

SOLUTIONS

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WINTER 2008

Secrets of the Hive

Propolis might have life-saving properties

What's Evolution Got to Do with It?

A basic tenet of science flows through CFANS research

Cultivating Culture

Scientists learn how to learn from native populations

Seeing the Forest for the Trees

Woody biomass could help solve sustainable fuel questions



College of Food, Agricultural
and Natural Resource Sciences

UNIVERSITY OF MINNESOTA

Solutions magazine is published three times a year for friends, alumni, faculty, staff and students at the College of Food, Agricultural and Natural Resource Sciences. Like the college, the magazine focuses on how science leads to solutions for today's problems in food and agricultural systems; global climate and environmental change; biodiversity; and bioenergy and bioproducts.

CFANS is composed of six divisions, 13 academic units (two are held jointly), seven research and outreach centers throughout Minnesota, the Bell Museum of Natural History and the Minnesota Landscape Arboretum. The college also participates in many interdisciplinary centers and cooperatives.

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Tell us what you think.

Solutions welcomes readers' comments and story ideas.

Solutions Editor:

Martin Moen
mmoen@umn.edu
(612) 624-0793

Solutions Managing Editor:

Becky Beyers
bbeyers@umn.edu
(612) 626-5754

Solutions Designer:

Sara Specht
sspecht@umn.edu
(612) 624-1746

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Calendar of upcoming CFANS events featured on back cover

Welcome to our third issue of *Solutions*.



Photo by Patrick O'Leary

Welcome to our third issue of *Solutions* magazine. This issue reports on some of the exciting new developments in our strategic areas of focus:

- **Food and Health**
Honeybees create propolis, which may hold the key to the bees' health as well as that of humans.
- **Environment/Climate Change**
Working in cooperation—rather than a top-down approach—with people from different cultures takes on increasing importance in a globally focused society.
- **Alternative Energy and Biofuels**
Projects that investigate using trees for fuel may provide a way to supply food, fiber and fuel all in one package.
- **Biodiversity**
Evolution remains controversial even though it's the basis for many of the topics studied at CFANS. The Bell Museum is hosting a major international conference on the subject next summer.

In addition to these stories and others, we highlight the accomplishments of our stellar students, staff, faculty, donors and alumni. This issue also puts the spotlight on an exciting new development: pending approval of the Legislature, the Bell Museum will move to a brand-new \$36 million facility on the St. Paul campus in 2010. The new museum will be built to current green-building standards and will feature outdoor space that highlights our latest environmental research.

Here at CFANS, we emphasize Solution-Driven Science, and *Solutions* aims to inform and entertain, leading to continued discussions and partnerships in the areas of food, agricultural and natural resource sciences.

Please let us know how we're doing; we'd love to hear your feedback.

A handwritten signature in black ink that reads "Allen S. Levine".

Allen S. Levine ('73—M.S., botany; '77—Ph.D., nutrition)
Dean

On the cover: A queen bee, tagged with the number 15, and her colony on the University of Minnesota St. Paul campus. Photo by David Hansen.

Secrets of the Hive

Photos by David Hansen

By Sara Specht

Unexplained disappearances, a baffling plague, an irreplaceable society crumbling: these are not the trappings of a musty history textbook or war coverage from across an ocean. They are essential pieces of a modern-day mystery that spans the globe.

This is the story of honeybees, their struggle to survive and the secret they may have to saving themselves. It's the tale of three CFANS investigators and their team, who hope to learn the bees' secret and use it to save humans, as well.

And it all began with a sore throat.



Propolis

Once upon a time

About seven years ago, a researcher from the Ukraine working at the University of Minnesota medical school on lab trials to combat HIV came down with a cold. She, like countless people around the world, had always relied on a traditional treatment for such woes, a substance found in any honeybee hive: propolis.

Propolis, sometimes known as bee glue, is a thick, sticky resin that bees collect from tree buds and use to cement holes in the hive and defend it against invading parasites and diseases. Traditional healers from South America to China, Japan to Eastern Europe, have valued propolis as a remedy for such ailments as gum problems and dental health, skin issues and oral sores, as well as viruses and the common cold.

The researcher tracked down propolis at the Minneapolis farmers' market and made herself a tincture to soothe her viral woes. Then she brought her cure to work with her and ran a test: propolis versus HIV. Propolis won.

Propolis demonstrated antiviral activity against HIV, prompting a study on propolis that paired the medical school with a team of researchers from CFANS. That project showed promising results, but propolis is an incredibly complex substance, and the mystery of precisely which elements are active remained unsolved. The researchers involved, though, didn't stop considering the study's implications.

Where the bees are

"I started thinking, 'wait, if propolis is so good for humans, it's got to also be good for bees,'" explains Marla Spivak, co-principal investigator in a new two-year project to identify the active compounds in honeybee propolis.

For the past several decades, bees have been stricken by parasites and viruses introduced by humans and global movement, to the point that wild or feral honeybees have become virtually extinct, explains Spivak, a professor in the Department of Entomology and bee expert. In the past year, entire colonies have mysteriously disappeared, an epidemic bee experts have named Colony Collapse Disorder (CCD), which has decimated some beekeepers' bee populations.

Spivak speculates that CCD could be the cumulative effect of diseases and parasites that affect only honeybees, new systemic insecticides, crop specialization and destruction of native plant corridors, among other things. Whatever the cause, CCD threatens the pollinators of one-third of all U.S. food crops.

"Honeybees are a very ancient society. They've been closely associated with humans forever. As long as human history has been recorded, we've been beekeepers," says

Spivak, citing the innumerable food crops humans rely on bees to pollinate, as well as honey and other hive products. "Now bees are suffering, and they're suffering for reasons mostly that we've created."

She reasoned that a study could be designed to address both honeybee and human health. Testing chemical compounds against bee diseases can be done much quicker than any done with human subjects, and could produce results that can quickly be applied to combat bee diseases. Those same results could then be tested against HIV and other human viruses. She enlisted two of her colleagues from the university's original propolis study to join her on the project, which is funded by a grant from CFANS: Jerry Cohen and Gary Gardner from the Department of Horticultural Science.

"I went to Jerry and said, what would be really cool would be to analyze the components of propolis and to use the bee as a screen to quickly test which are active against bee diseases and bee viruses," Spivak explains. "So I came up with the idea to use the bees as a screen and they came up with the methods."

According to the limited research available on the chemical makeup of propolis, it is composed of between 300 and 500 compounds. But these researchers are

interested in things present in very small amounts that may be novel and active, Cohen said, so the number may be closer to 3,000 to 5,000. In order to purify a single compound, he says, the researchers have to be able to analyze literally thousands of compounds. The key to analyzing so many compounds, and fractions of those compounds, is to create a process that can run a large number of tests of many different

Mike Wilson, Jerry Cohen, Gary Gardner and Lana Barkawi in their lab on campus.



chemical compounds very quickly. In similar tests, such assays have taken longer because there was no screen with which to score relative antibacterial or antiviral activity.

“One of the limitations of the original project we worked with was that we had no rapid assay for biological activity,” Cohen says. “It involved harvesting cells from patients, so it wasn’t trivial. What makes the bee part of this project very important is that quick screening system for bee pathogens, bacteria that cause the death of bees.”

Using propolis supplied by Spivak’s contacts from countries around the world, as well as from her own hives on the St. Paul campus, the study will identify any variations that arise from different plant sources in propolis from different locations, as well as any role the bees may have in altering its chemistry. The three professors collaborate with Lana Barkawi, a post-doctoral biochemist in Cohen’s lab, and toxicology Ph.D. student researcher Mike Wilson to create their new screening process.

The ultimate goal of the rapid assay will be to identify any new compounds—compounds that have not been identified or tested against HIV—that show anti-microbial activity, both toward bacteria and viruses using insect pathogens. Then the researchers will submit those compounds to an external service to do specific anti-HIV tests on enzymes unique to the virus.

“The danger with something like propolis, because it’s been looked at for literally millennia, is that you can move down the line, and discover something that’s already known,” says Gardner. “Our focus is on two key terms: active and novel.”

Barkawi, who participated in the original HIV study, says the bee pathogen screen is an entirely practical step, because contract labs aren’t interested in getting huge numbers of fractions to run through their assays. “It’s how many compounds, thousands? And we’re looking for the needle in the haystack. There has to be a selection somehow.”

“We might find something novel that’s never been evaluated on HIV, we might not,” Gardner says. “But we have this background in propolis and HIV expression, so it’s not like we’re saying we can cure AIDS because propolis is good.”



Marla Spivak harvests propolis from her hives on campus, as well as from contacts around the world.

A broader forecast

“Of course, a long-term hope is that after testing propolis components on bee diseases and viruses, we can find components that would be really helpful to treat human viruses, and particularly an inexpensive treatment for HIV for developing nations,” Spivak says. But hopefully “within two years we’ll have identified fractions that are active against bee pathogens for sure, and hopefully bee viruses. Another application of this research is that beekeepers may be able to diversify their income by harvesting and selling propolis, so this can be lucrative for them.”

The researchers hope this study will have impacts beyond the initial identification of active compounds, like isolating other antimicrobial properties in the plant products, Cohen suggests. “Especially when you run into things like antibiotics with growing

resistance. Most of our existing antibiotics come from fungal sources.”

They each credit the grant’s unique opportunity for interdisciplinary cooperation as the motivation for an investigation none of them would be able to perform on their own, and they foresee prospects of related inquiry. Gardner says he and Cohen would be interested in following the plant agents in propolis back to their sources in individual plant resins.

