FINANCIALS

OARDC FISCAL YEAR 2007

APPRIOPRIATED STATE FUNDING

State Year Appropriation $35,830,188

STATE 46%

OTHER 54%

OTHER REVENUE SOURCES

Grants, Contracts, Gifts $29,831,909

Federal Base Funds 6,297,125

Endowment, Sales, Other 6,574,264

Total Other Revenue $42,703,298

USES OF STATE AND FEDERAL FUNDS

Salaries, Wages, and Benefits 74%

Supplies and Other Operating 13%

Equipment 3%

Investment in People and Programs 10%

Total 100%

GROWTH OF LEVERAGED GRANTS AND CONTRACTS

110% increase since 2001

$23,284,435
$22,844,239
$23,726,561
$18,430,785
$15,978,724
$12,916,754
$11,075,067

Bringing Knowledge To Life

www.oardc.ohio-state.edu • oardcreport.osu.edu
Better Soy Oil Research Boasts Industry-Wide Impact

In the early 1980s, soybean oil was barely a blip on the culinary radar screen. By 2006, its value had climbed to $141 billion worldwide.

David Min at the Ohio Agricultural Research and Development Center is credited with the turnaround. And he continues to use his expertise to solve new challenges.

Min brought worldwide attention to Ohio by resolving a problem that had vexed industry for decades: flavor reversion. During processing, undesirable flavor compounds were removed from soybean oil, but, too often, the flavor reverted back within hours after packaging.

Previous research had pieced together many parts of the puzzle, but Min put it all together. His first big discovery involved an unusual form of oxygen. Singlet oxygen, first observed in 1934 and “rediscovered” in 1969, has no unpaired electrons, compared with the common atmospheric “triplet oxygen,” with two unpaired electrons.

“People asked me, does singlet oxygen occur in foods? It had never been found before.” Min investigated — and found it in soybean oil. The find was significant: “We must have published 30 to 40 papers on this,” he said. The properties of singlet oxygen explained some riddles of flavor reversion, but how did it form in the first place?

Min solved that puzzle, too. Unlike other oils, soybean oil contains chlorophyll. When Min removed it, nothing happened. But when he added it back and exposed the oil to light, the oil went bad. Min determined that when normal oxygen combines with chlorophyll and is exposed to light, singlet oxygen forms, producing flavor reversion.

All of a sudden, the answer was simple: Industry could easily remove chlorophyll by filtering soybean oil through diatomaceous earth, a natural medium. Flavor reversion became a problem of the past.

Min earned accolades for his pioneering work on singlet oxygen and lipids, which continues today. Current projects include:

» A $300,000 U.S. Department of Agriculture project to reduce trans fats in hydrogenated fat. Many food manufacturers that previously relied on hydrogenated fat have switched to oils for more healthful products. But hydrogenated fat remains much more economical, and Min and a colleague at Miami University believe they’ve found a way to make it more healthful, with room-temperature electronic hydrogenation. “Trans fatty acids form at high temperatures,” Min explained. “By conducting the electronic hydrogenation at room temperature, we can decrease trans fats significantly.”

”

» A project funded by Samsung Electronics to slow off-colors from forming on beef during refrigeration. Retailers and the beef industry lose an estimated $1 billion a year when raw beef experiences oxidation and turns gray or brown. Ohio State and Samsung Electronics are studying the effects of different levels of electrons, different times and temperatures of exposure, and different polarities to improve the beef quality during storage.

For more information:
David Min: min.2@osu.edu

Clean water. Nothing is more important, at least to Karen Mancl, researcher with the Ohio Agricultural Research and Development Center.

Mancl’s life work has been to help homeowners, businesses, and communities meet the high standards of the Clean Water Act. Her focus has been on rural on-site treatment, because traditional septic systems with leach fields often fail. Her workshops on alternative systems, such as bioreactors, can offer better results.

Bioreactors treat wastewater by filtering it through sand or other material containing microbes, which feast on the organic matter. Afterwards, the water can be disinfected with ultraviolet light or chlorine to remove any remaining pathogens.

In a current study, Mancl believes bioreactors hold promise for the city of Columbus, whose sewer system, like many across the United States, overflows with a sudden downpour or extreme snow melt. These overflows occur at about 100 points throughout the city, and, three to five times a year, allow untreated sewage into waterways.

