



LEOPOLD CENTER  
FOR SUSTAINABLE AGRICULTURE

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## Looking for resilience after a year of flooding

By LAURA MILLER, Newsletter editor

Faced with massive and frequent flooding throughout much of the state for the second time in three years, Iowans may hear a new term in discussions about long-term solutions: resilience.

Resilience is defined as the capacity of a system to absorb disturbance and still retain its basic function and structure. Recently, resilience has been linked to how people view the capacity of natural resources and ecosystems to manage risk, whether from too

much rain or too little, effects of an unstable climate, or changing environmental conditions that lead to new pests and disease.

The Leopold Center queried researchers who have been studying alternative systems to see how their projects fared during last summer's floods. We checked in with investigators of two Leopold Center projects, one fairly new and another alternative system established nearly 20 years ago.

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

## New web tool helps farmers explore markets

A powerful new version of a popular tool promises to help Iowa farmers explore new markets for fruit, vegetables and tree nut crops. After two years of development, the Leopold Center and Iowa State's Institute for Transportation have released the web-based Iowa Fruit and Vegetable Market Planner.

The new Iowa Fruit and Vegetable Market Planner shows rates of demand for 80 different crops. Users can target specific regions, consumers by age group, different time frames and product mixes – from fresh off-the-farm produce to demand for canned, dried or frozen products. All results are shown in retail weight, which takes into account spoilage and processing losses that occur after a crop leaves the farm.

“We wanted the Iowa Fruit and Vegetable Market Planner to be flexible, so that farmers could look at their marketing territory, even if it extended outside Iowa because markets transcend state boundaries,” said

Associate Director Rich Pirog, who worked closely with Randy Boeckenstedt at the Institute for Transportation to develop the application.

Users of the tool select crops and a central location (such as a farm or business) for the target market, choosing from all incorporated communities in Iowa. They also determine the driving distance from this location to include in the target market, with or without areas in adjoining states.

The tool calculates a rate of demand for each crop the farmer selects, based on food availability data reported each year by the U.S. Department of Agriculture's Economic Research Service, and U.S. Census data for consumers in the target market. Target market demand can be compared with state-level production (or supply) of a crop to see where the greatest opportunities exist for farmers.

**TOOL** (cont. on page 2)

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LEOPOLD CENTER

### 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/research/topics.html](http://www.leopold.iastate.edu/research/topics.html)

## Scientific Journals

*Leopold Center-supported projects have resulted in these papers, recently published in peer-reviewed journals. Check at a research library or the journal's website for abstract or full report.*

- Sharma, Amit, Mary Gregoire and Catherine Strohbehn (2009). Assessing Costs of Using Local Foods in Independent Restaurants, *Journal of Foodservice Business Research* 12 (1):55-71.

A two-year project funded by a Leopold Center Marketing and Food Systems Initiative grant included interviews and surveys to determine costs of using locally purchased food in restaurant operations. The project was "Economic viability of local food marketing for restaurant operations and growers/producers in Iowa."

- Atwell, Ryan, Lisa Schulte and Lynne Westphal (2009). Linking Resilience Theory and Diffusion of Innovations Theory to Understand the Potential for Perennials in the U.S. Corn Belt, *Ecology and Society* 14(1):30. URL: <http://www.ecologyandsociety.org/vol14/iss1/art30/>
- Atwell, Ryan, Lisa Schulte and Lynne Westphal (2009). Landscape, community, countryside: Linking biophysical and social scales in U.S. Corn Belt agricultural landscape, *Landscape Ecology* 24:791-806. URL: <http://www.springerlink.com/content/kl12337814116550/>
- Atwell, Ryan, Lisa Schulte and Lynne Westphal (2010). How to build multifunctional agricultural landscapes in the U.S. Corn Belt: Add perennial and partnerships, *Land Use Policy* 27:1082-1090. DOI: 10.1016/j.landusepol.2010.02.004

These papers document results from a project funded by two Leopold Center Ecology Initiative competitive grants on land use changes and views of landowners, farmers and regional stakeholders in the Clear Creek watershed near Stanhope, Iowa. The projects were "Using the past to plan the future: Retrospective assessment of landscape and land use change in Clear Creek watershed," and "Participatory ecology for 'Agriculture of the Middle': Developing tools and partnerships to bridge gaps among science, people and policy in landscape change."

## LOCAL FOOD GROUPS, PLANNERS MAY FIND TOOL HELPFUL

**TOOL** (continued from page 1)

An early version of the tool, the Iowa Produce Market Potential Calculator created in late 2005, included only 37 crops, county-level data for supply and demand, no regions outside Iowa.

Pirog said the scope of the new tool will extend beyond farmers. "We think the Iowa Fruit and Vegetable Market Planner will be used by local food groups and county and city governments as they develop planning strategies to increase local food commerce," he said.

Additional adjustments can be made for age of the consumer, from elementary school-age to retirees, with rates of demand calculated according to population differences for each age group in each area. "We think this option will be very helpful for farm to school groups, and groups working on food and nutrition programs for the young or elderly so they can better assess their population's needs," Pirog added.