But Spivak reflects on the dangers to her bees, their colonies and beekeepers, and hopes for something different. “I really hope that bees change propolis when they collect it, because that leaves bees in the picture,” she says. “I want them to be indispensable, so that people maintain the bees, which are so important.” ■

Building a Better Holstein

Les Hansen advocates crossbreeding despite controversy

Look around Les Hansen's office and you'll see cows, lots of cows.

Most of the bovine statues and knickknacks are black-and-white, like the purebred Holsteins that Hansen grew up with and studies to this day. But right next to his computer is a big reddish-brown cow—a symbolic reminder of where Hansen thinks the dairy industry is headed.

Holstein producers take great pride in their breed; Holsteins produce high-quality milk and lots of it, and purists say crossbreeding could put that superior productivity at risk. But over the last 50 years, Holsteins have gotten bigger—sometimes too big to comfortably fit in a stall—and have more trouble conceiving and giving birth to healthy calves.

The main culprit, according to Hansen ('73—B.A.; '78—M.S., Animal Sciences), is inbreeding. Holsteins are bred via artificial insemination, most often using semen from just a handful of bulls. Some studies show that about 30 percent of the current international Holstein gene pool can be traced back to just two bulls.

That's where crossbreeding comes in. Hansen and others in the Department of Animal Science have gotten international attention for their work with seven California dairy producers who in 2002 began artificially mating their Holstein heifers and cows with the Normande and Montbeliarde breeds from France, as well as the Norwegian Red and Swedish Red breeds.

The results convinced Hansen that crossbreeding could help solve the dairy industry's reproductive and health problems. That's controversial in an industry where only 1 percent of U.S. dairy cattle have been crossbred, but it's made Hansen a popular speaker worldwide.

While some of his audiences may not agree, Hansen says his real-world experience helps build his case. "I grew up with Holsteins and on collegiate judging teams. I'm not some ivory-tower geneticist who's unfamiliar with on-farm concerns."

"In 2002, there was not much curiosity about crossbreeding," he says. "But now, the producers I talk to are becoming more frustrated, they've seen more reports and results that confirm this. Two or three years ago, it was kind of a 'wait and see' attitude, but now I'm seeing a lot of people who are at least dabbling in crossbreeding."

He expects a study beginning this winter to provide insight into how crossbreeding could help boost profits and productivity, as well as better tracking of the cows' health information. The study, which will involve 10 to 12 large Minnesota dairies and is partially funded by producers and artificial insemination suppliers, will last for eight years.

The study will cross-breed Holsteins with two other breeds—Swedish Red and Montbelier—in the 3-breed rotation that



Les Hansen

Hansen and his colleagues now recommend; with just two breeds, hybrid vigor from crossbreeding is greatly reduced and with four or more breeds, tracking becomes too complicated.

Hansen expects that over time, crossbreeding will become more routine for commercial milk production. "Not all change comes easily," he says. "But for now the momentum is headed in the right direction." —Becky Beyers



New Bell Museum planned for St. Paul campus

A new home for the Bell Museum of Natural History is part of the university's proposed bonding request to the 2008 Minnesota Legislature.

The new \$36 million museum, which will be built to meet the U.S. Green Building Council's environmentally sustainable "gold-level" performance specifications, will reinterpret the best of the museum's existing exhibits including the world-class Jaques habitat dioramas and the popular Touch-and-

See Room. New exhibits will be introduced celebrating "Minnesota's Nature" and the latest university environmental research. Flexible galleries for traveling exhibits and exhibits comprising the museum's own collections are also planned.

Ultimately, the new facility will include 12 acres of interactive outdoor space representing Minnesota's three ecosystems, prairie, northern coniferous forest and maple-basswood deciduous forest. The

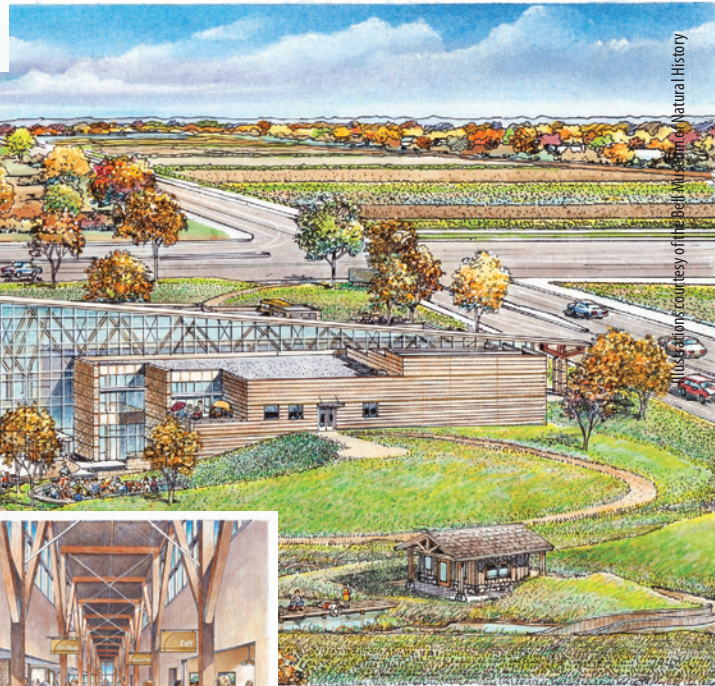
building and landscape will be designed to attract wildlife and will include trails, ponds, observation posts and a range of nesting sites for birds, bats, flying squirrels and other creatures. The building also will include an auditorium, community meeting rooms, classrooms, a café and a gift store.

The building is scheduled to break ground in 2008, with doors opening in 2010. Funding for the project will come from a requested \$24 million in state appropriations and \$12 million in private support and federal appropriations. The Bell Museum, part of CFANS, is now located at 10 Church St. S.E. on the University's Minneapolis campus.

Research Center improvements Included in bonding request

Renovations and building at two research centers will be part of the University of Minnesota's request for financing this spring at the Minnesota Legislature.

The requested improvements include a new maintenance and farm support facility at the Northwest Research and Outreach Center at Crookston and additional research and education space for renewable energy and "green" building work at the West Central Research and Outreach Center at Morris.



Grant funds new program in introduced species

A training program and new minor for graduate students will focus on the study of newly introduced species and genotypes and how they affect ecosystems.

The program is funded through a five-year, \$2.99 million National Science Foundation grant to faculty in CFANS and the College of Biological Sciences. Up to 40 faculty from across the university will participate in teaching courses in the curriculum. The

University's Board of Regents approved the minor in October.

"Increasing globalization has made the need for studying new species and genotypes more urgent," said Ray Newman ('82—M.S.; '85—Ph.D., fisheries and wildlife), a professor in the Department of Fisheries, Wildlife and Conservation Biology and principal investigator for the grant. Students will examine the introductions of exotic species and genetically modified organisms and learn how to analyze the risks of adding new organisms to an ecosystem.

"Not all exotic species are problems; some

can be desirable. The question is how to prevent the damaging introductions."

The new minor will include courses in risk modeling, as well as hands-on practical experience with state and federal agencies that deal with introduced species. Those projects will be aimed at solving a specific exotic-species problem, or a small part of a larger problem.

The grant is awarded as part of the NSF's highly competitive Integrative Graduate Education and Research Trainee program. About 20 such grants are made or renewed nationwide each year.

SOLUTION-DRIVEN SCIENCE™ SYMPOSIUM

Challenges & Opportunities for the 21st Century

The third Solution-Driven Science Symposium is called "The Food System and Human Health."

The symposium, scheduled for the afternoon of Feb. 14 at the St. Paul Student Center, will include presentations by three speakers followed by a panel discussion among three CFANS faculty members, who will ask questions and foster discussion between the speakers and audience members.

The symposium is based on the idea that human health is influenced by environment and personal choices, and that one aspect of the environment is the inter-relationship among quality, availability, accessibility and costs of foods.

"Solution Driven Science" symposia are intended to highlight topics that are relevant to CFANS' strategic initiatives. For details about the event, see www.cfans.umn.edu/Solution-driven_Science_Symposium.html.

Polasky named AAAS Fellow

Steve Polasky, a professor in the Department of Applied Economics, has been named a Fellow by the American Association for the Advancement of Science (AAAS). The award recognizes scientifically or socially distinguished efforts toward advancing science. Seven University of Minnesota faculty members earned the honor this year. Polasky has been on the faculty since 1999 and is one of the Founding Fellows of the University's Institute on the Environment.



Photo courtesy Steve Polasky

Wolf work lands Mech a spot on MN150

L. David Mech, a professor in the Department of Fisheries, Wildlife and Conservation Biology, is featured in the new "Minnesota 150" exhibit at the Minnesota History Center in St. Paul. Mech is recognized for his work in changing human attitudes about wolves.

The nomination for Mech reads, in part: "Perhaps more than anyone else, Dr. L. David Mech is responsible for major changes in human attitudes toward one of the world's most controversial animals—the wolf. Throughout his nearly five decades as a wildlife biologist, David Mech's work has produced a long list of milestones in wildlife research. Respected the world over, he has been a leader in making the state of Minnesota a model for living with wolves and for helping develop plans to manage expanding wolf populations.

CFANS has two additional closely connected representatives on the Minnesota 150 list: alumnus Norman Borlaug and the University's fruit-breeding program. To read more about the exhibit, go to www.mnhs.org.



Mech and his students spend research time in Yellowstone National Park.

