Leopold Letter

LEOPOLD CENTER
FOR SUSTAINABLE AGRICULTURE

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From energy to food and back again

By GEETHA IYER, Leopold Center Graduate Communications Assistant

When Stephanie Jung clears her children's plates after dinner, she doesn't see banana peels and bread crumbs but an untapped source of biofuel, just being thrown away.

An associate professor of food science and nutrition at Iowa State University, Jung studies how to make food processing technologies more sustainable, by reducing the amount of energy used or waste produced, or adding value to the production cycle by collecting food byproducts. Funded by a grant from the Leopold Center's Cross-Cutting Initiative, she has found that the sugars, starches and fibers in food waste can be broken down and fermented into bioethanol using just a dose of yeast, some warmth and enzymes.

This waste-to-fuel cycle involves no harsh chemical pre-treatment steps. It has the advantage over other biofuel sources, including corn and soybeans, of not competing with food crops for land area. And on a more sobering note, Jung points out that we are in no danger of running out of the source material—in 2012 alone, over 95 percent of the solid food waste produced in the United States was dumped or incinerated. That's 35 million tons of food left to rot or burn.

Globally, food waste is an issue of combined excesses and shortages. Upward of 30 to 50 percent of the food produced will never be eaten, while 15 to 50 percent of people in the world do not know where their next meal will come from.

***WASTE** (cont. on page 6)*

Work begins on 24 new projects in 2014

The Leopold Center has awarded grants to 24 innovative research and demonstration projects that will help Iowa farmers improve soil health, take advantage of opportunities related to local foods and fine-tune alternative practices that protect the environment while using fewer outside inputs.

All grants are for one year, totaling $731,817. In addition to new projects, work will continue on more than three dozen multi-year projects already in progress and supported by the Leopold Center's long-running competitive grants program. The new grants bring the Leopold Center's current investment in research to nearly $1.16 million.

In the **Ecology Initiative**, new grants focus on cover crops, soil health and conservation buffers. Iowa Learning Farms will continue to collect soil quality and yield data from seven farmer-partners who have planted cover crops the past five years. The Iowa Water Center will use existing data to quantify soil erosion and its economic value for all of Iowa's 1,616 HUC 12 (hydrologic unit code) watersheds.

In the **Marketing and Food Systems Initiative**, three new projects support creation of food hubs that will aggregate and/or process food for larger markets in the Cedar Valley, Allamakee and Winneshiek counties in northeast Iowa and the Iowa Valley corridor in eastern Iowa. Two projects address growing interest in urban agriculture, including

***GRANTS** (cont. on page 7)*

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LEOPOLD LETTER MISSION

The mission of the *Leopold Letter* is to inform diverse audiences about Leopold Center programs and activities; to encourage increased interest in and use of sustainable farming practices and market opportunities for sustainable products; and to stimulate public discussion about sustainable agriculture in Iowa and the nation.

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The Leopold Center for Sustainable Agriculture seeks to identify and reduce adverse socioeconomic and environmental impacts of farming practices, develop profitable farming systems that conserve natural resources, and create educational programs with the ISU Extension Service. It was founded by the 1987 Iowa Groundwater Protection Act. The *Leopold Letter* is available free from the Leopold Center at 209 Curtiss Hall, Iowa State University, Ames, Iowa 50011-1050; (515) 294-3711.

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Research Results

On the web: **www.leopold.iastate.edu/news/results**

Summaries

Easy-to-read summaries are available for these recently completed projects funded by Leopold Center grants:

- Evaluating the impact of a decade of regional food system work on growers in northeast Iowa
- Impacts of conventional and diversified rotation systems on crop yields, profitability, soil functions and environmental quality
- Improving soil quality by conserving insect pathogens
- Increasing access to healthy, fresh and local food to students in three rural public schools in northeast Iowa
- Sustainable Agricultural Land Tenure (SALT) Initiative II

Scientific Journals

Leopold Center-supported research has produced these papers published in peer-reviewed journals. Check at a research library or the journal's website for an abstract or full report. Additional information is available on each competitive grant (see ID number in brackets).

- Tyndall, John, L. A. Schulte, M. Liebman and M. Helmers (2013). "Field-level financial assessment of contour prairie strips for enhancement of environmental quality," *Environmental Management* 51(6):736-47. DOI 10.1007/s00267-013-0106-9

  This is related to the STRIPS Research Team project at Neal Smith National Wildlife Refuge in Jasper County. A lay publication, The Cost of Prairie Conservation Strips, *outlines findings from this paper, and can be found by title on the Leopold Center website:* www.leopold.iastate.edu/pubs/alpha
- Jaynes, D.B. and T.M. Isenhart (2014). "Reconnecting tile drainage to riparian buffer hydrology for enhanced nitrate removal," *Journal of Environmental Quality* 43:631-38. DOI 10.2134/jeq2013.08.0331

  Investigators redirected an underground field tile that drained a 10-acre field in Story County to a riparian buffer, which removed 55 percent of the total flow from the tile outlet in a two-year period. They found this saturated buffer system to be an effective way to remove nitrates before entering a stream. [E2013-13]

News & Notes

The Leopold Center has completed a new evaluation of seven one-year projects in the Local Food and Farm Initiative, a statewide program funded by the Iowa Legislature under Senate File 509. The projects, which were conducted in 2012 and 2013 at a cost of $36,879, leveraged more than $660,732 including two major grants from the U.S. Department of Agriculture. More information about the LFFI program and a summary of the evaluation is on the Local Food and Farm Program page on the Leopold Center website: www.leopold.iastate.edu/local-food-and-farm-program

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Grants in 2012 and 2013 supported a case study of six Iowa fruit and vegetable operations and how size, diversification, marketing strategies and production methods affected decisions about farm machinery. The results are in a new publication, *Potential for Machinery: A Case Study of Fruit and Vegetable Growers in Iowa*. These decisions are key when growers look to scale up their operations to supply large-volume markets. Find the publication by title at: www.leopold.iastate.edu/pubs/alpha. The project was featured in our Fall 2013 issue of *The Leopold Letter*.

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The Leopold Center's 2011-12 Annual Report, *A New Day*, was a winning entry in the GS USA American Graphic Design Awards. The report, which featured a signpost on the cover, was designed by julsdesign in Ankeny. The theme of the 36-page annual report looked at the past year as a turning point for the center with a new permanent director, Mark Rasmussen. Mary Adams is editor of the Leopold Center's annual report.

