









Wisconsin Institute for Sustainable Technology

Annual Report

December 2017



Wisconsin Institute for Sustainable Technology
College of Natural Resources

University of Wisconsin-Stevens Point

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Research, laboratory services and education provided by the Wisconsin Institute for Sustainable Technology (WIST) help businesses and organizations meet their goals in ways that make more sustainable use of natural resources. Technology and ideas developed by WIST and its partners will spur economic growth in Wisconsin and the region and help preserve a healthy environment for future generations.

WIST is an institute within the College of Natural Resources at the University of Wisconsin-Stevens Point. It is a multidisciplinary institute powered by the energy and expertise of faculty, staff and students across the UW-Stevens Point campus.

A Note From the Director



Paul Fowler Executive Director

Thank you for taking an interest in the work of WIST and for taking the time to browse this 2017 Annual Report.

2017 marked a number of firsts for WIST. In February, we hosted our first conference targeting the residuals of vegetable production and processing titled Market Opportunities for Natural Chemicals from Vegetable Production and Processing. This inaugural event was held in the state-of-the-art Operations, Technology and Training Center of Heartland Farms in Hancock, Wisconsin. Read more about the conference on page 10.

In July, we hosted our first Midwest Compost School, which provided an immersive three days of instruction, hands-on practical experience, a tour of Hsu's Growing Supply and the opportunity to view composting equipment in action. The class was fully subscribed. Read more about the school on page 12.

Throughout the year, we participated in our first application to the Rathmann Family Foundation's Rathmann Challenge. Our proposal targeted the large-scale use of compost to mitigate climate change. You can read about our efforts and the unique Rathmann model on page 13.

2017 was also a pivotal year for WIST from a funding perspective. We received tremendous support and counsel from our stakeholders, customers and economic development organizations advocating for restoration of state funding that was eliminated in the 2015 biennial budget. As a result of the hard work and dedication of our business and economic development partners and with the support of the state legislature, we were able to secure an appropriation for the 2017-18 fiscal year. Our challenge remains moving towards sustainable and diverse sources of revenue as we look out to 2019 and beyond.

I trust you will enjoy reading about some of the diverse work that we do at WIST as you browse this report. Should you have any questions or need more information, please do not hesitate to contact me at 715-346-3767.

WIST Advisory Board Update

The board added two new members in 2017

The WIST Advisory Board was formed in 2011 and meets twice annually with WIST staff to discuss institute priorities and provide guidance. The board comprises members with a range of perspectives and experiences, with representation from the agriculture sector, both in production and marketing, biotechnology, manufacturing, forest products, higher education, economic development and venture capital. Joining the board in the past year were Dean Benjamin and Gordon Crow, replacing retiring board members Ed Buehler and Nelson Dahl.



Dean Benjamin received a
Bachelor of Science degree in
paper science and engineering
from UW–Stevens Point
and then went on to earn
a doctorate in chemical
engineering from the
University of Minnesota.
While at Minnesota, he
studied computational and
experimental fluid mechanics

of the roll coating process under Professor L.E. Scriven.

Upon graduation, Benjamin joined Avery Dennison as a research engineer at the Avery Research Center in Pasadena, California, where he led projects to develop coating processes for the production of pressure sensitive labels and tapes.

Benjamin then joined Consolidated Papers Inc. as a senior research engineer at their R&D facility in Wisconsin Rapids, Wisconsin. His research focused on developing new coating and finishing equipment and he eventually became the manager of the Coater Research and Engineering Department. He also worked in the areas of coating color preparation, paper finishing technology, high-speed coaters, fountain applications, corrosion engineering, kraft chemical recovery systems and product development. Benjamin then became the manager of Product Development - Publication Papers where he worked on a variety of product developments including high-bulk paper, alternative-finish paper and high-brightness, carbonate-based paper coatings, and later was appointed as director of research for NewPage. Dean is now the director of product development for Verso Corporation.



