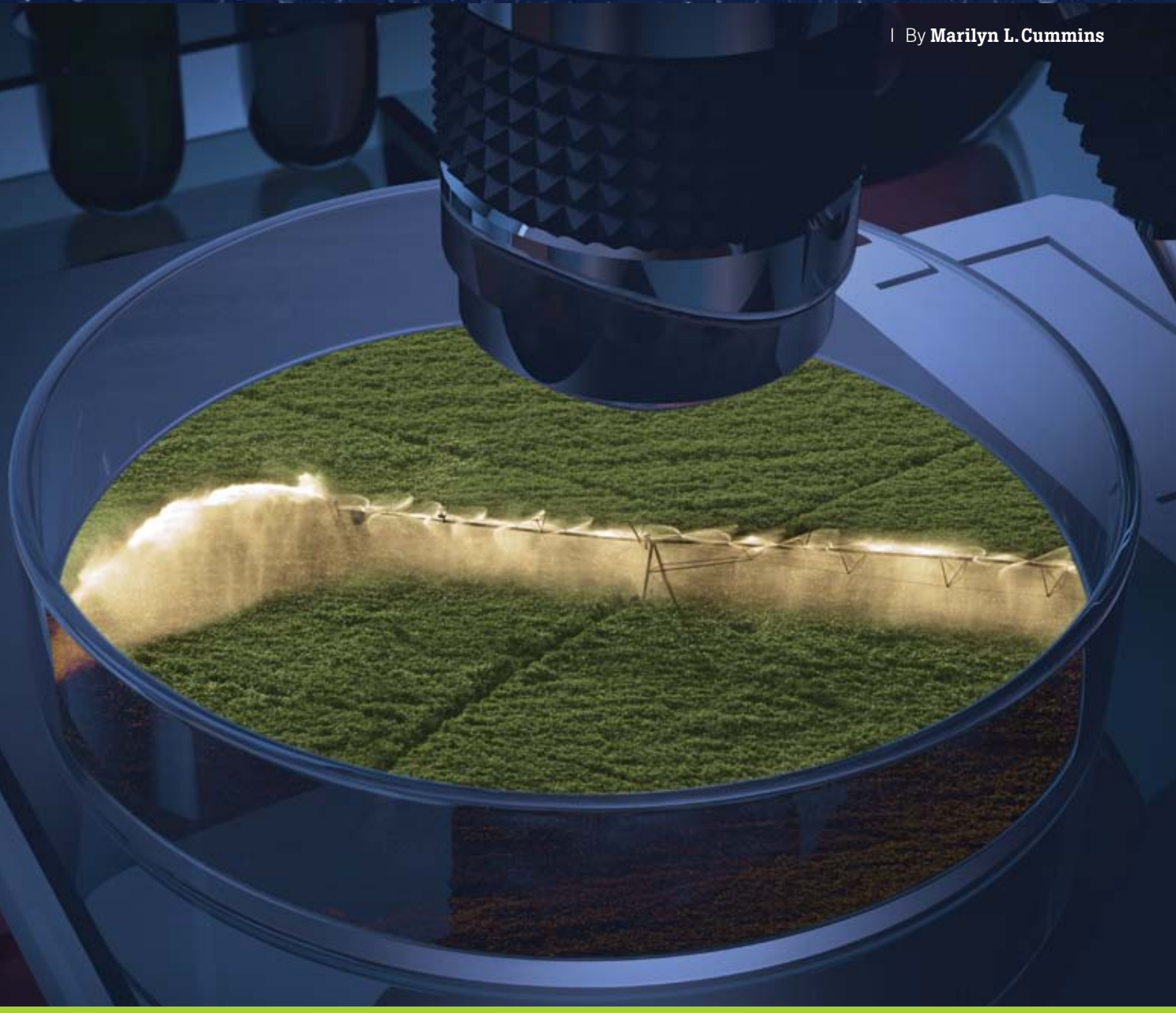
WATER
Under the Microscope



By **Marilyn L. Cummins**

More than ever before, it seems all eyes are focusing on the way agriculture uses and cares for water. While the increased attention has its pros and cons, many thought-leaders are optimistic about what the future holds.

