futures

MICHIGAN AGRICULTURAL EXPERIMENT STATION

SPRING/SUMMER 2007
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Fisheries & Wildlife Research:

Protecting & Managing Natural Resources

looking into futures

Valuing, Protecting and Managing Michigan's Natural Resources

Five Great Lakes.

Forests.

Streams, rivers and wetlands.

One of the most productive fisheries in the country.

Grasslands.

Wildlife, including a rattlesnake, moose and elk.

Like Michigan's amazing array of natural resources, the fisheries and wildlife research projects funded by the Michigan Agricultural Experiment Station are impressive in their breadth as well as depth.

In this double issue of *Futures*, you can read about MAES fisheries and wildlife scientists who are studying ecosystems, white-tailed deer, butterflies and cherry orchards, and almost everything in between that has to do with natural resources.

MAES scientists Kelly Millenbah, Rique Campa and Shawn Riley have a number of projects examining the interactions among ecosystems, wildlife and human management. The goal is to help the state create natural resources management programs and policies that ensure that all users get what they need. Millenbah is also associate director of the Environmental Science and Policy Program at MSU, where she helps recruit future researchers and teachers into the doctoral specialization.

William Taylor, chairperson of the Department of Fisheries and Wildlife, has spent a large part of his career studying fisheries ecosystems. He was also one of the architects of the PERM (Partnership for Ecosystem Research and Management) program, a unique partnership between MSU and the Michigan Department of Natural Resources (DNR) Fisheries, Wildlife, and Forest, Mineral and Fire Management divisions, as well as the Great Lakes Fishery Commission and the Great Lakes Science Center.

Many people consider invasive species to be the most problematic issue facing natural resources. After painstaking work to identify the pheromone that allows sea lampreys to communicate with one another, MAES scientist Weiming Li is now working to create a synthetic version that looks very promising as a control method for the destructive parasites.

About 15 years ago, DNA testing was expensive and time-consuming. It was used only in cases considered extremely important: murder, paternity and diagnosis of rare illnesses. Today, DNA testing has gone to the dogs — and cats, deer, fowl and fish. MAES population geneticist Kim Scribner uses genetic markers to identify poached game, manage fish populations and design hunting seasons.

A Michigan State fisheries and wildlife alumna, DNR Director Rebecca Humphries talks with Futures about research partnerships with MSU, as well as long-term conservation efforts and the most pressing issues facing the DNR.

We hope you enjoy this issue of *Futures* and that it helps you understand a little more about the Michigan Agricultural Experiment Station and the research it funds. If you have comments about this issue or would like to subscribe (it's free!), send a note to *Futures* Editor, 109 Agriculture Hall, Michigan State University, East Lansing, MI 48824-1039, or send an e-mail to depolo@msu.edu. You can also call 517-355-0123.

For the latest information about MAES research and events, I invite you to subscribe to the free MAES e-mail newsletter. Sign up by visiting the MAES Web site at www.maes.msu.edu/news.htm. You also can view this and past issues of *Futures* on the Web site by clicking on the "research publications" tab.

::: *Jamie DePolo*

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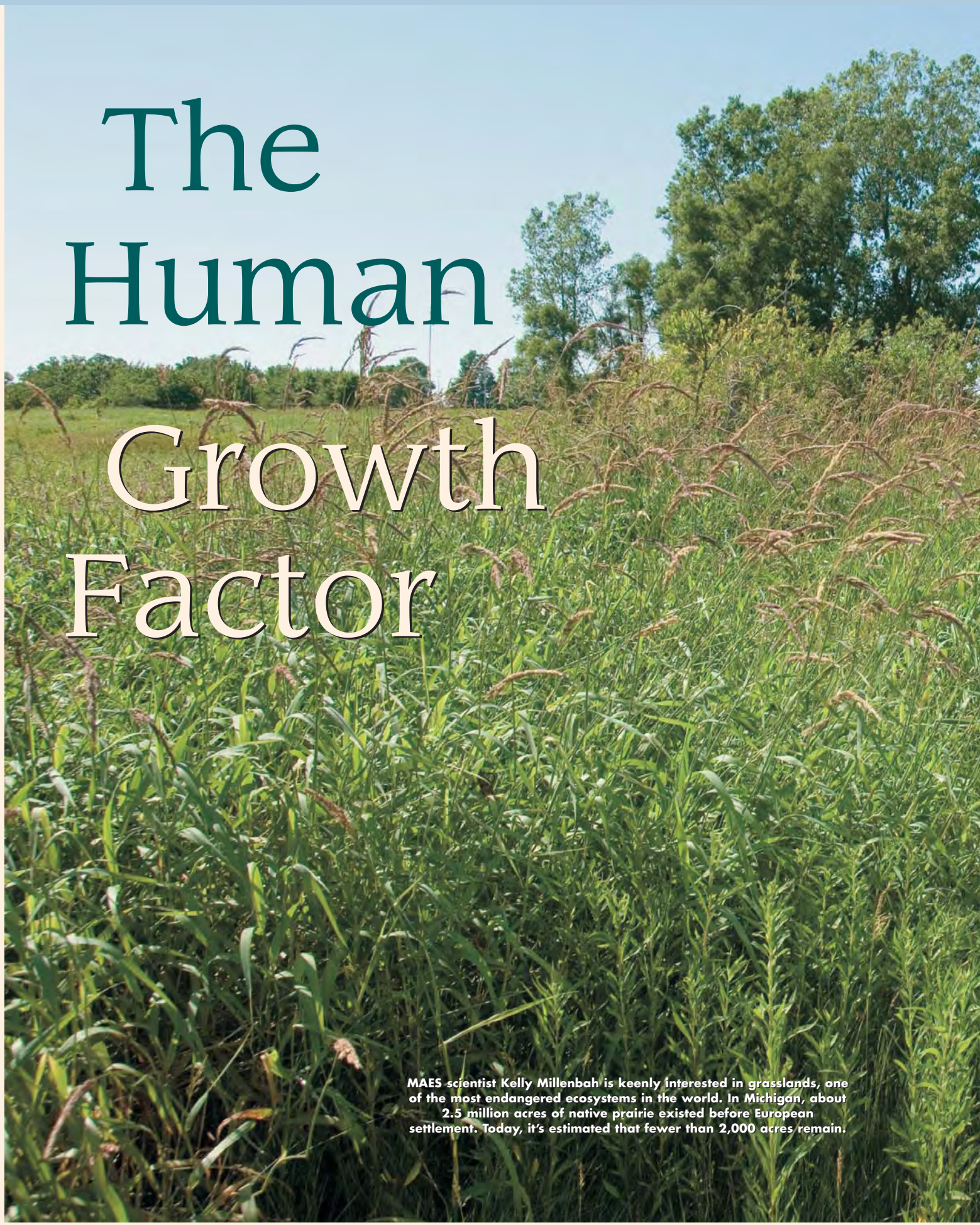
The Human Growth Factor



MAES scientist Kelly Millenbah is keenly interested in grasslands, one of the most endangered ecosystems in the world. In Michigan, about 2.5 million acres of native prairie existed before European settlement. Today, it's estimated that fewer than 2,000 acres remain.

What happens to Michigan's plants and animals when people move in and start managing them?

Hundreds of acres of forests, prairies, streams and wetlands, encircled by the spectacular beauty of the five Great Lakes and all the wildlife they support and shelter. To many people, Michigan's natural resources are the state's most powerful attraction and its strongest asset, supporting a number of tourism and recreation industries.

The state has a number of policies and programs in place aimed at managing, conserving and protecting Michigan's diverse populations of flora and fauna. But how should the success of these policies be measured? Is the answer tied to the number of acres affected and how long they may be enrolled in conservation programs? Or is success linked to how long the acreage can remain undeveloped and support the same plants and creatures? Should biodiversity be considered? How does wildlife respond to changing landscapes? What if a conservation area attracts large numbers of creatures to an area — white-tailed deer for example — and then the deer cause damage to nearby landscapes? Is that successful? Ultimately, what do people expect from the land and the wildlife? And how willing are they to participate in the management programs?

To help the state answer these questions and assess and refine its policies, several MAES fisheries and wildlife scientists have studied state conservation and management programs to create objective measurement parameters.

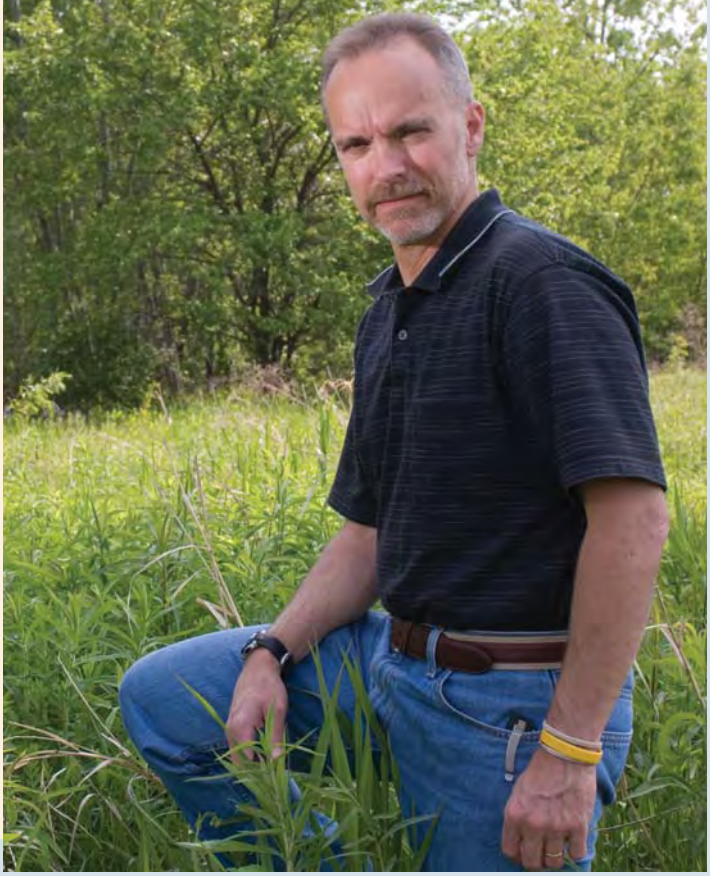
"Many of the areas in state and federal reserve programs are presumed to be vital components in the conservation of biodiversity throughout the state," said Kelly Millenbah, MAES fisheries and wildlife scientist and associate director of the Environmental Science and Policy Program. "Whether these areas provide distinct ecological values to the landscape isn't always understood."

Millenbah and MAES fisheries and wildlife scientists Henry "Rique" Campa and Shawn Riley are working on a number of projects to provide more information to state departments and officials about conservation policies. In some cases, the scientists are assessing public willingness to participate in the programs, as well as what people expect from the programs.

"Deer are a good example of the range of opinions that can surround conservation programs," Campa said. "Some people like to hunt deer, and some people like to see deer in the woods and around their homes. Other people think deer are a nuisance and are concerned about them spreading disease and damaging crops, as well as deer-vehicle accidents. By collecting deer habitat and population demographic data important for deer management programs, we can give the state agencies a scientific basis on which to assess the management programs and make future decisions."

More Hospitable Habitat for Wildlife?

The Conservation Reserve Program (CRP) and the Conservation Reserve Enhancement Program (CREP) are two conservation programs administered by the Farm Service Agency of the U.S. Department of Agriculture. Both programs offer landowners economic incentives to voluntarily retire land from agricultural production. The goals of the programs are to reduce soil erosion, enhance water quality, sequester carbon, protect wetlands, and expand and improve wildlife habitat.



Rique Campa, MAES fisheries and wildlife researcher, is studying a number of wildlife-ecosystem management issues, including those related to white-tailed deer and eastern massasauga rattlesnakes.

According to federal statistics, Michigan had 271,730 acres enrolled in the CRP and CREP in 2006.

"Once the acreage is enrolled in CRP or CREP, the land can't be worked in an agricultural sense," Millenbah explained. "Depending on which county the land is in, there are different interpretations of what 'out of production' means. The land can

Kelly Millenbah

Training Future Environmental Researchers and Teachers

Besides her research and teaching responsibilities, Kelly Millenbah also serves as associate director of the Environmental Science and Policy Program (ESPP), where she's primarily responsible for the ESPP graduate and fellowship programs.