Photo by David Hansen

New BSL3 facility dedicated

Researchers will be able to study dangerous pathogens in a safe environment in a new state-of-the-art building on the St. Paul campus. The Plant Pathology Research Facility will allow scientists to research pests that cause diseases such as Asian soybean rust, sudden oak death and new strains of stem rust on small grains.

The \$6 million building was dedicated in November with an open house and ribbon-cutting. The facility will be jointly operated by the Minnesota Agricultural Experiment Station and the Minnesota Department of Agriculture.

When licensed by the USDA Animal and Plant Health Inspection Service, the facility will be approved as a biosafety three (BSL3) facility and eligible to study a variety of plant diseases. Currently, only three BSL3 facilities in the United States are allowed to work with and conduct research on exotic plant pathogens. Special security and air filtration systems in the new facility will ensure the pathogens aren't released into the environment.

Research in the building will focus on plant pathogens that could damage crops or forests if they were introduced to Minnesota. Plant pathogens can be inadvertently spread by wind, travelers, food products or shipping, or deliberately spread to cause economic, political or human health problems.

The Plant Pathology Research Facility is a final piece of the \$24 million plant growth facilities project that includes classrooms, 15,000 square feet of growing space in state-of-the-art greenhouses and an Insect Quarantine Facility. The Insect Quarantine Facility opened in 2003 and allows researchers to analyze the potential usefulness of beneficial insects in the control of soybean aphids, buckthorn, garlic mustard and other pests.

The University of Minnesota, the Minnesota Department of Agriculture, the Minnesota Department of Natural Resources, the U.S. Department of Agriculture and the USDA Forest Service all will use the facility.

Agreement reached for agricultural education cooperation

A new agreement between CFANS and the College of Education and Human Development reaffirms the university's commitment to students majoring in agricultural education.

Students who choose the major specialize either in a program that prepares them to teach agriculture to students in grades 5-12 or in a program focused on agricultural leadership and communications. Currently, about 90 students are enrolled in the major.

The agreement clarifies academic procedures for students who choose the major and reiterates the University's commitment to the program. Several new faculty are expected to be hired in the immediate future to teach courses in both specializations.

Nationwide, agricultural education graduates are in high demand. Nearly one in four Minnesota agricultural education teachers will retire in the next four years; the University of Minnesota is the only institution in the state that trains and certifies agriculture teachers. Agribusiness employers also need graduates with a background in agricultural leadership and communications.

The major has been jointly operated by the two colleges. Starting in fall semester 2008, students in the program will be able to keep their academic home in CFANS throughout their college careers, rather than transferring to the other college in order to gain teaching certification.

"Agricultural education is a unique partnership between two academic disciplines," said Jay Bell, CFANS associate dean of academic programs and faculty affairs. "This agreement renews our commitment to preparing the agricultural teachers and business leaders of the future." Dean Darlyne Bailey, CEHD, says "This new partnership reflects that the best-prepared students need to effectively address the world of agricultural education. We are thrilled that CFANS shares this belief."



The official ribbon-cutting was held in November.

Plant pathology celebrates centennial

A century ago, wheat farmers and the fledgling Minneapolis grain-milling industry suffered repeated epidemics of wheat stem rust, with dire economic consequences. In response, the U of M created its plant pathology department. Today, the department is internationally known for its work in preventing plant disease and ensuring and enhancing safe food crops. The department celebrated its centennial in September with lectures, panel discussions and a ceremony honoring its most famous alumnus, Nobel Peace Prize laureate Norman Borlaug ('37—B.S., forestry; '41—M.S., plant pathology; '42—Ph.D., plant pathology).



Photo by Martin Moen

Alumnus Norman Borlaug was recognized at the Centennial by department head Carol Ishimaru.

New hires boost climatology research

Three new faculty members in the Department of Soil, Water and Climate will play key roles in the department's efforts to understand how the earth's climate is changing.

Expanding the climate-change team "was a critical need for us. Climate change has an impact on numerous issues of importance to society—from crop production to forest health, biodiversity to urbanization," says Ed Nater, department head. The scientists' specialties will complement each other and those of existing faculty to provide a more comprehensive picture of how the atmosphere closest to the earth is changing.

The new scientists are:

- Assistant professor Dylan Millet, whose research is in atmospheric chemistry; he was most recently a postdoctoral fellow at Harvard University.
- Assistant professor Peter Snyder, who works in large-scale global climate modeling; he was an assistant professor at the University of Illinois.
- Assistant professor Tracy Twine, whose research focuses on biosphere-atmosphere interactions. She had been an assistant professor at the University of Illinois.

Adding the new scientists will increase opportunities for university-wide interdisciplinary research and teaching in the atmospheric sciences, Nater says. "We're trying to understand the near-surface interactions between the atmosphere, soil and plants. If you're going to understand climate change, you need to understand those interactions. This is probably the issue of our times."



BELL MUSEUM
of Natural History



Join Now!

Become a member and support the Bell Museum's work in environmental education, scientific research, and the arts. Enjoy free admission and discounts on programs and special events. For information: www.bellmuseum.org or 612-624-0089.

By Becky Beyers

Scientists develop a strain of rice with purple stems, to make it stand out at harvest time from similar-looking weeds. Nature responds: within a couple of years, the nearby weeds develop purple stems too.

Antibiotic drugs that can help humans and animals fight off bacterial infections become widely used in health and agriculture. Nature responds: antibiotic-resistant bacteria evolve, raising the specter of a "superbug" immune to ever more powerful antibiotics.



What's *Evolution?* Got to Do with It

Both examples show how evolution is at work every day in the world that scientists and students study in CFANS. Yet evolution, one of the basic tenets of modern science, remains a controversial topic in American society.

“There’s a misconception that evolution is something that happened in the past and isn’t relevant to our world today,” says George Weiblen, a professor in the Department of Plant Biology and chief organizer of Evolution 2008, an international conference on evolution that will take place at the Bell Museum of Natural History in June (www.evolution2008.org).

“Evolution runs through agriculture, food and medicine and its importance is often underestimated.”

How evolution became a dirty word

Evolution is about much more than how humans are descended from apes. The respected biologist Theodosius Dobzhansky said nearly 40 years ago that “nothing in biology makes sense except in the light of evolution.”

Since Charles Darwin proposed his theory of natural selection nearly 150 years ago, scientists have refined their ideas about how plants and animals adopt new traits. Among biologists, there’s no debate as to whether the theory of evolution explains the facts of life.

Still, about a third of adult Americans don’t accept it, according to a study published in the journal *Science* in 2006. “Evolution has become entangled with religious positions, which is largely an American problem,” Weiblen says. “There’s no evolution controversy. But there are historical reasons why some American religious groups are

unable to come to terms with the facts of evolution. Belief in a creator is theology, not science, and we confuse the two at our peril.”



Photo by Martin Moen

Scott Lanyon

who have been taught by the sociological controversy over evolution that you can either be religious or scientific, but not both,” says Scott Lanyon, director of the Bell Museum and a professor in the Department of Ecology, Evolution and Behavior. “That tends to reinforce the notion that you can choose which science to believe, and it doesn’t work that way. Choosing to not accept evolution makes about as much sense as choosing not to accept gravity. If you drop an object it will fall as a result of gravity regardless of whether or not you accept the concept.”

For CFANS research—and students’ potential future employers—that could become a crucial distinction, Lanyon says. “Who is industry going to hire? If this continues, they’ll have trouble hiring competent people who understand how science works, and they’re going to make mistakes, potentially costly ones.”

Why biodiversity matters

As crops and animals evolve in response to changing environmental conditions, biodiversity plays an important role. A food

system that relies solely on only a few crops or crops with little genetic variation won’t have the diverse traits needed to adapt to those changing conditions and resist potential disasters.

“Our society is based on five main crops,” Lanyon says. “What if a superbug comes along that attacks them? The more crops we have with diverse genetics, the safer our society will be.”

Interest in perennial grasses as biomass crops complicates the evolutionary picture even further, says Nick Jordan, a professor in the Department of Agronomy and Plant Genetics. “It creates some interesting challenges; you’re doing a different kind of agriculture because you’re not planting for just a year and you’re dealing with a polyculture (a mixture of crops). We’ll be selecting for team performance (among plants), not individual.”

Farming that is based on crop mixtures could affect how individual plant species evolve, as well as how soil bacteria and other micro-organisms adapt, Jordan says. “Crop breeding has been done as if plants functioned all by themselves, when in fact below ground there’s this whole army of symbionts.”

Team approaches will become important for breeders and farmers as well, Jordan says. Crop mixtures can produce environmental benefits as well as grain and other commodities, but these multiple “outputs” mean that plant breeding for crop mixtures will require a more decentralized, site-specific and interdisciplinary process that could involve soil specialists and other kinds of biologists as well as traditional breeders. “Evolutionary thinking becomes relevant because we probably will want to breed crop mixtures that are adapted to weather, soil and biological communities that occur in particular places.”

Still, the gains outweigh the risks, he says. “I’m much less interested in the scary parts (like the evolution of ‘super-weeds’) than the hopeful parts...there are enormous potential gains out there.”

(EVOLUTION continued on page 14)

Evolution evolves

The University of Minnesota's strong team of evolutionary biologists made it a natural choice to host Evolution 2008, Lanyon says. "A lot of us are frustrated with the lack of public awareness about this topic as a central theme in science. We have a reasonably well-educated public in this state, and with a little bit of help, more people will get it."

Weiblen is similarly optimistic about how a better understanding of evolution will help solve other kinds of problems and prevent them in the future.

