



## Biological Systems Engineering

UNIVERSITY OF WISCONSIN-MADISON

# 2013 Annual Summary of Teaching, Research & Extension

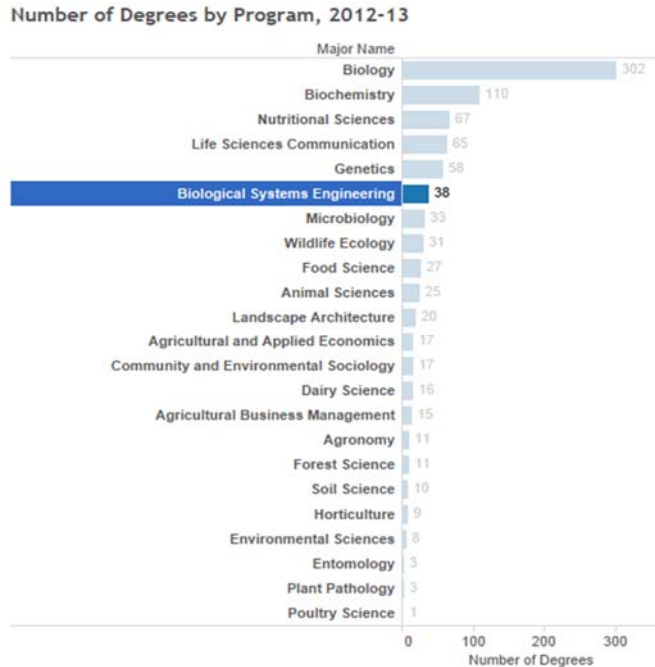
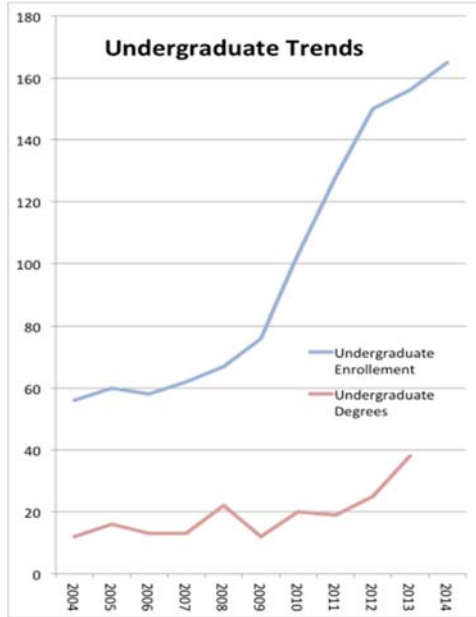


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University of Wisconsin-Madison

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## Executive Summary

We just completed a 10-year review of our program for the college and campus. A lot has been happening in the department in the past decade and I am happy to report that the Biological Systems Engineering program is thriving.



Undergraduate enrollment is at an all-time high with continued growth projected into the future. We have become one of the largest of the applied agriculture departments in the college as indicated by number of degrees granted by program. The success of our undergraduate program is great news and has stressed our instructional capacity, especially for our lab courses.

We attribute this growth to our relevance in meeting the grand challenges at the intersection of population growth, quality food supply and, environmental quality, combined with our reputation of high-quality, personalized instruction and the success of job placement for our students.

Our graduate instruction and research programs are also thriving with major growth in research grants and associated graduate student numbers in the department since our last program review. Our Extension program is highly regarded in the UWEX system. While the number of Extension faculty FTEs have declined in the past 10 years, our Extension faculty have responded by developing alternate sources of funding for our extension and outreach efforts.

Our faculty and staff enjoy a productive and collegial atmosphere, as indicated by a recent department climate survey. We are faced with budgetary challenges in the next biennium and are looking for ways to maintain the high level of scholarly activity and high quality of undergraduate and graduate instruction and extension and outreach for which we are known. The support of our alumni and friends is becoming increasingly important to help us meet these challenges.

Douglas J. Reinemann, Professor and Chair  
Biological Systems Engineering Department, University of Wisconsin-Madison

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## **FACULTY**

**Anex, Robert:** Professor, Ph.D., Teaching/Research  
**Bohnhoff, David R.:** Professor, Ph.D., Teaching/Research  
**Choi, Christopher:** Professor, Ph.D., Teaching/Research  
**Gunasekaran, Sungaram:** Professor, Ph.D., Teaching/Research  
**Kammel, David W.:** Professor, Ph.D., Extension/Research  
**Karthikeyan, K.G.:** Professor, Ph.D., Teaching/Research  
**Larson, Rebecca:** Assistant Professor, Ph.D., Teaching/Research  
**Pan, Xuejun:** Associate Professor, Ph.D., Teaching/Research  
**Reinemann, Douglas J.:** BSE Chair, Professor, Ph.D., Extension/Teaching/Research  
**Runge, Troy:** Assistant Professor, Ph.D., Teaching/Research  
**Shinners, Kevin J.:** Professor, Ph.D., Teaching/Research  
**Straub, Richard J.:** Professor, Ph.D., Teaching/Research, Associate Dean of CALS  
**Thompson, Anita M.:** Associate Professor, Ph.D., Teaching/Research