Led by Tom Dietz, assistant vice president for environmental research, the ESPP was created in 2003 as an umbrella organization for all the outstanding environmental science and policy research, education and outreach taking place at MSU. The ESPP fosters collaboration across MSU departments to address complex environmental issues facing the state, the country and the world. By taking a decentralized approach, the ESPP aims to respond quickly to emerging issues.

"The ESPP idea is to integrate the natural sciences with the social sciences," Millenbah explained. "We want our graduate students to speak both languages so they can work effectively in interdisciplinary teams."

In the ESPP doctoral specialization, students pursue their degrees in a program with an environmental focus. In addition, they complete the specialization in environmental science and policy coursework. Each specialization course is designed to provide an understanding of how various disciplines conceptualize environmental issues and how scientific information can be brought to bear on environmental decision making and environmental policy.

"My role includes recruiting students into the Ph.D. special-

be leased to hunters, and Pheasants Forever is a big supporter of the programs. In some counties, owners are allowed to mow the fields, but they can't sell what they mow."

Millenbah is keenly interested in grasslands, one of the most endangered ecosystems in the world. Since the Europeans settled in North America, native grasslands have declined severely, primarily because the land was converted to agricultural use. In Michigan, experts estimate that about 2.5 million acres of native prairie (a type of grassland) existed before European settlement, mostly in the southern Lower Peninsula. Today it's estimated that fewer than 2,000 acres remain. According to Millenbah, the disappearance of the grasslands has caused declines in many plants and animals, most notably bird populations.

Working with Campa, other MSU scientists and representatives of the Michigan Department of Natural Resources (DNR) Wildlife Division, Millenbah has studied the vegetative makeup of CRP and CREP lands, as well as numbers and types of birds. The CRP study was completed several years ago; the CREP study is ongoing.

"One of the issues we focused on was finding out if there were any differences between native and non-native grasses for wildlife," Millenbah explained. "Many of the CRP lands were planted with non-native grasses; many of the CREP lands used native grasses."

The scientists found that the non-native grasses didn't support what they called "priority land birds" — birds such as the western meadowlark and grasshopper sparrow, which are classified as "species of special concern." These birds don't have legal protection under the Endangered Species Act, but their populations are dwindling, and if they continue to decline, they would be recommended for threatened or endangered status.

Both of the programs have helped increase grassland acreage in the state, and bird populations on the fields increased the longer the fields were in the program, though younger fields had more diverse species than older fields. Younger grasslands are more likely to have more diverse vegetation, which would attract a wider array of birds. Millenbah explained that grasslands are disturbance systems — they need a big event to happen every 3 to 4 years to keep them healthy and productive.

"Preferably, it would be fire," she said, "but we don't have a lot of burning in Michigan. Landowners can mow or disc the field to disturb it, but neither of those options is quite as good as burning."

The study marked the first time science had attempted to put a value on the conservation lands.

"A paper from the CRP study received the publication of the year award from The Wildlife Society," Campa said. "The decision makers in Washington, D.C., were very interested in the results and used them when writing previous Farm Bills."

Millenbah and her colleagues are also evaluating Michigan state game and wildlife areas to assess their value as conservation resources. Because the lands are owned by the state, they're managed differently than CRP and CREP lands. Some areas are actually farmed, though most parcels are managed to promote specific plant or animal species. In state game areas, hunting is the major intended land use. State wildlife areas include both hunting and the conservation or protection of wildlife as the major intended land use. State fish and wildlife areas have fishing/hunting and conservation or protection of fish and wildlife as the major intended land use.

Using the Michigan Wildlife Action Plan as a framework, the DNR works with other state, federal and tribal agencies, and with local governments, conservation organizations, universities, private landowners and other interested individuals to manage these lands. The goal is to create a long-term holistic approach to wildlife conservation.

"The DNR wanted to know if state game and wildlife areas strong academically but who also can clearly articulate their potential for integrated work in issues related to the environment."

For more information on the ESPP Ph.D. specialization, visit: http://www.environment.msu.edu/specialization/.

::: Jamie DePolo

ization program, as well as recruiting faculty members to teach the specialization courses," Millenbah said.

Currently the program has 25 students, and the courses feature teams of professors from across the university. The courses focus on:

- The physical, chemical and biological processes in the environment.
- Human systems and environmental change at multiple scales, from local to global.
- Commonly used methods for integrating scientific information into a form that is useful for decision making.
- An experiential opportunity to apply knowledge learned in previous ESPP courses.

The ESPP also offers fellowships to students who plan to enroll in the Ph.D. specialization program; each fellowship provides 2 years of support, with an additional 2 years guaranteed by the student's home department.

"We want to attract the strongest possible students interested in doctoral work on the environment," Millenbah said. "The fellowships are competitive. We're looking for students who are

Tom Dietz

look better to wildlife, compared with private land," Millenbah said. "Our results show that there is no difference between state and private lands for a number of variables."

In this study, Millenbah used numbers and diversity of reptiles and amphibians as markers to assess habitat quality.

"Reptiles and amphibians are sensitive to environmental conditions and are good indicators of habitat quality," she said. "They're very sensitive to environmental changes.

"What we want to do," she continued, "is give the DNR sound science on which to base management decisions. The DNR can then compare management techniques and decide which will be the best for what it wants to accomplish."

Terms of Endearment

Alternately reviled as a nuisance that causes crop damage and spreads disease or revered as a symbol of Michigan's great outdoors and a prized hunting trophy, the white-tailed deer seems incapable of sparking indifference. In 2005, the DNR estimated Michigan's deer population to be about 1.7 million, with more than half of the animals located in the southern Lower Peninsula.

"People perceive deer as an indicator of ecosystem health, which factors into their quality of life," MAES fisheries and wildlife scientist Shawn Riley explained. "Most people have a higher tolerance for crop damage from deer than for deer-vehicle collisions. That's because crop damage is something that is occurring to a shrinking number of commercial farmers. In contrast, people in rural areas who commute to work on roads originally designed to haul agricultural products to market have a relatively high probability of experiencing a deer-vehicle collision."

"We've got changing landscapes and habitat conditions, diverse stakeholders and different perceptions of what should be classified as a severe problem or an incidental nuisance," Campa explained. "State officials want to know what they should do about 'the deer problem,' but no two people define 'the deer problem' the same way. Illinois, South Dakota, Nebraska and Wisconsin are all grappling with the same issues."

Though the states faced similar deer issues, no one had ever thought to examine deer from a multistate perspective until Campa, Riley and Scott Winterstein, MAES fisheries and wildlife scientist, decided that a broader approach could help all involved.

"We're looking at deer and how they interact with the landscape and how various landscapes affect deer population dynamics and how they select habitat," Campa explained. "We're also looking at how willing people are to participate in management projects and their attitudes toward deer."

Investigators on the multistate project are collecting standardized data — meaning that the information is collected at the same time, in the same way and under the same conditions in each state.

"Historically, this hasn't been done for deer," Campa said. "But it makes sense. Deer are a species that attracts a lot of attention."

The scientists' preliminary results have found that deer biology is different in various areas of the states being studied. This may indicate that management programs need to be finely tailored to the various landscapes that deer inhabit. For example, deer in Michigan's Upper Peninsula and northern Lower Peninsula frequently migrate to "deer yards" — places where groups of deer gather for food and shelter during harsh winter months. In the southern Lower Peninsula, deer don't seem to migrate and make smaller movements, but they do tend to seek out nearby agricultural fields, mixed hardwood forests and developed areas for food and shelter.

Working Together to Protect Endangered Species

MAES scientist Kelly Millenbah also has applied her habitat management research to agriculture. She's partnered with cherry growers and natural resources agencies and organizations to help identify how agricultural practices may interact with the habitats of endangered species in Michigan.

When the experimental use of a pesticide was planned for cherry trees in Oceana County in 2003, the Environmental Protection Agency (EPA) asked for information on any endangered species in the area. The pesticide in question was considered harmful to the Karner blue butterfly, an endangered species that lives in the county. So the EPA rejected the experimental use request.

Millenbah, along with MAES entomologists Mark Whalon and Larry Olsen, and Gary Roloff, visiting assistant professor of fisheries and wildlife, saw the situation as an opportunity to be proactive.

"It was a chance to support the production of quality crops and encourage endangered species conservation," she said.

PHOTO: U.S. FOREST SERVICE IMAGE DATABASE

Karner blue butterfly

"Our project took all the variables of habitat suitable for the state's endangered species, created maps of where the species might be in the state, and then layered those endangered species maps over the locations of the cherry orchards."

Phil Korson, executive director of the Michigan Cherry Committee, said cherry growers had filed for a special environmentally friendly label for the pesticide, which was new, more

MAES scientist Shawn Riley *(near left)* and graduate student Rebecca Christoffel *(far left, holding snake)* have begun a campaign to change people's perceptions of the eastern massasauga rattlesnake. Though the snake is timid and poses little threat to people, the perception is that the massasauga is dangerous.

"As with the CREP and CRP study, the goal is to give managers sound scientific data on which to base their decisions," Campa said. "Hunters, farmers, homeowners, drivers, small business owners and just about everyone else all have perceptions of deer. The managers have to take all those into account, as well as the deer's needs."

Hisssss-torically Hated

Michigan is home to only one venomous snake, the shy, sluggish eastern massasauga rattlesnake, a snake so shy that it prefers to vacate the area when it feels threatened rather than stand its ground. Though it poses little threat to most people (the few bites that do happen each year are usually the result of someone trying to antagonize or kill a snake), Riley's research has shown that people's perception is that the risk posed by the snake is very high.

"Michigan is one of the last strongholds for the eastern massasauga," Riley explained. "The snake is listed as a species of special concern in Michigan because its numbers and habitat have been steadily declining. We expect it to be endangered soon.

efficient than traditional pesticides and made from materials that pose no environmental risk. Cherry growers in the county were shocked to learn about the ban on the pesticide because the butterflies' habitat was not located near the cherry orchards.

"The EPA action sustained the protection of the endangered butterfly, but it potentially jeopardized the ability of Michigan cherry growers to produce healthy crops," Millenbah said. "So in addition to producing maps of the endangered species habitats, we're also establishing communication networks between growers and commodity and natural resources entities. Improving communication among the various groups to protect both the quality of the state's commodities and its endangered species is a win-win strategy."

Together, the groups are working to find the best ways to identify potential areas of overlap between endangered species and commodity ownership, eventually leading to actions that minimize impact to endangered species' habitats by agricultural practices. Millenbah and her colleagues developed a working group made up of people interested in and knowledgeable about topics related to endangered species and commodity quality. The group included representatives from the EPA, the Michigan Department of Agriculture, the Michigan Department of Natural Resources (DNR), the U.S. Fish and Wildlife Service, the Michigan Natural Features Inventory, the Nature Conservancy, the Cherry Marketing Institute, the Michigan Apple Committee and the Michigan Potato Industry Commission.

The pilot research project produced maps showing the habitats of three federally listed endangered species: Karner blue butterfly, Indiana bat and Pitcher's thistle. The habitat maps were then compared to maps of some of the state's cherry orchards. It was then possible to determine where pesticides from cherry orchards may move to affect endangered species habitat. The scientists plan to develop habitat maps for all the federally listed endangered species in Michigan.

"The cherry growers were wonderful to work with," Millenbah said. "It was a great project to be involved with.

"We think this can be adopted as a national procedure for these situations," she continued. "Other commodity groups have been watching what we did here, and we're making our process readily available to them. The data was basically there — we put it into a new, perhaps more useful form."