Results can be shown based on a 10-month school year, a 20-week growing

season, a three-month growing season or any time period from one day to a year. Demand can be shown in many units of measurement – from the number of acres required to grow a crop, cubic feet or storage space needed, 20-ton truck loads of the crop, or servings.

Pirog and Boeckenstedt have anticipated interest from other parts of the country about this new tool. A technical guide, explaining how to set up a similar application for other states and regions, also will be available in the near future.

Pirog recommends that people first review a brief user's guide before doing their own calculations on the Iowa Fruit and Vegetable Market Planner, which is on the tool website.

[www.leopold.iastate.edu](http://www.leopold.iastate.edu)  
Iowa Fruit & Vegetable Market Planner:  
[www.intrans.iastate.edu/marketplanner/](http://www.intrans.iastate.edu/marketplanner/)

# Conversations

WITH INTERIM DIRECTOR LOIS WRIGHT MORTON

## Sustainability and Resilience



Many of us have spent the summer scanning the Iowa skies, emptying our rain gauges and checking online weather radar. Painful memories of 2008 and August 2010 flooding have us re-evaluating this year's land management decisions to prepare for next year's risks and uncertainties. Eugene Takle, ISU professor of climate science, predicts wetter springs, drier autumns, more variability of summer precipitation with more intense rain events, an increase in humidity and, on average in Iowa, about five more frost-free days than in 1950.

Regardless of where you stand on the public debate about whether climate change is human induced, a natural cycle or some combination, there is scientific consensus that the natural variability of climate is significantly departing from our past experiences (Takle 2010; Milly 2009). The world we live in is dynamic and constantly changing. We see natural variability around us. Many of these changes we expect because of past experience. We expect that the Leopard frogs will call to each other in spring pools; the corn seeds will germinate and grow into straight tall stalks, ears bursting with yellow kernels; and our children will grow up to become adults.

However, some changes surprise us and we are unprepared for their impacts.

We are unprepared for a number of reasons. The change may be outside our current knowledge and past experiences. Change may have come slowly, creeping up on us so that we do not notice its evidence. We may have seen the changes but were too busy with other things in our lives and did not stop to consider future effects. Other times our science is incomplete. We have not discovered the patterns, trends or mechanisms that could predict change and prepare us for risks and uncertainties associated with change.

Rapid change is visible. A river overflows into an urban floodplain, submerging buildings and bringing soil washed from cultivated fields upstream. We are not as good at recognizing slow, less visible changes. Eastern redcedar encroachment on grasslands

can amaze us by how quickly it dominates a landscape in a few short years, turning productive grassland into woody expanses. A decrease in natural forest patches in agricultural landscapes can lead to gradual habitat fragmentation, reducing the resilience of some bird and butterfly species that require tree habitats (Scheffer 2009).

Changes in water quality also can catch us unprepared. An overload of phosphorus and nitrogen nutrients in a shallow lake stimulates growth of microscopic vegetation called phytoplankton, turning the water greenish with a corresponding loss of clarity (Scheffer 2009). Vegetation feeding on nutrients can reduce turbidity (or cloudiness) and return lake clarity. However, at some point there can be too many nutrients for lake vegetation to get sufficient light and

Some changes surprise us and we are unprepared for their impacts.

so it loses its capacity to clean the lake and disappears. The cloudiness returns, creating a new, hostile environment for fish and animals that require clear water to survive. Once nutrient levels exceed some threshold, it is not an easy process to reverse, as those who live in Shagawa Lake, Minnesota can attest (Carpenter 2003).

Changing weather patterns, Eastern redcedar encroachment, habitat fragmentation, soil erosion, and water quality are only a few of the serious resource management issues that threaten sustainability in Iowa. The "key to sustainability lies in enhancing the resilience of social-ecological systems, not in optimizing isolated components of the systems" (Walker and Salt 2006). Thus, it is critical that we not focus on one aspect of production or the environment, but learn to view our landscape as multiple, linked systems.

Our challenge is to better understand

interactions among humans and nature, to recognize when they are vulnerable and in danger of losing resilience. Resilience is the ability of a system to absorb a disturbance and yet retain its structure and function (Walker and Salt 2006; Scheffer 2009). Gradual changes can reduce resilience and put the system at risk from small disruptions. We need to learn more about what makes a system fragile to the point that even a minor disturbance can trigger drastic change (Scheffer 2009). Resilience and sustainability are intimately linked. Managing our natural resource base and achieving sustainability requires understanding the resilience of the systems involved (Walker and Salt 2006).

The Leopold Center's mandate from the Iowa Legislature is to build the science of sustainability in our agricultural landscapes and to communicate that science so that Iowans can make good decisions under uncertain and changing conditions. The Leopold Center exists because of the bold foresight of Iowa leaders who recognized that gradual and abrupt changes in agriculture have significant impacts on Iowa's valuable natural resource base.

