Published by the Illinois Agricultural Experiment Station, Office of Research. Produced under the direction of Jozef L. Kokini, Associate Dean for Research.

In cooperation with

Department of Agricultural and Biological Engineering
K.C. Ting, head

Department of Agricultural and Consumer Economics
Robert J. Hauser, head

Department of Animal Sciences
Neal R. Merchen, head

Department of Crop Sciences
Robert G. Hoeft, head

Department of Food Science and Human Nutrition
Faye Dong, head

Department of Human and Community Development
Robert Hughes, Jr., head

Department of Natural Resources and Environmental Sciences
Bruce Branham, interim head

Division of Nutritional Sciences
Sharon M. Donovan, director

Director of Marketing: Lee Busselman
Editor: Debra Levey Larson
Staff Photographers: David Riecks, Brian Stauffer
Copy Editor: Molly Bentsen

REPORT ON RESEARCH is available in alternative formats. Visit our web site: aces.illinois.edu
Research in the College of ACES is making a difference in Illinois and around the globe. The projects featured in this Report on Research will give you a glimpse at the work being done in laboratories, fields and other research facilities—from examining how a single gene can control the fate of one of Illinois’s crops to understanding the relationship between a mother and her infant. This research is finding real solutions to help our families, our state and our world.

Robert A. Easter
Dean

Even before I joined the College of ACES in 2007, I was impressed by the enormous breadth of research being conducted here. Now, as Associate Dean for Research, I am proud to be an active participant in fostering research that seeks to improve our land and atmosphere, food and crops, the health of animals and people, as well as Illinois families and communities. ACES research is blazing new frontiers every day in an effort to make Illinois healthier and stronger.

Jozef Kokini
Associate Dean for Research
<table>
<thead>
<tr>
<th>Page</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Field Research Centers Serving Illinois</td>
</tr>
<tr>
<td>8</td>
<td>Robots Go Solar; New System Could Dramatically Reduce Herbicide Use</td>
</tr>
<tr>
<td>10</td>
<td>Private and Public Land Conservation Efforts: Not Always Happy Bedfellows</td>
</tr>
<tr>
<td>12</td>
<td>Hens Provide Clues in Ovarian Cancer Study</td>
</tr>
<tr>
<td>14</td>
<td>Nematodes: Illinois Soybean Growers Losing $250 Million Yearly to Pervasive Pest</td>
</tr>
<tr>
<td>16</td>
<td>Combination of Technologies Works Best Against E. Coli Pathogen on Food Products</td>
</tr>
<tr>
<td>18</td>
<td>Illinois Farmers Increase Profits by Selling Direct</td>
</tr>
<tr>
<td>20</td>
<td>Climate Change Creates Dramatic Decline in Red-Winged Black Bird Population</td>
</tr>
<tr>
<td>22</td>
<td>Scientists Put Cameras on Swine 24/7</td>
</tr>
<tr>
<td>24</td>
<td>MarketMaker Provides Food Chain Connections across State Lines for Producers, Consumers</td>
</tr>
<tr>
<td>26</td>
<td>Researchers Developing Creative Strategies to Broaden Food/Fuel Choice for Corn Crops</td>
</tr>
<tr>
<td>28</td>
<td>Scientists Suspect Gene Encoding as Key in Waterhemp’s Resistance to Herbicides</td>
</tr>
<tr>
<td>30</td>
<td>How Does Your Mouth Feel About It? Developing a Better-Tasting Diet Soda</td>
</tr>
<tr>
<td>32</td>
<td>Upset by Your Baby’s Distress and Tears? Mother’s Responses Make a Difference</td>
</tr>
<tr>
<td>34</td>
<td>New Apple Proves Resistant to Scab Fungus</td>
</tr>
<tr>
<td>36</td>
<td>Helping Ethanol Plants Recycle More Water</td>
</tr>
<tr>
<td>38</td>
<td>To Improve River Basin Environmental Impact, State Conservation Program Needs Changes</td>
</tr>
<tr>
<td>40</td>
<td>Regenerating Bones Using Adult Stem Cells</td>
</tr>
<tr>
<td>42</td>
<td>Researchers Collaborate on Development of Soybean Varieties with Rust Resistance</td>
</tr>
<tr>
<td>44</td>
<td>Bioactive Compounds in Veggie Combo Work to Shrink Prostate Tumors in Rodents</td>
</tr>
<tr>
<td>46</td>
<td>Robots Go Solar; New System Could Dramatically Reduce Herbicide Use</td>
</tr>
<tr>
<td>48</td>
<td>Rural America More Prepared for Disaster but Paradoxically Also More Vulnerable</td>
</tr>
<tr>
<td>50</td>
<td>Research Affiliates</td>
</tr>
</tbody>
</table>
Field Research Centers Serving Illinois

Field Research Centers located throughout the state of Illinois provide a vital testing-ground where research from the College of Agricultural, Consumer, and Environmental Sciences can generate practical applications to ultimately benefit consumers, farmers, commodity groups, agricultural organizations, environmentalists, conservationists, government agencies, industry and business. The Research Centers are field laboratories for proof-of-concept research conducted by faculty of the College of ACES, and also serve as important sites for hands-on learning for ACES undergraduate and graduate students.

Above: Dixon Springs is one of seven field research centers operated by the College of Agricultural, Consumer and Environmental Sciences at the University of Illinois Urbana-Champaign. Left: Penny Newkirk volunteers at the St. Charles Center.
Brownstown Agronomy Research Center
Route 2, Box 36A
Brownstown, IL 62418
618.427.5239

Crop Sciences Research and Education Center
AW-101 Turner Hall
1102 South Goodwin Avenue
Urbana, IL 61801
217.244.5444 or 217.333.2965

Dixon Springs Agricultural Center
Route 1, Box 256
Simpson, IL 62985
618.695.2790

Northern Illinois Agronomy Research Center
14509 University Road
Shabbona, IL 60550
815.824.2029

Northwestern Illinois Agricultural Research and Demonstration Center
Route 3, Box 111; 321 210th Avenue
Monmouth, IL 61462
309.734.7459

Orr Agricultural Research and Demonstration Center
Box 212
Perry, IL 62362
217.236.4911

St. Charles Horticulture Research and Demonstration Center
535 Randall Road
St. Charles, Illinois 60174
630.584.7254

St. Charles
Northern Illinois
Brownstown
Dixon Springs
Northwestern Illinois
Crop Sciences (South Farms)
Orr
U of I Robots Go Solar; New System Could Drastically Reduce Herbicide Use

An on-board computer allows solar robots to identify weeds and apply herbicide directly to the plant, rather than broadcasting uniform rates across a field.

A solar-powered robot with 20/20 vision, on a search-and-destroy quest for weeds, soon will be moving up and down the crop rows at the experimental fields at the University of Illinois. What’s more, this robot has the potential to control weeds while significantly reducing herbicide use.

“The robot uses GPS for navigation, and two small cameras mounted on a frame on top of the machine to give the robot depth perception, just like a human,” said Lei Tian, agricultural engineer at the U of I. “If he sees a weed, he can actually tell how far away it is.”

An on-board computer offers access to information that provides the morphological features of plants, to help the robot determine just what is and isn’t a weed.

Once a weed is identified, a robotic arm attached to the front of the machine engages a device the researcher calls “a custom-designed end effector.”

There are two layers to the device, according to Tian. One layer cuts the weed, while the second layer applies herbicide to the cut weed.

“This type of application is extremely effective,” said Tian, “because it applies herbicide directly to the plant, instead of broadcasting uniform rates across a field.”

With this level of precision, Tian said the system has clear environmental benefits. In addition to cutting herbicide use, chemicals do not drift off-target when placed directly on the plants.

The original inspiration for this robot came several years ago, when Tian and two graduate students were working on remote-sensing systems for a C-FAR (Council on Food and Agricultural Research) project.

“We were collecting field data from satellite imagery, such as soil moisture and plant conditions, but we needed to have ground reference data to validate that information,” said Tian.

“But that kind of data is tedious to collect,” he continued, “and it’s very hot work. The grad students who collected this information stayed in the field most of the day, and one of them was fainting from the heat.”

At the time, Tian was working on a robot that could go into the field and continuously collect data, but the battery that powered the system required charging about every two hours.

“So I thought, what if we had a system that could collect data but could also convert the heat of the sun into an energy source?” said Tian.

“We could replace the grad student worker with a robotic system.”

That system evolved into today’s model, and two other graduate students worked with Tian to present a paper on the robot at the Annual International Meeting of Agricultural and Biological Engineers this July in Portland, Oregon.

Hongyoung Jeon, a PhD candidate in agricultural and biological engineering, and Nathanael Gingrich, a master’s student, have worked steadily on the system design that cuts the weed and applies herbicide. They have also mounted the curved solar panel that powers the robot.

“We custom-built a shelf...
that holds the solar panel,” said Gingrich. “It also protects the machine from weather and gives it shade for its vision system.”

Although the robot is equipped with ultrasonic sensors that go all the way around the machine, “we’re going to try and use only the camera vision for navigation,” said Jeon, “which makes it a lot more difficult.”

The robot stands a little more than two feet tall, is 28 inches wide and almost five feet long. He can travel about three miles per hour and moves on wheels, although the researchers have treads they can put on him to give more grip.

At the current stage, the robot is used to combat weed infestation; but in the future, Gingrich and Jeon hope to place different sensors and cameras on the robotic arm that would be used to judge soil properties or plant conditions.

“It has a full-blown Windows computer with an 80-gigabyte hard drive and a wireless connection to the Internet,” said Gingrich, “so the amount of information we can collect is virtually unlimited.”

Hongyoung Jeon was part of the team of Illinois professors and graduate students who developed the prototype for the computerized solar robot.
Private conservation areas in Illinois appear to discourage private conservation efforts in adjacent areas, according to a research project involving a University of Illinois environmental economist.