::: Jamie DePolo

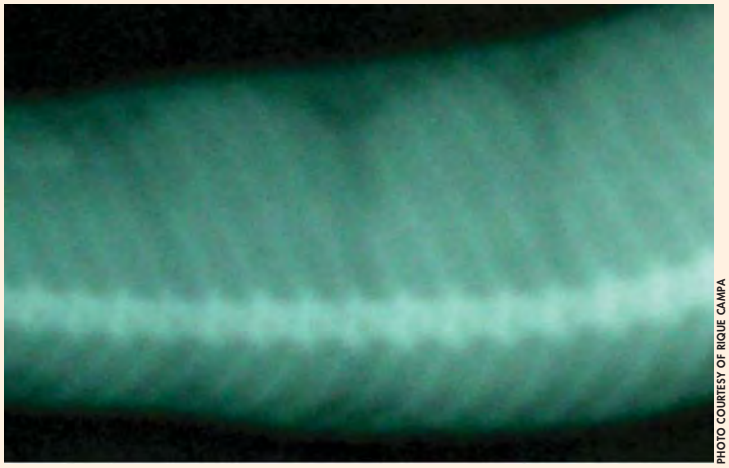


PHOTO COURTESY OF RIQUE CAMPA

Top: **Rebecca Christoffel, graduate student working with Shawn Riley, explains the differences between common Michigan snakes to a class at the MSU Pavilion. Her research has shown that children are more open to recognizing the value of the eastern massasauga rattler than adults are.** ***Above:*** **MAES scientists worked with Tara Myers Harrison, Potter Park Zoo veterinarian, to take X-rays and ultrasounds of pregnant eastern massasaugas to build a population model of the snakes. The model has helped the the scientists identify the landscape conditions that allow snake populations to thrive.**

People's tolerance for the snake is very low — they don't see that it adds value to their landscape."

Using the data that he and doctoral student Rebecca Christoffel collected on how people form their opinions of snakes, especially rattlesnakes, Riley has mounted a campaign to change the perception of the snake in hopes of buoying its population and preserving an important piece of Michigan's natural history.

"People develop their perceptions from television, songs, just about anything you can think of — except an interaction with a live snake," Riley explained. "We've also found that increasing affluence means decreasing tolerance for species that may pose a perceived risk."

Eastern massasaugas typically live in wetlands and nearby woods and feed on mice, voles and other small mammals, and frogs and toads. As more and more housing developments have pushed into wetlands, the chances of a human-rattlesnake interaction have increased.

Riley and Christoffel are testing whether their education program is changing people's minds — even a little — about the eastern massasauga rattlesnake.

"Our goal and challenge is to promote awareness and tolerance," Riley said. "Rebecca has gone to several metroparks to teach people good human behavior around snakes. Right now, the acceptance of the snakes is so low that it won't sustain the species. People's first thought when they see one is to kill it. It's interesting to compare the snakes to deer. People generally love deer, which present risks — we probably need to reduce that tolerance — and they hate snakes, which really present little risk. We need to increase that tolerance if the species is to survive.

"By giving people education and information, we're giving them control over how they assess risk and adjust their behavior accordingly," he concluded. "That's our hope."

Christoffel conducts pre- and post-education session testing to determine if perceptions of the snake changed. A preliminary analysis seems to indicate that children and young adults tend to be more open to recognizing the value of the snake.

Campa and Millenbah worked with graduate student Kristen Bissell (now a DNR biologist) as well as veterinarian Tara Myers Harrison, from the Potter Park Zoo in Lansing, and the DNR to implant radio tracking devices in rattlesnakes, providing the scientists with unique information about the species' movements, population dynamics and landscape requirements.

"We found the eastern massasauga used upland vegetation, not just wetlands," Campa explained. "That allows wildlife managers to survey an area's habitat and decide if the snake would likely be there and manage the landscape accordingly."

The scientists also developed a population model that they're evaluating by comparing the model's estimates with ultrasounds of female snakes carrying young. They also went out into the field and counted the number of young snakes at the birth sites. (Massasaugas are born alive rather than from eggs deposited in the environment.) The model has helped them identify the landscape conditions that allow snake populations to thrive — important information if the snake's population levels are to increase.

"Reptile conservation is different in developed areas," Campa said. "If the populations get isolated, they can't survive. So if a developer eliminates a big wetland and replaces it with a number of separate, smaller ones — even though they add up to the same acreage — they may not be effective habitats for the eastern massasauga. We believe our model can help managers improve conditions for the snakes."

"The challenges are great," Riley said, "but MSU scientists are conducting research to better inform decisions about how people and wildlife can share Michigan's rich landscapes for generations to come."

::: Jamie DePolo

Go Fish

William Taylor has spent much of his career studying fisheries ecosystems. The results of his work help ensure that the Great Lakes provide healthy environments for fish and for the people who depend on them.

The Great Lakes are one of the most productive fisheries in the United States, providing thousands of commercial and recreational anglers with livelihoods and leisure time pleasure. The lakes are under the jurisdictions of two nations, eight states, one province and several tribes. The fish, however, care about none of that and zip across boundaries faster than a college student on a 20-countries-in-10-days European trip. The Great Lakes Fishery Commission (GLFC) was created in 1955, partially as a response to the sea lamprey invasion. Today, the GLFC still sponsors research on lamprey control and eradication, as well as control of other invasive species, but its larger mission is to facilitate cooperative Great Lakes fishery management among the state, provincial, tribal and federal management agencies.

William Taylor, chairperson of the Department of Fisheries and Wildlife and MAES scientist, is an internationally renowned expert in

fisheries ecology, population dynamics and Great Lakes fisheries management. Taylor was one of the architects of the PERM (Partnership for Ecosystem Research and Management) program, a unique partnership between MSU and the Michigan Department of Natural Resources Fisheries, Wildlife, and Forest, Mineral and Fire Management divisions, as well as the GLFC and the Great Lakes Science Center. PERM work is led by researchers who are MSU faculty members in the MSU departments of Agricultural Economics, Fisheries and Wildlife, Forestry and Geography. Many of these scientists are also affiliated with the MAES. PERM scientists are located at the university but maintain strong ties to the other funding partners.

"We found that zebra mussels were not necessarily having as big an effect on whitefish as was thought. The density of the whitefish plays a much bigger role..."

"PERM allows our partners the capacity to build programs toward the effective and efficient management of natural resources and the environment," Taylor said. "There's no gap between research and implementation. Through their joint efforts, PERM researchers have heightened awareness of and responsiveness to issues such as infectious and emerging wildlife-borne diseases, exotic and aquatic nuisance species, the Great Lakes fishery and water quality, and public opinion and human dimensions of fisheries and wildlife management. PERM is successful because it combines a shared vision with hard work and promotes dialogue and cooperation among our partners."

Taylor serves as a GLFC commissioner and is keenly interested in environmental policy and management at all levels. His research creates new tools for fisheries managers across the Great Lakes. One of his recent projects focused on whether whitefish could be used as a marker fish to determine the extent of damage to the ecosystem from zebra mussels.

"Lake whitefish is one of the largest commercial fisheries in the upper Great Lakes," Taylor explained. "After the zebra mussels were found in the lakes, we starting seeing lower numbers of whitefish — and the whitefish that were there were thin."

Long prized for their excellent taste and quality as an entrée, lake whitefish are found in all the Great Lakes, though Lake Huron and Lake Michigan are most productive for Michigan commercial fishermen. A member of the trout/salmon family, the lake whitefish swims in schools, so it's more convenient to catch than some other fish. According to statistics from the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service, Michigan commercial anglers caught 7.3 million pounds of whitefish in 2005, which had a value of more than $5 million.

The lake whitefish has a smaller, more delicate mouth than its trout and salmon relatives, and it eats insects, tiny freshwater shrimp known as Diporeia, small fish, fish eggs and lake bottom organisms.

In a research project he completed in 1987, Taylor had looked at lipid levels in whitefish and in their eggs. He found that if the eggs had more fat in them, they were more likely to survive the winter. If there was also a high level of whitefish food, there would be a large whitefish population 3 years later.

"If there's less whitefish food, then it shows in reproduction numbers and somatic growth," Taylor explained. "So the fish are smaller and have less fat. People began wondering if the zebra mussels were responsible for a decline in whitefish food and thus causing the thinner fish. If so, then whitefish could possibly be a marker fish for zebra mussel populations.

"We had the historical data on how much fat was on the fish and the eggs, as well as estimated whitefish population numbers from the earlier research, so we decided to resample the areas and see if we could figure out what was going on."

Zebra mussels eat by filtering water and pulling tiny plants and animals out of it, including Diporeia. One zebra mussel can filter 1 liter of water per day; in the western basin of Lake Erie, water clarity has increased by 77 percent since the arrival of the zebra mussels. One of Taylor's two theories on possible causes of decreasing whitefish populations, as well as their thinness, was that

zebra mussels were filtering out the Diporeia that the whitefish normally eat.

"Whitefish will eat zebra mussels, but they're not a high energy food," Taylor explained. "Diporeia are a much better source of energy for whitefish."

The other cause for the whitefish decline could have been larger than usual fish for the previous few years, as well as larger populations of the fish, which Taylor had seen in his earlier work. Could these larger populations have been so large that they were now declining because there was less food per whitefish?

In the final analysis, whitefish fat levels were more affected by the population of whitefish than by Diporeia levels.

"We found that zebra mussels were not necessarily having as big an effect on whitefish as was thought," Taylor said. "We couldn't really blame the zebra mussel for this issue. The density of the whitefish plays a much bigger role in how big the fish get and how many eggs hatch the next year. This is important for fisheries managers to know so they can implement policies that will achieve their goals."

Going Back to School to Understand Ecosystems

As shown by his work to create the PERM program, Taylor isn't afraid to think outside the box — or throw the box away altogether. His groundbreaking work on food webs combined social science and aquatic resource management and showed that fisheries ecosystems and educational systems have a lot in common.

Food webs are a network of interconnecting food chains. Each chain consists of a sequence of organisms eating and being eaten by other organisms. Taylor and his colleagues from the GLFC, the University of Maryland and the Great Lakes Environmental Research Laboratory found a way to describe food webs in compartmental rather than hierarchical contexts. The scientists described food webs as being akin to high school — a complex web of relationships and cliques.

Instead of progressively bigger fish making lunch of the little guys, food webs are more about compartments of plants and animals and the strength of their bonds to form groups within the food web. Changes or stresses to one species within the compartment hit its compartment members — members of its "clique" — harder than they hit other species or groups that do not interact as much.

"There is a common perspective here," said Chris Goddard, GLFC executive secretary. "From the unique combination of social science and environmental science we have a new way to study ecosystem health and a new way to better address the ecosystem response to stress. Now we can break the system down into components."

"Bringing in a social science perspective gave us a whole new way to look at the food web," said Taylor, who co-authored a paper on the research that was published in the international science journal Nature. "It gives us a whole different picture of how changes reverberate through the system. It gives us new tools to understand how changes affect the system."

Ken Frank, associate professor in the Department of Counseling, Educational Psychology and Special Education, who normally studies the social structures of organizations and systems — mainly schools — collaborated with Taylor and doctoral student Ann Krause to study the domain of ecosystem ecology and management.

The research team of Krause, Frank and Taylor, from MSU; Robert Ulanowicz, from the University of Maryland; and Doran Mason, of the NOAA Great Lakes Environmental Research Laboratory, studied five food webs in locations ranging from the Chesapeake Bay to a forest on St. Martin Island in the Caribbean.

"Ken developed a scientifically sound method for identifying cliques in social networks which works well to identify whether compartments existed in these five food webs," Krause explained. "In addition, we mapped out the food web to provide a tangible picture of these compartments for ecologists."

Taylor and Goddard explained that this method offers natural resource managers a different and more holistic way to evaluate stresses on ecosystems — invasive species such as sea lampreys, zebra mussels and Asian carp in the Great Lakes, for example. It also holds promise of more targeted and more efficient ways to manage changes in the food web, with more specific ways to address which groups of species are most likely to be strongly affected and which may experience minimal impact.

::: Jamie DePolo

Controlling Sea Lamprey u

An MAES scientist identified the pheromone that male sea lampreys use to lure love-sick ladies to their nests. Now he and his colleagues have developed a synthetic version that holds promise as a control for the destructive invader.

On the off chance that its disc-shaped, sucking mouth lined with rows of razor teeth and its slick, eely body aren't enough to attract a suitable partner, the male sea lamprey also secretes a chemical come-on so a lady lamprey can follow her nose (which is bigger than her brain) to her dream mate.

Pheromones, chemical scents used to attract a mate, are well-documented in the insect world. In many cases, the female releases a pheromone to attract males to her. But the idea that fish could use odors to communicate with one another didn't receive much attention until the 1960s.

"We know now that fish have a very well-developed sense of smell," said Weiming Li, MAES fisheries scientist, who has focused much of his

PHOTO: ISTOCK

...ith a Chemical Come-on

research on sea lamprey pheromones. "Humans get about 80 percent of our information on our surroundings from vision. But fish can't rely on vision. If a female needs to find a male a mile away in a cloudy stream, vision won't work. In the 1960s, scientists began discovering that female fish were attracted to male fish in the lab, which pointed to pheromones. So I started my work on the basis of that."