In 2005, the city unveiled a 40-year, $2.6 billion plan to upgrade the system and prevent overflows.

“I think we might be able to fix at least part of the problem a lot faster, for a lot less money,” Mancl said.

In a $200,000 pilot project, Mancl is testing bioreactors that could be placed at one site to capture and treat overflows. If it works, bioreactors could be used throughout the sewer system.

In southwest Ohio, a bioreactor could save a family business and 120 jobs.

Since the 1930s, Kevin Kopp’s family has run Whitewater Processing Inc., a turkey processing facility in northwest Hamilton County. But Whitewater began facing a serious challenge in the 1990s when the Ohio Environmental Protection Agency questioned its wastewater treatment. The company slaughters and processes 6,000 to 8,000 turkeys each day and produces about 145,000 gallons of high-strength wastewater.

Mancl had just completed a study on how to treat high-fat wastewater from cheesemaking. The Whitewater waste contained fat, as well as protein and suspended solids.

“With our success from the cheesemaking facility, I was confident we could help,” Mancl said.

Working with Mancl and the Ohio EPA, Kopp received permission to install a bioreactor. The design was so simple that he and a friend built it themselves.

The pilot system treats just a few hundred gallons of water a day, but results appear promising. An initial test showed output with a BOD (biological oxygen demand) of 3, far below the EPA’s limit of 10. A low BOD indicates a low pollution level. Testing will take place through spring 2008.

If results meet expectations, Kopp will begin building a large bioreactor system to treat all of the facility’s wastewater—keeping his business open and 120 people employed.

For more information:
Karen Mancl: mancl.1@osu.edu
Soil Environment Technology Learning Lab: setll.osu.edu
Bug/off: OARDC uses latest genomics techniques to fight costly insect pests

Tiny proteins and genes — and not insecticide bottles or mom’s old fly swatter — hold the key to pest management in the not so distant future.

OARDC entomologists are using state-of-the-art genomics techniques and innovative research approaches to understand how insects survive and develop new pest control methods that are harmless to the environment.

OARDC scientist and National Academy of Science member David Denlinger has discovered that many insects living in northern climates such as Ohio’s employ a number of specialized proteins to survive the chilly months. These “heat-shock proteins” are turned on almost as soon as the temperature dips, helping insects stay alive during winter and make an unwelcome comeback in the spring.

With funding from the U.S. Department of Agriculture (USDA), the National Science Foundation, and the National Institutes of Health, Denlinger and colleagues studied this survival mechanism using the flesh fly as a model.

The team found 11 previously undiscovered genes that turn on heat-shock proteins during diapause — a hibernation-like state that insects enter when temperatures drop and in which they can stay for several months. Previously, scientists knew of only two such proteins that were activated in flesh flies during cooler weather.

Denlinger also analyzed the expression of one of those previously discovered heat-shock proteins, Hsp70, in five agricultural and forest pests that cause millions of dollars of damage every year: gypsy moth, European corn borer, walnut husk maggot, apple maggot, and tobacco hornworm.

While all of these insects were in diapause, Hsp70 was active. And when Denlinger’s team “knocked out” the Hsp70 gene that makes the heat-shock protein, they died at a low temperature of 5°F.

“There may be steps we can take to disrupt the diapause process and make an insect vulnerable to low temperatures,” Denlinger said.

Another way OARDC is using gene technology to combat insects is by creating highly effective biological controls. Parwinder Grewal leads an international project aimed at sequencing the genome of insect-parasitic nematodes — microscopic roundworms that kill a wide variety of pests.

Funded by the National Institutes of Health and USDA, the project could revolutionize biological control by boosting the effectiveness of nematodes as insect killers, increasing the number of their target pests and the environments where they could be applied, and making them cost-effective for use in high-acreage crops such as corn and cotton.

“Lots of research has been conducted to make nematodes commercially available,” Grewal explained, “but there are limitations that have kept them from going mainstream in the insecticide market. Genome sequencing will help us get rid of those hurdles.”

Among other things, this project will allow researchers to know the nematodes’ genes and their functions; identify nematodes with desired traits in the field; and develop transgenic nematodes that can be stored longer and are more virulent to pests, reducing their price significantly.

