THE GREEN LEAP

Will green technologies and green market opportunities transform agriculture?

BY KIRSTEN FERGUSON

Driving down a highway in northwestern Washington, en route from a meeting in his role as director of the Washington State Dairy Federation, Jay Gordon can't help but ponder whether some of the state's highway beautification money would be better spent protecting the Skagit Valley farmland that provides feeding habitat to a quarter of the world's Trumpeter Swans.

More than 17,000 Trumpeter Swans—their population dwindling in recent years—migrate from their summer breeding grounds in Alaska to warmer winter climates in southern British Columbia and the Pacific Northwest. The largest waterfowl species native to North America, the swans prefer to roost in grassy fields and farmland near water.

"With some of the money spent on landscape projects by state highways, you could buy development rights on farmland," says Gordon, who operates an organic dairy farm near Elma, Washington. "Instead of having another frog pond along the freeway, you could have protected farmland, protected water and protected Trumpeter habitat. That seems like a fair trade to me."

Working with American Farmland Trust, the Trumpeter Swan Society, Capitol Land Trust and the National Parks Foundation, Gordon received funding several years ago for an easement protecting farmland that shelters swans displaced from an area further north along the Olympic Peninsula's Elwah River.

It takes education, Gordon says, for people to realize that farmland is the preferred habitat for some species, such as an endangered spotted frog that thrives on Washington's grazed wetlands. "We need to keep the farmland. There's a reason the frogs

ABOVE: A juvenile Trumpeter Swan takes off from a cornfield near Nooksack, Wash. AP PHOTO/ELAINE THOMPSON

and birds are there," Gordon says. "There's a reason the farms are there."

Gordon is just one of many farmers around the country participating in the "green economy," an emerging marketplace that extends the economic notion of "capital" to environmental (or "natural") goods and services. Whether improving water quality or helping to reduce greenhouse gas emissions, farmers increasingly are being paid to produce environmental benefits, renewable energy, locally grown food and other "green" products.

Last year, the United Nations Environment Programme (UNEP) called for a "Global Green New Deal" to lead the world out of economic crisis through a surge in green jobs and a restructuring of the global economic system to reduce fossil fuel dependence.

As countries around the world take steps to address climate change, generate renewable energy and feed a growing world population, agriculture has a major role to play.

"It is important to look at this in the broader context of energy security, resource depletion and climate change," says Carole Brookins, former U.S Executive Director to the World Bank and vice president of the Chicago Climate Exchange. "If you believe that there are going to be eight to nine billion people living on this planet, then we're going to have to manage resources better. If you believe that climate change will force us to change our agricultural practices and rely less on oil production, then we're going to have to become much more innovative."

Coming changes in how we manage our resources represent not a threat to agriculture but a great opportunity, Brookins says. "Agriculture has always taken a lead on this. We've moved to improve irrigation and genetically breed crops that are drought resistant. Technology has allowed us to speed up the process of developing hybrids. Technology is going to help us better utilize our biological materials in the soils and convert our animal waste into power in ways we never dreamed possible. This is the march of progress. I don't believe it's a challenge. I see this as a golden age."

In the future, the competitive edge may belong to farmers and rural communities that start early to develop renewable products and invest in new technologies. In the pages that follow, we present six ways that farmers and ranchers across the nation already are participating in a burgeoning green economy (continued on page 16).

AP PHOTO/JOHN FROSCHAUER

Jay Gordon on his organic dairy farm in western Washington's Chehalis Valley near Elma, Wash.

The FARM of the

❶ *The growth in wind power may help to revitalize rural communities and generate new income for farmers.*

❷ *Agricultural crops and residues offer significant new market potential for farmers as fuel.*