"This is the most exciting time to be an evolutionary biologist," he says. "We have the molecular and computational tools needed to give us a deeper understanding than ever before."

Global change makes evolutionary processes even more interesting and important to society, Weiblen says. "As a species, we are speeding up the pace of evolution because we are accelerating environmental change around the world. It's the genetic responses of organisms to circumstances we create that will determine the future." ■

EVOLUTION 2008

The three professional societies who will meet at Evolution 2008 differ slightly in their specific focus, but they all revolve around evolution:

Society for the Study of Evolution: Scientists study evolutionary processes on a micro scale, such as mutation and natural selection.

Society of Systematic Biologists: Scientists study evolution on a macro scale, looking at species and lineages and how the diversity of life is all related.

American Society of Naturalists: Evolutionary biologists who focus on putting the evolutionary process in an ecological context.

The conference runs from June 19 to 24 on the West Bank of the University of Minnesota campus. It's expected to draw about 1,200 participants and will be one of the largest academic conferences ever held on campus. For details about the conference, see www.evolution2008.org.

Other evolution-related events at the Bell Museum of Natural History:

Paradise Lost: Climate Change in the North Woods

February 16 - April 13
West Gallery

An exhibition highlighting the human impacts on the environment and what the future may hold for unique northern ecosystems affected by climate change.

What Would Darwin Think? — Evolution in Today's World

February 19, 26 & March 4, 11, 18
7 - 9 p.m.

University of Minnesota's
St. Paul Campus (Ecology 150)

This series of noncredit adult classes will explore how the theory of evolution is a unifying concept in biology today. Classes will focus on species survival, the impact of disease, animal altruism and cooperation as well as current evolutionary research.

Thursday, February 14
12:30 - 5:00 p.m.
Northstar Ballroom
St. Paul Student Center

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Understanding the Outdoors

David Fulton studies why hunting, fishing passions are fading

Are changing recreational preferences threatening North America's wildlife? Fewer people are hunting and fishing, and the declining participation rates are occurring primarily in people under 40. This drop in participation could be a real threat to the well-being of America's wildlife because money from hunting and fishing licenses provides the majority of funding for habitat conservation efforts in North America. And, with the push for growing biofuels, state and federal conservation policies that paid farmers to remove land from production are less appealing.

"Clearly, the revenue model that created wildlife conservation and habitat protection successes during the 20th century is in serious jeopardy at the start of the 21st," says David Fulton, assistant unit leader in the U.S. Geological Survey's Minnesota Cooperative Fish and Wildlife Research Unit and associate professor in the Department of Fisheries, Wildlife and Conservation Biology. Fulton's research into the attitudes and interests of outdoors people is helping natural resource managers understand these changes and make the best decisions in this new situation.

Keeping people happy

"With the apparent drop in hunters and anglers, recruitment and retention are the buzzwords for those concerned with management of fish and wildlife," Fulton says. In the nine years he's been at the University, Fulton has built an impressive collection of data about hunters and anglers.

"While we might not be able to reverse the decline in participation, if people have a good outdoors experience, they'll continue to buy licenses and join hunting and fishing

organizations. The challenge is identifying and then managing for the conditions that produce a 'good' experience," Fulton says. "If we can keep people connected to wildlife and the land, we know that devoted outdoors people are going to promote conservation of land and game and nongame species."

What is a "good" experience for hunting and fishing? For some, the opportunity to shoot a trophy buck or successfully call in a skittish tom turkey is rewarding. Others value the chance to get outdoors—bringing home the catch is secondary. Still others get outdoors for the solitude and feel their experience is diminished when their favorite fishing hole is crowded with other anglers.

The survey data Fulton collects helps resource managers for the Minnesota Department of Natural Resources, U.S. Fish and Wildlife Service and others create the range of experiences that keep people coming back. While controlling license numbers or bag limits is the ingrained response for managing recreational use of fish and wildlife, Fulton's research suggests that managers need to develop a more holistic approach focused on the outcomes people get from hunting and fishing if we want to ensure a beneficial experience for hunters and anglers.

Overcoming barriers

Fulton also studies what keeps people from participating in their favorite outdoors pursuits. To gain perspective, Fulton jokes that he need only look in the mirror. He was raised in a family with strong hunting and fishing traditions, and loves nature and natural history. Then Fulton started a family, moved from a rural to an urban community, and accepted a white-collar job that demands more of his time. The



Photo by David Hansen



David Fulton

result is that his opportunities to hunt or fish are increasingly constrained.

"Our theory is that less-engaged participants," Fulton says, "are less likely to join sporting organizations, less engaged in conservation issues and less willing to contribute time or money to conserve habitat."

In the future, Fulton wants to learn more about access to hunting lands, which is becoming more of a barrier as more of Minnesota's land is carved into smaller ownership parcels and the new landowners might be unfamiliar with a hunting tradition. In other parts of the United States and around the world, people buy access by leasing hunting rights from landowners. But previous research suggests Minnesotans are uncomfortable with the leasing arrangement; partly because their pricing expectations are too far apart to strike a deal.

"The health of our natural resources depends on a collaborative relationship between landowners, hunters and anglers. Perhaps with greater understanding a solution can be found," Fulton says.

—Martin Moen

Main photo: This *Aquilaria* tree in Vietnam is three years old.

Small photos: Blanchette shows conference delegates results from experiments to produce agarwood during the First International Agarwood Conference field trip at Nui Guai Mountain, Vietnam (left); graduate student Joel Jurgens has worked closely with local residents in Vietnam for several years (center); dark regions of agarwood form inside the trees (right).



Photo by David Hansen



Photos courtesy Robert Blanchette

By Becky Beyers

The *Aquilaria* trees were in trouble.

Old-growth *Aquilaria* trees produce a rare form of incense that's highly valued in many cultures. Because the incense comes from the resin inside the trees, by the mid-1990s *Aquilaria* had been harvested in southeast Asia to near-extinction.

But a team led by CFANS plant pathologist Bob Blanchette worked with Vietnamese farmers to develop a cultivated version of the trees that provides a sustainable crop for some of the world's poorest regions while saving an endangered species.

The project is one example of how scientists are learning to work in cooperation with people from different cultures. Traditionally, scientists have worked alone to produce innovations or ideas and transferred their work to communities with the expectation that community members would put the ideas to work as directed by the scientists.

Cultivating

But modern science recognizes that a bidirectional, cooperative process can benefit both the scientists' work as well as the end result for users. That may become an increasingly important factor in a changing global climate.

Blanchette's project, begun about 12 years ago through the Rainforest Project Foundation, started with a meeting of scientists and village leaders. "They were excited about the possibilities," he says, because the incense has such important religious significance and because the trees were disappearing so fast.

Research into how the agarwood could be harvested from younger trees continued, and now cultivated fast-growing *Aquilaria* trees are being planted in large numbers and can be harvested after just two years for a sustainable production of the valuable resin.

Local farmers played an important role in the development of the new crop: their traditional knowledge of how the trees grow and the importance of agarwood helped the Western scientists understand the process. As the project began to see success,

the community," Blanchette says.

Training the next generation

Kristen Nelson has been studying the ways in which communities interact with scientists for most of her career. The associate professor in the Department of Forest Resources and Department of Fisheries, Wildlife, and Conservation Biology recently finished a handbook for scientists and regulators working on environmental risk assessment in multiple countries.

"Science is embedded in societies," she

Culture



Eventually, the scientists discovered that *Aquilaria* trees produced agarwood as a response to micro-organisms that invaded when the trees were wounded. "Usually you want to limit decay, but in this case, we wanted to stimulate it," Blanchette says.

more local farmers asked to participate in demonstration plot plantings.

One of Blanchette's students, Joel Jurgens ('98-B.S., forest resources), spent six weeks in the Vietnamese village where the project began as part of an Undergraduate Research Opportunities Program project 10 years ago. He lived with village elders and says he was welcomed as part of the family.

Jurgens had never been outside of North America before and relished the immersion in the culture, he says. "Much of the work was the process of building trust as we communicated through translators, but living in the village made this work incredibly easy—we had the groundwork built."

Today, the cultivated agarwood crop is thriving and similar projects are taking root in Thailand, Bhutan and Malaysia. In addition to growing the trees, the communities are processing the resin to make incense and making the wooden boxes the incense is shipped in. "They have a finished product, with very significant beneficial effects for

says. "You cannot just transplant what works in one country into another. What works in Iowa doesn't necessarily work in Chiapas."

Cross-cultural work is evolving out of necessity, she says. "We originally had the idea that science was about separating yourself, but problems are more complex than that. There are things you can share and learn from others. You have to build knowledge across networks."

Nelson's approach to training scientists focuses on two concepts: getting past the assumption that "I do it the right way," so that contributors can be true equals, and avoiding the problem of relativism—the other extreme. "That's not respecting what you are and what you think. This isn't about becoming a blank slate."

While the traditional scientific method still dominates, cooperative thinking comes more naturally to the next generation of scientists, she says. "They see scientists as part of society, not as a separate entity."



Hundreds of thousands of seedlings are being planted for agarwood production.



Photo by David Hansen

The Maori take a sustainable approach to the environment.

Scientists who are in graduate school now will spend their careers dealing with “wicked problems,” which have been defined as issues with contradictory, uncertain, or changing requirements that involve complex interdependencies. Finding ways to create sustainability on a global scale is one example, Nelson says.

Prentice Beadell, a master’s of agriculture student in the Department of Horticultural Science, spent nearly five weeks last summer in New Zealand studying how environmental change was affecting the native Maori people.