In talking about the future of water and agriculture with several key leaders in the field – from farmers to conservation advocates to Environmental Protection Agency officials – a common theme stands out. To varying extents, they say they believe the best way to manage a finite and precious resource – water – and meet the future food and fiber needs of the world, is to work as partners to give farmers and landowners the tools, incentives and support they need to voluntarily use the best practices for their farms and watersheds in sustainable and profitable ways.

Water-quality trading

Dave White, former chief of the National Resources Conservation Service (NRCS) and now president of Ecosystem Services Exchange, lays out the challenge facing agriculture this way: "Farmers are going to have to produce the same amount of food in the next 40 years that has been produced in the last 10,000 years combined. And we're going to have to do it in a way that adapts to climate change. We're going to have to do it so those little Americans who follow us will still have clean air, and clean water, and abundant wildlife and a healthy environment. It's really the challenge of our time."

He says agriculture has made amazing progress in improving water quality, especially in the past five years, but there is great room and need for improvement. One example he gives is the more-than 100 million acres of farmland that are artificially drained, the majority with tile lines that let the water run 24/7 instead of being managed to hold water in the soil profile for dry times.

"Tools are coming along for real-time drainage water management where you can open and close valves with your smartphone," White says. "There are practices like bio-reactors, and a new practice is being developed by the Agricultural Research Service right now called saturated buffers. So there are some structural ways that we can help with the water-quality issues and even quantify the nitrogen reductions, and if water-quality trading comes about, then we may even have a new asset class for farmers."

To help fund on-farm conservation practices that have the biggest off-site impact on water quality, he envisions robust trading systems in which regulated entities like a city's water treatment plant could meet its pollution-release permit requirements at substantially less cost by investing in on-farm nutrient reduction vs. building a new plant.

"If we could get water-quality trading up and going, if we could get that bio-reactor or drainage water management as an asset so the farmer looks on it the same way they do their tractor, their silo or their barn, then that's a whole different world," White says.

"I think that the fate of the environment really is going to depend on the quality of the decisions that the men and women who own and operate that land make everyday. For that reason, I think the voluntary, incentive-based approach to private land conservation is what will work best."

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Brian Hicks tests controlled drainage on his farm near Tracy, Minn. He adjusts one of two tile outlet control structures that control the water table in this flat 100-acre field. Photo by Liz Morrison