Conversations

WITH DIRECTOR MARK RASMUSSEN

HONORING A LIFETIME OF SERVICE

Mike Duffy has left his mark on sustainable agriculture in Iowa. He worked with two Leopold Center directors, Dennis Keeney and Fred Kirschenmann, and has offered valuable guidance for Center programs. A professor of economics, he managed the ISU annual land value survey and coordinated the long-running ISU Soil Management Conference. He was active in beginning farmer programs and the go-to expert on land tenure and ownership, and ag production and natural resources economics. He was part of the committee that developed the Center's framework in 1987, and continues to champion sustainable agriculture. We thank Mike for his dedication and offer this space for advice and reflection as he heads into retirement on April 30.

Mark Rasmussen

Thirty years later

By MIKE DUFFY, Guest columnist

When asked to write this column that looked back on my time at ISU and with the Leopold Center, as well as the changes in sustainable agriculture, I readily agreed, without realizing what that meant. I started this piece many times, only to decide some other way would be more appropriate and interesting. Then two things happened.

First, I read *The Last Lecture* by Randy Pausch, a professor dying of cancer. The book shares his struggles to prepare his last lecture. Obviously, I am not facing anything that traumatic, but his approach resonated with me. He chose to look back at all the good things that had happened to him and realized how lucky he had been. As I survey the past 30 years, I realize I have been lucky, too.

Throughout my career I have been blessed to know many wonderful people and have great opportunities. I began as a field scout with an integrated pest management project in 1973. Since then I have had the opportunity to work with sustainable agriculture under a variety of titles and capacities. One of the more fortunate connections is my involvement with the Leopold Center. I had the privilege of working directly with the Center as Associate Director between 1992 and 2005. I also have been the beneficiary of countless grants, issue teams and other Center projects that have helped me examine important issues facing Iowa agriculture.

The second important thing was hearing a speech by Iowa Secretary of Agriculture Bill Northey when he received the Outstanding Club Alumni award from the ISU Agricultural Business Club. Part of his message was that agriculture is about people. Personal relationships too often are overlooked in our discussions about agriculture, particularly sustainable agriculture. The interrelationships of plants, animals, insects and the overall ecosystem are critical. But, if we can't communicate those ideas or if we present them in an antagonistic manner, what good is that knowledge? Too often, I am afraid we talk *at* each other and not *with* each other.

Thirty years after joining Iowa State and following 40 years of involvement with ecologically-based agriculture, I see good and bad signs. Today we have more people participating in local food systems, farmers markets and an array of marketing outlets designed to bring the farmer and consumer closer together. This new spirit extends to the White House, where the First Lady has promoted gardening and healthier diets. We are more aware of problems in our food system and possible links with food additives and unhealthy diets.

The environmental impacts of agriculture are becoming more obvious. It isn't that we are just recognizing the problems; the Iowa Legislature passed the Groundwater Protection Act nearly 30 years ago. The difference is that almost everyone recognizes something has to be done. We have the tools and technologies to help alleviate some of the problems. Also being discussed are the serious challenges of the loss of farmers and rural communities and other problems associated with "getting big or getting out." Again, these aren't new issues. People have talked about them for decades, but it seems there is a renewed urgency.

What concerns do I have as we look ahead? I sense a misplaced concreteness in some attitudes. We don't know it all, none of us do. At best, we can only hope we are asking the relevant questions. There are too many people on both sides of the agriculture divide who feel they know the answers and all they have to do is convince you that they're right. In this era of easy communication and instant messaging we often don't take time to talk to one another. As Secretary Northey said, agriculture is about people. If all we do is look at a screen, punch buttons and read diatribes from people we already agree with, we aren't going to progress no matter how quickly we send messages. Technology can help with some of our dilemmas, but it isn't the panacea many believe. We need what E. F. Schumacher in *Small is Beautiful* called "appropriate technology."

Here we are, 30 years later and in some ways things aren't very different. I grew up with songs that talked about the "eve of destruction" and that the problems were nature's way of telling us something was wrong. It is sobering to listen to those songs and realize that basic problems haven't changed that much.

There is a prayer that tells us that we should "seek not to be understood but to understand." I think all of us in sustainable agriculture would do well to remember that. We have come a long way, but we have a great distance to go and we need to adjust our attitudes. We all have biases. We must recognize them and realize that other well-intentioned people may have different biases and life experiences. Remember, you will learn more by listening than talking.

I am grateful to everyone who has helped me over the years. I wish you well in all your endeavors.

Progress continues on conservation strips

www.leopold.iastate.edu

Find the latest STRIPS publication and other resources:
www.leopold.iastate.edu/strips-research-team

The winter months have been productive for the STRIPS Research Team (Science-based Trials of Rowcrops Integrated with Prairie Strips).

The team has been meeting with organizations and landowners interested in prairie conservation strips. They've been sharing research results and studying fields where strips of native prairie might be planted to curb erosion and nutrient runoff.

Until last June, the only place to see this new conservation practice was at the team's Jasper County research plots at the Neal Smith National Wildlife Refuge. Seth Watkins, who farms in southern Iowa, planted STRIPS in one of his fields and has been promoting the practice ever since.

The team has identified 14 other sites that have strong potential to adopt STRIPS in Boone, Carroll, Cass, Cedar, Cherokee, Clayton, Dubuque, Ida, Lucas, Montgomery, Polk, Tama and Washington counties in Iowa, as well as Putnam County in Missouri.