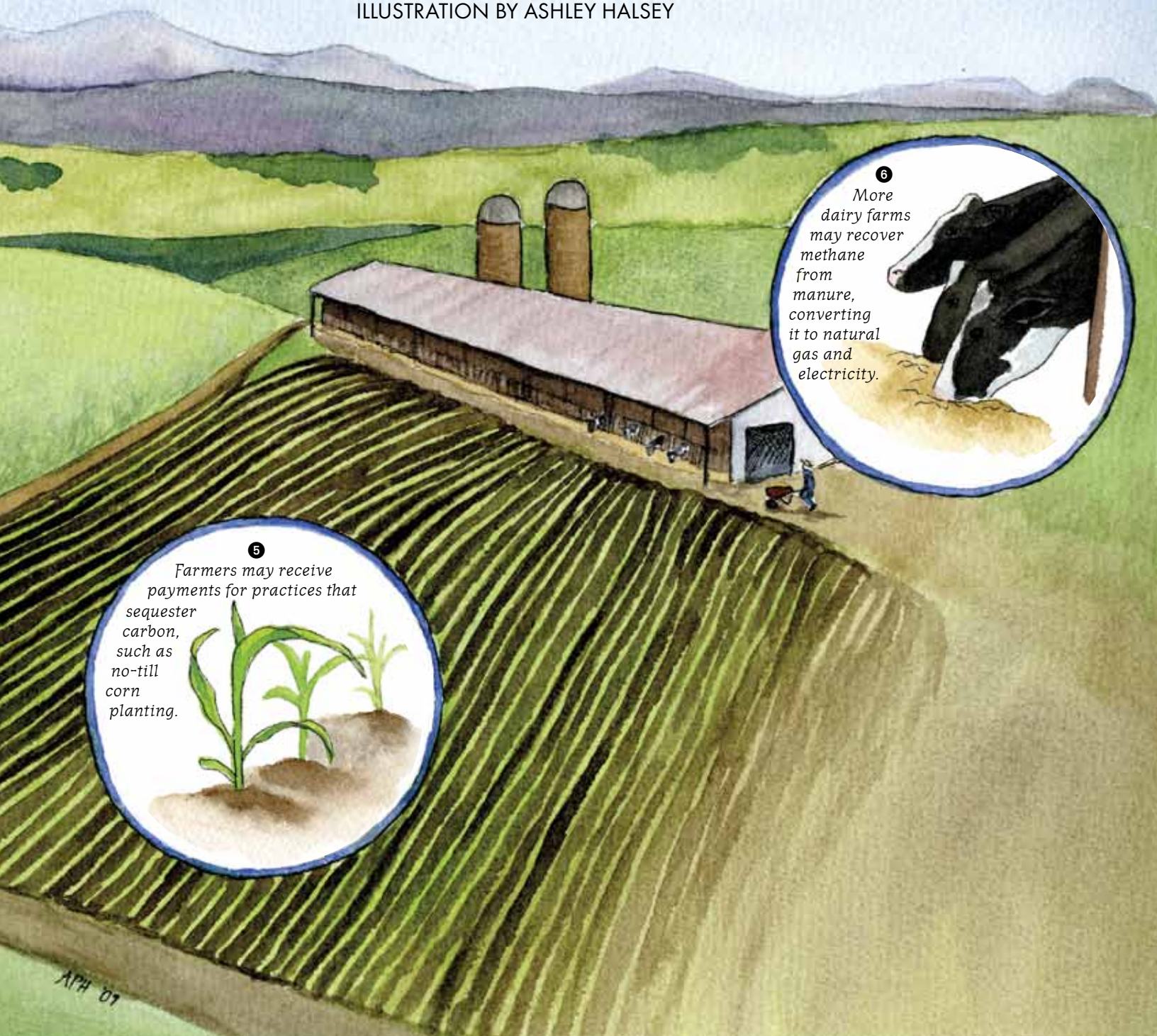
❸ *Farms and ranches may receive payments from ecosystem markets for sheltering wildlife.*

❹ *More farms may capitalize on the growing consumer preference for locally grown food.*

FUTURE?

New technologies and trends are changing the face of agriculture. Here are just a few of the ways that farms now—and into the future—are harvesting new sources of income from "green" products and services.

ILLUSTRATION BY ASHLEY HALSEY



ISTOCKPHOTO/TERRANCE EMERSON

RENEWABLE ENERGY

The small farm community of Rock Port, Missouri, made national headlines last year when it became the first town in America to run completely on wind power. Towering over Rock Port's cow pastures and cornfields are four 40-story wind turbines that harvest the town's newest crop: wind-generated electricity.

Although Rock Port is the first U.S. town to power its every appliance and light with wind energy, wind turbines are becoming a common sight in many Midwest towns. According to the U.S. Department of Energy, America could be 20 percent wind powered by 2030.

"I think you will see in the next three to five years an enormous growth in wind energy that will directly impact rural farm communities," says Jan Andersen of Wind Capital Group, the St. Louis, Missouri company that erected turbines in Rock Port and is currently developing projects in 16 states.

