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Research to Energize Michigan's
Economic Development

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According to the state Department of Energy, Labor and Economic Growth, Michigan's unemployment rate in March 2010 was 14.1 percent, more than 4 percentage points higher than the U.S. average. The state's economy shrank 1.5 percent in 2008, continuing a trend — from 2003 to 2008, the state economy lost 3.5 percent of production.

Times are definitely tough, but agriculture, including energy and fuels made from plants, remains a bright spot in the gloomy outlook. MSU Product Center for Agriculture and Natural Resources scientists estimate that the total economic impact of Michigan's agriculture, food and bioenergy system was \$71.3 billion in 2008, a nearly 12 percent increase from 2006. This is a fifth of the state's economic output and represents more than 1 million jobs.

In this issue of *Futures*, you can read how the work of MAES researchers is aiding the state and its businesses as everyone works together to turn the economic tide.

The MAES is a research engine that helps to power and energize the state's food, agricultural and natural resources industries. As they address issues facing these industries, MAES scientists are also creating new technologies and devices that can be licensed and brought to the marketplace by Michigan entrepreneurs. At the same time, MAES researchers are creating other tools specifically aimed at encouraging, teaching and supporting businesses as they start or expand.



The MSU Product Center for Agriculture and Natural Resources and MSU Business-CONNECT together have worked with nearly 600 entrepreneurs, established businesses and non-profits in fields ranging from cherry topping to economic development to biodiesel.

A diverse team of MAES scientists envisions a fresh approach to cultivating new jobs and new markets and is investigating the economic potential of a more local, seasonal and sustainable food system. Other researchers are working side-by-side with biofuel and distilled spirit entrepreneurs, helping them develop the expertise and equipment they need to become important cogs in the state's economic revitalization. In Flint, a city that has become emblematic of the auto industry's collapse, turfgrass scientists, sociologists and economists have joined forces with city officials and the turfgrass industry to demonstrate how well-kept green spaces and lawns may foster social capital and economic recovery.

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 also can 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" link.

— *Jamie DePolo*

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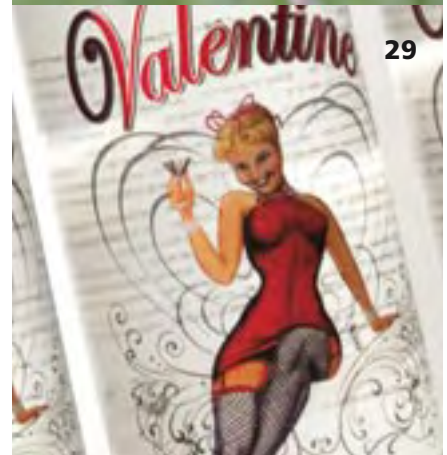
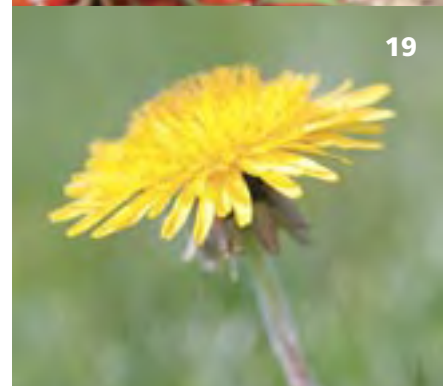
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Boosting Michigan's Economy

One Business at a Time



Ruben Derderdian, Chris Peterson and Tom Kalchik (left to right) of the MSU Product Center.

THE PRODUCT CENTER PRODUCES RESULTS

SERVICES PROVIDED	SINCE 2004	SINCE 2009
One-on-one client counseling sessions	12,667 sessions	2,799 sessions
Assistance with business concept development	1,166 clients	274 clients
Venture startups (based on commencement and continuation of planning for a new business or an expansion for an existing business)	721 clients	235 clients
Specialized services (including product testing, detailed marketing analyses and feasibility studies)	713 clients	162 clients
Venture launches (commencement of economic activity for new or existing businesses through new sales, investment or employment)	145 ventures	19 ventures

The Product Center's assistance in launching 145 known new businesses and business expansions had the following estimated direct economic impacts:

- INCREASED ANNUAL SALES: \$278.5 MILLION (CUMULATIVE FIRST-YEAR SALES ONLY).
- VALUE OF INCREASED INVESTMENT: \$204.6 MILLION.
- JOBS CREATED: 711; JOBS RETAINED: 351.

Statistics are through Dec. 31, 2009.

According to the state Department of Energy, Labor and Economic Growth, Michigan's unemployment rate in March 2010 was 14.1 percent, more than 4 percentage points higher than the U.S. average. The state's economy shrank 1.5 percent in 2008, continuing a trend — from 2003 to 2008, the state economy lost 3.5 percent of production.

Times are definitely tough, but agriculture, including energy and fuels made from plants, remains a bright spot in the gloomy outlook. MSU Product Center for Agriculture and Natural Resources scientists estimate the total economic impact of Michigan's agriculture, food and bioenergy system to be \$71.3 billion in 2008, a nearly 12 percent increase from 2006. And the Product Center can count itself as one of the contributors to this increase. In 2009, the center conducted 2,799 counseling sessions with 572 clients, 254 of whom went on to the next phase of business planning or successfully started businesses involving agriculture or natural resources.

Since starting operations in 2004, the center has helped launch 145 new businesses or business expansions that created 711 jobs while preserving another 351 jobs. Increased sales attributable to the Product Center are valued at \$278.5 million, and the value of increased investment because of its work is another \$204.6 million.

"We had 39 client applications in January 2010, the most we ever had," said Chris Peterson, MAES agricultural economics scientist and Product Center director. Peterson also holds the Homer Nowlin Chair for Consumer-Responsive Agriculture and was one of the authors of the agricultural economic impact study. "We do work with a number of inventors, but I think the economy is helping drive up these numbers. Many people are becoming what we call 'entrepreneurs of necessity.'"

The brainchild of Peterson, the Product Center receives funding from the Michigan Agricultural Experiment Station, MSU Extension and the Michigan BioEconomy Network. In 2009, the center added a bioeconomy program led by associate director Ruben Derderian because the markets for biofuels, bioenergy and other bioproducts are very different from other agricultural product markets. The bioeconomy program receives additional support from the departments

of Chemical Engineering and Materials Science, and Biosystems and Agricultural Engineering. The center aims to improve economic opportunities in the Michigan agriculture, food and natural resources sectors, and its experts are available to assist first-time entrepreneurs and established companies. Acting as a single point of entry to Michigan State's vast network of knowledge, research and expertise, the center helps guide clients through all phases of conceptualizing, planning, starting, maintaining and growing a business.

Center economists conduct research on markets and assess business opportunities in major areas such as vegetables, fruit, dairy, and nursery and greenhouse plants. The Product Center also provides access to Michigan MarketMaker, a Web site that makes it easy for producers and potential customers to find one another. MarketMaker is loaded with demographic, business and census data, so, for example, a producer who wants to sell a particular type of meat to Hispanic consumers can request a map of the densest concentration of upper-income Hispanic households and then ask for a complete demographic profile of those locations. Conversely, a chef at a high-end restaurant who wants to find a source of organic eggs and produce for her restaurant can search MarketMaker for farmers who sell directly to restaurants.

"It's a powerful tool," said Tom Kalchik, Product Center associate director, who leads food, agriculture and natural resource programs. "You can search for customers or producers and generate contact data."

At the heart of Product Center services is a network of counselors located around the state who help assess the developmental phase of a business or product, identify markets, assist with business plan creation and help entrepreneurs make critical decisions about going forward. The counselors also help link entrepreneurs to other resources at MSU, such as testing, packaging or design services, as well as state and federal resources.

"There are a lot of ideas that should be abandoned early because they're not going to be successful," Peterson explained. "Many times people just aren't aware of everything that's involved with creating a new product. Our counselors help clients come to grips with the realities of product development and marketing. Then the client makes the decision to go forward or not."

Peterson, Kalchik and Derderian all agreed that a decision to halt the process is just as successful as one that goes forward because it saves quite a bit of time, money and effort that would have been spent on a product that wasn't going to work. Avoiding those losses makes good business sense.

"About 50 percent of new businesses fail," Kalchik said. "We help people do better planning so more of them are successful."

Some recent standout Product Center clients who count themselves as successful include three sisters who started their first business when most of their friends were retiring. Others are a Warren-based biodiesel company and a whitefish marketing cooperative.

**THE MSU PRODUCT CENTER FOR AGRICULTURE AND
NATURAL RESOURCES OFFERS ESTABLISHED
COMPANIES AND FLEDGLING ENTREPRENEURS AN
INSTANT NETWORK OF SUPPORT SERVICES,
EDUCATION AND MARKET RESEARCH THAT HELP
SPIN BUSINESS DREAMS INTO GOLD.**



PHOTO: ERIN GROOM

Life is a Bowl of Cherries for the Herkner Sisters

“We’re just three grandmas trying to improve the Michigan economy, one jar of cherry topping at a time,” said Sue Keegstra (nee Herkner). “We absolutely could not have done any of this without the Product Center and counselor Matt Birbeck and the MSU Small Business and Nonprofit Law Clinic. They’re still guiding us on this incredible journey.”

The Herkner sisters’ journey started in April 2009. Keegstra’s older sister, Lynda Herkner, a Realtor in the Traverse City area for 25 years, found herself dealing with the harsh reality of Michigan’s economy. The real estate market flat-lined; Herkner was working day and night and still wasn’t making ends meet. Two of Herkner’s four siblings still lived in Michigan — Keegstra and Judy Harmon — so the three sisters decided they were going to form a company to market the cherry ice cream topping their parents had developed to help Herkner through her rough patch.

“... IF WE CAN DO IT AT OUR AGE — I’M 64, LYNDA IS 72 AND JUDY IS 67 — AND IN THIS ECONOMY, THEN OTHER PEOPLE CAN, TOO.”



PHOTO: ERIN GROOM

Above from left: Judy Harmon, Sue Keegstra and Lynda Herkner. The sisters started a company to market their family cherry topping recipe in 2009. With the Product Center’s help and demand that has outstripped supply, the company has grown beyond their wildest expectations.

Left: A jar of Herkner’s homemade cherry topping. Product Center counselor Matt Birbeck continues to advise the women on various aspects of the business.

The company has grown beyond the sisters’ wildest expectations. The first batch of 600 jars of Herkner’s Homemade Cherry Topping was available in September 2009. It immediately sold out. Seven months later, just about a year after they first thought of starting the company, production is up to 143 cases (each case holds 12 pint-sized jars) and growing, and the topping is available in stores across Michigan, from Suttons Bay to West Bloomfield, as well as selected stores in Wisconsin, California, Vermont, New York and Florida. The sisters also have developed a recipe book that expands uses for the topping to salad dressings, meat glazes, pancakes and cookies.

“We worked with the Herkner sisters from concept to startup,” Kalchik said. “They launched their business at the Starting Block, a kitchen incubator in Hart, Mich. Within a few weeks, they had exceeded the capacity of that incubator. They’re working with two major companies to distribute their product and have moved to a larger copacking operation to keep up with demand. Everyone is really pleased with their success.”