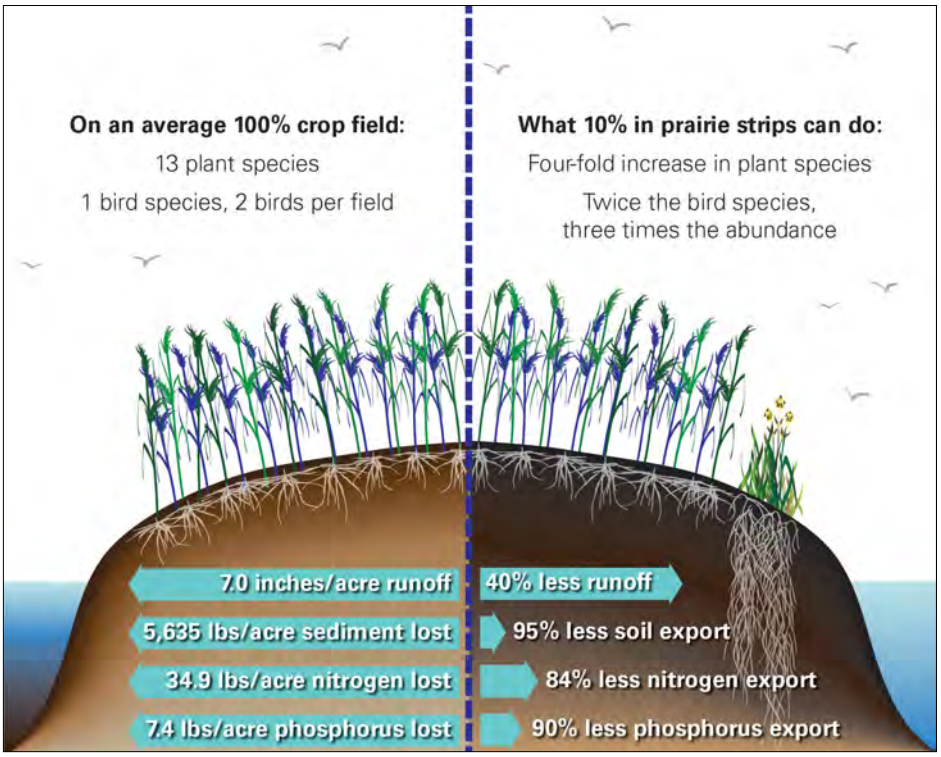
A new agricultural specialist with the project, Timothy Youngquist, will work closely with landowners to help guide the implementation of STRIPS on their operations. He planted prairie strips on his own land—a century farm near Kiron that has been in his family since 1871.

"I'm intensely proud of that and I want to see the land stay productive and healthy," he says of the family farm. "We've got a chance to make Iowa a better place, one field at a time."

Working with the Leopold Center, the STRIPS team has produced a new publication that provides a "big picture view" of the practice. *Small Changes, Big Impacts: Prairie Conservation Strips* takes into account Iowa's historic land use changes to explain why the new conservation practice is important for the future of agriculture in the state. Infographics created by Leopold Center graduate student Geetha Iyer show how STRIPS appear on the landscape, and summarize the project's major findings (see right).

The STRIPS team hopes that the demonstration sites established this year, as well as the new publication, will continue to spread the word about prairie strips. The take-home message: "Agriculture in Iowa does not need to compromise between production and conservation."

To find out more about prairie strips implementation, contact: Mary Harris, an Iowa State adjunct assistant professor and biodiversity specialist for STRIPS, **maharris@iastate.edu**, 515-294-2171; or Timothy Youngquist, **timyoung@iastate.edu**, 712-269-0592.



Source: STRIPS Research Team and Leopold Center for Sustainable Agriculture

Iowa's conservation toolbox: Expanding options

www.leopold.iastate.edu

Managing Nutrients:
www.leopold.iastate.edu/nutrients

Iowa Nutrient Reduction Strategy:
www.nutrientstrategy.iastate.edu

While farmers look for ways they can participate in the Iowa Nutrient Reduction Strategy program, research on expansion of those choices continues. One focus of Leopold Center grant research is changed land use through extended rotations.

Diversifying operations to include more crops and fewer external inputs shows promise, according to Iowa State agronomist Matt Liebman. Liebman directs research trials that began more than a decade ago at the ISU Marsden Farm near Boone, Iowa. He has added alfalfa, small grains and a red clover cover crop to the traditional two-year system of corn and soybeans to create three- and four-year systems. The systems are compared on a suite of performance measures, and across time. The alternative systems have fared well, even during the past two years that have included an early spring, too much rain and drought.

Nearly all of the practices evaluated in the Iowa Nutrient Reduction Strategy have some history of research support from the Leopold Center. Currently, Leopold Center grants totaling more than $1 million support 17 research projects related to water quality and nutrient management.

TOWARD A SUSTAINABLE Future

Redefining wealth

Wealth is something we all want. Wealthy is rich, after all—but rich in what? In possessions, money, income? This depends on how you define the word. Its original meaning, from the Old English weal (as in commonweal) was simply prosperity or well-being. — From the book, Creating Wealth: Growing Local Economies with Local Currencies *(Hallsmith and Lietaer 2011)*

The belief that material wealth and a consumptive lifestyle are essential to happiness is deeply rooted in our modern, industrial culture. As city planner Gwendolyn Hallsmith and financial consultant Bernard Lietaer put it in their prescient new book, *Creating Wealth: Growing Local Economies With Local Currencies*: "In our dreams, money solves all our problems, gives us resources to meet needs we never knew we had."

In other words, we define wealth and well-being as synonymous with the amount of money we individually acquire and the amount of material goods we can accumulate. This idea is entrenched in our cultural value system and also, unfortunately, is how we have come to describe most of our food and agriculture system.

The good news is that an increasing number of scholars—philosophers, ecologists, evolutionary biologists, and even some economists, farmers and politicians—are beginning to acknowledge the downsides of this point of view, and that this perspective places us on an *unsustainable* trajectory. They recognize the vulnerability of our "maximum-efficient-production-for-short-term-economic-return" food system—especially as we head into the future.

One example of this awareness is evident in a recently published collection of essays, *Food Systems Failure* (Rosin et al. 2012). The book provides a comprehensive assessment of the vulnerability of our current food system and its inability to meet future challenges. All the authors of these essays recognize that at the heart of the many challenges facing our food system is "the need for a serious transformation of the neoliberal, market-driven model for providing solutions to world hunger," a model consistently referred to as "business-as-usual" (220). The authors acknowledge that the failure of our current neo-liberal economy, and our troubled food system, are tightly coupled.

One false assertion is that unlimited, individual financial wealth and a consumptive lifestyle are essential to *quality of life*. This assertion tends to sanctify a "business as usual" perspective. There's an additional inaccurate assumption that cheap, natural resources (fertile soils, fresh water, fossil fuels, stable climates, etc.), which have subsidized our industrial economy, always will be there or, in the presence of scarcity of any of these resources, new technologies always will produce substitutes. This assumption further sanctifies a "business as usual" attitude. Together, these two assertions perpetuate what has been called "the dreamy belief."

The "dreamy belief" is, of course, totally false. It fails to recognize that all of these natural resources are, in fact, what Ernest Schusky called, "old calories,"—i.e., they are nonrenewable. Hence, once they are used up we can no longer "sustain" an economy, or a food system, dependent on them (Schusky 1989). Schusky designates this modern era of agriculture as the "neo-caloric era," which only will last for a very short period of time.