"These wind farms inject millions of dollars into local businesses during construction," Andersen says. "They also contribute hundreds of thousands—even millions—to local tax revenue. So you can imagine the kind of income these wind farms can generate for rural America, which is struggling right now."

Depending on the size of the turbine and how much wind they generate, farmers can earn between $3,000 to $7,000 per year for each turbine. "There's little disruption to their day to day farming," Andersen says. Each turbine requires only about a half acre of land after installation, and farmers can graze cattle or grow crops right up to the turbines.

Although his company has a team of field operators who scout out areas with good wind potential, Andersen recommends that farmers and rural communities interested in wind take a proactive approach. "Most farmers will know if they live in a windy area or not," he says. "A good place to start is to get with your neighbors and see if other people have an interest in this. Then seek out companies like ours."

Other renewable energy sources are just as promising for the nation's farmers—from solar power to energy generated from plant and animal waste. "There are going to be a lot of efforts to use the whole plant, not just for food and feed but to improve the use of biomass on the farm and for feeding into the electrical grid," says Brookins.

"The global demand for energy is not going away," says Iowa farmer Thomas Dorr, a former Under Secretary for Rural Development at the U.S. Department of Agriculture. "New energy sources will be rural in nature, which will have positive implications for our rural areas.

Wind turbines on farmland in Rio Vista, California

There's a lot of power out there that we can capture and utilize. In livestock areas, people will capture that methane [a greenhouse gas emitted by livestock that can be converted to electricity]. I would not be surprised within 10 years to see substantial growth in alternative energy resources."

For Dorr, the real issue is how that energy will be distributed. "We know we have extraordinarily efficient wind technologies—especially in the upper Midwest and Northwest. But you can only use it if you have the technology to transmit it to population centers. It reminds me of what we went through in the development of the microchip—it took time for Texas Instruments to figure out the technology, but when they did the production was unbelievable."

"America's energy demand is not going to go down," concurs Andersen. "As our grid stands today, it's not going to be able to handle that capacity. You can liken it to when they built the highway system many years ago. The nation needs to tackle our energy infrastructure in a similar way. On a federal level, we need to find a way to level the playing field for renewable energy to compete with fossil fuel."

Iowa crop and livestock farmer Varel Bailey in front of his hoop buildings that decrease energy use.

Dorr counsels farmers looking to get involved in renewable energy production to step back and rethink their role as business people. "Producing these new energy resources is going to be substantially different than producing a commodity," he says. "Instead of being 'price takers,' farmers will be going into a business venture that has considerable monetary value to it. They need to work closely with consultants and counselors and investment advisors to make sure they appreciate this investment opportunity and capture it in a way that's sustainable."

BIOTECHNOLOGY

Varel Bailey, a crop and livestock farmer in southwest Iowa, recently returned from a trip to Prague, where he spoke to Czech farmers about new breakthroughs in farm technology. Sharing knowledge with farmers in other countries is valuable work to Bailey because farms around the globe will need to become more efficient in order to produce feed and fuel for a world population projected to reach nine billion in 40 years.

"I simply say to farmers and bureaucrats in other countries, 'Biotechnology is not the only answer. But it is one tool,'" Bailey says. "And I tell them they've got a choice. If they don't figure out how to meet the growing demand in the future, they'll have to import their food."

In some ways, the European farms that Bailey visits are technologically ahead. He marvels at farms he's seen in Germany and the Czech Republic where farmers feed their silage (fermented plant stock typically used as livestock feed in the United States) directly into biomass generators that convert the plant matter into electricity to power the farms.

Trends in green technology can help agriculture meet the global demand for food and fuel while addressing climate change, according to a recent study by the World Wildlife Fund. The report found that improved energy efficiency in agriculture, along with new technologies that convert plant and animal waste into fuel, could save the planet up to 2.5 billion tons of carbon dioxide emissions per year by 2030.

Bailey is especially excited about "biochar": fuel made out of plant and agricultural matter that provides renewable energy and addresses climate change by sequestering carbon in the soil.

Whenever he can, Bailey also speaks to farm producers at home about the coming transformation in food and fuel production. His message: "All change is expensive. The best way to reduce the cost of change is to prepare for opportunities before they come along. Farmers by nature are independent people. But they will have to work together,

because many of these projects will require a joint effort among farmers and communities."