## **JOINT& ADJUNCT FACULTY**

**Etzel, Mark:** Professor, Ph.D., Food Science  
**Hanna, Awad:** Professor, Ph.D., Civil & Environmental Engineering  
**Hartel, Richard:** Professor, Ph.D., Food Science  
**Kung, King-Jau (Sam):** Professor, Ph.D., Soil Science  
**Muck, Richard:** Professor, Ph.D., USDA Agricultural Research Service  
**Nelson, Shawn:** Associate Professor, Ph.D., Biological Systems Engineering  
**O'Leary, Philip:** Professor, Ph.D., Engineering Professional Development  
**Purschwitz, Mark A.:** Associate Professor, Ph.D., Farm Safety  
**Ralph, John:** Professor, Ph.D., Biochemistry  
**Roa-Espinosa, Aicardo:** Professor, Ph.D., CEO Soil Net  
**Shutske, John:** Professor, Ph.D., Teaching/Research, Associate Dean of CALS  
**Thompson, Paul D.:** Professor, Ph.D., Senior Scientist Biological Systems Engineering  
**Vadas, Peter:** Professor, Ph.D., U.S. Dairy Forage Research Center  
**Zhu, Jun Yong:** Professor, Ph.D., Forestry

## **EMERITUS FACULTY**

<b>Bubenzer, Gary D.</b>	<b>Holmes, Brian</b>
<b>Buelow, Frederick H.</b>	<b>Koegel, Richard G.</b>
<b>Chapman, Larry</b>	<b>Massie, Leonard R.</b>
<b>Converse, James C.</b>	<b>Peterson, James O.</b>
<b>Cramer, Calvin O.</b>	<b>Rowell, Roger M.</b>
<b>Denes, Ferencz S.</b>	<b>Schuler, Ronald T.</b>
<b>Finner, Marshall F.</b>	<b>Walsh, Patrick</b>

## **ACADEMIC STAFF**

Contresras-Govea, Francisco: Outreach Specialist  
Cronin, Keith: Assistant Researcher  
Janish, Vicki: Senior Outreach Specialist, AgrAbility of Wisconsin  
Lee, Joshua: Assistant Faculty Associate  
Lin, Hailin: Visiting Associate Professor with Sundaram Gunasekaran, Ph.D.  
Lu, Fachuang: Associate Scientist with Xuejun Pan  
Nelson, Jeffrey W.: Senior Research Specialist (IT Dept.)/Lecturer (Farm Equip. & Power) M.S.  
Newenhouse, Astrid C.: Associate Scientist, Ph.D., Healthy Farmers/Healthy Profits Project  
Panuska, John C.: Distinguished Faculty Associate, Ph.D.  
Sanford, Scott A.: Senior Outreach Specialist, Rural Energy Program with Doug Reinemann  
Skjolaas, Cheryl A.: Senior Outreach Specialist, UW Center for Agricultural Safety & Health  
Stenjem, Ryan: Research Specialist  
Zopp, Zack: Assistant Researcher

## **TECHNICAL PERSONNEL**

Bohne, Harold M.: Senior Instrument Maker  
Brooks, Bradley A.: Instrumentation Specialist  
Freide, Joshua: Associate Instrument Specialist

## **OFFICE PERSONNEL**

Reinen, Sue: Department Administrator  
Wall, Jeremy: Financial Specialist  
Spahn, Pam: Payroll and Benefits Specialist  
Sumwalt, Debra K.: Student Services Coordinator  
Grochowski, Andrew: Student Worker  
Shinners, Dana: Student Worker  
Gerbitz, Hannah: Student Worker  
Sanford, Jennifer: Student Worker

## **RESEARCH ASSOCIATES**

Anthony, Renil (Runge/Anex)  
Fan, Yongming (Pan)  
Necpalova, Magdalena (Anex)  
Seenivasan, Rajesh (Gunasekaran)  
Sundramoorthy, Ashok Kumar (Gunasekaran)  
Yang, Qiang (Runge)  
Yoo, Chang Geun (Pan)

## **MASTER'S STUDENTS**

Accola, Joshua: MS (Thompson, Anita)  
Bradley, Alysa M.: MS (Larson, Rebecca)  
Deines, Nickolas F.: MS (Larson, Rebecca)  
Dietsche, Scott C.: MS (Shinners, Kevin)  
Francis Clar, Jordi T.: MS (Anex, Robert)  
Gu, Lei: MS (Anex, Robert)  
Gunawardhana, Thilina L.: MS (Anex, Robert)  
Holly, Michael A.: MS (Larson, Rebecca)  
Jordan, Kari: MS (Gunasekaran, Sundaram)  
Karlen, Jacob D.: MS (Shinners, Kevin)

Krantz, Sarah M.: MS (Runge, Troy)  
Li, Ao: MS (Anex, Robert)  
Mei, Chaoqun: MS (Pan, Xuejun)  
Nigon, Brandon J.: MS (Shinners, Kevin)  
Orrick, Justin D.: MS (Shinners, Kevin)  
Polich, Michael J.: MS (Thompson, Anita)  
Sanford, Joseph R.: MS (Larson, Rebecca)  
Stubbe, Ashley: MS (Shinners, Kevin)  
Wei, Liping: MS (Ralph, John)  
Zhang, Shuting: MS (Pan, Xuejun)