Gordon Crow is executive director of Centergy, an economic development corporation representing central Wisconsin.

Crow was elected to three terms in the Idaho State Senate and is one of the principal architects of welfare reform in Idaho. Senator

Crow chaired the Senate Commerce and Human Resources Committee, the State of Idaho Employee Compensation Committee, and the State of Idaho Permanent Building Fund Advisory Board. He played a significant role in rewrites of Idaho's Administrative Procedures Act, Personnel Code, and Worker's Compensation laws.

Crow is knowledgeable in federal and state regulatory processes, skilled at interacting with local governments, and with identifying and initiating corporate participation in beneficial economic development efforts. He is also experienced at developing and managing grassroots strategies and campaigns.

He is married to Sandy Crow. He has two children, three grandsons and one great-grandson. He is passionate about his Catholic faith, and he loves to read, golf and ride his bike.

Advisory Board Members

Dean Benjamin
Director of Product Development
Verso Corporation
Stevens Point, Wisconsin

Mary Blanchard Associate Director Wisconsin Energy Institute Madison, Wisconsin

David A. Brukardt Associate Vice President Office of Economic Development University of Wisconsin System Madison, Wisconsin

Gordon Crow Executive Director Centergy Inc. Wausau, Wisconsin

Tamas Houlihan
Executive Director
Wisconsin Potato and Vegetable
Growers Association
Antigo, Wisconsin

Meleesa D. Johnson Director Marathon County Solid Waste Ringle, Wisconsin

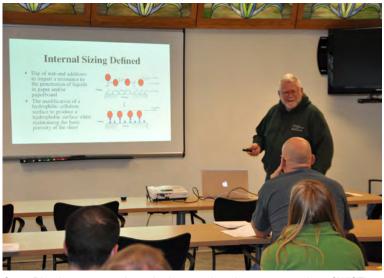
Barb Fleisner LaMue
Vice President of Economic
and Community Development
Wisconsin Economic Development Corporation
Green Bay, Wisconsin

Leon Ostrowski President Ostrowski Ventures Plover, Wisconsin

Richard Pavelski CEO and Owner Heartland Farms Naples, Florida

Francis J. Podvin Podvin Law Firm Wisconsin Rapids, Wisconsin

Alan Rudie Supervisory Research Chemist U.S. Forest Service Forest Products Laboratory Madison, Wisconsin



Gerry Ring instructs students in the morning classroom session of WIST's course in paper making additives. In afternoon sessions, students perform hands-on exercises using the UW-Stevens Point pilot paper machine.

Education Update

WIST in 2017 completed its second year of collaboration with TAPPI in marketing the institute's series of <u>short courses in paper making</u>. The schedule included multiple offerings of each of the three hands-on paper making courses. WIST also offered Coating and Lamination in Packaging Applications and its introductory course in Concepts and Technologies of Biomass Economy.

The biomass course and a couple of the hands-on courses were cancelled for lack of enrollment in 2017, and with that in mind WIST is trimming its course schedule slightly. In 2018, the three paper making courses are scheduled just twice, with one series beginning in April and a second series beginning in September. The courses are not required to be taken in sequence and students may take courses in either or both series, spring or fall.

The coating and lamination course is scheduled in January and July. The biomass course is not offered in 2018. Other changes in 2018 include a tweaking of the paper making curriculum and concordant name changes for two of the courses. Rather than introductory, the additives and formation courses are now named Advanced Hands-On Paper Making: Additives, and Advanced Hands-On Paper Making: Formation.

Gerry Ring, emeritus professor and former chair of the UW-Stevens Point Paper Science and Engineering Department, continued as instructor for the hands-on papermaking courses and will continue in that role in 2018. Roland Gong, assistant professor of paper science and engineering, teaches the coating and lamination course.