An inherent problem with this "dreamy belief" is that it distracts us from our need to anticipate the changes coming at us, and getting a head start preparing for them. Consequently, it leaves us ill-prepared to meet the challenge of imagining a *sustainable* future, and a sustainable food system, in a post-neo-caloric era. As Dennis Meadows writes in his preface to Hallsmith and Lietaer's book:

> A century from now social analysts will look back with angry astonishment at the extent our generation accepted the economists' fantasy—happiness requires perpetual growth. This may have been true once; definitely now it is false.

Meadows also points out that, regretablly, a growing number of people who have come to understand that any notion of perpetual growth is false, "tend to seek technological changes [... but] none of these efforts will succeed without a fundamental change in our understanding of human wealth." In other words, technological fixes won't repair misguided perceptions. Therefore, Meadows predicts that our current culture "will prevail until industrial society collapses."

It is not hard to imagine that Meadows could be correct. That's why it is so important to consider the new possibility he now envisions—that "individuals, families, communities, perhaps even regions, can begin now proactively to make the necessary changes that will lead to true happiness and sustainable wealth."

I would add that this "new possibility" also is reason enough for us to organize and design prototypes of *new food and agriculture systems*. These new systems need to be more self-renewing and self-regulating, not as dependent on old calories, and more responsive to the health and nutritional needs of people in every community on the planet. In that regard, implementing the "right to food" concept articulated by the United Nations Special Rapporteur would be a logical place to start (De Schutter 2011).

Two of the most positive signs demonstrating that these new prototypes are possible are: 1) the new generation of young people in the United States who share this vision already (many of whom want to farm); and 2) the growing number of women in the developing world who also share this vision and already are beginning to design local, agro-ecological food systems that feed local populations. Francis Moore Lappe has provided us with a powerful example of women in India who already have achieved this vision (Lappe 2013).

It's time to get started—now!

Find a list of references on the web:
www.leopold.iastate.edu/content/writings-fred-kirschenmann

PROJECT LOOKS AT BIOETHANOL

WASTE *(cont. from page 1)*

"As a consumer, and a mom with a family, I am ashamed at the quantity of waste," Jung admits. "Most of it will end up in landfills and will produce methane eventually."

Methane is a potent greenhouse gas—lost energy an with enormous environmental impact. So food waste represents more than just lost nutritional value, but also social, environmental and economic costs—in water, nutrients, fuel, labor and many other variables—of agricultural production, transport, processing and packaging before food arrives on the plate. Then there's the cost of processing, transport, dumping and release of pollutants from what isn't sold or eaten.

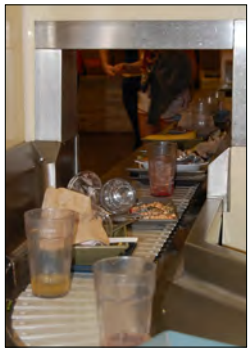
"I don't think people really realize the consequences," says Jung. She cites the Environmental Protection Agency's food recovery pyramid, which explains that landfills and incinerators should be a last resort option in the farm-to-fork-to-waste cycle. Source reduction is the first step—for individuals and institutions to produce and consume only what they need and to reduce food access inequalities that result in hunger and waste.

Recycling comes next. Options include composting to return nutrients to the soil, extracting fatty byproducts for industrial purposes, or feeding protein-rich scraps to livestock. Jung thinks converting the sugars and starches into bioethanol is just one other way to retrieve value from it. That's why she found an institutional partner to look at the feasibility of collecting and fermenting food scraps for ethanol production.

"I contacted ISU Dining, and they were very excited about the idea, because they are also looking at green approaches."

What food waste recovery looks like

ISU Dining has implemented its own measures to sustainably process food and recover waste. They use a trayless dining system, which results in less dishware to wash, and raises students' awareness of how much food they're loading onto their plates.

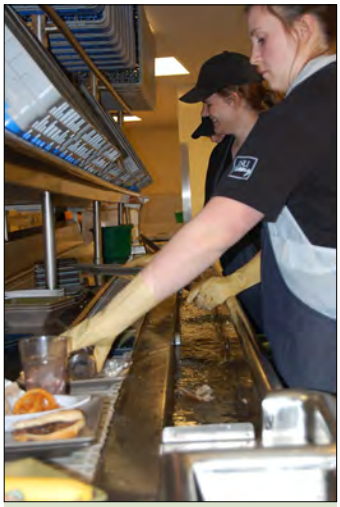


Students place their used plates and glasses on a conveyor belt leading to the dish room. They remove silverware from the plates to be washed separately.

In the dish room, student staff separate organic materials on the plates from inorganics such as waxed cups, soda bottles and foil packaging. The organics are washed through a pulper to remove most of the liquid waste and reduce the volume—and transportation cost—of the solid remains. The reduced particle size of the pulped solids also makes it easier to compost. ISU Dining belongs to a small but growing number of institutions that redirect food waste to gardens and farms, closing the loop on nutrient cycling.

Jung was invited into the dish room to collect the buckets of pulped organics for her ethanol fermentation research. She says typical solid food waste includes fruit and vegetable peels, cereal grains, and meat scraps. This raw material is composed of sugars, starches, fibers, proteins and fats, of which the first three may be fermented into ethanol. But there was an additional, unexpected source of fiber—used paper napkins.

"I was looking at these plates coming from the students with these huge amounts of napkins," says Jung. She asked if the dish room staff could separate the napkins from the waste so she could compare fermentation results for food waste alone, food waste combined with napkins, and napkins alone. She found that more ethanol is produced from napkin fermentation than just food waste.



Students Hanna Johnson, Loren Reed and Sabrina Groenenboom sort food waste from inorganics.

That's because Jung's fermentation process involves tweaking the enzyme-to-yeast ratio to match the sugar-to-fiber ratio of the pulped raw material. To maximize ethanol production, Jung suggests that along with silverware, students can also remove napkins from their plates for separate processing. Like the trayless system, this has the added benefit of raising students' consciousness of how much paper they waste with their meals.

Scaling up research and implementation

Raw food and napkin waste is generated in homes, schools, hospitals and shopping malls. Based on what Jung has seen at ISU Dining, it might not require much effort to implement waste collection and fermentation into existing waste disposal systems. She points out, for example, that while there is no large-scale system in place for collecting food waste in Ames, there's an ethanol distillery nearby in Nevada that potentially could be modified to process food waste in addition to corn byproducts.