“In areas like Illinois and Massachusetts, we found that established public reserves seem to repel private conservation from nearby lands,” explained Amy Ando, an associate professor in the Department of Agricultural and Consumer Economics.

“This repulsion does not necessarily reflect a bad outcome if the public reserves successfully meet the benefit thresholds in those areas and if private activities simply shift to conservation efforts not targeted by the government.”

Ando and Heidi J. Albers of Oregon State University co-authored two papers—“Patterns of Multi-Agent Land Conservation: Crowding In/Out, Agglomeration, and Policy” and “A Spatial-Econometric Analysis of Attraction and Repulsion of Private Conservation by Public Conservation”—under a grant from the National Science Foundation.

Both papers examine facets of the interactions between government and private conservation efforts in given areas.

The second paper examined the spatial relationships among reserves in California, Illinois, and Massachusetts. The first paper developed a model of interacting conservation agents to determine which land conservation patterns develop in different settings and to compare those patterns with the pattern that is best for society as a whole.

The network of protected areas in the United States, Ando noted, arises from conservation investments made by a mix of public and private agents. Data from the Land Trust Alliance shows that 1,500 non-national land trusts exist and that the acreage protected by such groups doubled from 1998 to 2002.

Private groups may not coordinate conservation decisions with other agents. “And it is difficult for public agencies to choose where to locate new public reserves without knowing how they might influence the configuration of private conservation,” Ando said.

Ando’s and Albers’ study found that in places like California, where even private conservation agents consider the value of having connected networks of public reserves, public reserves might spatially attract private conservation by increasing the benefits associated with protecting nearby lands.

However, the tendency in Illinois and Massachusetts was in the other direction.

“Agency planners in states like Illinois and Massachusetts should recognize that public reserves can repel private reserves like the north poles of two magnets,” Ando said.

In California, private conservation areas seem to focus in areas with high-valued resources that are under high levels of threat.

“Private reserves in Illinois...
seem to locate in townships where conservation yields large ecological and recreational benefits," she said.

“In Massachusetts, however, ecological characteristics seem to play little or no role.”

Ando said that land conservation provides a wide range of environmental benefits, some of which are better provided by particular configurations of conserved land. However, because of the potential for decisions by uncoordinated government agencies and private groups, socially preferred patterns of conservation may not arise.

The first paper’s examination of land conservation patterns when public and private agents interact produced a number of policy implications and suggestions for land trusts.

“A private conservation group that is focused on a particular territory can induce government conservation in its territory with land purchases that are strategic in location,” Ando said. “And government programs to promote coordination between land trusts can be cost-effective tools to encourage socially preferred patterns of conservation.

“When conservation benefits contain important thresholds, public conservation encourages private conservation.”

She noted, however, that governments can encourage private conservation by leaving some high-benefit areas for private organizations to conserve.
Understanding and treatment of human ovarian cancer, known as the silent killer, may be a step closer, thanks to some chickens at the University of Illinois.

Ovarian cancer is the fourth leading cause of cancer deaths in women; and unlike other cancers, its rate of mortality has not been reduced. “That’s because ovarian cancer is usually not detected until it is in the third or fourth stage, when it has metastasized and spread to other parts of the body,” said Janice Bahr, a professor of physiology in the Department of Animal Sciences and one of the nation’s leading poultry researchers.

Bahr is part of a research project involving the University of Illinois at Urbana-Champaign, U of I-Chicago, and Rush University Medical Center that is looking for clues to human ovarian cancer in chickens. “Scientists have tried for years to develop a model for ovarian cancer in rats but...
have not been successful. However, the chicken is the only animal that spontaneously develops ovarian cancer,” she said.

Dale Buchanan Hales, an associate professor of physiology and biophysics at UIC, said that about 50 percent of hens develop ovarian cancer.

“A two-year-old hen is at the same reproductive age as a middle-aged woman, the time when ovarian cancer usually develops,” he said. “And chickens and humans tend to develop the same type of ovarian cancer, one that develops on the surface of the ovaries.”

Because the rate of ovarian cancer in hens is so high, the research team will be able to track hens from before they develop the disease and on into its later stages. That tracking might provide clues that could be used to better predict ovarian cancer earlier in humans.

The Rush University team, led by Judith Luborsky and Animesh Barua, is looking for markers in the blood that could lead to a test that would be equivalent of the current blood test for prostate cancer in men.

“They’ve already found a change in blood proteins over time,” said Bahr. “Ideally, they will be able to find a marker.”

Another aspect of this study involves the use of ultrasonography to detect ovarian cancer in chickens. Jacques Abramowicz and Animesh Barua, Rush University Medical Center, have thus far found that pathological sonographic changes associated with ovarian cancer in chickens are similar to those detected in women with ovarian cancer.

Not only are chickens a good model for studying ovarian cancer and plentiful at the U of I Poultry Farm, but there are also extensive genomic resources available for chickens.

“The chicken is the largest meat animal in terms of consumption in the world,” explained Hales. “As a result of its dietary and agricultural importance, the chicken genome has been sequenced, and the resources available are outstanding.”

Hales’s group of researchers is currently investigating cancer-associated changes in gene-expression patterns using these chicken genomic resources.

“We are utilizing DNA microarrays that represent more than 13,000 different chicken genes to investigate,” Hales explained. “This discovery approach will enable the research team to investigate the same changes in gene expression in human ovarian cancer.”

Grants from the Department of Defense and the American Institute of Cancer Research currently fund the project for three to five years, and two other grants are pending that could carry it into the next decade.
Nematodes: Illinois Soybean Growers Losing $250 Million Yearly to Pervasive Pest

Soybean cyst nematodes are present in nearly 85 percent of the fields in Illinois, according to a recent survey conducted by researchers from the Department of Crop Sciences at the University of Illinois. Soybean growers in the state suffer more than $250 million in yield losses every year because of the nematodes. Varietal rotation of soybean seed at planting time can make a positive difference, researchers found.

Almost half the soybean fields in Illinois show levels of soybean cyst nematodes (SCN) that exceed the threshold for measurable economic damage, according to a recent survey conducted by researchers from the Department of Crop Sciences at the University of Illinois. That translates into more than $250 million in yield losses every year.

The survey was conducted at 260 random locations around the state, according to Terry Niblack, professor of nematology at the U of I. Primary funding for the survey was provided by the Illinois Soybean Association.

“The objective was to find out where the nematodes were present and what the population density levels were at those locations. We also wanted to determine whether the populations of SCN could attack the resistant soybean varieties that are widely planted by growers.”

Niblack noted that the fields in Illinois showed an average of about 2,700 eggs per cubic centimeters of soil, which is five times the threshold for economic damage from SCN. Nearly 5 percent of the fields had levels that exceeded 10,000 eggs per cubic centimeters of soil. That level of infestation marks the threshold above which no varieties are resistant.

“We also found that about 65 percent of the nematodes in our samples could attack the most common source of resistance found in varieties planted around the state,” Niblack said. “Almost 95 percent of the varieties available to farmers use that same source of resistance. The conclusion that we came to was that simply growing any single resistant variety is not enough to control the problem.”

She noted that a similar
Many growers in Illinois think they do not have a problem, when they are actually suffering some significant yield losses.
—Terry Niblack

Terry Niblack’s research shows that not all soybean varieties are created equal when it comes to fighting cyst nematode infestations. With today’s high-yielding resistant varieties, farmers should be able to harvest 70 to 85 bushels per acre.
Combination of Technologies Works Best Against E. Coli Pathogen on Food Products

In laboratory experiments, Listeria monocytogenes on a stainless steel chip were eliminated in 30 seconds, using a combination of ultrasound and ozone. This extremely positive result has promising implications for the sanitation of food processing equipment.

No one weapon in the food-safety arsenal will take out E. coli 0157:H7, a nasty little pathogen that’s becoming far too familiar to Americans, said University of Illinois scientists Scott Martin and Hao Feng.

And they should know because they work on this problem in their labs every day. The food science professors work with ozone, high-intensity ultrasound, electrolyzed water, irradiation, and temperature; and they say no treatment singlehandedly can reduce the number of pathogens sufficiently to meet the standards set by the FDA.

“We don’t believe there’s any one technique out there that’s going to be effective,” said Martin. “We’re constantly trying different combinations to achieve the 5-log (99.999 percent) reduction in the number of organisms required by the FDA,” he said.

Obviously maintaining quality is a real challenge because if you do anything very harsh to something like spinach or lettuce, the product won’t be acceptable even if it’s pathogen-free,” Martin said.

Both scientists believe they’re getting closer to a solution. “With ultrasound, we can actually damage the pathogen’s cells to the point that they can’t be repaired. Ultrasound is a complicated technology, and we’re still trying to learn how to use it effectively. But this technology causes physical damage—ruptures in the pathogen’s cells—and that’s important,” said Feng.

“Obviously maintaining quality is a real challenge because if you do anything very harsh to something like spinach or lettuce, the product won’t be acceptable even if it’s pathogen-free.”—Scott Martin
In Martin’s lab, a graduate student has eliminated all Listeria monocytogenes on a stainless steel chip in 30 seconds, using a combination of ultrasound and ozone. This extremely positive result has promising implications for the sanitation of processing equipment, the scientist said.

And Martin said the scientists have reduced the length of time it takes to reach the FDA’s 5-log reduction standard to 30 seconds, which may still be too long for industry. “The thing is, we’re making steady progress,” he said.

And the work goes on. Accounts of Feng’s use of ultrasound, irradiation, and acidic electrolyzed water to eliminate E. coli on alfalfa and broccoli seeds and his use of high-intensity ultrasound to eliminate E. coli in apple cider were published in the February and June 2006 issues of the Journal of Food Science. Their work on inactivation of E. coli 0157:H7 with peroxycetic acid, acidic electrolyzed water, and chlorine on cantaloupes and fresh-cut apples was published in the November 2006 article of the Journal of Food Safety.