Research Spotlight

WIST works with Madison-based Aquafix to clean up waterways and reduce the use of chemicals in the environment

evin Ripp is director of science and innovation for Aquafix Inc, a company out of Madison, Wisconsin, that works with WIST to research new products and improve existing products. His company is focused on the biological sciences, specifically studying biology in aquatic environments. Their mission is to develop pioneering biological products that clean up waterways and reduce the use of chemicals in the environment. Aquafix has two divisions; the first develops products for wastewater, the second division—under the name Naturalake Biosciences—develops biological technologies for cleaning up lakes, ponds, and aquaculture environments.

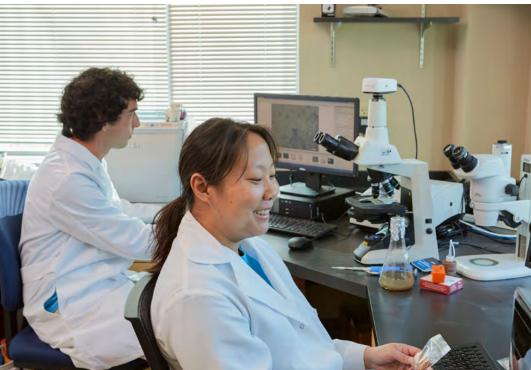
Ripp started working with the company in its infancy back in 2000 and it has now grown to 24 employees and separate production and laboratory locations. In that time, the company's stated mission to develop products based on real science seems to have struck a chord; they can name steady customers from all over the world.

"We have products on every continent except Antarctica," Ripp says in a phone interview. "The problems in wastewater plants are similar regardless of geography, and we work with WIST to help us identify those issues on a fundamental level and then develop solutions as a result. WIST's team of scientists and instrumentation has been key in helping a small company like ours develop world class technologies."

The Aquafix division includes products for wastewater plants and lagoons as well as grease control in lift stations. The company also offers laboratory services and education, including instructional articles on its website and free webinars, many of which are archived online.

The other division, Naturalake Biosciences, was founded to aid lake front homeowners who have concerns with algae or harmful algae blooms and also want to reduce the use of chemicals in their waterways. Naturalake Biosciences uses the biological





sciences to allow these chemistries to be more effective and to keep the water body healthier as a whole. Aquafix's partnership with WIST has already been fruitful. WIST recently helped Aquafix in the development of a carbon source for wastewater called SmartBOD as well as an intensive comparative study of SmartBOD against other carbon sources. Now they are working with WIST on new technologies to degrade wastewater fat, oil, and grease—a line of study that is showing real promise.

Ithough Aquafix has a state-of-the-art biological laboratory of its own, the company began working with WIST a couple of years ago after learning about the institute through industry connections.

"There aren't too many higher-level universities that are passionate about solving wastewater issues, and UW-Stevens Point is, of course, well-known in natural resources field but it's also known for training people in wastewater," Ripp says. "Over the years several of our customers have been graduates of UW-Stevens Point."

Those customer contacts led first to a conversation with Rob Michitsch, an associate professor of Soil and Waste Resources who has worked with WIST on several projects, and then to Paul Fowler, WIST executive director, and Justin Hall, WIST project specialist.

Ripp explains that his company has a number of projects in the works with WIST and that the first step is always internal, with several months taken to define the scope of the project.

"Then once we define the scope we meet with Justin and Paul and review it, what equipment they'll need, and how we want to do the tests," Ripp says. "We're very exacting and we understand in the beginning the answer we're looking for in the end. We want the answer whether it's good or whether it's bad. The fundamental thing is to learn, and not every experiment goes your way and when they don't go your way you probably learn more about your process than when they do."

Ripp and Aquafix are happy to do that learning with WIST. When asked about why he finds this relationship rewarding, Ripp says, "The combination of renowned professors working together and millions of dollars in equipment allows us to seek deeper truths and create better products than we could without WIST."



Kevin Ripp, director of science and innovation for Aquafix.



