PERC Case Studies

Flint River Basin Irrigation:

Wireless Water for Biodiversity




By Reed Watson & Brandon Scarborough

Edited by Laura Huggins

Farmers in the drought plagued Flint River Basin of southwestern Georgia are working with conservation organizations to keep water instream and underground while maintaining profits in their agricultural operations. By retrofitting their traditional center pivot irrigation systems with high efficiency sprinkler heads and real-time soil moisture monitors, irrigators can limit water output to meet the precise needs of their crop. The result is a cost-cutting, water-saving measure that aligns profitability with environmental stewardship.

This case study explains how conservationists partnered with farmers and university researchers to improve irrigation efficiency and conserve water in the Flint River Basin. It also explains how this sort of collaborative effort is possible whenever water conservation becomes profitable and when farmers can treat their water as a crop.

BACKGROUND

Agriculture is the foundation of southwest Georgia's economy—totaling an estimated $5.4 billion or approximately 35 percent of the region's annual economic output.[1] Peanuts, corn, and cotton are the primary crops and all of these are water intensive. As a consequence, water is crucial to the region and its economy.

Historically, most farms in the region used minimal or no irrigation, relying instead on precipitation as their primary water source. The advent of center pivot systems in the 1970s allowed farmers to tap into the region's vast groundwater supplies—thereby increasing the productivity and profitability of their operations. The use of center pivot irrigation soared state-wide and particularly in southwest counties. According to Calvin Perry, superintendent of the University of Georgia's C.M. Stripling Irrigation Research Park, the number of center pivots in Georgia went from 87 in 1970 to more than 11,000 today.

Other than increased agricultural production, this massive growth in groundwater withdrawals had few noticeable consequences. Then a severe drought hit the region in 1998 and lasted until 2003. During this time, water tables fell and pumping costs rose. Seemingly endless groundwater supplies proved exhaustible and farmers throughout the region felt the pinch of water scarcity.

Farmers in the Flint River Basin were not the only ones affected by a lack of water. Migratory birds and endangered species such as

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the wood stork and gopher tortoise were also imperiled by the multi-year drought. Moreover, pumping pressure worsened the situation for the region's wildlife and plant species by drawing aquifer levels even lower. As is often the case, drought, and the resulting water shortages, polarized agricultural and conservation interests—with the apparent trade-off being species or farm survival.[2]

COLLABORATION TOWARD WATER CONSERVATION

During the drought, the Georgia General Assembly passed the Flint River Drought Protection Act, a legislative attempt to maintain a minimum flow in a river by paying farmers to reduce pumping during extreme drought. Compared to irrigation restrictions without compensation, the legislation helped to ease some of the tension between wildlife conservation and local agriculture. Still, the compensation program created an either-or choice between crops and wildlife during times of water scarcity.

For folks in the Flint River Basin, the wildlife-agriculture trade-off was not acceptable. Working with the Nature Conservancy, Flint River Soil

LET'S MAKE A DEAL

Flint River Basin farmers never had to sell their water to conservation groups. Instead, they struck deals with conservation groups who paid for them to farm in a less water intensive way, including: redesigned pivots systems, rotating perennial grasses, and using wireless technology to improve irrigation efficiency.

and Water Conservation District, and the U.S. Department of Agriculture, farmers in the Flint River Basin have adopted a new technology and growing practices that align the water conservation goals of agricultural production and environmental stewardship. This collaborative approach to water conservation has three distinct elements:

1. Redesigning the pivot system and the way that it releases water;
2. Rotating perennial grasses and adopting conservation tillage practices; and
3. Using wireless technology to improve irrigation efficiency.

The first element is relatively straightforward. By retrofitting the center pivot irrigation systems with low pressure nozzles, less irrigation water is lost to evaporation in the hot Georgia sun. The new nozzles do not produce the cone-shaped mist of the high pressure nozzles they replaced, but the crops being irrigated actually receive more water because more hits the ground and ultimately reaches the root system.

The second part of the water conservation collaboration dealt more with farming practices than technological innovation. By adopting conservation tillage techniques and by rotating cash crop and perennial grass planting, farmers are able to significantly increase soil moisture levels. These techniques also reduce erosion during episodic precipitation events. Farmers are not paid for rotational grazing or conservation tillage, but these changes ultimately improve profitability of Flint River Basin farms by reducing pumping and erosion control costs.

The third and most innovative water conservation strategy adopted by basin farmers is called variable rate irrigation (VRI). Developed by researchers at the University of Georgia and Stripling Irrigation Research Park, VRI employs soil moisture monitors and a wireless broadband network

HOW WIRELESS WATERING WORKS

- A GPS is mounted on the end of a pivot.
- A controller is then attached near the pivot point. It contains a "water map" on a data card programmed from a desktop computer.
- The water map and controller manage the water rates according to soil moisture data collected from wireless monitors.
- As the sprinkler pivot moves across the field, hydraulic valves connected to each nozzle are automatically turned on or off as needed to maximize crop water use efficiencies and minimize waste.