For more information:

David Denlinger: oardc.osu.edu/entomology/personnelsingle.asp?strid=154

Parwinder Grewal: oardc.osu.edu/entomology/personnelsingle.asp?strid=254
It’s All in the Basics: Genetics studies translate into better poultry, crops

In the era of high-tech agriculture, the success or failure of Ohio’s No. 1 industry is decided way before livestock and poultry are raised or grain fields are planted on farms across the Buckeye State — and it all happens within the four walls of a lab.

Researchers at the Ohio Agricultural Research and Development Center spend countless hours conducting the basic science needed to provide the state’s agricultural industry with high-performance, healthy food-producing animals and high-yield, disease-resistant crops that make all the difference come harvest time.

One example of this vital connection between basic research and end results is the work of animal scientist Sandra Velleman, whose groundbreaking studies in poultry genetics have found how muscle growth is regulated at the genetic level — ultimately leading to the breeding of birds that grow faster and exhibit commercially desirable meat characteristics, a big boost to Ohio’s $3.3 billion poultry industry.

“A one-percent increase in breast meat yield is worth $75 million to the U.S. poultry industry,” Velleman explained. “Thanks to this ongoing work in genetic selection, broilers now are ready for harvest 38–40 days after hatching, compared to 60–70 days 40 years ago. And turkeys are ready in 14 weeks, two less than in the 1960s and 1970s. And the birds are bigger, too.”

With eight turkey gene sequences published in the National Institutes of Health’s (NIH) GenBank, Velleman is an international authority on the extracellular matrix (ECM) and the satellite cells that lie just outside the muscle fiber. Her studies have shed light on how these cells help regulate muscle growth.

In her lab, Velleman analyzes genes known to be involved in muscle development, looking for molecules that have a role in different growth factors. The poultry industry, she said, hopes to use these genes as genetic markers for breeding. DNA microarrays allow her to scan thousands of genes at a time as she searches for novel genes that may participate in muscle growth at different stages of a bird’s life.

Basic research at the cellular and molecular level is also key to soybeans — Ohio’s No. 1 field crop commodity, generating over $1 billion to the agricultural industry every year.

Soybean production in Ohio is constantly threatened by Phytophthora root rot, which causes economic losses of up to $120 million in any given year. Plant pathologist Anne Dorrance leads a team that develops soybean varieties resistant to this devastating disease.

As a result of meticulous genetic experiments, Dorrance’s team has discovered a new and effective gene, Rps8, for Phytophthora resistance. OARDC has licensed germplasm carrying this gene to private industry, and varieties carrying Rps8 are expected to be on the market by 2010 — potentially helping farmers save millions through higher yields.

For more information:
Sandra Velleman: www.ag.ohio-state.edu/~ansci/showdetails.php?FID=50
Anne Dorrance: plantpath.osu.edu/faculty-and-staff/faculty/dorrance-anne-e
Highly publicized outbreaks of foodborne illnesses in the past few years—including the E. coli outbreak in spinach that sickened 199 people and killed three in 2006—have reminded us that food safety cannot be taken for granted.

That’s why OARDC researchers have stepped up research efforts to learn how such organisms infect food-producing animals and contaminate; how to more effectively communicate findings to growers, retailers, and consumers to reduce risk; and how to develop preventative tools such as vaccines to limit the number of people who get ill.

Microbiologist Jeff LeJeune leads several projects dealing with E. coli and food safety, which have recently received more than $4 million in funding from the U.S. Department of Agriculture.

One project focuses on working with small and medium-sized vegetable farms and with vegetable farmers who may be underserved, such as African-Americans or the Amish, in Ohio, Kentucky, and Indiana. This effort expands upon another study that seeks to reach larger commercial growers in Ohio. Both studies examine how contamination occurs and what can be done to remove it. And both were developed with direct input from Ohio produce growers.

“These produce-related outbreaks have been occurring for some time, but the spinach outbreak seemed to be a wake-up call,” LeJeune said. “Everyone started thinking more about what they could do better, about developing new standards and best management practices. But we need data to support those kinds of recommendations. People want to know what to do, and we need the research to be able to tell them what to do.”

A third project is looking at the relationship between wild birds—particularly the invasive, abundant, livestock feed-loving European starlings—and E. coli contamination on dairy farms. In this first-of-its-kind study, LeJeune and USDA experts are using radiotelemetry to track the birds’ movement and behavior coupled with DNA testing of E. coli subtypes from birds and cattle to determine patterns of infection. The goal: see to what degree wild birds contribute to the spread of pathogens and figure out ways to keep them off cattle-feeding areas.