## **PH.D. STUDENTS**

Aguirre-Villegas, Horacio Andres: PHD (Larson, Rebecca)  
Bashar, Rania: PHD (Karthikeyan, K.G.)  
Cho, Sung Hyuk: PHD (Larson, Rebecca)  
Choi, Kyeongok: PHD (Gunasekaran, Sundaram)  
Drewry, Jessica: PHD (Choi, Christopher)  
Guan, Jiehao: PHD (Gunasekaran Sundaram)  
Gunukula, Sampath R.: PHD (Anex, Robert)  
Holly, Michael A.: PHD (Larson, Rebecca)  
Holstein, Andrew: PHD (Choi, Christopher)  
Lamba, Jasmeet: PHD (Thompson, Anita)  
Lan, Wu: PHD (Ralph, John)  
Li, Ning: PHD (Pan, Xuejun)  
Liang, Yifan: PHD (Choi, Christopher)  
Liu, Zong: PHD (Gunasekaran, Sundaram)  
Lu, Lin: PHD (Gunasekaran, Sundaram)

Mondaca Duarte, Mario: PHD (Choi Christopher)  
O'Dell, Jane: PHD (Etzel, Mark)  
Ortiz Reyes, Edgardo: PHD (Anex, Robert)  
Singh, Harsh: PHD (Thompson, Anita)  
Sritham, Eakasit: PHD (Gunasekaran, Sundaram)  
Su, Yi-Kai: PHD (Jeffries, Thomas)  
Wang, Hui: PHD (Larson, Rebecca)  
Wang, Yi-Cheng: PHD (Gunasekaran, Sundaram)  
Xiang, Zhouyang: PHD (Runge, Troy)  
Yang, Jiang: PHD (Gunasekaran, Sundaram)  
Yang, Qiang: PHD (Pan, Xuejun)  
You, Youngsang: PHD (Gunasekaran, Sundaram)  
Zhong, Shengfei: PHD (Runge, Troy)

# **TEACHING**

One part of the department's mission is undergraduate and graduate education. The department is responsible for:

- Undergraduate Major – Biological Systems Engineering
- Graduate Program:
  - Master of Science - Biological Systems Engineering
  - Doctor of Philosophy - Biological Systems Engineering
- Technical/Service Courses
- Farm and Industry Short Courses
- College of Agricultural and Life Sciences
- Student Advising

## **Biological Systems Engineering**

Currently there are more than 150 undergraduate majors in Biological Systems Engineering. The major consists of a core of courses taken by all students and four emphasis areas of which students choose one: machinery systems; structural engineering systems; natural resources and environment; food and bioprocess engineering. The food and bioprocess emphasis area is split into a food engineering track and a bioprocess engineering track. The following courses are dedicated to the Biological Systems Engineering major.

- Surveying Fundamentals (1 cr)
- Engineering Principles for Biological Systems (3 cr)
- Introduction to Computer Aided Design (3 cr)
- Structural Design for Agricultural Facilities (3 cr)
- Sustainable Residential Construction (3 cr)
- Engineering Properties of Food and Biological Materials (3 cr)
- Measurements and Instrumentation for Biological Systems (3 cr)
- Renewable Energy Systems (3 cr)
- On-Site Waste Water Treatment and Dispersal (2 cr)
- Quantitative Techniques for Biological Systems (3 cr)
- Career Management for Engineers (1 cr)
- Rheology of Foods and Biomaterials (3 cr)
- Heat and Mass Transfer in Biological Systems (3 cr)
- Sediment and Bio-Nutrient Engineering and Management (3 cr)
- Irrigation and Drainage Systems Design (2 cr)
- Biorefining: Energy and Products from Renewable Resources (3 cr)
- Food and Bioprocessing Operations (3 cr)
- Engineering Principles of Agricultural Machinery (3 cr)
- Engineering Principles of Off-Road Vehicles (3 cr)
- Biological Systems Engineering Design Practicum I (2 cr)
- Biological Systems Engineering Design Practicum II (3 cr)
- Small Watershed Engineering (3 cr)

## **Curriculum**

The curriculum consists of 125 credits. Our undergraduate program was evaluated in 2012 and accredited by the Engineering Accreditation Commission of ABET (<http://www.abet.org>) for another six years (the maximum allowable) as a Biological Engineering program. We are the only such accredited program in Wisconsin. Approximately 40 students earn B.S. degrees each year.

## **Technical/Service Courses**

The department provides several service courses for other majors.

- Milking Machines (1 cr)
- Integral Ecology (1-3 cr)
- Advanced Life Cycle Assessment Methods (3 cr)
- Operating and Management Principles of Agricultural Machines (3 cr)
- Operating and Management Principles of Off-Road Vehicles (3 cr)

## **Farm and Industry Short Course Program**

The department teaches the following courses for the Farm and Industry Short Course (FISC) program offered through the College of Agricultural and Life Sciences.

- Agricultural Safety and Health
- Agricultural Energy-Management
- Farm Machinery
- Farm Power
- Introduction to Precision Agriculture
- Livestock Housing

## **Graduate Programs**

Each year about 45 graduate students are pursuing a Master of Science or Doctor of Philosophy degree in Biological Systems Engineering. In addition, our faculty advises several graduate-level students in other departments and in the programs of Water Resources Management and Land Resources Management of the Institute for Environmental Studies. The M.S. degree requires a minimum of 18 credits of course work and 6 credits of thesis work. A Ph.D. requires a minimum of 42-54 credits of course work and 24 credits of thesis work for a minimum of 66-78 credits beyond a B.S. degree in Biological Systems Engineering. Students who have bachelor's degrees in non-engineering fields may pursue a Master's degree in Biological Systems Engineering but must complete appropriate prerequisites.