Li and his research team found that not all female sea lampreys are attracted to all male lampreys. Lamprey rules of attraction dictate that each gender is attractive to the other for only about 2 to 3 weeks during a fish's lifespan. During this brief mating season, females ovulate and the males become so filled with sperm that a gentle push on their bellies makes sperm come out.

"It's a very narrow window of reproduction opportunity that needs an excellent communication system," Li said.

In 2002, after 4 years of painstaking work, Li and his research team published a paper in the journal Science detailing their revolutionary methods to isolate and identify the chemicals that male lampreys use to lure females.

"The identification took a long time," Li said. "It was difficult, but we finally found a way to isolate and identify the pheromone that was suspected but never documented."

To find the chemical, the research team spent 2 years comparing the tank water from spermiating males and non-spermiating males and then condensing a ton of tank water to about 30 milligrams of pure compound.

Their methods included creating bioassays to trace the key chemicals and sorting compounds by washing them through a lamprey's nose and tracking its neurological (called an electro-olfactographic) and behavioral responses. High performance liquid chromatography, fast atom bombardment mass spectrometry, nuclear magnetic resonance and thin-layer chromatography were used to examine the structure of the compounds released by the males. Initially the scientists thought the compound was a steroid, but it turned out to be bile acid manufactured in the liver and released through the male's gills.

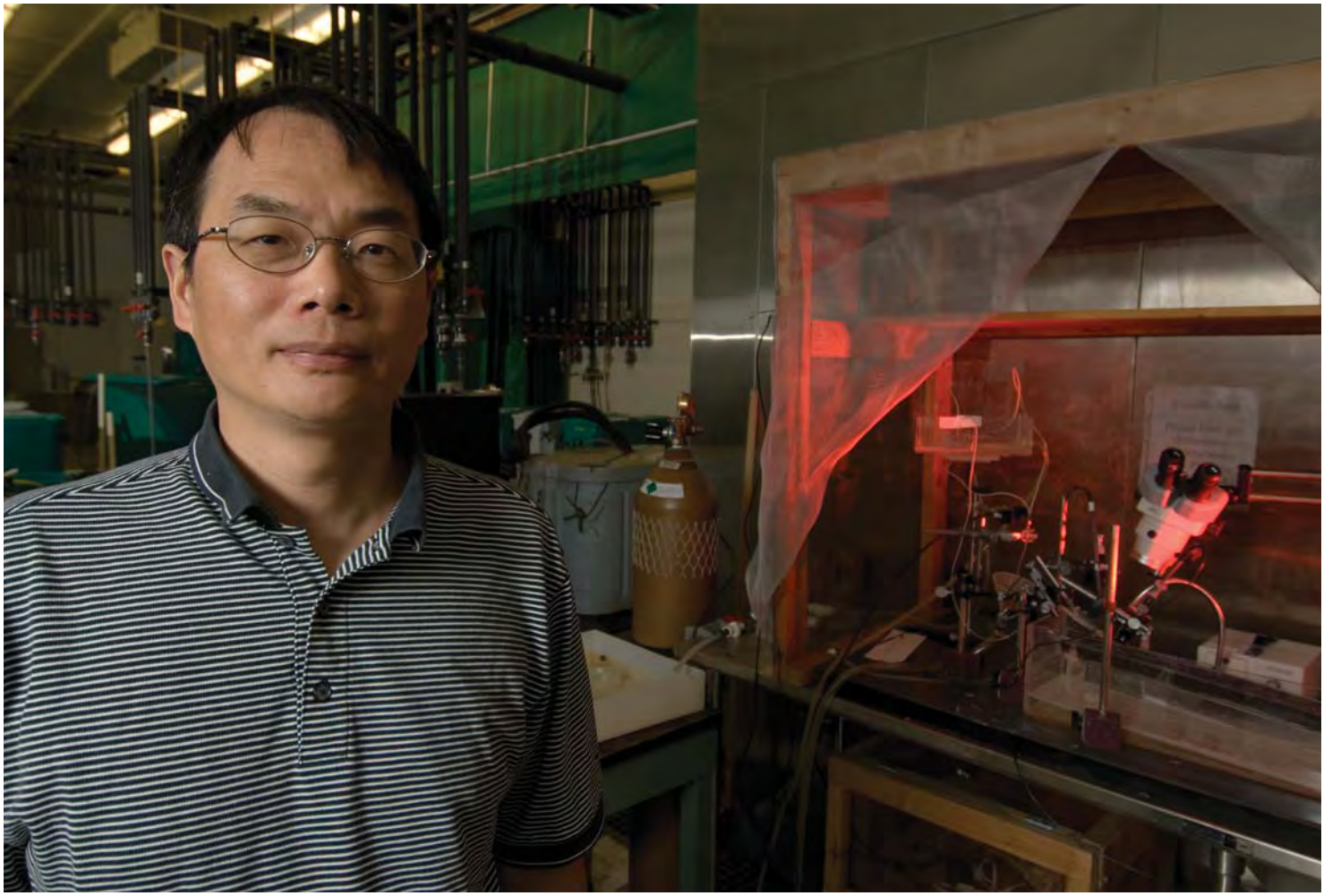
Ultimately the scientists ended up with a vial of purified, distilled pheromone: the equivalent of super-powered sea lamprey cologne guaranteed to draw the lady lampreys.

Besides Li, other members of the team that identified the lamprey pheromone were Michael Siefkes, doctoral student; Honggao Yan and Douglas Gage, associate professors of biochemistry and molecular biology; Qin Liu and Sang Seon Yun, research associates; and Alexander Scott, senior scientist at the Center for Environment, Fisheries and Aquatic Sciences, in the United Kingdom.

Sucking the Life Out of the Great Lakes

Sea lampreys, which resemble 18-inch-long eels, are aquatic vertebrates native to the Atlantic Ocean that likely found their way into the Great

Sea lampreys are the ultimate hangers-on: they stay alive by attaching themselves to other fish, such as salmon and trout, and then sucking out the fish's body fluids. The lamprey's sucking disk and sharp teeth scar the host fish, and the experience kills many hosts.



MAES fisheries and wildlife researcher Weiming Li spent 4 years isolating and identifying the chemicals that male lampreys use to lure females. Now he's working on creating a synthetic pheromone to control the parasites.

Lakes via shipping channels (they can live in both salt and fresh water). They were found in Lake Erie in 1921, in Lake Huron in 1932, in Lake Michigan in 1936 and in Lake Superior in 1946. Because they're an exotic invasive species, lampreys have no natural predators in the Great Lakes.

The lamprey life cycle is somewhat flexible, Li said. Adults swim into the streams and rivers that feed the Great Lakes to spawn and then die. A champion of fecundity, each female lays about 60,000 eggs. The fertilized eggs hatch into small, wormlike larvae that burrow into stream bottoms and feed on organic debris and algae. They usually spend 3 to 6 years in the larval stage before transforming into parasitic lampreys, though they can stay in the larval stage for up to 20 years under some conditions. Parasitic lampreys then migrate into the Great Lakes to feed on fish.

Postlarval lampreys are the ultimate hangers-on: parasites, they stay alive by attaching themselves to other fish, such as salmon and trout, and then sucking out the fish's body fluids. The lamprey's sucking disk and sharp teeth scar the host fish, and the experience kills many hosts.

In its parasitic life, which can last up to 2 years, a sea lamprey can kill 40 or more pounds of fish. Lampreys are so destructive that, under some conditions, only one of seven fish attacked by sea lampreys will survive. In the early 1940s and '50s, sea lampreys were the main cause of the collapse of lake trout, whitefish and chub populations in the Great Lakes. Lampreys caused the extinction of three species of whitefish. The lack of natural predators allowed lampreys quickly to become dominant and disrupt ecosystems by killing the native fish. Lake trout, whitefish and chubs are some of the top predator fish in the Great Lakes. With these species on the decline because of lampreys, another invasive species from the Atlantic moved in: the alewife. Though alewives are vulnerable to spring die-offs, they caused further disruption of the ecosystem.

It's difficult to separate out economic losses caused solely by sea lamprey. Information presented at a March 7 meeting of the U.S. House Transportation and Infrastructure Subcommittee on Water Resources and the Environment estimated economic losses due to invasive fish in the Great Lakes at about $1 billion per year. The U.S. and Canadian governments spend about $10 million to $15 million per year on lamprey control.

"It made sense for us to focus on the sea lam-

"It made sense for us to focus on the sea lamprey. It's a poster animal for invasive species — very destructive, very expensive to control effectively."

prey," Li said. "It's a poster animal for invasive species — very destructive, very expensive to control effectively."

Right now, lampreys are controlled mainly by a larvae-killing compound known as TFN, which is dumped into the freshwater streams where lampreys spawn. Identified in the late 1950s, TFN has brought recreational fishing back to the lakes. But there are environmental concerns about adding the chemical to steams, as well as the possibility that lampreys could develop resistance to TFN.

The Great Lakes Fishery Commission (GLFC), which was established in 1955 in part to control the sea lamprey, has adopted an integrated pest management approach to lamprey control and has set a goal to reduce reliance on TFN. Besides Li's pheromone research, which the GLFC helps fund, other alternative control methods include building cement barriers to keep lampreys out of spawning streams and sterilizing males.

"The GLFC would like to deploy one new alternative control method by 2010 as a milestone for its sea lamprey management program," Li explained. "It considers regulating spawning and migrating behavior with pheromones the most promising control method for future implementation. So we're excited about the possibilities."

Creating the Faux Pheromone

In the 5 years since the Science paper, the research team, with the addition of doctoral student Nicholas Johnson, used the same painstaking techniques to develop a synthetic version of the pheromone. The synthetic is viewed as a promising lamprey control, and it's easier to create it than to distill the natural pheromone from a ton of lamprey tank water. By luring fertile females to traps baited with synthetic pheromone, fishery managers could prevent the females from mating and so reduce lamprey populations. The synthetic pheromone also could be used to attract females for harvesting as a food fish. In France and Portugal, sea lamprey is considered an exquisite gastronomical delicacy.

"The pheromone is very expensive to synthesize," Li said, "but only a very small amount is needed for it to work successfully. It's very potent. Only a few hundred grams, less than a pound, would be used each year."

Given the estimated environmental and economic losses due to lamprey and the money spent on lamprey control, the synthetic pheromone could prove to be cost-effective in the long run.

In the first test to ensure that the man-made pheromone would work its come-hither magic on the ladies, Li and the research team inserted a tiny electrode in a female lamprey's nose and then exposed the female to synthetic and natural versions of the pheromone. The measured response to both was the same — an excellent sign that the synthetic version would work in the wild.

The researchers then baited traps with both versions and observed the female lampreys' behavior. In traps with the natural pheromone, the females were attracted and then lingered in the area. In traps with the synthetic pheromone, the females came but then soon departed.

"We believe the difference in behavior happened because the males are releasing other compounds in addition to the one pheromone we've identified," Li said. "We're working on identifying those right now. A single pheromone would work to attract females, but a composite might be more effective."

Tests on the synthetic pheromone are being done under an experimental use permit from the U.S. Environmental Protection Agency (EPA) and are being done only in very limited areas.

"Before this can be used widely as a control, it has to be demonstrated that the pheromone has a benign effect on the environment and other species," Li explained. "Our research has shown that the synthetic pheromone would work as a lamprey control in the Great Lakes and their tributaries. But more needs to be done, so we continue to work."

::: Jamie DePolo

Decoding

In the poacher's mind, the plan was beautiful. Illegally shoot a deer on private property and then grind it up and make venison sausage. A whole deer carcass might attract attention, but sausage must have seemed so…innocuous. That is, until the poacher was pulled over for driving a stolen car. Suddenly the sausage was attracting quite a bit of attention. That's when MAES scientist Kim Scribner got a call.

"Forensics became part of state-sponsored work in my lab about 6 or 7 years ago," Scribner said. A population geneticist, he has appointments in the MSU departments of Fisheries and Wildlife and Zoology. "Using DNA testing based on a panel of genetic markers, we can identify species, assign an animal to a specific population of origin, identify parentage and match DNA profiles from multiple sources of material. At times, people don't tell the truth about where an animal was harvested. We can provide scientific evidence on where an animal came from. Because my lab has developed genetic markers and databases for so many animals, we have the data sets to perform many of the tests desired by law enforcement and natural resources management agencies."

