

momentum

Institute on the Environment • University of Minnesota

LIVING LAB

Minnesota research with global reach



Q&A Thomas Friedman's
green expectations

local food for thought

algae as energy
HOPE OR HYPE?

**PREMIERE
ISSUE**



All along the 2008 campaign trail, the candidates have been vying for the title of Ultimate Change Maker. Yet, while talking about change can be a good way to wake up jaded voters, it's just that: Talk.

Today's world needs real change. We need the sort of massive change that one party, one president or one institution working alone simply cannot make.


Over the past five decades, our population has doubled, while global food and water consumption has more than tripled. In the next 50 years, the human population is on a trajectory to increase by 50 percent, and per capita consumption by 140 percent, leading to further, potentially catastrophic stresses on the environment.

For decades, we've pushed Earth to the limits. Now, everything's hitting the fan at once: climate change, biodiversity loss, land and water degradation, emerging diseases, and so on. Society is facing problems that can't be solved with business-as-usual thinking. It's time for something different.

That's why the Institute on the Environment is thinking about today's challenges in a new way. We need to be a place where creative conversations take place and where unexpected collaborations unfold. We need to serve as a network builder, inspiring and mobilizing experts from across academia, business and industry, government and nonprofits, and the environmental community at large.

Our goal with *Momentum* magazine is to create a venue for innovative ideas. In each print and Web feature, we've tried to dig below the surface of the buzzwords. We hope readers will walk away with a solid grasp of environmental issues, including the complexities, the policy implications and the need for an interdisciplinary problem-solving approach.

When I took the helm as director in August, the production of *Momentum* was well underway. I want to express my sincere gratitude for the leadership of Interim Director Deborah Swackhamer, who played a central part in planning the magazine, among countless other efforts. Her role in creating the Institute's initial structure and mission and in building it to its current strength has been exemplary.

It is a great honor and privilege to be named director of the Institute. The more I learn about the University of Minnesota's breadth and depth of expertise, the more I realize this is the opportunity of a lifetime. Through progressive leadership, public engagement and bold innovation, I'm certain that the Institute on the Environment will serve as a true world-changer. 

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momentum

FALL 08 – 1.1

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The Institute on the Environment is committed to sustainability. This magazine is printed on FSC-certified paper with a 20 percent soy-based ink.

Momentum is published three times per year by the University of Minnesota's Institute on the Environment. To change your address or to request an alternative format, contact Eve Daniels, danie419@umn.edu, 612-626-2670.

Several researchers quoted in the articles are founding fellows of the Institute. Visit environment.umn.edu to learn more.

The University of Minnesota is an equal opportunity educator and employer.

on the cover

Los Angeles-based illustrator OKSANA BADRAK, a Moscow native, developed her distinctive style at the



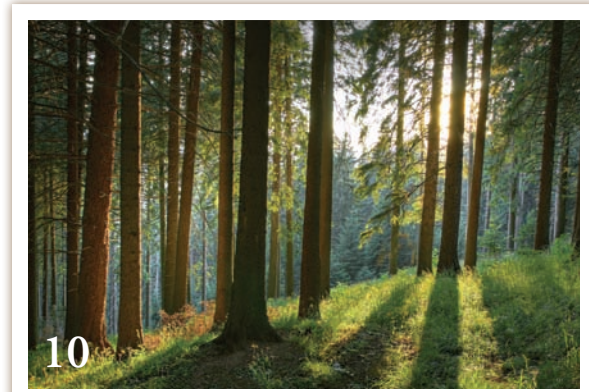
Art Center College of Design in Pasadena, Calif. In addition to numerous group and solo exhibitions in the United States and abroad, Badrak's work has appeared in *Entertainment Weekly*, *Esquire*, *Wired*, *Rolling Stone*, *Oprah*, *Fast Company*, *The New Yorker* and many other publications.

DEPARTMENTS

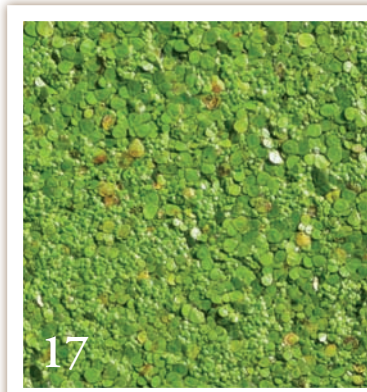
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THE RIGHT TIME AND PLACE

INSTITUTE ON THE
ENVIRONMENT



A look inside (and outside) the IonE

If you keep up with the region's environmental news, you've probably seen or heard at least one mention of the Institute on the Environment in the past year. Be it a headline about one of our founding fellow's recent projects (i.e. Dave Tilman's biofuels study, Paige Novak's research on environmental estrogens), or water cooler talk about the Statewide Conservation and Preservation Plan, the "IonE" has generated its fair share of buzz.

But who are we, exactly? A quick Google search shows that environmental institutes are all the rage these days. What makes us so special? In short: Location, location, location.

When it comes to climate change, we

often think about the oceans or the ice caps. But Minnesota sits at the crossroads of three major ecosystems, right in the middle of a changing climate (read all about it in the cover story, starting on page 10).

Combine this setting with the powerhouse that is the University of Minnesota—a land-grant and sea-grant institution with an amazing range and depth of expertise—and you've got the perfect place for conducting environmental research with real-world relevance.

Since fall 2006, we've been assembling a team of scholars, practitioners and students who bring intellectual imagination, entrepreneurial energy and many more talents to the Institute. Top researchers from the natural

and social sciences, design, engineering, law, health, policy and other disciplines are working with each other and community partners to tackle problems of local and global significance.

"Environmental issues will be at the center of our public discourse for at least the next 100 years," says U of M President Robert Bruininks, "and the Institute will play a key role in shaping the conversation."

Indeed, this century calls for a nationwide effort on the order of a race to the moon for solutions. The Institute on the Environment is leading this effort by discovering solutions and delivering results to the state, the country and the world.

PROGRAMS

We're collaborating with colleges and centers across the U of M to pursue several research, education and outreach programs. To date, these efforts include:

- Initiative for Renewable Energy and the Environment (IREE)
- Sustaining Global Agriculture (SAGA)
- River Life: The Mississippi and U
- Geospatial Research and Teaching Collaborative
- Sustainable U

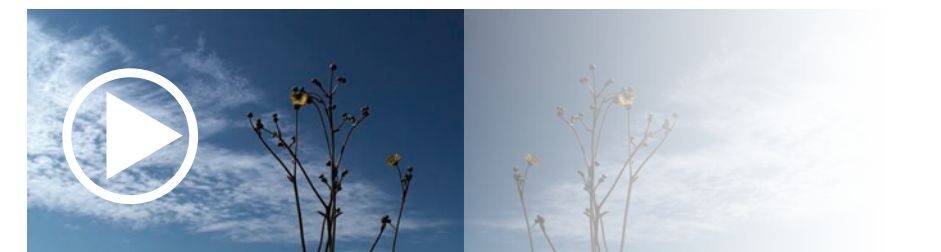
THEMES

Our research fellows will continue to rotate, and the themes they address will evolve over time—bringing a constant flow of new skills, ideas and challenges. Current IonE research focuses on:

- Mitigating and adapting to climate change
- Developing renewable energy technologies
- Sustaining and restoring the "critical interface" of landscapes and watersheds
- Exploring the interactions between human and ecosystem health

environment.umn.edu/momentum

Want to dig deeper into the issues explored in this magazine? Check out *Momentum* online.



BIOFUELS: BEYOND THE HEADLINES In the first video produced by the Institute on the Environment, University of Minnesota researchers Stephen Polasky and David Tilman attempt to clear up the confusion surrounding biofuels.

WEB EXTRAS

Look & Listen

VIDEOS Watch world-renowned ecologist David Tilman's response to the climate change skeptics; learn about cutting-edge environmental research on the Great Lakes; and more.

PODCASTS Enjoy an extended version of our interview with Thomas Friedman, an in-depth conversation with local food experts, and a Q&A session on Minnesota's declining biodiversity.