“We’ve shown that we have some effective weapons to use against the pathogens that have been in the news so often lately,” Martin said. “But we’ve seen the best results when we’ve combined the various technologies.”

Other co-authors on the papers published in the Journal of Food Science and the Journal of Food Safety are Edgar Ugarte-Romero, Keith R. Cadwallader, Scott J. Robinson, Hyun Jung Kim, Mosbah M. Kushad, and Hua Wang, all of the University of Illinois, Xuetong Fan of the USDA’s Eastern Regional Research Center, and Yaguang Luo of the USDA’s Produce Quality and Safety Laboratory in Beltsville, MD.

The work was funded by the Illinois Council on Food and Agricultural Research (C-FAR) and the Illinois Agricultural Experiment Station.
Illinois Farmers Increase Profits by Selling Direct

In a survey of farmers in 13 central Illinois counties, researchers learned that grower’s entrepreneurial efforts to sell their agricultural products directly to consumers paid off when it came to bottom-line financial results. Preliminary findings suggest developing an adequate customer base is one key to success in home-grown food sales.

Some Illinois farmers have found a way to make more income from farming fewer acres. The secret? A combination of producing a high-value product and selling directly to the customer.

This conclusion came as part of a recent University of Illinois study which looked at the condition of the local food system in central Illinois. “Local food system” is defined as the “production, processing, distribution, marketing, and consumption of food within a 50- to 80-mile area.”

One of the first steps in the study was to conduct a survey of producers within a 13-county region in central Illinois to find out what they were selling, to whom and where (farmers’ markets, roadside stands), what their challenges were, and what U of I Extension can do to help them.

“What we learned was that a large percent of farmers were making more money selling their products directly to consumers and using fewer acres to do it,” said Sarah Hultine, a graduate student in Urban and Regional Planning and research assistant in the Laboratory for Community and Economic Development.

Leslie Cooperband, Pat Curry, and Anne Heinze Silvis also worked on the project with Hultine.

“About 40 percent of the farmers who responded to the survey were also raising livestock, corn, or soybeans as commodities; but two-thirds of those farmers were earning more from their direct-market crops or products,” said Hultine.

“They saved on transportation costs by selling at roadside stands or nearby farmers’ markets; and by selling directly to consumers, they eliminated the middleman and were able to keep more of the profit.”

In addition to surveying direct-market farmers, the study also examined six farmers’ markets within the same 13-county region — looking at variables such as location, number of vendors/customers, and products sold, as well as community and economic impacts.

Bloomington and Urbana both have farmers’ markets that are well-established and attract about 3,000 customers on Saturdays during their peak season in July. They each have 40 to 50 food and crafts vendors.

“The success of these big markets was in part related to the fact that they have a critical mass of shoppers and a critical mass of vendors — making it more worthwhile to make the trip there on a Saturday morning,” said Hultine.

“Metamora is our anomaly,” said Hultine. “It’s a small market with only four or five food vendors and crafts, but it attracts about 300 people per Saturday. The town works hard to make it a fun event, connecting with other businesses on the square so people can shop at the farmers’ market, then go for a cup of coffee or tour the courthouse which is on the National Register of Historic Places.”

Hultine says that the Metamora farmers’ market is an anomaly because it’s a rural market but is successfully drawing customers from the larger neighboring communities such as Peoria, 17 miles away.

The other rural farmers’ markets studied each averaged about 100 shoppers per Saturday. “The farmers who sell at these markets tend to be more ‘hobby’ or backyard-gardener food vendors, and going to the market for them is more of a social occasion than an opportunity to make money,” said Hultine.

“What we’ve discovered is
that not all rural communities have what it takes to build and maintain a successful farmers’ market,” said Leslie Cooperband, principal investigator for the U of I project. “Our preliminary findings suggest that farmers’ markets need a critical mass of food vendors who are there primarily to sell their products. This critical mass of farmers attracts a critical mass of customers, who spread the word about the great farmers’ market in their community. “However, there are other opportunities for buying and selling locally grown produce that may be better suited for small, rural communities. The Fairbury project is a successful market for local foods that other rural communities can learn from.”

Fairbury, a town with a population of about 4,000, doesn’t have a farmers’ market, but it has developed a local-food following in Dave’s Supermarket. “In 2004, a group of four farmers began selling their produce in a mini-farmers’ market inside Dave’s. Last year seven farmers participated, and this year there were 10 farmers who participated. This year they have advertised more heavily, and it has been more popular,” said Hultine.

Dave’s Supermarket provides farmers with shelf space, advertising, and accounting. In return, store receives 20 percent of the purchase price. The farmers are responsible for stocking shelves and pricing products. One of the reasons that this mini-market inside the store has been a good solution for farmers is that Dave’s is the only grocery store in the community. The next closest is 30 miles from Fairbury. The store sponsors community events and serves as social gathering place for senior citizens, who eat in the cafeteria.

Source: Sarah Hultine, 217.333.8232; hultine@uiuc.edu
Climate Change Creates Dramatic Decline in Red-Winged Black Bird Population

Illinois researcher Patrick Weatherhead reports that the red-winged black bird population in Ontario, Canada, has decreased by 50 percent since 1972. The decrease is related to a positive shift in the North Atlantic Oscillation, which is also causing warmer, wetter winters in the southeastern United States.
When Patrick Weatherhead put the 25 years of data about the red-winged black bird he had collected alongside climate records, he found a direct correlation with the North Atlantic Oscillation (NAO).

NAO is a dominant cause of winter climate variability in the North Atlantic region, which includes central North America to Europe and much of Northern Asia. The NAO has been on an upward trend for the past 30 years.

Weatherhead, an ecologist who specializes in the behavior of birds and snakes, says that although some people may be in denial, global warming exists. “There are long-term records that show melting glaciers and altered ecological patterns like earlier migration and earlier nesting of birds.

“When you first start out, you don’t set out to get 25 years of data on a topic,” he said. “But when you’re in the field long enough like I have been, that’s what you wind up with—long-term ecological data that may have unintended uses.”

The data was collected in Ontario, Canada at the Queen’s University Biological Station from 1975 to 2000, with some additional data in 2005.

“We also found that although the breeding season started at the same time each year, it lasted longer,” said Weatherhead. “The birds appear to be interpreting the longer season as the end of the season lasting longer, when more female eggs typically hatch, so that shift has affected the population sex ratio.”

Over the years, Weatherhead’s team has put bands on the legs of thousands of red-winged black birds to track their nesting habits. The birds winter in the southeastern United States. In mid-July they switch from eating insects to eating corn and have caused millions of dollars of damage.

Red-winged black birds feed on corn borers, so that makes them well-liked by farmers, until they switch in the breeding season to eating corn. That’s when the hero suddenly becomes the pest.

So is the 50 percent decline in population a good thing for the environment?

Weatherhead said that what will happen in the future isn’t clear, but if the climate trends continue, there are likely to be further changes in population size.

In 2005, Weatherhead returned to the marshy region of Canada where the other decades of data had been collected. The North Atlantic Oscillation had returned to neutral values. “We found that the harem size [the number of female birds per male] had rebounded to 2.06, which is less than expected; but it did go up. We are currently measuring the length of the breeding season to see if that has changed, affecting the sex ratio as well.”

The data collection was funded by the Natural Sciences and Engineering Council of Canada and the University of Illinois.
University of Illinois researchers are embarking on a major new study in which they videotape sows around the clock to find out how elements of their “microenvironment” create stress.

Although this may sound like an animal science version of the “Big Brother” reality show, the ultimate goal is to find out how the microenvironment can affect the reproductive health and well-being of sows.

Robert Knox and Janeen Salak-Johnson, associate professors, along with Xinlei Wang and Kaustubh Bhalerao, assistant professors at the U of I, will conduct their research to investigate the effect of variability in gestation-stall microenvironment on sow well-being, physiology, and productivity. Their findings could give an economic advantage to producers, said Wang.

“Reproductive failure is the primary limitation to performance and profitability for producers,” said Wang. “There’s also an overwhelming concern for the well-being of gestating sows in individual stalls in the United States. Once we develop better environmental control methods and automatic monitoring systems that will enhance the well-being of individually housed sows, we can transfer those management technologies to other swine housing systems if we need to.”

Up to this point, the microenvironment of a gestating sow has not been considered as one of the control factors that impact the animal’s welfare or productivity, Wang said. A microenvironment is defined as the immediate surroundings that impinge on a single animal in its individual space; and those surroundings are highly variable among sows within the same building.

“For example,” said Wang, “you and I could be sitting in the same room where the thermostat says 72 degrees; but if I’m next to a cold window, I will feel colder than you. Our microenvironments will be much different.”

Temperature has been the primary environmental factor considered in previous stud-
ies, but the U of I study will include humidity, air velocity, and lighting.

“Sows should be protected against heat stress prior to mating, for two to three weeks just after mating, and for two or three weeks just before farrowing,” he said. His objective is to develop a heat-demand sensor that will effectively control all aspects of the thermal environment.

But how do you determine whether changes in the microenvironment really affect the pig’s physiological well-being?

“One way we measure a sow’s welfare is by looking at her behavior,” said Salak-Johnson, another member of the research team. “A sow might play with her water to try and cool herself, or she might pull her legs underneath her if she’s cold.”

“Animals also sometimes perform behaviors in particular patterns, so if there’s a change in their environment that causes them to be stressed, they might change that pattern,” she added. “We’ll see if there are certain patterns that occur in animals that are in a positive environment (one that improves well-being), versus those that are in a negative environment.”

In addition, researchers will be looking at social interaction with other pigs because that plays a significant part in the sow’s well-being, Salak-Johnson said. More than 70 percent of the sows in the United States are housed in individual gestation stalls (as opposed to group pens); but Salak-Johnson said pigs in general have a social ranking, no matter where they’re housed, and that ranking carries a physiological consequence.