Scribner said the availability of DNA testing is a significant deterrent to poaching and other illegal hunting activities in the state. Because people are aware that the Michigan Department of Natural Resources (DNR) has DNA testing capabilities — the state is one of a handful that can perform the sophisticated analysis — anyone arrested has so far confessed to his or her wrongdoing, eliminating the need for a trial.

"I haven't had to go to court yet," Scribner said, knocking on the wooden conference table in his office.

DNA ABCs

DNA (deoxyribonucleic acid) is the material that controls eye color, height, bone density, hair color, body type and many other human and animal traits. The DNA in all organisms is made up of four basic chemical building blocks: adenine (A), guanine (G), cytosine (C) and thymine (T). The order of AGCT in the DNA is a code that determines many cell properties. A complete set of human DNA, called a genome, has about 3 million pairs of these building blocks, bundled together in distinct groups called chromosomes.

Besides dictating how a living thing will look, its DNA also contains information about its ancestors. The offspring of two parents is almost entirely a mix of genetic material created by the union of the mother and father. At times, the A's, G's, C's and T's get mixed up along a specific area of the DNA, creating a unique genetic mutation that is passed down through a family tree.

As technologies to identify DNA have been refined and become more easily accessible, a wealth of genetic information is becoming increasingly available. For example, a dog owner curious about the heritage of his canine companion can order a DNA testing kit for $65 via the Internet. A doggie cheek swab is returned to the company by mail, and after a few weeks the owner receives a certificate of DNA breed analysis.

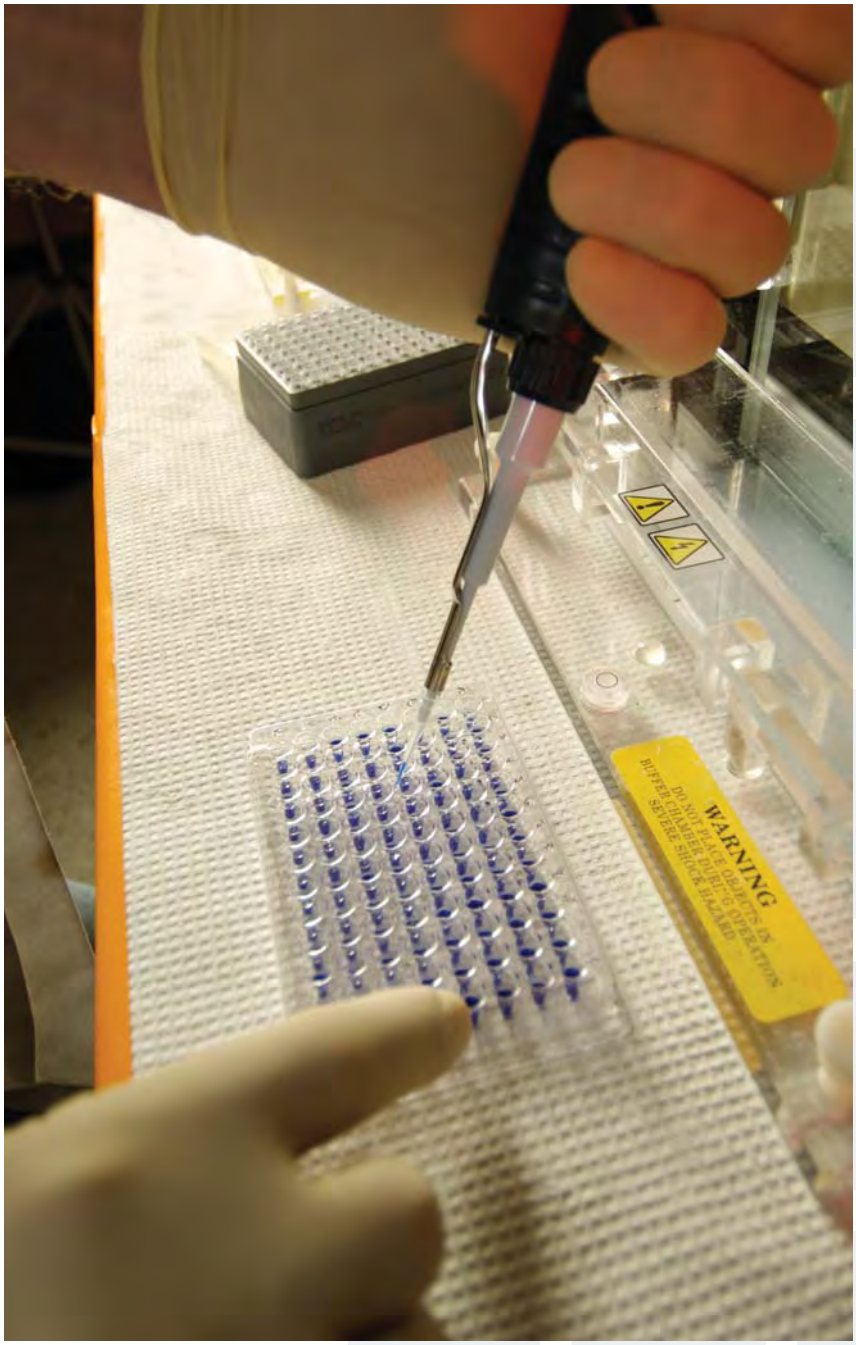
"As the knowledge of genetics and availability of genetic markers has expanded, the information has carried over to many other species besides humans and companion and food animals," Scribner explained. "So we're applying these new tools to some of the basic questions in fisheries and wildlife management. The management issues and questions faced by natural resources professionals haven't changed; we're just looking to answer them with different sources of information."

Scribner's research is a mix of basic science in population ecology, evolutionary biology and animal behavior, and applied, practical work. DNA data can be used to piece together critical information on species ecology. In one applied project, he's studying the

In the early 1990s, DNA testing was expensive and time-consuming and used only in cases considered extremely important: murder, paternity, diagnosis of rare illnesses. Today, DNA testing has gone to the dogs — and cats, deer, fowl and even fish. MAES scientist Kim Scribner uses genetic markers to identify poached game, manage fish populations and design hunting seasons.

Wildlife DNA

MAES scientist Kim Scribner is a population geneticist. His lab has developed genetic markers and databases for a wide variety of animals, as well as new ways to extract geneotypes from wildlife hair, feathers and fecal matter.



Scribner uses newly identified genetic markers and new genetic tools to help answer some basic questions in fisheries and wildlife management. He says the management issues haven't changed, but scientists are looking to answer them with different sources of information.

timing of migration for various breeding populations of birds during the hunting season to ensure that a higher percentage of abundant local birds, rather than non-local migratory birds, are harvested. This mix of basic and applied research is due in part to MSU being a land-grant university, but it's also because Scribner is one of a cadre of PERM (Partnership for Ecosystem Research and Management) scientists at the university. PERM researchers are physically located at MSU but maintain strong ties to the other funding partners: the Michigan Department of Natural Resources Fisheries, Wildlife, and Forest, Mineral and Fire Management divisions, as well as the Great Lakes Fishery Commission and the U.S. Geological Survey's Great Lakes Science Center.

Scribner also has developed advanced new scientific techniques to extract genotypes from wildlife hair, feathers and fecal matter, as well as some clever but perhaps not-so-sophisticated techniques to get the hair and other raw materials from unsuspecting donors.

"You really can't walk up to a bear or a bobcat and yank out a tuft of hair," he explained.

And bears and bobcats don't fill out questionnaires detailing where they've lived or the number of offspring they've produced.

So he and his team fashioned barbed wire "combs" to snag bear hair and glue traps to capture hair from larger cat species. He also works with a group that trains dogs to find scat (feces) from specific animal species. The more samples that Scribner has, the more DNA types that can be identified, all of which makes for more accurate estimates of population parameters such as population size or the propensity for movement across various land cover types.

"By using these techniques to get more hair or scat, we've been able to get thousands more samples, which gives us much more accurate counts on populations," he explained. "Because we work on so many different animals, we're building a number of databases that are important to many people. This is a hugely valuable resource for MSU to have."

Some of Scribner's projects include:

Fish genetics. By using genetic markers to identify especially productive hatchery strains and their locations, Scribner is offering fishery managers information they can use to make decisions.

"By looking at fish genotypes, we can identify the pedigree of any fish," he explained. "We're trying to pinpoint all the variables that affect reproductive success. Is it the size of the fish, the timing of spawning, or the susceptibility of the fish to harvesting or other events? With this information we can come up with an estimate of how fish from a particular area contribute to the entire fishery and then assess the risk to the population in terms of time and location. It also allows us to look at production differences between different strains of hatchery fish."

"Because we work on so many different animals, we're building a number of databases that are important to many people. This is a hugely valuable resource for MSU to have."

Different strains of the same species of fish need different environments — water temperature, plants, etc. Greater understanding of a fish's genetic background can help a manager understand the environment that is best for that fish and the best management techniques to maintain a critical mass of that environment to sustain populations of appropriate size into the future.

Canada goose hunting season. Though majestic to look at as they pass overhead, especially silhouetted against a late autumn sunset, Canada geese are not universally loved. Just ask any homeowner or golf course or park manager who has had to clean up their droppings, and he or she will tell you exactly how lovely the geese are.

Michigan's Canada geese are primarily from three groups: two migrating flocks, the Mississippi Valley population and the Southern James Bay population and one local, non-migratory flock. Goose hunting season is partially designed to help control local bird populations, since these year-round avian residents are responsible for a large portion of the goose poop problem. No one is completely sure, however, if local geese are the ones being harvested each year.

As he compiles an extensive database of goose genetic markers, Scribner is testing feather samples sent in by hunters to determine if the geese that are taken each year are from the local population.

"If the geese are local, that's great — that's the desired outcome," he said. "If not, then the DNR can design the hunting seasons so they're earlier — before the migratory birds come in."

Disease ecology. Bovine tuberculosis (TB) began showing up in deer harvested in northern Michigan in the mid-1990s. A contagious lung disease usually spread between cattle packed together in close quarters, bovine TB in deer puzzled scientists, who initially thought that the disease couldn't sustain itself within free-ranging deer populations. But the disease did persist, and a cow in an Alpena County beef herd tested positive for the disease in 1998. Almost 10 years later — after the loss of millions of dollars, quarantines, testing of more than 1 million animals, and contentious conversations between deer hunters and dairy farmers — things are looking up. Disease prevalence has dropped by about 50 percent in the core infection area in the northeastern Lower Peninsula. But bovine TB is still in cattle and deer in Michigan, so there is still research to be done.

Scribner is studying genetic markers in deer to determine if there are specific genes that affect an animal's susceptibility to the disease. Knowing that particularly susceptible deer were in a particular area of the state would allow the DNR to adopt more stringent disease control methods in that area. He's also using genetic markers to understand how the disease is passed from one deer to another.

"Identifying the mechanisms of pathogen transmission is critical to controlling disease," Scribner said. "We can use genetic markers to look at the mechanisms of disease transmission without spending a lot of time observing how deer interact."

In the past, scientists assumed that disease transmission dynamics in a wildlife population were random and that probability of infection increased as the size of the population increased. But more recent research has found that the social structure of the group influences contact among the animals, so genetics could be used to tease out the role of familial relationships in disease transmission.

"Deer are social animals," Scribner explained. "So it seemed logical that animals that were related would be more likely to be sick."

His research proved him right — Michigan deer infected with bovine TB were more closely related than non-infected deer. This was the first time this had been documented.

"We're finding the same thing in Wisconsin with another disease, chronic wasting disease [CWD]," Scribner said. "The mechanism of transmission is likely different, but deer infected with CWD also are likely to be related. This information needs to be incorporated into the epidemiological models for the disease."

::: Jamie DePolo

Valuing Michigan's Natural Resources Today,

PHOTO: DAVID KENYON

Rebecca A. Humphries was named director of the Michigan Department of Natural Resources in April 2004. She had served as chief of the DNR's Wildlife Division since December 1998. Humphries is responsible for the administration and direction of the department, which has 1,600 employees and a $280 million budget that supports programs for wildlife and fisheries management, state parks and recreation areas, conservation and law enforcement, forest management, state lands and minerals, and communications.