Herkner’s Foods received the 2009 Start-Up to Watch Award, which recognizes a Product Center client who has demonstrated excellence, innovation and

growth through consistent success and growth in entrepreneurial and business development, sales, profits and related financial performance.

“I can’t sing the praises of the Product Center enough,” Keegstra said. “We didn’t know anything about marketing or packaging or even how to scale up the recipe to commercial-sized batches. The Product Center and Matt helped us with everything. And if we can do it at our age — I’m 64, Lynda is 72 and Judy is 67 — and in this economy, then other people can, too.”

“We consult with Matt before we make most decisions on the business,” Herkner added. “I don’t think we’ll ever get so big that we don’t call Matt.”

Kalchik is delighted that the Herknors are pleased with the Product Center’s services, but he also pointed out that the sisters were willing to do the time-consuming work necessary for success.

“They went to farmers’ markets all over the state and sold the topping out of vans and trailers,” he said. “They were very aggressive.”

In the end, though, if the topping didn’t please the palate, people wouldn’t buy it — even people who don’t like cherries have purchased jars after being cajoled into accepting a taste by one of the sisters. A closely guarded family recipe, the topping was developed by the women’s parents in 1962.

“Our parents had the second largest cherry farm on the Old Mission Peninsula,” Keegstra said. “They were always experimenting with ways to use cherries in all sorts of recipes.”

The Herknors’ parents wanted to market the topping but had trouble making large batches that had the same taste and consistency as the original recipe. The family kept making the topping for themselves and to give as gifts to friends for holidays and special occasions.

“We wanted to fulfill our parents’ dream and also help Lynda,” Keegstra said. “We’re having the time of our lives. Most of the money is going back into the company, but we’re making a small profit. Our goal is to be able to have Lynda work full-time for the company so she can quit working in real estate.”

Refining Fuel Alternatives

The Motor City is known for automobiles; less so for the fuel it takes to operate them. But four entrepreneurs based in Warren want to change that. The Power Alternative, incorporated in 2006 by Jim Padilla Sr., Jim Padilla Jr., Daniel Angell and E. Lance Stokes, has been selling biodiesel since June 2008. Drawing on the partners’ expertise in chemistry, manufacturing, plastics, the auto industry, and business development and startup, the

company aims to make biodiesel fuel competitive with the wholesale price of petroleum diesel fuel (known as the rack price) without government subsidies.

“We’re the highest capacity plant in Michigan,” said the younger Padilla. “We can produce one barrel of biodiesel per minute, and we’ve made thousands of barrels of spec fuels.” (Spec fuels are made to meet certain specifications.)

In the wake of the cooling of the biodiesel market, The Power Alternative is diversifying its offerings. Efforts include developing other products, developing feedstock parameters and setting up biodiesel plants for other people. The company also has patented a process for growing algae for biofuel in cold weather climates.

“I think it was someone at the Michigan Economic Development Corporation that recommended the Product Center to us,” Padilla Jr. said. “We had talked to a lot of people. The Product Center was different — they gave us contacts that were useful. They brokered meetings that were helpful and assisted us in setting up relationships with other public and private entities. It’s been a very good experience for us.”

“The principals at The Power Alternative have quite a bit of research experience,” said the Product Center’s Derderian. “Originally they were planning on processing canola oil, but because of prices, they’re looking at using other feedstocks, including pennycress.”

Pennycress, also known as skunkweed, can grow on marginal soil that can’t be used to grow food. It also has been shown to remove heavy metals from soil, so it may serve a dual purpose of helping to clean up contaminated land. The Power Alternative is working with a Canadian company to install a pennycress crushing plant and biodiesel refinery in Alberta.

“Pennycress is basically a weed and not a food crop,” Padilla explained. “It’s also more cold-tolerant than canola, which means the biodiesel made from it will do better in cold weather than biodiesel made from canola. I’ve seen it work at -28 degrees Celsius [-18 degrees Fahrenheit].”

One general knock against biodiesel is that it becomes very thick at cold temperatures and won’t flow through engines.

Padilla said his company is working with Detroit policymakers to explore options for growing pennycress in proposed urban farming plots on vacant land around the city. He believes pennycress is an ideal crop for former industrial sites that can’t be used to grow food.

“We want to work with the city of Detroit to establish a project to grow pennycress and make biodiesel,” he said.

The Power Alternative continues to look to the Product Center for help in setting up meetings with farmers who may be interested in growing pennycress or other biodiesel feedstock crops.

Business-CONNECT works to link businesses to MSU research and services



Charles Hasemann, executive director of MSU Business-CONNECT, aims to make MSU resources accessible to business. “Any business that wants access to MSU should contact me first,” Hasemann says.

the MSU Product Center helps agriculture and natural resources-based businesses launch or expand by offering an immediate network of support services. But both new and established businesses may have other needs that MSU can meet, such as access to research and development resources, sources for hiring MSU talent, or training programs for employees and executives. MSU Business-CONNECT can help business make those connections to MSU.

“Our goal is to make MSU accessible to businesses,” said Charles Hasemann, executive director of MSU Business-CONNECT.

“Business-CONNECT is business’s front door to MSU for research partnerships, entrepreneur support and economic development.

“One important way we can help companies is by coordinating the contractual negotiations and other business agreements that are part of any collaboration between MSU and private organizations,” he explained. “Chief among these are privately sponsored research contracts. In an economic downturn, research and development is an early area to be cut. Companies can partner with MSU to help bridge the need for research expertise and high-end specialized testing facilities and equipment. Business-CONNECT can facilitate these working relationships by helping to design mutually beneficial contracts between businesses and MSU resources.”

Like the Product Center, Business-CONNECT introduces companies to university experts, scientific equipment and facilities — the goal is to make connecting to the vast expanse of MSU knowledge a productive and personal experience for clients.

Hasemann has worked with The Right Place, Inc., a non-profit economic development organization based in Grand Rapids that promotes economic growth in western Michigan. Bill Foley, advanced production innovation director for the group, helped link Business-CONNECT with the West Michigan Manufacturers’ Council. The council conducted a needs assessment, and Hasemann used that to pull together a pool of MSU resources, including faculty members, and technology transfer and intellectual property information.

“Working with Dr. Hasemann means we have confidence that we can talk to the right people and receive quicker feedback about opportunities or challenges for collaborations with MSU,” Foley said in an interview. “Time is valuable, and our manufacturing decision makers want dynamic, forward-moving relationships because their economic survival depends on it.”

“Any business that wants access to MSU resources should contact me first,” Hasemann said. “Things will happen much faster when Business-CONNECT helps navigate the university’s wealth of resources.”

— *Jamie DePolo*

“The Product Center is opening up a lot of new opportunities for us,” Padilla said. “When you run your own business, it’s very easy to be insularly focused. The Product Center helps us think broadly and gave us an instant network when we started. And a network is so important when you’re operating your own business.”

Marketing a Legendary Fish

As anyone who’s savored a perfectly prepared filet knows, whitefish is one of the most prized catches in the Great Lakes. In 2007, Michigan commercial anglers caught more than 7 million pounds of whitefish. Wisconsin had the second largest catch at nearly 2 million pounds.

Funds from another USDA program — the Rural Cooperative Development program — allowed the Product Center to help the group organize as a cooperative and start a marketing program.

“The idea was to get a better price for a filet that meets stringent size and quality standards,” explained Tom Spaulding, of Gauthier & Spaulding Fisheries. “Matt Birbeck [Product Center project consultant] helped us develop our accounts, including Spartan Stores, our largest account.”

Meijer and stores in Chicago are considering stocking Legends of the Lakes after meetings that Birbeck helped broker. The Product Center also put the co-op in touch with a design firm to develop the product’s logo, Web site and packaging.

Cooperative members are pleased with the product’s

“THE PRODUCT CENTER HELPS US THINK BROADLY AND GAVE US AN INSTANT NETWORK WHEN WE STARTED. AND A NETWORK IS SO IMPORTANT WHEN YOU’RE OPERATING YOUR OWN BUSINESS.”

“We started working with the state’s whitefish industry in 2004 at the request of Michigan Sea Grant — Ron Kinnunen and Chuck Pistis,” said the Product Center’s Kalchik. “There were some economic issues, and they needed brand recognition for Michigan whitefish.”

Using a grant from the U.S. Department of Agriculture (USDA) Agricultural Innovation Center, representatives from the Product Center and Michigan Sea Grant facilitated a series of meetings between everyone involved in the industry, including commercial fishermen, processors, packers and regulators, outlining a strategy that focused on quality to set Michigan whitefish apart from whitefish from other states.

In 2008, four commercial fishing/processing companies — Gauthier & Spaulding Fisheries in Rogers City; the Bay Port Fish Company in Bay Port; Marine Management Ltd., in Muskegon; and LeBlanc Fisheries in Cheboygan — decided to form the Legends of the Lakes cooperative to market a superior whitefish filet to retail stores. In 2009, the co-op accepted a fifth partial member, the Mackinac Straits Fish Company. Members pay a fee to join, and those that produce fish must meet strict requirements for freezer temperatures and time from dock to processor.

success, which includes an increasing share of the whitefish market and a \$2-per-pound price premium.

“We grew from nothing to a viable co-op,” Spaulding said. “We sold more than 2,000 pounds of Legends of the Lakes whitefish last year. Everyone is very satisfied with the growth. The Legends filets are the best in Michigan.”

Not content to sit dockside and rest on their fishing laurels, Legends of the Lakes members are working to introduce new whitefish products, and the Product Center will be there with them as they expand and take advantage of their growing reputation for excellence. Gauthier & Spaulding plans to introduce a new line of breaded whitefish cakes, and the Mackinac Straits Fish Company is working on a microwavable flavored filet. The Bay Port Fish Company has plans to introduce a smoked whitefish spread, and the members are talking about developing a lake trout filet.

“It’s been impressive to watch the success of Legends of the Lakes,” Kalchik said. “Matt helped them address all the issues they faced, and now they’re looking into expanding into other states.”

— *Jamie DePolo*



It's a cold February Saturday in Michigan, and you're heading out to buy groceries for a dinner party at your house that evening. You swing by the community farmers' market and purchase some baby leaf salad greens and kale that were just harvested from a farm a half-hour away, and radishes and carrots from a vendor who operates a small urban farm on the west side of town. Wait . . . fresh, locally grown vegetables available in the dead of winter?

Relocalizing the Food Supply

to Feed Michigan's Economy

As Michigan works to nurture and diversify its transitioning economy, a team of MAES researchers is envisioning a fresh approach to cultivating new jobs and new markets in the state by investigating the economic potential of a more local, seasonal and sustainable food system.

“Michigan won't have a godfather economy to drive it as it had in the 20th century with the auto industry,” said MAES researcher Mike Hamm, who holds the C. S. Mott Chair of Sustainable Agriculture and heads the 12-member C.S. Mott Group for Sustainable Food Systems at MSU. “If we're going to build the economy of Michigan for the 21st century, it will need to be a diverse, networked, green industry economy. Otherwise, there isn't going to be an economy.” ▼

“Certainly a big part of the green economy in a place like Michigan is agriculture... but it can’t be the agriculture we’ve had for the past 30 or 40 years.”