# CORE FACULTY ACTIVITY REPORTS



## Robert Anex

Professor, Ph.D.

60% Research / 40% Teaching

Bioprocess, Systems Analysis, and Life-Cycle Assessment

Dr. Anex's research is focused on developing and assessing systems for producing energy, fuels and products from biorenewable resources. For example, Dr. Anex's research group is studying economic and environmental feasibility of biorenewable chemicals being developed in the Engineering Research Center for Biorenewable Chemicals (CBiRC), nutrient recovery and cycling in biofuel systems, and impacts of biomass production on the hydrologic cycle. Dr. Anex's research combines process development in the laboratory with large-scale model-based assessment of agricultural-industrial systems. Key tools used to evaluate the economic efficiency and environmental sustainability of biobased products are Life Cycle Assessment (LCA) and Techno-economic Analysis (TEA). Dr. Anex and his students have been working to improve LCA and TEA methods to address the unique ways that biorenewable products couple agricultural and industrial systems.

### Teaching:

Spring 2013:

BSE 309: 2 Credits, 6 Enrolled

BSE 349: 3 Credits, 59 Enrolled

BSE 990: Various Research Credits, 7 Enrolled

Fall 2013:

BSE 509: 2 Credits, 6 Enrolled

BSE 990: Various Research Credits, 6 Enrolled

### Graduate Student Advisees:

Francis Clar, Jordi (Master's Degree)

Gu, Lei (Master's Degree)

Genawardhana, Thilina (Master's Degree)

Gunukula, Sampath (Ph.D. Student)

Li, Ao (Master's Degree)

Ortiz Reyes, Edgardo (Ph.D. Student)

### Research:

- 1) Cost-Effective Soil Nitrous Oxide Emission Monitoring. Funded by the National Institute of Food and Agriculture (NIFA) and Hatch Program funds. Collaboration with Tim Parkin and USDA-ARS National Laboratory for Agriculture and the Environment.
- 2) Dried Distiller Grain Based Polymer Dispersions for Paper Coatings. Funded by the USDA National Institute of Food and Agriculture and Critical Agricultural Materials Program.
- 3) Regional Biomass Feedstock Partnership – Biomass Residue Removal Tool Development. Funded by North Central Sun Grant Center and South Dakota State University. Collaboration with USDA-ARS National Laboratory for Agriculture and the Environment and Idaho National Laboratory.
- 4) Biofuels and the Hydrologic Cycle. Funded by the National Science Foundation. Collaboration with Iowa State University. This project was featured on the radio program "Living on Earth" on August 19, 2011 in a segment titled "The future of biofuels and the weather". The program can be found here: <http://www.loe.org/shows/shows.html?programID=11-P13-00033>
- 5) NSF-Engineering Research Center for Biorenewable Chemicals (CBiRC). Funded by the National Science Foundation. Collaboration with Iowa State University (lead institution), Rice University, University of California – Irvine, University of New Mexico, University of Virginia, Salk Institute, University of Michigan, Abo Akademi University (Finland), Eindhoven University of Technology (Netherlands), Fritz Haber Institute, Max Planck Society, and Technical University of Denmark.
- 6) A regional program for production of multiple agricultural feedstocks and processing to biofuels and biobased chemicals. Funded by

USDA-NIFA-AFRI Coordinated Agriculture Project (CAP). Collaboration with Louisiana State University AgCenter (lead institution), Southern University, Texas A&M University, University of Arkansas at Monticello, Danisco Inc. and Virent Inc.

- 7) Biofuel Cropping Systems for Feedstock Production and Greenhouse Gas Mitigation. Funded by the USDA-NIFA. Collaboration from Iowa State University (lead institution).
- 8) Climate Change, Mitigation, and Adaptation in Corn Based Cropping Systems. Funded by USDA-NIFA Coordinated Agriculture Project (CAP). Collaboration with Iowa State University (lead institution), Lincoln University, Michigan State University, The Ohio State University, Purdue University, University of Illinois, University of Minnesota, University of Missouri, University of Wisconsin, USDA Agricultural Research Service – Columbus, Ohio, South Dakota State University, and USDA National Institute of Food and Agriculture (USDA-NIFA).
- 9) On-Farm Biomass Processing: Towards an Integrated High Solids Transporting/Storing/Processing System. Funded by USDA-NIFA Biomass Research and Development Initiative (BRDI). Collaboration with University of Kentucky (lead institution), North Carolina State University, Oak Ridge National Laboratory, University of Wisconsin, USDA-ARS–FAPU, USDA-ARS-NSL, Cornell University, USDA-ARS-GSWRL, and Case-New Holland America.

