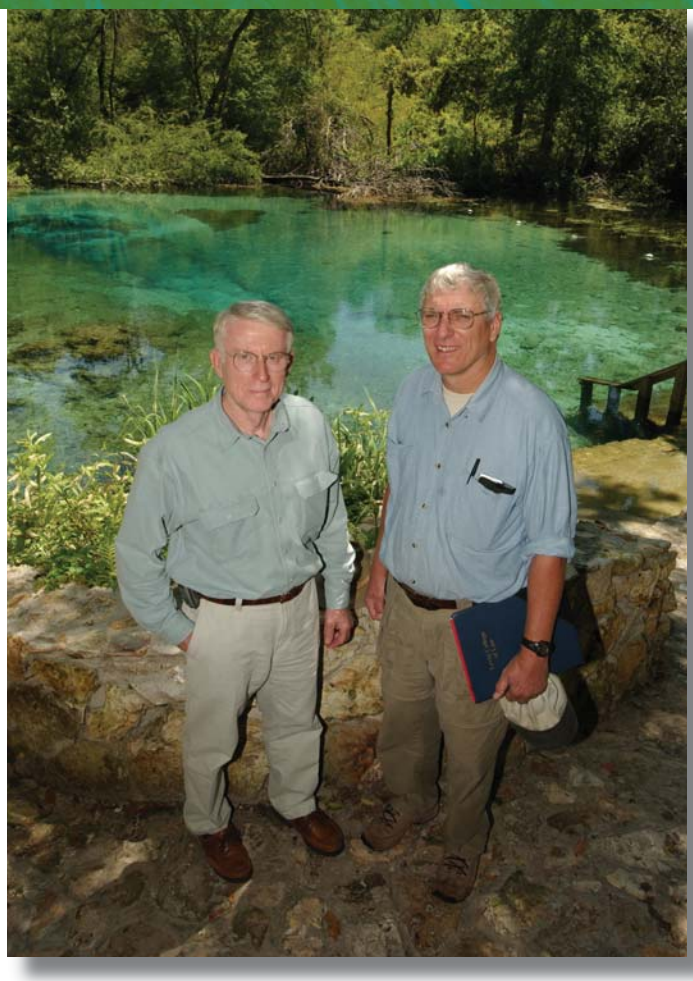


Eelgrass grows on the bottom of Ichetucknee Springs.

Four years ago, Carr led a group of 17 urban and regional planning and architecture students who developed a land-use plan to protect the water quality, water quantity and native habitats of the Ichetucknee springshed.

The final plan the team presented to Columbia County elected officials and administrators sought to balance population growth around Lake City, with the desire to preserve the area's agrarian heritage and protect the Ichetucknee springshed.

One of the keys to effective legislation and land-use planning to protect springs is understanding exactly how water moves through the karst system. That's what UF geological



Jim Stevenson and Richard Hamann at Ichetucknee Springs State Park.

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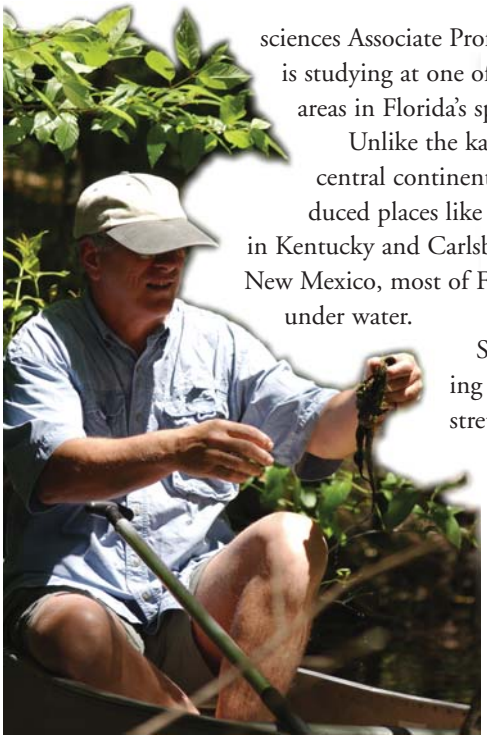
— Richard Hamann

Richard Hamann snorkles the Ichetucknee.



Algae floats along the surface and covers the eelgrass that grows along the river bottom.

sciences Associate Professor Jon Martin is studying at one of the most unique areas in Florida's springs system.

Unlike the karst geology of the central continent that has produced places like Mammoth Cave in Kentucky and Carlsbad Caverns in New Mexico, most of Florida's caves are under water.

So Martin is focusing his research on a stretch of the Santa Fe River that goes underground for more than six miles through O'Leno State Park in High Springs.

"O'Leno is a great natural laboratory because it has been extensively mapped by cave divers," says Martin, who is a member of the Springs Task Force. "We can track water as it enters the system and as it comes out."

Martin and his colleagues, including geological sciences doctoral student P. J. Moore, are using a variety of mechanical and chemical techniques to track water in the Santa Fe River from when it disappears beneath the surface at a point called the river "sink" until it reemerges six miles later at the river "rise."

"We monitor the chemical composition of the water along the flow path," Martin say. "We also monitor the temperature and measure the chemistry to see how it changes. We're basically developing a natural chemical fingerprint for the water."

Specifically, Martin's team is trying to understand how

(Clockwise from left) Jon Martin inserts a pump into one of eight wells his team has drilled around O'Leno State Park. The samples, clearly marked by date and location, are fixed with acid by doctoral student P.J. Moore to prevent them from spoiling before they can be analyzed in Gainesville.

water moves between large conduits like sinkholes and springs and the saturated limestone "matrix" that surrounds them.

"Water flows rapidly through the big conduits, but much more slowly through the matrix," Martin says. "We're trying to understand how these two types of flows interact."

Interaction between the matrix and the conduits has important implications for human and ecological health, Martin says.

"The water we drink comes from the matrix porosity. If a contaminant gets in the matrix, it could reside there for a very long time and cleanup would be very difficult," he says. "It will also slowly seep into the conduits and get out into the springs, changing the ecology."

In addition to monitoring the water going through the conduits, Martin's team has drilled eight 100-foot-deep wells to get samples of the matrix water near the conduit.

"Using all of these techniques, we can plot what portion of the water is from the matrix and what portion is from the conduit," Martin says. "A lot of attention has been focused on sinkholes and other large pathways for contaminants to enter aquifers. What is less commonly appreciated is that the porous matrix provides an additional, significant route for contaminants from the ground surface. Consequently, results from this work could provide the basis for a more realistic conceptual model of water flow in the Floridan Aquifer."

O'Leno State Park.

Related Web sites:
http://www.law.ufl.edu/conservation/index.shtml
http://www.geoplan.ufl.edu/projects/springs/index.html
http://www.floridasprings.org/

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