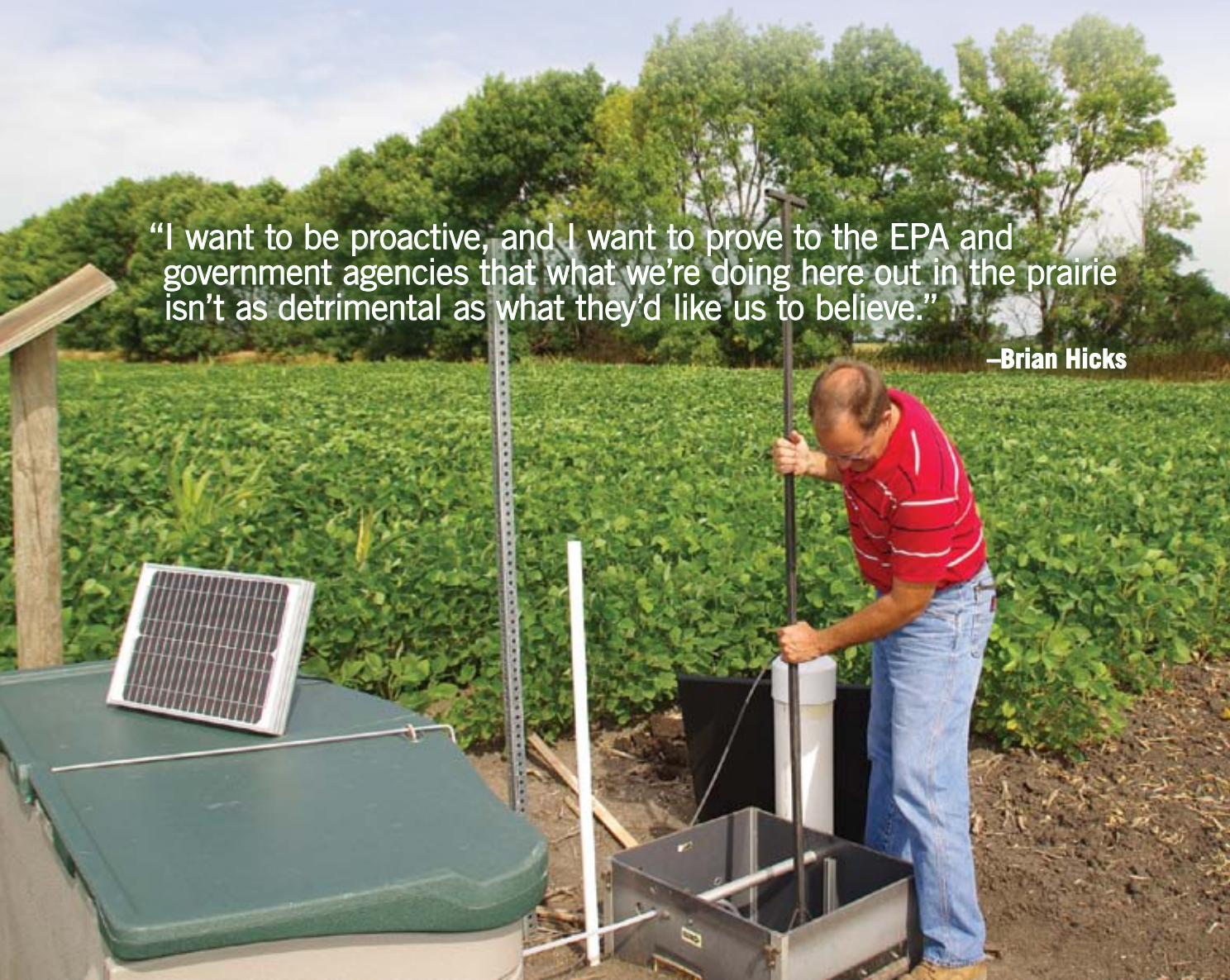
Being proactive

Brian Hicks, who raises corn, soybeans and his "main crop, 10 kids," at Tracy, Minn., installed a controlled drainage system on 125 acres in 2005 and has been monitoring and sampling to measure its effects for the past decade.

"When we started, my main goal was yield enhancement, keeping more water in the soil profile longer into the growing season. Now, because of my work with water quality and drainage issues and a multitude of different things dealing with water, nutrient retention is becoming a higher priority on the list every year," Hicks says.

"Our friends in the Gulf of Mexico who make their living fishing have told us loud and clear that they don't want our nutrients because of the hypoxic zone. I spend lots of dollars every year to apply those nutrients in my fields to grow the crop, so it just became blatantly obvious to me that we have got to find a way to better manage these nutrients and keep them on our farms."

In addition to conserving nutrients and having water when he needs it for his crops, Hicks says he has additional incentives: "I want to be proactive, and I want to prove to the EPA and government agencies that what we're doing here out in the prairie isn't as detrimental as what they'd like us to believe."



Stopping nutrient loss

The director of environmental programs and services for the Iowa Soybean Association (ISA), Roger Wolf, says the big challenge with nutrient loss from the agricultural land is that it's a weather-driven system, and growers are experiencing more extreme weather events that are impacting production systems.

"Particularly in the upper Midwest, we've drained the landscape; we have high organic soils; and we have a lot of rainwater that has to be managed. So in order to have technologies that are effective in reducing nutrients being washed from the ag landscape, we really need to look at starting in the field with optimizing the management and then using practices that build organic matter and change the water-holding capacity in the soils and so on. But also we need to think about treating the landscape with buffers and wetlands and edge-of-field practices that can help capture and really treat the water that's leaving."

