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Psst... Groundwater and Surface Water Do Mix

By [FELICITY BARRINGER](#)

An [article](#) published in the journal Geophysical Research Letters this week describes a new and simple way of measuring groundwater's contribution to small streams on the surface.

By taking snapshots of streams with a device designed to capture, through infrared radiation images, the temperatures in various parts of the water, the approach "advances the immediate detection and quantification of localized groundwater inflow for hydrology, geology and ecology," the article's authors, Tobias Schuetz and Marcus Weiler of the University of Freiburg's Institute of Hydrology, wrote.

Sinking land levels in the San Joaquin Valley.

Groundwater, they found, tends to be cooler than surface water in summer and warmer in winter; the infrared devices record the difference and produce images that show groundwater as clearly as night goggles show a human figure in the dark.

By coincidence, on Tuesday, the same day the article was officially published, the California state assembly's committee on water, parks and wildlife held a [hearing](#) on groundwater that was part science class and part exploration about what to do to regulate the use of groundwater in the state.

More than any state in the West, California severely limits the circumstances under which groundwater can be regulated in view of its connection to both surface water and other pockets of groundwater.

Only when it is in a "known and definite channel" underground is groundwater subject to significant controls. Hard pumping of the groundwater located outside such channels over the last 60 years has caused land in the San Joaquin Valley to drop more than 25 feet.

So while the Freiburg researchers show side-by-side photographs of streams as seen by the naked eye, and the same streams with the groundwater inflow clearly visible to infrared sensors, California water law, figuratively, closes its eyes, operating under theories that are largely oblivious to the connections that the Freiburg researchers and others have been documenting for decades.

Pumping groundwater beneath one's land is commonplace in agricultural areas, and largely unregulated. Although the state does now [monitor](#) the levels of groundwater tables, legislative efforts to establish a state system to permit wells or simply monitor the amount of water pumped have failed repeatedly over the past decade.

But, as demonstrated by the hearing called by Assemblyman Jared Huffman, chairman of

the water and parks committee, the effort to manage groundwater as if it were part of the surface water system may finally be gathering momentum. (It was going nowhere when I first [wrote](#) about the issue back in 2009.)

As Thomas Harter, a hydrologist at the University of California, Davis and a witness at Tuesday's hearing, said in an interview, "In legal terms, there are, historically, two very different doctrines on how groundwater and surface water has been allocated."

But, he added, "to the degree that groundwater feeds streams it's important to stream flows and stream ecosystems." And "streams are an important component of the groundwater budget in California," he said.

Tony Rossmann, a lawyer in San Francisco. said that the state is unlikely to abandon its current legal distinction between groundwater an surface water soon.

The major constituency for the status quo is California's \$30 billion agricultural industry. But each new study that confirms the connections between water on underground and water on the surface gives a little more ammunition to environmental groups, legislators and water lawyers who want to bring groundwater under unambiguous state control, as it is in every other state except Texas.

Barry Nelson of the National Resources Defense Council took up the issue in a [blog post](#) this week, noting that over eight years, overpumping averaged even million acre-feet each year, he noted. "The impacts of this level of unsustainable pumping are far-reaching — declining water tables, increasing pumping costs, rivers like the Cosumnes literally sucked dry from below, subsiding land and more."

"Liquid Assets," a [report](#) issued last year by the California legislature's legislative analyst's office, recommended phasing in a system of permitting groundwater withdrawals.

As the authors of the new Freiburg study, even though their methodology is currently limited to small streams, their measuring process "may well improve our ability of sustainable water management in water-scarce regions" — maybe even regions governed by laws and court rulings that create distinctions that fly in the face of this kind of science.