



**Wisconsin Institute for Sustainable Technology**

# Annual Report

**August 2015**



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. Major funding for WIST operations has been provided by the US Department of Agriculture National Institute of Food and Agriculture.

## A Note from the Director



Paul Fowler  
Executive Director

Keen readers of WIST's annual report will notice that this year's edition has been published a couple of months early. This is to coincide with, and mark, the fifth anniversary of WIST's launch on August 2010. Take a look at pages 8 and 9 for a timeline highlighting some of our achievements over the past five years.

The year just passed has been no less eventful than the previous four in respect of WIST's evolution. At the start of the reporting period we recruited a career papermaker, Brian Bandow, into the role of paper machine and laboratory specialist and towards the end of the period said goodbye to Dale Nachman, another paper industry veteran, who provided WIST exemplary service in the maintenance and upkeep of the pilot paper machine. We wish Dale all the best in his retirement. These two individuals help form a part of WIST's laboratory services team, which continues to refine its skills and expertise and in the past 10 months has delivered over \$200k of projects on behalf of private industry. In addition, this team has contributed to the delivery of outcomes in over \$4m worth of UW-System Economic Development Incentive grants. One highlight of the grants is the work with our private sector partner, American Science and Technology, to install a pilot scale biorefinery plant in Wausau, Wisconsin. You can read about the facility on Page 12.

This reporting period also coincides with the development of the WIST Compostability Testing Laboratory and, as we go to print, finishing touches are being applied to documentation and procedures ahead of having the laboratory and assessed for compliance with the globally recognized ISO 17025 standard for testing laboratories.

I hope you will take a moment to read through this report and if you have questions, need further information or wish to engage our services or research expertise, then please do not hesitate to contact me at (715) 346-3767.

# WIST Marks Five-Year Anniversary

In August, 2010, when the University of Wisconsin-Stevens Point officially launched a new program aimed at promoting entrepreneurial activity on campus, it marked the culmination of several years of discussion and planning. But of course it was also just a beginning.

Paul Fowler began his work that month as the first executive director of the new Wisconsin Institute for Sustainable Technology. He has presided over



Paul Fowler

an organization that has grown from several part-time employees to a staff of 12. Asked in an interview what he was most proud of the institute accomplishing in five years, Fowler pointed to the organization's

success in moving from an unknown startup to achieving widespread recognition for its work.

"I'm proud of the fact that we have a presence now and there's a community of businesses out there across the United States that know the name, which five years ago they didn't," Fowler said. He noted that the institute is doing business with companies from the West Coast, Maine, Florida, Washington State and other places in between.

"The WIST name has got some reach and we've established a track record of working with businesses," Fowler said. "That wasn't there before WIST for the university. We've actually filled more than 200 contracts for industry. There's a half-million dollar coater laminator, which if it wasn't for WIST wouldn't be on campus. RiverPoint® paper is a nice success. I'm proud of all those things."

The institute has evolved in five years. Laboratory services have become an important part of the

operation, particularly in response to needs in the paper industry. WIST's lineup of professional education short courses has grown. Research early on was focused tightly on biofuels from cellulosic biomass, but projects now include work on deriving other value-added chemicals from biomass.

"I think WIST's underpinnings on sustainable technology have generally stood us in pretty good stead," Fowler said. "Our interests have broadened and expanded to capture the range of renewable chemicals and materials, and polymers and fibers that are still encapsulated in that technology. But the opportunity goes far beyond energy into more value-added opportunities."

**"The WIST name has got some reach and we've established a track record of working with businesses."**

— Paul Fowler

he noted that the broadening of research interests had been good for WIST.



Eric Singsaas

"We've expanded the industries that we are serving from primarily research with pulp and paper, which we still do," Singsaas said. "But we're working with Siemens [on sustainable wastewater treatment], we're working with Okray's [on extracting marketable chemicals from agricultural

products], we're in discussion with biotech industries across the state. This whole area of extractives from agricultural products was something that we had only thought about five years ago. But now we have several projects going on."

Gerry Ring, former chair of the UW-Stevens Point



Gerry Ring

Department of Paper Science and Engineering, was one of the co-founders of WIST and served as its director of education. Now retired from the PS&E department, Ring is an emeritus professor and continues to work with WIST both as a consultant

on paper development projects and as an instructor of the institute's series of papermaking courses.

One paper development project, a collaboration between WIST and other campus departments, led to creation of a new fine art paper named RiverPoint®. After Pacon Corporation, a Wisconsin company, expressed interest in using the 100 percent cotton paper as the premier grade in a new line of printmaking art paper, Ring led WIST's development work to create two additional grades of RiverPoint for Pacon, devising a blend of wood fibers that met performance needs. Substituting wood fiber allowed the company to market the paper at different performance levels and price points to meet additional customer needs. Pacon now markets a full line of printmaking papers under the name Strathmore® RiverPoint.

Ring says WIST's success has actually exceeded his expectations. In early proposals for creation of the institute, he envisioned it as a replacement for the Institute of Paper Chemistry, the former research center in Appleton that had been supported by the paper industry. That institute in 2003 left Wisconsin and integrated its operations with the Georgia Institute of Technology.

"Really what I was looking at was tapping into the expertise of the faculty at the university," Ring said. "What I was looking for was [to provide] sound technical advice and analysis service, to reach out to the paper industry. Product development is above

what I anticipated. Product development is huge." Ring said he's been pleased with the growth of the education courses offered by WIST and the annual Focal Point conference hosted by the institute.

"I think Focal Point is a nice success," Ring said.

**"Product development is above what I anticipated. Product development is huge."**

— Gerry Ring

"That is continuing to develop its audience. That was one of my expectations, that we would be able to provide technical programs and that happened."

Barb Fleisner LaMue was executive director of Centergy, the central

Wisconsin economic development organization, at the time WIST was founded and serves on the institute's advisory board. She is currently vice president of economic and community development for the Wisconsin Economic Development Corporation.



Barb Fleisner LaMue

"In my role with WEDC and as a continued advisory board member, I have witnessed the growth within WIST in research, the assistance given to Wisconsin companies, and the movement from academic

research to market developed ideas," LaMue said.

Fowler said he expects to see more of that movement in the next five years for WIST.

"We will have several more products like RiverPoint under our belt," Fowler said. "We've got a pipeline of materials coming through from research towards commercialization right now including paper and nonpaper-based products."

**See a timeline of WIST milestones on the following two pages.**



# Timeline Notes WIST Milestones



WIST is launched with presentation in Dreyfus University Center featuring Congressman Dave Obey, who secured major funding through the U.S. Department of Agriculture.



WIST convenes first meeting of its newly formed Advisory Board, comprising leaders from industry, business development groups and research organizations.



WIST researchers Don Guay and Eric Singaas awarded patents for production of isoprene from cellulosic sugars using genetically modified bacteria.



First annual Focal Point conference is hosted by WIST, features UW-Stevens Point research across campus.



Compostability Lab launched, becomes the only university-based lab in U.S. providing testing to ASTM standards for compostability to help companies develop sustainable packaging.



RiverPoint® fine art paper, developed in a collaboration by WIST, Department of Art and Design, and Department of Paper Science and Engineering, debuts for public at Print:MKE, a printmaking conference in Milwaukee.