This golf course pond was cleaned up with Aquafix biocatalysts and probiotics.

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Entrepreneurial Conference

Market opportunities for natural chemicals from vegetable production and processing

A one-day conference held in late February may provide the spark for new entrepreneurial activity in Central Wisconsin. WIST put together the gathering as part of its activities under a federally funded grant exploring value opportunities in vegetable processing waste. (See sidebar, opposite page.)

While the research project aims to isolate promising chemicals from the residual materials, further steps will be needed to bring those chemicals to market and the grant partners also are working to grow a network supportive of such activities. That's where the conference came in. Producers, processors and other entrepreneurs were invited to hear from and talk with presenters experienced in various aspects of the natural chemicals industry.

Presenter Ken Seguine has worked at large companies, including AVEDA, Intelligent Nutrients, and UAS Labs, but he was at the conference to talk about small-scale oil production at a startup he founded with his partner in northwestern Wisconsin. His experience offered positive lessons for anyone interested in pursuing new business

opportunities in natural products. Other presenters discussed harvesting and processing techniques, the economics of value-added chemical extraction and purification, drivers for increased use of naturally occurring chemicals in non-food applications and the challenges that exist in bringing such chemicals to market.

Heartland Farms hosted the event at its Operations, Technology and Training Center in Hancock, Wisconsin. The Midwest Food Products Association and the Wisconsin Potato and Vegetable Growers Association helped spread word about the conference throughout their membership. The two organizations are partners in the research project, and contributed financial support for the conference.

WIST Executive Director Paul Fowler said a second conference is being planned for early 2018, aimed at moving the discussion forward to aspects of production logistics and startup opportunities. Check the WIST website for project updates and information on the 2018 conference as it develops.



Ken Seguine describes challenges overcome in starting Hay River Pumpkin Seed Oil, a company that grows pumpkins organically for their seeds and markets the oil as a healthy and tasty alternative for use in salad dressings and other non-cooking food preparation (pumpkin seed oil doesn't do well at high heat so it's not for use in cooking).

Conference Presenters

Ken Seguine
Vice President of Sales and Marketing
UAS Labs

Michael Javes Director of Operations and Business Development Avoca Inc.

Khalid Mahmood Fellow, Emerging Science and Innovation, Naturals Platform Johnson & Johnson Consumer Inc.

Mark Mueller
Founder, Chief Technology Officer
and Board Member
Botanic Innovations

Paul Fowler Executive Director Wisconsin Institute for Sustainable Technology

Naturally occurring products — so-called green chemicals — extracted from vegetable residual material could complement the synthetic chemical market.



Photo: istock/com: zlikove Potato peels and other residuals from potato processing contain chemicals such as chlorogenic acid that are used in health supplements and other natural products.

Proof of Concept Center

The U.S. Economic Development Administration in February 2016 awarded a three-year i6 Challenge Grant to WIST to pursue opportunities in creating value from the waste or residual streams of vegetable production and processing.

Wisconsin is one of the nation's leading states in potato and vegetable production and processing. Residuals such as peels, stems and wrong-sized or blemished vegetables must be disposed of, and that represents a cost to the industry.

Working with materials supplied by project partners, WIST Technical Project Manager Justin Hall has analyzed processing residuals of potatoes, onions, cucumbers, beets, carrots, green beans and cranberries.

As of October 2017, just over 18 months into the work, the project has identified several promising materials. Chlorogenic acid, used in health supplements, cosmetics and pharmaceuticals, is present in potato peels. Residuals from onion processing contain quantities of quercetin and catechin, while green beans show promise in catechin quantities. Further work is being done purifying the chemicals and evaluating market conditions and opportunities.