Comment

LETTERS TO THE EDITOR Send us your thoughts on the articles you read in the magazine or online. We'll review them for inclusion in the next issue.

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GET THE MAGAZINE Sign up for a free subscription to *Momentum*, delivered right to your door (or desk) three times a year. While you're there, be sure to subscribe to our monthly e-mail updates on University of Minnesota environmental news, events, research and funding opportunities.



Watch for this symbol throughout the magazine, and visit us online for special features.

New Terrain

Imagine spending your summer vacation camping out in a “state savanna” rather than a state forest, spotting a trillium, a red pine or a white spruce as rarely as a four-leaf clover. As the climate changes so, too, will our natural landscape. Many of the species that give us a sense of place may be unable to survive over the next century. • Are we prepared to protect and manage Minnesota’s biodiversity—that is, all the different species of plants and animals that live here today—in the face of a changing climate? This is a question that **SUSAN GALATOWITSCH**, a restoration ecologist at the University of Minnesota, has been thinking about a lot lately, and one she recently tried to answer for us.



How is Minnesota’s biodiversity being impacted by climate change? I think our best information comes from northern forests, boreal forests in particular, where we’re seeing a much higher regeneration of things like the red maple, which we wouldn’t have expected to see under historic climate conditions; and a lack of regeneration of species that we would consider colder-climate trees like pines. By 2069, we might be looking at a climate that’s more similar in the Boundary Waters to what is right now in Des Moines, Iowa. And we can go to various parts of the state and see the same possible magnitude of change.

Why should the general public care? Many of the places that Minnesotans care deeply about—our state parks, our northern forests, our lakes—are poised to be very different in the next few decades. There are going to be species that will be more able to capitalize on these rapid climate changes than others, and some of those species are perhaps weedier and more aggressive in their growth and spread. So, what we could lose are a lot of the special plants and animals that many people find quite wonderful in the state, and that are unique to this part of the world.

For example? Well, our state flower, the [showy] lady’s slipper. Our slow-moving, ant-dispersed plants, and many species that are moved by anything other than wind. Most of our plants in Minnesota are not wind-dispersed, so we expect that it’s going to be too slow of a transition.

With regard to other organisms like animals, some of the landscape they need to traverse as they make their way north is not going to be easy for them to move across. It’s going to be bisected by landscape that’s not very suitable, like roads in the Twin Cities or farm fields. That would be particularly true for organisms that move on the ground, rather than fly, like amphibians.

Where do we go from here? This year and going forward, we’ll have strategy sessions where we try to make sure this information is in the hands of policymakers and develop strategies that allow us to adapt between now and the next 70 years.

The good news in Minnesota is we have a lot of talented biologists sitting in state and federal agencies and in government, and a high level of interest here at the U of M and other universities around the state. I think, as a team, we can begin to come up with ideas and a way forward. And if we do, we’ll be leading the way, because this is something that few people have figured out how to manage around the world.

As the election approaches, do you have any advice for voters? The campaigns have not at all been focused on the environment. Even back in 1988, there was a clear focus on the environment, even though we had similar economic and foreign policy issues at play. I think it’s important to begin to press candidates for their interest and commitment, and the extent to which they will help support all of the activities that we’re going to need to push ahead.



environment.umn.edu/momentum

PODCAST

Visit us online to hear the full conversation.

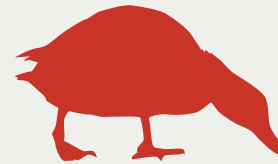
How to Deal Minnesota’s biodiversity is under fire. The experts weigh in on how to react.

Throughout our planet’s history and its many ice age cycles, native species have migrated without going extinct. Why is it a problem now? • For starters, the magnitude of climate change we expect to see in the next few decades occurred in the past over a 2,000- to 3,000-year period. Factor in today’s fragmented landscape, declining habitat, increase of storms, droughts and fires—not to mention invasive species—and we’ve got a full-grown Biodiversity Bear on our hands. • During a recent conference at the Minnesota Landscape Arboretum, leading researchers thrashed out current and potential strategies for tackling this complex issue. The following are some of their finer points.

“**THERE ARE A LOT OF SPECIES WE DON’T KNOW ANYTHING ABOUT** and we need to remedy that quickly. For most species of Minnesota’s native plants, we don’t even know how to germinate the seed. . . . I would start doing experiments now that are not in natural areas or wilderness areas. Just take some industrial forests or abandoned farm fields and do transplant experiments and see how things do. So, if we decide we need to bring a new species into the Boundary Waters, for example, we would know how to do it.”

LEE FRELICH

forest ecologist, University of Minnesota



“**THE PRAIRIE POTHOLE REGION IS KNOWN AS THE ‘DUCK FACTORY,’** since it produces, on average, about 70 percent of the ducks in North America. And it doesn’t take but a few degrees Celsius to shift the most productive area in this region several hundred kilometers. Colleagues of mine have estimated that if we have just a 3- to 4-degree Celsius rise in temperature, it would cut the waterfowl population in half. . . . Minnesota could play a key role in bringing greater geographic resilience to the Prairie Pothole Region by restoring wetlands and grasslands.”

CARTER JOHNSON

wetland scientist, South Dakota State University

“**ONE WAY TO THINK ABOUT SETTING UP CONSERVATION LAND** and land for ecological reserve is to choose areas that have high physical diversity—preferably large areas—so that the diversity over time can remain high, even though the biological assemblages on those landscapes are changing. . . . So, if we take a slightly longer time perspective, areas that may not seem like much now because of some recent land use history could actually be very special. With the rather short life cycle of many of the plants, there can be many generations of vegetation in just a few decades.”

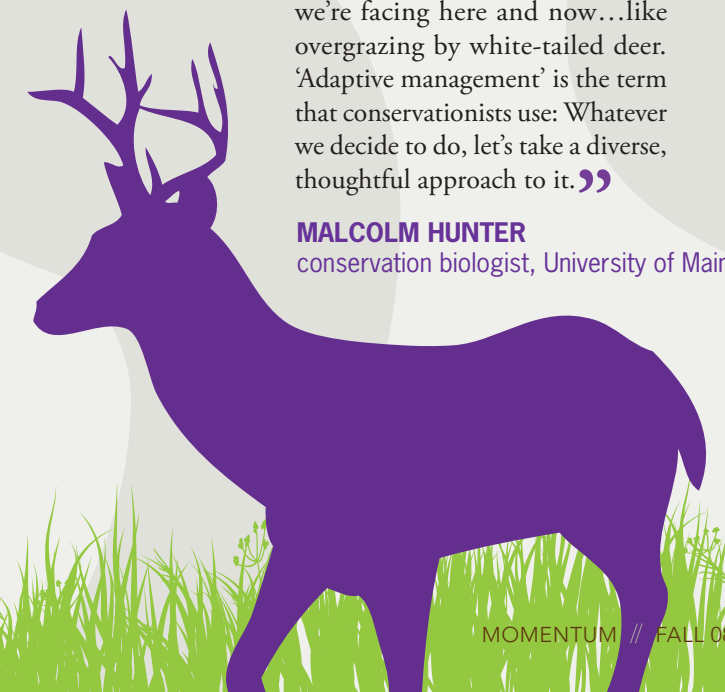
GEORGE JACOBSON

paleoecologist, University of Maine

“**DESPITE THE SUCCESS OF JOHNNY APPLESEED**, the overall track record of moving species is not good. Roughly half of the projects that have attempted to move an endangered species from one place to another have failed. I think there will be places where it will make sense to do this rather than to sit back and watch a species go extinct. But before we start thinking about elaborate projects like assisted colonization, we need to deal with the problems we’re facing here and now. . . . like overgrazing by white-tailed deer. ‘Adaptive management’ is the term that conservationists use: Whatever we decide to do, let’s take a diverse, thoughtful approach to it.”