WIST and partners secure two Economic Development Incentive grants to pursue opportunities in specialty paper and cellulose processing innovation to grow Wisconsin's economy.



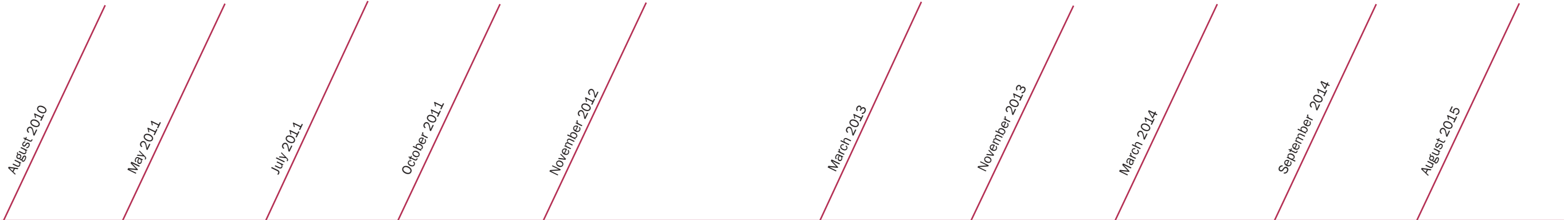
WIST develops two additional grades of RiverPoint paper for Pacon Corporation, a Wisconsin company, and the three papers are marketed as Strathmore® RiverPoint® printmaking papers, launched at national trade show in Pittsburgh.



WIST professional short courses expand to include fundamentals of formation and papermaking additives, building on WIST's portfolio of courses in papermaking and sustainability.



Cellulose Pilot and Processing Lab biorefinery construction nearly complete; projected operational in late October 2015, will work with companies on new ways to process cellulose into chemicals, textiles, packaging and fuels.





# Specialty Paper

WIST made big strides over the past year toward its goal of helping Wisconsin's pulp and paper industry take advantage of growth potential in specialty paper markets. An Economic Development Incentive grant from UW System awarded to UW-Stevens Point in November 2013 has been a key to these advances.

Specialty papers are those designed for specific applications and in the broadest sense include all products beyond typical printing paper and tissue. Examples include labels, coated papers and packaging.

"Specialty paper has emerged as a lucrative segment for the paper industry," according to a report in *marketsandmarkets.com* published in June. The report notes that specialty paper is projected to be the fastest-growing segment of the paper industry from 2015-2020, and within the sector, packaging and labels is expected to be the largest market.

One driver for specialty paper's growth is the demand for more sustainable packaging, particularly in food packaging. Innovations in paper coatings are allowing new uses that can compete directly with plastics in many applications, yielding packaging made from renewable materials. Additionally, research and development work is being done to produce paper-based packaging that is either repulpable or recyclable or is compostable, yielding additional environmental benefits.

WIST assists industry with papermaking including grade development, additive studies and small production runs. The institute has worked with several companies over the past year on grade development for specialty papers and has additional projects in the pipeline. Unique capabilities allow the institute staff to take a project from conceptual stage through piloting on the university's Fourdrinier paper machine.

The addition of a pilot coater and laminator in 2014, purchased with the grant funds, builds on this capacity. The Faustel LabMaster™ Coating Line can handle paper, film, foil and nonwovens on

roll sizes up to 300mm wide and at speeds of up to 30m/min. Gravure roll and slot die coating; water-based or solvent-less formulations; and dry bond laminating are all within the machine's capabilities.

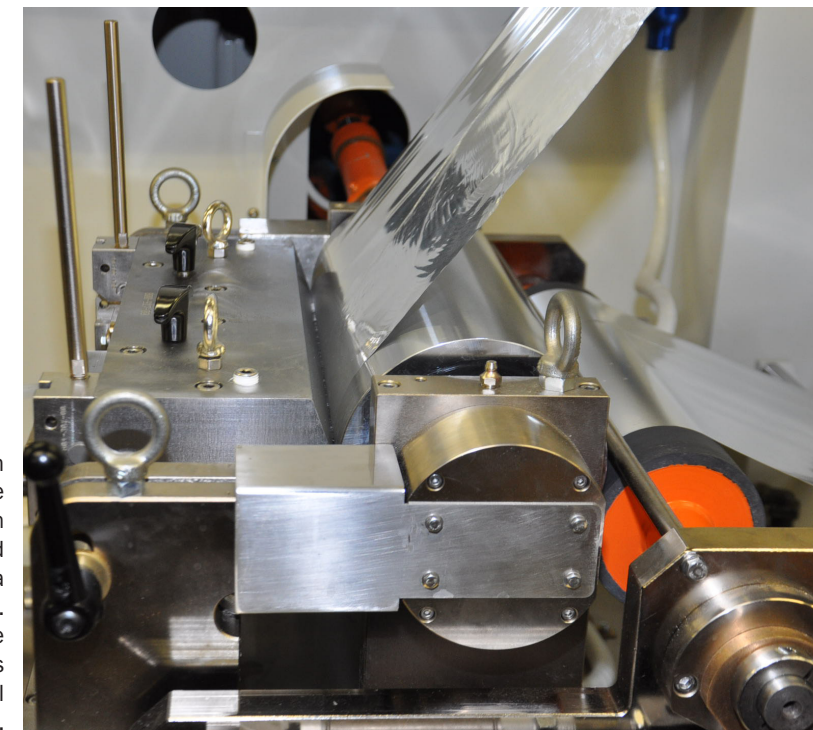
The coater and laminator pilot line is used in classes for the university's paper science and engineering program, and WIST offers a two-day introductory course on coating and laminating for industry professionals. The course was designed by Roland Gong, UW-Stevens Point assistant professor of paper science and engineering. Gong also teaches the short course for WIST.

Other specialty paper services include compostability testing, and pulping and bleaching trials with wood and non-wood biomass including food processing by-products and agricultural residues.

The UW System grant also funded upgrades to the university's pilot paper machine and development of new professional short courses for the paper industry, which were provided at no cost to 78 participants from 19 different companies as part of the pilot program to create the courses.



The reel on the UW-Stevens Point pilot paper machine takes up RiverPoint® 100 percent cotton printmaking paper during a recent production run. The paper, developed at UW-Stevens Point, is marketed across the U.S. and Canada by Pacon Corporation under a licensing agreement. WIST also developed two additional grades of RiverPoint, with wood fiber, for Pacon that are produced in larger volume at a commercial mill in Wisconsin.



Foil advances from rollers toward the coating elements in the pilot coating and laminating line during a trial run for WIST staff. The pilot line can handle a range of substrates including paper, film, foil and nonwovens.



Lindsey Hoffman, WIST papermaking and laboratory project specialist, center, uses the touch screen control panel on the coater and laminator to make adjustments during a trial run, as three WIST student summer employees observe. The pilot line is used both to assist industry and as an educational tool for the university's paper science and engineering program.



# Cellulose Pilot and Processing Lab

This has been a building year for the Cellulose Pilot and Processing Lab (CPPL), a research facility being developed in a partnership between WIST/UW-Stevens Point and American Science and Technology, a private company with operations in Wausau.