ECOSYSTEM MARKETS

The easement project on dairy farmer Jay Gordon's land works out well. He continues grazing his cows on the land as he did before, which keeps the willow trees down and provides good habitat for the swans. But Gordon has seen other opportunities for ecosystem protection squandered because the habitat value of farmland wasn't always fully understood or appreciated.

"There's a dairy up the valley from me that has endangered lupine on the farm," he says of a rare species of the lavender-colored perennial flower that provides habitat for an endangered butterfly. "But if you stop grazing there, as some people initially wanted the farm to do, the fields grow up into invasive species. Finally the biologists said, 'We get it. Your cows don't eat lupine so they're keeping this habitat alive for the endangered butterflies to feed on.'"

Oregon's endangered Fender's blue butterfly, which depends on the threatened Kincaid's lupine plant to survive

Times are changing, however. Officials in the Pacific Northwest and around the country increasingly are recognizing—and placing a monetary value on—the many ecological benefits provided by farmland. In 2008, the Washington state legislature passed SB 6805, a bill that establishes private "ecosystem markets" to compensate farm and forest landowners for providing environmental services, from wildlife habitat to water purification and flood control.

Such ecosystem markets currently take three forms, addressing air emissions, water quality or habitat and biodiversity. In private trading systems, the market determines a value for environmental benefits and has a system to buy and sell those benefits in the form of credits. Public payments may come from government programs that reward farmers with conservation payments for their stewardship.

"The landscape is very environmentally sensitive here. There's lots of water, lots of agriculture and a rapidly growing population," says Don Stuart, American Farmland Trust's Pacific Northwest director, who worked to get the SB 6805 legislation passed and holds workshops throughout the Pacific Northwest to help farmers and agricultural groups become more familiar with the concept of ecosystem markets.

The workshops are important, Stuart notes, because in the future, officials will be looking to farm and forestland as a cost effective way to offset the environmental damage caused by growth. "The question is, will the government regulate or use incentives?" he asks. "If we don't get ecosystem markets in place, regulation will become inevitable. But if farms are regulated out of business, we lose all the environmental benefits. That's why we need to protect farmland and get the agricultural community engaged in developing ecosystem markets that work for farmers and the environment."

Washington's conservation market legislation was a landmark first step, Gordon says. But he can't shake the feeling that there is much more work to be done. "Every time we lose a chunk of farmland somewhere, or another piece of habitat provided by farmland, it adds to my feeling that, 'Oh gosh, we've got to work on this harder.'"

LOCAL FOOD

In Fairfax County, Virginia, next to Tyson's Corner—one of the nation's biggest malls—is a small farm stand with a green sign reading, "Potomac Vegetable Farms." Multi-million dollar houses sprout up in surrounding fields, but farm owner Hui Newcomb, her daughter Hana and their partner Ellen Polishuk have found a way to turn the intensely suburban location into more of a boon than a burden.

A worker picks garlic scapes out of green buckets, as a neighboring Salvadoran family stops by the farm to purchase a live chicken. The garlic scapes are bundled with rubber bands to prepare for the week's farmers markets in Washington, D.C., where the farm sells a cornucopia of freshly picked veggies and fruits: lettuce, Chinese cabbage, mixed mustards, Swiss chard, sugar snap peas, sweet onions, dandelion greens.

In the 1960s, when Hui and her husband Tony first started farming in the area, Tyson's Corner was a little crossroads, with "cattle lolling under the peach trees." The couple grew sweet corn on 100 acres of rented land. "That was our main crop," Newcomb says. "We had a reputation for great sweet corn. When we started, we were 100 percent wholesale. Now we're five percent wholesale."

These days, the farm generates about a third of its income from farmers markets, a third from its roadside stand and a third from selling CSA shares (where customers purchase a portion of the season's harvest). It also sells directly to a few restaurants and delis in the area. Despite the economic downturn, their sales are better than ever. "If someone complains that it's three dollars for a bunch of chard, I say, 'What else are you buying for three dollars that's as good and healthy for you?" Newcomb says. "What's more important than what you put in your mouth and body?"

Like Newcomb, many farmers around the country—especially those in urban-edge locations—are selling their goods directly to consumers who are eager to buy locally grown food. Some customers are driven by concerns about food safety; others find that farm fresh food tastes better and enjoy the experience of knowing the person who grew the food.