Cultivating a New Vision for Economic Prosperity

“The umbrella for this work is health, jobs and food,” said MAES horticulturist and Student Organic Farm (SOF) coordinator John Biernbaum. “Mike [Hamm] and I are especially interested in new farmer training, producer access to financial capital and land, technologies that extend the growing season, direct marketing to the public, soil improvement and crop diversity.”

Hamm said that a more sustainable food and agriculture system, with greater emphasis on local markets and fresh produce, can bring an array of benefits to Michigan and to society at large.

“Historically, Michigan agriculture has tended to go after a single market,” he said, “so most of the state’s fruits and vegetables have been processed. For example, the state has 48,000 acres in potatoes; 40,000 acres of those potatoes go to Frito Lay. Meanwhile, the residents of Michigan or that ‘little place’ called Chicago are buying in a lot of niches — organic, fresh, local, pasture-raised — and Michigan is going after only a very small piece of those markets.

“Certainly a big part of the green economy in a place like Michigan is agriculture,” Hamm added, “but it can’t be the agriculture we’ve had for the past 30 or 40 years. The state’s agricultural sector has to go beyond claiming that it’s the second most diverse agricultural state in the country. That’s based on numbers of things grown — it says nothing about the markets that those things penetrate.”

A recent study conducted by Hamm; MAES researcher Chris Peterson, who holds the Homer Nowlin Chair for Consumer-Responsive Agriculture; Mott Group economist David Conner; and agricultural economist Bill Knudson showed that almost 2,000 new off-farm jobs, 37,000 more acres of production and \$200 million in new farmer income would be created within the state in a scenario in which residents increased fruit and vegetable consumption by about 20 percent to help meet U.S. Department of Agriculture (USDA) consumption guideline levels by eating more seasonally available, Michigan-grown fresh produce.

“It is clear that relatively small changes in individual eating habits across a state’s population can have signif-



MAES horticultural scientist John Biernbaum also coordinates the MSU Student Organic Farm. He has been a big proponent of hoophouses, which allow farmers to extend their growing seasons and intensify production.

icant direct and indirect impacts on employment and income,” Hamm said. “In a sense, the figures we came up with are conservative in that they don’t account for the economic benefit resulting from improved nutrition and health.”

Hamm said that a major challenge for Michigan agriculture in the development of local food systems is the state’s fairly limited growing season.

“Because Michigan agriculture is seasonally challenged, it’s not possible to eat a broad array of locally grown, fresh produce year-round,” he said, “and yet 10 million Michiganders and about another 10 million people in the Chicago area are eating fruits and vegetables year-round. So we can also expand opportunities for building the economy by asking how we can extend the season over which we deliver those things to market. That’s where season extension technology comes in, along with postharvest management and controlled-atmosphere storage for produce such as apples.”

“Building dimensions of diversity into our agricultural system is a prerequisite for it being a larger part of Michigan’s future economy,” Biernbaum said. “It’s a development process of building the market, the people,

the land and the infrastructure. We can build the capacity, get the farmers, and provide the necessary training and resources. The necessary vision is seeing how we get all these pieces to come together so that people who want to buy local food and the people who want jobs producing local food are all successful.”

Capitalizing on a New Kind of Hoops in Michigan

As researchers and others explore strategies to shift emphasis to fresh wholesale and direct-market production, season extension technologies are receiving increased attention. More and more Michigan farmers are experimenting with the use of hoophouses (also known as high tunnels because they’re tall enough to stand in) to extend the growing season, increase the number of market days and intensify production. Hoophouses are simple structures characterized by a peak or Gothic frame typically constructed using a series of bowed lengths of tubular steel covered with a layer of greenhouse plastic film.

“I was introduced to hoophouses by John Biernbaum and the SOE,” said Conner, who studies the economic impacts of community-based food systems and the

marketing of sustainably raised products. “He and his team showed us that hoophouses work in Michigan — the SOE runs a 48-week, community-supported agriculture program using hoophouse technology. Although it’s clear that produce can be grown year-round, there’s still the need to see how profitable it can be on Michigan farms with hoophouse novices. So we decided to take hoophouses for a test drive.”

Twelve farmers agreed to test the technology and its economic potential — three each in Sault Ste. Marie, Traverse City, Muskegon and Ann Arbor. One 3,000-square-foot hoophouse (30 feet by 96 feet) was donated to each farmer in exchange for 30 months of data, including revenue and sales, direct costs and hours of labor. Participating farmers also were interviewed to document their experiences, the lessons learned and the challenges they faced in adopting this technology.

To help with this work, Biernbaum and Conner teamed up with Michigan Food and Farming Systems (MIFFS) to hire Adam Montri — a former MSU horticulture student — as an outreach specialist to provide Michigan growers and, more recently, partners in Flint and Detroit, with hoophouse construction and crop management information through the SOE.

A hoophouse (also called a high tunnel) at the Student Organic Farm. MAES scientists teamed up with Michigan Food and Farming Systems to teach farmers how to build hoophouses and manage the crops grown in them. Research shows that these farms can make money and pay off hoophouse construction costs in about two years.





Getting Concrete Results from Urban Agriculture

Another key piece of the food access equation is investigating the use of vacant and abandoned land in Michigan cities to develop urban agriculture systems.

"Detroit is demonstrating tremendous opportunity in this area," Hamm said.

The Detroit of the 1950s is not the Detroit of today. The city of 2 million people and 139 square miles worked in 1950. Fast forward 60 years, and Detroit still has an infrastructure designed for 2 million people but a population of just under 1 million. What should be done with all the extra space?

"Detroit has no major supermarkets within its city limits," Hamm said. "There are retail outlets and corner grocery shops, but they're limited. So one of the big issues is how you ensure food access for all Detroiters. One thing that is emerging is the opportunity to turn large amounts of the open space in Detroit into productive farmland, and to think about Detroit, in part, as a food production center for Michiganders and the region."

Hamm worked with then MSU graduate student Kathryn Colasanti (now an academic specialist with the Mott Group), who analyzed the publicly owned open space in Detroit. Her study included only public land with no buildings that could potentially be put into production.

"In my analysis, I found that there are 4,800 acres or about 7.6 square miles of empty, publicly owned, available land within the city limits," Colasanti said. "Then we asked, 'If we put a small percentage of that land into production, what would that mean in terms of the ability to produce food in Detroit?' We determined that using four-season farming technology and postharvest storage technology on 2,000 acres, Detroit could produce up to 75 percent of the vegetables and about 50 percent of the fruit needed for 900,000 people."

The question then became how to go about making this a reality.

MSU Extension already had teamed up with Greening of Detroit and the Detroit Agriculture Network to create the Garden Resource Collaborative (GRC) in 2003. The GRC works with community gardeners in the city to provide garden space,

resources and education. In recent years, the emphasis has expanded to include efforts to seed 1- to 3-acre farms that provide opportunities for people in Detroit to be small business entrepreneurs.

In addition, Greening of Detroit currently has a 3-acre site at the Eastern Market that will be established as an education and training four-season market garden similar to the MSU SOF. Montri and Biernbaum are working with Greening of Detroit to develop the four-season production plans for the site, and Hamm, Colasanti and Conner are working with the group to model the economics and production potential of a 3-acre farm.

"We're just starting to develop partnerships and formulate a plan to look at whether these small-acreage urban farms can be profitable," Colasanti said. "Three acres is a reasonable scale — it makes sense for an urban family farm. The next phase of our project is to collect data over the next two growing seasons — 2010 and 2011."

"Production will begin this summer on at least half the site, which includes three hoophouses that are movable and one stationary hoophouse, representing about 7,500 square feet of growing space," Montri added.

Hamm knows that turning Detroit into an agricultural hub isn't going to be easy. He suggested that various scales of agriculture will be needed to reach, for example, a 2,000-acre goal.

"Two entities are looking at creating 30- to 40-acre farms," Hamm said. "These larger scale farms would complement small-scale farms to realistically reach 2,000 acres."

"Urban agriculture is a good synergy in a number of ways," Conner said. "For example, Detroit has been called a 'food desert' because of its relative absence of fresh, affordable food. There is a need for fresh fruits, foods and vegetables there, and there is affordable land available. For young farmers who are just getting started, land in rural areas can be fairly expensive, so we think urban farming is an option worth investigating, especially for beginning farmers."

— Val Osowski

So, can these farms make money?

"Yes, they can certainly make money," Conner said. "Some farmers netted up to \$6,000 in the first year. The hoophouses used in the study cost \$10,000 to \$12,000, which means that these farmers could realistically pay off their hoophouse expense in two years. One farmer during the course of the study made almost \$19 per hour. One farmer made 28 cents. This said to me that

management matters. The tool works — it's a matter of how it's managed."

Hoophouse management includes deciding what to plant, how much of it to plant, when to plant it and how to keep it growing. The team also found that one of the key predictors of success for these 12 farms was record keeping.

"Those who kept good records were more successful,"



From left: Mike Hamm, Kathryn Colasanti and David Conner examine produce grown in a hoophouse. The scientists are working with Greening of Detroit to develop a four-season market at the Eastern Market that will use hoophouses to grow produce.

“Farmers’ markets are seen by many as the flagship of the local food movement... they’re very visible, they’re colorful, and they bring good food and people together.”

Conner said. “What’s the old adage — ‘You can’t manage what you don’t measure’? When each farmer placed his or her numbers next to the averaged numbers of all the farmers in the study, a lot of light bulbs went on in heads. We heard things such as, ‘Wow, I’ve been spending a lot of time on that compared to others,’ and ‘These crops are making me money, these are not.’”

Conner said that there is also well-documented difficulty with credit access for farmers, particularly farmers who are using technologies that are not familiar to lenders.

“Naturally, lenders see things that they are less familiar with as higher risk,” he explained. “Most lenders aren’t familiar with hoophouses, so we decided to create a model business plan to give farmers using this technology a better chance at securing financing. The team started by taking what it thought a good farmer would do — maybe not even the very best farmer — but a good farmer, and ran the numbers.”

On the basis of those results, Conner wrote up the model business plan.

“I called the plan ‘David’s Farm’ and wrote it up as if I were a farmer,” he said. “Then I shared it with three people — one person who specializes in helping small business but is not in agriculture, and two agricultural lenders. They looked at it, picked it apart and said, ‘This is good, this is good, this is good, this needs work.’”

The plan is now complete and is available as a free, downloadable document on the Mott group Web site [www.mottgroup.msu.edu].”

“The nice thing about this hoophouse technology is that whether you’re talking about urban or rural or peri-urban [between the suburbs and the countryside] farms, it’s applicable from right downtown to all the way out,” Montri said. “Our hope is that this is a document that a farmer can take, put in his or her own numbers and his or her own marketing/business strategy, and then take to a lender and get a loan to buy a hoophouse.”

“I think it’s a really defensible plan,” Conner added. “I think it’s realistic. It’s what a good farmer with good markets and good management can do.”

Tapping the Economic Potential of Farmers’ Markets

Farmers’ markets are another important tool in relocating Michigan’s food supply. MSU has a long history of working with farmers’ markets. Since the 1960s, MSU researchers and Extension specialists have tracked farmers’ market numbers and provided informational resources, educational programs and technical assistance to help keep these markets growing and viable.