## Publications:

- 1) Necpalova, M., R. P. Anex, A. N. Kravchenko, S. J. Del Grosso, et al. 2014. What does it take to detect a change in soil carbon stock? A regional comparison of minimum detectable difference and experiment duration in the North-Central United States. *J. Soil Water Conservation*. (accepted 10/11/13)
- 2) Jarchow, M. E., M. Liebman, S. Dhungel, R. Deitzel, D. Sundberg, R. P. Anex, M. L. Thompson, T. Chua. 2014. Tradeoffs among agronomic, energetic, and environmental performance characteristics of corn and prairie bioenergy cropping systems. *GCB Bioenergy* (doi: 10.1111/gcbb.12096).
- 3) Khanal, S., R.P. Anex, B.K. Gelder, C. Wolter. 2014. Nitrogen balance in Iowa and the implications of corn-stover harvesting. *Agriculture, Ecosystems & Environment* 183:21-30. (<http://dx.doi.org/10.1016/j.agee.2013.10.013>).
- 4) Rafique, R., M.N. Fienen, T.B. Parkin, R.P. Anex. 2013. Nitrous oxide emissions from cropland: A procedure for calibrating the DAYCENT biogeochemical model using inverse modeling. *Water, Air, and Soil Pollution* 224:1677 (DOI 10.1007/s11270-013-1677-z).
- 5) Khanal, S., R.P. Anex, C.J. Anderson, D.E. Herzmann, M.K. Jha. 2013. Implications of biofuel policy-driven land cover change for rainfall erosivity and soil erosion in the United States. *Global Change Biology Bioenergy*. DOI: 10.1111/gcbb.12050.
- 6) Anderson, C. J., R. P. Anex, R. W. Arritt, B. K. Gelder, S. Khanal, D. E. Herzmann, P. W. Gassman. 2013. Regional climate impacts of a biofuels policy projection. *Geophysical Research Letters* 40: 1217-1222. (DOI: 10.1002/grl.50179).



## David Bohnhoff

Professor, Ph.D.

50% Teaching / 50% Research

Structural and Building Construction Engineering

My program falls into three primary areas: (1) structural design of post-frame buildings, (2) building environment control, and (3) appropriate technologies for sustainable farming enterprises.

Work associated with the structural design of post-frame buildings falls into three primary categories: development of new analysis techniques, development and evaluation of new structural components, and dissemination of knowledge via development and interpretation of national standards and rewriting of the NFBA Post Frame Building Design Manual. New analysis techniques that I have recently developed include (1) modeling the behavior and predicting the lateral load resisting capacity of soil surrounding an embedded post/pier, and (2) assignment of allowable design values for axial tension, axial compression and weak axis bending of mechanically-laminated wood assemblies. New structural components designed in 2013 include a high moment connection for attaching wood posts to concrete, and a unique floor suspension system that eliminates interior support columns. Considerable time in 2013 was dedicated to rewriting of the NFBA Post Frame Building Design Manual (a project that should be completed in 2014), and explaining provisions of the new ASABE engineering practice governing the design of shallow post and pier foundations.

Research on building environment control in 2013 was largely centered around three projects: construction of a rotatable guarded hot box, numerical analysis of the impact of convective currents on the performance of post-frame thermal envelopes, and evaluation of an efficient and economical heat recovery ventilator for agricultural buildings.

Research on appropriate technologies for sustainable farming enterprises has many different facets with a variety of end users/interested parties. Specific needs have been identified by UW-Extension agents. The UW-Madison Center for Integrated Agricultural Systems, and via direct contact with farmers. Much of the actual research and development work has involved undergraduate students. Work in 2013 involved fabrication and testing of a hazelnut husker, separator and sorter; design of a refrigerated trailer for the storage, transport and display of fresh produce; design of a batch barrel washer for produce (primarily root crops), conversion of an Allis G to an electric tractor for field research; investigation of trellis systems for growing organic hops, and design of a portable hoop house for fruit and vegetable production.

### Teaching:

BSE 309: 2 Credits, 46 Enrolled

BSE 351: 3 Credits, 12 Enrolled

BSE 356: 3 Credits, 37 Enrolled

INTEREGR 160: 1 Credit, 31 Enrolled

BSE 509: Senior Design Faculty Advisors for 3 Teams

- 1) Storage, Transport, and Display Trailer for Fresh Produce (Placed 4<sup>th</sup> in 2013 AGCO Student Design Hops Competition)
- 2) Barrel Washer for Root Crops
- 3) Hops Trellis Design

### Graduate Students Advised:

Andy Holstein (Ph.D. Student)

Jonathan Styx (Master's Degree)

### Extension/Outreach Activities

- 1) *Hazelnut Processing*. This work is an extension of activities associated with the Upper Midwest Hazelnut Development Initiative headed by UW Extension Agent Jason Fischbach. In 2013, I completed a second prototype of a machine for husking, cleaning and sorting hazelnuts. Worked with Rutgers and Oregon State University to establish the first major trial planting of EFB disease resistant OSU hazel cultivars in WI.

- 2) *Growing and Processing Hops and Barley*. My work in this area is in support of efforts spearheaded by Vernon County extension agent Tim Rehbein and Buffalo County extension agent Carl Dooley. Current work involves the analysis and design of trellis systems for organic hop production.
- 3) *Wisconsin Frame Builders Association*. Serve as WFBA advisor. Attended WFBA board meetings and assisted in planning of activities such as the annual tour and conference.