MALCOLM HUNTER

conservation biologist, University of Maine



The Power of Positive Energy

Feeling run-down by high gas prices, dire climate predictions and the latest case of “greenwashing”? Recharge at the **E3 2008** conference, taking place Nov. 18 at the Saint Paul RiverCentre. Billed as the “Midwest’s premier energy, economic and environmental conference,” E3 brings together renewable energy enthusiasts from across the globe. If you’ve ever wondered about the potential for algae to cure our oil addiction, the future of solar power or the role the media plays in environmental awareness—this is the place to be. And you just might leave the conference feeling like there’s hope after all.

www.iree.umn.edu/e3

Bear Mugs

Lynn Rogers, a world-renowned biologist and University of Minnesota alum, has spent four decades studying black bears on their home turf. Based at the Wildlife Research Institute and the North American Bear Center in Ely, Minn., Rogers uses airplanes, land vehicles and snowshoes to radio-track more than 100 bears in the wilds of northeastern Minnesota. For as long as 20 years, he’s studied and photographed certain bears at close range—and he’s still alive to tell about it. His secret? “As I’ve learned their language, I’ve been able to interpret their behavior and



vocalizations in terms of their fears rather than my fears,” he says. Fresh from a national tour, “**The Hidden World of Bears: Photography by Lynn Rogers**” is back at the Bell Museum through Jan. 4. Get a rare and colorful glimpse into the daily life of bears, minus the mud or mosquitoes. bellmuseum.org

The More the Merrier

Over the past few months, an A-list of the region’s best minds has teamed up with the Institute on the Environment. We’re excited to put our heads together as we take on today’s toughest challenges.

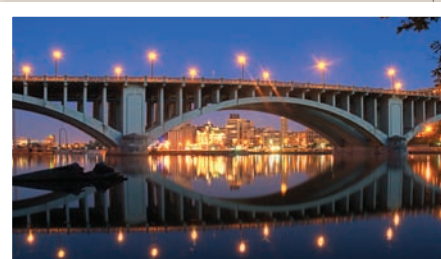
Associate Fellows With expertise ranging from public health to wildlife conservation, biotechnology to policy, more than 55 scholars and professionals have joined the Institute as associate fellows. These intellectual leaders represent the University of Minnesota and other universities, as well as government, industry and nonprofit sectors. They’ll collaborate with the Institute on multidisciplinary research, education and outreach, with a chance to renew their appointments in summer 2009.

Affiliated Organizations

As of press time, three University of Minnesota organizations have aligned with the Institute’s mission. In June, the Water Resources Center became the Institute’s first affiliated organization, followed by the Center for Applied Research and Technology

Development and the Center for Water and the Environment. The latter two are part of the Natural Resources Research Institute, based at the Duluth campus.

A People’s History of the Big River



Far beyond Mark Twain or William Faulkner, a lot of folks have a lot to say about the Mississippi River. Trying to gather their stories into one place—well, that’s another story. Lucky for us, **Telling River Stories** is doing just that. A multidisciplinary project led by the Institute on the Environment’s River Life program, the Telling River Stories Web site uses maps, photos, videos, podcasts and text to convey what the Mighty Miss means to its surrounding communities.

“We cross the Mississippi all the time and we don’t think about it, but it’s a big deal,” says the project’s director, Pat Nunnally. “It’s critically important in American history.” Right now, Nunnally and his team are collecting stories from 10 priority sites each in the Twin Cities, St. Louis and New Orleans. In the coming months, the team will share that collection online and in a series of installations constructed along the river itself. www.riverstories.umn.edu

Rebuilt, but Not Forgotten

Speaking of Big River stories, “**The City, the River, the Bridge**” symposium—presented on Oct. 9 and 10 by the University of Minnesota’s Institute for Advanced Study—will provide a sweeping view of the I-35W bridge collapse and its aftermath. “The new bridge should be open by then, but it’s not like you can just walk away from what happened,” says Nunnally, one of a dozen-plus speakers who will discuss the consequences, changes and opportunities that have emerged since the August 2007 disaster. Other participants include U of M President Robert Bruininks, memoirist Patricia Hampl, historian Brian Horrigan, urban affairs reporter Steve Berg and more.

environment.umn.edu/events

Regular, Premium... Low Carbon?

Options at the fuel pump may soon increase. With funding from the Energy Foundation and the Initiative for Renewable Energy and the Environment, University of Minnesota researchers are looking at the economic and environmental impacts of a **low-carbon fuel standard** for Minnesota. “An LCFS would assign a carbon intensity score to each gallon of fuel produced in the state,” explains project lead and U of M economist Steve Taff. “This score will then impact the ability to sell the fuel in markets around the country that adopt similar policies.” umn.edu/iree



Super Bus to the Rescue

The current Metro Transit hybrids use less fuel and emit less exhaust than those old-school gas-guzzlers. But the power they use for lights, fans, doors, heating, cooling and other auxiliaries is not produced efficiently, especially when idling at intersections.

No need to fear: Super Bus is (almost) here! Experts at the U of M are monitoring a hybrid bus to find out how much extra energy savings are possible. By January, the team will be ready to specify an onboard, auxiliary power unit to supply all power except for vehicle propulsion. This APU, which runs on a small, highly efficient diesel engine, would allow the main diesel engine to shut down at traffic stops without sacrificing passenger comforts. The next step will be to transition to an APU powered by a solid oxide fuel cell, which could operate on a range of petroleum diesel and biodiesel blends, ethanol or methanol.

“What we’re trying to create is basically a hybrid of a hybrid,” says David Kittelson, the Super Bus principal investigator and co-director of the U of M’s Center for Diesel Research. “The current systems are already green, but we want to make them a brighter green.”

This project is supported by the Metropolitan Council, as well as the Initiative for Renewable Energy and the Environment and Center for Transportation Studies at the U of M. umn.edu/iree

GREEN »

REUSING

BUYING FRESH

CARBON NEUTRAL

DINNER BY CFL

DRIVING A HYBRID CAR

SPREADING THE WORD

GREENER »

REDUCING

GROWING FRESH

CARBON NEGATIVE

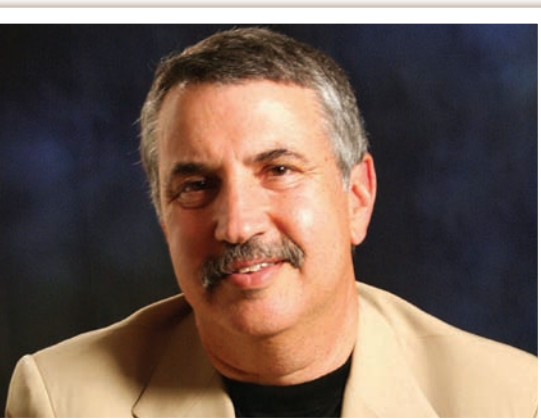
DINNER BY DAYLIGHT

RIDING THE HYBRID BUS

CASTING YOUR VOTE

Green Expectations Interview by EVE DANIELS

Contrary to the Minnesota stereotype, there's nothing passive about **THOMAS FRIEDMAN's** aggressive views, especially when it comes to foreign and domestic affairs. And his readers wouldn't have it any other way. Friedman's hard-hitting commentary in *The New York Times* has earned him three Pulitzers to date, while all of his books (including the smash hit, *The World Is Flat*) have won awards and topped bestseller lists the world over. This month, he adds another manifesto to the library: *Hot, Flat and Crowded: Why We Need a Green Revolution—and How It Can Renew America*. • When *Momentum* caught up with the St. Louis Park native back in June, he was busy finalizing his new book. He was also juggling jet lag and a column deadline, but he still made our 15-minute phone call count.



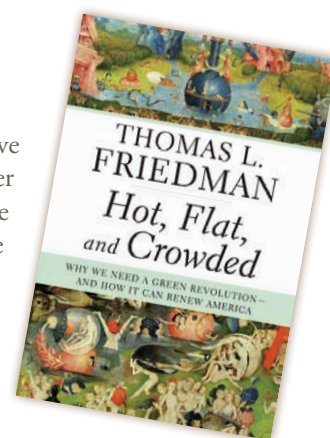
Did your opinions about environmental issues change while you were doing your research? I think the only thing that changed was it strengthened two views. One is what a huge-scale project this is. If you're not using words that begin with "T," as in "trillion," whether it's the trillions of watts or the trillions of dollars it's going to require, you're getting nowhere. And lastly, the thing that impressed me is the scale of the opportunity. Clean power, clean energy, clean water—those are going to be the next great global industries. Are we going to lead them, or are others going to lead them?

