

SFI CHRONICLE

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SPECIAL POINTS OF INTEREST:

- > Links to faculty and student web pages can be found at www.sfi.mtu.edu
- > SFI obtains NSF MUSES grant for water research in Great Lakes
- > MTU Faculty Hiring Initiative in Sustainability www.admin.mtu.edu/hro/facpers/facvac.htm

We're on the Web:
www.sfi.mtu.edu

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SFI Faculty Awarded \$2 million for Water Research

In July 2007, NSF awarded four SFI faculty members a \$2 million MUSES grant for their proposal, entitled "Modeling and Analyzing the Use, Efficiency, Value, and Governance of Water as a Material in the Great Lakes Region through an Integrated Approach." The project will determine the impact of direct and

indirect drivers such as population growth, climate change, land use, and emissions on water quality, quantity, and availability in the Great Lakes region. Research will consider the value of water as a material, and will incorporate modeling of water quality and quantity,

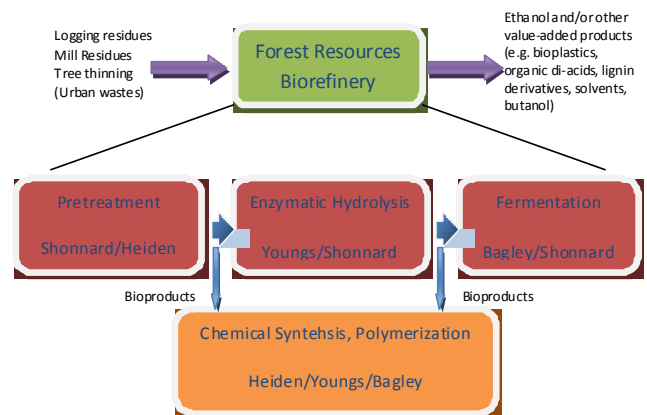
embodied energy of water treatment and distribution, scenarios of global change, and identification of areas where technological innovations are most needed to protect vulnerabilities in the Great Lakes systems. The PI is Dr. Alex Mayer, director of the Center for Water and Society. The co-PIs are Drs. Qiong Zhang, David Watkins, and James Mihelcic. The grantees will partner with Dr. Julie Zimmerman and Dr. Sheila Olmstead, both at Yale University. MTU's share of the budget is \$1,078,322.



GM Awards \$275,000 to Multidisciplinary Team of SFI Faculty

David Shonnard (Chemical Engineering), Susan Bagley (Biological Sciences), Heather Youngs (Biological Sciences), and Patricia Heiden (Chemistry) are teaming up to develop new forest-derived high quality ethanol in support of GM's flexible fueled vehicle strategy plus the co-production of value-added polymeric materials. The research team is ideally suited for the biorefinery approach, because of its interdisciplinary expertise. The two-year project will involve research related to pretreatment,

enzymatic hydrolysis, fermentation, and chemical synthesis and polymerization.



Selected Research Grants

G. Subhash (ME), **G. Caneba** (CM), and **D. Shonnard** (CM) received \$1,316,501 from Raytheon Co. for the project "Development and Characterization of Environmentally Benign Functional Materials."

John Sutherland (ME) received \$725,000 from the National Science Foundation for the project "IGERT: Achieving Environmental, Industrial, and Societal Sustainability via the Sustainable Futures Model."

M. Mullins (CM), J. Holles, J. Keith, J. King, and T. Rogers received \$481,000 from the US Department of Energy for the Michigan Technology Center for Nanostructure and Light Weight Materials.

D. Shonnard (CM), **S. Bagley** (BL), **P. Heiden** (CH), and **H. Youngs** (BL) received \$275,026 from General Motors Corp. for the project "A Systems Approach to Improve Processing Efficiency of Forestry Biomass for Co-Production of Biofuels and Biopolymers."

J. Naber (ME), **J. Beard** (ME), and **D. Michalek** (ME) received \$272,145 from General Motors Corp. for the project "Direct Injection Ethanol Flex-Fuel Engine Optimization and HC Cold-Start Emissions Reduction for Hybrid Applications."

N. Urban (CE) received \$242,199 from the National Science Foundation for the project "Collaborative Research: The Carbon Balance of Lake Superior: Modeling Lake Processes and Understanding Impacts on the Regional Carbon Budget."

R. D'Souza (ME) received \$229,445 for the project "Graphics Hardware Accelerated Real-time Machinability Analysis of Free-from Surfaces."