They realized we need to know much more about interrelationships among agricultural systems, our rivers and lakes, soils, air, communities and economic health. They defined "sustainable agriculture" as "the appropriate use of crop and livestock systems and agricultural inputs supporting those activities which maintain economic and social viability while preserving the high productivity and quality of Iowa's land."

"Sustainability" and "resilience" are our goals. In the coming year the Leopold Center will focus on measuring sustainability and resilience and supporting projects that have potential to give Iowa more resilience and sustainability.

The more we learn together about the processes and mechanisms of our social-ecological systems, the greater our capacity to change our policies and behaviors to adapt

**SUSTAINABILITY** (cont. on page 5)

# SDS meets match in rotations, sets scene for research mystery

By LAURA MILLER, Newsletter editor

A cool, wet summer created flooding problems for many Iowa growers along with another crop headache: an outbreak of soybean Sudden Death Syndrome (SDS), the worst in many years.

SDS is caused by a soil fungus that infects soybean roots soon after planting, producing a toxin that later moves up the plant, damaging leaves and eventually causing them to die and drop. In mid-August, soybean fields infected with the fungus began to turn brown and drop leaves, leaving nearly denuded plants and empty pods in some places. If the disease gets ahead of soybean maturation, yield losses can be as high as 80 to 100 percent, and growers have no effective treatments on the shelf to rescue the crop.

Iowa State agronomist Matt Liebman saw some of the same effects of SDS in his soybean plots at the Marsden Farm west of Ames with one surprising exception: crops in three-year rotations with corn, oat and red clover, and in four-year rotations with corn, oat and alfalfa, remained green into early September. Soybean plants in the two-year corn-soybean rotation suffered markedly from SDS, even though they were one row away from the healthier soybean plants.

“We have had SDS in these plots, but it’s just so dramatic this year,” Liebman said. “It’s definitely a rotation effect because everything else is the same, we just don’t know why.”

All soybeans in the experiment follow corn. All rotations have Roundup Ready™ and non-Roundup Ready™ soybean

varieties. All are planted under similar conditions, on similar days, with similar rainfall. The longer rotations have fewer external inputs, relying on red clover, alfalfa and cattle manure for weed control and nutrients.

Liebman has been studying the longer rotations the past eight years, thanks to an initial competitive grant from the Leopold Center and continued with support from the Leopold Center and the U.S. Department of Agriculture.

ISU plant pathologist Leonor Leandro visited the plots in early September and was eager to look at what might be causing the differences. “We don’t know the exact mechanism,” she said, “but the differences in SDS severity are impressive.” ISU research shows that SDS fungus can survive in corn kernels and stalks, but they have not looked at oats, wheat or alfalfa. Other microbes or bacteria in the soil could be suppressing the pathogen, or allowing roots to grow with fewer problems.

Liebman said he would like to add plant pathologists and microbiologists to the team researching these plots.

Ninety percent of the plants were infected by SDS in the two-year rotation while less than 10 percent were infected in the longer rotations. Of the plants that were infected, severity was considerably greater in the two-year rotation (90 percent) compared to the longer rotations (60 percent and 35 percent).

The plots had not been harvested as of press time, so no yield data were available.



**Left:** This photo was taken Sept. 3rd at the ISU Marsden Farm in Boone County west of Ames. Soybeans left of the flag (in center) have been part of a three-year rotation (corn-soybean-oat-red clover) the past eight years. Soybeans right of the flag are grown in a two-year (corn-soybean) rotation.

**Top:** Plant pathologist Leonor Leandro shows where SDS has affected soybean in the three-year rotation;

**Above:** Severe defoliation caused by SDS in the two-year rotation plots about five feet away.



## Imagining Resilience

*The future in the modern imagination has always stretched out ahead like a broad highway drawing us onward with the promise of tomorrow. Now rather suddenly, as it becomes impossible to ignore dramatic physical changes taking place across the Earth, the future looms like an urgent question. Whatever the coming century brings, it will not unfold smoothly as some improved but largely familiar versions of life as we know it. This is the only thing that seems certain.*

– Dianne Dumanoski, *The End of the Long Summer*

Recently the concept of resilience has been creeping into sustainability literature – finally! To many of us, it was long overdue. Sustainability is, after all, about “maintaining something, keeping something going” (as most standard dictionaries define sustainability).

The crucial question: How do we maintain enterprises such as agriculture in the face of the inevitable, significant physical changes taking place on our planet? How do we make our food and agriculture systems resilient as we face the end of cheap energy, climate destabilization, depleted fresh water resources, loss of biodiversity and declining soil health? Cheap energy, stable climate, abundant fresh water, diverse seeds and breeds, robust soil and ample sources of phosphorus and potash for fertilizer all have been essential resources used to maintain productivity in modern agriculture. How will we “keep it going” when these resources are no longer available?