In October, Agriculture Secretary Tom Vilsack announced that the number of farmers markets in the United States grew by more than 13 percent from last

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(TOP) Hui Newcomb; (BELOW) Potomac Vegetable Farms in Fairfax County, Virginia, now sells 95 percent of its produce locally.

year (to a total of 5,274 markets nationwide). "I think local food systems are going to continue to grow and expand in the next decade. We've seen a significant increase in demand," says Jerry Kaufman, a Professor Emeritus in urban and regional planning at the University of Wisconsin-Madison. "I think it is spreading to all parts of the country."

Kaufman notes that several factors are driving the burgeoning local foods movement, in addition to a growing consumer awareness. One is increasing corporate interest. Kaufman serves as president of Growing Power, a nonprofit in Milwaukee, Wisconsin, that recently helped Kohl's department store install three vegetable gardens on their corporate campus. "I think that's a wave of the future when major corporations are becoming aware that the good food movement has appeal, not only for the health implications for employees but also because they want to be out front doing things that give them a better public image," Kaufman says.

Kaufman also sees the potential for health care reform to be a major driver, particularly if new health care legislation insures more Americans and prohibits insurance companies from denying coverage on the basis of preexisting conditions. "If that happens, then healthcare companies will have more people that they're serving. Prevention measures will become more important, and they'll pay more attention to obesity and diet-induced health problems. Food is going to become more important."

The "explosion" of food policy councils—organizations created in many areas to expand the capacity for local and regional food—is another factor, as well as the growing number of cities, towns and planners addressing local food systems for the first time. "The notion of scaling up consumption of locally grown foods is something local governments have become interested in," he says. "How do you do that? You need more farmers to produce local food, better distribution centers in the region, land available for production of local food, and you need to get local food into the mouths of people connected to big institutions, like hospitals, schools and corporations."

The surge in consumer demand for local food provides new market potential for all farmers, Kaufman says. "I don't see why a conventional farmer couldn't see there is a market opportunity in growing local food—maybe as only a small part of their operation, but they do have the land. It seems to me that an entrepreneurial farmer would see that as an opportunity."

Farmers in the Chesapeake Bay watershed are joining efforts to reduce fertilizer use and nitrogen runoff.

American Farmland Trust's Mid-Atlantic director Jim Baird (right) speaks with a farmer participating in AFT's BMP Challenge. GRETCHEN HOFFMAN

WATER CREDITS

More than 150 rivers and streams drain into the Chesapeake Bay, the nation's largest estuary, which covers parts of six Mid-Atlantic region states. In the 1970s, marine dead zones were first identified in the shallow bay—areas where large algal blooms, fed by farm and industrial runoff, depleted the water of oxygen, killing off fish and aquatic vegetation. Since then, efforts have been underway to clean up the bay and its tributaries, with mixed results.

Four bay jurisdictions—Maryland, Pennsylvania, Virginia and the District of Columbia—have committed to significantly reduce pollutants by 2010, setting goals to reduce nitrogen from agriculture by nearly 65 million pounds annually—approximately 60 percent of the reduction needed to restore the bay and its tributaries.

Mike Brubaker, a dairy and poultry farmer in East Donegal Township, Pennsylvania, is one of 30 Chesapeake Bay farmers enrolled in an American Farmland Trust pilot program, the BMP Challenge, that helps him reduce his use of nitrogen fertilizer through no-till planting, covering his loss of income if his crop yields are lower as a result. "Certain environmental practices are risky," Brubaker says. "We have conservation plans on 100 percent of our lands that we farm. That is not risky to me. But reducing nitrogen fertilizer I felt was a little more risky. This program helps us cover that risk."

American Farmland Trust is also working with Chesapeake Bay farmers to generate "nutrient credits" from their fertilizer reductions, which they can then sell through a water quality trading market set up by the state Department of Environmental Protection (DEP).

"Wastewater treatment plants can only discharge so much nitrogen," explains Jim Baird, American Farmland Trust's Mid-Atlantic director. "But say 100 families just moved into their area—now they've got a problem because they're over the limit. Under a nutrient trading system, they could go to a farmer and say, 'Hey, if you remove so much nitrogen, we'll pay you.'"