She spent much of her time there simply talking to people about their views. “I found the best thing to do was to make the questions simple, and then stand back and listen,” she says. One thing that struck her was how Maori people’s spiritual beliefs affected their views on sustainability and land use, and she thinks some of that approach can be used in Minnesota.

“It raised questions with me about what it means to own the land and to treat it with respect. I want to try to bring that holistic approach and the connection with past generations back and try to instill more of that here.”

Culture at home

As Minnesota’s population becomes more diverse, cross-cultural engagement is becoming important at home too.

Craig Hassel, an associate professor in the Department of Food Science and Nutrition, works to interface scientific research with other ways of knowing in a way that respects the knowledge from other cultures.

For example, he says, nutrition science tends to dismiss ideas of food as it relates

to people’s sense of memory, consciousness and nurturance because these dimensions of personal experience are not easily measured from a biomedical perspective.

“When we study native foods only in terms of nutrients or bioactive molecules,” he says, “it emphasizes the physical and chemical dimensions and discounts the personal and cultural dimensions.”

Hassel is part of an ongoing project involving local herb growers and Chinese medicine practitioners that uses both traditional knowledge and modern science. While medicinal herbs have gained popularity in the United States, evaluating their quality is a matter of perspective. The situation is complicated because traditional Chinese medicine typically involves combinations of many herbs.

From a Chinese medicine viewpoint, medicinal herb quality is evaluated through many of the same characteristics that are commonly used to evaluate food—texture, taste and other sensory qualities.

So the group’s current project uses descriptive sensory analysis—a process in food science where participants are trained to detect those characteristics—on herbs. Graduate students are sampling teas made from different kinds of herbs and trying to define attributes of flavor and aroma. Once practitioners assess the quality of these herbs from a clinical standpoint, the attributes can be understood as positively or negatively associated with herb quality, Hassel says.

“It’s a way of communicating quality,” he says. “How do you know what’s any good? This is a way to learn.”

Students are “very hungry for knowledge as understood from different cultural perspectives,” Hassel says. “They recognize that the world is a bigger place than what we sometimes offer.”

“I believe this is a huge opportunity for our land-grant research universities...all it requires is a shift in perspective.” ■



Photo by David Hansen

Practitioners of Chinese medicine taste herbs as Craig Hassel (background) observes.

Cold Hardy

New grape varieties help grow fledgling wine industry

Minnesota wineries are taking a breather now, waiting for last summer's grapes to mature into fine wines. More than 20 wineries now dot the state, up from just four a decade or so ago.

Winemaking in Minnesota may seem like a new phenomenon, but developments in wine grape varieties have been going on for almost 40 years. James Luby ('82—Ph.D., plant breeding), head of fruit breeding in the Department of Horticultural Science, has led the group that developed four cold-hardy wine grape varieties that can stand the tests of time and winter.

Luby credits a great deal of local wineries' growth to their collaboration with the University.

"This is a really good example of Minnesota citizens taking a research product that was developed by the U and being able to put it to commercial use," says Luby. "It's a kind of a partnership between the U and the local wine community, a partnership to work out some of the difficulties of growing grapes and making wine in our climate. It's taking a bit of the U and bringing it off campus, working together to turn it into something that is good for the state."

The benefits of this partnership are apparent to U alum John Maloney, '85, who co-owns Cannon River Winery in Cannon Falls, Minn., with his wife, Maureen.

"I became very intrigued with the whole idea that the U of M was breeding cold-hardy wine grapes that were actually capable of producing some very good quality wines," says Maloney.

The history of grapes at the U goes back an entire century, but it wasn't until the 1970s that the idea of producing wine grapes was explored. Local farmer Elmer Swenson and U researchers Patrick Pierquet and Cecil

Stushnoff began crossing local grapes with traditional wine grapes in hopes of creating a good wine grape that could survive the Minnesota climate. The seedlings from these crosses began to produce fruit around the time of Luby's arrival in 1982.

Key to the success of the budding grape-breeding program was the arrival of scientist Peter Hemstad in 1984. Since then, four varieties have been introduced.

Then, in 1997, the Minnesota Legislature appropriated funds for an enology program. That allowed Luby and other researchers greater exploration into the study of wine and winemaking.

The U's first varietal was Frontenac, a red-wine grape variety introduced in 1996. In 2002 came La Crescent, a white-wine variety, followed by Frontenac gris, a white-wine variety and surprise mutation of the Frontenac. Marquette, a red-wine variety, debuted in 2006.

The U connects with the local wine community in ways besides grape variety

development. Anna Katharine Mansfield, a senior research fellow in horticultural science since 2001, hosts workshops throughout the year to provide an in-lab experience for winemakers that builds their knowledge about the chemistry of wine. Luby, Mansfield and horticultural science faculty member Gary Gardner also teach a popular introductory course, Vines to Wines: Introduction to Viticulture and Enology.

Luby believes the growth of the Minnesota wine industry will only continue, and he sees collaboration with the local wine community as a means of fostering the growth.

"We have always had a significant part of our efforts in applied research and outreach," says Luby. "Our products, varieties, and information are primarily developed for the public rather than other academics, and we have always been engaged with the grower community through participation in educational programs that are jointly developed."

—Stephanie Wilkes

This story was reprinted from UMNews.



Peter Hemstad and Jim Luby lead the grape breeding program at the University.



Photos by David Hansen

A Sustainable U Initiative seeks to build a greener Minnesota



The rain garden on the St. Paul campus is one piece of the initiative.

The image is etched indelibly into the minds of Minnesotans: then-Gov. Wendell Anderson on the cover of Time, holding a freshly caught northern pike. “The Good Life in Minnesota,” trumpeted the magazine. But for how long?

If its lake home gets polluted, the northern could disappear; so, too, could the majestic moose, as development gobbles up its forest habitat. To prevent these and similar scenarios, the University of Minnesota is helping citizens envision and create a future where their state’s abundant natural resources are protected and life can continue to be good.

The effort is a major thrust of the U’s Sustainability Initiative, which also includes research on topics like energy use, housing, transportation, and food and fiber production.

“We’re at a turning point in history,” says Kris Johnson, program coordinator for the initiative. “Local leaders are beginning to see the interconnections between people and

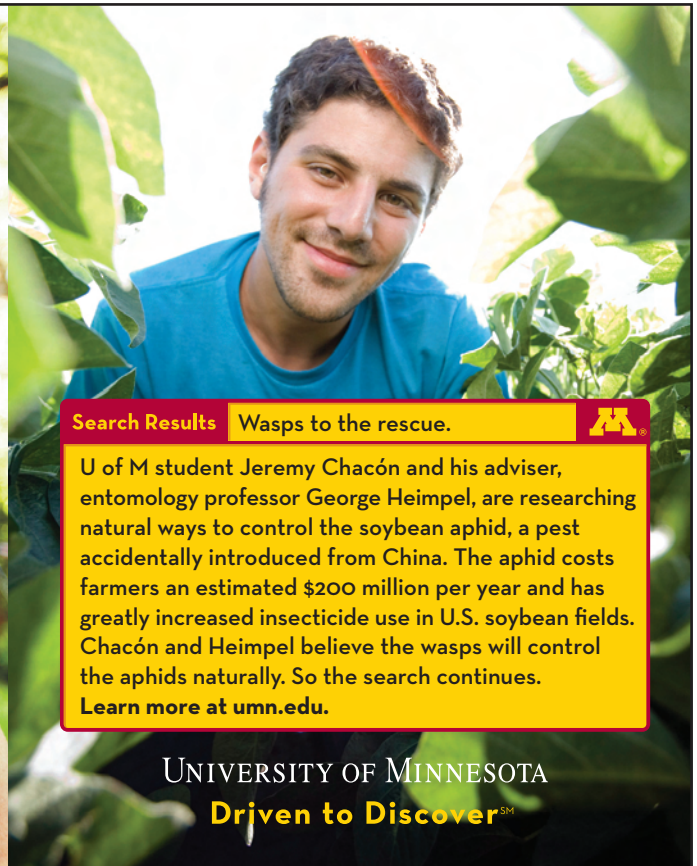
ecosystems and want to apply this systems-thinking to sustain the environment and a high quality of life”

To better prepare for the future, one must first imagine it. Launched in summer 2004, the initiative is convening 12 workshops in collaboration with the University’s Regional Sustainable Development Partnerships to help Minnesotans envision how life might be in the year 2050.

“Minnesota is finally developed enough that every Minnesotan can see the effects of human domination of the environment, such as more people on trails,” says Anne Kapuscinski, a professor in the Department of Fisheries, Wildlife and Conservation Biology and a leader of the initiative.



Search Is there a natural way to protect crops? 



Search Results Wasps to the rescue. 

U of M student Jeremy Chacón and his adviser, entomology professor George Heimpel, are researching natural ways to control the soybean aphid, a pest accidentally introduced from China. The aphid costs farmers an estimated \$200 million per year and has greatly increased insecticide use in U.S. soybean fields. Chacón and Heimpel believe the wasps will control the aphids naturally. So the search continues. [Learn more at umn.edu.](#)

UNIVERSITY OF MINNESOTA
Driven to DiscoverSM

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“The question is, ‘What are the possible futures, and how do we change our habits as individuals and communities so we don’t end up with [undesirable consequences]?’”

With that in mind, the state’s Legislative and Citizen Commission on Minnesota Resources has tapped the expertise of people in the initiative and the U’s new Institute on the Environment for help in conserving and preserving natural resources.