She collaborated with Mark Mba Wright, an assistant professor of mechanical engineering at ISU, to assess the feasibility of the food waste-to-bioethanol cycle based on her preliminary data. He calculates that at a conventional facility, 2,000 tons of consumer waste per day, sourced from an institution like ISU Dining, could generate between 5 and 42 million gallons of ethanol. By comparison, processing corn stover into ethanol generates about 49 million gallons of ethanol.

Mba Wright points out that the lower-range value is for food waste alone. The upper-range value is for food waste and napkins combined, producing much more ethanol. The biggest limiting factor for the entire conversion cycle is the cost of enzymes, which are expensive to procure. The question underlying both Jung and Mba Wright's research is—is it worth the effort?

"If the only motive was to make a profit, corn-ethanol still will be the best way to go, both short-term and long-term," says Mba Wright. But, there also is a social imperative that underlies food waste reduction. "Even though I focus on economics, I understand that the question shouldn't just be just framed in terms of the cost, but also in terms of the social and environmental value of it."

"I believe it has to be a joint effort," says Jung in agreement. "We cannot only focus on waste conversion. We have to have more programs about educating the consumer. It can start just

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on campus," she points out, noting ISU Dining's efforts. Food waste will not go away, but the conversion process could offset production, processing or transportation costs. It also rescues waste from incineration and landfills.

The next steps for Jung's research could include more detailed life cycle assessment for the waste-to-fuel process, as well as consumer education and outreach programs. But waste reduction research is still a very new field, with few sources of funding. Jung believes it will improve in the future, but right now, interest in the field is limited by people's awareness of how large the problem is, and how it continues to grow.

"This is what is holding us back," says Jung. "This is why I'm very grateful to the Leopold Center. We hope this preliminary data will convince others that it's worth it."

A new hot topic: Food waste

In its February 2014 annual food price report, the World Bank points out the "shameful" amount of food wasted and lost each year with impacts on food insecurity as well as economic, energy and natural resource losses. The U.S. Environmental Protection Agency is sponsoring a nationwide program to reduce food waste in businesses. Promoting awareness and action at the state level is the Iowa Food Waste Reduction Project, housed at the Leopold Center's sister organization at the University of Northern Iowa.

Food waste is a multi-faceted issue. To learn more, check out these links:

- Iowa Food Waste Reduction Project, with sections for teachers, homeowners, farmers, food retailers, government and industry, **foodwaste.iwrc.org**
- EPA: Reducing Food Waste for Businesses shows six ways to divert food from landfills, **www.epa.gov/foodrecovery/**
- World Food Bank Food Price Watch, February 2014, shows food calories lost by region, **www.worldbank.org/en/topic/poverty/publication/food-price-watch-february-2014**

2014 RESEARCH INITIATIVES

GRANTS *(continued from page 1)*

www.leopold.iastate.edu

For descriptions of the work, who will be conducting each project and other details, go to: **www.leopold.iastate.edu/grants/current**

development of a toolkit for regional planners and an assessment of opportunities in Des Moines.

The **Policy Initiative** will support development of a new guide for city zoning issues related to local foods. Drake University Agricultural Law Center also will produce a model "Legacy Report" that outlines management options for farmland undergoing generational changes in ownership, which is expected to peak in coming years.

Topics for research in the **Cross-Cutting Initiative** include aquaponics systems, winter canola and capturing experienced producer knowledge about growing small grains such as barley, oats and triticale. New competitive grants also allow investigators to continue ongoing research on diversified crop rotations, organic practices, and development of a sustainable source of biomass for renewable energy production at the University of Iowa.

ECOLOGY INITIATIVE – 9 projects, $298,570

- Covering the ground: A transformative approach to scientific learning for greater cover crop adoption in Iowa
- Determining threshold responses of plant-soil feedbacks to nitrogen deposition
- Economic impacts of soil erosion in Iowa
- Management and performance of Iowa cover crops
- Quantifying nitrogen credits and impacts of cover crops on soil biology and health in vegetable cropping systems in Iowa
- Quantifying the effects of alternative surface inlet protection strategies on water quality
- A smartphone-based device for measuring soil organic matter
- Soil health and productivity in riparian grass buffers: A re-evaluation after 13 years
- Understanding microbial contributions to soil aggregation and organic matter accumulation

MARKETING AND FOOD SYSTEMS INITIATIVE – 7 projects, $160,906

- Agricultural Urbanism Toolkit
- Increasing the capacity of a local food hub to service the public school market
- Insurance benchmarking for Iowa fruit and vegetable producers, Year 2
- Market development and logistics for local food distribution in the Cedar Valley
- Planning grant for the establishment of a food enterprise center
- Small-farm business development incubator for refugee farmers
- Using spatially explicit supply/demand and local participants' perspectives to integrate urban agriculture with community planning

POLICY INITIATIVE – 2 projects, $56,121

- Reducing local regulatory barriers to local foods: Municipal Zoning for Local Foods in Iowa Guidebook
- Sustainable Agricultural Land Tenure: The legal rights and duties of entity ownership of Iowa farm land and the next generation of landowners

CROSS-CUTTING INITIATIVE – 6 projects, $216,220

- Capturing indigenous knowledge of small grain production
- Food safety, economics and environmental impacts of aquaponics in Iowa
- Impacts of conventional and diversified rotation systems on crop yields, soil functions and environmental quality: Stage II/Year 2
- Linking soil and water quality with crop performance across a continuum of tillage and management strategies: Enhancing sustainability through soil-health-promoting practices
- Suitability of winter canola for enhancing summer annual crop rotations in Iowa
- The University of Iowa Biomass Energy Sustainability Index: A decision-making tool for the University of Iowa Biomass Partnership Project

Who speaks for the soil?

By JERRY L. HATFIELD, Guest columnist

The existence of humankind depends on the soil and its ability to provide water, nutrients and oxygen for plants, microbes and all living creatures that make their home under the ground. If we lived below ground and relied on these resources for our quality of life, we probably would have a different view of the soil and how it should be treated. Unfortunately, there is no one who speaks for the soil and it is imperative that some of us become the voice for the soil. Soil is one of the most precious resources we have, yet we ignore its value and consider soil a renewable resource that always will be there for us.

Photo contributed by Geetha Iyer, taken in Boone County, early March.