### Research:

- 1) NFBA Post-Frame Building Design Manual. Completed four chapters of the principle design document for the post frame building industry in 2013. Funded by National Frame Building Association. \$14,000 in 2013.
- 2) Structural Design of Hoop Houses. Made WFBA and ASABE presentations on an insulated wood foundation for hoop houses. ASABE paper was accompanied by a paper on the subject. Recently designed unique portable hoop house for use at WMARS. Construction of hoop house with wood foundation funded in part by \$6000 USDA grant.
- 3) Evaluation and Optimization of Post-Frame Thermal Envelopes. Continued work with graduate student Holstein on a rotatable guarded hot box. Federal Hatch for 3 months at \$43,000/yr. BSE Department for 9 months at ~\$36,000/yr.
- 4) Development of Small-Scale Storage Facilities For Winter Storage of Fresh Produce. Supports Scott Sanford work. SARE Grant through University Of Minnesota. \$36,000/yr.
- 5) Development of Sustainable Post-Frame Building System. Worked with Holstein on submittal of ASCE and ASABE journal articles for this recently completed Hatch supported project.
- 6) Sustainable Air Conditioning Systems For Plant Growth, Animal Growth And Food Storage Facilities. Worked with graduate student Styx on the development of a low-cost, high volume, heat exchanger for high-moisture environments. Project was completed for Styx's M.S. degree. Project funded with money from EPD professional development courses.

- 7) Moment Resisting Post-to-Concrete Connection. Designed, fabricated and installed (for field testing) a new post-to-concrete pier connection with high bending strength in 2013. Personally funded. Working to secure funds for laboratory testing.

### Peer-Reviewed Journal Articles

- 1) Bohnhoff, D.R. 2013. *Shallow Post and Pier Foundation Design*. *Frame Building News*. 25(2):60-64
- 2) Holstein, A.J. and D.R. Bohnhoff. 2013. *Bending Properties of Wood I-Sections Fabricated with Screws and Polyurethane Adhesive*. *J of Structural Engineering*. ASCE. 139(11):2019-2027

### Books & Chapters

- 1) Bohnhoff, D. R. 2013. Introduction to Post Frame Buildings. Submitted for publication in the NFBA Post Frame Building Design Manual. National Frame Builders Association. Chicago, IL
- 2) Bohnhoff, D. R. 2013. Building Regulations. Submitted for publication in the NFBA Post Frame Building Design Manual. National Frame Builders Association. Chicago, IL
- 3) Bohnhoff, D. R. 2013. Structural Load and Deflection Criteria. Submitted for publication in the NFBA Post Frame Building Design Manual. National Frame Builders Association. Chicago, IL
- 4) Bohnhoff, D. R. 2013. Structural Design Overview. Submitted for publication in the NFBA Post Frame Building Design Manual. National Frame Builders Association. Chicago, IL

### Conference Proceedings, Technical Papers/Reports

- 1) Bohnhoff, David R. 2013. Insulated Wood Pier Foundation for Hoop Houses. ASABE Paper No. 1551475. ASABE. St Joseph, MI.
- 2) Bohnhoff, David R. 2013. Modifications and Extensions to Design Specifications for Mechanically-Laminated Wood Assemblies. ASABE Paper No. 1620162. ASABE. St Joseph, MI.
- 3) Holstein, A.J. and D.R. Bohnhoff. 2013. The Design and Fabrication of a Rotatable Guarded Hot Box (RGHB) Capable of Static Pressure Application. ASABE Paper No. 1578832. ASABE. St Joseph, MI.

## Abstracts, Posters, Presentations

- 1) Post Frame Research Update, WFBA Annual Meeting, January 16, 2013 (Invited Presentation)
- 2) Code Building Design: Why Engineered Structures? EPS Annual Meeting, January 28, 2013 (Invited Presentation)
- 3) Overview of Revisions to the Shallow Post Foundation Standard, Frame Building Expo, Memphis, TN, February 21, 2013 (Invited Presentation)
- 4) Insulated Wood Pier Foundation for Hoop Houses. Presented at the 2013 ASABE Annual International Meeting, Kansas City, Missouri, July 21–24, 2013
- 5) Modifications and Extensions to Design Specifications for Mechanically-Laminated Wood Assemblies. Presented at the 2013 ASABE Annual International Meeting, Kansas City, Missouri, July 21–24, 2013
- 6) The Design of an Efficient and Economical Heat Recovery Ventilator for Agricultural Buildings. Presented at the 2013 ASABE Annual International Meeting, Kansas City, Missouri, July 21–24, 2013
- 7) Fundamentals of Building Design, EPD Course for Building Inspectors, Milwaukee, WI October 8, 2013 and again on October 9, 2013

## Professional Development Activities

- 1) Wisconsin Frame Builders Annual Tour and Conference, January 15 and 16, 2013, Warrens, WI
- 2) NFBA Frame Building Expo, February 20-21, 2013, Memphis, TN
- 3) Midwest Organic and Sustainable Education Service (MOSES) Organic Farming Conference, February 22-23, 2013, La Crosse, WI
- 4) Upper Midwest Hazelnut Growers Conference, March 1-2, 2013, Eau Claire, WI
- 5) ASABE Section Meetings, March 27, May 21 and October 2
- 6) ASABE Annual International Meeting, July 21-24, 2013, Kansas City, MO

## Professional Service

- 1) Profession (ASABE/other)
  - i. American Society of Agricultural and Biological Engineers
    - Structures and Environment Standards Committee, SE-03