Cellulose is a primary component of biomass and one of the most abundant materials on Earth. Innovative companies are looking into new sources of cellulose and new ways to process cellulose into chemicals, textiles, packaging and fuels. The CPPL is intended to serve as a facility at which businesses can test processes in collaboration with UW-Stevens Point researchers. One of the goals is to find new value in material that currently is considered waste, and the CPPL will be working with a wide range of biomass including agricultural waste such as residuals from harvesting or from food processing, forestry products or waste, or other waste material in any form from sawdust to wood chips.

The Economic Development Incentive Grant from UW System funding construction of the CPPL originally had an end date of June 30, 2015, and the goal was to have the facility completed by that time. However, the grant was extended (with no additional funding) to December when it became clear that the biorefinery could not be finished by June. There were some delays in equipment procurement, and it turned out that more extensive building modifications than expected were required to meet safety codes.

Eric Singaas, WIST director of research, said he is not worried about the delay of several months in getting the CPPL fully operational.

"It's normal for anything of this size," Singaas said. "There's always some redesign and there's always some unforeseen problems."

And after those earlier delays, construction is proceeding rapidly. Wisconsin is home to outstanding manufacturing and construction capabilities and in building the pilot plant, AST relied on local suppliers as much as possible.

Baisch Engineering of Kaukauna designed the digester, which has to handle operational pressure of 400 PSI and is constructed of stainless steel.

"This is the heart of the whole system," said John Guenther, the biorefinery plant manager, as he showed a visitor the digester. The walls of the jacketed tank are 1 ¼ inch thick and the specialized manufacturing capability to roll that heavy stainless steel material and construct the pressure vessel was found at Northland Stainless in Rhinelander.

Guenther noted other Wisconsin suppliers included Amerequip, an engineering, design and manufacturing company in Medford, Urban Construction, a commercial contractor in Wausau, and August Winter and Sons, a mechanical contractor headquartered in Appleton.

The biorefinery at the AST facility, with a capacity to process two tons of biomass per day, is one part of the CPPL. The second aspect of the unit is the laboratory at UW-Stevens Point, where researchers test processes at bench-top scale.

"At the university level we focused most of our capacity-building in the fermentation lab," Singaas said. "We've built the lab and we've begun serving customers with that fermentation lab already."

The university lab now includes six half-liter fermenters, which allow researchers to test multiple parameters simultaneously, and a 20-liter fermenter that allows trials at a larger scale.

"We've already begun using that equipment to demonstrate mostly cellulosic ethanol, but also biobased products production from various kinds of biomass," Singaas said. "We completed a large piece of work using waste products from the paper mill industry and used those fermenters to then test the conversion of the waste products into fermentable sugars and then the conversion of that into ethanol. We are currently bidding out two projects for conversion of residual waste products from two different industries into ethanol or other biobased chemicals."



The CPPL biorefinery is located in the Wausau West Business and Industrial Park.

## Cellulose Pilot and Processing Lab capabilities

- Biochemical reactors for up to 400 PSI and 450 degrees F
- High pressure/high temperature fractionation
- Solvent recovery
- Pulp production, washing, drying
- Acid and enzymatic hydrolysis
- Sugar purification and dehydration
- Fast pyrolysis
- Fermentation
- Paper making and testing
- Analytical/experimental analysis
- Independent process/products development and evaluation
- Biomass characterization
- Chemical analysis



The digester, left, at the pilot plant in AST's Wausau plant, with 450 kg capacity, is shown during installation of equipment in August 2015. Plastic and draped cloths protect the high pressure, stainless steel tank while other equipment is welded into place. Above, a view into the digester is shown.



# Research Update



Eric Singaas

In the past year, WIST research has both deepened and broadened its capabilities and the areas in which it is active. Eric Singaas, WIST director of research, said much of the core work still revolves around cellulose, which is present in substantial amounts in waste streams at pulp and paper mills, but the institute is exploring new opportunities as well.

“We have made good progress in our understanding of the opportunities around pulp and paper waste,” Singaas said. “We knew in the past we could convert them into biobased products. So the advances in the past year came in discoveries that allowed us to do that more efficiently, to do it for lower costs, and to bring it to a place where it becomes an attractive economic opportunity

for an ethanol plant or a paper mill.” The researchers have two patent disclosures related to isoprene production now under review, have published a paper on their findings on bioconversion of paper mill sludge to bioethanol, and have several additional papers either under review or scheduled for publication.

In addition, with funding from an Economic Development Incentive grant from UW System, WIST was able bring on board post-doctoral researcher Raghu Gurram and enlist help from Malek Alkasrawi, an assistant professor of paper science and engineering at UW-Stevens Point.

“Through work with Malek and Raghu, who are chemical engineers, we can actually put some numbers on what it would cost to build a plant to do this and what it would cost to operate this,” Singaas said. “So we’ve pushed the ball

down the road in terms of moving it from the laboratory scale to at least an engineering diagram that could potentially be used by a mill.”

Another component of woody biomass, in addition to cellulose, is lignin, the substance that gives the plant its structural strength, sort of what puts the “wood” in “woody.” Lignin has for the most part been treated as low-value by-product of the bio-separation process and is typically burned as fuel. More recently, however, there has been new interest in finding higher-value uses for lignin. The bio-separation process developed by WIST produces a lignin with high purity.

“We’re providing lignin samples now to three different research groups to develop products out of it and these include everything from solvents to chemicals to fuel to plastics,” Singaas said. “And one person is working with adhesives, to develop a formaldehyde-free adhesive for plywood and other applications.”

Singaas and several partners have created a spin-off business, Refined Bioproducts, which is doing market research on the economic potential of products that could be developed by WIST and its partners.

One category would be biobased chemicals that are functionally equivalent to petroleum-based chemicals but are new products on the market or being developed for the market, and it’s important to understand how soon those markets will develop.

“Through Refined Bioproducts, we’re talking with investors about the opportunity to invest in full-scale biomass to biobased chemicals production, skipping over paper and skipping over ethanol,” he said. “What is the opportunity to connect our biomass resources in the Upper Midwest with the chemical industry?”

WIST is also working with the local agriculture industry, exploring possibilities for value-added products such as nutraceuticals – health-enhancing additives – from agricultural products.

Singaas had a recent conversation with Mike Demchik, a UW-Stevens Point professor of forestry who is involved with other researchers in a long-term project to develop hazelnut as a new oilseed crop for farmers in Wisconsin and elsewhere. There are husks around the hazelnut and the group is interested in learning if value lies there as well.

“They want us to analyze those for phenolics, potentially valuable compounds,” Singaas said. “What you call extractives, products

derived from various kinds of agricultural products – that’s turning into a good niche.”

**WIST researchers have two patent disclosures related to isoprene production now under review and have published a paper on their findings on bioconversion of paper mill sludge to bioethanol.**



Raghu Gurram, a WIST research associate in chemical engineering, works in the fermentation lab.



WIST research associate Shona Duncan, a fermentation specialist, is shown with the recently installed 20-liter fermenter in the WIST lab.