“Farmers’ markets are seen by many as the flagship of the local food movement,” said Susan Smalley, Mott Group director. “Although they account for only a relatively small portion of food that people purchase, they’re very visible, they’re colorful, and they bring good food and people together.”

“A lot of consumers are now hooked on fresh, local food.”

There are currently 5,274 operating farmers’ markets in the United States, according to USDA data. In Michigan, the number of farmers’ markets more than tripled from about 70 in the early 1990s to about 250 markets in 2009. To help support this growing market niche, MSU helped MIFFS found the Michigan Farmers Market Association (MIFMA) in 2006.

“Farmers started realizing that the industrial agriculture model wasn’t working for all scales of farming,” said Dru Montri, MIFMA manager and MSU doctoral student. “Farmers’ markets fill a niche for small- and medium-sized farmers and provide a way for them to put a larger portion of food dollars in their pocket through direct marketing.”

Smalley said that agricultural census data indicate that approximately 6,300 Michigan farmers are selling

directly to consumers. Excluding consumer sales through roadside stands and CSA programs, she estimates that about 5,000 farmers are selling at least some of their produce at farmers’ markets.

“Of all the ways farmers can sell food, I see farmers’ markets as having the lowest barriers to market entry,” Smalley said. “People can come in and sell for part of the season and try it out, stall fees are very low, you don’t need a lot of equipment, and you get direct feedback from your customers. It’s a really good way for people to put their toe in and try out the market on a small scale before they jump in and make an expensive mistake.”

On the consumer side, Montri said that, as people gain access and are exposed to fresh, healthy food, they want more and become interested in a greater variety and diversity of foods.

“A lot of consumers are now hooked on fresh, local food,” Montri said. “They don’t want it to end in October, and they don’t want it to start in June or July — they want it year-round. So farmers’ markets are really working with growers to help them understand simple season extension techniques and the ability to extend not only the growing season but the market season.”

“We’re seeing a number of these markets try winter hours,” Smalley added. “Most farmers’ markets close at the end of October, but some of them are now trying

Mott Group Director Susan Smalley works with farmers’ markets across the state. Smalley believes that the development of farmers’ markets needs to be considered as part of the state’s economic recovery.





Dru Montri (*right*), Michigan Farmers Market Association (MIFMA) manager, talks with Christine Miller, manager of the Meridian Farm Market. MSU worked with Michigan Food and Farming Systems to found the MIFMA in 2006.

one or two days the week before Thanksgiving and a day in December just before Christmas. If that proves successful, maybe they'll try selling monthly through the winter."

Montri said that a lot of downtown development authorities and chambers of commerce are very interested in establishing farmers' markets as a part of their community development strategy.

"These groups see farmers' markets not only as a way to provide access to fresh, locally produced food but — even more importantly — as a way to invigorate their downtown areas by bringing more people to downtown businesses and creating traffic in less frequented parts of their communities," she said.

"A neat example of how farmers' markets and urban communities are working together is the Grand Rapids Fulton Street Farmers' Market," Smalley said. "The market isn't right downtown, so the city's local transit authority set up a bus route on Fridays. It runs two bus loops from downtown to the farmers' market during the lunch hour to encourage people to shop for healthy food."

Montri said that MIFMA also is seeing a lot of hospitals and people in the health and wellness industry interested in establishing farmers' markets.

"It's not just about the traditional places where you think a farmers' market might be," she said. "There are a lot of healthcare professionals that view having an on-site market as a very important part of what they're doing for both their employees and their patients. For example, Beaumont Hospital in Royal Oak has a farmers' market; Bronson Hospital in Kalamazoo hosts an indoor winter market with its municipal farmers' market; Hurley Hospital in Flint is doing a trial market in conjunction with the Flint Farmers' Market; and Sparrow Hospital

in Lansing has a satellite market of the Allen Street Farmers' Market once a month."

It's also very important to look at farmers' markets as places where people can go regardless of their socioeconomic status, Montri said. For this reason, a national effort began in 2007 to increase the number of farmers' markets that used the Electronic Benefits Transfer system to accept Supplemental Nutrition Assistance Program (SNAP) benefits. The system accepts a plastic card similar to a bank debit card to deduct food purchases from a shopper's SNAP account. Because the card used in Michigan shows the Mackinac Bridge, it has become known as the "bridge card."

"The biggest barrier to bridge card transactions at these markets was the development of an efficient, centralized system," Montri said. "Although we still have a way to go, Michigan leads the Midwest states in the number of farmers' markets that accept bridge cards with more than 50. During the 2009 market season, more than \$297,000 in bridge card benefits were redeemed at farmers' markets across the state — a 224 percent average increase per market over 2008 redemptions. This growth is a testament to the success of bridge card programs at Michigan farmers' markets."

So how do farmers' markets fit into Michigan's overall recovery?

"Of all the ways farmers can sell food, I see farmers' markets as having the lowest barriers to market entry."



“When we think about economic recovery, too often it’s about bringing in a big factory or a big anything,” Smalley said. “In the long run, we might be better served by placing an emphasis not just on finding jobs but on helping people create viable businesses. Farmers’ markets are one way, at a pretty low cost, to accommodate this. If we’re in this for the long haul — and I hope that we are — including the development of farmers’ markets as part of the state’s broader economic recovery effort is something that really needs to be considered.”

Growing Michigan’s Future Together

Although health, job creation and local access to fresh food are key goals of this endeavor, the group is quick to point out that the foundation and ultimate success of such an approach lies in a collective effort that includes many groups and cultures across the state.

“The opportunities we’re facing will not be addressed by one faculty member doing a project and making a dramatic difference,” Biernbaum said. “We’re trying to develop a system that has room for everyone to join in and participate. There will always be people with more or less wealth, but we need systems that are diverse and respect the need for small, medium and large.”

Adam Montri emphasized that, although the group is pushing for more urban agriculture in the state, they see these mostly small-scale farms as a supplement to, not a replacement for, rural farm operations.

“I don’t think anyone in Detroit or Flint or Grand Rapids or Traverse City would say that their goal is to grow all the food for the populations of these cities,” he

said. “We don’t want our rural areas to be islands, and we don’t want our cities to be islands. There’s an interconnection there — strengthening one strengthens the other.”

Conner agrees.

“There’s a false competition in the perception of a zero-sum game,” he said. “Some take the position, for example, that ‘If they’re growing vegetables in Detroit, consumers there won’t be buying mine.’ I don’t believe that’s true. I believe it’s ‘They’re growing vegetables in Detroit; they’re getting a taste for fresh, healthy food; they feel good; they’re productive; they want to buy more; and they can’t grow all of it.’ There’s a new market. Too often, people think in either/or when they should think in both/and.”

The urban-rural connection is also important to the role that farmers’ markets play in connecting people to their food, to the land and to one another.

“Direct relationships between the people who grow the food and people who eat the food helps people care more about the way their food comes to them,” Smalley said. “If I just go to a supermarket and pick food off a shelf, there’s not really a lot there that encourages me to care much about where that food came from; the only things I might pay attention to are the price and whether my family will eat it. But at a farmers’ market, people can talk with one another and ask questions such as ‘Did you use pesticides and, if you did, why did you use them?’ There’s an opportunity for real relationships between people and between people and their food that isn’t part of most other ways of getting food.”

Hamm said that, although transitioning to a more local, sustainable food system shouldn’t be oversold as the end-all, be-all of economic development, it has great potential to help revitalize Michigan and generate broadly applicable lessons for many other areas.

“We’re going to need a network of innovative, sustainable industries and small- and medium-scale agriculture that’s locally sourced and locally consumed,” he said. “Whether the food is rural- or urban-produced, relocalizing the state’s food supply is an important piece of the economic system of the future. By understanding and articulating the interconnectedness of food and agriculture, nutrition and health, and economics, we can create opportunities for broad conversations on potential solutions to a variety of problems.”

— Val Osowski

Turf's Up!

Using Lawns and Parks to Catalyze Urban Revitalization

As the industrial model that once drove the United States' economic engine continues to downshift, communities across the country are looking for innovative, sustainable ways to cultivate their economic and social well-being. Population decreases and urban decline caused by the contraction of manufacturing jobs have taken their toll, and urban areas are increasingly driven to find ways to survive and thrive as smaller cities.

There is perhaps no more telling example of the magnitude of this challenge than the collapse of the auto industry in the 1970s, and no more emblematic and well-publicized story than the decline and fall of Flint. In his 1989 documentary film, "Roger & Me," Flint native Michael Moore portrayed the negative economic impact that resulted from the closing of several General Motors auto plants in Flint, eventually costing more than 80,000 people in the region their jobs and devastating the city. Known as "Vehicle City" and the birthplace of GM, Flint saw its population drop from a peak of about 197,000 during the GM heyday of the 1950s and 1960s to 112,900 (according to a 2008 Census Bureau estimate) — a 43.7 percent decline. ▼



Turfgrass scientists Kurt Steinke (left) and Thom Nikolai are examining how the functional and environmental aspects of grass can benefit three test sites in Flint. Project leader Nikolai has studied turfgrass since 1993.

Of particular concern are the thousands of abandoned buildings and vacant lots now scattered throughout the city's deteriorating neighborhoods. These properties can become quickly overgrown and unsightly, diminishing property values and the overall quality of life of area residents. Faced with a \$10 million budget deficit for the coming year, the city has little ability to keep up with the maintenance of these problem properties.

To help address this plaguing situation, a team of Michigan Agricultural Experiment Station researchers — comprising turf experts, a sociologist and an economist — embarked on a three-year project in autumn 2009 with the Genesee County Land Bank and three Flint communities to investigate the interaction between the biological environment and social change, and how this connection may affect the ability to recreate prosperous, vibrant communities.

ROLLING OUT THE GREEN CARPET

Since the early 1900s, lawns and green space have played an important role in U.S.

urban and suburban areas (see box on page 23). When laying out plans for suburbs, landscape architects often used lawns to link the homes and residents of communities together. And for the individual homeowner, owning that little patch of green was a personal point of pride and, for many, connoted hope for prosperity and happiness.

MAES turf expert and project leader Thom Nikolai said the team hopes to combine the attachment value embedded in lawns with growing and maintaining healthy turf to build community capacity and help contribute to Flint's economic recovery.

"I've been involved in turfgrass research since 1993, and as I've become more and more specialized in putting greens, I've developed a real interest in the functional aspects of turf — such as how thicker, well-maintained grass keeps soil and polluting runoff in place, and the ability of the turf-soil ecosystem to decompose and render harmless pesticides and other toxic organic chemicals," said Nikolai, who is also an

academic specialist with the MSU Institute of Agricultural Technology.

Nikolai said that turf is often viewed in extremes — either as ornamental, visually pleasing and desirable as a surface for outdoor sports and recreation, or as a source of negative impacts on the environment. On the basis of his research, Nikolai sees far more positives than negatives on the environmental side as long as best management practices are used.

"It seems counterintuitive, but if you fertilize grass in a responsible manner, you end up with a denser turfgrass stand, which means less sediment movement," he explained. "As a result, since chemicals such as phosphorus — which is a big issue for surface water quality — adhere to the clay and organic matter in sediment, you actually have fewer pollutants entering these water bodies."