What inspired you to write *Hot, Flat and Crowded*? I actually started out to write a book called *Green is the New Red, White and Blue*, and I came to realize that there was a bigger story going on: What happens when we enter a world where so many people can live like Americans? It's a great thing that so many people can now enjoy the kind of lifestyle that we enjoy, but with that comes much greater consumption and energy usage.

What's the big question you tried to answer in your book? "What do we have to do to have abundant, clean, reliable and cheap electrons?" To me, the answer to the problem is you need a market signal. I'm not a believer in a Manhattan Project. I'm a believer in the market. But markets have to be shaped, and the way they're shaped is with price signals. You get the price signals right and it will stimulate the market to do massive innovation on the scale we need.

If America doesn't step up and lead, what are the consequences? Imagine if we didn't lead the I.T. revolution. Where would we be today? Well, another revolution is [emerging]. It's called the E.T. revolution—energy technology—and nobody's claimed this one yet. We made the I.T. revolution; let's make sure we make the E.T. revolution. If we don't, we will not be a superpower.

Given the recent debate surrounding biofuels, what's your stance on traditional food-crop biofuels like corn ethanol? I'm not a fan of corn ethanol. I don't think it really makes sense to put all that water and all that energy into food that is going to produce so relatively little bang for the buck. I am for basically an all-electron system. I don't think that molecules are the future. We will need molecules for transition, but we have to move to a system of clean power generation, of clean electrons, into a smart grid, into a smart home, into a smart car. That's what I call the Energy Internet, and that, to me, is the future.



What are your thoughts on the potential federal ban of products, like the incandescent light bulb? I have a motto which is, "Change your leaders, not your light bulbs." [It's important] for everyone to change their light bulbs, but we have to focus on changing leaders. I'll put it this way: Leaders write rules. Rules shape markets. Markets give you scale. If we have the wrong leaders—leaders who are in no way sensitive to the green necessities—we're just not going to go anywhere.

Let's say you have two minutes with the next U.S. president. What's your advice? To think big. Swing for the fences. We need a carbon tax, cap and trade, some kind of price signal, a national renewable energy portfolio standard.

How do we get the rest of the world—places like China and India—not to make the same mistakes we've made? My approach to China is very simple. Every time I go there, young Chinese say to me, "Mr. Friedman, you got to grow dirty for 150 years. Now it's our turn." And I say to young Chinese, "You're absolutely right, it is your turn. Take your time. Grow as dirty as you want." ... Because this is going to be the next great global industry, and I want to make sure [America has] the people to lead it.



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PODCAST
Visit us online to hear the full conversation.

A Tale of Two Countries

In the next 50 years, global population is on a trajectory to increase by 50 percent—to 9 billion people—and per capita consumption by 140 percent. In China alone, the increases in construction, automobiles and energy use are staggering: Half of the world's new building construction by 2015; more than 50 percent of global cement production; 5 million new cars just this year; 40 percent of the world's growth in oil consumption since 2000; and 70 new coal-fired power plants annually. Yet, despite such mind-boggling numbers, China still lags behind the United States in personal car ownership, per capita energy consumption and overall greenhouse gas emissions. How long can the rest of the world survive this race to consume?

Sources: Energy Information Administration, U.S. Geological Survey, peopleandplanet.net, World Bank



PHOTO: SHANGHAI, CHINA

LIVING LABORATORY

By Jessica Marshall

With its rivers, lakes, forests and plains—not to mention its cityscape—Minnesota is a hotbed for environmental research with global reach.

At the end of the last ice age more than 10,000 years ago, the glaciers retreated from this region and their meltwaters pooled to form an astonishing feature: Lake Superior, the world's largest freshwater lake by surface area, holding 10 percent of the world's surface freshwater.

The glaciers also left tens of thousands of smaller basins that filled with water to make lakes—while the boreal forest, which had fled southward against the cold, returned north into the once-icy landscape. As the land warmed, prairie grasses spread north and east. In the warmest days some 7,000 years ago, they covered what is now the Twin Cities.

But as the climate cooled slightly, deciduous and boreal forest pushed back the prairie. These climate shifts created the Minnesota we know today, “out on the edge of the prairie,” as Garrison Keillor describes it.

We sit in the middle of the continent, at the intersection of three ecosystems: The southernmost boundary of the boreal forest; the northwestern edge of the deciduous forest, stretching in a ribbon from southeast to northwest through the state; and the eastern edge of the prairie rolling 1,000 miles west. Dotted across the landscape are more than 11,000 lakes and the headwaters for three major rivers, with the massive Lake Superior serving as our northeast border.

Such diverse habitats allow for the activities and industries that define life and work in Minnesota, from fishing, skiing and swimming to hunting, farming and forestry.

They also create a prime locale for environmental research, says University of Minnesota Provost Thomas Sullivan. “We have the perfect ecosystems for studying the environment in ways that have applications worldwide.”

Studies of our state's forests, at the frontline of climate change, can provide a window into how forests will respond in other places. Research on biofuels made from native prairie grasses is informing the future of biofuels everywhere. And tracking persistent toxic pollutants in the Great Lakes provides a bellwether for how these pollutants behave globally.

Thanks to this dynamic setting, Minnesota researchers see the landscape as an ideal “natural laboratory.”

“In the Duluth area, we have a laboratory in terms of developed versus undeveloped streams,” says Lucinda Johnson, a landscape and aquatic ecologist at the U of M, Duluth. To track the effects of development on streams, Johnson is using the contrast between pristine streams feeding into Lake Superior and those entering the lake near shoreline developments.

The extreme storms and fires that tear through Minnesota woods have created a natural experiment for understanding how the forest

PHOTO: KYLE D. GRIMES

“THINGS ARE GOING TO HAPPEN HERE FASTER THAN ANYWHERE ELSE.”

recovers afterward, says U of M forest ecologist Lee Frelich. He's been tracking recovery from a 1999 windstorm that wrought havoc in almost half-a-million acres of trees in Superior National Forest.

“We're observing whether the forest is going back to what it was or whether it's moving to some new state,” says Frelich. “It's too early to tell,” he adds, but such experiments may help researchers make predictions about the future of forests elsewhere.

Stuck in the middle of change

A great deal of the environmental research going on in Minnesota is oriented toward understanding how ecosystems will respond to climate change. And with good reason, says Frelich.

“We have the triple point where [the ecosystems] all come together,” he says. “We're right in the middle of the continent, and right on these edges, so we think things are going to happen here faster than anywhere else.”

Models predict that boreal forests may retreat 300 miles north under warming. With threats to our deciduous forests from climate change, fragmentation of the habitat, overgrazing by deer, and the spread of invasive species, the woods may all but disappear from the state. Minnesota's moose population, which relies on forest habitat, is already declining.

During a recent symposium at the Minnesota Landscape Arboretum, Frelich and other academic and government researchers discussed how to manage the state's ecosystems under climate change. The experts considered the approach of protecting endangered species and maintaining forest habitats by transplanting southerly species further north, and which “assisted colonization” approaches might work the best.

“I think assisted colonization is going to be a much bigger deal for Minnesota than it is in other places,” says Frelich. “We have these really sharp changes where there are completely different species in different parts of the state.”

Deborah Swackhamer, a founding fellow and former interim director of the Institute on the Environment, says that figuring out how to adapt to climate change is a strong focus at the U of M.

“A lot of people don't like to talk about adaptation because it sounds like we're giving up and throwing in the towel,” says Swackhamer. “But it's definitely going to be one of the strategies.”