In ecological literature the concept of resilience has been interpreted in two different ways (Holling, 1973, 1996). Throughout most of the industrial era, resilience has been achieved through what ecologist C.S. Holling called “engineering resilience.” From this perspective, resilience is the capacity to quickly restore an enterprise to a stable steady state following a disturbance. Achieving this type of resilience assumes a certain degree of predictability, and that innovative technologies can be developed to return a situation to a desired steady state. For example, if increased droughts and floods caused by climate change threaten corn and soybean yields in Iowa, we will be able to come up with innovative technologies to maintain crop yields.

An alternative view of resilience is what Holling called “ecological resilience,” which is the capacity of a system to continue functioning after a disturbance. In fact, from the perspective of ecological resilience, steady state regimes are rare if not impossible to sustain. Since nature is dynamic, replete with emergent properties, natural systems are constantly in a state of change.

As significant uncertainties loom in our future, the need to build resilience into our social, economic and physical enterprises is becoming increasingly apparent. In her recent book, *The End of the Long Summer*, Dianne Dumanoski outlines the scale and scope of some of the changes we are likely to encounter on our planet in the decades ahead changes that will profoundly affect our food and agriculture systems.

As we confront our uncertain future, Dumanoski reminds us of another critical issue – the importance of making a significant cultural shift. Given the natural resources that have been available to us throughout the industrial era – cheap energy, surplus fresh water, stable climates we have come to regard nature as a “predictable, imperturbable machine” that we can control. That world is now “giving way to the very different picture of a dynamic and potentially

volatile living system. Domination, it turns out, has not given humans dominion. Immense power has not given us control. To understand this is to recognize that the modern era has ended.” (page 64f)

Of course, this is a lesson that Aldo Leopold also suggested we must learn if we are to live successfully on “the land” – namely, that we are not the “conquerors” of the land community, but simply “plain members and citizens of it.”

Consequently, if we are to be successful in building resilience into our food and agriculture systems of the future, the better option might be “ecological resilience,” which attempts to design systems that enhance the capacity for self-renewal and self-regulation.

Finally, as Leopold also reminded us, to achieve such “land health” we will need to cultivate an “ecological conscience.”

C.S. Holling, 1973. “Resilience and Stability of Ecological Systems,” *Annual Review of Ecology and Systematics* 4:1-23.

C. S. Holling, 1996. “Engineering Resilience Versus Ecological Resilience,” in *Engineering Within Ecological Constraints*, ed. by P.C. Schulze, Washington DC: National Academy Press 31-43.

Dianne Dumanoski, 2009. *The End of the Long Summer*, New York: Three Rivers Press.

### SUSTAINABILITY (continued from page 3)

to, mitigate, and manage our agricultural landscapes and the natural resource base on which they depend.

Watch for guest columns in upcoming newsletters and on our website as we explore the meaning of sustainability and resilience, and how we can transfer what we learn to farmers, landowners and citizens of Iowa.

We are planning a Measuring Sustainability and Resilience workshop on May 25, 2011 for Iowa colleges, universities, private nonprofit agencies and foundations that are eligible to apply for the competitive grants we sponsor annually. These are our partners who are helping us build knowledge and work together on behalf of our precious Iowa landscape.

Carpenter, S.R. 2003. *Regime Shifts in Lake Ecosystems*. Ecology Institute, Oldendorf/Luhe, Germany

Milly, P.C. D., J. Betancourt, M. Falkenmark, R. M. Hirsch, Z. W. Kundzewicz, D. P. Lettenmaier, and R. J. Stouffer. 2009. Stationary is dead: Whither water management? *Science* 319, 573-574.

Scheffer, M. 2009. *Critical Transitions in Nature and Society*. Princeton University Press: Princeton, NJ.

## LAND USE DIFFERENCES TIED TO RESILIENCE

**RESILIENCE** (continued from page 1)

### Neal Smith National Wildlife Refuge, Jasper County

**What:** Horizontal strips of perennial prairies planted among corn-soybean fields in 12 sub-watersheds (2 to 10 acres). The strips comprise either 10 or 20 percent of the watershed area and vary in size from a tenth of an acre (about 50 X 100 feet) to one acre. Flumes catch runoff after rainfall, and depth of runoff is calculated. Water and sediment are sampled.

**When:** Plots set up in 2007 (prairie plants still getting established)

**Findings:** In general, plots with prairie strips reduce overall amounts of runoff, and are most effective after small and medium storms. Heavy rain on already wet soil results in a greater percentage of the rainfall leaving the system as runoff.

**2010 flood observations:** All cropping systems in the experiment were stressed. By the end of August, more than 40 inches of rain were recorded, including 9.75 inches in two days. Very large rainfall events are difficult to manage in these experimental settings, no matter what system is in place.

**Comments from Matt Helmers, ISU ag and biosystems engineer:** Plots with some perennial vegetation have less runoff than those without it, but can farmers afford this option? That's a big question. This experiment uses 10 percent and 20 percent of the land area for perennials. I think we'd still see positive effects with only 5 percent of the land in perennials but this is important to study in the future.

