

Groundwater Pumping: A Pernicious Threat

by Robert Glennon
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From Arizona to Massachusetts, rivers have recently dried up. The cause is not any of the usual culprits: diversions, dams, or drought. Instead, American rivers face an unseen and largely unknown but profoundly pernicious threat: groundwater pumping.

Groundwater comes from underground aquifers—large repositories of water once thought to be as ubiquitous and plentiful as the air we breathe. We now know better. The science of hydrology teaches that groundwater is part of a hydrologic cycle that provides freshwater to lakes, rivers, creeks, springs and wetlands. If this seems surprising, consider the following riddle: where does water in a river come from if it hasn't rained recently? The answer is it comes from the ground. When the water table surrounding a river is higher than the river, groundwater flows subsurface toward the river to provide "base flow"—flows even in the absence of rain.

Groundwater pumping disrupts this cycle: it steals water from our rivers. Because groundwater moves slowly, the impact may occur imperceptibly over years or even decades. Eventually, stark consequences—rivers that dry up—are apparent. Pumping that gradually reduces flows and causes a decline in the number of birds, butterflies, fish or trees, incrementally diminishes our enjoyment of the resource. As a consequence, we may not notice the effects until they are disastrous.

In the United States in 2000, we pumped a staggering 30 *trillion* gallons of groundwater. Over half of us rely on groundwater as our drinking water source. And we are dramatically increasing the amount of groundwater pumped. During the recent drought, farms, cities, mines and even individual homeowners desperately searched for new water supplies. The usual solution was to drill new wells because groundwater

pumping is largely unregulated. Think of an aquifer as a giant milkshake glass and think of each well as a straw in the glass. The legal rules in most states allow anyone to insert a new straw into the glass. The legal rules permit limitless access to a finite resource, a phenomenon known as the tragedy of the commons. Such unrestricted and unsustainable access will eventually deplete the supply, cause land subsidence, create water quality problems and induce salt water intrusion. But for those of us who care about our rivers, the most horrifying prospect is the drying up of rivers, creeks, springs and wetlands.

This increase in groundwater pumping often comes from quite innocent human activities, such as the country's new-found fascination with bottled water. Sixty percent of us drink the stuff, which has made bottled water the fastest growing product among supermarket categories.

Consumption has risen 1,300 percent in the last 15 years. Consider Nestlé Waters North America, the largest bottler of water in the United States whose brand names include Arrowhead, Calistoga, Poland Spring, Ice Mountain, Zephyrhill and Osarka. Nestlé's marketing strategy has generated protests from citizens' groups in Michigan, Wisconsin, Maine, Texas and California. Nestlé sells "spring" water because the company thinks that American consumers find greater cachet with bottled "spring" water than with "artesian," "natural," "flavored" or "mineral" water, which are other U.S. Food and Drug Administration approved categories. But to market "spring" water, the company's wells must be adjacent to the springs. Those wells pump water that would discharge to the springs and provide cold, renewable supplies of water to downstream rivers, often creating just the right habitat for trout reproduction. Diminishing the flow of a spring may increase the ambient temperature of the

river and impair trout reproduction. It's a water folly because if Nestlé moved its wells away from the springs, the water would have the same chemical corporation and the springs would be protected. A marketing strategy drives this water use.

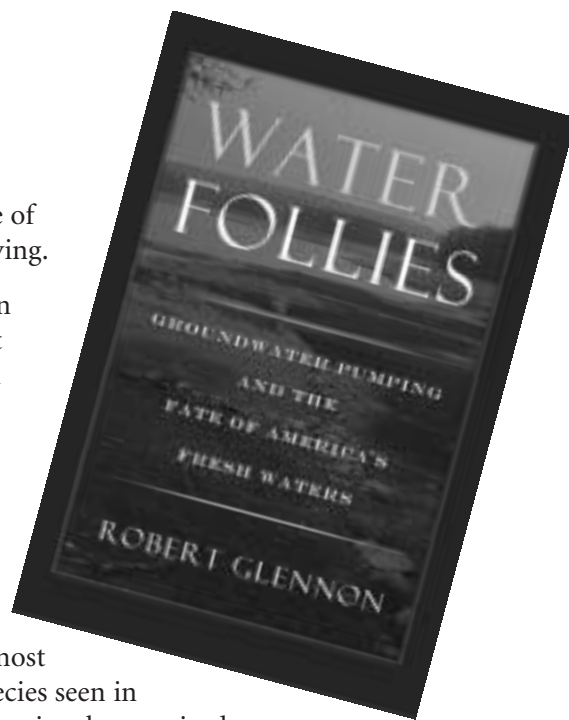
For another new use of groundwater with ominous implications for rivers, consider McDonald's french fries. Until recently, farms in the Midwest, the East and the Southeast were "dry-land" farmed, meaning that the farmers had no irrigation systems. However, our love affair with french fries (the average American consumes 30 pounds a year) has caused some potato farmers to shift from dry land to irrigation farming. The size, shape, and texture of dry-land potatoes depends heavily on seasonal weather patterns. During the growing season, potatoes need constant moisture or they will have knobs and odd shapes. A misshapen or knobby potato is perfectly edible, but it is not acceptable to McDonald's. In 1988, McDonald's began to offer consumers "super-sized" meals with larger portions of french fries served in rectangular boxes with flat bottoms. Since then, McDonald's will only accept potatoes from farmers who irrigate. Irrigation produces fries with a uniform length—just long enough to jut out of the super-sized box to allow the consumer to grasp the fry between index finger and thumb and dip it in ketchup. In Minnesota, this change in potato-farming practices threatens rivers, such as the Straight River, a blue-ribbon trout stream. This water use is a folly because the insistence on an "industrial" potato (as the trade calls it) has consequences for our rivers.