Lake Superior is another critical sentinel for climate change. Jay Austin at the U of M, Duluth, has documented warming in Lake



Alongside his students and colleagues at the Center for Hardwood Ecology, Lee Frelich is working to manage and protect the region's north woods wilderness in the face of a changing climate.

Superior that is roughly twice as fast as the regional air temperature increase.

Swackhamer warns that this warming may remobilize persistent organic pollutants like polychlorinated biphenyls, quantities of which have remained sequestered in the lake water since their ban in the 1970s.

“Even a minor 2-degree warming in summer would have a huge impact on the volatilization of chemicals,” she says, pointing to the large-scale implications. “If we see contaminants in Lake Superior, it means they've been globally transported. They're a pretty good canary in the mine.”

Johnson is also working to understand how climate change will affect our ecosystems, specifically the prairie pothole wetlands of western Minnesota. Through a blend of experiments and modeling, Johnson is studying how frogs living in these wetlands will adapt to climate change, especially with the added pressures from herbicides and other types of agricultural runoff.

Her research has shown that some wetlands tend to dry out and stay dry for long periods of time. Since frogs can't move very far across the landscape in their lifetime, they need groups of wetlands with a variety of water levels to survive. “This will form habitat that is suitable for frogs over a wide variety of climatic conditions,” Johnson explains.

Why should we care about frogs? For starters, says Johnson, they are important food for ducks, which are vital to the hunting economy. And if you're not a hunter, you should still appreciate them: “They consume tons and tons of mosquitoes.”

Prairie Home-grown

With ever-more food crops grown to make ethanol for fuel, Minnesota has become a major player in the biofuel economy. Going against the grain, so to speak, U of M ecologist David Tilman is looking for alternative biofuels approaches in his research at the Cedar Creek Ecosystem Science Reserve.

In the past year, Tilman has become well known for his biofuels research, though he says he entered the field by accident. “I never planned on being interested in biofuels. But I think early on people were so enamored with the potential of corn ethanol that they weren't asking the questions that were necessary,” such as how much water, fertilizer and energy are needed to grow crops for ethanol.

“At the same time, we had this long-term experiment at Cedar Creek,” says Tilman, who started out by studying the effects of biodiversity on prairie grass yields, asking how the number of species in a plot affected the amount of biomass that grew.

Switchgrass was a species that was part of his experiment, and the native plant soon emerged as a major candidate for second-generation biofuels: cellulosic ethanol made from the woody parts of plant stems and leaves. Developing processes for making ethanol this way has proved relatively difficult, but this approach has the advantage that the ethanol could be made from plant waste or crops like switchgrass that don't require irrigation or fertilizer.

“The 16-species plots were always much, much more productive than any of the species growing by themselves,” says Tilman. “We had 238 percent more energy in these plots compared to switchgrass growing by itself.” And, since the plants' roots remain in the soil, they actually sequester carbon, making the process a net carbon sink.

Now Tilman's group is testing how fertilization and irrigation affect grass plots. He's determining the optimum amount of

“Land Clearing and the Biofuel Carbon Debt”—the globally-cited report by U of M ecologist David Tilman (right), the Nature Conservancy's Joe Fargione (left) and other experts—evolved, in part, from research on Minnesota prairie grasses.



fertilizer that would allow the plants to use it all without creating runoff, and whether plots of prairie grasses might even be useful in helping to capture agricultural runoff from other fields.

“These are sort of off-the-wall ideas,” he says, “but we're trying to find out if there can be some synergy.”

All that, and a big city

While the varied ecosystems in Minnesota allow research here to be of global relevance, the presence of the Twin Cities metro area also presents an opportunity for studying urban environmental problems that trouble cities everywhere.

U of M civil engineer Paige Novak works with Swackhamer to study the minute concentrations of hormonally active chemicals in our wastewater. One source of these is various pharmaceuticals, especially birth control pills, which end up in urine and make their way to wastewater treatment plants. Other sources Novak has looked at include facilities that process plant matter, such as paper mills and soybean processing factories, because plants naturally make estrogenic compounds.

The compounds are of concern because they may exert hormonal effects on wildlife, even at low levels. Novak and Swackhamer have found that the two wastewater treatment plants they've studied remove about

90 percent of the estrogenic compounds from the water entering the facility. Yet, the remaining 10 percent could still present problems.

“Both of these plants are already doing ‘above and beyond’ levels of treatment,” says Novak. “Now we're doing studies in the lab to see if we can improve the amount that's removed.”

Beyond the ideal physical environment, Novak says the state's progressive stance also supports her research. “We have access to these facilities which are forward thinking,” she says, adding that the wastewater treatment facilities in many other states might not have cooperated.

Swackhamer also values the region's political and social climate. She believes the combination of landscape, culture and expertise in Minnesota lays a foundation for the Institute on the Environment to thrive.

“So much of what has been done in environmental research is to study the problem after it has occurred,” says Swackhamer. “What I really would like to see us do is research that helps us get ahead of the curve, research that will prevent problems—not just to provide solutions to yesterday's problems.”

JESSICA MARSHALL is a lecturer in the U of M's School of Journalism and Mass Communication. She is a science and environmental journalist, and the environment correspondent for Discovery News.

ACTION HEROES

by EVE DANIELS

STUDENT ENVIRONMENTALISTS ARE GIVING A WHOLE NEW MEANING TO “ACTIVE ENROLLMENT.”



A few of the U's campus champs (from left): Sarah Wolbert, officer, Greenlight; Stephen Peichel, president, Applied Environmental Solutions; Bridget Ulrich, officer, Minnesota Public Interest Research Group; Erick Boustead, co-founder, Substance

Two weeks before the big event, Erick Boustead still needs to bring in \$40,000. Boustead, 23, is the sustainability coordinator for Substance, the University of Minnesota student group and nonprofit booking company he co-founded last year. Ripple Effect is the event in question.

For months now, Boustead and his Substance cohorts have been pitching the green, zero-waste festival as a contender for front-page news. If all goes well on Sept. 2, thousands of Gen Y-ers will gather on the Minnesota State Capitol lawn in the name of environmental and social justice. But to pull it off as planned, Boustead is banking on some generous, last-minute donations.

More money or not, he'll find a way to make it work. The budding eco-entrepreneur, who graduated this year from the Carlson School of Management, has a proven track record of adapting to sudden change.

Back in May, just a couple days prior to their Justice Jam festival, the Substance group was forced to move from the central location they'd been advertising all semester to a nondescript parking lot several blocks away. In the thick of spring finals, Boustead and company met with U of M administrators, contacted all the vendors and devised a new promotional plan.

“Our biggest concern was continuing to provide a way for people to get involved,” says Boustead, “but overall we were happy with the turnout,” which topped 500 by the time local hip-hop artists Heiruspecs took the stage.

Boustead represents a league of extraordinary students who—in addition to their heavy course loads, research projects, scholarship commitments, internships and jobs—are volunteering for a level of responsibility that many professionals twice their age would sooner avoid.

The U of M is currently home to more than 20 environment-focused student organizations, with motivated Millennials at the helm of most of them. Through an equal dose of successes and setbacks, the students are learning what it takes to be a leader long before they enter the workplace.

“The nice thing about student groups is that it's a chance to try and to fail sometimes, but without losing your job,” says Holly Lahd, president of EcoWatch, a student organization that's been committed to “expanding the environmental dialogue” across campus for six years and running.

EcoWatch brings together experts from academia, government, business and industry to discuss biofuels, carbon sequestration and other complex issues in a way that's accessible to everyone; not just seasoned “ecowatchers” like Lahd, who's now in her final year as a double-major in applied economics and environmental sciences, policy and management.

As a summer intern in the Minnesota Technical Assistance Program, Lahd used the management and planning skills she's honed through EcoWatch to lead a waste-reduction project at St. Luke's Hospital in Duluth. This fall, she returns to the busy life of a 20-year-old student, research assistant and all-around action heroine.

Fortunately, she's also sharpened her skills as a team player. “Eco Watch

has taught me how to build leadership in other people, because with 18 credits and working part-time, I can't do this alone.”