# New Opportunity for Wisconsin Agriculture

## Cold-climate grapes could become a source of value-added products for the health and wellness industry

Many people have heard of the health benefits claimed for drinking red wine. Probably fewer are familiar with the chemical, called resveratrol, found naturally in grapes and identified with these health enhancements. But resveratrol is now used in a growing number of health supplements.

“Most resveratrol in these products is now sourced from China,” says Paul Fowler, WIST executive director. “It’s produced from Japanese knotweed and the quality can be uneven.”

Fowler saw potential for Wisconsin in tapping the growing market. The idea fit well with the institute’s goal of helping Wisconsin agriculture by developing new, value-added uses of crops, particularly in ways that make use of non-food parts of plants or residual products from processing.

In a collaborative project, WIST is working with Dick Okray, whose Plover Family Farms is growing the grapes on a two-acre test plot west of Plover. Paul Skinner, a California wine producer and UW-Stevens Point alum, provided advice on vineyard establishment, including selection of grape varieties with which to start. He continues to provide advice on culturing the grapes.

Just as resveratrol is thought to have health benefits for people, it may also help the plants ward off threats: grape plants produce resveratrol in response to stress. Growing the grapes in Wisconsin’s climate, with its harsh winters and hot, humid summers, will add stress and should elevate resveratrol production.

The test plot holds nine varieties of grapes. Over the next three years each will be evaluated to see which grow best and produce the most resveratrol. WIST researcher Shona Duncan, a fermentation specialist with a doctorate in biological sciences

from the University of Waikato in New Zealand, has done the laboratory work on the project. She has confirmed that the highest resveratrol concentration is not in the grapes but in the canes and in the peduncles that hold the grape clusters.

The project also will determine whether the plants contain higher concentrations at different times of the year. Prunings from the vines will be tested throughout the season. Other variables that could increase the resveratrol concentration involve how the grapes or prunings are stored, so WIST will test material throughout the off-season as well.

Current practice is to either burn or compost the vines that are pruned, so this project could turn a residual product into a source of a valuable commodity.

“The goal is to develop knowledge that can be shared with other producers,” Fowler said. “Ultimately, we’d like to see this as an opportunity growers across Wisconsin can tap into.”



In spring 2013, project partners discuss the project at the future test plot site. From left are Dick Okray, Gabrielle Eck, Paul Fowler and Paul Skinner.



Clockwise from top left: Workers at Plover Family Farms plant grape varieties in prepared ground in spring 2014; Gabrielle Eck, who is managing the test plot for Plover Family Farms, checks on vines prepared for winter in October 2014; the grape vines, having come through the winter and extended new shoots, are being trained onto trellis wires in June 2015. The black hoses provide drip irrigation.



# Education Update

## Focal Point 2015

**Paper-Based Food Packaging and Serviceware**  
Enhanced performance and reduced environmental footprint

**October 20/Dreyfus University Center, UW-Stevens Point**

As part of its portfolio, WIST Education each year plans and delivers the one-day Focal Point conference. While the last two conferences have featured presentations on both plastic film and paper in packaging and converting, this year the annual event focuses squarely on paper-based materials and products.

Paul Fowler, WIST executive director, says the conference theme reflects increased interest in broadening applications for paper in food packaging and serviceware. Recent research and development work has resulted in improved performance of paper-based products.

“The conference has tended to have a regional focus, but we anticipate success in drawing a number of delegates from all around the U.S. as we have each year,” Fowler said. “We expect participation from QSRs, paper manufacturers, converters, composters and the like.”

While some details haven't been settled as of this publication date, WIST has announced the keynote speaker and several session presenters. Brent Denniston, senior vice president for business development/international operations at LBP Packaging, will discuss momentum that paper-based serviceware is achieving in the market and look at what may be on the horizon.

Denniston has unique perspective from both the retailer and the supplier side. Prior to arriving at LBP, Denniston was the global procurement manager for packaging at Starbucks, which has worked to reduce waste in its packaging and find new materials including recycled fiber.

Other speakers already confirmed for Focal Point 2015 include Nicholas Jermstad of Intertek, Jeffrey Leitinger of Dow Chemical, Michael Richmond of HAVI Global Solutions, Erin Weinland of WestRock and Brian Lansing of Cargill.

### Education division highlights

- Organized and hosted industrial composting workshop in conjunction with Wisconsin Integrated Resource Management Conference
- Organized and hosted Focal Point 2014: Packaging at the Leading Edge
- Created new courses in coating and lamination, biomass bioeconomy, and nanotechnology
- Conducted six courses in papermaking hands-on series, including new courses in papermaking additives and managing and optimizing sheet structure
- Papermaking courses improved professional skills and knowledge for 78 participants from paper mills and related industries; participants overwhelmingly said they would recommend the courses to others

### Focal Point 2014: Packaging at the Leading Edge

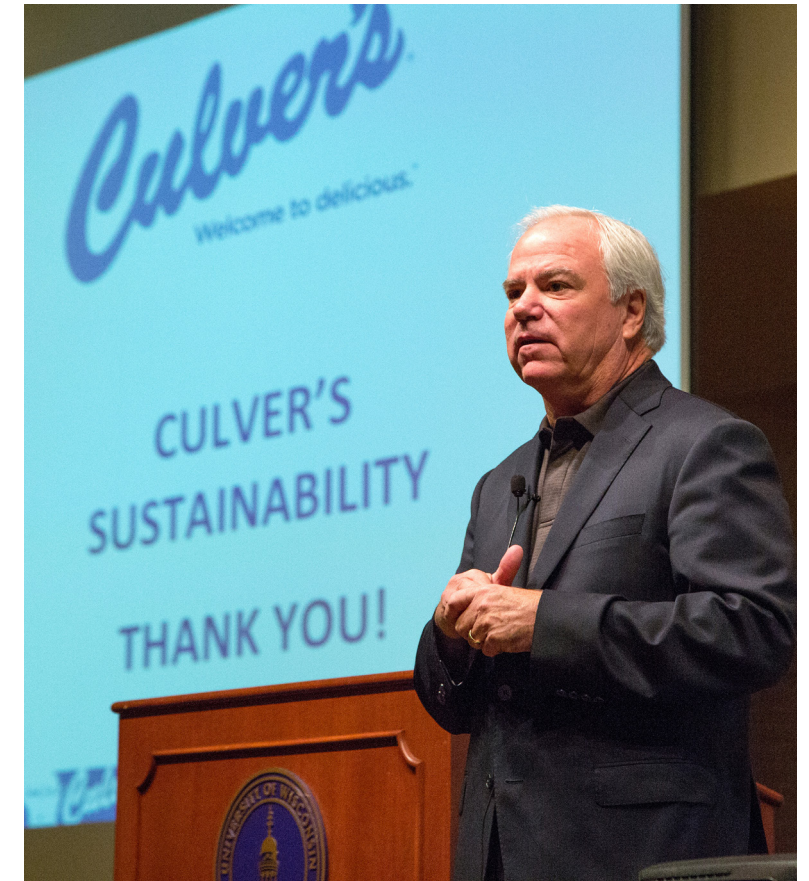
#### The fourth annual conference was held October 24 at UW-Stevens Point

Opportunities for sustainability gains in food and beverage packaging exist from the supply chain through end-use and end-of-product-life solutions, speakers at Focal Point 2014 told conference delegates.