“In the management of the environment there are separate [agencies] for water, air, soil, agriculture and so on,” says Kapuscinski. The idea is to take an integrated approach to problems. For example, residents of lakeshore homes might fertilize their lawn and pull up cattails. As chemical nutrients, unimpeded by hungry cattails, run off into the water, walleye and northern pike may give way to bass and panfish, then carp and bullheads. And as climate change raises lake temperatures, this effect could work in synchrony with pollution.

But different sectors of government deal with water pollution, fisheries and agriculture. “The impact cuts

across sectors. We need an analysis to show how nutrient pollution will affect fish and interact with climate change,” Kapuscinski says.

Much of that job falls to Laura Schmidt, a postdoctoral associate. Using data on scientific, economic and other factors, she is analyzing how they could all interact to produce different patterns of land use, pollution, impact on plants and animals, and so forth.

But, cautions Johnson, it can give “a false sense of confidence that you know where you’re going.” Therefore, the analysis is geared toward identifying multiple possible futures so that, as Kapuscinski says, “we do all we can to sustain what is important to us, but are better prepared for whatever may come to pass.”

Of course, not much will happen unless people’s attitudes change and the next generation learns to think in terms of the environmental and social consequences their actions will have.

There are, however, signs that the message is starting to get through.

Workshops for teachers led by Karen Oberhauser and Robert Blair—both faculty members in the

Department of Fisheries, Wildlife and Conservation Biology—and Barbara Coffin of the Bell Museum help teachers incorporate concepts of sustainability into their curricula and teach ecological principles and scientific inquiry.

In 2006 the University unveiled a new minor in sustainability studies, open to students from every major. Through its courses, students learn about ecological sciences, but also the social and economic factors that affect human and environmental well-being.

As she contemplates today’s U students, Kapuscinski sees hope.

“Seniors now are much more on the ball than 10 years ago,” she observes. “We want the next generation of leaders, politicians, white-collar workers, and so on, to have been exposed to these ideas. We want them to be as much a part of the curriculum as algebra.”

—Deane Morrison

This story was reprinted from UMNews.



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Finding more options

If all the cropland in Minnesota's Morrison County were used to produce biofuels, the county still would need to import energy. While those research results are not surprising and no one believes farmers should supply all our energy, the study illustrates the land use decisions at the heart of our development of renewable energy from biomass.

How should we allocate our finite land resources to supply food, fiber and fuel as well as space to live, work and play? Research published in April 2007 by professors C. Ford Runge and Benjamin Senauer of the Department of Applied Economics found that using more highly productive cropland for bioenergy crops would drive up food prices, possibly forcing more people toward malnutrition. Their study ignited the so-called food versus fuel debate—a firestorm of discussion that still burns today.

From Stan Hokanson's viewpoint, there's an element missing from the debate. "What if we could utilize marginal lands that are too nutrient-poor or too wet to produce food or forest crops?" Adding these un-cropped acres to the potential land-base for biofuels crops might take some pressure off the more productive land.

Seeing the FOREST for the TREES

By Martin Moen

“As long as we don’t diminish the wildlife and ecological benefits these marginal lands provide,” says Hokanson, an associate professor in the Department of Horticultural Science, “purposely cultivating these woody species on this ‘extra’ land might be really beneficial.”

Hokanson is focused on alder, aspen, hybrid poplar, and willow. Of these, hybrid poplar is most often mentioned as a woody source of cellulosic ethanol. The potential for alder, aspen and willow is virtually unknown. Scientists also have little understanding of which species of these woody plants will thrive on marginal lands, in a far north climate, while producing maximum levels of fermentable sugars.

A Team is Born

Those questions helped Hokanson form a research team and attract nearly \$650,000 to fund a four-year study. The plan is to



Photo by David Hansen

Stan Hokanson evaluates various kinds of trees.

evaluate 14 species of alder and 10 willow species and selections, and compare the results with similar tests on two selections each of hybrid aspen and hybrid poplar. The team will evaluate how well each species grows on various sites, the fiber and chemical composition of wood produced by each species, the amount of glucose each species produces, and the efficiency with which the glucose can be released.

As a plant breeder for the Minnesota Agricultural Experiment Station, Hokanson has increased understanding of genetic resistance to disease in rose and strawberry plants. He’s also worked to develop new varieties of landscape trees and shrubs. For this project, he will identify the genetic traits of the alder and willow species that help them survive on marginal sites in northern climates and produce economically viable amounts of cellulosic ethanol.

“If we can identify one or two genotypes of each that are worthy of further testing or that can be hybridized to produce an advanced generation of plant material,” Hokanson says, “this project will be successful. It’s a thrill for me to pursue an opportunity that didn’t exist five years ago, before all the interest in woody biomass.”

Associate professor Andy David of the Department of Forest Resources will evaluate how well all the species and selections grow on marginal lands. From his office at the North Central Research and Outreach Center in Grand Rapids, David has secured two planting sites.

“We have a site in Koochiching County where the growing season is quite short and the winters are quite cold,” David says. “Near Grand Rapids we’re planting on a mine spoils site. We also have a site on the Anoka Sand Plain in central Minnesota where soil fertility is low. If these species can make it on these sites, they’ll do very well elsewhere.”

David is especially interested in studying the survival, growth and eventual regeneration



Photo by David Hansen

Andy David considers how trees grow on marginal lands.

of the aspen selections that have come out of his breeding program.

Economically viable

The evaluations of willow also intrigue research associate Dean Current of the Department of Forest Resources because willow bark is a good source of salicylic acid, which is used in skin care products, as a food preservative and as an antiseptic in toothpaste.

“Salicylic acid could be a valuable co-product from willow grown commercially,” Current (’85–M.S., forestry; ’97–M.A., anthropology; ’00–Ph.D., forestry) says, “and that’s vital to making willow competitive in the bioenergy economy.”

If willow or alder have good potential, Current says, landowners will be receptive to planting them. He leads the college’s Center for Integrated Natural Resource and Agricultural Management, which has worked with landowners statewide for over 10 years to develop woody crops that produce income. Current has been working with landowners in central Minnesota to grow willow in a three-year cropping cycle with the plants regenerating on their own for seven cycles before replanting is needed. After three years, the plants are 12 to 15 feet high and are cut down and ground up for easy transport—usually to a facility that burns them as fuel.

Near the end of the study, Current and David will share their evaluations of alder

and willow with interested landowners. They'll also pass along their recommendations for techniques that help the trees survive and thrive.

Growing alder and willow for their cellulosic biomass makes sense in an agricultural setting, says Alan Ek, head of the Department of Forest Resources. "There are fewer environmental issues on the planting, cultivation and harvesting of an agricultural crop as compared to forest crops," Ek says. "Growing cellulosic biomass is an unlikely scenario in wildlands or existing forest settings."

Overcoming obstacles

Ulrike Tschirner points out that biomass is a great source of glucose and other sugars that can be fermented to ethanol or other products.

The woody parts of plants contain varying amounts of cellulose, hemicellulose and lignin. These chemical compounds are often called cellulosic biomass. Breaking the chemical bonds in cellulose and hemicellulose yields glucose and other sugars, which can be fermented to ethanol. The difficulty is in finding an effective way to break down the cellulose and hemicellulose into their sugar components. Tschirner, an associate professor in the Department of Bioproducts and Biosystems Engineering, will evaluate various methods for extracting the sugars, including various pre-treatment techniques that might improve the process. She also will determine which species will produce the most fermentable sugar.

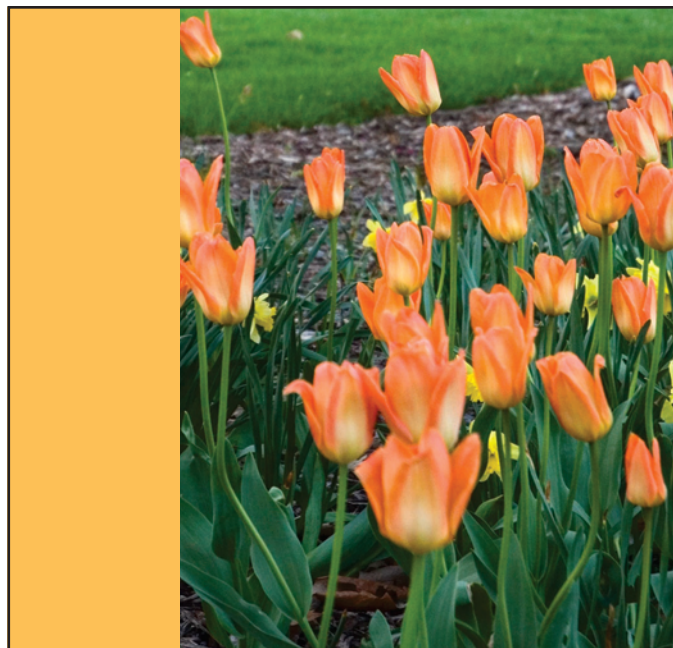
Another obstacle to Tschirner's work is that the trees planted in the project's first year will have grown very little by the time the study concludes four years later. "We're obtaining samples [pencil lead-size cores removed with a hollow drill] from mature trees in botanical gardens," Tschirner says, "because the young trees we grow won't provide good samples for testing."

Tschirner will know fairly soon which species of alder and willow hold promise for producing ethanol. "The question is, will trees grown here produce similar results?" Samples from the mature trees will be compared with the young trees grown in Minnesota to learn how climate and planting conditions affect the production of cellulosic fiber and lignin in these species.