While student-led activism is nothing new, it has come a long way in the past five decades. For starters, today's young activists are speaking a more refined language than that of their parents or grandparents.

“A student in the '60s would yell at the university president and call him a fascist,” says *Planet U* author Michael M'Gonigle, a co-founder of Greenpeace International and the eco-research chair in environmental law and policy at the University of Victoria.

“A student of this generation would look at a university professor and quietly say, ‘I'm sorry, you're just behind the innovation curve.’”

“A LOT OF STUDENTS SEE VERY CLEARLY THAT TIME IS NOT ON OUR SIDE.”

If you're wondering what counts as innovative, you may want to follow the lead of the Hennepin Energy Recovery Center, a waste-to-energy facility located near the new Twins ballpark. In February, HERC sought advice from Greenlight, a student group in the College of Design, during an intensive, two-day workshop.

“They came to us and said, ‘We know our building doesn't look great. People will think it's smelly and there's a lot of truck traffic. What can we do to make it more sustainable?’” explains Greenlight officer Sarah Wolbert, 30, a grad student in the College of Design.

The students came up with more than a few cool ideas for HERC, including a green roof, “living walls” and a natural ventilation system. To build awareness at the ballpark, the students also proposed a “sustainability scoreboard” that compares environmental statistics between Twins Territory and the visiting teams' hometowns. The Hennepin County officials loved the ideas, so much that they created four summer jobs for the students.

It seems protesting is out and problem-solving is in. Shaped by the solution-driven culture of the 21st century, students aren't asking “why?” so much as “how?”

“The reality of change today is unique in that a lot of students see very clearly that time is not on our side,” says M'Gonigle. “We don't have the luxury of arguing anymore. We need to act.”



environment.umn.edu/momentum

See how Ripple Effect turned out and hear more from the U's green action heroes in our next video, coming later this fall. *Momentum* online also links to a campus-wide directory of environmental student groups, as well as details on how the Institute on the Environment is supporting the groups' efforts.

PHOTO: JONATHAN CHAPMAN

When Nikki Anderson, general manager of The Inn on Lake Superior, first jumped into the lake that gave her hotel its name, she found the water “so cold it almost stopped my heart.”

Luckily, that heart kept beating, and Anderson survived to supervise a full-scale green makeover of the Inn, turning it into a Midwestern showplace for sustainable tourism. Guests use bamboo towels and recycled paper products, walk on lawns fertilized with “worm juice” from the compost pile, see by the light of compact fluorescent bulbs that shut off with motion detectors, and sleep on sheets washed without chemicals. Don’t look for a Styrofoam cup, because there aren’t any. And waste industrial steam that would be otherwise vented is used to heat the hotel pool and spa.

“I get warm responses from customers on everything from using the CFLs to cutting out the Styrofoam,” says Anderson. “And, after a period of adjustment, we’re starting to see big reductions in our electricity and water bills.” Her next project is greening the 32 other properties owned by the Duluth, Minn.-based Zenith Management Company.

The Global Development Research Center defines sustainable tourism as “an industry which attempts to make a low impact

on the environment and local culture, while helping to generate income, employment and the conservation of local ecosystems.”

To reach this industry standard, destinations need to do more than paint themselves green. They also have to make sure they’re reducing their carbon footprint, supporting regional food production, and employing local people at fair wages.

That’s just good business, because the Travel Industry Association of America reports that, across the country, 38 percent of all vacationers say they are willing to pay significantly more to patronize companies that work to protect the environment.

Minnesota is blessed with a variety of sustainable travel options, backed by resources to connect people with them. For example, the University of Minnesota Tourism Center opened in 1986 and now has four full-time employees and a network of faculty and advisors.

“From large convention centers to small hotels, implementing sustainable practices will produce substantial bottom-line benefits,” says Cynthia Messer, an extension educator at the tourism center.

Research is an important part of the center’s work, and a 2007 poll of state travel professionals revealed that more than three quarters identify strongly with the key tenets of sustainable tourism. However, building awareness of what’s on offer can be a challenge.

“Most folks don’t think of the Midwest as the epicenter for ecotourism,” says John Ivanko, co-author of the book *Rural Renaissance*. Ivanko is a major cheerleader for the green Midwest and, with his wife, operates the Wisconsin-based Inn Serendipity (where the electricity comes mainly from a 10-kilowatt wind turbine). Despite the promotional challenges, he says business is good due to a rising public interest in environmental stewardship.

As the industry continues to grow, so does the need for access to it. That’s where Green Routes (greenroutes.org), a Minneapolis-based tourism initiative, comes in. Launched in 2004 by a group of individuals and organizations collectively known as “Renewing the Countryside,” the Web site uses a variation on global positioning software to introduce users to green stopovers along their intended routes.

Judging by the research, that’s the kind of route many tourists are ready to take.

JIM MOTAVALLI is the executive editor of New Mass Media newspapers, senior writer at *E Magazine*, and author of several books including *Feeling the Heat: Dispatches from the Frontlines of Climate Change*. His articles have appeared in *The New York Times*, *The Boston Globe*, *Sierra*, and many other publications.

Tourist Attraction

by JIM MOTAVALLI

Nowadays, travelers are trying to tread lightly, and the industry is responding with greener pastures.

Hope OR Hype

ALGAE HAS
BEEN CALLED
THE “FUEL OF
THE FUTURE.”

BUT WHEN
THAT FUTURE
WILL COME IS
STILL HARD
TO CALL.

by MARK NEUZIL

TALK ABOUT MAKING LEMONADE OUT OF LEMONS.

University of Minnesota scientist Roger Ruan and his colleagues are busy figuring out how to produce biofuel from the stinky stuff of sewage treatment plants.

No, not that stuff. The algae that can grow in it. There are hundreds of thousands of types of algae, and scientists have found some that contain up to 75 percent oil. The trick is to produce fast-growing, oil-rich algae from the wastewater, harvest it, extract the oil and convert it to fuel.

The process involves drying and pressing the algae before adding a solvent to extract the oil, not unlike a method used for soybeans. Ruan says the equivalent of 15,000 gallons of oil could grow annually in an acre of algae, as opposed to 20 gallons of oil from an acre of corn.

Last February, Ruan’s pilot project was the headline of the month in newspapers across the country, only to take a back seat to other “Next Big Things” a few months later. So, is algae really the fuel source of the future? Or will it go the way of other highly hyped but still unproven gasoline substitutes, such as hydrogen?

Like any new technology, Ruan says, the idea is not without its hurdles. “There is a general consensus that there’s great potential here, but the key is cost.”

A national boom in interest from venture capitalists, the Pentagon, utilities and oil companies has corresponded with more media attention to the industry, not coincidentally while gas prices skyrocket.

But at a current cost of about \$20 per gallon of algae biofuel, you won’t be filling up your Ford Focus with pond scum byproducts anytime soon.

Moreover, in order to keep up a steady cash flow, individual companies need to sell other high-value components from the same stock, says Clemson University professor David Brune, who has worked with algae for 20 years.

“There is no simple answer,” says Brune. “You are not just making one product. Biorefineries need to make many products. The bottom line is, how well can you use all the materials?”

As one revenue-producing measure, Ruan’s team is looking at the potential of using left-

over biomass to produce bio-oils and other products such as protein-rich animal feed.

Along with creating new economic opportunities for the state, the Metropolitan Council, Xcel Energy and the University of Minnesota’s Initiative for Renewable Energy and the Environment are supporting the project with an even bigger-picture goal in mind. Currently, the wastewater solids incinerators at two local treatment plants release carbon dioxide into the atmosphere. These emissions could be captured, while simultaneously enhancing the algal growth.

From New Mexico to New Zealand, growing algae in large, open ponds is a widespread practice in warmer climates. However, “that wouldn’t work so well in Minnesota in February,” says IREE Director Dick Hemmingsen. In addition, open ponds are prone to evaporation and are vulnerable to contamination by bacteria or invasive species.

Ruan’s team has responded by growing the algae indoors, in a closed-loop system located at a Mississippi River treatment plant near St. Paul. The system utilizes the wastewater and heat produced by the treatment plant.