Nikolai continued to think about and conduct research to demonstrate the efficacy of these benefits as well as how they might be applied beyond the golf course.

"So the idea became 'Let's get into a city and see what impact these benefits may have, especially in urban areas challenged with large numbers of abandoned homes and vacant lots,'" he said. "We wanted to answer the questions 'Is it economically worthwhile for a city to put money into taking care of these areas?' and 'If these areas are taken care of in a sustained way, what impact would that have economically, socially and environmentally on the community?'"

After several years of looking for a community partner to work with, Nikolai attended a meeting in 2008 with Joan Nassauer, professor of landscape architecture at the University of Michigan. Nassauer, internationally recognized for her work on the cultural sustainability of ecological design in human-dominated landscapes, had been brought in by the Genesee County Land Bank because it had a turf problem.

"At that point, there were about 4,000 abandoned homes in Flint," Nikolai said.

“We wanted to answer the questions ‘Is it economically worthwhile for a city to put money into taking care of these areas?’ and ‘If these areas are taken care of in a sustained way, what impact would that have economically, socially and environmentally on the community?’”



Nassauer’s work indicates that selectively keeping some mown turf is key in improving community pride and acceptance of vacant properties — an important first step in what she recommends to make “vacant land a natural asset.” When she met with Nikolai, she said, “In Flint, even more than in cities that don’t have much vacant land, many properties should stay in lawn because that’s how people know someone is taking care of them — it’s the social side of things.”

Armed with Nassauer’s findings, Nikolai identified three test sites — Hartland Manor near the Carriage Town Historic District, the McKinley Park area and Ramona Park in the Metawananee Hills neighborhood — and approached the Land Bank to negotiate a study to test his ideas. When the Land Bank approved, he used his long-standing relationships in the golf industry to secure funding, supplies and equipment for the project. Nikolai landed \$150,000 plus lawn care supplies from lawn and garden products maker The Scott’s Co.; \$20,000 from the Michigan Turfgrass Environmental Stewardship Initiative (a partnership between MSU, the Michigan Turfgrass Foundation, the Golf Association of Michigan, the Michigan Golf Course Owners Association and the Michigan departments of Agriculture and Natural Resources and Environment); and donated lawn mowers from John Deere — three mowers for each community and a commercial mower for the Land Bank.

THE MANY SIDES OF TURF

As planning began for the project, Nikolai quickly recognized the need for a multi-disciplinary approach.

“My field of expertise is the putting green, so when I received this money and things got started, I realized that I didn’t

have the social science expertise needed for the project, so I got in touch with MAES colleague Stephen Gasteyer,” he said. “Fortunately, he was interested in participating.”

“I was fascinated with the Nassauer study,” said Gasteyer, MAES sociology researcher. “There’s a lot written about the ideal constructed natural environment where people don’t have to manage it — it just takes care of itself. In Flint, you have communities saying, ‘No, we want something we can manage, something we can control.’ It’s a neat take because, if it’s something you have to manage, then it implies interaction and building capacity at the local level to do that management in perpetuity. This is especially relevant in a

place like Flint, where you’re dealing with a local government that won’t be providing these services anytime soon, and everyone understands that.”

Another key aspect of the project involves looking at the broader question of community capacity, and that gets into questions of social capital — sympathetic and trusting relationships that can produce important benefits.

“As I’ve engaged with the neighborhood associations in these communities,” Gasteyer said, “I realized what should have been apparent all along — that lawn is really one piece in a big puzzle of how residents make their neighborhoods places where they can walk around, greet and get to know one another, and have positive interactions



MAES scientists Lindon Robison (left) and Stephen Gasteyer are studying the social side of turf — how lawns can build positive relationships and community capacity.



“...lawn is really one piece in a big puzzle of how residents make their neighborhoods places where they can walk around, greet and get to know one another, and have positive interactions.”

rather than the negative interactions of drug deals, guns, violence and prostitution.

“In one neighborhood, the place that we’re planning to lay the largest piece of turf is currently an area where prostitutes hang out,” Gasteyer added. “The residents see this as a way to take back community space from people and activities that have a negative influence on their neighborhoods. As a social scientist, my job is to try to connect this to the broader efforts at creating local capacity to give people the power to take back control of their lives.”

Acknowledging the importance of quantifying these social interactions and what people get out of them, the team added MAES agriculture, food and resource economist Lindon Robison to its roster. Robison, who studies the social capital paradigm and how the value and meaning of objects change as a result of social interactions, said he was interested in seeing the extent to which the value and meaning of these neighborhoods changed as residents participated in the shared opportunity created by the project.

“Social capital alters the terms and level of trade,” Robison said. “In other words, if I’m selling my car to my sister, I don’t charge her the same price as I place in a newspaper ad to sell to someone I don’t know.”

Robison said that social capital is similar to other forms of capital — such as machinery, land and natural resources — because it produces goods that satisfy social-emotional needs and that can then become embedded in things such as flags, songs and mascots, creating what is called attachment value.

“I’m interested not only in the economic side but also in how an object like grass can



Michigan Turfgrass Foundation Executive Director Gordon LaFontaine helped Nikolai secure donations of lawn care supplies and lawnmowers for the project.

acquire attachment value, how that value can change because of the exchange of social-emotional goods between people as they create rules and manage the resource, and how that change in value then spreads to houses, roads, etc.,” he said. “It’s exciting to bring together the intersection of the physical resource and the social resources. This is one of very few projects I know of where the main goal is to look at and quantify these types of interactions.”

Rounding out the project is an environmental component led by MSU turfgrass ecologist Kurt Steinke, who will conduct research in the Hartland Manor area.

“We’d like to explore some storm water

runoff issues by looking at phosphorus and sediment loading and various types of urban vegetation to better assess perceived versus actual environmental impacts. In other words, we want to examine the residents’ rationale for selecting certain ground covers and gain insight into whether they feel certain types of vegetation may or may not contaminate the surrounding environment.”

Steinke explained that, although a lot of this type of research has been conducted at MSU and other land-grant institutions, the work hasn’t been done in a location such as Flint.

“We’ve done studies like we’re going to do in the Hartland Manor area at turfgrass research centers throughout the country, but the general public doesn’t come to view the results,” he said. “We want to put that study in right in the middle of a neighborhood so that residents living directly across the street can walk over and examine the results firsthand. I’m hopeful that we’ll have a field day in Flint next year to share our findings.

“We’ll also be looking at water quality coming into the Flint Golf Club and water quality leaving the golf club as it enters Thread Lake, which borders the McKinley Park area,” Steinke said.

Nikolai added that leaf mulching studies will be an important part of the project’s environmental palette.

“Leaf mulching is a way that communities can save lots of money by mowing their leaves into their lawns instead of having them picked up,” he said. “The cost of leaf pickup in Flint is approximately \$500,000 annually. In addition to the contribution that leaf mulching makes to healthy turf, we want to document the cost savings it

A Brief History of Lawns: Turning Green into Gold



The roots of our attachment to grass-covered yards can be traced back to the beautifully maintained English lawns of the 19th century. Americans with enough money to travel overseas during this period returned to the United States with images of the English lawn firmly planted in their imaginations. Lawns were seen as a luxury expense for only the wealthy, who could afford groundskeepers to maintain the fine-bladed plants using scythes. It wasn't easy to reproduce an English lawn in the United States, however. Grasses native to North America proved unsuitable for a tidy and well-controlled lawn, and its extremes of climate were less than hospitable to the grass grown from English grass seeds.

By 1915, the U.S. Department of Agriculture was collaborating with the U.S. Golf Association to find the right grasses or combinations of grasses that would create a durable, attractive lawn suitable to the variety of climates found in North America. Fifteen years later, the USDA had discovered several grass combinations that would work.

Mechanical mowing came about early in the 19th century, with the invention of a reel-type mower by Englishman Edwin Budding in 1830. In 1870, Elwood McGuire of Richmond, Ind., designed a machine that basically brought push mowing to the masses. By 1885, America was building 50,000 lawnmowers a year and shipping them to every country on the globe.

For the average American, readily available grass seed and the invention of the rotary mower and the garden hose made

home lawns a more realistic option. However, the big demand for grass-covered front yards didn't happen until The Garden Club of America – established in 1923 — stepped in. Through contests and other forms of publicity, the group convinced homeowners that it was their civic duty to maintain beautiful and healthy lawns. The Garden Club further stipulated that the appropriate type of lawn was "a plot with a single type of grass with no intruding weeds, kept mown at a height of an inch and a half, uniformly green, and neatly edged." So effective was the Garden Club's campaign that lawns were soon an accepted form of landscaping. America thus entered the age of lawn care.

Today, there are an estimated 27.6 million acres of turfgrass in the United States, 21 million acres of which are in home lawns. An estimated 80 percent of U.S. households have a private lawn.

In Michigan, maintained turfgrass areas cover large portions of the state. Turfgrass accounts for 5 percent of the state's total land mass, encompassing almost 1.9 million acres, and 1.58 million acres of that are attributed to residential lawns. The use and maintenance of turfgrass contributes significantly to Michigan's economic, cultural and recreational well-being, adding more than \$1.86 billion dollars into the state's economy through jobs, materials and equipment. Michigan is also a major producer of sod, a significant agricultural commodity for developing areas.

— Val Osowski

affords and then explore how a community might use that money if it weren't spent on picking up leaves."

Robison said he is hopeful that this type of project will gain attention as the state works to address the challenges of both urban and rural communities, especially during these trying economic times.

"This whole idea of an economic model that is multidisciplinary and accounts for intangible goods and their effect on values is a new direction that involves looking at new kinds of resources," Robison said. "What we appreciate is that these problems are not going to be solved within an isolated discipline. And I think down the road there's the opportunity to say, 'OK, how do you manage the relationship between urban and rural, and what's happened in that relationship where it's clearly been depreciated?' We haven't really demonstrated those connections very well."

CREATING A NEW KIND OF COMMUNITY 'TURF'

Although the project is just getting off the ground, Nikolai is encouraged by the enthusiastic reception the team is receiving.

"We are extremely welcome when we meet with these community groups," he said. "The city council reps are often at these gatherings, and they start out talking about the fact that 46 police officers and 23 firefighters just got laid off. Next, a woman in the back stands up and talks about how her kids don't have a park to play in. Then I'm introduced toward the end of the meeting and tell them that we want to give their neighborhood some mowers and fertilizer and work with them on managing their lawns and parks, and you'd think we were the Beatles in 1964! They're excited!"

The team believes that this project will provide real opportunities for future research to look at the integrated environmental, social and economic impacts of turf application in revitalizing abandoned space in urban environments.

"We believe that there are going to be interactions in this project that can really



Though some may view turfgrass as a source of negative environmental impacts, research has shown that, if grass is fertilized in a responsible manner, it becomes denser and helps reduce sediment movement, which can keep pollutants out of surface water.

push new theories of neighborhood development but also neighborhood environment and sustainability," Gasteyer added. "This is really about urban sustainability in the new millennium, and we have a window to think about that in a dynamic and unique way."

Replication is one area where additional funding will be instrumental.