Meanwhile, Gireesh Rajashekara—a colleague of LeJeune’s at the Food Animal Health Research Program—is zeroing in on Campylobacter, the leading bacterial disease responsible for gastroenteritis and diarrhea. He is working with chickens, the main source of Campylobacter contamination in people. The premise of this study is that by reducing the presence of the bacteria in chickens at the farm level, the risk of human infection will significantly decrease.

“We are using cellular imaging technology to find out which genes are responsible for Campylobacter colonization in poultry tissues,” Rajashekara said. “These genes can then be targeted to develop a vaccine or antimicrobial therapies for chickens and can serve as a model for human campylobacteriosis prevention and control tools, too.”

For more information:
Jeff LeJeune: www.oardc.ohio-state.edu/fahrp/people/faculty/lejeune.html
Gireesh Rajashekara: www.oardc.ohio-state.edu/fahrp/people/faculty/Gireesh.html

According to the U.S. Centers for Disease Control and Prevention (CDC), E. coli O157: H7 (one of hundreds of strains of the bacterium Escherichia coli) causes an estimated 73,000 cases of infection and 61 deaths in the United States each year.

Campylobacteriosis is responsible for $6 billion in losses due to medical care and missing work hours worldwide.
The Big Cheese: Ohio profits from researcher’s long experience

In 2000, with more than a half-century of dairy research behind him, W. James Harper focused his eye on Swiss cheese. His research has improved the ability of Swiss cheese manufacturers to produce a better tasting, better looking cheese for consumers, and has helped keep Ohio firmly at the top in U.S. Swiss cheese production. In 2006, the state produced 130 million pounds—up from just 10 million in 1970.

Harper, who started his Ohio State career in 1949, is a dairy industry icon. Recognizing his expertise, as well as Ohio’s preeminence in production, the national Swiss cheese Consortium moved its research base to Ohio State in 2000. Since then, Harper has helped Swiss cheese manufacturers enhance the flavor and characteristics that make their product unique.

In one major project, Harper’s team has collected, analyzed and catalogued dozens of strains of starter bacteria. Swiss cheese gets its characteristics from three types: *Streptococcus thermophilus*, *Lactobacillus helveticus*, and *Propionibacterium freudenreichii*. However, cheese manufacturers, which purchase these bacteria from starter-culture companies, don’t always get what they expect, because different strains of the same bacteria can behave differently. The outcome can mean surprising results in the final product — and substantial losses.

“We can take an unknown strain that a cheese manufacturer has gotten from a starter company, and identify it from our library,” said Harper. For example, some strains of *Propionibacterium* permit cracks to develop in a block of Swiss cheese as gases form its characteristic holes. Cracks and splits considerably reduce value, so identifying the exact strain assures manufacturers they are one step closer to a high-quality product.

The effort is proving its worth in other ways, too. Harper is working with four companies to test different combinations of starter bacteria strains to enhance their products’ flavor. “It’s heartening to see that what we’ve done in the lab and the pilot plant is being applied to commercial manufacturing,” Harper said.

Harper’s team has also developed a rapid system to analyze starter cultures, reducing the time needed from several days to 30 seconds. Assistant Professor Luis Rodriguez-Saona perfected the technique, known as FTIR (fourier transform infrared) spectroscopy. It has replaced more expensive traditional methods involving cell morphology, biochemical tests and molecular typing.

Rodriguez-Saona also developed a technique to use the technology to examine cheese protein and fatty acids during ripening. The method is so accurate that it could become a primary support to flavor analyses conducted by nationally recognized panels at North Carolina State University, Harper said.

Harper, who officially retired and earned emeritus status in 1981, became the Parker Chair in Dairy Foods in 1992. “I’ve been working on cheese forever,” he said. And he has no plans to stop anytime soon. “There are too many interesting things to work on.”

For more information:

W. James Harper: harper.9@osu.edu
OARDC and the Ohio BioProducts Innovation Center (OBIC) are making important investments in an effort to lead academia and industry in a new “race to the moon”: one that will revolutionize the way we make and look at products such as plastics and paints.