Yet, one major hurdle remains, says Michael Briggs, a lab manager in the University of New Hampshire’s Biodiesel Group: We need 9.5 million acres of algae farms to grow enough biofuel to replace our current oil consumption. That’s an area about the size of Maryland.

“They never talk about the big problem, which is the big scale,” says Brune. “If they did, funding agencies would run for the hills.”

Despite the complexities, Hemmingsen believes that algae will have staying power for several reasons, and our basic needs are high on the list. “The potential yields don’t compete with tortillas or cornflakes, so it gets us out of the food-fiber-fuel debate.”

In what might be the perfect storm of alternative fuel ideas, at least one company is attempting to extract hydrogen from algae.

At any rate, algae holds promise. But if it doesn’t work out, perhaps lemons are next.

MARK NEUZIL is a professor in the Department of Communication and Journalism at the University of St. Thomas, St. Paul. He is a regular contributor to *MinnPost.com* and the author of five books, including *The Environment and the Press: From Adventure Writing to Advocacy* (Northwestern University Press, 2008).

Mission: Sustainable

The U transfers possibility into practice.

by STEPHANIE XENOS

Anyone who's made a trip to the western Minnesota town of Morris in recent years will have noticed the 230-foot wind turbine that rises from the prairie. It attracts attention—and even a bit of a social scene. In the evenings, groups of students sprawl on blankets under the whoosh of the turning blades.

But the turbine is more than a local landmark. It's a symbol and an integral part of the University of Minnesota, Morris' efforts to become a sustainable campus.

The campus, which has pledged to become carbon neutral by 2010, is drawing on local resources of wind and biomass to move toward complete energy self-sufficiency. The turbine generates nearly half of the campus' electricity. And when the UMM's first-of-its-kind biomass gasification facility is completed, it will provide energy for more than 80 percent of the campus' heating and cooling.

Add in recycling, green buildings, a hybrid fleet and several other initiatives, and you've got a gold-star standard of campus sustainability.

Jacqueline Johnson, UMM chancellor, attributes this progress to the school's rural and agricultural ties, highly motivated students and general openness to collaboration. "Whatever a campus does has to be tied directly to its mission," she says.

UMM's action-driven mission is echoed across the University of Minnesota system.

In fact, the U has been at the forefront of implementing sustainability programs, including a new sustainability minor within the College of Liberal Arts, award-winning composting and recycling programs, and early membership in the Chicago Climate Exchange.

Still, without a comprehensive plan, such ambitious efforts remain fragmented. Sorting out what's already working, where the gaps are and how to bridge them is no small feat. The sheer number of programs and initiatives at the University of Minnesota, referred to collectively as "Sustainable U," presents a challenge in itself.

Enter the Sustainability Goals and Outcomes Committee, which convened earlier this year. The committee is charged with determining exactly what sustainability means for the U and how to achieve it.

As the new sustainability coordinator at the U of M, Amy Short is helping to steer the committee's efforts. She sees challenges ahead, but also an obligation based on the university's guiding principles and a mission to move forward.

"The U already has a strong policy. We need to model what works," says Short. "All of higher education is taking on this responsibility."

Of course, "strong policy" is a relative term. That's why many schools are turning to organizations such as the Association for the Advancement of Sustainability in Higher Education to make sure they're on track. Right now, the association is developing a framework using data collected from 90 institutions, including the Morris campus.

Julian Dautremont-Smith, associate director of the AASHE, suggests that higher education institutions should be models of sustainability in both principle and practice.

"Campus sustainability isn't just about building greener buildings and using less energy," says Dautremont-Smith. "Those things are really important, but the biggest contribution that higher education can make is in education and research."

STEPHANIE XENOS is a writer and editor with the University of Minnesota's College of Biological Sciences and a regular contributor to *Mpls.St.Paul Magazine*.

Sustainable Campus Upswing

Nearly 500 schools nationwide, including the University of Minnesota, have already signed on to the American College & University Presidents Climate Commitment—an agreement to work toward carbon neutrality (i.e. balancing the amount of carbon released with the amount absorbed or otherwise offset).

In 2008, the University of Vermont and the University of Washington were recognized for their leadership in the College Sustainability Report Card, released each year by the Sustainable Endowments Institute. Harvard, Carleton, Dartmouth and Middlebury have also earned high marks for their sustainability efforts.

Outside the country, the University of Leeds has won accolades for its waste recycling program, and the University of British Columbia for its sustainability curriculum. The University of Glasgow gets almost half of its energy from renewable sources, while schools such as the College of the Atlantic in Maine and EARTH University in Costa Rica are built entirely on the concept.

Order of the Day

With a full menu of options, the Statewide Conservation and Preservation Plan will serve Minnesota today and for many days to come. by LEE EGERSTROM

An 18-month-long study involving more than 100 University of Minnesota scientists, private consultants and experts from state agencies and nonprofit groups has served up the most sweeping look yet at Minnesota's natural resources and the pressures altering the state's environment.

In the technical world, the study is known as the Minnesota Statewide Conservation and Preservation Plan. It was presented in July to the Legislative-Citizen Commission on Minnesota Resources.

In the not-so-technical world of everyday life, the question becomes how to make this massive project a workable template guiding public and private land and water uses in the years ahead.

"That's what we've been asking ourselves since Day 1," says Jean Coleman, the project coordinator from CR Planning in Minneapolis. "We've tried to keep future use in focus, every step of the way."

Team member David Mulla, a professor in the U of M's Department of Soil, Water and Climate, likens the entire effort to "writing a menu for a restaurant. We're offering something for everyone," says Mulla, a founding fellow of the Institute on the Environment, which is leading the SCPP partnership.

This is one big menu.

Heading into the final weeks of tweaking and testing, team members were rethinking some 65 recommendations that emerged from the hearings and conferences conducted across the state.

Like a five-course meal, all recommendations were grouped into five strategic areas, including Integrated Planning; Critical Land Protection; Land and Water Restoration; Sustainable Practices; and Economic Incentives for Sustainability.

In doing so, coordinator Coleman says the final project task is "prioritizing so it is workable for most everyone."

Fortunately, many of the recommendations aren't new. Rather, they bring together "best practices" now employed by private land owners, businesses, agencies and groups, says David Nelson, a private consultant with Nelson Sustainability in Afton, Minn., who attended the project's public forum in May. That helps, he says, because it doesn't add

multiple benefits across multiple natural resource areas, says Deborah Swackhamer, the SCPP principal investigator.

"We put the recommendations into a comprehensive and integrated framework, rather than a list that policymakers would cherry-pick from," she says.

A spokesperson for the LCCMR adds that the full menu of recommendations doesn't need immediate implementation. The plan is for guidance in future years; funding public investments to carry out the plan will be incremental.

At the same time, there is an urgency to make best economic use of the recommendations, say team members, because Minnesota's quality of life and economic health are closely tied to clean air, water, forests, wildlife, fish and outdoor recreation.

This is especially true with emerging alternative energy development, says Laura Schmitt Olabisi, who is part of a team of U of M scientists advocating new research on perennial crops for fuel use.


"Minnesota is a leader in bio-fuels development," she says. "It's in our economic interest to lead in alternative energy research and development, but we have to do it right."


LEE EGERSTROM is a fellow of the Minnesota 2020 think-tank and an author of several books on economic development themes. He is a former journalist with the *St. Paul Pioneer Press* and *Knight Ridder Newspapers*.



60 or more new criteria for development and zoning people to learn at local levels of government.

Yet, what makes this plan unique from other conservation plans is that it provides

 environment.umn.edu/scpp

 Download the final Statewide Conservation and Preservation Plan.

Local Food for Thought

Farm to fork. Food miles. Foodsheds. Locavores. While these concepts and buzzwords are nothing new, they've recently seen an American revival. Spurred by environmental, economic, health and lifestyle concerns, society is getting back to the basics once again. • But the exact definition of "local" is just one of many issues left to contend with. Proponents are still sorting out the details of transportation, distribution, supply and demand, and a batch of other conundrums. • In search of some clarity, *Momentum* sat down with two members of the University of Minnesota's Local Foods Task Force. Here, we've rolled the key ingredients of the conversation into bite-sized remarks.