Iowa Soybean Association Director of Environmental Programs and Services Roger Wolf.

Wolf says there are private benefits to farmers, but some edge-of-field practices lead more directly to a public benefit.

"What we're seeing is that it's more of a good role for federal farm bill dollars, and we're really keen on the new Regional Conservation Partnership Program, because then that can come into play and really help watersheds and groups of farmers deploy some of those practices that might not provide as much private benefit," he says.

ISA is working aggressively to assess the science of innovative edge-of-field practices like bioreactors and saturated buffers and translate the results into what it means for individual farms and targeted watersheds. The association has employed 20 wood-chip bioreactors on tile drainage systems and is monitoring the effectiveness while working closely with NRCS to refine the practice standard.

"Farmers like the idea that it has a small footprint on their production system and a relatively low cost, and it actually performs really well," he says of the bioreactors. And he says the use of cover crops and the ensuing changes in organic matter and water-holding capacity "could be a game-changer in Iowa from the nutrient strategy perspective."

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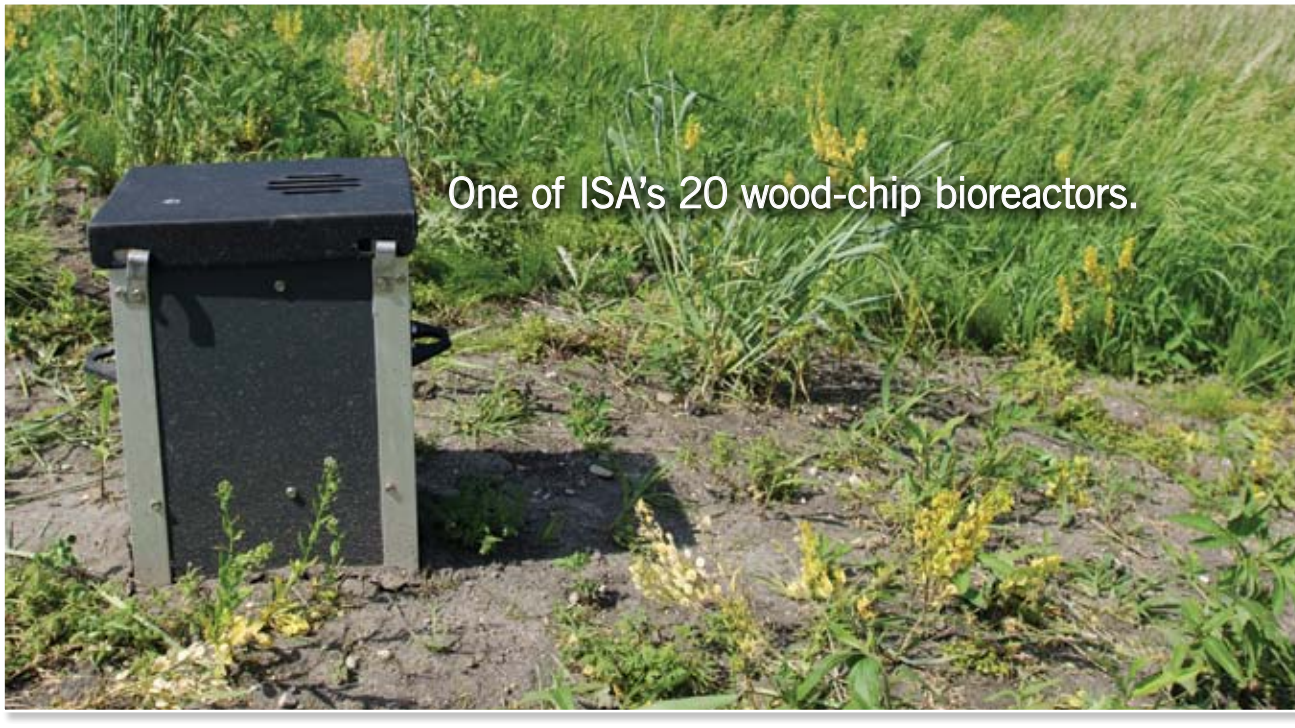

One of ISA's 20 wood-chip bioreactors.