Over the past few years, I've noticed some disturbing trends in our attitudes about this resource. We are satisfied seeing erosion each spring. We do not express major concern about scars in the landscape and the need for more aggressive conservation practices. When soil moves, all that lives within it is disturbed; these life forms cannot effectively function when their environment constantly is changing. Erosion from water or wind moves the soil surface; tillage is a large-scale disruption of the upper soil profile. Yet how can we build soil without first keeping it in place? Soil biological systems don't like change any more than we do, yet we expect these systems to tolerate everything we do to the soil, which is their home. If we could hear soil biological systems, I am sure we would hear them screaming.

Traveling throughout the Midwest over the past 25 years, I've had the opportunity to make many observations. I believe that modern agriculture is content to separate soil management from agronomic management. Many people believe that we can achieve productivity goals by supplying inputs, using soil simply as the medium that holds these inputs. We fail to recognize that agriculture is a complex set of interactions which must be understood as a system rather than individual components.

We continue to underestimate the extent to which soil degradation is occurring. My observations of the landscape around Ames show that the amount of light-colored soils is expanding because we continue to remove, rather than replenish, the soil organic matter in the soil profile. The summer of 2012 was a lesson in the true value of soil: Many producers were surprised by the high yields on good soils and the major differences in yield between good and poor soils.

On a larger scale throughout the Midwest, we have been investigating a similar effect. We have found that for both corn and soybean, average county yields increase with the quality of the soil. We've also noted an increased chance of crop failure in poorer soils. As an outcome of our field-scale studies, we have observed two responses. First, crop yields vary across fields because of soil water availability during the grain-filling period of growth. Second, total soil water use by both corn and soybean was nearly twice as large in good soils, compared to poor soils. Since crop yield is dependent upon the amount of water used by the crop, these observations explain why yields vary across fields. Improving our soils will pay dividends in terms of decreased yield variation within fields and among years.

My personal journey to understand the value of soil has led me on a path to discover what is happening to our soils and what we need to understand to improve them. Soil degradation continues to threaten this vital resource, and throughout the world the consensus is that tillage and residue removal are two primary factors contributing to this problem. In Iowa, we seem to be satisfied with the occurrence of soil degradation because our overall productivity continues to rise. However, in many cases we are beginning to see that crops no longer can achieve their potential because soil has become a limiting factor.

If we want to improve our soils, we must reverse the trend of losing soil organic matter. We need to "encourage" the biology in our soils to help restore organic matter content. To do this, we need to build up biological populations in the soil by providing them with food during the times they are active. When we are hungry, we tend to express our concerns about lack of food, sometimes loudly. If soil biology could express its desires, I am sure the vociferous message would be "Feed me, I'm hungry!"

Our soils are a resource. Many of our environmental concerns—sediment loads in streams, rivers and lakes; nutrients in water; dust in the air, etc.—would be reduced if we began to consider how to manage our soil as part of the solution to these problems. If we would adopt an attitude of managing our soil biology as part of a soil fitness program, similar to the fitness program we have for our own health and our own bodies, we would be amazed at the positive impacts. In turn, we would observe changes in the soil that benefit everyone. Most of all, I believe we would see how efficient our agricultural systems could become as a result of our soil biology saying thanks for providing a stable home with lots of food.

We should all be a voice for the soil. It is our responsibility—and our duty to future generations—to enhance this resource over our lifetime.

Jerry L. Hatfield is director of the National Laboratory for Agriculture and the Environment in Ames, a research facility of the U.S. Department of Agriculture, a position he has held since 1989. Hatfield also directs the Midwest Climate Change Hub, one of seven regional centers that will study challenges that farmers face due to climate change. He has a Ph.D. in Agricultural Climatology and Statistics from Iowa State University, and M.S. and B.S. degrees in Agronomy from the University of Kentucky and Kansas State University, respectively. Prior to joining the USDA Agricultural Research Service in Texas, he was a biometeorologist at the University of California-Davis.

Shallow wells and water quality in farm country: What else can we do? Research project offers options

By JERI NEAL, Leopold Center Ecology Initiative Leader

For Iowa farmers, nitrogen loss from fields means that dollars spent on fertilizer aren't being used effectively. For urban citizens, it can mean a higher risk to drinking water supplies. Nitrate levels in the 12 shallow water wells that supply Sioux Center were increasing each year, but action by an area water protection team and new on-farm research results from a five-year Leopold-funded study have all parties smiling.

The project also shows how research can be used to expand farmer options outlined in the Iowa Nutrient Reduction Strategy.

The project brought together local landowners, city officials, the Sioux County Soil and Water Conservation District, state and federal service providers and professors from nearby Dordt College. This unique partnership looked at alternative cropping systems that would both protect the water quality and keep the land in agricultural production. The project fit the Leopold Center's Ecology Initiative as well as the Iowa Department of Natural Resources' Source Water Protection Program for Targeted Community Water Supplies. Findings were presented at a March 20 public meeting attended by more than 50 people.

At the forefront, offering land and labor, was Matt Schuiteman of AJS Farms. The Schuiteman family has been farming the land used in this study for more than 30 years. The parcel is located on County Road B40 across from the former Sandy Hollow Golf Course.

One way to address the rising nitrate levels in the city wells was to enroll additional productive land in the well field in the federal Conservation Reserve Program. For AJS Farms, the question was, "Is there anything else we could do?"

Beginning with the Leopold Center research grant in 2009, Schuiteman worked with Robb DeHaan, professor of environmental studies at Dordt College. They designed and implemented five experimental cropping systems on roughly 40 acres of land adjacent to and above a bank of shallow wells that provide more than 50 percent of the drinking water for Sioux Center, a city of about 7,000 people.

"The idea was to use perennial crops and cover crops to keep the nitrogen in the upper layers of the soil and available for the next season, and apply just what the crops need when they need it," DeHaan said.

The systems were designed for standard farm equipment ranged from continuous corn with a winter rye cover crop to perennial grass for hay (common for wellheads but generally a low-income choice for the landowner). Three other systems used rotations of oat-alfalfa-corn; oat/red clover-corn; and soybean-winter wheat-corn. The perennial grass and alfalfa systems receive no commercial nitrogen applications; other systems received nitrogen fertilizer as needed.

Researchers collected 6-foot-deep soil samples from each plot every fall, and divided these into 1-foot segments for analysis of nitrate N concentration. The information was used to construct nitrate N profiles for each plot, and to track nitrate N movement over time. Results illustrate opportunities for farming the land as well as managing water quality.