The conference was held at the Dreyfus University Center on the UW-Stevens Point campus October 14. The agenda ranged from a panel discussion on sustainable sourcing of fibers to presentations on compostability and recycling solutions. News coverage of the event by WSAW television of Wausau, Wisconsin, highlighted how the packaging industry is working to improve sustainability.

The conference opened with a keynote address from Craig Culver, cofounder and CEO of Culver's. The restaurant chain has grown in 30 years from a single family-owned restaurant in Sauk City to more than 500 locations in 22 states. Culver described sustainability initiatives undertaken by the company including recycling in the restaurants, use of packaging made from recycled material, and construction of a LEED-certified restaurant in Baraboo. Following his presentation, Culver stayed for a lively question-and-answer session of nearly half an hour.

Other presentations were: “Waste prevention and recycling: the correct manufacturing strategy,” Tim Haggerty, Ocean Spray; “Food waste: science, solutions and perceptions,” Daniel Daggett, Sealed Air; “Sustainably sourced



Craig Culver, cofounder and CEO of Culver's, addresses the Focal Point 2014 audience in a keynote address.

biobased polyethylene,” James Kahn, Braskem; “Responsible fiber sourcing: a panel conversation,” Panelists: Robyn Buma, Global Procurement Director-Paper, Avery Dennison; Ian Lifshitz, North American Director of Sustainability & Stakeholder Relations, Asia Pulp & Paper; Scott Peplinski, Director of Sustainability and Product Stewardship, NewPage Corporation; “Where food packaging and FDA regulation and enforcement collide: how to package your risk on the new food safety battleground,” Shawn Stevens, Gass Weber Mullins; “Barrier coatings and laminates for paperboard,” Paul Corcoran, Asia Pulp & Paper; “Ecostar: challenges and successes with closing the loop,” Nicole Bookhout and Megan Moore, Placon; “Compostable packaging: food for thought,” Michele Riggs, Cedar Grove. The conference concluded with a tour of UW-Stevens Point's new Faustel Coating and Laminating Pilot Line.



# Laboratory Services Update

When WIST was founded five years ago, the institute's first director of laboratory services, Don Guay, filled the role on a part-time basis while also serving as a full-time faculty member in paper science and engineering. When Guay left to take a job in the private sector, WIST experimented with putting a full-time director of lab services in place. When that person also returned to the private sector in late 2014, WIST Executive Director Paul Fowler took on a more direct role in supervising laboratory services. At the same time some of the other duties of the lab services director were spread among staff. And while there has been some turnover in top lab management, the opposite is true in the rest of the staff, Fowler noted, which makes his job easier.

"I think we've got a well-trained, highly competent and stable staff within the lab services section," Fowler said. "And that makes management and business development within that group a little more straightforward."

The institute provides a range of paper testing and analysis services as well as pilot-scale work on the UW-Stevens Point Fourdrinier paper machine. In addition to extensive services for the paper industry, WIST has analysis capabilities including gas chromatography and mass spectrometry.

A major emphasis during the past year has been on the work to get WIST's compostability testing

lab certified to the ISO (International Organization for Standardization) 17025 standard. This is the main standard used for calibration and testing laboratories and is considered the standard for accreditation deeming a lab technically competent.

**WIST has fulfilled 32 contracts for services to industry in the past year**

of creating the final draft of a quality manual, all of the standard operating procedures that must accompany it, and the record keeping system that goes along with all that."

"The process is very involved," Fowler said. "We've gone through a preliminary stage, in which an ISO auditor spent two days with staff here reviewing policies and procedures. We're in the process

With upcoming audits by ISO scheduled this fall, WIST is on track for certification by the end of 2015. Along with ISO 17025, WIST is on track for certification as an approved compostability test provider by the Biodegradable Products Institute (BPI). WIST tests material according to ASTM D6400 and D6868 standards to determine whether a product will compost under industrial composting conditions. BPI licenses its logo to organizations that have products tested by approved labs.

"Companies can have their product tested by our lab right now, and we in fact have done or are doing work for a number of organizations and companies," Fowler said. "But having the ability to add that BPI logo will be important to companies that want to use it for market differentiation, so obtaining these certifications is going to add market value to the testing we do."

WIST is also one of just a handful of organizations in the U.S. approved by the Fibre Box Association to perform the Voluntary Standard for Repulping and Recycling Corrugated Fiberboard. WIST performs the protocol with private industry partner IPS Testing of Appleton. The protocol is used to certify the repulpability and recyclability of wax alternatives for corrugated products that have been treated to improve performance in the presence of water and water vapor. IPS performs the bench-top scale part of the protocol and WIST performs the pilot scale test in the UW-Stevens Point pilot plant.



Lindsey Hoffman, WIST papermaking and laboratory projects specialist, performs a lab test to determine the lignin content of paper sent to WIST for analysis. Katie Ebelt, in background, a Paper Science and Engineering student employed by WIST, pulps another sample of the paper for an additional trial.



Amber Davidson, WIST compostability lab manager, checks vessels in a temperature-controlled unit in the laboratory.



# WIST Advisory Board Adds New Members

Since its formation in early 2011, the WIST Advisory Board has met 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. The board members, all accomplished in their own fields, lend their expertise and provide critical links to economic sectors WIST seeks to help with its research, education and laboratory services.

Several members left the board in the past year, with our appreciation for their service. Leaving were Dave Mead, founder of Lucigen and co-founder of C5.6 Technologies; H. Tony Hartmann, co-founder of Great

Lakes Ag Energy; and Troy Runge, assistant professor of biological systems engineering at the University of Wisconsin-Madison and former director of the Wisconsin Bionenergy Initiative. All were charter members of the advisory board. Also leaving was Duane Maatz, former executive director of the Wisconsin Potato and Vegetable Growers Association, who served a two-year term.

Joining the board were Mary Blanchard, associate director of the Wisconsin Energy Institute, and Tamas Houlihan, executive director of the Wisconsin Potato and Vegetable Growers Association. Short, introductory bios of Blanchard and Houlihan are on the opposite page and a complete listing of the current board membership is below.

## Advisory Board Members

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

Ed Buehler  
Vice President, Business  
Development - Specialty  
Verso Corporation  
Stevens Point, Wisconsin

Tad Campana  
President  
Services Plus, Inc.  
Green Bay, Wisconsin

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

Meleesa D. Johnson  
Director  
Marathon Co. 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

Peg Sullivan  
Executive Director  
Centergy, Inc.  
Wausau, Wisconsin

Lori Dehlinger Van Alstine  
Executive Director  
Portage County Business Council  
Stevens Point, Wisconsin

Ted Wegner  
Assistant Director  
U.S. Forest Service  
Forest Products Laboratory  
Madison, Wisconsin

## New member introductions



Mary Blanchard

**Mary Blanchard** is the Associate Director of the Wisconsin Energy Institute at the University of Wisconsin-Madison. Focused on real-world energy innovation and opportunity, the Wisconsin Energy Institute supports clean energy research, moves new technology toward commercialization, and prepares students for future leadership in the energy sector.