We've been lucky in Iowa to have ideal growing conditions in recent decades for corn and soybeans. But what if we have more seasons with too much or too little moisture? How will corn-soybean rotations function? They may not function as well as in the past.

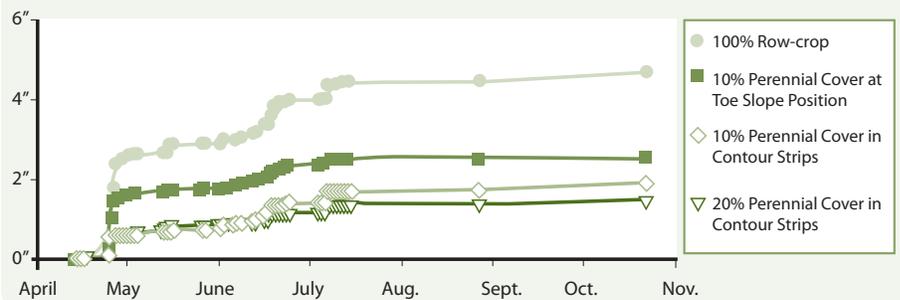
This project has been done on small watersheds and catchments, and we can see effects on a small scale. I'm interested in how it might work on a larger scale.

Flooding is a natural process and what happens during a flood is very visible. But what we do on the landscape other times of the year when it is not flooding also is very important.



**Neal Smith:** Here are flumes that collect runoff from two small watersheds. The research plot on the left is 100 percent cropland and sediment covers the bottom of the flume; the research plot on the right is 100 percent prairie and the flume has no sediment.

### 2009 Season Cumulative Surface Runoff Chart



**Bear Creek:** Much of the 2010 flood debris and sand were caught in the buffer area before reaching crop fields.

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



**Prairie Creek:** The 2010 storm resulted in deep cuts along the stream bank. ISU students are working on other parts of the stream to stabilize the bank, and those areas showed no bank erosion.

## Bear Creek National Demonstration Watershed, Story County

**What:** Plantings of native trees, shrubs and perennial grasses at least 66 feet wide on both sides of Bear Creek, the first on a half-mile section of stream. In addition to buffers, the project includes stabilizing streambeds and banks with in-stream or bioengineering techniques and other riparian management practices next to crop fields or within pastures

**When:** First buffer planted in 1990 on Ron Risdal farm north of Roland and has now expanded to 10 landowners along 7 miles of Bear Creek, with a variety of widths, designs and plant species.

**Findings:** Depending on design and characteristics, buffers can reduce sediment in runoff by 70 to 95 percent, with dramatic increases in soil organic matter, fine root biomass and infiltration observed after 5-6 years. Stream banks returned to perennial vegetation are much less susceptible to ero-

sion, even during large flood events.

**2010 flood observations:** After the August 10 storm that caused massive flooding downstream in Ames, the depth of water in Bear Creek was at least four feet over the top of a bridge at the original research site and 3-4 feet over some adjacent crop fields. Normally 10 feet wide during typical August conditions, Bear Creek spanned 300 feet in flat areas where the channel was in contact with the flood plain.

**Comments from Dick Schultz, ISU Natural Resource Ecology and Management:**

We definitely had significant flooding but as the water receded, almost all parts of the buffered stream bank covered by grass and/or trees had very little evidence of accelerated bank erosion. I saw deposits of sand, woody debris and corn stover caught in the buffer, so the farmer didn't have to deal with them in a crop field.

The buffers did exactly as we had hoped. We compared what happened at Bear Creek this summer to a similar-sized stream in

Boone County, where we have just started working with a private landowner on bank stabilization. The area, which was grazed pasture, was decimated by extensive bank erosion, but that's exactly how the land along Bear Creek had been used before we planted buffers. Our erosion pins on the Boone County stream showed that more than one to two feet of soil were lost from many areas of the stream bank during the August storm.

**Comments from Tom Isenhardt, ISU Natural Resource Ecology and Management:**

Usually we think of buffers keeping things out of the stream, but during extreme flooding events they also have a reverse effect, keeping water in its place longer before it moves downstream. Buffers are a drag on water flow, which can reduce the severity of flooding. The flooding may last longer, but peaks are not as high or as ruinous.

**Comments from Ron Risdal, farmer and landowner along Bear Creek:**

While there were a couple of areas with some erosion of the stream bank, it was nothing like it would have been before the buffer was planted. There may not have been anything left the way it was before.



**Bear Creek:** Receding floodwaters from the August 2010 storm cover a bridge on the Ron Risdal farm north of Roland, surpassing previous high levels recorded in 1996.

## An easier way to weed vegetables?

By MARY ADAMS, Policy and Outreach Coordinator

Weeding isn't the favorite activity of most home gardeners, but it is manageable. A producer who wants to grow vegetables in commercially viable quantities, however, may see weeding as a major business challenge that gobbles up time and energy. Two Iowa State University agricultural and biosystems engineering professors are looking at mechanized solutions to help farmers remove weeds from their vegetable crops with greater ease.