“One of the reasons sows are kept in individual stalls during gestation is their aggressive nature. If you let them roam in pens, the dominant sow will eat all her feed and then start moving everybody else out from theirs,” she explained. “But even if they’re in individual stalls, a gilt (a sow pregnant with its first litter) could be right next to a fifth-parity sow (one pregnant with its fifth litter) who is intimidating her. That puts a tremendous amount of psychological stress on the gilt.”

The stress caused by that type of interaction between sows could cause the gilt to give birth to lower-weight pigs or more stillborn pigs.

Salak-Johnson will videotape the sows around the clock to monitor their behavior and eventually hopes to develop an automatic monitoring system that will optimize the animals’ reproductive health and well-being.

This research will be conducted at the U of I’s Swine Research Center. A building is being remodeled to create three control rooms that are similar in size, temperature control, air flow, animal numbers, and housing.

“Each control room will have two different types of lighting, bright and dim,” said Wang, “and we will test each room at three different thermal levels, cold (55 to 64 degrees F), neutral (65 to 80 degrees F), and hot (81 to 95 degrees F). There will be six stalls in each room, so the animals will have social interaction similar to a commercial set-up.”

To carry out this work, the four researchers have received a grant of $271,000 from the Council on Food and Agricultural Research Sentinel Project.

Sources: Xinlei Wang, 217.333.4446; xwang2@uiuc.edu
Janeen Salak-Johnson, 217.333.0069; johnso17@uiuc.edu
MarketMaker Provides Food Chain Connections across State Lines for Producers, Consumers

More than a dozen states are either already using the MarketMaker website or have plans to join the effort to build this powerful marketing resource for consumers, farmers, and food-related enterprises.

From producer to consumer and back again, the food chain winds its way from field to fork across America. But connecting the product with the customer can be difficult, particularly for smaller operations that may not have the resources to do extensive marketing. The MarketMaker website is helping make those connections on a multi-state level.

MarketMaker currently includes Illinois, Iowa, Nebraska, and Kentucky; but Michigan and Indiana have just recently announced plans to become part of the network. New York’s site is expected to be launched this summer. Nearly a dozen other states have entered into discussions to join the effort to build this powerful web-based marketing resource for consumers, farmers, and food-related enterprises.

“MarketMaker began as an online database of Illinois businesses and was so successful that now other states have joined the effort,” said University of Illinois Exten-
tion specialist Richard Knipe. “U of I developed and owns the tool, but the multi-state partnership that is able to pool large amounts of food industry data and provide it to the public really adds value to the resource.”

Individuals can use the MarketMaker website to search for restaurants or places to buy things such as maple syrup, wine and produce; and producers can search for farmers’ markets, grocery stores and other outlets to sell their food products.

The original website is located at www.marketmaker.uiuc.edu. “It’s more than a directory of information because it has interactive features like mapping and search capabilities, so users can really target and focus on the data that they need,” said Knipe.

The National MarketMaker Portal (http://national.marketmaker.uiuc.edu/) includes a clickable map of the entire United States. Participating states are highlighted, making it easy for users to navigate from state to state or to regionalize their data searches. There is no charge associated with having a business or farm listed on the site.

“Our goal is to make the site a resource for all farmers and businesses in the food-supply chain,” said Knipe. “We are as interested in helping a grocery store find farm-fresh eggs as we are in helping the farmer find a place to sell them, so it’s important to include as many producers in our database as possible.”

Each state has a unique site, but all the data from all other MarketMaker states can be accessed from any location.


MarketMaker was developed through a collaboration between the University of Illinois Initiative for the Development of Entrepreneurship in Agriculture (IDEA), the Illinois Department of Agriculture, and C-FAR (Illinois Council on Food and Agricultural Research).

The project was funded by the Illinois Department of Agriculture, University of Illinois Extension, and the Illinois Council on Food and Agricultural Research (C-FAR).
Research under way in the University of Illinois Department of Animal Sciences has developed methods for allowing the same field of corn to be used for the production of livestock feed and ethanol. “The fundamentals of what we need to do are well known,” explained Larry Berger, professor of animal nutrition, who heads the ef-
fort, “now we are seeking to make greater improvements in the process over the next couple of years and move toward a final answer that can be used by corn growers and livestock producers.”

The process is important because of the growing demand for corn by the ethanol industry, a development that could reduce the amount of corn available for the livestock industry, which relies heavily upon the crop.

“The rapid development of the ethanol industry means that the supply of corn available for livestock production may decrease in the future,” Berger said.

“How rapidly could this happen? Today, enough ethanol plants are being built that within four to five years that industry could be using five billion bushels of corn each year, out of an average domestic supply of 11 billion bushels.

“In 2006, the livestock industry is expected to consume 50 percent of the corn crop; so unless we have increased production of corn or a decrease in corn exports, there will be competition between the ethanol industry and the livestock industry for the corn.”

Berger’s work, partially funded by ADM, looks at maximizing the food and fuel production per acre of corn.

“A field of corn doesn’t have to be exclusively all for ethanol or all for livestock,” he said. “We can do that by taking the corn plant’s stalk and treating it to increase its digestibility. Then, we combine that treated cornstalk with distillers grain—the by-product of ethanol production—to create a high-quality diet for livestock.”

The new feed product is being used in trials with beef and dairy cattle. Another part of the study is examining various processing options, including using corn residues mixed with distillers grains in a pelleting application and chopping cornstalks and handling them as silage in an “ag-bag,” a long, sausage-like container commonly used on livestock farms.

“Some of the things we’re trying are fairly high tech; others involve technology that is easily accessible to producers,” said Berger.

“The essence of the project is using cornstalks to produce meat and milk and the grain to produce ethanol and still have enough protein left among the stalks and distillers grain to provide a balanced diet for the livestock.”

“A field of corn doesn’t have to be exclusively all for ethanol or all for livestock.” — Larry Berger

Source: Larry Berger 217.333.2006; llberger@uiuc.edu
Scientists Suspect Gene Encoding as Key in Waterhemp’s Resistance to Herbicides

The fact that there are two different protoporphyrinogen oxidase-inhibiting (PPO) enzymes in plants may explain why resistance to PPO inhibitors is so rare. A mutation in a gene encoding just one or the other may not be sufficient to confer resistance. Waterhemp got around this problem by having a gene encoding both forms. So, one mutation yielded two different resistant enzymes.

Weed scientists in the Department of Crop Sciences at the University of Illinois have recently published the results from a study on a unique population of waterhemp that shows resistance to three classes of herbicides once effective for management of waterhemp in corn and soybean fields.

“The initial discovery of this waterhemp population in 2001 led to the first-ever report of three-way herbicide resistance in a summer-annual weed species in the United States,” said Aaron Hager, assistant professor of Extension weed scientists in the Department of Crop Sciences at the University of Illinois.

According to Hager, this waterhemp population is also resistant to the classes of herbicides that inhibit acetolactate synthase (ALS) and triazines, leaving only glyphosate as a potential means of postemergence control in soybean.

Waterhemp was not considered much of a problem weed species in agronomic crops until it began to spread across the state during the late 1980s and early 1990s. According to Hager, this once-obscure weed species now is considered the most problematic broadleaf weed species in the state.

“One adaptation of particular importance that has allowed waterhemp to flourish is its ability to thwart attempts at control with herbicides,” Hager said. “In fact, various levels of resistance in this weed to the ALS class of herbicides have been widely reported across the state for several years now.”

He points out that there are currently only four herbicide active ingredients for postemergence waterhemp control in soybeans, and three of these belong to one chemical family. The diphenylether herbicides (PPO-inhibitors), such as Ultra Blazer, Flexstar, and Cobra/Phoenix, were once used extensively for waterhemp control in soybeans until being largely displaced by glyphosate.

“In 2001, U of I Extension specialists began to receive reports from around Illinois indicating that waterhemp control was much less than expected following applications of diphenylether herbicides,” Hager said. “We soon focused our attention on a population of waterhemp from western Illinois that was not controlled by postemergence applications of diphenylether herbicides.”

The researchers conducted a series of experiments to determine how this waterhemp population responded to various soil-applied and postemergence herbicides under actual field conditions.

“It soon became obvious that this waterhemp biotype did in fact demonstrate resistance to various PPO-inhibiting herbicides,” Hager said. “After several years of extensive field, greenhouse, and laboratory research, we documented in 2005 that this waterhemp biotype was resistant to not simply one herbicide family but three different herbicide families: ALS inhibitors, PPO inhibitors, and triazines.”

This effort involved extensive collaboration with Pat Tranel, associate professor of molecular weed science at the U of I, and his team of researchers. Major portions of the research were conducted by graduate student William Patzoldt and by Joel McCormick, who was an undergraduate student at the time.

After extensive laboratory work, the group recently published their results in the Proceedings of the National Academy of Sciences. Their research identified a unique mechanism of resistance used by this waterhemp biotype to survive exposure to PPO herbicides. Funding support for this research was provided by the soybean checkoff through the Illinois Soybean Association.

“Plants have two different forms of the PPO enzyme, one that functions in chloroplasts and one that functions in mitochondria,” Tranel said.

“Typically, these two forms of the enzyme are each encoded by its own gene. What we found in waterhemp was a gene that encoded both forms of the enzyme.”

He noted that this turned out to be the gene in which they identified the mutation that resulted in the herbicide resistance.

“That there are two different PPO enzymes in plants may partly explain why...”
one mutation yielded two different resistant enzymes.”

Tranel explained that the second novel aspect of the resistance mechanism is the type of mutation.

“Herbicide-resistance mutations typically involve a single change in the DNA sequence that, in turn, confers a single change in the protein, or enzyme,” Tranel said. “In other words, there is a substitution of one amino acid for another in the enzyme, and this is responsible for the insensitivity of the enzyme to the herbicide.”