In *Water Follies: Groundwater Pumping and the Fate of America's Fresh Waters*, I tell these stories and a dozen others from around the country. My stories illustrate human foibles including greed, stubbornness and especially, the unlimited human capacity to ignore

reality. A recent development in one of my stories is horrifying.

In July 2005, the San Pedro River, the last free flowing river in southern Arizona, went dry for the first time in recorded history. The San Pedro supports an estimated 390 species of birds (almost two-thirds of all species seen in North America). The river has received special designations from the Birder's Digest, the Nature Conservancy, the American Bird Conservancy and the National Audubon Society. However, population growth in the nearby city of Sierra Vista and surrounding Cochise County is exploding and this growth is entirely dependent on groundwater. The issue of fostering sprawl versus protecting the river is well framed. But not surprisingly, local developers claim that groundwater pumping has not caused water levels in the river to decline. Scientific uncertainty attends many disputes over the impact of pumping on a particular river or spring. Some of this debate is in good faith, an honest disagreement about what the evidence suggests and the computer models predict. Other positions seem animated by gross self-interest. With so much money at stake, developers pay consultants handsome fees to help obtain lucrative permits to pump. My hydrologist friend, Tom Maddock, dismisses such hydrologists as "hydrostitutes."

Golly, you (readers) must be thinking, this is a cheery, uplifting article. Is it all doom-and-gloom or does he offer some solutions? Indeed I do. To begin, we must recognize the urgency of the problem. It may take



In a striking collection of short stories that brings to life the human and natural consequences of our growing national thirst, Glennon provides an occasionally wry and always fascinating account of groundwater pumping and the environmental problems it causes. Water Follies brings this widespread but underappreciated problem to the attention of citizens and communities across America.

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years or even decades before the effect of pumping on the environment becomes apparent. The irremediable fact is that groundwater pumping that has already occurred will cause environmental damage in the future. Those consequences are spilt milk. Our focus should be on reforming the system to control pumping by restricting new wells. Although the cure will not be easy or quick, there is great incentive because Mother Nature has enormous regenerative capacity. If we change direction and chart a new course for the future based on wise policies, then there is reason to be hopeful for the future of our rivers.



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We should combine a command-and-control model of government rules and regulations with the market forces of transferable rights and price incentives. Any meaningful reform should do two things. First, it should protect the rights of existing users by creating quantified water rights that are transferable (and therefore valuable), and second, it should halt the tragedy of the commons by placing restrictions on drilling new wells.

States should require new users, developers who wish to place additional straws in the milkshake glass, to pinch someone else's straw. States should foster a market in water rights by allowing the easy transferability of rights from existing users to newcomers. We use an enormous quantity of groundwater for extremely low-value economic activities. For example, in California, an acre-foot of water (325,000 gallons) used to grow alfalfa generates \$60 in revenue. That same acre-foot used in California's Silicon Valley generates \$980,000 in revenue. State law should facilitate the reallocation of water to higher-value uses by encouraging water markets.

But water markets alone are not a sufficient response because markets are notoriously incapable of internalizing environmental

harms. Companies such as Nestlé do not absorb the environmental costs of habitat that is degraded by their pumping. To correct for this market malfunction, we need governmental rules and regulations. Water conservation regulations make a great deal of sense, as do rules that set minimum flow levels in rivers. But most importantly, rules should protect rivers by prohibiting the drilling of new wells in areas that are hydrologically connected to surface flows.

There is another solution that has received scant attention. We need to price water appropriately. In the United States, most of us pay more for our cell phones and cable television than for water. In fact, most of us pay nothing for water. When we receive a monthly water bill from a public utility or the public water department, that bill usually includes only the extraction cost of drilling the wells, the energy costs of pumping the water, the infrastructure costs of distribution and storage system, and the administrative costs of the water department or company. With rare exceptions, water rates do not include a commodity charge for the water itself. The water is free!

Our habits as consumers will change only *if and when* the cost of water rises sufficiently to get our full attention. We should adopt inverted block rates that raise the price of water as the volume used increases. Such rates would protect persons of modest means and discourage discretionary water uses, such as outdoor landscaping and swimming pools.

In the end, I am optimistic. Now that we understand the connection between groundwater pumping and rivers, it is time to act. If we have the political will, our springs will bubble and our rivers flow.