"We'd like to take whatever model comes out of this project and be able to adapt it to a different community," Steinke said. "However, I think we're all aware that the model may not work for a community that doesn't have a 29 percent unemployment rate and a median household income in the upper \$20,000s; if unemployment is 5 or 6 percent and median household income is much higher, the end result may be completely different from what we find in Flint. So from a biological, physical, economic and social science perspective, we have to document and develop specific aims well enough so that we can pinpoint where

in the Midwest or South or Northwest this model can be adapted and used."

Gasteyer said that the project also provides an avenue to start thinking about sustainability in a place that most people don't think about it — in an urban setting.

"For those of us doing this type of work in the Midwest, one of the things we have to grapple with is shrinking cities, whether they are the size of Flint or Detroit, or the size of Mancelona," he said. "We will be building on work that's already been done in more rural settings but applying it to particular shrinking urban cities. I think this is going to be one of the challenges in the new millennium — how do you create sustainability as you're scaling back cities that were developed around industrial models that are no longer functional? Reinventing public space is going to be an important part of that story."

— Val Osowski

The Business of Biofuel

By conducting research in partnership with companies

large and small, MAES scientists are helping Michigan's

fledgling biofuel industry power up.

In Michigan, much research and development aimed at developing and growing the bioeconomy — an economy based on renewable resources rather than non-renewable resources such as petroleum and coal — focuses on making renewable fuels from cellulose: trees and plant stems and stalks that aren't food products. Other scientists are working to introduce to Michigan farmers new crops that could be grown for either food or fuel and to develop markets for them in the state.

MAES researchers are working with a number of companies, from small start-ups to subsidiaries of international corporations, that all have the same goal: finding ways to grow and process plant biomass into biofuels and bioenergy that are economically, environmentally and socially sustainable.

Fuel, Cubed

When the K.I. Sawyer Air Force Base closed in 1995, communities in and around Marquette County in the Upper Peninsula braced themselves for the economic effects. The base provided more than 4,500 jobs and had a military payroll of more than \$100 million.

Fifteen years later, the decommissioned base is home to the Sawyer International Airport, a golf course, an



PHOTO: COURTESY OF RENEWA FUEL.

At the former K.I. Sawyer Air Force Base, Cliffs Natural Resources plans to make these cubes from plant biomass, including switchgrass. The cubes can be burned with coal to heat Cliffs iron ore processing facilities.

elementary school and an economic development renaissance zone that has attracted dozens of businesses, including renewaFUEL, LLC, a subsidiary of Cliffs Natural Resources, an international mining and natural resources company. RenewaFUEL plans to manufacture and distribute cubes made from plant biomass, including switchgrass, which can be burned along with coal to heat Cliffs iron ore processing facilities. Cliffs managers believe the cubes have the potential to replace about 20 to 25 percent of the coal used to fire the kilns.

The company announced in November 2009 that it



MAES forage researcher Doo-Hong Min has been working with Cliffs scientists in the U.P. to identify the best switchgrass varieties to grow, as well as the best way to grow them. A Cliffs scientist called his support “invaluable.”

was building a plant to produce the fuel cubes at the Telkite Technology Park at the former base, as well as leasing two former B-52 aircraft hangars. The plant is expected to be finished and start producing cubes this year.

MAES forage scientist Doo-Hong Min, based at the Upper Peninsula Experiment Station in Chatham, has been working with Cliffs and renewaFUEL scientists since 2007 to help them identify the best varieties of switchgrass to grow in the U.P., as well as the best way to grow the crop. As the company moves forward, Min continues to offer guidance and support. Thirty bales of switchgrass produced at the U.P. Experiment Station were donated to renewaFUEL last December for testing purposes.

“Dr. Min’s research and advice have been invaluable to us,” said Michelle Jarvie, an environmental engineer with Cliffs, who has been working on switchgrass test plots. “His expertise has made it much easier for us to start working with this new crop. He and technician Chris Kapp helped us pick out varieties and prepare the beds — they knew immediately if something wasn’t done correctly.”

Min’s research focuses almost exclusively on switchgrass and forages and looks at such things as how tillage practices affect carbon sequestration and greenhouse gas production. He’s testing nine varieties of switchgrass at the U.P. Experiment Station; renewaFUEL has one test site in the Upper Peninsula.

“Switchgrass is a perennial crop,” Min explained. “A farmer plants it once and it can last 15 to 20 years. It

also has lower nutrient requirements than other crops such as corn or wheat, so it can be planted on fallow fields or in areas that can’t be used to produce food. This allows farmers to make those fallow areas more value-added.”

Min’s research also is benefitting area farmers. Dale Hemmila, public affairs district manager for Cliffs, said the company plans to buy the switchgrass and other raw materials needed to make the fuel cubes from local growers within a 75-mile radius of the new facility in K.I. Sawyer.

“I talked to the president of renewaFUEL at the press conference announcing the fuel cube production plant,” Min said. “He told me that renewaFUEL is going to buy any available feedstock, including switchgrass and reed canary grass, so this is a good opportunity for local farmers who want to grow bioenergy crops. I’m working with growers to put in more switchgrass in Dickinson County.”

“We are pleased to be able to begin the necessary renovations and equipment installations to commence operations at the Sawyer location,” said William A. Brake, chairman of renewaFUEL and executive vice president for human and technical resources for Cliffs Natural Resources, in a statement. “This is an exciting new economic development opportunity for renewaFUEL and Michigan’s growing renewable energy industry.”

The \$19-million plant is expected to create 25 new jobs and will produce 150,000 tons of biofuel cubes per year. The cubes are about 1.25 inches square and about

2 to 3 inches long and generate the same amount of energy as coal from the western United States. According to Hemmila, they emit 90 percent less sulfur dioxide, 35 percent less particulate matter and 30 percent less acid gas than coal. Once the plant reaches full production, renewaFUEL expects to sell 60,000 tons of the cubes to power the steam plant of the Marquette Board of Light and Power. Because of the cubes' size and density, most solid fuel systems can use them with no problem.

“Our objective with this first full-scale plant is to establish safe, profitable production and demonstrate to utilities and other industries currently using non-renewable energy sources that renewaFUEL energy cubes are a cost-effective way to supplement or replace fossil fuels in their operations,” Brake continued. “We anticipate being in production at the Sawyer facility by the end of 2010.”

Sense and Cents Figure into Fuel Production

When Dan Blackledge started Marion Bio-Energy three years ago, biodiesel was selling for \$3.50 per gallon and his business model predicted a profitable business. One of his goals was to help develop a biofuel market in Michigan that would be profitable for both farmers and processors. A farmer and former software company owner, he had read an article about MAES scientist Dennis Miller's research on making biofuel from canola on the MAES Web site. He and Miller went to lunch in 2007, and the meal resulted in a two-year research project funded by the MAES on developing markets in Michigan for canola and the best processes to make biodiesel from canola oil.

The fact that a single canola seed is more than 40 percent oil makes canola one of the world's most oil-dense crops. In comparison, a soybean is only 18 percent oil, and a kernel of corn is 4 percent oil. Canola was developed in the 1970s by Canadian plant breeders. In the late 1980s, Michigan farmers grew about 15,000 acres of canola, but the amount tailed off dramatically in the ensuing years because the state lacked processing plants. Most of the canola was grown in northern Michigan, and the closest processor was in Windsor — trucking the crop all the way to Canada meant lower profits for growers. Farmers could make more money selling crops such as corn and soybeans to a local elevator.

As part of the biodiesel project, Miller conducted research on converting canola oil to fuel, and MAES canola breeder Russ Freed provided advice on the best varieties to grow. Blackledge worked with MSU

Extension directors Jerry Lindquist, in Osceola County, and George Silva, in Eaton County, to recruit farmers as contract growers of winter and spring canola that Marion would process into biodiesel. The goal was to have participating farmers growing 40,000 acres of canola within five years. The company's future looked promising.

Then the bottom dropped out of the biodiesel market in 2008, and prices plummeted. Suddenly, the company's financial future didn't look as rosy. To produce biodiesel, Blackledge needed to invest an additional \$6 million to buy a crusher, bins, barns, vats and other necessary equipment. And though Blackledge, Lindquist and Silva had recruited more farmers the second year to grow canola, 2009 acreage reached only about 500 acres — far short of the 40,000-acre goal and not nearly enough



Zachary Thompson, chemical engineering student, processes canola. Since it's more profitable to grow canola for food, Dan Blackledge developed a new business model and renamed his company Michigan Canola Products.

raw material to produce the amount of biodiesel needed to offset a \$6 million investment.

“Right now, biodiesel doesn't make sense economically,” Blackledge said. “It's more profitable to grow canola for food. The amount of capital I needed to finance a crusher coupled with a limited amount of product [canola] meant we had to rethink what we were doing.”

“Everyone in the chain has to make a profit, or the business won't succeed,” Miller added.



MAES chemical engineer Dennis Miller studied how to convert canola to fuel when he started working with Marion Bio-Energy. He now serves on the Michigan Canola Products advisory board and assists with refining canola for food.

Instead of shuttering his business, Blackledge developed a new business model that markets the canola that the contract farmers grow to food processors and other niche markets. Rich in omega-3 fatty acids, which can lower triglyceride levels and promote heart health, and very low in saturated fat, canola oil has become a popular diet choice for people looking to trim their saturated fat intake. The contract growers supported the change, and all are still working with Blackledge and his revamped operation, now called Michigan Canola Products. Some farmers made a profit from the canola last year and have upped their acreage for the upcoming year.

Miller and Freed also still work with Blackledge as research consultants and serve on the company's advisory board.

"Dennis is a chemical engineer, and if anyone has questions about refining, he's available to answer them," Blackledge said. "His research and reputation add credibility to the company."

Blackledge also has received advice and business plan assistance from Ruben Derderian, associate director for the bioeconomy in the MSU Product Center for Agriculture and Natural Resources (*see story page 4*). Blackledge received the 2009 Best Innovative Business Idea Award from the Product Center.

"Michigan Canola Products works with farmers to grow new varieties of canola and is developing value-added specialty oil markets," Blackledge explained. "We still have the option to process the canola oil into biodiesel if prices are such that biodiesel is competitive with petroleum diesel; we could easily switch back to that business model."

Rather than studying the optimal techniques for refining canola oil into fuel, Miller is now focusing on refining techniques to meet the very specific standards of the food industry.

"We're researching the best ways to degum, decolor and deodorize canola oil," Miller said. "Food-grade canola oil requires more processing and filtering than oil that's going to be turned into biodiesel."

Besides food processors, Blackledge also sees people who want to open a small crushing facility or biodiesel operation, perhaps just large enough to produce biodiesel for a local co-op, as potential buyers of his company's canola oil. Canola oil also can be used as an industrial chemical oil, so that's another potential market. He's also working to make Michigan Canola Products the sole distributor of canola seed in

Michigan.

"Selling seed is a sure thing to start," Blackledge said. "That allows us to build relationships and cultivate interest."

Though his business model has gone through some twists and turns, Blackledge has never swerved in his belief that canola is a viable crop for Michigan growers. As Freed has pointed out, much of the food-grade canola used in the United States is imported; in 2009, more than 2 billion pounds of canola oil and 1.8 billion pounds of canola seed were imported. Increasing domestic production is just a matter of connecting the growers and the markets. And Blackledge sees Michigan Canola Products as the ideal matchmaker.