A unique university-industry alliance created in 2005 by an $11.5 million Third Frontier award, OBIC is bringing together Ohio’s two largest industries — agriculture and the chemicals, polymers, and rubber materials sector — to create a new generation of industrial materials made from Ohio-grown crops and other renewable sources instead of foreign oil. Ohio is No. 1 in polymers in the United States. “Biobased polymers are primary sources of innovation for Ohio’s polymer industry — essential for the state’s economic future,” said Wayne Earley, president of Polymer Ohio, Inc.

One example of how OBIC is helping drive the Buckeye State’s biobased engine is its soybean platform. Ohio’s No. 1 field crop, soybeans promise to be an excellent source for anything from lubricants to powder coatings to ink toners.

Ohio-based companies such as Ashland, Sherwin-Williams, and Hexion — only a few of OBIC’s industry partners — are interested in using soybean oil instead of fossil oil, but not all soybean varieties are created equal in terms of yield, disease resistance, and specific traits needed for different specialty materials and industrial markets.

That’s where OARDC’s genetics research and breeding comes in. With guidance from the Ohio Soybean Council, OBIC has made significant investments to support facilities and researchers involved in the development of soybean varieties targeted for industrial use. These include the purchase of a $500,000, state-of-the-art genome analyzer for OARDC’s Molecular and Cellular Imaging Center (MCIC), which has been assisting soybean breeders in using genetic marker technology to identify genes that carry specific characteristics.

“Soy oil would be a better raw material if its fatty acid composition were changed somewhat. These changes can be made genetically,” soybean breeder Steve St. Martin said. “We are working on developing varieties that incorporate genes for modified fatty-acid profile. Thanks to marker technology, we can actually pick out genes we are trying to transfer and quickly identify which plants exhibit those genes.”

The new equipment, MCIC Director Tea Meulia explained, will help researchers find genetic markers much faster. How much? “We will go from being able to analyze 480,000 bases (gene components) in three days to 1 billion bases in the same period of time,” she said. “That’s 15,000 times faster than when MCIC opened six years ago.”

Columbus-based Battelle Memorial Institute — a key OBIC partner — is already analyzing soybean oil samples from varieties St. Martin and colleagues recently released. One of the varieties yields low linolenic acid soybean oil, which is healthier to use for cooking and also highly promising for industrial applications.

OBIC has also contributed $1.2 million toward the completion of a state-of-the-art Feedstock Processing Research Facility on OARDC’s Wooster campus, which will have the capabilities to perform the initial stages of processing or biorefining the raw product — a key to the development of renewable products.

For more information:
OBIC: bioproducts.osu.edu
Slowing Global Warming: Land-use change and ag management play critical role

As the demand for ethanol—an alternative biofuel to petroleum—increases worldwide, so do the challenges of balancing agricultural production with environmental conservation. Ohio State University researchers with the Ohio Agricultural Research and Development Center have been leading long-term efforts to identify the impacts of deforestation on carbon storage in trees and soils, and atmospheric carbon emissions—with the loss of the former and the increase of the latter as suggested causes of global warming.

Brent Sohngen, an environmental economist with OARDC and OSU Extension, has spent nearly a decade exploring the magnitude of carbon lost to deforestation and offering ways for farmers to maintain forested land rather than converting it to agriculture. The greatest threat to deforestation is in tropical areas, where 37 percent of the world’s carbon is stored and where lack of money and resources force the conversion of forests to crops or pasture.

“Every year, land the size of Ohio is stripped of its trees. As ethanol becomes more of a global commodity as a biofuel, that deforestation will increase,” said Sohngen. Through economic models, Sohngen has offered alternatives to deforestation. One option is to pay farmers to practice carbon sequestration—an effort that could be more valuable than converting the land for other uses. He has written international standards for voluntary carbon market participation.

“Many farmers convert forested land to pastures for grazing. Grazing values are very low, anywhere from $20 to $30 per hectare per year,” said Sohngen. “Forests of relative size could be storing 100 to 150 tons of carbon and with a carbon trading price of $10 per ton per year, with 50 cent rental land values, you would be looking at $50 per hectare per year to keep land forested.”

Another option is to bolster the economy so government authorities can enforce deforestation laws—already on the books, but generally not adhered to.