BL – Department of Biological Sciences

CE – Department of Civil and Environmental Engineering

CH – Department of Chemistry

CM – Department of Chemical Engineering

ME – Department of Mechanical Engineering - Engineering Mechanics

SFI GRADUATE STUDENTS TRAVEL TO BOLIVIA FOR AN INTERNATIONAL SUSTAINABLE DEVELOPMENT RESEARCH EXPERIENCE



Pictured above: The ISDEREP 2007 Team- (Back Row -from the left) Andrew Manty, Martin Aliaga, Engineer Nathan Reents, Elizabeth Quinley, Meredith Ballard, Abigail Clarke, Afton Sather-Knutsen (Front Row-from the left) Engineer Rufino Plato, Johansen Chino, Maria Jose Quezada, Rachael Feldpausch, Sunny Pereira, Gabriela Gemio, Sandra Quevedo, Engineer Santiago Morales

Students from Michigan Technological University (MTU), in collaboration with students from Universidad Tecnológica Boliviana (UTB) and the non-governmental organization ACDI-VOCA, completed a sustainable development engineering research project on wastewater treatment systems in the Alto Beni region of Bolivia during June 2007. The research initiative, International Sustainable Development Engineering Research Experiences Program (ISDEREP), pairs MTU undergraduates with doctoral students and UTB students to work on development projects for Bolivian communities. SFI graduate students Abigail Clarke and Meredith Ballard investigated the sustainability of rural wastewater systems in three communities: Palos Blancos, San Antonio, and Sapecho. Clarke's focus group explored the quality and function of the systems and how well they meet users' needs from a social-environmental/technical perspective. Ballard headed an environmental/technical-economic focus group that specifically analyzed the efficiency of the local wastewater system's treatment method. The groups completed water monitoring in both the wastewater and potable water systems; and they compiled data, completed social surveys and interviews with local citizens, water committees and ACDI-VOCA. ISDEREP will continue this exchange for the next two years.

Selected Honors

SFI Director **John Sutherland** was elected Fellow to the American Society of Mechanical Engineers.

John Gierke was named Michigan's first Distinguished Michigan Professor of the Year by the Presidents Council of the State Universities of Michigan for both his research and his superior achievement in undergraduate education.

Brian Barkdoll was elected Diplomat of American Academy of Water Resources Engineers as well as Associate Editor of the *ASCE Journal of Hydraulic Engineering*.

Jaime Camelio earned a 2007 SME Outstanding Young Manufacturing Engineer Award in recognition of his significant achievements and leadership in the field of manufacturing.

Dave Hand won AEESP Award for Outstanding Teaching.

Jackie Huntoon, Dean of the Graduate School, was elected Counselor of the Geological Society of America.

Jim Mihelcic, former SFI co-director, was named president-elect of the Association of Environmental Engineering and Science Professors by the Board of Directors at their fall board meeting.

Barry Solomon was named a member of the Michigan Economic Development Corporation's new Research Council as one of two representatives from the UP.

SFI SCHOLAR HIGHLIGHT



T.J. Eatmon an SFI Scholar attending Southern University, is a Visiting Scholar in Residence in the Environmental Science Department at Allegheny College in Meadville, Pa. This fellowship gives him one year to focus on dissertation research and teaching experience. During the spring semester he will teach ES 490: Policy and Economics of Climate Change in the United States, a course he helped develop. T.J. is also organizing an all day teach-in on January 31, 2008, as part of the national effort to address climate change sponsored by focusthenation.org. T.J. finds his experience at Allegheny College to be very rewarding and is learning from the best about how to become a successful teacher in higher education. His interdisciplinary background has been well received at Allegheny and he feels his IGERT Traineeship has prepared him well to maximize the benefits of this opportunity.

GRADUATE HIGHLIGHT

Deborah Huntzinger is the first IGERT Trainee to complete her doctoral studies. Her dissertation is entitled *Carbon dioxide sequestration in cement kiln dust through miner carbonation* (2006). She recently accepted a postdoctoral position in the Department of Environmental Engineering at the University of Michigan. On October 1st she began working with Dr. Anna Michalak of the North American Carbon Project to look for ways to reconcile bottom-up and top-down approaches to modeling carbon fluxes in North America.



PhD Candidate Santosh Ghimire (CEE) won the People's Choice Award during this Fall's SFI Banquet.

Wood-to-Wheels Brings Disciplines Together

Wood-to-Wheels is a perfect example of what Michigan Tech does best. A multi-disciplinary approach to research run in a businesslike manner with specific deliverables. It is the first graduate student version of the nationally recognized undergraduate Enterprise Program pioneered at MTU. Researchers from disciplines as diverse as Forest Resources, Engineering, and Social Sciences have come together to solve the multi-faceted problem of producing a clean-burning, cost-effective, and socially responsible biofuel from an abundant local resource – trees.