In this case, however, there was a deletion of an amino acid, rather than a substitution.

“Prior to our research, a deletion mutation had not been reported as a naturally occurring herbicide-resistance mechanism,” Tranel said. “The net result is the same—the plant is resistant due to an altered site of action. However, this unique mutation illustrates the genetic diversity that waterhemp has, and its ability to evolve in response to our attempts to control it.”

Hager points out that the effort to better understand waterhemp resistance is made even more important by the recent discovery of a glyphosate-resistant waterhemp population in Missouri.

“This research marks a classic example of how Extension and basic research can work together on a problem,” Hager said. “Without the involvement of each, this entire project would not have yielded the significant results that were made possible through our collaboration.”

He noted that Extension weed scientists are often the first to learn of unique challenges facing farmers. In this case, they initiated field and greenhouse research to begin investigating this waterhemp population but soon realized that the scope of this particular problem would need to include researchers with expertise in the molecular sciences.

Hager pointed out that the collaboration with basic researchers who had molecular and analytic skills provided results that helped them to more fully understand what is going on and increased what they could learn from the situation and take back to help soybean growers around the state.

“This is exactly the way the system is supposed to work, combining the expertise of the basic and applied scientists to solve a real-life problem,” said Robert Hoeft, head of the Department of Crop Sciences at the U of I. “I am really pleased that the collaboration between research and Extension provided such meaningful results.”

Source: Aaron Hager, 217.333.4424; hager@uiuc.edu
How Does Your Mouth Feel About It? Developing a Better-Tasting Diet Soda

A well-trained panel of taste testers helped researchers discover that the perceived taste difference between diet soda and regular soda has a lot to do with the elusive quality of “mouth feel.” Ideally, the scientists would like to find an ingredient that gives body to diet soft drinks without adding calories or other unpleasant side effects.

University of Illinois researchers Soo-Yeun Lee and Shelly Schmidt are trying to solve a mystery: Why doesn’t diet soda taste more like regular soda? Can a well-trained panel of “taste testers” pinpoint the exact problem? And can food scientists do anything to fix it?

“If we could make diet soda taste better, it would be a big step in fighting the obesity epidemic,” said Shelly Schmidt, a U of I professor of food chemistry. “Many people know they should cut calories, but they won’t drink diet pop because they don’t like the taste.”

Consumers may claim they don’t like diet soda because of artificial sweeteners, but Schmidt and sensory scientist Lee think people are also influenced by a subtle difference called “mouth-feel.”

Think body, fullness, thickness; regular soda contains high-fructose corn syrup, diet soda doesn’t.

What makes these scientists think mouth-feel is the culprit? For one thing, artificial sweeteners have been greatly improved and extensively studied. “Taste profiles for artificial sweeteners now closely match the one for sucrose, which humans describe as the perfect sweet-
ness,” Lee said.

But the most compelling piece of evidence is the verdict of Lee’s sensory panel—12 people trained for four weeks to use a 15-point scale to rate the characteristics that contribute to the mouth-feel of diet and regular soda. Lee called her panelists “highly trained instruments” because they could detect significant differences in the mouth-feel of 14 samples that the scientist’s super-sensitive lab instruments identified as very, very small.

“We worked with solutions of sucrose and high-fructose corn syrup, asking panelists to detect when beverages began to differ from water in mouth-feel. And they were able to accurately identify varying degrees of viscosity on our 15-point scale,” Lee said.

“The human mouth cavity appears to be a super-rheometer (the lab instrument that measures viscosity or thickness),” Schmidt added.

Enjoying food, according to the scientists, is more complicated than you’d think, involving not only taste and mouth-feel, but aroma, vision, and even hearing.

“If you bite into an apple and it doesn’t crunch, it affects your perception of the way the apple tastes. And if a beverage doesn’t feel right in your mouth, that affects your perception of the way the beverage tastes too,” said Lee.

All kinds of things affect the way we complicated humans make sensory “sense” of our food. Sensory scientists say an attribute has a halo effect if that attribute is enhanced by other characteristics of the product. If a sensory attribute is decreased by other characteristics of the product, it is said to have a horns effect.

“For example, when color was added to a lemon-lime beverage, panelists believed the beverage had more body (a halo effect). But color also influenced the panelists to think that the beverage had less carbonation (a horns effect),” Lee said.

The scientists found that flavor really can make a difference in the acceptance of diet drinks. It’s not all halos and horns, or even hype, Schmidt said.

“We think the lemon-lime flavor, which is exciting to the mouth, helps mask the mouth-feel difference, and that’s why diet lemon-lime drinks were perceived as tasting more like their non-diet counterpart than cola-flavored drinks,” Lee said.

“It’s probably also the reason the new lime diet colas are so popular. The sour taste of the lime works with the carbonation to keep the mouth busy so the consumer doesn’t notice the lack of body as much,” she added.

Ideally the scientists would like to find an ingredient that gives body to diet soft drinks without adding calories or other unpleasant side effects. “We’ve identified the problem, but we haven’t solved it yet. We need to find an ingredient that has no calories but gives the same mouth-feel as sucrose,” they said.

When science finds that ingredient, the researchers believe diet drinks will be a lot more appealing to people who want to make the switch from regular to diet soda.

Lee, Schmidt, and S.M. Kappes, a former Ph.D. student who now works for Tate and Lyle applying this research, have co-authored four studies about the sensory characteristics of diet beverages, which appeared in issues of the Journal of Food Science in 2006-2007. The study was partially funded by the Cargill Women in Science Advanced Degree Scholarship.

Sources: Soo-Yeun Lee, 217.244.9435; soolee@uiuc.edu.
Shelly Schmidt, 217.333.6369; sjs@uiuc.edu.
A mother’s attentiveness to her baby’s distress, especially in the first year, is more important to his secure attachment than lots of positive feedback when he’s happy and content, concludes a University of Illinois study published in the Journal of Family Psychology.

“Unfortunately, sometimes it’s difficult for parents to deal with their child’s distress,” said Nancy McElwain, a U of I assistant professor of human and community development. “A mother may become anxious when her baby is really unhappy and try to comfort him by saying, ‘Oh, don’t cry, don’t cry.’ But it’s okay to cry.

“If the new mother wasn’t comforted very well by her own mother when she was a child, she may need help learning to console her own infant,” the researcher said.

In the study, McElwain coded maternal sensitivity to distress and nondistress in 357 mothers and their babies at six and 15 months, then...
assessed attachment security in the babies at 15 months. Infant difficult temperament was also used as a predictor and found not to be a factor. The data came from the National Institute of Child Health and Human Development (NICHD) Study of Early Child Care and Youth Development, which involved more than 1,300 families.

“A mother’s sensitivity to her baby’s distress at six months was a significant predictor of the baby’s attachment security at 15 months, but sensitivity during times of nondistress was not. It’s important that babies become securely attached to their caregivers because it’s the foundation for future healthy child development,” she said.

Mothers who realize they are uncomfortable with their baby’s distress should find ways to compensate or cope with those feelings so they can change their behavior, she said.

What does a sensitive response to distress look like? “Ideally, you want to show your child through your facial expression and your tone of voice that you understand how she feels and that you empathize with her,” the researcher said.

“Respond in a timely way to your infant’s cues, and let your interactions with your infant be driven by the baby’s agenda, not your agenda,” she added.

Recent research has shown that children respond more positively to mothers who are able to think of their infant as a person who has needs, desires, intentions, and a mental world, McElwain said.

“Try to see things from the infant’s point of view as much as possible. When mothers talk to their babies, even at six months, about the baby’s mental state and how the baby is feeling, infants respond to that verbalization,” she said.

But don’t obsess over your baby’s distress. “Sensitivity doesn’t necessarily mean responding to your baby every minute of the day. It does mean thinking about why the baby is upset. Of course, it’s easier to interact sensitively with a baby when he’s happy, and no mother can respond perfectly 100 percent of the time. It’s the pattern that’s important,” McElwain said.

Being attuned to your baby’s emotional life should result in a securely attached toddler who seeks out his caregiver when he needs to be comforted and is able to explore his environment relatively freely when he isn’t stressed, said the researcher.

“The first year of life is so important,” McElwain said. “And we can see from this study that the way mothers and caregivers respond to a baby’s distress is a very important factor in the child’s healthy development.”

Cathryn Booth-LaForcen of the University of Washington is co-author of the study. Funding was provided by the National Institute of Child Health and Human Development.

Source: Nancy McElwain, 217.244.7168; mcelwn@uiuc.edu
New Apple Proves Resistant to Scab Fungus

Apple scab is a problem in orchards throughout the world, with growers typically having to spray fungicide 12 to 15 times each year to curb outbreaks. With its resistance to apple scab, “Juliet” is an environmentally friendly apple that tastes good, too.

An apple a day may keep the doctor away, but what keeps the doctor away from the apple? And when that apple is infected with apple scab, the prognosis is grim for the entire tree. Enter Juliet—an apple that showed so much potential that a French company created a cartoon character and advertising campaign to market it in Europe.

Juliet is a late-season apple that carries the Vf gene that provides a high level of resistance to apple scab disease triggered by a fungal pathogen, Venturia inaequalis. Juliet has also shown resistance to powdery mildew and fire blight and reduced susceptibility to another fungal pathogen that causes cedar-apple rust.

University of Illinois plant geneticist Schuyler Korban collaborated with researchers at Purdue and Rutgers universities to develop Juliet. “Because the original seedling was selected here, U of I holds the licensing rights to the variety,” said Korban.

Juliet is about 85 percent red, with some green undertone. It has less sugar than the Fuji but enough balance of sugar and acid to be considered full-flavored. It also stays on the tree for a longer time without dropping off and can be kept in cold storage for six to seven months.