“Without these economic estimates, most policy makers believe that the costs of climate policy are very high, and that the only alternatives involve changing the energy system and geological sequestration,” said Sohngen. “It’s much easier and cheaper to stop the action of deforestation than it is to change to a new energy system.”

Due to Sohngen’s economic efforts, legislative proposals to slow global warming have shifted to addressing more land use options than in the past.

“The entire Kyoto negotiations post 1997 ignored soil carbon and virtually eliminated land use options from consideration,” said Sohngen. “Now there is more interest in focusing on the landscape.”

Sohngen is a contributing author of the Intergovernmental Panel on Climate Change (IPCC), which strives to address climate change and its potential impacts based on scientific, technical, and socio-economic information. IPCC shares half of the 2007 Nobel Peace Prize with former U.S. Vice President Al Gore.

For more information:
Brent Sohngen: aede.osu.edu/people/sohngen.1/
IPM in Developing Countries
Fights Hunger, Poverty: Opens door to more U.S. exports

Small farms in southern and southeastern Asia can make more money and use fewer pesticides by growing vegetables, not rice. But a range of hurdles, including pests, diseases, and inadequate training, combine to limit production. India, for instance, annually loses one-fifth to one-third of its total fruit and vegetable harvest to these and related problems, says the Nutrition Foundation of India.

The losses mean more than lost potential income, though making more money would certainly help many small farmers rise out of poverty. The losses mean malnutrition for some and sometimes even starvation.

That’s why a program funded by the U.S. Agency for International Development (USAID), with Sally Miller, an international expert on vegetable-crop diseases with the Ohio Agricultural Research and Development Center, is taking steps to stop them.

For a project under USAID’s Integrated Pest Management Collaborative Research Support Program (IPM CRSP), Miller and colleagues work with vegetable growers in a region stretching from Nepal in the Himalayas to southern India to Bangladesh. Miller’s experience is invaluable; in Ohio she develops better ways to manage vegetable-crop diseases, especially in high-value peppers, tomatoes, and salad crops.

The program and Miller’s project center on Integrated Pest Management, or IPM, a strategy that uses an array of methods — cultural practices, beneficial insects, resistant varieties, and more — to protect crops and use fewer pesticides.

Project leader Ed Rajotte of Pennsylvania State University said vegetables, especially those grown near cities, “provide a marked increase in income for the farmer compared with traditional broad-acre crops such as rice.”

Indeed, one study shows that in Bangladesh, vegetables earn 29 percent more net income than other crops, and in South Vietnam, 189 percent more. Vegetable production also provides three times as many jobs per acre as rice does, helps grow businesses, and creates new economic opportunities, says a report by the Asian Vegetable Research and Development Centre, Taiwan.

And Ohio and the U.S. can benefit too — and represent good reasons for OARDC to be involved. The International Food Policy Research Institute finds, for example, that each $1 increase in a developing country’s farm output leads to 73 cents in new imports by that country — imports “captured largely by countries that supported (the) growth with aid” — while each $1 of aid invested in international agricultural research generates 29 cents more in imports by developing countries.

In April, Miller hosted plant-disease scientists from 12 developing countries, including Africa and Central America, on OARDC’s Wooster campus. The scientists received training in diagnostic procedures, part of a broader effort called the International Plant Diagnostic Network. Funded by USAID and led by Ohio State, the project, Miller said, organizes scientists in developed and developing countries into “a communications and data-sharing network to improve plant disease diagnostic capacity.”

Science, it seems, in more ways than one, is making developing countries greener.

For more information:
Sally Miller: miller.769@osu.edu
As ethanol demand increases, harvesting corn stover (plant residue) as a source of energy is becoming more popular. However, studies have shown that removing residue from the soil surface can cause carbon loss to the atmosphere—a suggested contributor to global warming.

But there is a way of balancing green energy initiatives with environmental conservation, and Ohio State University soil scientists have discovered how.

Humberto Blanco, a soil scientist with the Ohio Agricultural Research and Development Center, has been studying the impacts of removing corn stover on soil carbon levels. The goal of the research is to determine how much residue can be removed from fields without having an impact on carbon storage, soil quality, and other agricultural processes.

He found that, in certain instances, stover removal rates as low as 25 percent reduced soil organic carbon and degraded soil structure within as little as one year. And the more residue that was removed, the more soil carbon was lost.