The bioprocessing initiative, led by Professor David Shonnard (CE), involves developing treatments to break down the tough cell walls and partially decompose wood chips into the sugars using naturally occurring enzymes from fungi. These are then fermented to produce ethanol.

Shonnard and his team are researching new and better ways to turn that woody material into ethanol for fuel, while Associate Professor Jeff Naber and his mechanical engineering students are designing new engines to burn that ethanol more efficiently with less-toxic emissions.

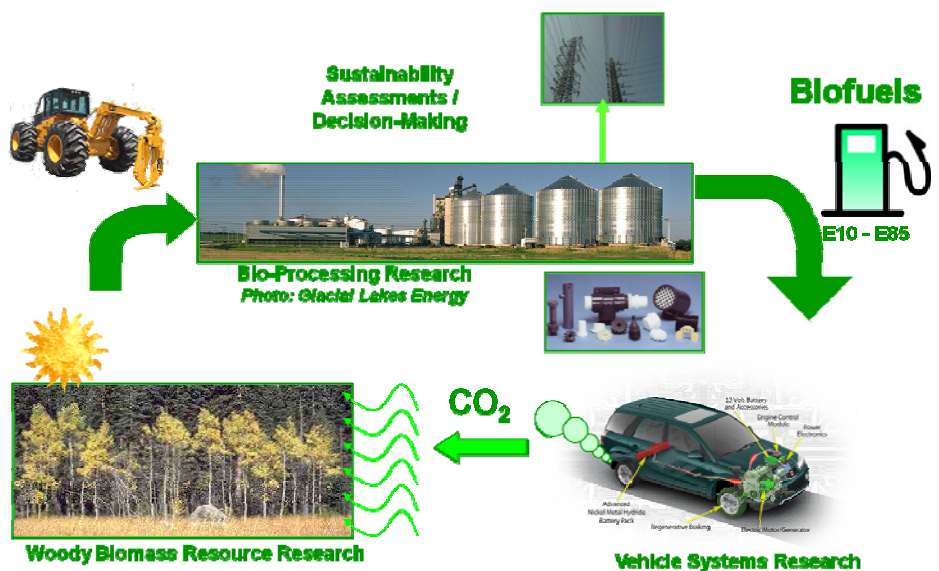
Forestry Professor Chung-Jui Tsai tackled the task of helping trees become better ethanol factories. A molecular biologist, Tsai is working to grow trees with cell walls that are easier to break down; healthier trees grow faster and handle environmental stresses better.

Forest Resources professor Ann Maclean and her students are working on another piece of the puzzle, using Geographic Information Systems (GIS) to determine where the most plentiful woody plants of Michigan, Wisconsin, and Minnesota are located.

Meanwhile, Mechanical Engineering Professor John Sutherland and his postdoctoral associate, Vishesh Kumar, are addressing harvesting, handling, and transportation issues. Kathy Halvorsen, an Associate Professor in the School of Forest Resources and Environmental Science as well as the Department of Social Sciences, is working with environmental policy Professor Barry Solomon to study public perceptions of the connection between global warming and petroleum-based fuels and how that affects public policy.

Margaret Gale, Dean of the School of Forest Resources and Environmental Science, calls Wood-to-Wheels “a new science of integration, bringing together all the expertise in so many different areas.” And, Gale adds, “it’s just what our students need, in a world where more and more engineers have to think about the ecosystem, and more and more forestry graduates must apply engineering solutions to natural resources problems.”

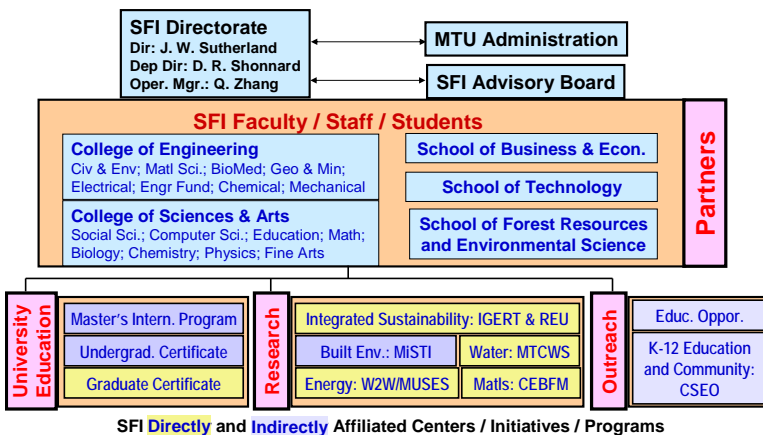
Adapted from “From Wood to Wheels” in Michigan Tech Magazine vol. 44 no. 2 by Jennifer Donovan