Lie Tang and Brian Steward are beginning their second year of work on "An Automated Mechanical Intra-row Weed Removal System for Vegetable Crops," a project funded by the Leopold Center's Marketing and Food Systems Initiative.

The engineers started by talking with several Iowa vegetable growers to better understand what design criteria should be emphasized in the process. They also reviewed the literature to determine the state of engineering science in mechanical and automated weeding technology. Two ISU graduate students worked to develop the two primary technical components of the proposed automated mechanical intra-row weed removal system: the weed sensing system and the mechanical actuation system. The major early hurdles for the researchers were finding the appropriate electric motors and linear drives and developing software for the machine's operations.

This year, they will finish construction of the mechanical actuation system and perform field experiments to determine the power and speed requirements of the rotary weeding tool and linear drive as well as weed control success. This experimental data will help them determine how the system can



**Above:** ISU professor Lie Tang (far right) and his design team (from left) Akash Nakarmi, Ji Li, Mohd Taufik (kneeling), and Andrew Thompson with the latest version of the automated weeder.

**Right:** This is a close-up of the rotating tines that also will move back-and-forth as the machine travels down the row. They plan to field-test the prototype yet this year in grass plots.



be used most effectively in the field and provide operational guidelines for users. The researchers want to devise systems to help the machine deal with those vegetable crops (e.g., cabbage, kale and broccoli) that have more distinguishable features than weeds.

During the second year of the project, their research team (Tang and Steward, graduate students Ji Li and Mohd Taufik, and undergraduate student Andrew Thompson) will develop the system prototype at the Agricultural Automation and Robotics Laboratory in the Agricultural Engineering Department at

Iowa State.

They will work with local vegetable growers to collect image samples of vegetable and weed plants and perform field tests. The team plans to travel to the organic vegetable farm operated by Susan Jutz, Leopold Center advisory board member, to test their prototype machine. In addition, they have used the preliminary results to leverage a potential multi-state grant proposal for the USDA Specialty Crop Research Initiative program.

### 'Ramping up' vegetable production

Participants at an August 22 workshop test out planting equipment for fruit and vegetable growers. The event featured a number of hand-operated and mechanically-powered machines designed to help market growers scale up operations. The Leopold Center's Fruit and Vegetable Working Group hosted the event at Andrew and Melissa Dunham's Grinnell Heritage Farm.



# New publication touts benefits of prairies in Iowa landscape

By AMY THOMPSON, Communications intern

Iowa's landscape has not always been devoted to growing corn and soybeans or raising livestock. Before European settlement, Iowa—like the rest of the United States—was covered with prairies.

Researchers at Iowa State University hope to return prairies to the Iowa countryside.

Meghann Jarchow, a Ph.D. candidate in the ISU Department of Agronomy, and her advisor, Matt Leibman, have prepared the new publication, *Incorporating Prairies into Multifunctional Landscapes*. The publication covers prairies and their many benefits for all types of Iowans.

“Within the next few decades it is likely that the conditions surrounding agricultural production will have changed. As these changes occur, other types of cropping systems that are less reliant on stable weather, government subsidies, and low fossil fuel costs than corn and soybean are likely to become more desirable cropping system options,” said Jarchow. “Prairies are one of those other types of cropping systems, which is why it is important for farmers and landowners to be familiar with these alternatives.”

Tallgrass prairies developed in Iowa more than 10,000 years ago. Extensive root systems of prairie plants are responsible for the state's fertile soil that is rich in organic matter. Today nearly all of Iowa's prairies have disappeared because of the growth of agricultural production, according to the USDA's Natural Resources Conservation Service. It is estimated that less than 0.1 percent of Iowa's native prairies remain.

The publication has seven sections:

- What Is a Prairie?
- How Can Prairies Benefit My Farm?
- How Can Prairies Be Incorporated into Farms?
- How Are Prairies Established and Managed?
- How Will the Prairie Affect My Crop?
- Why Prairies? Why Now?
- Can Prairies Be Used as Part of Multifunctional Landscapes?

Jarchow's background is in plant ecology. She also has plenty of experience with prairies, providing many of the full-color photographs in the publication. Currently she works on a Leopold Center-funded research project that compares corn and prairie systems for bioenergy production, and examines relationships between prairie diversity, productivity and nitrogen fertilization.

“I would like people to know that Iowa's

native ecosystem, which is tallgrass prairie, has many beneficial uses for farmers and landowners,” she said.

The publication has information about establishing your own prairie and various uses for grazing and hay production, growing biomass feedstocks, reducing soil erosion and nutrient pollution, sequestering carbon and providing habitat for beneficial insects, wildlife and songbirds. Jarchow and Leibman worked more than a year on the publication project.