- Structures Committee, SE-20
  - Agri-Industrial Facility Design and Operation Committee, SE-07/1
  - Evelyn E. Rosentreter Standards Award Committee, M-160
  - Mechanically Laminated Columns working group, X559
  - Wisconsin Section – Attended 2 section meetings in 2013 and printed student awards
  - Manuscript reviewer
- ii. National Frame Builders Association
    - Technical Publications Review Committee. Review 4 FBN manuscripts in 2013.
    - NFBA T&R Committee. Attended four meetings in Chicago in 2013
    - Answer numerous technical questions via phone and e-mail on behalf of NFBA
- 2) College/Campus/University
    - i. Interdivisional Curriculum Committee (5 hours per month)
    - ii. College of Engineering Academic Planning, Curriculum, and Regulations Council (CoE APCRC) (1.5 hr per month)
    - iii. Advisory Committee for International Engineering Certificate
    - iv. BSE Undergraduate Instruction and Program Committee Chair (3 - 4 days per month)
      - Provided overview of BSE program to at least 60 students in 2013. Included many meetings and tours involving parents and potential transfers from outside the university
      - Averaged approximately 45 assigned undergraduate student throughout 2013
      - Provided help/assistance to numerous other BSE students with unique questions regarding study abroad, internships, course substitutions, and graduation requirements
      - Shepherded new courses and course change proposals through the approval process

## Awards

ASABE Standard Development Award, ASABE, July 22, 2013



## Christopher Choi

Professor, Ph.D.

60% Teaching / 40% Research

Biological Heat and Mass transfer

My research program is primarily focused on computational and experimental heat and mass transfer in biological, agricultural and environmental systems. Specifically, I have initiated and conducted research on the following topics Algal Biofuel, Pathogen transport that occurs during spray irrigation of liquid manure, design and evaluation of systems for cooling dairy cows, and ground source heat exchangers. :

### Teaching:

Spring 2013

BSE 309: 2 Credits, 46 Enrolled (team taught)

Summer 2013

BSE 375: 3 Credits, 10 Enrolled

Fall 2013

BSE 375: 3 Credits, 19 Enrolled

BSE 509: 2 Credits, Advised 1 Team

New Courses Created

BSE 270: Introduction to Computer Aided Design  
(3 Credits)

BSE 464: Heat and Mass Transfer in Biosystems  
(3 Credits)

### Graduate Students Advised:

Jessica Drewry (Ph.D. Student)

Matthew Harper (Master's Degree)

Andrew Holstein (Ph.D. Student)

Yifan Liang (Ph.D. Student)

Mario Mondaca (Ph.D. Student)

### Research:

- 1) Optimization of Dual Conjunctive Water Supply and Reuse System. Funding from National Science Foundation (\$47,292). 09/2012-08/2013
- 2) Advancement of Computational Model Algal Growth. Funded from Sandia National Laboratories (\$38,823). 07/2013-06/2014
- 3) Pathogen Transport during Spray Irrigation of Liquid Manure. Funding from WI DNR (\$140,000). Collaboration with Rebecca Larson and Mark Borchardt. 07/2013-06/2014
- 4) Online CAD Course Development for Engineers. Funding from UW CALS and Continuing Studies (\$20,000). Collaboration with Kim Manner. 09/2012-08/2014

- 5) Cooling Dairy Cows with Impinging Jets.

Funding from USDA-Hatch (\$80,000).

03/2014-02/2016 Pending Approval

- 6) Assessment of Environmental Impacts of Geothermal Source Heat Exchangers from Wisconsin Groundwater Coordinating Council, (\$90,463). 7/2014-6/2016. Approved.

### Peer-Reviewed Journal Articles

- 1) Mondaca M, \*F Rojano, CY Choi, and K Gebremedhin (2013) Conjugate heat and mass transfer model to evaluate the efficiency of conductive cooling, Transactions of the ASABE, 56:6, 1471-1482.
- 2) Andrade MA, D Kang, CY Choi, KE Lansey (2013) Heuristic post-optimization approaches for design of water distribution systems, ASCE Journal of Water Resources Planning and Management. 139:4, 387-395.
- 3) Kim M, CY Choi, CP Gerba (2013) Development and evaluation of a decision- supporting model for identifying the source location of microbial intrusions in real gravity sewer systems, Water Research, 47, 4630-4638.
- 4) Tamimi E, M Kacira, CY Choi, L An, (2013) Analysis of microclimate uniformity in a naturally vented greenhouse with a high-pressure fogging system, Transactions of the ASABE, 56:3, 1241-1254.
- 5) Anderson SD, BJ Bradford, JP Harner, CB Tucker, CY Choi, JD Allen, LW Hall, S Rungruang, RJ Collier, JF Smith (2013) Effects of adjustable and stationary fans with misters on core body temperature and lying behavior of lactating dairy cows in a semiarid climate, Journal of Dairy Science, 96, 4738-4750.
- 6) Mondaca, M, MA Andrade, CY Choi, KE Lansey (2014) Development of a cost function of water distribution systems for residential subdivisions, Urban Water Journal. (in press)

## Patents

- 1) CY Choi, Cook NB, and Nordlund KV (May, 2013) Floor Heat Exchanger for Reducing the Risk of Heat Stress and Lameness in Livestock, WARF Ref. No. P130304US01 (US Patent Pending). 50% Responsible.