“I spend time every year in Mexico and their local food system is alive and well. There are families that walk out to the backyard, grab an egg out of a coop, pull a mango off the tree, and dad comes back with a fish that he caught that morning. It doesn't mean they don't have an industrial food system. But it's not necessarily seen as a cultural movement because they haven't gotten so far away from it.

Local food isn't just about food miles. It's about relationships to place, to foodways, to mealtime, to food traditions. It's a look backward and a realization that we need to retool our food systems. There's a family life policy dimension, too. It's not just about the support of policy to get the food in and out of the ground. It's also about making people's lives manageable to create this shift.

With commodity-based agriculture, the price tag might be cheaper, but the farmer doesn't necessarily get a fair price. Then, there are all the costs that are unaccounted for in the industrial food system. There's a lot of math left to be done on the exact formula for reducing our carbon footprint. Maybe we'll end up with stills in our basement and coops in our backyard to avoid the problem altogether.

We're renewing an old way of doing things and, at the same time, we're layering in new technologies and ideas. There's an enormous learning curve. And it's not an either/or issue, where you're either a locavore or an industrial food-meister. There's this huge gray area in the middle. We're not going to figure it all out before we do it. We're going to figure it out by doing it.”

MARGARET ADAMEK

research fellow, Regional Sustainable Development Partnerships
University of Minnesota

“When they find these old Greek ships, what's in them? It's food. It's wine and olive oil and other things. Trade in food products has been happening for thousands of years and people have benefited from that. So, we shouldn't lightly give up the benefits of trade. Local foods can help support the local economy by cycling more dollars in, but if you want to export food, you should be willing to import it.

One challenge right now is that local foods systems are inefficient from a transportation standpoint. When you look at a farmers market, for example, you've got a lot of trucks going a fair number of miles, carrying fairly little, and going back empty. You've got consumers who often drive a long way to get to the market. And farmers can spend many hours getting ready for and going to the market. So, I think we need to look at how well they're getting compensated.

Also, we need to get up to a scale where more efficient means of distribution can be used. Yet, I believe there are people in this movement who don't want to get to that scale. We need to find ways to achieve scale without losing that connection with individual people. And there will be times of the year when it's not feasible to be getting fresh vegetables. For those times, maybe we want to think about connecting with communities in warmer places.

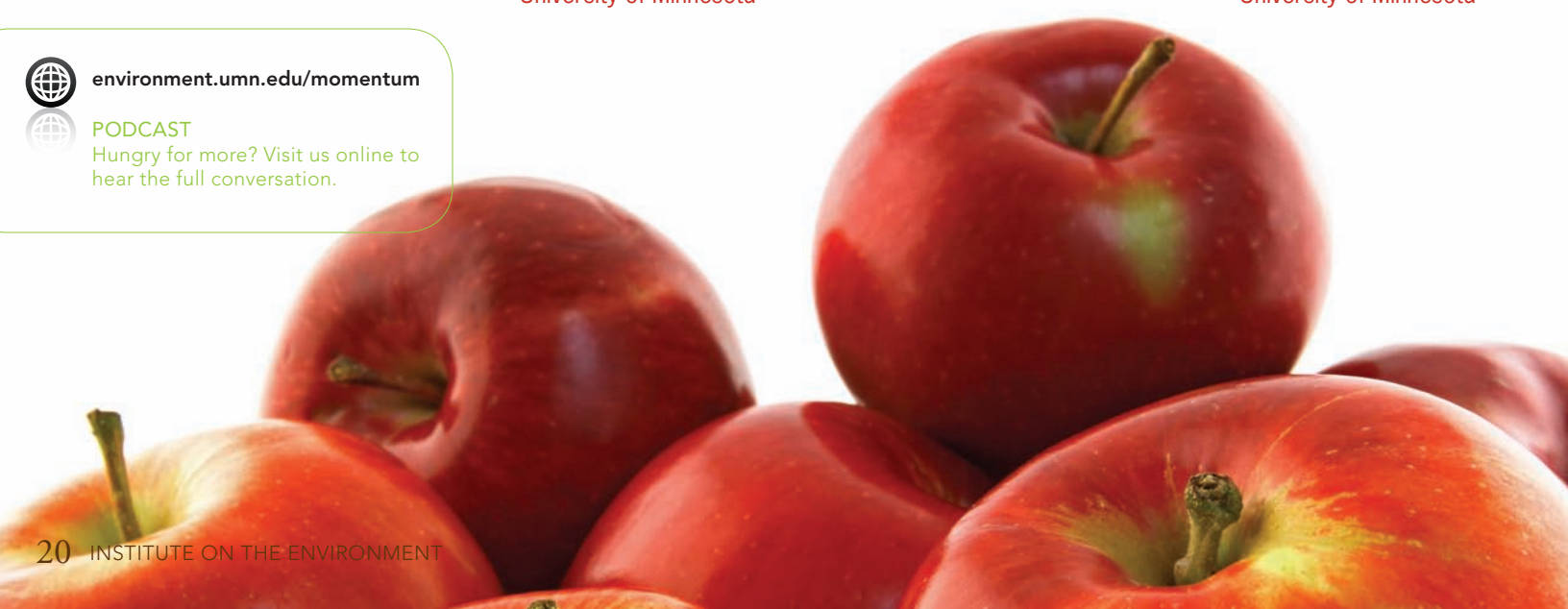
The question is, 'How do we create a local foods system where the contributions people make get rewarded fairly, but also one that's efficient and not too expensive for people to participate in?' That's going to be an exciting challenge.”

ROBERT KING

professor, Department of Applied Economics
University of Minnesota

 environment.umn.edu/momentum

 **PODCAST**
Hungry for more? Visit us online to hear the full conversation.



Search How can we slow global warming? 



Search Results A cool plan. 

U of M geography professor Steven Manson and his students research human activity and its effects on global environmental change. By generating agent-based modeling, a way to examine how humans alter land surface on the earth, they predict probable environmental consequences of this surface alteration. This research could help avert potentially disastrous changes in climate. Seems like modeling is a model way to slow global warming. So the search continues. **Learn more at umn.edu.**

UNIVERSITY OF MINNESOTA
Driven to DiscoverSM

UPCOMING EVENTS

SEPT 19	St. Anthony Falls Laboratory, Minneapolis	OUTDOOR STREAMLAB GRAND OPENING Public ceremony for the new U of M research and educational facility
SEPT 24-26	Ted Mann Concert Hall, Minneapolis	CLIMATE CHANGE, SUSTAINABLE AGRICULTURE AND BIORESOURCES Public forum presented by the U of M's Center for Austrian Studies
SEPT 28 -OCT 3	Various locations in Minneapolis, St. Paul and Mankato	INTERNATIONAL BIOENERGY DAYS Conference presented by ÄFAB, a Sweden-based environmental engineering company
SEPT 29-30	McNamara Alumni Center, Minneapolis	AMMONIA FUEL CONFERENCE: THE KEY TO U.S. ENERGY INDEPENDENCE Fifth-annual event presented by the Iowa Energy Center
OCT 9-10	Ted Mann Concert Hall and Nolte Center, Minneapolis	THE CITY, THE RIVER, THE BRIDGE I-35W bridge aftermath symposium presented by the U of M's Institute for Advanced Study
OCT 26-29	Duluth Entertainment and Convention Center	MINNESOTA INVASIVE SPECIES CONFERENCE Presented by the Minnesota Invasive Species Advisory Council and the U of M
OCT 27-28	Saint Paul RiverCentre	MINNESOTA WATER RESOURCES CONFERENCE Presented by the U of M's Water Resources Center
NOV 18	Saint Paul RiverCentre	E3 2008: THE MIDWEST'S PREMIER ENERGY, ECONOMIC AND ENVIRONMENTAL CONFERENCE Presented by the U of M's Initiative for Renewable Energy and the Environment