But its resistance to apple scab is what makes it most attractive to growers. “Apple
scab is a problem around the world, and unfortunately the conditions in Illinois are perfect for apple scab,” said Korban. “Washington State has lower heat and humidity than Illinois, but apple scab is still a problem worldwide.”

Korban said growers typically have to spray 12 to 15 times per growing season. They mix a cocktail of pesticides and insecticides that isn’t always the same, but fungicide to prevent apple scab is in every application.

“The resistance to scab makes Juliet environmentally a better choice because it requires fewer chemical sprays than other apple trees,” said Korban. “And it ripens two weeks after Red Delicious, making it more marketable as a late-season apple.”

A nursery in France called Escande realized Juliet’s potential and acquired the rights to grow and market the variety in Europe. They are hoping to find apple growers in the United States that would be willing to abide by their rules for growing this apple. Because Juliet is being marketed as an organic apple, it would need to be grown by certified organic growers.

The marketing firm created a cartoon character whose likeness appears on brochures, packaging, and tiny apple stickers. “You can even become a ‘friend of Juliet’ on the website at www.pomme-juliet.com,” said Korban.

Korban said the fungus that causes apple scab is transmitted via infected leaves, even those left on the ground over the winter. The disease affects blossoms, leaves, and fruits, eventually killing the tree. The infected fruit can sometimes be used in processed products that include apples but the appearance renders it unsellable for the fresh market. Juliet is the fifteenth apple cultivar developed by the cooperative breeding program between the University of Illinois, Purdue University, and Rutgers University.
Helping Ethanol Plants Recycle More Water

By adding a membrane filtration at the thin stillage stage in ethanol production, researchers hope to improve the ability to recycle more of the water.

Ethanol plants use about four gallons of water for every gallon of ethanol they make, using the dry-grind process. But investigators at the University of Illinois are trying to determine if the amount of water that is recycled during ethanol production can be increased—significantly.

“If you have a plant that’s going to produce 100 million gallons of ethanol, like the proposed Anderson plant, that’s about 400 million gallons of water per year; and that’s not a trivial amount,” said Kent Rausch, a U of I agricultural and biological engineer involved in the project.

“If we can increase the amount of recycled water from 50 to 85 percent, that will make a big difference from economic and environmental standpoints.”

In the conventional dry-grind process, raw corn is finely ground and cooked; then the starch is fermented and converted into ethanol. After the ethanol has been recovered, the remaining ma-
terial is called whole stillage. It contains water, protein, fat, fiber, and ash from the corn kernel and yeast.

The stillage is run through a centrifuge, and about 50 percent of the water is recycled. The soluble material that remains after centrifuging is called thin stillage.

Rausch and his colleagues are planning to add membrane filtration—filtration through very small holes—to the process at this point. “We’re looking at filtering the thin stillage to improve our ability to recycle it,” said Rausch.

“Impurities that inhibit yeast growth build up in the water and reduce ethanol yield; that makes the process less efficient.” Although a total recycle may not be possible, he said, “Our goal is to get rid of those impurities so more water can be recycled.”

Rausch and his colleagues are also experimenting with a modified dry grind process that removes much of the protein, fiber, and fat before the fermentation process.

“As a result, the thin stillage obtained from the modified dry grind process will be different,” said Rausch. “This will affect the filtration rate through the membrane, so we will test which membrane construction and pore size will work most effectively with each process.”

Vijay Singh, an agricultural and biological engineer at the U of I, and Ron Belyea, an animal scientist at the University of Missouri, are coinvestigators for this study, funded by the Council on Food and Agricultural Research (C-FAR).

“Water use is important to the economic well-being of the plant even where water is plentiful,” Rausch concluded. “Reducing the demand for water in the process should reduce the environmental footprint. We want these facilities to do all they can to be good stewards in the community.” —Kent Rausch
To Improve River Basin Environmental Impact, State Conservation Program Needs Changes

An Illinois economist believes the current ‘first-come first-served’ implementation policy of a state conservation initiative limits both the environmental benefits and the cost-effectiveness of the program.
An Illinois program that targets environmentally sensitive cropland in the Illinois River basin needs some fundamental changes to effectively meet its goals, according to a researcher in the University of Illinois Department of Agricultural and Consumer Economics.

“The Illinois Conservation Reserve Enhancement Program (CREP) was established to achieve numerically defined environmental benefits by restricting the definition of regions eligible for the program,” explained Madhu Khanna, a professor of agricultural and consumer economics.

“However, it lacks any mechanism for selectively enrolling eligible land to ensure that land parcels with higher environmental-benefits-to-opportunity-cost ratios will be enrolled in the program or that program goals will be achieved.”

As administered, CREP allows a land parcel to be enrolled on a first-come, first-served basis at the maximum soil rental rate for that parcel.

Established in 1996 as a program within the Conservation Reserve Program (CRP), CREP allows land to be included for an extended period of 15 or 35 years or permanently. Illinois has the largest CREP in the country, with 132,000 acres enrolled between 1998 and 2001, located either in the 100-year floodplains, in wetlands, or on sloping land adjacent to a riparian buffer.

Currently, the program seeks 85 percent of its parcels from the 100-year floodplains and 15 percent from the erodible lands next to a riparian buffer.

Khanna believes changes should start with the types of land targeted if greater success toward the program’s goal is to be achieved.

“The eligible region should be limited to a narrow buffer, with a width of about 900 feet, along all streams and tributaries of the Illinois River Basin and not restricted to the 100-year floodplain,” she said.

“Another improvement would involve modifying selection criteria so that land parcels that are closer to a water body, more sloping, more erodible, and less productive would be enrolled in the program. To provide incentives for such land parcels to enroll in CREP, rental payments should be designed to vary across land parcels based on these observable on-site characteristics of the land parcel.

Observable characteristics of land parcels, she noted, can play an important role in determining rental payments to target cost-effective enrollment and can typically be determined by program administrators using easily available information about land parcels.

“Enrolling land parcels based on these observable characteristics would increase sediment-abatement benefits to opportunity cost ratio and lead to the achievement of CREP’s sediment abatement goal with enrollment of fewer acres and lower overall costs in the form of rental payments,” she said.

The study examined the performance of CREP with regards to its sediment-abatement objectives only and did not consider the program’s other aims in terms of wildlife habitat or wetland preservation.

“Still, incorporating these goals would not change the main arguments the study produced,” she said.

“First, we need to design a mechanism to select parcels for enrollment to cost-effectively achieve CREP’s goals. Second, incentives need to be created to target those land parcels that could contribute most effectively to meeting CREP’s goals.”
Regenerating Bones Using Adult Stem Cells

Today, individuals with knee or jaw problems often face painful knee replacement or jaw surgeries. Using pigs as a biological model for humans, researchers are developing methods to use adult stem cells to regenerate damaged tissues. In the future, that may translate into fewer surgeries and less pain for humans.

Five years from now, human testing on bone regeneration may be one of the fruits of a large-scale research project that includes the University of Illinois Department of Animal Sciences. In essence, the project seeks to grow new bone and other tissue in...
humans by using techniques perfected in swine.

“Pigs are a good biological model for humans,” explained Matt Wheeler, a professor in the department who is also affiliated with the U of I’s Institute for Genomic Biology (IGB). “Because of the biological similarities, pigs provide good opportunities to work out technologies before you go to human trials.”

Wheeler’s portion of the project, which also involves Russ Jamison and Amy Wagner-Johnson of the College of Engineering and Dr. Michael Goldwasser, a maxillofacial surgeon with the U of I College of Medicine, deals with developing technologies to generate therapies to replace bone lost in humans due to cancer of the jaw, severe periodontal disease, and traumatic injury.

Larry Schook, also of the Department of Animal Sciences and IGB Leader of the Regenerative Biology and Tissue Engineering Theme, is also part of the larger project funded by the State of Illinois’s Illinois Regenerative Medicine Institute (IRMI).

“I’m working on developing methods to isolate and purify cells that can be used in the studies by building technologies to isolate cells from adult stem cells and purify them for use,” he said.

Eventually, Schook said, the findings in pigs could be applied to humans to address a range of diseases and injuries that destroy tissue.

“For instance, heart attacks and strokes destroy muscles and tissues,” he said. “What if you could use adult stem cells to regenerate those damaged tissues? There could be many opportunities to help the healing process.”

One example is the growing need for knee replacements in young women who are injured playing sports at a young age. When they finally need knee-replacement surgery, the artificial equipment involved will last only about 10 to 15 years.

“That means a young woman could face a number of knee replacement surgeries throughout her lifetime,” Schook said. “But if you could get the body to regenerate that damaged tissue, you eliminate the need for surgery.”

Wheeler’s work involves the specific problems associated with replacing jawbones.

“Now if someone loses a portion of the jawbone due to disease or injury, you have to go somewhere else in their body, the ribs, for example, to find bone to replace it,” he said. “That can be terribly painful, plus involve extensive surgeries.”

Wheeler and his colleagues are taking an interdisciplinary approach to develop “scaffolds” upon which the body can rebuild bone through the use of cells that are “pushed” toward regeneration.

The “scaffolds” essentially involve materials that are compatible with the body and around which the cells can rebuild tissue. The engineers are focusing on this work.

“I’ve developed some robotic methodologies that push cells toward making bone,” said Wheeler. “We’re using adult pig stem cells from fat and bone marrow, and we’ve had some success in vitro and with the scaffolds in some animals.”

This work is also partially funded by the State of Illinois’s Illinois Regenerative Medicine Institute (IRMI).

In the future, patients needing some form of bone replacement could simply have five grams of fat removed from their body, harvested for stem cells, and then have the cells used to rebuild the necessary bone tissue.

“We’re hoping that within the next couple of years we’ll have a good handle on the swine model for this process,” said Wheeler. “Then on to clinical trials, and perhaps we’ll see studies in humans within five years.”