 [www.leopold.iastate.edu](http://www.leopold.iastate.edu)

**Incorporating Prairies into  
Multi-functional Landscapes:**  
[www.extension.iastate.edu/store/](http://www.extension.iastate.edu/store/)



**Top:** Bee on purple prairie clover (*Dalea purpurea*).

**Bottom:** Photo of a reconstructed prairie at the Neal Smith National Wildlife Refuge near Prairie City. (Photos by Meghann Jarchow)

# News & Notes

The Leopold Center's Summer 2010 Request for Pre-proposals (RFP) resulted in 54 submissions: 23 in marketing and food systems, 19 in ecology, 4 in policy and 8 cross-initiative projects. Leopold Center advisory board members and staff have requested full proposals from investigators of 26 pre-proposals. Final funding decisions will be announced in early 2011.

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The Leopold Center is sharing the cost to support two positions in ISU's College of Agriculture and Life Sciences that will work in local food systems research and education and food crop production. The Leopold Center will contribute \$80,000 annually for three years from funds provided by an anonymous gift to the Center.

One position is for a state specialist to conduct an applied research and extension program in vegetable and small fruit crop production. This person will join two horticulture professors who work in commercial fruit production and six positions

involved in fruit and vegetable research and demonstration at ISU's Muscatine Island, Armstrong and Horticulture Station research farms. The second position is for a field specialist in central and western Iowa to focus on vegetable and small fruit production and handling. That person will join a food crops horticultural specialist who works in eastern Iowa. Search committees are in the process of interviewing candidates for the positions.

...

Amy Thompson, a senior at the ISU Greenlee School of Journalism and Communications, has joined the Leopold Center as communications intern beginning in the fall 2010 semester. She is a native of southern California but her family now lives in Knoxville, Tennessee. Her academic emphasis is in public relations and she recently completed



an internship at Ackermann PR of Knoxville, which is ranked as one of the top 100 public relations firms in the United States.

...

The Leopold Center has collaborated on a second Life Cycle Assessment study of system-wide environmental impacts related to livestock production. The most recent study looked at pork production – both high- and low-profitability operations in a conventional commodity system (confined animal feeding operations) and in deep-bedded hoop barns in a niche production system. LCA was used to compare the two systems in terms of their cumulative energy use, ecological footprint, greenhouse gas emissions and emissions that can contribute to water quality. Results have been published in the 2010 *Agricultural Systems* journal. A Question and Answer document about the project and journal article are available on the Leopold Center website at: [www.leopold.iastate.edu/research/marketing\\_files/LCA.html](http://www.leopold.iastate.edu/research/marketing_files/LCA.html)

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## I-FARM web program helps farmers make decisions

By RUSS HINKELDEY, *Communications intern*

Looking into expanding your farm operation or making a change and can't foresee the potential cost increase? I-FARM, a web-based program that lets people create farm scenarios based on their own land and farms, is available for farmers' use in their own home at no cost.

The program was written by Ed van Ouwerekerk as part of a three-state, Leopold Center- and USDA-funded project to help farmers make educated decisions on how to best use their land and manage their farm operation. The goal was to create an "integrated crop and livestock production and biomass planning tool."

When they use I-FARM, farmers can enter their operation description including figures such as how many acres of land they own and/or rent, a range of crops that could be harvested, and even how often they till the soil. An extensive range of other inputs can be included, for example, details of their animal production systems if they have

one. Some of the animal system data inputs include number of hogs, cattle, or poultry, feed intake, growth rate, grazing or confinement, and manure management methods. Users can customize the results further by including information about payments on loans for land, buildings or machinery investments.

A long list of results is calculated that will help people make decisions that can improve their bottom line, protect their land from soil loss, and save money on energy and labor costs. The tool also provides numbers on how much manure or biomass can be produced, as well as payments for subsidies and conservation programs.

The model incorporates the land, weather and environmental data for all 48 of the contiguous United States.

The program has received several updates since it first debuted in July 2004. One of those is the ability to use a geographic information system (GIS) to locate a farm. The

program takes the user to an aerial photo of their property and they can mark off their land and get specific figures for the soil type and slope of the land that is available from state and county databases. The newest update of I-FARM is a simplified version: I-FARM Light. It requires fewer inputs and is quicker to use, an important consideration, especially for new users.

Robert Anex, an ISU professor in Agricultural and Biosystems Engineering, is involved in assessing next steps for the model. "It's an impressive tool," he says, "but farmers do find it challenging to use, so we hope to address that in the near future by making some changes in the user interface."



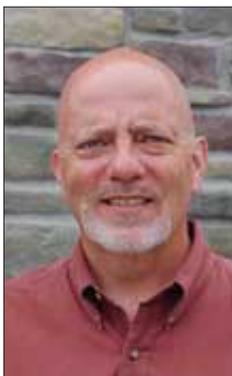
# Advisory Board

## Newest board member recalls Leopold Center early years

**D**an Frieberg is in business to help farmers use data for good decisions and to be profitable. Healthy soil and clean water are part of the successful formula.

Frieberg and his wife Kate are co-owners and managers of Premier Crop Systems LLC in West Des Moines. The company helps its customers, commercial growers and agronomists who manage more than two million acres of farmland in several Midwestern states

– understand and analyze precision ag data from yield monitors and numerous other sources. Frieberg will start a four-year term representing the Agribusiness Association of Iowa (AAI) on the Leopold Center



Advisory Board.