Variable rate irrigation employs soil moisture monitors and a wireless broadband network to collect real-time information on thousands of irrigated acres.

to collect real-time information on thousands of irrigated acres. Using this information, farmers can make adjustments to their irrigation schedules and apply water only where and when it is needed.

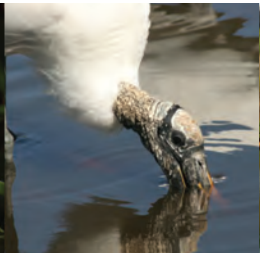
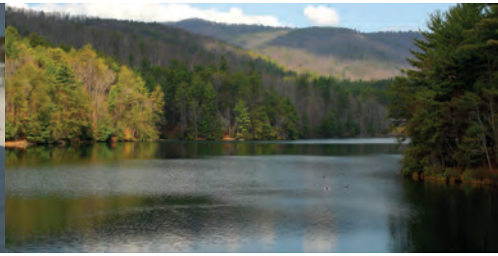
For farmers who have retrofitted their center pivots with VRI electronic circuitry, these adjustments can be incredibly precise. Instead of applying the same amount of water to an entire field, farmers can control to fractions of an acre where the water goes. Dry areas receive more water from the center pivots while bogs and unplanted ground receive none. Compared to driving miles of farm roads, kicking over soil to test its moisture level, then deciding whether or not to irrigate an entire field, VRI provides farmers with a more accurate, responsive, and efficient alternative.

RESULTS

Variable rate irrigation is not your father's approach to watering crops, and several farmers in the Flint River Basin were understandably skeptical of the sophistication and gadgetry. But when the "first-movers" realized significant water savings, the skepticism eased. By 2008, 22 farms in the Flint River Basin had employed some aspect of VRI on more than 75,000 acres, and enrollment continues to grow.

The water and cost saving results are impressive. Since the program began in 2003, farmers employing variable rate irrigation have saved more than 10 billion gallons of water. That's enough to meet the water needs of Orlando, Florida, for an entire year! Additionally, irrigation costs have fallen by 15–30 percent on the 22 participating farms, due primarily to reductions in the amount of water and diesel required.



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In addition to the water savings, the technology offers significant time savings. Farmers can gather more information very quickly using the remote soil moisture monitors and wireless broadband network—especially compared to driving from field to field for first-hand evaluations.

CONSERVATION COST SHARING

Because water savings on the farm mean more water for fish and wildlife, the Nature Conservancy and the Department of Agriculture helped farmers secure funding to offset the retrofitting costs. In effect, environmentalists are paying agriculturalists to lower the cost of adopting water saving technology. The contributions of conservation organizations and university researchers, namely technology and cost sharing, demonstrate the demand for water conservation and the benefits to agriculture of treating water as a crop.

As David Reckford, director of the Flint River Basin Program for the Nature Conservancy, said "Farmers are stewards of the land, and their adoption of technology-driven conservation practices opens new frontiers in sustainable crop production that can have far-reaching implications for conserving land and water for plants, animals and people."

LESSONS FROM THE FLINT RIVER PROJECT

Several elements of the Flint River Project are unique to southwest Georgia, but other characteristics are transferable around the country.

1. ***Increase the pie's size rather than fight over small slices.*** The improvements in irrigation technology and the collabora-

tion of scientists, conservationists, and farmers have worked to make water less scarce in the Flint River region. Conflict between environmentalists and agriculturalists turned into cooperation when the objective became water conservation.

2. ***Innovation requires experimentation.*** The variable rate irrigation technology came from university researchers but required a real-world proving ground before it could become commercially viable. The Flint River Basin farmers who partnered with these researchers were able to adopt this water saving—and ultimately money saving—technology for very little by volunteering their lands. Though not every technology will save water and money, and experimentation implies some risk for landowners, first movers in conservation programs like this one often realize the highest returns.

3. ***Stewardship and profitability go hand-in-hand.*** The water conservation practices adopted by Flint River Basin farmers significantly reduced their irrigation and maintenance costs

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The water conservation practices adopted by Flint River Basin farmers significantly reduced their irrigation and maintenance costs while benefitting the surrounding ecosystem.

while benefitting the surrounding ecosystem. This theme of profitable land stewardship and water conservation runs throughout the Water as a Crop case study series.

NOTES:

1. Waters, D. Davis, and John C. McKissick. 2004. *An Economic Impact Analysis of a Peanut Buying Point in a Three-County Region in Georgia*. CR-04-10.
2. The story of the Klamath River Basin in northern California and southern Oregon is a classic example of how scarcity-driven water conflict between environmental and agricultural interests can go terribly wrong. By some estimates, 35,000 salmon died in the Klamath Basin in 2002 when irrigation won out over fish and wildlife habitat. By all accounts, this result was avoidable had the legal institutions surrounding the issue allowed for private contracting between the two groups.

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