—Matt Wheeler
Researchers Collaborate on Development of Soybean Varieties with Rust Resistance

Testing soybean germplasm accessions from the USDA-ARS has identified 424 accessions with rust resistance—putting scientists one step closer to the goal of high-performance soybeans that minimizes the impact of rust on the crop.

Researchers from the University of Illinois at Urbana-Champaign are moving ahead with efforts to develop soybean lines with resistance to soybean rust through a grant from the United Soybean Board. Collaborators on this grant include Brian Diers from the U of I; Randall Nelson, David Walker, and Glen Hartman from the U.S. Department of Agriculture’s Agricultural Research Service (USDA-ARS) and the U of I; Roger Boerma from the University of Georgia; Perry Cregan from the USDA-ARS at Beltsville, Maryland; and Henry Nguyen, David Sleper, and Grover Shannon from the University of Missouri.

The goal of these efforts is to make rust-resistant soybean varieties available to soybean growers in Illinois and throughout the United States. The first step in developing these varieties is the identification of sources of resistance to soybean rust. As part of their work, researchers have conducted collaborative tests of accessions from the USDA-ARS germplasm collection. Numerous accessions have been tested for rust resistance in greenhouse and field locations.

From this total, 424 accessions that have shown resistance have been identified, and these will be tested further in field and greenhouse tests during 2007.

“The selection of these accessions was based on extensive testing at six field locations in the southern United States, field data from Vietnam and Paraguay, and greenhouse evaluations at Ft. Detrick, Maryland; Griffin, Georgia; and Urbana, Illinois,” Diers said. “The accessions range in maturity from 000 to X and come from 20 different countries.”

This past winter was the first time that researchers at the U of I were able to screen for resistance to soybean rust on campus. Because soybean rust was detected in the state during the 2006 growing season, Hartman was able to obtain permits for evaluating rust resistance in a greenhouse.

His program has also screened accessions with rust isolates that were collected in Florida. To ensure that rust does not spread from greenhouses at the U of I to fields in the state,
the greenhouse tests had to be complete by March 1, and all rust infected plants destroyed.

Some of the accessions have previously shown resistance in multiple locations and assays. Others have limited available data from past evaluations but appear to merit further testing.

Lists of the most resistant lines have been made available to soybean breeders throughout the United States. “There are several biological, experimental, and environmental factors that may have influenced their apparent resistance to soybean rust,” Diers said.

“Even so, we decided that providing this information to the soybean-breeding community would help interested researchers to decide which accession that they would want to work with in their own programs.”

Diers and his collaborators are mapping rust-resistance genes so that breeders will be able to develop rust-resistant varieties by selecting for the resistance gene using genetic markers, which will be easier than inoculating plants with the rust pathogen.

During the past year, they have already mapped two rust-resistance genes.

One was mapped by Cregan, and the other was mapped by Boerma. They expect that additional genes will be mapped soon.

The researchers expect that the associations between markers and these rust-resistance genes will be used widely by soybean breeders. A number of breeding programs are already using the linked markers to incorporate the two mapped genes into varieties.

“Through our collaborative efforts, we continue to move ahead in developing lines with rust resistance,” Diers said. “The goal is eventually to provide growers with high-yielding soybean varieties that can minimize the problems presented by the recent arrival of soybean rust.”
A University of Illinois study shows that tomatoes and broccoli—two vegetables known for their cancer-fighting qualities—are better at shrinking prostate tumors when both are part of the daily diet than when they’re eaten alone.

“When tomatoes and broccoli are eaten together, we see an additive effect. We think it’s because different bioactive compounds in each food work on different anti-cancer pathways,” said University of Illinois food science and human nutrition professor John Erdman.

In a study published in Cancer Research, Erdman and doctoral candidate Kirstie Canene-Adams fed a diet containing 10 percent tomato powder and 10 percent broccoli powder to laboratory rats that had been implanted with prostate cancer cells. The powders were made from whole foods, so the effects of eating the entire vegetable could be compared with consuming individual parts of them as a nutritional supplement.

Other rats in the study received either tomato or broccoli powder alone; or a supplemental dose of lycopene, the red pigment thought to be the effective cancer-preventive agent in tomatoes; or finasteride, a drug prescribed for men with enlarged prostates. Another group of rats was castrated.

After 22 weeks, the tumors were weighed. The tomato/broccoli combo outperformed all other diets in shrinking prostate tumors. Biopsies of tumors were evaluated at The Ohio State University, confirming that tumor cells in the tomato/broccoli-fed rats were not proliferating as rapidly. The only treatment that approached the tomato/broccoli diet’s level of effectiveness was castration, said Erdman.

“As nutritionists, it was very exciting to compare this drastic surgery to diet and see that tumor reduction was similar. Older men with slow-growing prostate cancer who have chosen watchful waiting over chemotherapy and radiation should seriously consider altering their diets to include more tomatoes and broccoli,” said Canene-Adams.

How much tomato and broccoli should a 55-year-old man concerned about prostate health eat to receive these benefits? The scientists did some conversions.

“To get these effects, men should consume daily 1.4 cups of raw broccoli and 2.5 cups of fresh tomato, or 1 cup of tomato sauce, or ½ cup of tomato paste. I think it’s very doable for a man to
eat a cup and a half of broccoli per day or put broccoli on a pizza with ½ cup of tomato paste," said Canene-Adams.

Erdman said the study showed that eating whole foods is better than consuming their components. “It’s better to eat tomatoes than to take a lycopene supplement,” he said. “And cooked tomatoes may be better than raw tomatoes. Chopping and heating make the cancer-fighting constituents of tomatoes and broccoli more bioavailable.”

“When tomatoes are cooked, for example, the water is removed and the healthful parts become more concentrated. That doesn’t mean you should stay away from fresh produce. The lesson here, I think, is to eat a variety of fruits and vegetables prepared in a variety of ways,” Canene-Adams added.

Another recent Erdman study shows that rats fed the tomato carotenoids phytofluene, lycopene, or a diet containing 10 percent tomato powder for four days had significantly reduced testosterone levels. “Most prostate cancer is hormone-sensitive, and reducing testosterone levels may be another way that eating tomatoes reduces prostate cancer growth,” Erdman said.

Erdman said the tomato/broccoli study was a natural to be carried out at Illinois because of the pioneering work his colleague Elizabeth Jeffery has done on the cancer-fighting agents found in broccoli and other cruciferous vegetables. Jeffery has discovered sulfur compounds in broccoli that enhance certain enzymes in the human body, which then act to degrade carcinogens.

“For ten years, I’ve been learning how the phytochemicals in tomatoes affect the progression of prostate cancer. Meanwhile Dr. Jeffery has been investigating the ways in which the healthful effects of broccoli are produced. Teaming up to see how these vegetables worked together just made sense and certainly contributes to our knowledge about dietary treatments for prostate cancer,” said Erdman.

Authors of the tomato/broccoli study are Kirstie Canene-Adams, Brian L. Lindshield, Elizabeth H. Jeffery, and John W. Erdman Jr. at the U of I and Shihua Wang and Steven K. Clinton of The Ohio State University. The study was funded by the American Institute for Cancer Research and the U.S. Department of Agriculture.

The U of I study of the effects of tomato carotenoids on serum testosterone was published in the December 2006 issue of the Journal of Nutrition. Authors are Jessica K. Campbell, Chad K. Stroud, Manabu T. Nakamura, Mary Ann Lila, and John W. Erdman Jr. Funding was provided by the National Institutes of Health’s National Cancer Institute.
Through extensive interviews with 19 abused women of varying backgrounds and in varying stages of the divorce process, Illinois researchers learned the factors that influence a not only a woman’s decision to leave an abusive spouse but also her stance toward child custody.

What influences women when they are making child custody decisions that will bring them into future contact with a violent or controlling ex-husband? Fear, pragmatism, and the belief—sometimes reinforced in mandated divorce education classes—that their children will suffer if both parents are not in their lives, according to a University of Illinois study in the Journal of Social and Personal Relationships.

“Will the mother and father be able to co-parent without a recurrence of violence or controlling behaviors? That’s the most important consideration in making child custody decisions,” said Jennifer Hardesty, an Illinois assistant professor of human and community development.

Unfortunately, other factors, including fear, practical considerations about money, and guilt over breaking up the family, influence such women heavily when they are making custody decisions, the researcher said.

Hardesty conducted extensive interviews with 19 abused women of varying backgrounds and in varying stages of the divorce process to develop a theoretical model for future research. The study was conducted in two Missouri counties that required divorcing couples with minor children to attend a class on post-divorce parenting.

“Fear was very important in the women’s decisions to leave, but guilt over breaking up the family was more influential in making custody decisions,” she said.

Aside from the obvious fear of being hurt or killed, mothers feared their former husbands would harm or take the children. Nearly all of the mothers experienced some form of abuse between the time they initiated separation and finalization of the divorce.

Women also feared courtroom dynamics and a lengthy custody battle. One participant said, “Get me into a courtroom where they’re going to grill me and ask me questions, and it’s frightening. I don’t like that grilling; it’s very reminiscent of what he did to me for many, many years.

“I didn’t fight it. I did like I always do. I backed down,” she continued. “I thought he was going to drag this out until I’m 100 years old.”

Half of the women believed their attorneys had not advocated for them as victims of abuse. Only one had an attorney who brought the prior abuse into the proceedings by including in the divorce petition threatening notes written by the woman’s husband.

And although experts recommend that abused women be screened out of co-parenting classes, such as the class...
mandated in the two Missouri counties studied, half of the women in the study were directed to participate in the classes, even though all but one of the women’s attorneys knew there had been violence in the relationship.

“Many women talked about the influence of that class on their thinking about custody,” said Hardesty. “They’d say, I can’t restrict his involvement with the children because I know it’s bad for the kids if we’re not getting along and both involved in their lives.”