Formerly the Director of Marketing and Governmental Affairs at Virent, Inc., Blanchard brings extensive knowledge of the biofuel industry and a broad understanding of the economic, social and environmental opportunities created by sustained, cross-disciplinary research on energy. Her career spans nearly twenty years of industry experience in business development, product management, governmental relations, and international and domestic marketing.

Blanchard holds a B.S. in Electrical Engineering and B.A. in English from the University of Notre Dame. She has also earned a M.Sc. from the London School of Economics and a M.B.A. from the Kellogg Graduate School of Management at Northwestern University.



Tamas Houlihan

**Tamas Houlihan** was named executive director of the Wisconsin Potato & Vegetable Growers Association (WPVGA) on December 4, 2014, by the WPVGA Board of Directors. For the previous 27 years, Houlihan served as the managing editor of The Badger Common Tater magazine, the official voice of the Wisconsin potato and vegetable industry. During that time, he also held the title of communications director. In the fall of 2014, Houlihan was in his third stint as interim executive director, having filled the role in 2000 and 2008. With his appointment in 2014, Houlihan became the thirteenth executive director of the state's potato association, which was founded in 1948. Headquartered in Antigo, Wisconsin, the WPVGA is a \$1.5 million trade association with more than 350 members. The organization's priorities include research, marketing, education and governmental affairs.

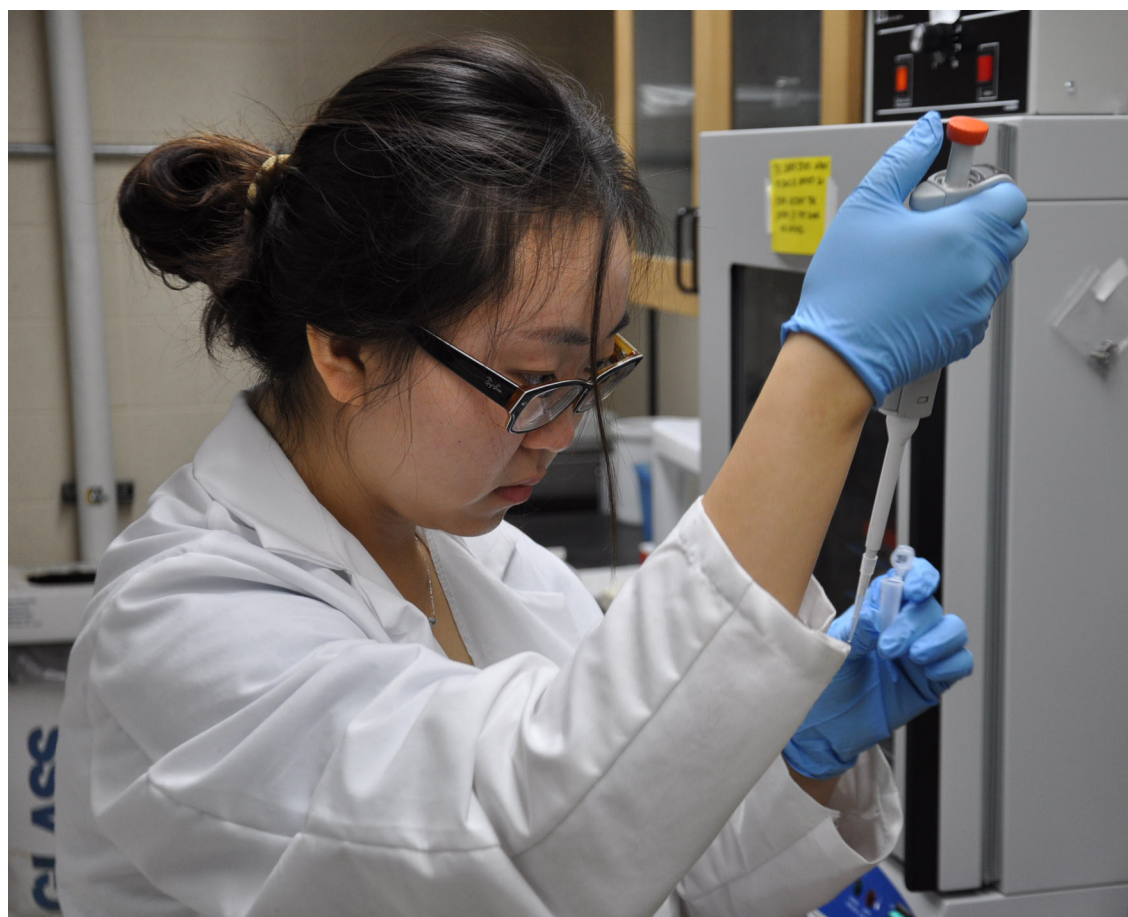
A 1985 graduate of UW-Stevens Point, Houlihan has a bachelor's degree with a double-major in communication and German. He received the Chancellor's Leadership Award and the Albertson Medallion at UW-Stevens Point. He worked as the sports editor and news editor at the Rhinelander Daily News before joining the WPVGA in 1987. At the WPVGA, Houlihan received a Distinguished Service Award in 1997; the President's Award in 2001; the Agri-Communicator Award in 2008; and the Wisconsin Seed Potato Industry Leadership Award in 2011. He received the WPVGA President's Award again in 2015.

Houlihan lives in Stevens Point with his wife, Paula. They have seven children, including two teenage daughters who still live at home. Tamas enjoys biking, playing softball, traveling and reading. He is an avid sports fan who loves football (especially the Green Bay Packers), basketball and baseball.



# Students Learn and Earn with WIST

The institute's research projects and laboratory services provide opportunities for students to gain experience working on real-world projects



Bohye Jeong, a senior in biochemistry at UW-Stevens Point, prepares material for PCR (polymerase chain reaction) to clone DNA for use in a research trial in the WIST laboratory. Jeong, an international student from Seoul, South Korea, is one of 22 students employed by WIST in the past year.

While many college students look forward to a break from campus and to summer sunshine, Bohye Jeong has spent a considerable part of her summer under fluorescent lights in the basement laboratories of the Wisconsin Institute for Sustainable Technology.

Jeong, a senior in biochemistry, is doing biotechnology work as part of the institute's research into deriving valuable, renewable chemicals from biomass. She is working under Alex Rajangam, a post-doctoral research associate in molecular biotechnology. Jeong plans to go on to graduate school after earning her undergraduate degree at UW-Stevens Point. The experience she gains working on research here will strengthen her graduate school applications, she said recently, as she carefully prepared material for a laboratory procedure.