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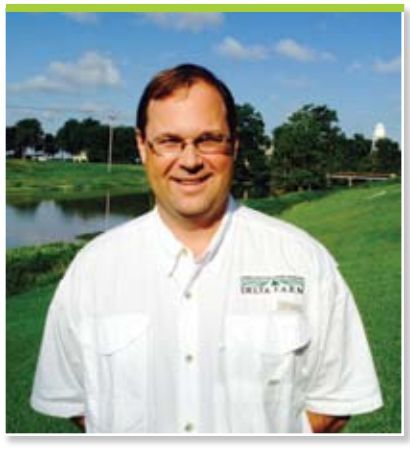
Adopting new technology

Trey Cooke, executive director of Delta F.A.R.M (Delta Farmers Advocating Resource Management) in northwest Mississippi, points out how different both production and water management practices are for farmers in the lower Mississippi River Valley than for those in the Midwest. They get 50 inches of rain a year or more – just not at the right time, so they still have to supplement water needs during the growing season with furrow irrigation.



Delta F.A.R.M Executive Director Trey Cooke.

"We depend on a shallow alluvial aquifer that's very productive, recharged by the Mississippi River and other surface sources," Cooke says. "But today, Arkansas and Mississippi are in a non-sustainable pattern. We're using more than is being recharged.

"So we have to as producers, as an ag industry, to learn how to better use our water resources to irrigate our crops to continue to be competitive and to continue to make the yields required for a producer to be profitable. Because if we're not profitable, we're not farming, it's just that simple."

The good news is that "we're learning that those technologies they've been using out West are transferable and are very effective here in our production systems," he says. Extension research using conservation practices like soil moisture sensors, surge valves and PHAUCET (Pipe Hole and Universal Crown Elevation Tool), an engineering program to get universal flow for irrigation, has achieved equivalent corn and soybean yields using nearly six fewer inches of irrigation water per acre, which is about a 40-percent reduction.

Even so, adopting existing conservation technology that will reduce water demand while maintaining yields – "almost a mandatory part of our long-term future" – may not be enough to ensure a sustainable water supply for agricultural irrigation needs, Cooke says. They also need to capture some of the 50 inches of off-season rainfall and hold it until irrigation season.

In Mississippi, he says they're exploring how to use the least-productive land as well as existing streams, wetlands and drainage systems to store water for later use (without flooding). He says state officials "feel strongly that our cheapest and easiest way to preserve our water is to do voluntary conservation first."

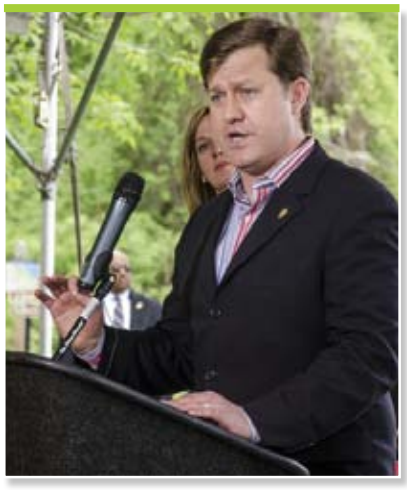
With soils high in natural phosphorous, northwest Mississippi farmers also have spearheaded farmer-led nutrient-reduction strategies in the mid-South, with all water-quality approaches focused on sediment reduction and erosion control, Cooke says. "We try to develop our conservation approaches to be conjunctive, to address both water-quality and water-supply issues."

"I am very optimistic that our long-term future is very bright when it comes to water supply and irrigation water supplies in the Mid-South," he says. "However, we won't be able to get there if we continue to employ the practices that our parents have been using."

Sustainable intensification

Having improved water quality outcomes is one of the main goals of The Nature Conservancy, says Sean McMahon, the group's North America agriculture program director. He says there has been tremendous progress by agriculture toward improved sustainability in recent decades, but more needs to be done regarding improving water quality at the watershed scale.