Family, friends, and social institutions promote what Hardesty called “a family ideology” that influenced the women. “I listen to Dr. Laura every day, and I know it is really good for the children to see both parents every day,” said one mother.

Many mothers wanted their custody decisions to balance their own and their children’s safety with the importance of father-child relationships.

“Denying him contact is not right to do to him. He’s had a hard life. I just know it would be hard on him for me to take away his rights to his kids,” said another.

Pragmatic concerns also played a large role in women’s decision making. One woman reluctantly agreed to a joint physical custody arrangement in which the children lived with their father during the week and she had them on weekends.

“I knew I had to have my job. Somebody had to support these kids. I was working 60 to 70 hours a week. If I had them on weekends, I’d have quality time. He had the time during the week because he didn’t work,” said one mother.

One woman agreed to joint legal and physical custody because she doubted she could find good, affordable child care.

“He came to me and said, ‘If you give me 50/50 custody, I’ll do whatever I can to help you pay your day care.’ For my three children to go to day care, it’s $1,000 a month. I really felt like I had no other choice.”

Women with health problems were concerned about having enough energy to endure a custody battle. “I was on heart medication and antidepressants. I could hardly function anymore. My lawyer said, ‘If you have a nervous breakdown, you may not get custody of your kids at all.’”
Rural America More Prepared for Disaster but Paradoxically Also More Vulnerable

From winter storms, to earthquakes, to terrorism—when disaster strikes a community, which fares better, a rural community or an urban one? Although rural residents may be more directly involved in responding to crisis, their location also makes them more vulnerable.

A new study at the University of Illinois attempts to understand the differences in how rural and urban citizens across the United States respond to disaster. Preliminary results show that although rural residents may be more directly involved in responding to crisis, their location also makes them more vulnerable.

Courtney Flint, a rural sociologist and assistant professor at the U of I, and one of her students, Joanne Rinaldi, interviewed 20 coordinators of Community Emergency Response Teams (CERTs) across Illinois.

“What we’ve learned so far is that in rural communities there is a tradition of being more self-reliant.”—Courtney Flint
there is a tradition of being more self-reliant,” said Flint. “They’re off the grid, so that makes them check on each other more, but they are also uniquely situated, closer in some ways to the physical environment and more isolated, making them uniquely vulnerable.”

Perhaps it’s that vulnerability that makes rural communities more self-reliant.

According to Flint, people in farm communities say, “We’re on our own. We know we’re not going to get the same first response in an emergency as the cities.”

While people in urban communities ask questions about liability, rural dwellers say, “We can’t wait around for funding. If we need bandages, we’ll just start ripping up old bed sheets.”

“Farm families have to keep going,” said Flint. “They may have livestock. They can’t wait for someone to flip the switch. They are more prepared for disaster. They have generators, kerosene heaters, snow plows, and other equipment.”

Tornadoes, flooding, winter storms, and hazardous material accidents can strike a city as well as a farm. But urban communities have a heavier concentration of people and a social vulnerability—neighbors don’t talk to each other as much.

Flint and Rinaldi are discovering that in rural communities, the CERTs themselves plan as if they might be the first responders to a disaster, while in urban and suburban communities in Chicago, for example, the need for CERTs is different because those communities have extensive first responder capacity in their police and fire departments.

“In the Chicago suburbs, the CERTs might do more crowd and traffic control, provide information, answer telephones, and work to unite blocks and neighborhoods in a disaster situation,” said Flint.

Most CERTS take an all-hazards approach—that is, they practice responding to a range of potential emergencies. Many of the CERT coordinators spoke about three broad categories of potential hazards: weather events, transportation accidents and hazardous materials, and terrorism.

“After 9/11, one county in Colorado did a big effort on anti-terrorism; but in 2006, they began shifting the focus to fire, flooding, and flu because they saw the likelihood for these occurring as much greater,” said Flint.

Before 9/11 there were only about 175 CERTs. Between 2001 and 2006, the number grew to a current listing of 2,435. CERTs were moved from being under the Federal Emergency Management Association (FEMA) to the Citizen Corps, which is under the Department of Homeland Security. There are 86 Citizen Corps groups listed in Illinois, but the total number of CERTs in the state is hard to assess. Part of Flint’s study is compiling a complete set of CERTs, and assessing how active each group is.

Flint’s study also explores what CERTs can do between disasters. “We tend to be more reactive than proactive; we wait for the first big freeze to go out to buy shovels, flares for the car, and plastic to cover windows,” said Flint. “Before disaster strikes, CERTs can do a lot in a community to be proactive by building awareness, educating, and training. In rural communities, they may do work such as stabilizing stream banks that may over-flow—that sort of thing.”

Defining the role of CERTs and the relationship with other first responders is critical to effective programs. “Funding consistency or a lack of sufficient funds was a common issue for a majority of the CERTs,” said Rinaldi.

Flint hopes that the study will help show policy-makers that one size doesn’t fit all—that urban and rural needs are different. She has a colleague in Florida working on a similar study. Flint wants to develop a national database of active CERTs and to share lessons learned across the state and country between CERTs.
Research Affiliates via the Web

AGMAS
Investigates the performance of farm market advisory services. (http://www.farmdoc.uiuc.edu/agmas/)

Agroecology/Sustainable Agriculture Program
Facilitates and promotes research and education which protects Illinois' natural and human resources while sustaining agricultural production forever. (http://asap.sustainability.uiuc.edu/)

C-FAR Funded Research
Updates on projects funded in partnership with the Illinois Council on Food and Agricultural Research. Scroll to Project Web Site (http://www.ilcfar.org/research/index.html)

CABER
The Center for Advanced BioEnergy Research (CABER) works closely with the nine UIUC colleges, multiple disciplinary and professional units and faculty and students to provide a facilitative structure for campus outreach, teaching and research in areas related to bioenergy systems. (http://www.ilcfar.org/research/index.html)

C-FAR Sentinel Program
Introduced in 1999, the C-FAR Sentinel Program at the University of Illinois at Urbana-Champaign was developed to fund creative, problem-solving research projects that would be unlikely to secure funding through traditional channels. (http://www.ilcfar.org/research/sentinel_final.html)

College of Veterinary Medicine Research
Profiles, projects and research to promote health and production, alleviate animal suffering, conserve animal resources and protect public health. (http://www.cvm.uiuc.edu/research/)

David Miller Lab
Research to develop more accurate fertility assays and to improve animal fertility. (http://www.anisci.uiuc.edu/labs/millerlab/index.html)

Dudley Smith Initiative
The Dudley Smith Initiative intends to support innovative research and outreach that advances its fundamental goal of invigorating the agricultural system in Illinois. (http://www.aces.uiuc.edu/DSI/)

Expanding the Commercial Grape and Wine Industry in Illinois
Data about grape and wine production in Illinois, variety trial sites and other research activities, including a photo tour of Illinois vineyards. (http://w3.aces.uiuc.edu/NRES/faculty/Skirvin/cfar/)

FARM.DOC
FARM.DOC provides comprehensive risk management information and analysis. The "Farm Financial Analyzer" helps users evaluate financial performance of a farm. "Outlook" offers popular weekly and monthly newsletters on markets and other economic topics. These and other tools and services make this a one-stop site for producers, lenders and agribusiness in Illinois. (http://www.farmdoc.uiuc.edu/)

Human-Environment Research Laboratory
Examines ways in which the physical environment affects the healthy functioning of individuals, families and communities, and ways in which ordinary citizens can participate in shaping the environment. (http://www.herl.uiuc.edu/)

Hymowitz's Soybean Genetics Laboratory
Soybean history, genetics and more. (http://www.cropsci.uiuc.edu/faculty/hymowitz/genlab/index.html)

Illinois Gap Analysis Project
Provides focus and direction for proactive, rather than reactive, land management activities at the community and landscape levels. (http://www.inhs.uiuc.edu/cwe/gap/gapintro.html)

Illinois Natural History Survey
Official site of the Illinois Natural History Survey, a state institution conducting research on the taxonomy, ecology and management of insects, plants and animals. Online research databases, research project pages, survey publications, contacts, history and more. (http://www.inhs.uiuc.edu/)

Illinois Specialty Farm Products
Explores strategies for improving farm incomes through specialty farm products and value-added processing. (http://web.aces.uiuc.edu/value/)

Illinois Specialty Farm Products
Provides up-to-the-minute information on Great Lakes issues, emphasizing concerns in the southern Lake Michigan region. Research and outreach activities address water quality, aquaculture and seafood safety, biological resources, sustainable coastal development and coastal processes. (http://www.iisgcp.org/)

Immunogenics Laboratory
Research, publications and activities related to bovine leukemia virus and gene mapping. (http://cagst.animal.uiuc.edu/)

Office for Futures and Options Research
Promotes and supports academic research and education on commodity futures and options markets. (http://www.ace.uiuc.edu/ofor/)

PorkNet
Designed to provide the Illinois swine industry with timely information to facilitate decision making and to strengthen ties between the Illinois pork industry and the UIUC. (http://livestocktrail.uiuc.edu/porknet)

Southern Illinois Regional Assessment Project (SIRAP)
Research conducted by Dr. Courtney Flint and Dr. Stephen Gasteyer, rural sociologists in the College of ACES. (http://research.aces.uiuc.edu/programs/sirap)

Stiletto Flies
(Therevidae: Diptera) Chronicles from collecting trips to obtain therevid specimens, progress reports, a specimen based database system and more. (http://www.inhs.uiuc.edu/cee/therevid/)

StratSoy
(Strategic Soybean System) Strategic tools and resources for the soybean industry. Includes resources for consumers interested soyfoods, soy-health research and more. (http://www.stratsoy.uiuc.edu/)

W.M. Keck Center
The W.M. Keck Center for Comparative and Functional Genomics conducts research on the comparative genetic organization, evolution and function of plant, animal and microbial genomes. (http://www.biotech.uiuc.edu/centers/Keck/)