Project Partners

- Wisconsin Institute for Sustainable Technology
- Del Monte Foods
- Heartland Farms
- Pavelski Legacy Partners
- Midwest Food Products Association
- Wisconsin Potato and Vegetable Growers
 Association
- Wisconsin Economic Development Corporation
- WiSys Technology Foundation

2017 Midwest Compost School

The Midwest Compost School came to Central Wisconsin in 2017, for the first time in its 22-year history, with the three-day course held at UW-Stevens Point July 11-13. WIST partnered with the Soil and Waste Resources discipline in the College of Natural Resources to organize and host the course. The school is held annually and has rotated among locations in Illinois, Minnesota and Iowa.

Instructor Tom Halbach has been a part of the Midwest Compost School since its inception. He said the enrollment has evolved over time. "When we started in 1995 with the first Midwest Compost School, we had a lot of municipal solid waste garbage companies," Halbach said. "We now have zero."

Instead, the course draws a more diverse group from both private industry and county and city governments.

"We've been getting more and more people interested in different kinds of compost," Halbach said. "These students are wanting to get a better understanding of the basic science so they can adapt it to their [programs]."

Carl Ott came to the compost school along with two coworkers from Iowa Select Farms, a pork producer. They're interested in improving mortality composting, that is, using compost techniques to decompose dead animals. Biosecurity is a big impetus for the composting operation, Ott said. By composting dead animals on site, they reduce traffic in and out of facilities that would be generated by removing the animals.

"We've been doing it for a while, but not as effectively and not at the scale we'd like to be doing," Ott said. "The goal is to get a better end product."

Throughout the three days, the school itinerary featured a mix of classroom work, hands-on activities and field demonstrations. Participants used classroom exercises to create recipes for compost, balancing nitrogen and carbon for effective decomposition. They then took those plans outdoors to build demonstration compost piles using various provided materials at UW-Stevens Point. The middle day of the school featured a tour of Hsu Growing Supply, a

composter at Wausau, Wisconsin, where the students also saw demonstrations of equipment by Komptech, Aeromaster, Vermeer, Scarab and Nortrax.

Paul Fowler, executive director of WIST, explained that hosting the Midwest Compost School was a natural for WIST and the College of Natural Resources. The institute and the Soil and Waste Resources discipline previously worked together to establish the Compostability Testing Laboratory at UW-Stevens Point, which tests materials to determine whether they are compostable under commercial composting conditions. The laboratory is managed by WIST and assists companies such as packaging manufacturers develop new products. The two units have also collaborated on other initiatives (see story next page on Rathmann Challenge).

"We spent the first half of 2017 planning to host the school, recruiting instructors and publicizing the event. We were delighted with the support shown by our world-class instructor pool and industry stakeholders," Fowler said. "The acid test for us was whether or not people would show up. We need not have worried: We ran a fully subscribed class and the quality and caliber of attendees was outstanding. We are currently considering offering a similar course in 2018."



Students in the 2017 Midwest Compost School build compost piles during a hands-on exercise in the course.



Joe Van Rossum, recycling and solid waste section chief for the Wisconsin Department of Natural Resources, teaches at the 2017 Midwest Compost School.

School Sponsors

Ecodrum
HSU Growing Supply
Scarab
Geobin
Nortrax
Aeromaster
Vermeer Wisconsin
Compost Manufacturing Alliance
BioCycle

Wisconsin Green Industry Federation Midwest Food Products Association

Media Partners

Compost Manufacturing Alliance BioCycle

Wisconsin Green Industry Federation
Midwest Food Products Association

WIST and Soil and Waste Resources Named in Top Five in National Contest

A proposed project to improve Central Sands soils with compost created from paper mill sludge, potato and vegetable processing by-products, and other material was named an Honorable Mention winner in the 2017 Rathmann Challenge. The win comes with an award of \$10,000 to WIST and the Soil and Waste Resources

Discipline, in recognition of their past work finding creative solutions to problems and successfully implementing programs.