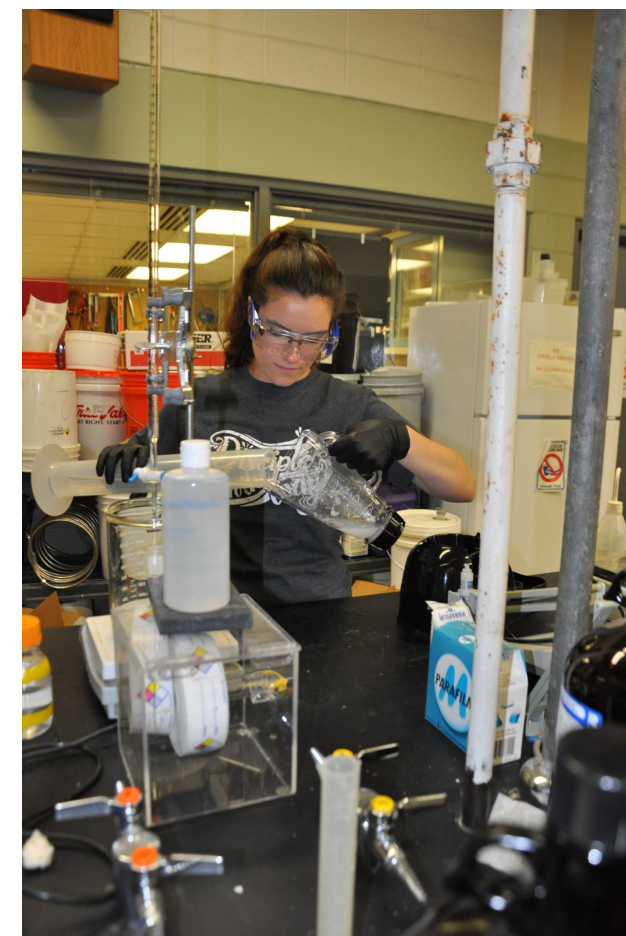
Jeong is one of 22 UW-Stevens Point students WIST employed part time and paid in the past year. While some students assisted on various aspects of research, others gained experience in paper testing and analysis as part of WIST laboratory services. Students worked on a range of projects including compostability testing, specialty paper production and paper grade development.

Student employees assisted on paper machine runs to make RiverPoint® fine art paper for Pacon Corporation. The paper, which was developed by WIST and partners at UW-Stevens Point, is marketed nationally and in Canada as Strathmore® RiverPoint paper.

Talented and motivated UW-Stevens Point students provide valuable extra hands on many WIST projects while they earn a paycheck and gain experience not found in the classroom. It's a great partnership.



At left, Ben Domasky, a sophomore in paper science and engineering, takes a newly produced roll of RiverPoint fine art paper off the pilot paper machine. Below, Katie Ebelt, a sophomore in paper science and engineering, prepares pulp for a paper analysis test.





# Conferences and Other Outreach

WIST communicates news about its work through a variety of means, including its website, regular e-newsletters, reports and publications. Institute staff also attend conferences and trade shows throughout the year, not only to spread the word about WIST but to gain industry knowledge and keep current on practices and procedures. Below is a sampling of that communication effort during the past year.

Lindsey Hoffman, Brian Bandow and Ron Tschida hosted a trade show booth with IPS Testing at PaperCon in Atlanta in April. Hoffman and Bandow also participated in the related conference, attending sessions on various aspects of papermaking and new products.

Angie Hauer and Ron Tschida hosted a trade show booth with IPS Testing at SustPack in Orlando, Florida, in March. The conference focus on sustainable packaging drew numerous attendees with interest in WIST's specialty paper services and testing capabilities.

Eric Singaas hosted a booth highlighting the capabilities of the new Cellulose Pilot and Processing Lab at the International Biomass Conference in Minneapolis in April.

WIST researchers Raghu Gurram, Shona Duncan and Eric Singaas, along with UW-Stevens Point faculty member Malek Alkasrawi and two additional authors published a paper in *Bioresource Technology*. The paper, "Bioconversion of paper mill sludge to bioethanol in the presences of accelerants or hydrogen peroxide treatment," reports on an aspect of the institute's research into value-added

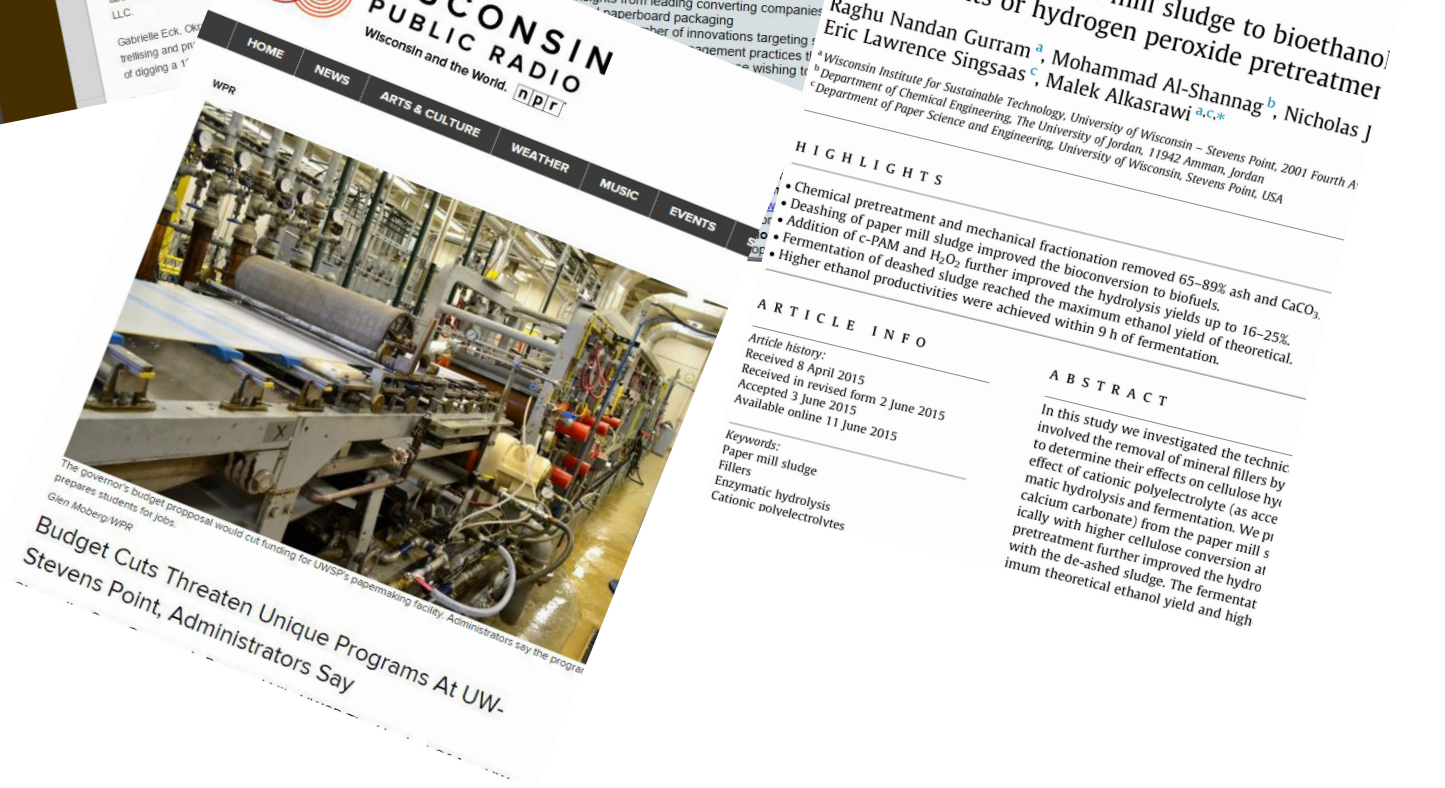
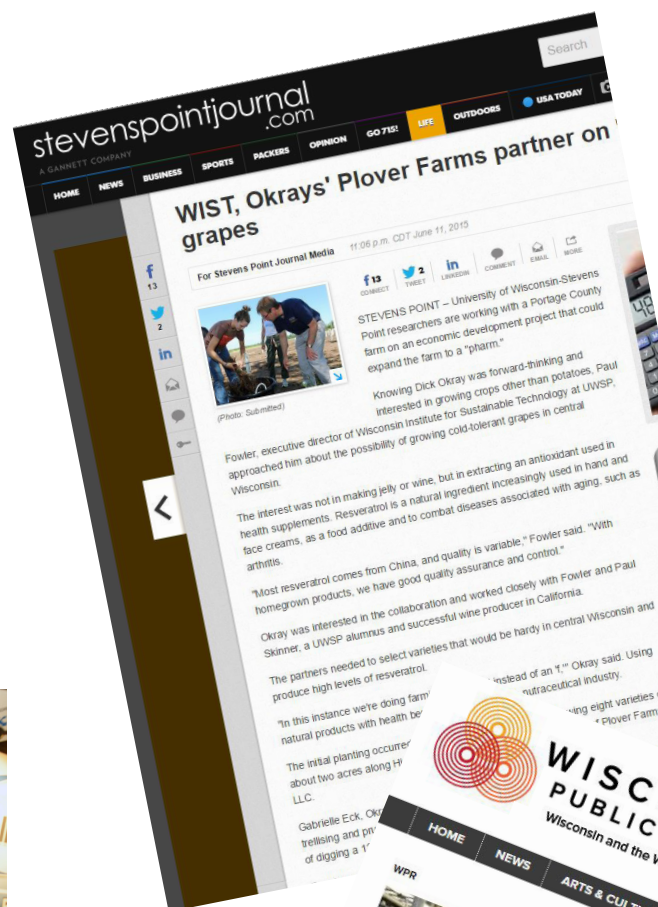
uses for materials currently treated as waste. Gurram, Singaas, Alkasrawi, with others, coauthored "Technical possibilities of biofuel production from coffee pulp for the production of renewable fuels," currently in press at *Clean Technologies and Environmental Press*.