Brubaker was one of the first Pennsylvania farmers to participate in a nutrient trade. When a municipal waste treatment plant needed to reduce its emissions, it paid for some plant upgrades but also purchased nutrient credits from Brubaker, who in turn cut down on his nitrogen use

Helping Farmers Make the "Green Leap"

American Farmland Trust's Role

In coming decades, farmers and ranchers will be depended on to increase their productivity to meet the food, fiber and energy needs of a rapidly growing global population. At the same time, they will be expected to help address climate change and become more sustainable in their use of natural resources—all while withstanding increasing urban development pressure on their land. To do so, they need help with conservation practices, national and regional leadership, and workable policies developed for the next century, not the last.

American Farmland Trust works on a number of fronts to help farmers and ranchers transition to a new, greener economy. We are:

Protecting farmland and fighting sprawl. Without farm and ranch land, the nation loses the foundation for its efforts to fight climate change, grow healthy food, produce renewable energy and protect the environment. American Farmland Trust continues to make farm and ranch land protection the underpinning of our work, partnering with states and local governments around the country to help landowners protect their land and communities plan for the future.

Developing ecosystem markets. In coming years, farmers and industries face increasing regulations of water quality and greenhouse gas emissions. At the same time, farmers and ranchers have the potential to help offset greenhouse gases, reduce water pollution and restore wildlife habitat in significant ways. American Farmland Trust's *Agriculture & Environment* initiative is working—on pilot projects in places like the Ohio River basin and Chesapeake Bay—to establish the framework for ecosystem trading markets that compensate farmers for their use of conservation practices that benefit the environment and fight climate change.

To learn more, visit www.farmland.org.

Allowing farmers to adopt risk-free conservation practices. American Farmland Trust's pioneering BMP Challenge program has helped crop farmers adopt conservation practices that minimize fertilizer use, protect water and soil, and reduce greenhouse gases. Farmers often fear that they will suffer from smaller crop yields and a loss of income when they adopt new conservation techniques, but American Farmland Trust's program—expanding around the country—protects producers from financial loss when they implement healthy farming practices.

Helping communities grow local. The consumer demand for locally grown food is booming, but farms—particularly those on the urban edge where most of our fruits, vegetables and dairy products are grown—are threatened by sprawling development, difficult market conditions and a host of other challenges. American Farmland Trust's *Growing Local* initiative is helping communities plan for local and regional food systems, save farmland and improve access to local food for their citizens.

Supporting policies that work for farmers and the environment. American Farmland Trust works on both national and state legislation to make sure the nation's food, farm, transportation and conservation policies protect farmland, promote sound stewardship of working lands, and allow farms and ranches to stay profitable. This will be ever more important as the nation adopts increasing regulations and legislation related to water quality and climate change—farmers need an advocate to make sure such policies work for farmers, the environment and the nation.

by using no-till planting on his fields. He received over $125,000 over three years for the deal.

"It helped save the taxpayer's money that they didn't have to do 100 percent of the plant upgrades," Brubaker says. "And it provided revenue for us that helped us make our margins that are so tight. I think that nutrient trading can be another piece of the puzzle for agriculture in the future. Farmers have to continue to search for ways to better use their resources. You hear about negative things that happen on farms, but there are so many good things that are happening all the time that farmers don't get rewarded for. This would be a way not only to reward farmers but also to provide a little food for the table of struggling farm families."

Don McNutt of the Lancaster County conservation district helped to facilitate Brubaker's trade and worked last year with three other Pennsylvania farmers trying to generate credits. Although the credits were certified by the DEP, he couldn't find a buyer. "With trading it's not simple," McNutt says. "Right now, industries are having a hard time getting comfortable with trading because a farmer cannot guarantee they'll be around in 20 years. Trading feels risky, so it's got to be a better deal than plant upgrades—brick and mortar. What would help to move the trading program forward is more buyers, and those buyers need to have a comfort level in those credits."

In some water quality trading markets, an aggregator or broker pools the nutrient credits and keeps some in reserve, insuring they are available. "Farmers have to have some way to transact with buyers of environmental services. That's not always easy. Right now there isn't an institution set up to do that," says Kitty Smith of the U.S. Department of Agriculture's Environmental Research Service. "Another barrier is verification of service—the buyer wants to have evidence that the seller has done what they said they did. The larger the market becomes, the more necessary it is to have rules and scientific evidence. Land tenure is a really important issue. Contracts have to be multi-year, but what happens if you sell the farm?"