As expected, the continuous corn with rye left high levels of residual nitrate N in the top 2 ft. of soil. The grass hay averaged five-fold fewer residuals for every year and at every depth, proving to be the most effective system for reducing nitrate N escape into local drinking water. However, wheat with soybean and corn performed better than continuous corn with rye. Adding a tap-rooted legume, such as red clover or alfalfa, to corn dramatically dropped residual nitrate N levels throughout the profile.

www.leopold.iastate.edu

More about the project: **www.leopold.iastate.edu/grants/e2009-22**
At the link you'll also find a video of DeHaan explaining the project, and a story from the Iowa DNR.

Schuiteman said he was surprised at the effectiveness of alfalfa in managing both the amount and distribution of nitrates in the soil profile. But he was disappointed that wheat and oats were less effective in cleaning up nitrate at the lowest depth. Based on the findings, he is planning to implement a four-year rotation of two years of alfalfa followed by two years of corn. Oats may be included for weed and erosion management during alfalfa establishment.

"To be sustainable it's got to work in the long run but it's also got to make money," Schuiteman said. Profitability, using ISU annual custom rates and prices, will be analyzed by Dordt College agriculture professor Ron Vos. Preliminary analysis comparing two of the systems, oat-alfalfa-corn and continuous corn with a winter rye cover crop, showed the continuous corn-rye with the highest average profit per acre but also the most variable for 2009 through 2012.

Schuiteman emphasized that a diversified farming operation is good for farmers, as well as the environment.

"The bigger picture from a farmer's perspective is that rotation changes can be a very effective, targeted approach in specific situations, and cover crops can be a broader solution on many more acres," he said. "If we truly can improve the soil through the use of cover crops and some of the other things we're doing, that soil is going to help us create wealth."

Full results from the project are expected later this year.

Right: Matt Schuiteman on his farm.

Below: Taking a soil profile.

Remembering a lost bird after 100 years

By LAURA MILLER, Newsletter editor

There will always be pigeons in books and in museums, but these are effigies and images, dead to all hardships and to all delights. Book-pigeons cannot dive out of a cloud to make the deer run for cover, or clap their wings in thunderous applause of mast-laden woods. They know no urge of seasons; they feel no kiss of sun, no lash of wind and weather. They live forever by not living at all.

Aldo Leopold, "On a Monument to the Pigeon" (1947)

Painting by Thomas A. Bennett, used with permission.

Aldo Leopold penned this essay 33 years after Martha, the world's last Passenger Pigeon, died in 1914. The occasion was the dedication of the first monument to an extinct species, on May 11, 1947 at Wyalusing State Park near Prairie du Chien, Wisconsin. The monument symbolized our sorrow, Leopold wrote, and that "for one species to mourn the death of another is a new thing under the sun."

Indeed, the worldwide attention that followed Martha's death may have spawned the wildlife preservation movement that led to the Endangered Species Act in 1973. To mark the 100th anniversary of this extinction, the Leopold Center brought noted ornithologist and scholar Stanley Temple to Ames on March 6.

Temple is Senior Fellow and Science Advisor to the Aldo Leopold Foundation in Baraboo, Wisconsin. For more than 30 years, he was the Beers-Bascom Professor in Conservation in the Department of Wildlife Ecology at the University of Wisconsin-Madison, a position originally held by Leopold. Temple uses the case of the Passenger Pigeon to call attention to the world's ongoing extinction crisis and our relationship with other species.

"It was a shocking extinction," he said. "The Passenger Pigeon had been the most abundant bird in North America, accounting for one in every four birds on this continent… it truly was one of the most spectacular species that man had ever known."

The birds migrated over a wide territory, moving continuously in flocks sometimes numbering tens of millions. They relied on mast (nuts and seeds) from deciduous forests of the Eastern United States and Upper Plains.

The only time the pigeons stayed in one place was for about a month when they bred and raised their young. Temple said huge nesting colonies could devastate a region, stripping trees of leaves and breaking huge limbs. This also is when the birds were hunted for recreation as well as for their meat (squab) by pigeoners who followed the flocks from region to region.

Temple said the largest documented nesting colony in Wisconsin covered 850 square miles and hosted more than a hundred million birds in 1871. The last mega-colony of Passenger Pigeons was believed to have gathered in Michigan in 1878.

Westward expansion of the railroad meant that large quantities of squab could be quickly transported to more populous markets. The birds were packed 300 to a barrel, and Temple said reports showed thousands of barrels leaving by train every day in areas where the birds roosted.

About the same time, the telegraph also aided market hunters by letting them know where the flocks had been and where they were headed. Bird populations began to decline by about 20 percent every year.

www.leopold.iastate.edu

Listen to Temple's presentation and see his slides:
www.leopold.iastate.edu/news/calendar/2014-03-06/extinction-passenger-pigeon-stanley-temple

By 1902, an Ohio hunter killed what was thought to be the last wild Passenger Pigeon. After several unsuccessful attempts to breed the bird in captivity, the Cincinnati Zoo lost its female, Martha, on September 1, 1914. Martha was packed in a 300-pound block of ice and sent by train to Washington, D.C., where her remains were stuffed and put on display in the Smithsonian.

Unfortunately, many audiences today know little about the Passenger Pigeon and often confuse it with the common rock pigeon. "We are still ruthlessly exploiting abundant wildlife species, pushing some to extinction by overkill," Temple said. "We do not have a very good track record."

Nearly 17,000 of the 44,800 known species are threatened with extinction. Although he notes successes in saving Sandhill cranes, wood ducks, wild turkeys, gray whales and trumpeter swans from extinction, many other species are endangered including Atlantic cod and Bluefin tuna.

Temple is working with Project Passenger Pigeon to share the story. Other efforts include a book by Joel Greenberg, *A Feathered River Across the Sky: The Passenger Pigeon's F light to Extinction* (2014 Bloomsbury USA) and a new documentary, "From Billions to None."

An interesting sidenote: The first symphony written in the United States was about the Passenger Pigeon. A Bavarian immigrant, who went on to form the New York Philharmonic, witnessed a sky darkened with Passenger Pigeons in 1831. The music was never performed in the United States. Temple said he hopes it will be picked up by various groups to commemorate this year's anniversary.

"We're very hopeful that with all of this attention a new generation will remember the Passenger Pigeon and perhaps by remembering they will be motivated to be more careful about our relationship with other living things," he said.

Stanley Temple at "The Shack" in Baraboo, Wisconsin.