"If we can get enough canola grown, then there may be interest from investors to allow us to build crush plants," he said. "It's all economy of scale."

— *Jamie DePolo*

A photograph of a snifter glass filled with an amber-colored spirit, likely whiskey or brandy, sitting on a wooden surface. In the foreground, a white document with some text is partially visible. The background is a soft, out-of-focus interior setting.

Setting Michigan's Economic Spirits Soaring

Kris Berglund's research on distilled spirits and other fermented beverages has helped create a new industry in the state.

A native of the Leelanau Peninsula, Rifino Valentine was a trader inside the Wall Street pressure cooker for a number of years before having what he called his “ah-ha” moment.

“I wanted to make the perfect dirty martini using vodka made in the United States,” explained the president and founder of the Ferndale-based Valentine Distilling Company. “So I signed up for Kris’s artisan distilling

Rifino Valentine started his distilling company to show the world that first-class spirits could be made in Detroit. He is committed to buying local — all his suppliers, except for the company that makes the glass bottles, are based in Michigan.



course at Cornell University and decided I was going to move back to Michigan to set up my business. I had thought about basing the company in New York City or Miami, but I wanted to go back to Detroit and show everyone that the city could produce world-class spirits.”

Valentine is part of an emerging industry in Michigan, one that has grown tremendously in the past two years thanks to a law passed in 2008 allowing small distillers to market and sell their products on-site. The state has 11 licensed artisan distilleries — second only to California — and many of them, as well as the law, can trace their beginnings back to the research of the “Kris” that Valentine credits for helping the genesis of his company: MAES scientist and university distinguished professor Kris Berglund.

Berglund, forestry and chemical engineering and materials science researcher, has been studying distilling processes and conducting how-to workshops since 1997, envisioning a bright future for microdistilleries that would be similar to beer microbreweries. State economic studies estimate that microdistilleries will add more than \$400 million to Michigan’s economy and create about 1,400 new jobs. Today, much of Berglund’s research takes place at the MSU Biorefinery Training Facility at the Michigan Brewing Company (MBC) in Webberville, where a line of gleaming copper stills helps provide research results for distillers in Michigan and around the globe.

The facility received a \$20,000 Michigan Initiative for Innovation and Entrepreneurship grant in late 2009 to develop the MSU-MBC Artisan Distilling Business Accelerator to help fledging distillers develop and market their products. The accelerator has a commercial license and is certified organic.

Encouraging Artisan Entrepreneurs and Established Distillers

Berglund is passionate about his research and just as passionate about helping small companies find their way through the maze of regulations that govern alcoholic beverage production, especially distilled spirits.

Federal law requires a company to have an operational distillery before it can apply for a license to produce distilled spirits. Unlike beer and wine, there’s no minimum amount of distilled spirits that can be made without federal and state licenses. So an entrepreneur has to attract investors to build a distilling plant without being able to actually prove that he or she can make and market the product.

“It’s a chicken and egg problem,” Berglund said. “You need a prototype of your product to get investors interested, but federal law says you can’t make the prototype until you already have the plant. The incubator allows entrepreneurs to test and develop recipes and prototype products to show potential backers that they know what they’re doing.”

At the incubator, Berglund and his graduate students help a number of companies with pilot-scale fermentation, finishing and prototypes. The facility has four stills ranging in size from 10 to 800 liters and 2-, 30- and 400-liter fermenters, as well as a full lab.

“We can go from very small test batches all the way up to brewhouse quantities,” Berglund said. “We’ll do contract work for anyone. Our goal is to help anyone who is interested in getting into the business.”

Valentine Distilling does testing and finishing there, as does the Vlixir

Beverage Company, a California-based operation that makes organic vodka. When owner Robert Reagan was having difficulty finding organic wheat for his vodka, Berglund connected him with a Michigan grower. Berglund also is consulting with entrepreneurs on the Isle of Jersey, one of the Channel Islands off France's northern coast, who want to make vodka from the area's renowned Jersey Royal potatoes. A bit closer to home, Herman Mihalich, of Wrightstown, Pa., is using Berglund's research as he works to develop a rye whiskey for his company, Mountain Laurel Spirits. John Jeffrey, a graduate student working on his doctorate through the MSU distilled spirits program under Berglund, has started his own company, Novina Spirits, which also does work at the accelerator. Jeffrey is developing a line of spirits using seasonal Michigan products.

Berglund also continues to study the nuances and variables of beverage technology to help established companies in Michigan.

"Kris provided our initial training," said Don Coe, a partner in the Black Star Farms operation in Sutton's Bay, which includes a winery, a distillery, an inn, several tasting rooms, a restaurant and a creamery. Black Star Farms produces a variety of distilled spirits: eaux de vie — clear fruit brandies — made from apricots, cherries, pears and plums; four- and 10-year aged apple brandies; and white- and red-grape grappas.

"Lee Lutes, our winemaker, went to Kris' workshop; Kris advised us when we purchased our first still and analyzed our first results," Coe continued. "He shortened our learning curve on the distilling process by about five years."

Berglund is working with the New Holland Brewing Company, in Holland, Mich., to study the aging process for whiskey using 1- to 3-gallon barrels versus the standard 55-gallon size by analyzing the rate of extraction of color and flavor from the barrels.

"Our preliminary results indicate that smaller barrels shorten the aging process," Berglund explained. "So we're studying whether we can get the same flavor in a shorter time using a smaller barrel."

Just up the road from the MSU campus, in St. Johns, Berglund is working with Uncle John's Cider Mill co-owner Mike Beck to develop an apple vodka to complement the selection of wines and hard ciders produced by the Fruit House Winery at Uncles John's. Berglund noted that true apple vodka is different from the many fruit-flavored vodkas on the market.

"It takes a lot of apples to make apple vodka," he said. "About 30 pounds to make 1 liter. It also has a very different texture and mouth feel compared with a flavored vodka — it has a buttery flavor. So this could be a good way for Mike to make an added-value product with any extra apples he has after making cider."

Distilling Reality from an Idea

His business set in motion by a craving for a premium martini that didn't use imported vodka — his only choice at the time — Valentine said Berglund's research and advice have been indispensable as his company moved from brainstorm to bricks and mortar.

"When you start a business like this, you don't know all the stuff you don't know," he said with a laugh. "We're one of the first companies in the world to use a multigrain recipe to make vodka. Kris helped us get the exact character we wanted, and I'm very proud of it. It's warm with a hint of vanilla, but that all comes from the grains and the distilling process — we don't add anything to the vodka. It was complex to develop, and we went through hundreds of tests. I wouldn't have been able to do any of this without Kris."

A proprietary blend of barley, red wheat and corn, Valentine Vodka uses Michigan-grown grain. Valentine is so committed to buying local that all his suppliers, except for the company that makes the glass bottles, are based in Michigan. All production currently is done at the Webberville incubator, but Valentine plans to move production to his new Ferndale location by the end of the year. The new facility also will have a tasting room so potential customers can sample the product. The vodka is available all over the state, and Valentine plans to focus on expanding distribution in the next year.

"I'm just blown away by what's happened," he said. "We went from nothing to having more than 500 accounts, and the vodka has been on the market for only a year. In blind taste tests, we beat Grey Goose 19 out of 20 times."

For Coe, of Black Star Farms, the desire to become a distiller was rooted in the 30 years' experience he had in marketing and selling distilled spirits. After retiring from that position, he helped start the winery.

"I started the winery in 1997 because I wanted to distill fruit brandies," he explained. "But the laws are such that we had to have the winery first. I wanted to produce fruit brandies like those I had experienced in Europe and Italy. There really wasn't anything at that level of quality being made in the United States at the time."

The brandies and grappas make up less than 2 percent of Black Star's business, but Coe said their sales belie the products' significance.

"Distilled spirits will always be a small part of our overall sales, but they serve as a very important introduction for Black Star Farms to European-educated chefs at prestigious, high-profile restaurants," he said. "The distilled spirits open the door for our company and allow us to place our wines and other products at these white tablecloth restaurants. Fewer than 100 eaux de vie are made in the United States, so it's a very good marketing tool for us."

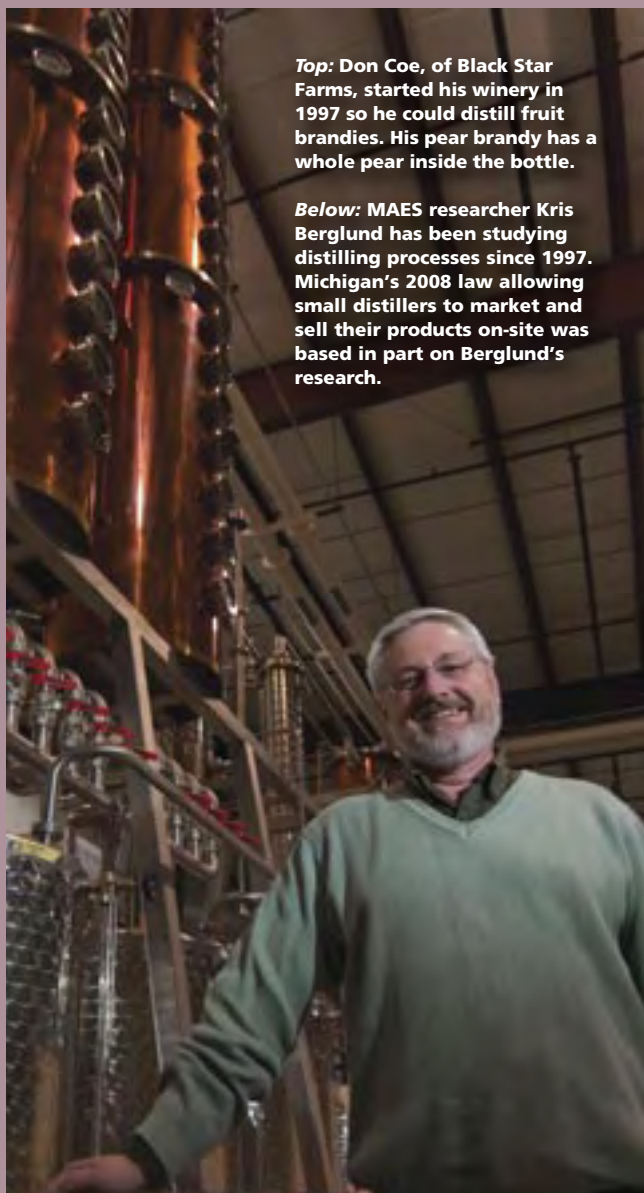
Coe also pointed out that Michigan brandy producers have had more difficulty reaching the marketplace than whiskey and vodka producers.

"Our brandy products are having difficulty navigating the state's distribution system, which makes it very difficult to get retail presence," he explained. "Since the state's brandy producers are almost all wine producers, too, they would benefit from the ability to offer samples and sell in all of their existing winery



Top: Don Coe, of Black Star Farms, started his winery in 1997 so he could distill fruit brandies. His pear brandy has a whole pear inside the bottle.

Below: MAES researcher Kris Berglund has been studying distilling processes since 1997. Michigan's 2008 law allowing small distillers to market and sell their products on-site was based in part on Berglund's research.



tasting rooms — not just at the production site.”