The <u>Rathmann Challenge</u> was initiated in 2014 to engage organizations "with forward thinking ideas and a willingness to challenge themselves and their professional colleagues to come up with a better solution," according to the Rathmann Innovation Center website. The 2017 challenge asked applicants for proposals on "Mitigating Climate Change by Expanding the Use of Compost."

The winner in the challenge was awarded \$100,000 for past work and the exclusive opportunity to apply for an additional \$200,000 grant with an Even Bigger Idea®. The top award of \$100,000 went to the Center for EcoTechnology, Pittsfield, Massachusetts. Three other organizations also earned Honorable Mention awards.

In their Rathmann Challenge entry, Rob Michitsch, associate professor in soil and waste resources, and Paul Fowler, executive

director of WIST, outlined initiatives already accomplished or ongoing at UW-Stevens Point. These included the wide range of composting education and composting activities at the Stevens Point campus and the development and commercialization of a range of new fine art printmaking papers.

For their Even Bigger Idea in the Challenge application, Fowler and Michitsch proposed research and programming to prove the viability of large-scale composting in the Central Sands region to build and sequester soil carbon; improve water retention capacity in the soil and reduce irrigation rates; improve nutrient retention and reduce the requirement to apply fertilizers; and improve crop yield.



Conferences and Other Outreach

Focal Point 2017 brings brand owners, converters, mills together

The seventh annual Focal Point conference drew more than 60 participants from the Midwest and around the country.

Matt Cook, CEO of LBP Manufacturing, provided the keynote for the conference. Cook told the audience the marketplace today demands a new way of thinking about innovation that emphasizes cooperation between supply chain segments. He noted that consumers have access to more information than ever, have high expectations of quality and safety, and increasingly have those same high expectations for environmental standards.

Consumers don't differentiate segments of the supply chain, Cook said. He cited the example of the media storm in early 2017 over fluorinated wrappers used

by quick-serve restaurants. Consumers didn't care where any of the chemicals used in the products were produced; they cared about their safety with the final product; accordingly, manufacturers at every step of the process must have knowledge of materials used at other stages.

"We're going to have to share information and cooperate in ways that we never thought possible," Cook said.

Focal Point 2017 continued the theme of the past several years: Paper-Based Food Packaging and Serviceware/Enhanced Performance and Reduced Environmental Footprint. In addition to Cook, presenters were Walter Peterson, manager of packaging innovation and sustainability at Nestlé;

Focal Point 2017

Enhanced performance and reduced environmental footprint

October 24/Dreyfus University Center, UW-Stevens Point

(Continued from previous page)

Emily Williams, product development engineer at Michelman; Elizabeth Petro, consumer safety office with the Food and Drug Administration; Paul Schutes, executive director of the Recycled Paperboard Alliance/Recycled Paperboard Technical Association; Christian O'Neill, manager of retail packaging at Caribou Coffee; Katherine Johnson, attorney with the Federal Trade Commission; and Lynn Morgan, manager of public affairs at Waste Management.

The annual conference is organized and hosted by WIST at UW-Stevens Point. It is entirely supported by registration fees and sponsorships.



Matt Cook, CEO of LBP Manufacturing, delivers the keynote address at Focal Point 2017

Other events

Paul Fowler participated in the Wisconsin Potato and Vegetable Growers Association Extension Growers Conference held in Stevens Point Feb. 7-8, where he presented a poster outlining WIST research. He attended SustPack, held April 24-26 in Scottsdale, Arizona.

Fowler also participated in several events and initiatives to promote Central Wisconsin's economy including:

- Central Wisconsin Days in Madison on March 22-23
- Regional Talent Development Summit, Rothschild, May 24-25
- Dairy Summit, Alliant Energy Center, June 19.

Amber Davidson, manager of the WIST Compostability Testing Laboratory, attended ISO/IEC 17025 Lead Assessor Training by the ANSI-ASQ National Accreditation Board in Orlando, Florida.