Blanco suggests that the impact of corn stover removal is dependent upon soil and terrain characteristics, such as clay content, drainage, and slope gradient.

“Corn stover removal had more of an adverse impact in silt-loam soils on undulating terrains than in clay soils on flat terrain,” said Blanco. “Sloping and erosion-prone soils are impacted the greatest, which suggest these soil types should not be targeted for residue-removal, or just a fraction of stover might be available for removal.”

Removal rates of more than 25 percent in sloping soils significantly reduced soil carbon concentrations, while as much as 75 percent of corn stover might be removed from clay soils over three to five years before having a negative impact on soil carbon content. Thus, in sloping lands and erodible soils only about 25 percent of corn stover may be available for removal.

“The results of the study suggest that, although corn stover can be removed and used in ethanol production, it shouldn’t be the only source of energy. It’s important to seek other energy alternatives,” said Blanco.

Researchers are also investigating the use of other crops for ethanol production. OARDC soil scientist Rattan Lal, director of the Carbon Management and Sequestration Center, is studying the production performance and economic feasibility of switchgrass in Ohio.

For more information:
Humberto Blanco: blanco.16@osu.edu

Switchgrass is an ethanol-alternative to field crops. Soil scientist Rattan Lal is studying production feasibility for Ohio.

Removing corn residue for ethanol: how much is too much? Soil scientist Humberto Blanco says removing as little as 25 percent residue can impact soil carbon and degrade soil quality.

“Corn stover removal had more of an adverse impact in silt-loam soils on undulating terrains than in clay soils on flat terrain.”
— Humberto Blanco
OARDC Technology: Allows us to see the big—and very small—picture of agriculture, conservation, urban planning

OARDC researchers are using state-of-the-art technology and innovative software to study things as big as the entire state of Ohio and as small as the tiniest components of a gene—a combination that is key for advancing crop-breeding programs, revolutionizing food safety research, and understanding the dynamics of soils to aid in conservation and urban planning.

Tomatoes: Crop scientist Esther van der Knaap has developed—with assistance from Ohio State’s Department of Computer Science and Engineering and the College of Wooster, and funding from the National Science Foundation—a unique software tool that allows the objective measurement of the shape and color of vegetables.

The Tomato Analyzer—which can also measure other vegetables such as peppers and squash—has become an essential tool for ongoing research looking into the effects on fruit shape and size of different regions of the tomato genome. This research can lead to the development of new varieties, helping growers to serve specialty markets and processors to reduce costs. The technology is also useful for the study of color disorders that can affect as much as 65 percent of Ohio’s processing tomato crop. Tomato production is a $100 million industry in Ohio.

“This software will allow breeders and companies to analyze varieties, calculate shape features, and characterize each variety with numerical values that will help standardize how we measure fruits,” van der Knaap said.

Food safety: OARDC has invested in an in-vivo imaging system that lets researchers visualize—in real-time—how harmful bacteria infects live animals.

Food-animal health specialist Gireesh Rajashekara is using this equipment to study Campylobacter jejuni, a leading cause of foodborne illness in humans that is very prevalent in chickens. Aided by a glowing gene, the imaging system maps out the progression of bacterial infection, allowing researchers to track mutations and pinpoint which genes are responsible for the spread of the disease—which can lead to the development of animal and human vaccines.

Soils: Another example of how OARDC technology is positively impacting the citizens of Ohio is the recent digitization of soil surveys for all counties in the state. In collaboration with the Ohio Department of Natural Resources (ODNR) and the Natural Resources Conservation Service (NRCS), OARDC researchers in the School of Environment and Natural Resources inventoried and categorized large amounts of hard-copy data and transferred it to a digital platform that can now be accessed online or through a CD-ROM.

Easy access to digitized soil spatial data will help growers make better land- and crop-management decisions and allow contractors to select the appropriate site for various types of constructions and reduce their environmental impact.

“Expanding access to this information will benefit everyone, from regulators to farmers using precision agriculture to builders looking to install the appropriate on-site wastewater treatment,” soil scientist Brian Slater said.

For more information on the tomato analyzer: oardc.osu.edu/vanderknaap/tomato_analyzer.htm

For more information on food safety: www.oardc.ohio-state.edu/fahrp/people/faculty/Gireesh.html
Next-door Land Use Affects Birds in Forests: How much buffer is enough along rivers?

