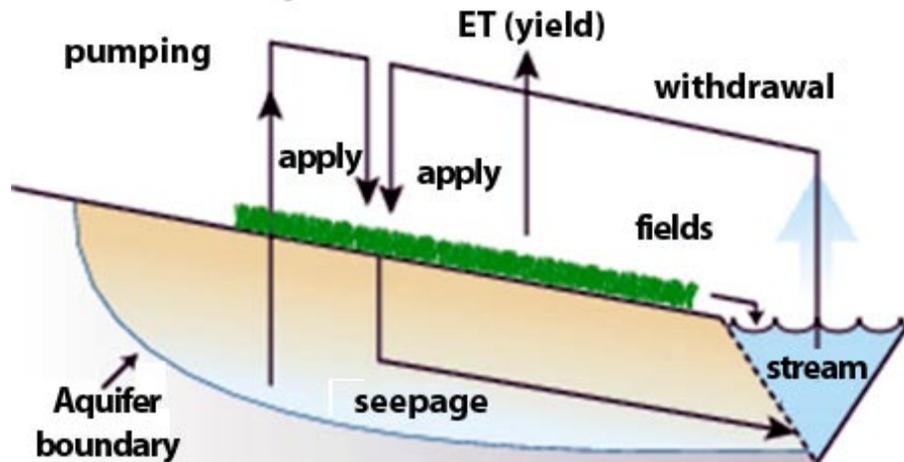


18 November (Berardelli)

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**Anatomy of waste.** Analysis of drip-irrigation methods shows it consumes more water than conventional flooding.

Credit: *PNAS*

## When a Flood Beats a Trickle

By Phil Berardelli

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Bad news for a thirsty world: The main conservation method for agricultural irrigation actually wastes water in many cases, a new analysis finds. As a result, government subsidies for this method, called drip irrigation, are not achieving their stated goal, the study concludes. The work is an "important addition to previous conceptual work" and something that may help influence policymakers, says natural resources economist Ray Huffaker of the University of Florida, Gainesville.

Agriculture is the world's largest consumer of water. In an effort to conserve, many farmers now use drip irrigation, which trickles water to crops, rather than flooding their fields. The method has boosted crop yields and farm income--"more crop per drop," as advocates say--and it has won the support of conservationists. But it does have a known drawback: It's considerably more expensive than flooding--because it requires more extensive irrigation equipment--so federal and state governments have promoted the technique by paying subsidies to farmers.

There are other disadvantages. "Most of us interested in water conservation assumed that drip irrigation was a big-time water conserver," says water resources economist Frank Ward of New Mexico State University in Las Cruces. But over the past few years, "several water managers and engineers have tipped us off" to problems with the method, he says. For one thing, it turns out that drip irrigation requires more water per plant, because plants irrigated in this way grow faster

and produce bigger yields; therefore, they consume more. At the same time, drip irrigation means less water available downstream and in local aquifers, because there's more evaporation and much less runoff.

To weigh the costs of drip irrigation against the benefits, Ward and colleague Manuel Pulido-Velázquez of the Polytechnic University of Valencia, Spain, used an economic model to analyze the Upper Rio Grande Basin in New Mexico, Mexico, and Texas, where environmentalists would like to see drip irrigation used more widely. The researchers studied its effects under a variety of subsidy levels and projected the outcomes to 2025. As the pair reports online this week in the *Proceedings of the National Academy of Sciences*, drip irrigation consistently drank up more water, particularly when it was heavily subsidized. For example, in one part of the watershed, the researchers calculated that with a 50% subsidy, farmers used nearly 15% more water overall--about 24 million cubic meters--annually with drip irrigation than with flooding. "We didn't think those effects would be quite so vivid," Ward says.

Ward says drip irrigation can still be useful in nations like Afghanistan, where there aren't other users downstream clamoring for a share. But in the United States and most developed countries, he says, a surer path to saving water in agriculture would be to grow more water-conserving crops and to periodically let fields lie fallow in order to remove the irrigation requirement temporarily.