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WIST Staff



Brian Bandow

Brian Bandow is WIST's paper machine and laboratory specialist. Bandow's duties span activities in both WIST and the paper science and engineering department. He assists in operating and maintaining the pilot paper machine and equipment in support of the paper science and engineering undergraduate program. For WIST, Bandow supports the institute's industry-focused contract research laboratory projects. His work includes outreach, research, testing, analytical and paper machine services to industry and other clients. Bandow brings a wealth of experience in papermaking and in related industries. He has a bachelor's degree from UW-Oshkosh and did post-graduate studies at UW-Eau Claire.



Amber Davidson

Amber Davidson is the compostability testing laboratory manager at WIST. She oversees the compostability testing services provided by the institute and performs laboratory tests to determine how well certain packaging composts under industrial composting conditions. In addition to laboratory work, she assists WIST in public outreach for compostability testing. She is a December 2012 graduate of the UW–Stevens Point with a Bachelor of Science degree in water resources and a minor in soil science and business administration.



Paul Fowler

Paul Fowler, WIST executive director, has 18 years of experience in contract research and development of new products and opportunities from biobased materials. At WIST, Fowler networks with public- and private-sector organizations and companies to develop new sustainable technologies with commercial applications to benefit the economy and the environment. Before taking the helm at WIST in 2010, he was director of the Welsh Institute for Natural Resources, a financially self-supporting unit at Bangor University in Wales, UK. Fowler has a doctorate in organic chemistry and extensive knowledge of biobased, renewable materials and applications.



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Justin Hall is a technical project manager at WIST. His duties include analytical work on WIST research projects. He also provides support for WIST research projects by maintaining and operating analytical instrumentation. Hall is experienced in ion chromatography, gas chromatography, liquid chromatography, and mass spectrometry. In addition to research support, Hall provides laboratory services for outside companies. He is a 2011 graduate of UW-Stevens Point with a bachelor's degree in water resources and a minor in chemistry.



Angie Hauer

Lindsey Hoffman carries out industry-focused projects and work performed on the UW-Stevens Point pilot paper machine as well as paper testing provided to industry by WIST. She also coordinates student and contract work, along with providing support

for the paper science and engineering undergraduate program. Hoffman graduated in

2014 with a bachelor's degree in paper science and engineering and a minor in chemistry

Angie Hauer, WIST program development coordinator, coordinates daily office

activities, supplies and correspondence. She has a bachelor's degree in resource

administration from Southern Illinois University at Carbondale.

management from UW-Stevens Point and a master's degree in outdoor recreation



Lindsey Hoffman

from UW-Stevens Point.



Ron Tschida

Ron Tschida, WIST communications manager, handles public relations, marketing and outreach, institute publications and the WIST website. Tschida has worked as a beat reporter and feature writer at several daily newspapers in the West, and before coming to UW-Stevens Point in 2005 he was city editor of the Bozeman Daily Chronicle in Bozeman, Montana. He has a master's degree in journalism from the University of Montana.



Rebecca Vagts

Rebecca Vagts, WIST business manager, is responsible for the fiscal management of WIST grants and contracts including developing budgets in grant narratives, budget review, account reconciliation and fiscal reporting. Vagts has an MBA with a global emphasis and a bachelor's in business management from Upper Iowa University.

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The Wisconsin Institute for Sustainable Technology —

Creating sustainability solutions and economic opportunities

WIST is an institute within the College of Natural Resources at UW-Stevens Point. Offices and laboratories are in the Science Building and the Dan Trainer Natural Resources Building on the UWSP campus.

Direct mail to:

University of Wisconsin-Stevens Point Wisconsin Institute for Sustainable Technology 800 Reserve Street University of Wisconsin-Stevens Point Stevens Point, WI 54481

For further information or to discuss this report, contact:

Dr. Paul Fowler

Phone: 715-346-3767

Email: Paul.Fowler@uwsp.edu

WIST is online at www.uwsp.edu/wist