“We need to move away from the ‘one size fits all’ approach because agriculture is part of a dynamic biological process,” he said. “If we’re going to manage nitrogen and maintain or build soil quality, we need to understand more about these biological processes.”

In many ways, we’ve only just begun, he said. “I’ve heard that the mapping of plant and animal genomes has been compared to the discovery of the periodic table for chemists. We might think we know a lot about biological systems when really we are just learning about the basic building blocks.”

He said the Leopold Center can help by providing seed money for researchers to explore these processes in novel ways. He said the Center’s work on local foods could fill a need that’s been around a long time, the need for additional high-value crops.

Frieberg said he remembers the Leopold Center’s early years. He was just starting work as the executive director for the Iowa Fertilizer and Chemical Association, later to merge

with the Iowa Grain and Feed Association to become AAI. As a retailer and IFCA president, Frieberg remembers the Association moving to fund Fred Blackmer’s initial N-15 nitrogen research at ISU to address Iowa’s water quality problems. This was prior to passage of the Iowa Groundwater Protection Act in 1987, which he characterizes as a research and education approach to solving environmental problems.

An Iowa native, Frieberg grew up on a small livestock/crop farm near Fairfield. In 1978, he received his B.S. in Farm Operations from Iowa State University, and he and Kate purchased a retail agribusiness that they operated until 1981. He was employed at AAI from 1989 to 1995, then was an independent business consultant until starting Premier Crop Systems in 1999.

The Friebergs live on a family horse-breeding farm south of Des Moines and have two adult sons.

### Long-time member honored

*Leopold Center advisory board chair Jennifer Steffen offers congratulations and a commemorative plaque to Jim Penney, who has served on the board since 1996, including one term as chair. Penney is retired from the Heart of Iowa Cooperative and had represented the Agribusiness Association of Iowa on the board.*



### 2010-2011 board officers

The Leopold Center Advisory Board decided that current officers will serve a second year in their respective positions to provide continuity during Lois Wright Morton’s transition as Leopold Center interim director. Jennifer Steffen, a southeastern Iowa farmer who represents the State Soil Conservation Committee, will serve again as board chair

through August 2011. John Olthoff, agricultural professor at Dordt College, will remain as vice-chair; and Bill Ehm, Iowa Department of Natural Resources, will continue to serve as member-at-large on the board’s executive committee. Dates for 2011 advisory board meetings will be March 3, June 1, September 15 and December 2.



*Jeremy Singer, agronomist at the USDA’s National Laboratory for Agriculture and the Environment in Ames, kneels beside a cover crop designed to fix nitrogen for next year’s corn crop and reduce inputs. His work is featured in a new On the Ground with the Leopold Center video found at: [www.leopold.iastate.edu/research/eco\\_files/ground/cover.html](http://www.leopold.iastate.edu/research/eco_files/ground/cover.html)*



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# Highlight Events

Learn about how to get support for events: [www.leopold.iastate.edu/news/support.html](http://www.leopold.iastate.edu/news/support.html)

## October 14

Pesek Colloquium on Sustainable Agriculture. 8 p.m., Great Hall, ISU Memorial Union, Ames.

Author and environmentalist Bill McKibben will talk about his new book, *Earth: Making Life on a Tough New Planet*, named for the new and dangerous conditions created by climate change. He also is founder of 350.org, an international climate campaign that has set October 24, 2010 as the International Day of Climate Action.

## October 26

“Greenhorn Grazing Workshop,” 1:30–7 p.m., ISU McNay Research Farm, 45249 170 Ave., Chariton.

This will conclude a five-session course for new and transitioning operators of grass-based systems for livestock. The series was supported by a Leopold Center competitive grant and is hosted by the Iowa Beef Center and ISU Extension.

## November 11

Errington Memorial Lecture. 8 p.m., Sun Room, ISU Memorial Union, Ames.

Marine biologist Barbara Block, Stanford University, will present “Tracking Giants across the Blue Oceans,” about her work with the Tuna Research and Conservation Center and Tag A Giant program to track tuna, billfishes and sharks around the globe.

## November 21-22

Tenth Annual Iowa Organic Conference Scheman Building, Iowa State University, Ames.

This conference features work of Iowa State’s organic agriculture program, which the Leopold Center has helped fund since 1998. Sessions will feature transitioning to organic, marketing innovations, organic grains, fruit and vegetables, livestock, crop insurance and more than 35 vendors and educational displays.

## More details, events

Check Leopold Center Web calendar: [www.leopold.iastate.edu/news/events.htm](http://www.leopold.iastate.edu/news/events.htm)

## May 25, 2011

Measuring Sustainability and Resilience Workshop Scheman Building, Iowa State University, Ames

The Leopold Center is hosting this event for its university, nonprofit and educational partners.



**Above:** Participants at an August 22 workshop test out weeding equipment. Also see page 8 for another photo.