Humphries is a graduate of Michigan State University, with a degree in fisheries and wildlife, and has completed course work toward her MBA through the University of Wisconsin. She was awarded an honorary doctorate in public service from Central Michigan University in December 2004.

In this interview, she discusses emerging issues, long-term conservation efforts and research partnerships with Michigan State.

Q: What are the most pressing issues facing the DNR, particularly in fisheries and wildlife, in Michigan right now?

A: From my perspective, the biggest problems we face are disease and exotic species. They're both having an effect on Michigan's native species and the health of our ecosystems.

VHS [viral hemorrhagic septicemia] is a viral fish disease from the Maritime Provinces of Canada. We're not sure how it got in the Great Lakes. It could have been through shipping channels, but no one is sure. We do know that it kills fish and could have a huge impact on fish in the Great Lakes. It's already having an economic impact on the state's bait fishing industry. So far, all the stocks in the state's hatcheries are clean, but we're being very careful.

Other disease challenges are bovine tuberculosis and avian flu. Michigan was the first state to test positive for low-pathogenicity avian influenza.

Public participation is another challenging issue the DNR faces. This agency is charged with making management decisions based on sound science. But the public has to support these management policies or they won't be around for long. The National Environmental Policy Act was signed into law in 1970 with very little public input. Today, we bring people to the table at the beginning of the policy process. We have more dialogue with the public on natural resources issues, and we start earlier so both the public and policy-makers are educated through the process. This leads to more informed dialogue and input. It takes people out of reactive mode and also allows the DNR to back up and consider public opinion before decisions are made. It's a different way to engage the public, and we're pleased with the way it's working so far.

Protecting and Managing Them for Tomorrow

Q: You've mentioned the need for long-term funding for conservation — can you talk a little bit about that? Do you see MSU playing a role in that?

A: The state, through the DNR, is responsible for managing all public lands, including state parks. The DNR also manages Michigan's fish and wildlife resources now and for the future.

The DNR has always had funding sources such as revenue from fishing and hunting licenses and park user fees to supplement its general fund (general tax dollars) allocation. But as the DNR has matured and its responsibilities have increased, our general fund allocation has decreased. Right now, general fund money makes up less than 10 percent of our budget. There's little money for wildfire suppression, enforcement agents and work on diseases such as bovine TB. Our other funding sources come from user bases that are stagnant or declining. So we're being asked to do more with much, much less.

Michigan has more public land than any other state east of the Mississippi. We have a tremendous legacy, but I don't think most people realize what the state has. People who move here from out of state are just amazed at the state forests and other public lands that are available for everyone to use. We had wonderful visionaries in the state who wanted to preserve and restore Michigan's natural resources.

I also don't think the public understands how the DNR is funded. Seventy-six percent of our budget comes from restricted funds, mostly user fees; about 15 percent is from federal dollars, and only 9 percent comes from the general fund — and half of that goes to local governments. In other words, about 4.5 percent of general tax dollars goes to conservation.

Michigan State plays a role in educating people about the value of the state's natural resources. There are links between natural resources and the state's agriculture and tourism industries, and research at MSU has demonstrated those relationships, as well as the importance of habitats to fisheries and wildlife. But these natural resources and habitats need to be managed. Nature is chaos — you can't just let it go. People have so much interaction with our natural resources; we have to be mindful managers so that we can reap the benefits today as well as preserve them for tomorrow.

Q: How does the Michigan Department of Natural Resources view Michigan State University?

A: We look at MSU as a full partner with the DNR. We share staff with MSU through the PERM [Partnership for Ecosystem Research and Management] program, and we both face some of the same issues. MSU helps the DNR address national and international issues; we know we can get expertise if we need it. This close relationship has grown out of the PERM program. Because the positions are funded by both MSU and the DNR, it allows the people who hold them to think outside tradition and look for cutting-edge solutions to help the people of Michigan solve problems.

MSU Extension and other university groups share information with the public and use DNR materials in educational programs.

MSU also helps us prepare for the future. The Diagnostic Center for Population and Animal Health has helped the DNR fight bovine TB and West Nile virus. That's just one example of how the university is helping us today and also anticipating what might be needed in the future.

"We look at MSU as a full partner with the DNR. We share staff with MSU through the PERM program, and we both face some of the same issues."

Q: MSU and the DNR have cooperated on the Partnership for Ecosystem Research and Management (PERM) program since 1993. From your perspective, what are the strengths of the program and what benefits has it offered the state? Are there any downsides to the program?

A: PERM has allowed us to attract and keep talented individuals that as an agency alone we wouldn't have been able to. These are people who want to work on policy issues as well as how the research can be directly applied to problems, such as bovine TB. PERM allows us to hire people that we couldn't hire on our own, and I think it's made both partners stronger and given us greater expertise in a number of areas.

PERM also allows us to take a more cutting-edge approach to problem solving. Through MSU, we can tap international experts and allow decision makers to hear what worked and what didn't work in similar situations around the world. We don't have to reinvent the wheel each time a new issue surfaces.

We can also tap experts from across the entire university — people we wouldn't normally have access to, such as veterinarians, political scientists and economists.

The PERM program has adapted as we've moved forward. I like to think of it as a small business incubator — we need to be nimble. We find the best expertise to work on problems, and we're constantly adapting to address new issues as they arise. People move in and out as they're needed.

PERM is a very successful program. Other states are looking at it as a model — no other states have an agreement like this. The program is a great framework for how universities and state agencies can work together.

Q: As both Gov. Granholm and MSU President Simon talk about building Michigan's bioeconomy, many people see the state's abundant natural lands as potential sources of the plant materials (trees, grasses, etc.) that are the raw materials for bioproducts. What is the DNR's view of this? What are the issues from your perspective?

A: The DNR supports reducing the country's dependency on foreign oil. We do have to think about what we do to reduce that dependency, though, and any risks associated with those actions. For example, if we put all our agricultural land into corn monoculture to make ethanol, we have to think carefully how that will affect the ecosystem.

Whatever strategies we develop that involve our natural lands have to consider Michigan's tourism and recreation industries. There may be some hard policy debates in the future, but we do have some history that we can look at for guidance. The Michigan Natural Resources Trust Fund is based on funds derived from the extraction of oil, gas and minerals from state-owned lands. The money in the trust is used to buy additional recreational lands and mineral rights.

We have to think about the surface of the state and what we want it to look like and develop strategies that meet that goal.

One of the issues we'll face is that the technology to make biofuel doesn't do well with mixed stands of trees. People are looking at the timber industry as it's changing — fiber and pulp production is now taking place in warmer climates — and wondering if Michigan can grow trees for biofuels. We might be able to, but we have to balance the needs of industry, recreation and wildlife.

There will also have to be an education component. People don't like to see clear-cutting of forests. We'll have to explain the benefits of what's being done.

We need to pull in all the partners for discussion and then create a good infrastructure for the biofuel industry. If we do that, I think we'll be very successful in meeting everyone's needs.

Q: What's your vision for the DNR's future?

A: I'd like the DNR to have a source of stable, long-term funding to support resource management. We'll address emerging issues and continue to be the state's leaders in resource management.

We spent a lot of effort over the past decade to protect and preserve Michigan's resources, and we were successful. Now we have to manage those resources, which we sometimes have an overabundance of. That's a little different mindset than "protect, protect, protect." Our mission is to protect, preserve and manage Michigan's resources. We've been very good at the first two; now we have to focus on management issues.

For example, right after we're done, I'm going to a media conference at which the federal government will announce that the gray wolf has been taken off the list of threatened and endangered species. So now the state takes over managing gray wolf populations.

I'd also like the DNR to continue to solicit public input on issues. This requires education on both sides. I'd like the DNR to be the one to bring all the partners to the table and initiate the dialogue. We don't all have to agree, but we do have to talk.

Research *in the news*

$125 Million Bioenergy Initiative Powered by Midwest Ag Industry, MSU Research

Renewable energy for American industry is at the root of a major Midwest research center funded by the largest federal grant exclusively for research endeavors in Michigan State University's history.

MSU will partner with the University of Wisconsin-Madison in establishing the U.S. Department of Energy (DOE) Great Lakes Bioenergy Research Center (GLBRC), one of three new DOE bioenergy research centers (BRC). The center, based in Madison, will be funded with $125 million over 5 years. MSU will use approximately $50 million for basic science research aimed at solving some of the most complex problems in converting natural materials to energy.

Ken Keegstra, MAES scientist and university distinguished professor of plant biology, and biochemistry and molecular biology, will be the executive director of the center, splitting his time between East Lansing and Madison. Keegstra and Tim Donohue, UW-Madison professor of bacteriology, led the initiative to bring the center to the Great Lakes region.

"This is a proud day for MSU and the state of Michigan — and a dramatic step toward an economy powered by strategic partnerships among states, research universities and industry," said MSU President Lou Anna K. Simon. "MSU's Office of Biobased Technologies and our preeminent scientists are dedicated to addressing problems and opportunities of today but, more importantly, of the future."

"This is a great partnership that uses Michigan State's comprehensive and powerful plant sciences to shape a green future in renewable resources," said Steve Pueppke, director of the MSU Office of Biobased Technologies. Pueppke is also director of the Michigan Agricultural Experiment Station. "This matches some of the world's best plant science with industry needs. The work will create momentum; these activities bring on more activities. This is how things start to happen."

The three DOE BRCs are established and operated to accelerate basic research on the development of cellulosic ethanol and other biofuels. The other two DOE BRCs are in Oak Ridge, Tenn., led by the Oak Ridge National Laboratory, and near Berkeley, Calif., led by the Lawrence Berkeley National Laboratory.

Research at the DOE GLBRC will be done by a dream team of scientists from Wisconsin; Michigan State; Lucigen, a Madison-area biotechnology company; the Pacific Northwest and Oak Ridge national laboratories; and the University of Florida, among others.

The research will focus on breeding new varieties of bioenergy plants, developing new processing techniques and agents from microbes for breaking down cellulose, improving the microbial and chemical processes that convert biomass to energy products, providing an environmental and economic framework for sustaining the biomass-to-fuel pipeline and integrating new technologies — including genomics and new computational methods — into bioenergy research.

Keegstra's expertise is in plant cell wall biology, a crucial area in making biofuels. He has extensive management and scientific experience, having served for 14 years as director of the DOE-funded Plant Research Laboratory at MSU and 15 years as a faculty member in the botany department at UW-Madison.

He said the two universities' complementary expertise — from agricultural sciences to microbiology to chemical engineering — combined with knowledge from the rest of the partners forms a team designed for progress and action.

"If we're going to start using plants in significant ways beyond food, there are a lot of issues that come into play that we need to figure out," Keegstra said. "Sustainability, competition for food, environmental issues — our universities already have a head start in studying these from many angles. There is tremendous compatibility between UW-Madison and MSU, and we have assembled with others a strong and dynamic partnership."

Wisconsin, Michigan and the Great Lakes region will be a hub for research efforts aimed at clearing the technological bottlenecks that prevent plant biomass from being used efficiently as a source of energy.

MSU Revs Up Efforts to Get Biofuels in Gas Tanks

Research to couple powerful new biofuels with efficient automotive engines has received a jump start from the U.S. Department of Energy (DOE).

Two teams of engineers from MSU — chemical and mechanical — have been selected to negotiate for $4.7 million in grants to work with industry to create new fuels from renewable resources that are more complex and sophisticated than existing biofuels, as well as engines that can take full advantage of those next-generation fuels.

During negotiations, MSU will match the DOE award with funds from other sources. MSU has been selected to negotiate for $2.4 million from the DOE to partner with Ford Motor Co. for a project to develop advanced, low-temperature combustion designs for diesel engines using biofuel blends optimized for engine performance. MSU is the only university to be selected as a lead in the project in this round of $21.5 million in award opportunities.

MSU engineers also are involved in another project with Visteon Corp. in Van Buren Township, which has been selected for negotiation of an award of $2.3 million to achieve gasoline-like fuel economy when using E-85 by minimizing thermal, dynamic, volumetric and other system

efficiency losses. Other partners will be the DOE Argonne National Laboratory and Mahle Powertrain.

Teaming up the chemical and mechanical sides of engineering can avoid some of the current problems with biofuels.