Highlights from the Western U.P. Center for Science, Mathematics and Environmental Outreach

- The Western U.P. Center for Science, Mathematics and Environmental Outreach and the Center for Water and Society received \$25,000 from the Michigan Department of Environmental Quality for a 2008 education/outreach program. This program provides K-12 fieldtrips aboard MTU's research vessel *Agassiz*, educational workshops with community leaders, and an Ecology of the Great Lakes Teacher Institute.
- The Great Lakes Fishery Trust (GLFT) has awarded \$200,000 to the Western U.P. Center for Science, Mathematics and Environmental Outreach, the Keweenaw Land Trust, Keweenaw Economic Development Alliance, the Center for Water and Society, and the Isle Royale Institute. The grant will be used to increase awareness and understanding of the Great Lakes and to encourage Michigan residents to become active stewards and advocates for strategies that support the long-term sustainability of the Great Lakes.
- More than 34 MTU faculty, staff, and graduate students have partnered with the Western U.P. Center to produce five Michigan-specific environmental education units for grades 4-9. These units have been provided free to more than 2,500 Michigan teachers who attended more than 200 workshops in just one year. Eighteen interactive web modules have been developed to support these units. The modules are available at <http://techalive.mtu.edu/>

RESEARCH CENTERS AND INITIATIVES INVOLVED IN THE SFI



SFI Organizational Structure

Since it was formally established in 2003, the students, staff, and faculty of the Sustainable Futures Institute (SFI) have been collaborating on a variety of initiatives related to research, education, and outreach.

The **Michigan Tech Center for Water and Society** (MTCWS) provides multidisciplinary perspectives and tools to address water-related problems of local, regional, and international interest.

The **Center for Environmentally Benign Functional Materials** (CEBFM) is chartered under SFI to investigate the synthesis, characterization, and analysis of material applications to sustainably

meet the needs of the U.S. and the world.

The **Wood-to-Wheels Initiative** envisions sustainable transportation utilizing fuels and co-products from forest and other biomass resources. The **Center for Extensible Assembled Systems** coordinates research to design assembled systems with more extensible life-cycles, more efficient assembly processes, and more carefully architected structures.

The research projects related to **Materials, Design, and Manufacturing for Sustainability**.

Education programs include the NSF **Sustainable Futures IGERT** (Integrative Graduate Education and Research Traineeship) project that supports doctoral students at MTU and Southern University, the NSF **Sustainable Futures REU** (Research Experience for Undergraduates) project to support supervised research opportunities for undergraduate students, a **Graduate Certificate** in Sustainability, and **Undergraduate Certificate** - International Sustainable Development Engineering. The **D80 Center Engineering Development for Humanity** promotes international sustainable development via several programs by educating young people to value and implement efforts to make a better world.

Environmental Sustainability at Michigan Tech

On Michigan Tech's campus, the Environmental Sustainability Committee has been promoting and supporting environmental initiatives while serving as a resource to the campus and community. For example, the ESC initiated the Michigan Tech's paper recycling program in 2002. Since the program began, Michigan Tech has recycled 523 tons of paper, saving \$26,000 in landfill fees and providing funding for student activities and speakers. In 2006, the ESC produced the "Greenprint for Environmental Sustainability in Campus Operations and Activities." This document was distributed to the Administration and all campus schools, departments, and centers last year, and is available online at www.esc.mtu.edu. Additionally, Energy Manager Dave Taivalkoski has produced a campus energy blueprint with recommendations through 2015. The ESC is also working to promote a composting program, a city bike plan, bike shelters, a carpool and rideshare website, and "turn off the lights" and "take the stairs" campaigns.



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Strategic Faculty Hiring Initiative in Sustainability

Michigan Technological University has received a gift to establish three Robbins Chairs in the area of Sustainability. The gift will contribute to the establishment of a total of ten faculty positions that will support our strengths in sustainability across disciplines at Michigan Tech, and our vision that our faculty, staff and students will be world leaders in the creation and communication of the Science and Technology necessary to support a sustainable future. Michigan Technological University is redefining graduate and undergraduate education through its interdisciplinary programs, which we plan to enhance through the creation of ten "growth" faculty positions each year. This year the theme is sustainability; it is a concept that informs research and learning in every discipline. Forthcoming interdisciplinary themes will be identified through far-reaching discussions both inside and outside the university community. A website dedicated to the Strategic Faculty Hiring Initiative is <http://www.mtu.edu/sfhi/>.

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