McNutt and others are looking to 2011 when tighter restrictions on water quality may come into play. "Right now there's a whole lot of talk about the potential for having considerably more regulation to clean up the bay," says Baird. "One of the conclusions is we have to reduce nitrogen in the water by 40 percent. That's a huge amount of reduction from all the contributors—not only farmers but also suburban and urban sources. But there is a window of opportunity. If we can take the things we're doing and really scale them up, then we could lessen the blow of these regulations. The BMP Challenge is one slice of that."

Under the Clean Water Act, many waters around the country—impaired by over-enrichment from nitrogen and phosphorus—are not meeting their stated uses, says Mark Kieser, an environmental engineer working with American Farmland Trust and other partners to develop water quality trading programs in the Ohio River basin and Minnesota's Sauk River watershed.

Municipalities are going to be regulated more and more, Kieser says, including not just wastewater but also urban storm water. "Permitted discharges are going to be much lower—that's going to be high cost and that's where trading comes in, which leads to economic opportunities for agriculture," Kieser says. "Trading is not going to work everywhere. It's not going to be needed everywhere. But where there's significant cost for plants to make improvements, and significant environmental benefits to be had, those are the areas you'll see trading."

Smith agrees regulation will be the driving force behind ecosystem trading markets. "There's got to be something that makes environmental damage costly and therefore makes environmental benefits valuable," she says. "Right now they're free to everybody."

CARBON TRADING

Regulatory action will also be the driving force behind the development of carbon trading markets that pay farmers to help offset greenhouse gases, Smith says. "It will be a whole new ball game in 10 years. We're going to have some regulation of carbon and a market will rise. We'll go through a lot of pain to get it working. But once it works with carbon, we'll have a model for how it can work on a national or global level."

Mike Walsh, director of research at the Chicago Climate Exchange, the first voluntary program for the trading of greenhouse gases in the United States, agrees that regulation is coming. "There's going to be organized regulatory action in the United States—whether through legislation or the EPA," he says. "Exactly how we'll move forward is hard to predict."

His program pays farmers for generating carbon credits on their land—mostly through continuous conservation tillage practices that sequester carbon in the soil. Other farmers are receiving payments for rotational grazing practices that allow grasses to recover and grow, holding carbon in the soil. A smaller number are generating credits for planting buffer strips and trees or for capturing methane on dairy farms. The credits are then bundled and sold to companies who sign contracts agreeing to reduce their greenhouse gas emissions.

The Chicago Climate Exchange currently has 16 million acres of productive land enrolled. "All the best viable solutions are going to have to be employed," to address climate change, Walsh says. "There is an appreciation

that these agricultural practices are win/win. They are good for protecting agriculture from the effects of global warming, good for soaking up carbon, good for soil quality and water quality. They're good for the U.S. agricultural economy and good for the landscape. We see scenarios where in a relatively short period of time, greenhouse gas mitigation services could grow to have a value of 20 percent of net farm income. We could potentially see $10 billion in income activity for the farm sector as a result. This can help keep farmland in farms. As our CEO often says, 'There are above-ground crops, and there's a below-ground crop: carbon.'"

THE COMING TRANSITION

Going forward, Varel Bailey believes farmers need to get more engaged in the discussion about carbon and water quality, in advance of coming regulation. "Farmers need to start now in learning about carbon and water trading markets and how they can take advantage of them," says Bailey. "When I have the opportunity to speak to farm groups, my message is get up to speed, get involved, do some investigation."

"Whether there's government regulation or not, we're going to see the downstream of the food chain demanding better resource management—there will be labeling for consumers and packaging," says Carole Brookins. "The Walmarts of the world are going to be saying to suppliers—you're going to have to reduce your carbon footprint and your water footprint. In part it will be market and consumer driven and in part driven by regulation."

Despite the many transitions taking place in agriculture, Brookins offers a reminder that agriculture has always adapted to meet the challenges of the times. "Farmers have always been practicing sustainable agriculture," she says. "Farmers have always wanted to maintain their farms in ways to pass them down to their children. My takeaway is that this isn't a time to be afraid. It's a time to be creative and innovative and look at policies that are going to benefit agriculture to optimize this transition we're going through—this new industrial age. We have an amazing capacity for innovation."

AP PHOTO/READING EAGLE, TIM LEEDY

Eric Rosenbaum on his 150-acre family farm in Birdsboro, Pa. Rosenbaum receives money through a program run by the Chicago Climate Exchange, which pays farmers for practices that remove carbon dioxide from the air.