"We're using an integrated approach, which hasn't really been done before," said Dennis Miller, MAES chemical engineering and materials science researcher, who is leading MSU's partnership with Ford. "These new biofuels will be more sophisticated than ethanol and biodiesel. By designing the engines at the same time, we believe we can optimize efficiency, performance and environmental benefits."

The chemical engineering team is Miller; Kris Berglund, MAES scientist and university distinguished professor of chemical engineering and materials science and forestry; Ramani Narayan, professor of chemical and biochemical engineering; and Carl Lira, MAES chemical engineering and materials science researcher.

Together they'll work on refining fuels from renewable resources such as soybean and other plant oils and woody stems and stalks from trees and other plants. A significant part of the biofuel work builds on earlier biofuel and fermentation work by the four scientists.

Much of the new work will take place at the MSU Biorefinery Training Facility at the Michigan Brewing Co. in Webberville, a state-of-the-art facility for refining a variety of biofuels, biochemicals and other bioproducts.

As the chemical engineering team designs these fuels, mechanical engineers, along with Ford, will be testing the fuels and working to create engines that can maximize the fuel performance, said Harold Schock, professor of mechanical engineering.

Schock describes the biofuels as an automotive revolution and the engine modifications as evolution.

"A lot of the details of how engines perform can have a serious influence on the improvement in efficiency," Schock said. "Designing the engines to accommodate new fuels and new fuel properties can make a tremendous impact. It can make a 20 to 50 percent difference in the way an engine operates."

Schock leads the engineering team, joined by associate professor Farhad Jaberi and assistant professor Tonghun Lee. Schock also is working on the Visteon project.

"If we're successful, then many jobs will be created as the biofuel industry expands and new engine technologies are implemented," Miller said. "Our approach should lead to much broader use of biofuels as we identify superior fuel blends, and as we begin to produce engines that are more compatible with the biofuels."

PHOTO: JAMIE DEPOLO

Swedish-Michigan Bioeconomy Partnership Announced

Chemrec AB, a Swedish company, and the NewPage Corporation, which operates a paper mill in Escanaba, have signed a memorandum of understanding to explore developing a plant to produce fuels from woody biomass at the Escanaba plant.

The Aug. 22 ceremony in Stockholm was presided over by Gov. Granholm, Swedish Ambassador Michael Wood and Maud Olofsson, Swedish deputy prime minister and minister for enterprise and energy.

At the beginning of the ceremony, Granholm recognized MAES researcher Kris Berglund, university distinguished professor of forestry and chemical engineering and materials science, as being instrumental to fostering the agreement.

In addition to his MSU appointment, Berglund is also a professor in the Department of Biochemical and Chemical Process Engineering, a department he helped found, at the Luleå University of Technology in Luleå, Sweden. His research collaborations in his family's native land (his grandfather is from a town 9 miles from Luleå) have laid the groundwork for formalized Michigan-Sweden corporate partnerships such as the Chemrec-NewPage agreement.

The NewPage-Chemrec plant would use Chemrec's black liquor gasification (BLG) technology. The plant would be closely integrated with the paper mill to provide energy efficiency and optimize pulp production at the mill.

"The idea of the Chemrec technology is to co-locate a black liquor gasification facility with a paper mill," Berglund explained. "The technology is interesting because it completely eliminates the food vs. fuel issue in the bioeconomy. Black liquor is a byproduct of the kraft [brown paper] processing system. Typically it's burned or disposed of in some way, but if it's gasified and formed into synthesis gas, that syngas can be used to make higher value alternative chemicals and fuels, which can raise the profit margins of a paper mill by 30 percent."

It's estimated that the technology could enable the Escanaba mill to produce up to 13 million gallons of liquid biofuel per year.

Escanaba is also the site of the Upper Peninsula Tree Improvement Center (UPTIC), one of 14 MAES field research stations located around the state. Ray Miller, UPTIC manager, and Steve Pueppke, MAES director, also attended the signing ceremony.

To learn more about the trip to Sweden by MSU scientists, the governor and others to explore the possibilities for growing Michigan's bioeconomy, read the special report at http://special.newsroom.msu.edu/sweden/index.php?home.

Tropical Insects 'Go the Distance' to Inform Rain Forest Conservation

The long-held belief that plant-eating insects in tropical forests are picky eaters that stay close to home, dining only on locale-specific vegetation, is being chal-

lenged by new research findings that suggest these insects feast on a broader menu of foliage and can be consistently found across hundreds of miles of tropical forestland.

These findings have significant implications related to the sustainability and conservation of these globally important areas.

MAES scientist Anthony Cognato and graduate student Jiri Hulcr were part of an international team that conducted this groundbreaking research, the results of which were described in the Aug. 9 online issue of the journal Nature. The group included scientists from Australia, the Czech Republic, the United Kingdom, New Guinea and the United States.

"Tropical rain forests are home to a rich diversity of plants, birds, insects and other animals," said Hulcr, an entomology doctoral student working with Cognato and co-author of the report. "They also play an important role in our global climate and provide aesthetic, recreational and medicinal benefits. For these reasons and others, it is critical that we understand how these forests generate and sustain their diversity and what we can do to help conserve them."

The study included approximately 500 species of caterpillars, beetles and fruit flies from common plant-eating families, and 175 species from four diverse plant groups across 28,950 square miles of contiguous lowland rain forest in Papua, New Guinea.

Cognato and Hulcr were key collaborators on the project because of their expertise related to the biology and ecology of the bark and ambrosia beetle family, a model group of insects composed of 6,000 species worldwide and common to tropical rain forests.

"What we found was that the composition of the community of beetles does not change with distance as long as the environment is stable," Cognato said. "Even communities hundreds of miles apart are the same. And if there are differences, they seem to be random and not caused by any environmental change."

Study findings were similar for the butterfly and fruit fly species examined in the study.

"Such knowledge is critical to understanding the roles of ecological processes in maintaining tropical diversity, predicting species extinction and designing the systems of protected natural areas," Hulcr said. "Because diversity doesn't necessarily increase with distance but animals in small reserves tend to go extinct, you should plan for one large area instead of having a lot of small and distant areas to manage and conserve."

Cognato and Hulcr expect similar patterns in other tropical lowland rain forests, which, like the study area in New Guinea, are typically situated in the extensive low basins of major rivers. They are currently conducting research in other areas of the tropics — Borneo, Ecuador, Guyana, Ghana and Thailand — to confirm the New Guinea findings.

"If we want the stability of these forests, especially given how much they are threatened now, we need to understand how to best set up conservation areas," Cognato said. "And it's not just about the flashy species; it's about the whole thing."

Cognato and Hulcr's work was funded by the National Science Foundation, the National Geographic Society and the Michigan Agricultural Experiment Station.

Plant Transformation Center Changes Name and Director

With a new focus and a broader scope, the Plant Transformation Center at Michigan State University has become the Plant Biotechnology Resource and Outreach Center.

In addition, Jim Hancock, MAES plant breeder and geneticist, has taken the reins as director of the center from Ken Sink, who retired in June. Hancock said the center will be expanding its services and resources.

"We have a solid plant transformation facility here at MSU that has been concentrating on genetically engineering specialty crops for Michigan and the rest of the country," he said. "Our vision now includes collaborations in such areas as biobased technologies. We also want to take the facility to an international level."

The new Plant Biotechnology Resource and Outreach Center will have four key areas of endeavor:

- Research, including the transformation protocols for recalcitrant, specialty or orphan crops. Research will continue on specialty crops (blueberry, celery, etc.) and the development of novel marker technologies.
- Contract services, which will involve transformation of crop species.
- Molecular fingerprinting of plant varieties and segregating breeding populations.
- Outreach and communication. Safe use and production of genetically engineered crops dictate that users of the technology must know how it works and how to use it.

"We'll be conducting daylong workshops on the environmental safety of genetically engineered crops for MSU Extension staff members," Hancock said. "In addition, we are teaching weeklong international short courses on the environmental safety of genetically engineered crops and on marker-assisted breeding and transformation technology. This is a collaborative effort with the Institute of International Agriculture's outreach efforts to work with other countries to elevate their biotechnological capacity. Developing countries could see a real benefit by adopting genetically engineered crops, and we want to be the place where they come to learn about the possibilities.

More information on the Plant Biotechnology Resource and Outreach Center can be found at www.ptc.msu.edu.

MAES Researchers JAZ (zed) About Plant Resistance Discovery

The mystery of how a major plant hormone works to defend plants against invaders has been revealed, thanks to collaborative research efforts by Michigan

State University and Washington State University.

Scientists have known for years that a common plant hormone, jasmonate, plays a crucial role in plant development and function, but the steps that convert the hormone's signal into genetic and cellular action have remained elusive. MAES scientists Sheng Yang He and Gregg Howe were part of two back-to-back discoveries that solved the mystery, described in the July 18 online issue of the journal Nature.

Jasmonate is the last major plant hormone to have its signaling process revealed. Initial research by WSU researchers identified the family of proteins — dubbed JAZ proteins — that are critical to plants receiving and responding to the jasmonate signal.

Independent of the WSU work, Howe and He used *Arabidopsis*, a common lab plant, and tomato plants to determine how the JAZ proteins work. Their experiments showed that the jasmonate signal causes direct interaction between JAZ proteins and a second protein complex, SCFCOI1, that works to eliminate the JAZ protein so that the plant can mount a defense response. He is an MAES plant biology, plant pathology, and microbiology and molecular genetics scientist. Howe is an MAES biochemistry and molecular biology scientist.

"In a healthy environment, these JAZ proteins are doing their job — they're blocking all the defenses and signals, because they are not needed," Howe said. "But when a plant becomes stressed by an insect or pathogen, the plant needs to respond very quickly if it's going to be successful in warding off the attacker."

Based on the research findings, there is strong evidence to suggest that Howe and He might have identified the SCFCOI1 protein complex as the receptor for jasmonate.

"We found that when jasmonate is present the COI1 and JAZ proteins bind together," said He. "This opens the way for the plant to turn on the necessary genetic or cellular response."

As part of their research, Howe and He have proposed a model for how this interaction works.

"Now that we know what the active signals are and have identified the key regulatory proteins — the JAZ proteins — involved, the hope is to be able to either genetically modify plants or develop compounds that mimic the jasmonate hormone," Howe said. "The research may help scientists engineer plants for increased resistance to insects and pathogens."

The research was funded by the National Institutes of Health and the U.S. Department of Energy and supported by the Michigan Agricultural Experiment Station.

New MAES Appointments

The MAES is pleased to welcome the following faculty members with new MAES appointments.

Cornelius Barry, assistant professor of horticulture, became affiliated with the MAES in August. His research focuses on using genetic and genomic-based approaches to understand the molecular mechanisms controlling fruit development and ripening that contribute to the quality and nutrition of fruit crops. Using the tomato as a model system, he has identified several genes that affect the ripening process, including a novel gene that disrupts the fruit's ability to respond to the ripening hormone ethylene.

Before coming to MSU, Barry was a research associate at Texas A&M University and the Boyce Thompson Institute for Plant Research in Ithaca, N.Y. He also was a postdoctoral fellow at the University of Nottingham, in the U.K. from 1995 to 1999. Barry received his doctorate in plant biology at the University of Nottingham in 1995 and his bachelor's degree in plant physiology from the University College of Wales in 1991.

Daniel Brainard, assistant professor of sustainable vegetable production systems, became affiliated with the MAES in August. A central goal of his program is to improve the profitability of vegetable production while enhancing environmental and human health. Toward that end, his research interests include development of crop rotation, cover crop and tillage strategies to reduce dependence on fossil fuels while building soil health and pest resilience. Brainard's work also examines the interactive effects of climate and cultural practices on important pests of vegetable crops, with particular emphasis on factors influencing weed seed production and fate.

Before coming to MSU, Brainard had been a senior research associate in horticulture at Cornell University since 2004. He received his doctorate in horticulture from Cornell University, his master's degree in economics from Stanford University and his bachelor's degree in economics and third world studies from Oberlin College.

Yoonhyeung Choi, assistant professor of advertising, public relations and retailing, became affiliated with the MAES in August. Her research focuses on the role of emotion in risk message processing. She is particularly interested in how different message frames (emotion vs. logic) influence the general public's risk perceptions and how distinct emotion-eliciting messages (e.g., worry, anxiety, fear) will influence risk message processing.