Gurram, Duncan and Singaas have coauthored several other publications currently under review by publications.

In addition, Gurram, Duncan, Alkasrawi and Singaas made four presentations on their work at the 2015 Wisconsin Science and Technology Symposium held July 27-28 at UW-River Falls.



Lindsey Hoffman, WIST laboratory and papermaking project specialist, is shown with the institute's display at PaperCon in Atlanta in April. WIST marketed its laboratory services and specialty paper development work at a trade show co-hosted with IPS Testing, a private-industry partner of WIST.





# WIST Staff

## Administration



Paul Fowler

Paul Fowler, WIST executive director, has 17 years of experience in contract research and development of new products and opportunities from biobased materials. At WIST, Fowler is networking 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 Ph.D. in organic chemistry and extensive knowledge of biobased, renewable materials and applications.



Angie Hauer

Angie Hauer, WIST development coordinator, coordinates daily office activities, supplies and correspondence. She has a bachelor's degree in resource management from UW-Stevens Point and a master's in outdoor recreation administration from Southern Illinois University at Carbondale.



Ron Tschida

Ron Tschida, WIST communications manager, handles public relations, marketing and outreach, institute publications and the WIST website. Before coming to UW-Stevens Point in 2005, Tschida 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 the 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 BS in Business Management from Upper Iowa University.

## Research and Laboratory Services



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 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 B.S. in water resources and a minor in soil science and business administration.



Shona Duncan

Shona Duncan is a research associate at the WIST. After receiving her doctorate in biological sciences from the University of Waikato, New Zealand in 2007, she studied fungal diversity and cellulose degradation in the Ross Island historic huts, Antarctic. Duncan has been involved in a project investigating fungal decay mechanisms and their potential use in the biofuels industry for feedstock pretreatment and hydrolysis of carbohydrates to glucose. While working at the University of Waikato, Duncan gained experience in running bench top and 600 L fermenters. She will be using that knowledge and experience while at WIST to scale up the bench top fermentation of sugars to isoprene to pilot scale (100 L) capabilities.



Raghu Gurram

Raghu Nandan Gurram was appointed a research associate in chemical engineering at WIST in July 2014. He received his Ph.D. in chemical and biological engineering from the South Dakota School of Mines and Technology in December 2013, with research focus on "Separation Techniques for an Efficient Conversion of Lignocellulosic Biomass to Biofuels." As a fermentation specialist, he got hands-on experience from lab to commercial scale bio-butanol fermentation (5 L to 1000 L) during scale up studies at Cobalt Technologies located in Mountain View, California. Presently at WIST, his research focus is on biochemical conversion of paper mill wastes and Wisconsin lignocellulosic forest residues to biofuels and value-added chemicals in establishing the source of revenue with experimental and economic feasibility studies using ASPEN PLUS software. Gurram is also collaborating with American Science and Technology (AST) in Wausau, providing his expertise in an economic investigation of moving its pilot scale facility to commercial scale.



Justin Hall

Justin Hall is an instrumentation specialist at WIST. He provides analytical 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.



Lindsey Hoffman

Lindsey Hoffman carries out industry-focused projects and work performed on the UW-Stevens Point pilot paper machine as well as paper testing provided 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 from UW-Stevens Point.



Alex Rajangam

Alex Rajangam is a molecular biotechnologist and has worked in various projects related to biosynthesis, biodegradation and bioconversion of lignocellulosic biomass and channelizing the processed biomass to various economically viable products using microorganisms. He is an expert in metabolic engineering of microorganisms that can potentially make biofuels and other biomaterials. Rajangam got his Ph.D. in the field of wood biotechnology at KTH, Sweden. During his doctoral research, he worked with discovery, characterization of Carbohydrate Active Enzymes (CAZymes) involved in wood biosynthesis and degradation in poplars and wood rotting microbes, respectively. He has worked in Indo-Israel, Swedish, European, Swedish-US and ARPA-E (DOE) funded projects during his career. Currently he is working as a research associate at WIST to develop various projects by metabolic engineering of microorganisms to make biofuels by transforming cellulose-rich biomass. The goal is to move research from lab scale to industrial scale production of various biofuels and useful biochemicals.



Eric Singaas

Eric Singaas is the director of research at WIST. He applies his scientific training to research in biofuel and bioproduct production, focusing on developing microbial pathways to produce isoprene from biomass. Singaas received his Ph.D. in botany from UW-Madison in 1997 studying the production of isoprene from oak and kudzu leaves. He went on to investigate the impacts of increasing greenhouse gases on forest ecosystems in Free Air CO<sub>2</sub> Enrichment experimental systems in North Carolina and Wisconsin. He has studied biological hydrocarbon production and plant-atmosphere gas exchange, working on scales ranging from genes to ecosystems.

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**The Wisconsin Institute for Sustainable Technology –**

*Creating sustainability solutions  
and economic opportunities*

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

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