Traditionally, land managers have used the width of a riparian forest — how far back the forest extends from the sides of the river or stream that it borders — to gauge the health of the ecosystem and decide how much of the forest to conserve. Wider was seen as better.

Now the view is less narrow. Or should be, according to a study by Amanda Rodewald, Ohio Agricultural Research and Development Center wildlife ecologist. Birds, forests, and people stand to gain.

“Land managers should carefully consider the potential impacts of current and anticipated future land uses surrounding forest remnants,” she said. “This is particularly important in urbanizing, fragmented landscapes, where conservationists and developers typically target the same areas for action.”

The land surrounding a streamside, or riparian, forest — whether that land is farm, city, or something in between — determines which birds nest in that forest more than the width of the forest itself.

Rodewald, who sampled bird communities in 33 central Ohio riparian forests found that differences in the next-door landscape accounted for nearly all — more than 94 percent — of the explained variation among those communities.

Specifically, the study reported fewer neotropical migrants — birdwatcher favorites such as the scarlet tanager and Baltimore orioles, which breed in spring and summer in Ohio and winter in South and Central America — as adjacent urban development increased, while the numbers of year-round residents and short-distance migrants — blackbirds, cardinals, chickadees, others — rose with it, possibly due to bird feeders, warmer winter temperatures or both.

A variety of local habitat factors, such as native trees and shrubs, can have big effects on birds.

But this study showed that land use surrounding a riparian forest has big effects, too.

The type of adjacent land use, including roads and commercial and residential development, strongly affects a riparian forest’s value to bird communities, Rodewald said.

“The traditional management paradigm for conserving riparian forests — maximizing forest width — is not sufficient to ensure that the forests serve the ecological roles often intended by managers and conservationists,” she said. “Our results suggest that even wide riparian forests are vulnerable to influences from surrounding land uses, and the conservation community should aim to establish low-development buffers around riparian forests.”

A report by the Ohio Legislative Service Commission calls Ohio one of the most urban and rapidly urbanizing states in the nation, ranking seventh in total acres of developed land and, from 1992 to 1997, having one of the top 10 fastest urbanization rates.

Keeping forests healthy, Rodewald said, “ultimately will require more complex conservation planning and land-acquisition strategies involving a variety of partners concerned with the social and ecological values of riparian forests.”

For more information:
Amanda Rodewald: rodewald.1@osu.edu
Terrestrial Wildlife Ecology Laboratory: twel.osu.edu/
As the research arm of The Ohio State University’s College of Food, Agricultural, and Environmental Sciences, the Ohio Agricultural Research and Development Center (OARDC) employs nearly 650 scientists and staff members throughout the state, conducting research that benefits all Ohioans. OARDC’s Wooster campus is the largest agbioscience research facility in the United States, and OARDC scientists work closely with researchers in Ohio State’s Colleges of Education and Human Ecology, Medicine and Public Health, Veterinary Medicine, Biological Sciences, and Engineering.

At any given time, OARDC scientists are engaged in more than 400 research projects in the areas of agricultural, environmental, and development economics; food, agricultural, and biological engineering; animal sciences; entomology; food animal health; food science and technology; horticulture and crop science; human and community resource development; human ecology; natural resources; and plant pathology. OARDC also trains graduate students in each of these areas.

The Ohio General Assembly established OARDC as the Ohio Agricultural Experiment Station in 1882. Since its founding, OARDC has been a leader in research that makes a difference for Ohioans and for the world.

OARDC is supported by a line-item appropriation from the Ohio General Assembly, competitive grants, gifts, contracts, federal grants, and other sources. OARDC uses these funds to provide direct research support and economic development for Ohio’s annual $90+ billion agbioscience industry. OARDC receives no funding from student tuition at The Ohio State University, nor is it supported by the higher education subsidy.

OARDC is...

- Nationally ranked in the top 10 in terms of research cited.
- The largest and most comprehensive agricultural research facility in the United States.
- Credited with more than 30% of all royalty income for The Ohio State University.
- Involved in annual collaborations with more than 130 businesses throughout the world.
- Credited with a 110% increase in grants and industry support for its scientists since 2001.
- Some 230 scientists conducting more than 400 research projects annually.
- A generator of more than $1 billion of annual economic impact and cost savings to Ohio and the United States.