Successful options

The insight the group hopes to gain into each species' genetic potential for adapting to northern growing conditions and its potential yield of cellulosic ethanol will be key to taking the next step: selecting a species or producing a hybrid specifically for the production of cellulosic ethanol.

Estimates for the ability to produce ethanol from cellulosic sources show promise. The U.S. Department of Energy estimates that an acre of land producing five tons of cellulosic biomass per year would yield about 325 gallons of ethanol. That's significantly less than the amount of ethanol brewed from an acre of corn. But producing ethanol from cellulosic sources requires fewer energy inputs. And if the team is successful, producing more energy may be possible without taking land away from other uses. ■



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Electric Ethanol

Biomass could heat and power ethanol plants

Making energy takes energy.

That's particularly true in the corn ethanol industry, where the heat and electricity needed to fuel production plants can be major costs, both financially and in terms of the plant's carbon footprint.

Most plants currently are powered by natural gas and electricity purchased from the grid. But a study by three CFANS scientists shows that corn biomass—cornstalks and the co-products of ethanol production—in various forms could be used to fuel entire plants, thus improving the plants' energy balance as much as three-fold and potentially making them more profitable.

The study by Vance Morey, a professor in the Department of Bioproducts and Biosystems Engineering; Doug Tiffany, a research fellow in the Department of Applied Economics; and Matt De Kam, a graduate student in Bioproducts and Biosystems Engineering shows how biomass can be an accessible, renewable source of fuel. Most ethanol plants are located in corn-growing areas, which reduces the cost of hauling corn stover; the plants also produce energy-containing co-products on site that can be used for heating and electricity.

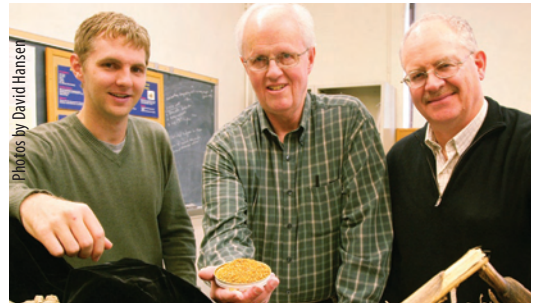
Extra power produced by the system could be sold to utility companies for redistribution. Even better, existing ethanol plants could easily be retrofitted to accommodate the biomass technology.

Morey and Tiffany's study involved using engineering and economic models to evaluate numerous combinations of biomass fuels and conversion technologies that provide energy on three levels: process heat; process heat and electricity for the plant; and process heat and electricity for the plant plus sale of surplus power. The researchers tested their theories by working with five corn ethanol plants in Minnesota and Wisconsin that were built using contrasting designs in the study funded by the Xcel Renewable Development Fund.

Other factors in the study include cost variables such as the market prices of natural gas, corn and ethanol. Some of those variables have changed dramatically since the project was proposed in 2004, Tiffany says. Corn prices have hit record highs, and ethanol supplies have increased, while prices have fallen. Natural gas prices have moderated from the very high levels that resulted in the aftermath of damage to natural gas infrastructure caused by Hurricane Katrina.

The next stage of the project will involve outreach to the ethanol industry, bankers, and pollution control staff. "We want to share this information with the plants that are out there; these are times of narrow margins in ethanol, so we expect there will be some added interest," Tiffany ('74—B.S.; '77—M.S., agricultural economics) says.

By using renewable fuels instead of fossil fuels, ethanol plants could benefit from



Photos by David Hanser
 Matt DeKam, Vance Morey and Doug Tiffany tested various combinations of biomass.

public policy changes aimed at reducing the amount of carbon dioxide emissions. Those environmental concerns ultimately may provide a strong incentive for implementing these changes, Morey says. "In the end, reducing greenhouse gases and control of energy costs are the factors that will drive this and the pursuit of other forms of renewable energy."

The researchers hope their work will provide a path for the ethanol industry. "We're not an engineering firm, we're a research institution," Morey says. "This is the step that has to be taken in order to be helpful to the next group. We have modeled substantial improvements to the corn-based ethanol production process that can be implemented in the near term. We hope this goes beyond the simplistic view of corn bad, cellulose good." —Becky Beyers

For more details about the project, visit www.biomasschpethanol.umn.edu/about.html

Corn stover in briquette, ground and pellet form was tested for its ability to fuel ethanol plants.



Giving Back

The Peterson farm becomes a legacy



Dorothy Peterson volunteers at the Minnesota Historical Society.

Willis Peterson loved farming, and he loved teaching.

The professor in the Department of Applied Economics taught in CFANS from 1965 until his death in 1999. While he was teaching full time, he also was operating his family's farm near Ham Lake, Minn., with the help of his wife, Dorothy.

Dorothy Peterson has since created two new endowment funds, the Willis L. and Dorothy L. Peterson Graduate Fellowship and the Willis L. Peterson Undergraduate Study Fund. A land trust including 94 acres of the farm will help fund those scholarships.

Willis Peterson earned both his bachelor's and master's degrees in applied economics at the University of Minnesota, in 1960 and 1962. From there, he went on to earn his Ph.D. at the University of Chicago.

While he was in Chicago, he met Dorothy, who was a vocal music teacher teaching at what's now Concordia College in River Forest, Ill. After they married and moved back to Minnesota so Willis could begin his

work on the applied economics faculty, his father offered to let them live and work part of the farm that had been in the Peterson family for three generations.

They took him up on the offer, at first in conjunction with Willis's father and eventually farming 90 acres, raising alfalfa

and running a cow-calf operation. Dorothy had done some substitute teaching since moving to Minnesota, but then retired to help with the farm work.

"I learned to drive the tractor and most of the machinery," she says. "I thought I'd married a college professor, but it turned out I had married a farmer."

Willis Peterson also was a highly regarded teacher and researcher. In 1992, he won the University of Minnesota's Horace T. Morse award for undergraduate teaching and earned several national and international awards for his research work.

Willis was primarily dedicated to teaching, and that's why Dorothy Peterson decided to create the endowments, she says. "He taught micro- and macroeconomics his whole career. He wrote some of the textbooks on those subjects, but he came to realize that he was very much an instructor and liked the teaching best.

"I thought this was a good way to carry on his legacy."

—Becky Beyers



Photos by Don Bremmman

Peterson's volunteer work involves categorizing photos.

Alumni Update

A message from CFANS Alumni Relations director Mary Buschette

I love January. Although I'm not always fond of the weather that comes with January in Minnesota, I do like the beginning of the New Year and the promise that it holds.

For me, January is like an unwritten book just waiting to be put down on paper. It's a time for believing in possibilities, setting goals for the New Year, looking for new opportunities, and dreaming up resolutions.

One of my goals for 2008 is to spend more time connecting with alumni at industry and other events around Minnesota. What are your resolutions for the year? Here are three you might want to consider:

- Use the CFANS Alumni Society to stay connected to the food, agricultural and natural resources community, to stay updated on current information, and to continue your educational opportunities. If you haven't previously attended Classes Without Quizzes, I invite you to join us this year on April 5. If you've attended previously, you will remember the excellent presentations that await you; in that case, I challenge you to bring along two friends or potential students this year.
- Do you know a student who is eager to learn, wants to build lifelong friendships and has demonstrated leadership in a CFANS-related area of study? Send CFANS their contact information at www.cfans.umn.edu/psr. Your words of encouragement can make a big difference in that student's life.
- Consider volunteering as a mentor or adviser to a student—it's an opportunity for you to help shape the future.

No doubt you can think of many other ways to give back to your college community. I look forward to spending time with all of you this year. Happy 2008!



Photo by Tom Foley



Photo by Martin Moen

New assistant director named

Darren Lochner is the new assistant director of alumni relations at CFANS and will focus on student and young alumni programming. He's a familiar face in the college: he's been on the Alumni Society Board of Directors and earned his bachelor's degree in fisheries and wildlife at CFANS in 1996 and a master's in forestry and conflict management in 2000. Before joining CFANS this fall, he worked for University of Wisconsin Extension and was named the Outstanding Young Professional of 2007 for the Young Professionals of the Chippewa Valley.

CFANS Alumni Society BOARD OF DIRECTORS

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January 26, 2008:
Florida Minne-College in Naples for all U of M graduates; CFANS professor Mark Seeley and Institute on the Environment interim director Deb Swackhamer will be presenters

SAVE THE DATE!

February 20, 2008:
CFANS dean Allen Levine will speak to the Phoenix Ag Club in Phoenix, Ariz.

April 5, 2008:
Classes Without Quizzes, St. Paul Campus

July 7, 2008:
Golf Scramble for Scholarships, Les Bolstad Golf Course, St. Paul

Can You Identify this Photo?



Photo courtesy University Archives. Copyright Regents of the University of Minnesota. All rights reserved.

Please tell us who this group of women is and why they're posing in the snow. Everyone who sends us the correct answer will be entered in a drawing to win a CFANS coffee mug. Send your answers to bbeyers@umn.edu.

Last issue's answer



In our last issue, we asked readers to identify this class and what the people in this photo are doing. Twenty-five readers responded and all but two of them had the right answer! The subjects of the photo are "sexing" chicks, a process that determines whether the chickens were destined to become egg producers or someone's dinner. Alumni Hal Routhe, ('51-B.S., agricultural education and agricultural economics; '54-M.S., agricultural economics) and Michelle Gerard ('96-B.S., animal science) both correctly identified not only what was happening in the photo, but the identity of the professor of the 1939 class—Thomas Canfield. He's at the far left, at the head of the table. For Hal and Michelle's above-and-beyond efforts, we'll send them each a fabulous CFANS coffee mug.