"There is really good national data that bears that out, and it reflects very well on the soybean sector in terms of the continuous improvement that has been attained," he says, noting the strides made in reducing the resources needed to produce a bushel of soybeans per the Field to Market national indicators report. "But I see in the next decade that what's going to be really important is going beyond that kind of national aggregated data and really getting at



The Nature Conservancy North American Agriculture Program Director Sean McMahon. AP Photo.

what's happening on the ground in particular growing regions as far as water quality."

McMahon also says he believes that it's not enough to manage water "just at the farm or edge-of-field scale in terms of a bunch of random acts of conservation that don't roll up into a collective outcome as far as improving water quality in an entire watershed." He underscored the importance of realizing water quality improvement at the watershed scale "so that we're able to maintain our current regime of voluntary conservation incentives and freedom to operate for producers."

The Nature Conservancy is also interested in seeing agriculture be able to meet the increasing domestic and global demand for food, feed, fiber and fuel in an increasingly sustainable manner while protecting as many natural areas as possible from conversion to cropland – an explicit strategy it calls sustainable intensification.

"We would like to see 100-bushel soybeans, 300-bushel corn," McMahon says, "but we would like to see that realized in as sustainable a manner as possible while maintaining or improving water quality and being more efficient about our resource utilization."

Farmers: First line of defense

When it comes to keeping as much water-quality management as possible voluntary, count the Environmental Protection Agency as an ally, says, Allison Wiedeman, acting agricultural counselor to the administrator of the EPA.

"The people in agriculture are our natural allies, in that they want the same thing that EPA does: they want clean air, clean water, clean land. We want to build better relationships with agriculture to achieve that goal, because they're absolutely our partners.

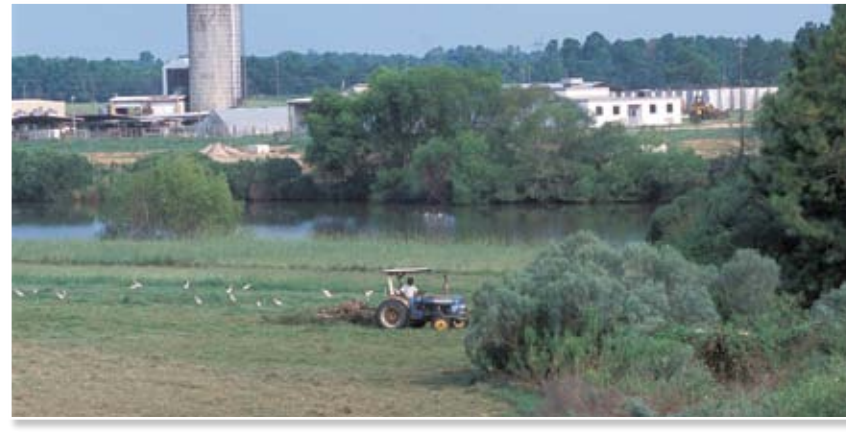
"Farmers are our first line of defense when it comes to environmental protection for the country," she says, and funded programs and recommendations have "to improve their bottom line. We recognize that we have to do things that are good for the farmer economically as well as environmentally, and there's no reason those two things can't work together."

Wiedeman acknowledges obstacles on the path to the EPA working more closely with farmers and some farm organizations, with trust being the biggest.

"Farmers don't want us to come on their land, because they've heard bad stories about EPA. What we need to do is overcome those bad stories and change the way we work with them," she says.

She cites the National Water Quality Initiative, in conjunction with the U.S. Department of Agriculture and other agencies, as just one example of new outreach to work with farmers on voluntary programs. EPA also helps sponsor recognition programs like the "Farmer Heroes" with the National Association of Conservation Districts, highlighting the stories of farmers who are implementing specific best management practices to reduce pollution while also improving or sustaining their profits, soil quality and/or yields.

"In the past, we spent a lot of time focusing on folks that were not in compliance. Now we are increasing the recognition of the majority of the farmers out there that are doing great things on the ground." ◘



Restored riparian forest buffers provide protection from nutrients running off into ponds and the downstream watershed. Photo: Peggy Greb