So the five Michigan brandy producers have one retail outlet each while the other 5,600 brands of distilled spirits listed by the state have access to more than 15,800 retail accounts.

“This provides a huge advantage for established, national brands and the most popular categories of products as opposed to our specialty products,” Coe continued. “They have none of these advantages to obtain retail presence.”

Coe credited Berglund with orchestrating the establishment of the distilled spirits industry in Michigan.

“With the research and education available from Kris and the College of Agriculture and Natural Resources at MSU, new laws from the legislature and investment from the private sector, this industry was created. Kris was the convener — he brought these three groups together.”

Expanding, Still

Between teaching graduates and undergrads, writing, advising entrepreneurs and conducting distilling workshops around the country, Berglund manages to maintain his own research program, studying issues that will affect the Michigan distilled spirits industry in the future. He’s also active in the Michigan Artisan Distilling Council, a relatively new commodity group for state distillers.

One focus of his research is controlling regulated compounds in distilled spirits. For example, the European Union limits the amount of methanol in vodka to 100 parts per million (ppm). Also known as wood alcohol, methanol is a simple alcohol that can be toxic to people at high concentrations. Because the EU standards are more stringent than those in the United States, Berglund is studying how to precisely control this and other regulated compounds in spirits.

“Methanol is just one example,” he said. “Methanol comes from pectin, which is in produce. Grains don’t have any methanol, so for vodka made from grain this isn’t an issue. But if the vodka is made from fruits or vegetables, we have to tightly control the amount of methanol in the final product if distillers want to export the spirits to Europe, which could be a lucrative market for them.”

Berglund also is building a yeast database. How various types of yeast affect specific fermentation conditions in beer and wine production is well known. Vintners and brewers can pair the conditions and yeast to get the results they want. But no research has been done for distillers, until now.

“No one really knows what distills over to spirits,” Berglund said. “So we’re studying what happens to various yeasts under a variety of conditions. So far, we know that each type of yeast seems to produce very different results. The effects are actually more pronounced in spirits — they’re more concentrated.”

Ultimately the results of these studies will help current and future distillers meet their goals.

“We’re here to support distilling entrepreneurs,” he said. “Because many of them are already in the brewing or winemaking business, the success rate is high — and we want to make sure it stays that way.”

— *Jamie DePolo*

Research *in the news*

“A Shining Example of Excellence” — MAES Ecologist Accepts National Award on Behalf of LTER Network



Powered by the research of more than 2,000 scientists, the Long Term Ecological Research (LTER) network was honored for its large-scale experiments that have transformed ecological and environmental science.

Phil Robertson (*above right*), Michigan State University distinguished professor, MAES crop and soil sciences researcher and chairperson of the LTER executive board and science council, accepted the 2010 Distinguished Scientist Award from the American Institute of Biological Sciences (AIBS) on behalf of the LTER network. Robertson directs the MSU LTER site at the W.K. Kellogg Biological Station, one of 14 off-campus field research stations in the MAES network.

“The LTER Network provides a fundamental understanding of ecological change otherwise unavailable,” Robertson said. “LTER scientists study how plants, animals and microbes in important ecosystems respond to long-term changes in climate, human influence and other environmental factors. What makes the network unique is a long-term record of change in environments as diverse as arctic tundra, southwest deserts and Michigan croplands, together with experiments that help to explain how and why ecosystems respond in the way that they do.”

“AIBS is pleased to recognize the contributions of the LTER network in this, its 30th anniversary year,” said Richard O’Grady, AIBS executive director. “A shining example of excellence in our nation’s scientific enterprise, the LTER program focuses on large-scale, multidisciplinary research and has truly transformed ecological and environmental science in the United States and worldwide. The

program and the scientists and students that have conducted research at LTER sites or with LTER data have fundamentally advanced human understanding.”

Funded by the National Science Foundation, the LTER network comprises 26 sites across a range of ecosystems where scientists study ecology and environmental biology to provide a better understanding of the ecology of both natural and managed systems. The MSU LTER site is the only one in the national network to focus on agriculture.

“We are both grateful for and humbled by this recognition,” Robertson added.

MAES Scientist Will Use \$1.7 Million Clean Energy Grant to Harvest Fuel from Bacteria



An MAES bioreactor expert was tapped to be on a team working to exploit a bacterium’s potential ability to produce a type of butanol that can be used as an automobile fuel.

R. Mark Worden, MAES chemical engineering scientist, is part of the group receiving \$1.7 million from the U.S. Department of Energy Advanced Research Projects Agency-Energy (ARPA-E) to build a reactor system for *Ralstonia eutropha*, a bacterium that scientists aim to engineer to metabolize hydrogen and carbon dioxide to produce isobutanol, a fuel that can be used as a replacement for gasoline.

Anthony Sinskey, MIT professor of biology, leads the genetic engineering team.

“The MIT group is focused on the biology of the bacterium and engineering it to produce isobutanol,” Worden explained. “Early this spring, they realized they needed a bioreactor expert, and I was asked to be a collaborator. My role is to build a reactor system at MSU for this unique fermentation system.”

Worden has to overcome two major challenges in developing the bioreactor system. Once *Ralstonia eutropha* is engineered to

produce isobutanol, the isobutanol eventually will build up to a toxic level and kill the bacterium. So he must create a way to “harvest” the isobutanol without interrupting the fermentation process. Secondly, because the bacterium’s energy source — hydrogen gas — is not very water-soluble, Worden must figure out how to feed it to the bacterium in a water-based system.

“We also have to make sure the bioreactor system is safe,” Worden said. “The *Ralstonia* cells need a little bit of oxygen to grow, but hydrogen and oxygen together are flammable. So I’ll figure out how the two gases can co-exist in the system and minimize any risk of explosion.”

Worden plans to start building the bioreactor immediately.

This project is part of the second round of grants from the ARPA-E, a program aimed at accelerating innovation in clean energy technologies, increasing America’s competitiveness and creating jobs.

“Thanks to the Recovery Act, dozens of cutting-edge research projects with the potential to dramatically transform how we use the energy in this country will now be able to get underway,” said Vice President Joe Biden when he announced the awards. “By investing in our top research, we’re not only continuing in the spirit of American innovation but helping build a competitive American clean energy industry that will create secure jobs here at home for years to come.”

Building a Sustainable Future: MSU Leads Global Effort to Study Links between People, Planet



Hundreds of scientists from around the world are involved in a new initiative at Michigan State University to improve cutting-edge research on the increasingly fragile relationship between humans and the environment.

Research in the news

The National Science Foundation (NSF) recognized this research as a priority and has selected MSU and an MAES scientist to lead the effort, called the International Network of Research on Coupled Human and Natural Systems, or CHANS-Net. The NSF is supporting the project with a \$1.5 million, five-year grant.

Jianguo "Jack" Liu, university distinguished professor, MAES fisheries and wildlife scientist and world-renowned ecologist, is directing CHANS-Net. He said the project reflects one of MSU's primary missions: to solve real-world problems through applied research, global engagement and collaboration among the scientific disciplines.

MSU's role includes building a global database of scholars and their projects, fostering collaboration, helping identify and train new talent, and raising awareness. In mid-April, Liu led a group of scientists to Washington, D.C., to present key research findings at an NSF symposium and at the annual meeting of the Association of American Geographers.

In the past three years, MSU scientists have received about \$6 million in NSF funding for coupled human and natural systems research, far more than any other university. The research focuses on everything from panda habitat in China to development along Nicaragua's Mosquito Coast.

"This is really an exciting frontier in research," Liu said. "We want to help people understand the value of ecosystems to human society rather than just for the sake of protecting the environment. A lot of people treat the environment as something that humans can use forever, when in reality that's not true."

The key is bringing researchers together and combining their strengths — getting the economists working with the hydrologists, for example, to develop irrigation systems that are both efficient and fair to farmers.

It's also imperative, Liu noted, to attack the environmental issues from an international perspective. The more than 300 scientists now involved in CHANS-Net work at institutions in the United States, Africa, China, India, the United Kingdom and elsewhere around the world. And the number is growing.

Thomas Baerwald, NSF program director, said Michigan State has done an excellent job of encouraging researchers to bridge the natural and social sciences in an effort to focus on groundbreaking sustainability research.

"It's a testament to the university's success in fostering interdisciplinary collaborations

that advance basic understanding and address significant environmental problems," Baerwald said.

Plant Genomics Program Offers Students Research Experience



MSU will use a National Science Foundation (NSF) grant to fund a 10-week summer research program designed to provide intensive experience for undergraduate students in areas such as biochemistry, genetics and cutting-edge biological science methods.

The \$282,606 grant will allow 30 students to participate in Research Experiences for Undergraduates (REU) in Plant Genomics. REU sites are funded by the NSF to provide research opportunities for undergraduate students.

"The plant genomics REU allows students to work alongside internationally respected scientists who are leaders in their fields," said Rob Last, MAES biochemistry and molecular biology scientist and project co-leader. "The students are involved in research spanning bioinformatics and functional genomics to analytical chemistry and metabolic biochemistry."

The program builds on the success of a five-year-old summer program (www.plant-genomics.msu.edu). Funding previously was provided by the university and individual NSF and Department of Energy research grants; the program has hosted 60 students from more than 30 institutions across the country.

"The REU program teaches research skills and emphasizes research ethics," said Richard Allison, MAES plant biology researcher and the other project co-leader. "The program combines effective use of literature, Web-based resources and presentation skills as a way to improve critical thinking skills."

The plant genomics REU is open to students entering their junior or senior year of studies in biology, chemistry, engineering and computational sciences.

In addition to Last's lab, where students

work on chloroplast biology and plant metabolism, other MAES researchers participating are Cornelius Barry, Christoph Benning, Robin Buell, Dan Jones, Tom Sharkey and Kevin Walker. Other MSU faculty members participating are Eva Farre, Jianping Hu, Beronda Montgomery-Kaguri and Shinhan Shiu. Each faculty member will serve as a mentor and assist the students in producing research to complement their lab activities.

Plant Scientists Work to Improve Production of Natural Sweetener

The world's leading supplier of all-natural, zero-calorie sweeteners is tapping MSU and some MAES scientists to help develop sweeter, more robust varieties of a South American plant.

PureCircle Ltd. engaged MSU horticulture researchers to help breed proprietary varieties of *Stevia rebaudiana*. Native to Paraguay, this offshoot of the chrysanthemum family has been known for centuries as "sweet leaf" by the Guarani Indians.

"We are excited to partner with an industry-leading company such as PureCircle to bring our cutting-edge knowledge and experience in horticultural plant breeding and genetics to this exciting new crop," said MAES horticulture scientist Ryan Warner, lead researcher on the project. "This is a great example of combining the strengths of industry and academia to bring value to consumers."

Some of the world's leading food and beverage manufacturers are increasingly turning to stevia as a source of high-intensity natural sweetener in products ranging from soft drinks to yogurt.

"The incorporation of MSU's leading-edge research combined with PureCircle's industry-leading proprietary varieties will ensure that we continue to lead the industry with sustainable agriculture while improving the economics for both farmers and our customers," PureCircle CEO Magomet Malsagov said.

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