Before coming to MSU, Choi worked as a public relations consultant at Burson-Marsteller in Seoul, Korea, and Hill & Knowlton in Chicago. She received her doctorate in journalism from the University of Missouri-Columbia in 2005, her master's degree in integrated marketing communications from Northwestern University in 2000 and her bachelor's degree in political science from Sookmyung University in Seoul in 1997.

Stuart Grandy, assistant professor of crop and soil sciences, became affiliated with the MAES in August. His research focuses on the soil biological processes that control organic matter dynamics and agricultural sustainability. Grandy is currently investigating how differences in soil microbial communities scale up to influence enzyme production and the molecular chemistry and turnover of soil organic matter. He is also beginning a project to explore the links between soil organic matter dynamics, biological diversity and plant disease. Grandy will be working with land managers throughout the state to develop strategies that use biological and ecological principles to improve sustainability.

Before coming to MSU, Grandy spent almost 2 years as a U.S. Department of Agriculture National Research Initiative postdoctoral fellow at the University of Colorado. He received his doctorate in

crop and soil sciences and ecology, evolutionary biology and behavior from MSU in 2005; his master's degree in plant, soil and environmental science from the University of Maine in 1998; and his bachelor's degree in environmental science from Evergreen State College in 1995.

Dana Infante, assistant professor of fisheries and wildlife, became affiliated with the MAES in January. Her research focuses on studying effects of the landscape on habitat, chemistry and the biology of river systems. Infante is currently working on a project to assess the status of fish habitat in rivers throughout the nation to identify protection and restoration opportunities to improve fisheries. She is also beginning research that will attempt to quantify specific ways that human land uses affect river fish assemblages, including encouraging the spread of tolerant fish and reducing numbers of endemic species.

Before joining MSU, Infante worked as a research associate for the Institute for Fisheries Research in Ann Arbor from 2005 to 2006. She received her doctoral and master's degrees in resource ecology and management in 2005 and 2001, respectively, and her bachelor's degree in scientific writing in 1994, all from the University of Michigan.

Songqing Jin, assistant professor of agricultural economics, became affiliated with the MAES in August. His main area of research interest is international development, with a focus on rural land tenure, land reform, and the emergence and functioning of rural land markets; the evaluation of agricultural technology and agricultural research and development; and the emergence and evolution of the rural non-farm economy and rural labor migration. Jin has conducted fieldwork and other research activities in eastern and southern Asia and Africa during the past several years.

Prior to joining MSU, Jin worked as a consultant and research economist in the rural development research unit of the World Bank. Jin received his doctorate in agricultural and resource economics from the University of California at Davis in 2004, his first master's degree and his bachelor's degree in agronomy from Zhejiang University (China) in 1991 and 1988, respectively, and his second master's in agricultural economics and marketing from Rutgers in 1997.

Jason Knott, assistant professor of animal science, became affiliated with the MAES in August. His research focuses on epigenetic control of gene expression during early mammalian development and in disease. To this end, he is working toward understanding the underlying epigenetic mechanism(s) responsible for regulating normal and abnormal development in various cellular contexts.

Before coming to MSU, Knott served as a postdoctoral research fellow at the University of Pennsylvania from 2003 to 2005 and completed a year of postdoctoral training at Serono Research Institute in Boston in 2006. He received his doctorate in reproductive biology and his bachelor's degree in animal science at the University of Massachusetts in 2002 and 1998, respectively.

Maria Knight Lapinski, associate professor of communication and faculty member in the National Food Safety and Toxicology Center, became affiliated with the MAES in August. Lapinski's research focuses on the impact of messages and social-psychological factors on health and environmental risk perceptions and behaviors, with a particular interest in culturally based differences and similarities. To this end, she has collaborated with other researchers on projects in Asia, the Pacific Rim, Central America and Africa. Lapinski's most recent international research project looked at perceptions of environmental and health risks among youth on the Mexico-U.S. border (Ambos Nogales). Her work has been presented at national and international communications and public health conferences, and published in public health and communications journals. It is currently funded by the National Science Foundation.

Before coming to MSU in 2005, Lapinski was an assistant professor of communications at Western Michigan University. She received her doctorate in philosophy from MSU in 2000, her master's degree from the University of Hawaii in 1995 and her bachelor's degree in communications from MSU in 1992.

Paolo Sabbatini, assistant professor of horticulture, became affiliated with the MAES in August. His research focuses on identifying environmental, physiological and cultural factors that limit vine growth and development, fruit maturity and quality of wine and juice grapes in Michigan. His current research interests include studying photosynthetic carbon assimilation and partitioning, the effect of biotic and abiotic stress on vine yield and fruit quality, canopy management, and evaluation of wine grape varieties and clones for Michigan's cool-climate growing areas.

Sabbatini joined MSU in 2004, working as a postdoctoral research fellow studying natural carbon isotope discrimination during photosynthesis. He received his doctoral and master's degrees in horticulture from the University of Ancona, Italy, in 2002 and 1997, respectively.

Kami Silk, assistant professor of communication, became affiliated with the MAES in August. She conducts research in the areas of health, risk and organizational communication. Silk's research focuses on how to influence individuals to engage in healthy behavior and prevention practices. She currently is working in the area of breast cancer prevention, with a focus on early prevention among adolescent females.

Before coming to MSU in 2003, Silk was a postdoctoral fellow at Pennsylvania State University from 2002 to 2003 researching how to most effectively communicate human genetics research to the lay public. She received her doctorate in speech communication from the University of Georgia in 2002, and her master's degree in communication and her bachelor's degree in English and mass communication at Bloomsburg University in 1993 and 1991, respectively.

Mark Skidmore, professor of agricultural economics and Morris Chair in State and Local Government Finance and Policy, became affiliated with the MAES in August. His research focuses on public economics and economic development. Skidmore has served as a consultant on a range of issues, including economic development, government public finance and policy, and price determination. Current research areas include economics of the public sector, economic development and the economics of natural disas-

ters. Much of Skidmore's research and outreach focuses on public finance policy and the relationship between public policy and economic development.

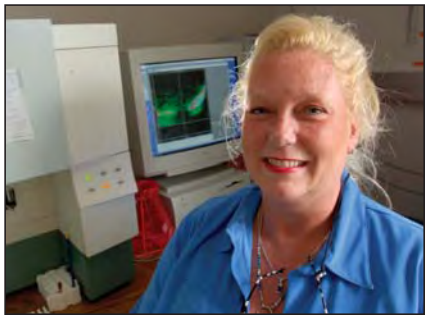
Before coming to MSU, Skidmore served as department chair and director of the Fiscal and Economic Research Center at the University of Wisconsin-Whitewater from 2003 to 2007. He received his doctoral and master's degrees in economics from the University of Colorado in 1994 and 1992, respectively, and his bachelor's degree in economics from the University of Washington in 1987.

Paul Thompson, W.K. Kellogg Chair in Agricultural, Food and Community Ethics, became affiliated with the MAES in August. His research focuses on ethical issues associated with food and agriculture. Currently, his research interests include emerging animal welfare standards, the role of food in establishing a feeling of community or sense of place, and the risks and benefits of nanotechnologies on the food system. Thompson is author of The Spirit of the Soil: Agriculture and Environmental Ethics (1995) and Food Biotechnology in Ethical Perspective. A collection of essays edited with Ken David entitled What Can Nano Learn from Bio? Lessons for Nanotechnology from the Debate over Agrifood Biotechnology and GMOs is slated for 2008.

Before coming to MSU in 2003, Thompson was the Joyce and Edward E. Brewer Distinguished Professor of Applied Ethics at Purdue University; he held a joint appointment in philosophy and agricultural economics at Texas A&M University from 1981 to 1997. He received his doctoral and master's degrees in philosophy from the State University of New York at Stony Brook in 1980 and 1979, respectively, and his bachelor's degree in philosophy from Emory University in 1974.

Wynne Wright, assistant professor of community, agriculture, recreation and resource studies, became affiliated with the MAES in August. Wright's work focuses on agrifood restructuring in global and local contexts. Her research has been primarily in rural sociology with emphasis on inequality, social movements and social change, often from the perspective of the political economy. Wright is currently conducting research on the role that cooperation plays in building sustainable agrifood systems. This work is shaped by civic engagement with agriculture and food system partners as they collaborate and plan for and envision sustainable agrifood futures. She is also pursuing research and outreach in civic engagement around contested issues in Michigan agriculture with funding from the Kettering Foundation.

Before coming to MSU, Wright held a Fulbright Fellowship at Szent Istvan University in Gödöllő, Hungary, in 2006 and was a sociology faculty member at the University of Northern Iowa from 2001 to 2006. She received her doctorate in sociology from the University of Kentucky in 1999, and her master's degree in sociology and bachelor's degree in psychology from Western Kentucky University in 1990 and 1988, respectively.



MAES Researcher Jeanne Burton Dies

Jeanne Burton, MAES researcher and Michigan State University associate professor of animal sciences, died Aug. 26 in Traverse City after a brief battle with cancer. She was 48.

Dr. Burton's research focused on bovine immunophysiology and immunogenetics. In addition to contributing significantly to understanding the genes that control animal health, Dr. Burton's work helped biomedical researchers realize that larger agricultural animals such as dairy cows or pigs may be better models to decode the secrets of human gene functioning and health than mice, rats or other rodents.

"Having known Jeanne, what I will always remember is her upbeat attitude and her willingness to always help out," said MAES Associate Director John Baker. "I also had several opportunities to hear her lecture over the years — she had a way of simplifying the complex and making it understood. Her enthusiasm was infectious. She will truly be missed by all of us in the MSU community, both professionally and as a great human being."

In addition to her research responsibilities, Dr. Burton was an advocate for comprehensive graduate student training and exposing students to the best minds in the animal functional genomics field. In May 2006, she organized the Second International Symposium on Animal Functional Genomics, featuring leading functional genomics scientists from around the world.

Dr. Burton, of Lansing, came to MSU in 1996 as an assistant professor of animal science and was appointed associate professor of animal science in 2001. Prior to coming to MSU, she served as a postdoctoral fellow for the USDA-Agricultural Research Service (ARS) National Animal Disease Center in Ames, Iowa from 1993 to 1995. She also was a postdoctoral fellow in veterinary microbiology and immunology at the University of Guelph's Ontario Veterinary College in 1992; a postdoctoral fellow in ruminant metabolism for the USDA-ARS in Beltsville, MD in 1991; and as a research associate in animal and poultry science at the University of Guelph, Ontario.

Dr. Burton received her doctoral, master's and bachelor's degrees in immunophysiology, immunogenetics and animal science from the University of Guelph, Ontario in 1991, 1986 and 1982, respectively.

She is survived by her husband, Paul Coussens, MAES animal scientist and director of the MSU Center for Animal Functional Genomics.

There was a celebration of Dr. Burton's life on Aug. 29 in Mancelona. There also was a memorial service at the MSU Alumni Memorial Chapel on campus on Sept. 6. A scholarship fund has been established in her honor. Donations may be sent to:

The Jeanne L. Burton Fund
Department of Animal Science
Michigan State University
Attn: Jamie Pratt
1290 Anthony Hall
East Lansing, MI 48824

futures directory

Henry "Rique" Campa
Professor of Fisheries and Wildlife
2A Natural Resources Building
517-353-2042
campa@msu.edu

Tom Dietz
Director
Environmental Science and Policy Program
273A Giltner Hall
517-353-8763
tdietz@msu.edu

Rebecca Humphries
Director
Michigan Department of Natural Resources
Mason Building, Sixth Floor
P.O. Box 30028
Lansing MI 48909
517-373-2329
HUMPHRIR@michigan.gov

Weiming Li
Associate Professor of Fisheries and Wildlife
13B Natural Resources Building
517-353-9837
liweim@msu.edu

Kelly Millenbah
Associate Professor of Fisheries and Wildlife
Associate Director of Environmental Science and Policy Program
2C Natural Resources Building
517-353-4802
millenba@msu.edu

Shawn Riley
Assistant Professor of Fisheries and Wildlife
13 Natural Resources Building
517-353-9456
rileysh2@msu.edu

Kim Scribner
Associate Professor of Fisheries and Wildlife
2E Natural Resources Building
517-353-3288
scribne3@msu.edu

William Taylor
Chairperson
Department of Fisheries and Wildlife
7 Natural Resources Building
517-353-3048
taylorw@msu.edu

109 Agriculture Hall
Michigan State University
East Lansing, MI 48824

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