Two join Leopold Center Advisory Board

The two newest members of the Leopold Center Advisory Board offer widely divergent perspectives on agriculture – from the sky above an Iowa prairie to the daily details of a family farm operation. They are University of Iowa assistant professor Marc Linderman and Michael Naig, who represents the Iowa Department of Agriculture and Land Stewardship (IDALS).

Michael Naig

Naig's parents still farm with his aunt and uncle on the same land near Cylinder in northwest Iowa where he grew up. Although the operation consists only of corn and soybeans, Naig remembers the many years they raised hogs in a farrow-to-finish operation.

"I was involved in 4-H and FFA and benefitted greatly from the experience and lessons learned," Naig said. "I am fortunate to remain directly connected to the farm through my parents and feel blessed to have been able to spend my entire career in agriculture."

Naig is now second-in-command at IDALS, a position he has held since September 2013. He previously served as manager of state and local government affairs for Monsanto and held a similar position at the Agribusiness Association of Iowa, which also has a representative on the Leopold Center Advisory Board. As deputy secretary at IDALS, Naig assists in management responsibilities for the Department in the areas of personnel and budget. He also travels extensively to represent IDALS at meetings across the state.

Among the Leopold Center's most critical contributions to Iowa agriculture is seed money for research, he said. "I support agricultural research that will benefit all Iowans and encourage a collaborative approach to addressing the challenges and opportunities that we face in protecting our environment and meeting the needs of a growing world," Naig said. "This research can provide a valuable return on investment for Iowans and have an impact beyond our borders."

Naig is a graduate of Buena Vista University in Storm Lake, with degrees in biology and political science. He has been active in agribusiness for more than 13 years, having served in public policy roles at state and national trade associations and in private industry. He succeeds Jay Johnson on the Leopold Center advisory board. He and his wife Jaime live in Urbandale with their three sons.

Marc Linderman

Agriculture from Marc Linderman's point of view would be from above, that is, remote sensing such as from unpiloted aerial vehicles (UAVs).

Linderman recently received an Innovations in Teaching with Technology Award to use this equipment in classes he teaches in UI's Department of Geographical and Sustainability Sciences. The market for UAVs is expected to more than double to $8 billion a year over the next decade. Commercial applications range from precision agriculture and real estate to monitoring traffic, pollution and infrastructure. UAVs also are expected to play a significant role in environmental monitoring and disaster response.

Linderman's research interests are ecosystem dynamics and land cover change as gauged by remote sensing and spatial-temporal models. His work has taken him to a giant panda reserve in China to study the spatial and temporal dynamics of panda habitat, particularly the relationship between local farming and fuelwood harvesting and understory bamboo regeneration, as well as sub-Saharan Africa and Iowa prairies and watersheds where he is studying the effects of land-use change and vegetation dynamics.

He has a B.S. in Physics from the University of Michigan, an M.S. in Environmental Monitoring from the University of Wisconsin, and a Ph.D. in Fisheries and Wildlife from Michigan State University. Prior to arriving at the University of Iowa in 2006, he was a National Science Foundation post-doctoral fellow at the University of Louvain, Belgium. He grew up in the Midwest, which presented many opportunities to enjoy outdoor activities.

"Iowa has a rich agriculture history," he said. "The Leopold Center provides an important link between farming and our ecosystems that I believe genuinely reflects Iowans' interest in preserving these incredible agro-ecosystems and improving our sustainability. I look forward to continuing to promote research and education related to connecting people to agro-ecosystems and the landscapes in which they reside."

Linderman replaces George Malanson, who had completed a four-year appointment.

Graduate student begins marketing projects

Savanna Lyons has experienced agriculture from both near and far. Before coming to Iowa in January, she worked with farmers and local food advocates in West Virginia in a 30-vendor farmers market and on the board of the West Virginia Farmers Market Association. She also set up and directed a statewide coalition to help build local food systems, which successfully changed several state policies, distributed food systems grants, conducted research and launched a free consulting program for food businesses.

She discovered a passion for working with farmers during a study abroad trip to northern Brazil, and returned the following year to interview more than 110 farmers and affiliates of the Landless Workers Movement about their views on the movement and sustainable agricultural practices. The project became her undergraduate thesis at Harvard, where she received a degree in Environmental Science and Public Policy in 2006.

At Iowa State, Lyons is pursuing a master's degree in the Graduate Program in Sustainable Agriculture and is a graduate assistant for the Leopold Center's Marketing and Food Systems Initiative and the Local Food and Farm program. She is updating a directory of Community Supported Agriculture (CSA) enterprises in Iowa, and will prepare toolkits on best practices in local foods aggregation and distribution. Her research will emphasize how to coordinate production among farmer groups to meet volume buyers's needs.

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Iowa Local Food Conference,• April 8, Quality Inn, Ames

"It's Your Business: Expanding Opportunities in Iowa's Food System" will feature keynote speaker Lucie Amundson sharing the clever way she has grown her pasture-raised chicken operation near Duluth. Also speaking will be Bill Menner, USDA state director of rural development, and Kamyar Enshayan, who leads the University of Northern Iowa's Center for Energy and Environmental Education. Tracks focus on food hubs, processing centers and marketing strategies for food-based businesses.

Spring GPSA Symposium • April 16, Sun Room, ISU Memorial Union, Ames

The Graduate Program in Sustainable Agriculture will host Elena Bennett, assistant professor in the Department of Natural Resource Sciences at McGill University, Montreal. She will talk about ecosystem services that can be provided by an agricultural landscape. Students also will share results of their research at ISU.

Second Agroforestry Academy • July 21-25, Winona, Minnesota

Natural resource professionals and educators from Iowa, Minnesota, Wisconsin, Illinois, Nebraska and Missouri are invited to attend a week-long training, hosted by the Mid-American Agroforestry Working Group and supported by the Leopold Center, to learn about concepts and principles of agroforestry, participate in case study design and tour farms that use agroforestry. A similar training was offered last year in Missouri.

Photo contributed by Pat Sauer

What's that again?

Dave Derrick is a fluvial geomorphologist, one of the nation's leading experts on river engineering. Here he energizes the crowd and demystifies stream and riparian rehabilitation and repair during a workshop funded by the Leopold Center during the 2014 Iowa Water Conference in Ames on March 4. If you missed the show, you can access his materials on the conference proceedings page at: **www.water.iastate.edu/content/iowa-water-conference-2014**