Alumni Profile

After a career in foods, Jon Blake turns to volunteering

Walk through the hallways at General Mills' world headquarters with Jon Blake and he regularly interrupts his tour-guide patter to greet nearly everyone he meets, explaining after each greeting who the person is and his or her history with the company. Even though he's been retired for nearly three years, he seems to know everybody.

That'll happen after you spend 38 years with the same company.

Blake, 64 ('77—B.S., food science & technology), is now officially retired from the giant consumer-foods corporation, but he remains active volunteering at the company and working on special projects. Each fall, he leads a charity poinsettia sale that includes workers in all five Twin Cities facilities as well as a "Breakfast with Santa" event that draws up to 1,200 people.

Volunteering is part of the General Mills culture, he says. Employees are encouraged to volunteer as well as to try new things in their work lives. "This company provides opportunities for anybody to find their passion, while at the same time they are focusing on success at work."

His career at General Mills started in the late 1960s with a job as a technician in the research department, shortly after he earned an organic chemistry degree in South Dakota. A few years later, he began taking classes in a new evening program offered by what's now the Department of Food Science and Nutrition. He eventually earned bachelor's degrees in food science and microbiology.

That training helped him rise through the ranks at General Mills: he finished his career as vice president of quality and regulatory affairs. Along the way, he oversaw various



One of Jon Blake's volunteer duties is organizing General Mills' poinsettia sales each December.

subsidiaries of the company and was part of teams that created dozens of new products.

Among the best-known of those products: Fruit Roll-Ups, the kid-friendly snack that debuted in the 1970s as the first fruit-snack product on the market. Blake was working in research at the time and he and his colleagues pursued the idea. "It was a good, healthy alternative to candy," he says.

In 1982, Blake briefly left the company to start a frozen dessert business in California with his wife, Carol. The chain of stores sold European-style gourmet ice creams. Eventually the company, Fono's, was sold and Blake returned to General Mills, managing subsidiaries in Toledo, Ohio and Buffalo, N.Y. In 1995, a new grandchild and the opportunity to lead the General Mills

cereal division brought the Blakes back to the Twin Cities.

In addition to his volunteer work, Blake now works as a technical adviser with Your Encore, a provider of technical expertise that hires retirees from General Mills as well as other Fortune 500 companies and matches them with companies that need help on short-term projects. "It's really the best of both worlds," he says. "You get to do challenging work, but at the same time you don't have a major commitment.

"You can do what is important: your family first, then your recreational life, then your job."

—Becky Beyers

CFANS named Outstanding Alumni Society

The CFANS Alumni Society was recognized Oct. 30 as the University of Minnesota Alumni Association's "Outstanding Alumni Society of the Year." The award cites the society's work in helping meld three alumni groups into one under the new college banner. The selection committee said "it succeeded masterfully, conducting its own strategic planning that resulted in a cohesive mix of dynamic activity." Activities mentioned included Classes Without Quizzes, the growing mentor program, Golf Scramble for Scholarships, increased membership and other new events.

UMAA also recognized Alumni Society past president Dan Kennedy (B.S. nutrition, '99), as the 2007 National Volunteer of the Year. As the first president of the brand-new College of Food, Agricultural and Natural Resources Sciences Alumni Society last year, he was asked to lead a large alumni board, whose members have very different backgrounds and viewpoints and represent three different disciplines. Dan made sure that each member felt welcome, listened to and understood.

Mark Seeley, a professor in the Department of Soil, Water and Climate, was recognized as the UMAA's faculty volunteer of the year for his support of alumni programs including four presentations at Classes Without Quizzes. The committee noted that Seeley is one of the most widely recognized members of the University faculty for his many outreach efforts.

CWQ 2008 examines biofuels

Classes WITHOUT Quizzes



The future of biofuels will be the keynote topic at the seventh annual "Classes Without Quizzes" event. The forum will be held from 8:30 a.m. to 12:30 p.m. April 5 on the St. Paul campus. Classes are designed for the general public, including students of all ages.

Nationally recognized experts from CFANS will present mini-seminars on the latest scientific research in horticulture and a variety of other topics and how the research affects people's daily lives.

This year's keynote speech will be presented by Doug Tiffany, a research associate in the Department of Applied Economics and nationally known speaker on the economics of biofuels.

Cost for Classes Without Quizzes is \$25 for the public, \$20 for University of Minnesota Alumni Association members and \$15 for students.

For information and to register, go to www.cfans.umn.edu/cwq or call (612) 624-0822.

John Foss earns Outstanding Alumni Achievement Award



John Foss, who earned his master's and Ph.D. in soil science at CFANS, has earned the University of Minnesota's Outstanding Achievement Award—the highest award bestowed on alumni at the University.

Foss helped create an interdisciplinary field of science that integrated information about soils and archaeology. He authored a soil development-age-related model to help archaeologists "read" a landscape and focus their efforts in areas where there is a high probability for finding artifacts. The model grew out of his expertise in understanding the effect of time on soil mineral weathering and soil profile development.

Foss taught at the University of Wisconsin-River Falls and the University of Maryland. He later became an administrator at North Dakota State University and the University of Tennessee.

In addition to a citation and medallion, Foss's name will be inscribed on the Wall of Honor maintained by the University of Minnesota Alumni Association at the McNamara Alumni Center. The Outstanding Achievement Award honors alumni who have attained unusual distinction in their chosen fields or professions or in public service, and who have demonstrated outstanding achievement and leadership on a community, state, national, or international level. Fewer than one in 500 alumni or former students have earned the award.

Interested in expanding your network of CFANS Alumni and Friends? Want to connect with classmates and colleagues?

Increase your connections within the CFANS community while taking advantage of networking opportunities across the Internet. Link to the alumni network for more information.

First Thursday Networking (FTN)

The FTN group includes both a listserv and regularly scheduled events (usually held the first Thursday of each month) as an opportunity for CFANS alumni and friends to socialize and network in the Twin Cities. In the past, FTN events have included networking with faculty, outdoor adventures, sporting events, site visits to area business and industries and social gatherings. Join the listserv to receive updates on upcoming events, job postings and other information.

LinkedIn

The CFANS Alumni and Friends group on LinkedIn allows alumni, current students and friends of the college to network with each other—and with each others’ networks beyond CFANS and the University of Minnesota. The CFANS Group is growing by the day: there are 17 million worldwide users of LinkedIn. The basic service is free of charge.

Facebook

Create a personal profile on Facebook and connect with CFANS and University of Minnesota students and alumni. There’s a CFANS Alumni and Friends group, message boards, CFANS events calendar and more. Free of charge.

Become a Mentor

The Mentor Program is a wonderful opportunity for students to develop their professional skills outside of the classroom through the guidance of a professional in the business community. It is also a great way for alumni and friends to connect with the University as well as current and future professionals in their field.

Please consider becoming involved with the CFANS Mentor Program. In addition to serving as a mentor, there are opportunities to connect with students by assisting with informational interviews, classroom speaking and panel discussions.

BY THE NUMBERS CFANS Enrollment, Fall 2007

31.5

Average age of CFANS graduate students

25.2

AVERAGE ACT SCORE FOR INCOMING FRESHMEN

81.6

Average high-school ranking (by percentage) of incoming CFANS freshmen

117

Number of graduate students majoring in applied economics, the largest graduate major

3.29

average g.p.a. of new transfer students

1,791

TOTAL NUMBER OF UNDERGRADUATES

13.3

Mean number of credits taken for fall semester, all students

744

total number of graduate students

57.2

PERCENTAGE OF CFANS UNDERGRADS WHO ARE FEMALE

369

NUMBER OF UNDERGRADUATES MAJORING IN ANIMAL SCIENCE, THE COLLEGE’S LARGEST UNDERGRADUATE MAJOR

Sources: Office of Institutional Research; CFANS internal reports

CFANS 2008 CALENDAR OF SPRING EVENTS

These are some of the many events supported by the College of Food, Agricultural and Natural Resource Sciences. All are open to the public; some may require a registration or fee to attend. Visit www.cfans.umn.edu/Events2.html or contact Honey VanderVenter at 612-625-6710 or hvander@umn.edu for more information.

January 22

Spring semester begins

January 31

Willard W. Cochrane lecture on Public Policy
St. Paul Campus

February 14

Solution-Driven Science symposium:
"The Food System and Human Health"
St. Paul Student Center

March 27

"Branding Beyond Borders" Food Industry Center Spring
Conference
McNamara Alumni Center, University of Minnesota East Bank

April 5

Classes Without Quizzes
St. Paul campus

April 9

Kermit Olson Memorial Lecture
St. Paul Campus

April 10

"Agriculture in the Natural World," a Minnesota state
sesquicentennial event
Coffman Memorial Union, University of Minnesota East Bank

April 27-29

Minnesota FFA Convention, St. Paul Campus

May 11

CFANS Commencement Ceremonies
Northrop Auditorium, University of Minnesota East Bank

May 17

Last day of Spring Semester 2008

June 19-24

Evolution 2008
University of Minnesota East and West Banks

June 26

St. Paul Campus Reunion
Minnesota Landscape Arboretum, Chaska

July 7

Golf Scramble for Scholarships
University of Minnesota Les Bolstad Golf Course



College of Food, Agricultural
and Natural Resource Sciences

UNIVERSITY OF MINNESOTA

277 Coffey Hall
1420 Eckles Ave
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