## Conference Proceedings

- 1) Choi CY, M Mondaca, (2013) Effect of radiation shields and conductive cooling to reduce heat stress in dairy cattle, ACTA Horticulturrae No. 1008, Proceedings of the Frist International Symposium on CFD Applications in Agriculture, pp. 279-285.
- 2) Choi CY, (2013) Advanced modeling of smart water distribution systems, Smart Water Grid International Conference, Incheon, Korea (5 pages) – Invited.
- 3) Drewry JL, CY Choi, (2013) A computational fluid dynamics model of algal growth in open raceways, ASABE Annual International Meeting, Kansas City, Mo. Paper No. 1598901.
- 4) Mondaca M, Choi CY, Cook NB, Nordlund KV, (2013) Evaluation of Positive Pressure Air Distribution Systems for Dairy Housing, ASABE Annual International Meeting, Kansas City, Mo. Paper No. 1598901.
- 5) Liang Y, Mondaca M, Rojano F, CY Choi, (2013) An advanced conductive cooling design to relieve heat stress in modern dairies, ASABE Annual International Meeting, Kansas City, Mo. Paper No. 1598937.
- 6) Mondaca M, \*Andrade MA, Choi CY, Lansey KE, (2013) Development of a Cost Function for Residential Subdivisions through Genetic Algorithms, Proceedings of World Environmental And Water Resources Congress 2013. ASCE Library, pp. 637-647.
- 7) Andrade MA, \*Mondaca M, Choi CY, Lansey KE, Kang, D (2013) Enhancing Artificial Neural Networks Applied to the Optimal Design of Water Distribution Systems, Proceedings of World Environmental And

Water Resources Congress 2013. ASCE Library, pp. 648-662.

## Professional Services

- 1) Department
  - a) BSE Information Technology Committee, Chair (2012-present)
  - b) BSE Advancement Committee (2012-2013)
- 2) College/Campus/University
  - a) CALS Facilities Committee (2013-present)
  - b) Dissertation/Thesis Committee, Member
    - i) John Reimer, PhD student in Civil and Environmental Engineering, in progress
    - ii) Adam Bechle, PhD student in Civil and Environmental Engineering, in progress
    - iii) Ayse Ozdogan, PhD student in Geological Engineering, in progress
    - iv) Sanghwa Lee, PhD student in Civil and Environmental Engineering, in progress
- 3) Profession
  - a) Associate Editor, Transactions of the ASABE and Applied Engineering in Agriculture (2011-present)
  - b) Session Organizer and Program Chair: Computational Fluid Dynamics (CFD) Applications in Agriculture, 2013 ASABE Annual International Meeting, Kansas City, MO.
  - c) Session Organizer and Program Chair: The SMART Water Grid International Conference 2013, Incheon, Korea (Invited).
  - d) Member of ASAE/ASABE's committees. IET-254 Emerging Information Systems, IET-217 (Computational Methods, Simulations, and Applications), and Representative of IET for PM5 (Publications Review).
  - e) Vice Chair of ASABE IET-217 (Elected)
  - f) Founding Member and Vice President of ASABE AKABFE (Association of Korean Agricultural, Biological and Food Engineers, 2012-Present)
  - g) Reviewer – Refereed Journals
    - i) Transactions of the ASABE
    - ii) Applied Engineering in Agriculture
    - iii) Journal of Hydro-Environment Research
    - iv) Journal of Phycology
    - v) Journal of Hydroinformatics



## Sundaram Gunasekaran

Professor, Ph.D.  
50% Teaching / 50% Research  
Food Engineering

My primary interests are in the area of engineering properties of food and biomaterials with special emphasis on rheological properties. We study and characterize food gels and other macromolecular systems in order to better understand their structure function relations and to engineer value-added food and non-food products. In the area of biopolymer gels we are investigating potential applications of preparing encapsulated microparticles and nanoparticles and controlled delivery of bioactive compounds. We also investigate heat and mass transfer and related unit operations in food and biprocessing. In the area of instrumentation and sensors we focus on nondestructive evaluation of properties and quality of food materials and development of biosensors for measuring certain allergens and toxins. Please see our web page for more information: [www.foodeng.wisc.edu](http://www.foodeng.wisc.edu).

Recent research is focused on synthesis and use of nanomaterials (gold nanoparticles, carbon nanotubes, graphene, etc.) and electrochemistry for biosensing and other novel applications. Efforts are underway to develop visible detection of pathogenic organisms in environmental water as well as in foods. Electrochemical methods are used to detect toxins, heavy metal, and other contaminants in foods and in environmental water. In situ green synthesis of nanomaterials is being pursued to develop these nanoreactors as visible indicators of food quality and safety. Adapting some of the biosensing techniques to detect circulating tumor cells is a new development, which is being pursued in collaboration with a faculty colleague in the School of Medicine. In addition, collaboration with a faculty colleague in Biochemistry is aimed at developing a biofuel cell.

### Teaching:

BSE 309: Advisor of One Design Team  
BSE 509: Advisor of One Design Team  
BSE 365: 3 Credits, 38 Enrolled  
BSE 441: 3 Credits, 19 Enrolled  
BSE 900: 1 Credit, 12 Enrolled  
BSE 901: 1 Credit, 12 Enrolled  
BSE 990: Thesis Research

### Advising:

#### Graduate Students:

Jiehao Guan (Master's Degree)  
Kari Jordan (Master's Degree)  
Zong Liu (Ph.D. Student)  
Lin Lu (Ph.D. Student)  
Yi-Chang Wang (Ph.D. Student)  
Youngsang You (Ph.D. Student)

#### Post-Docs/Visiting Scholars

Rajesh Seenivasan  
Ashok Sundramoorthy  
Nael Yasri  
Dilek Cokeliler  
Pelin Onsekizoglu  
Chitradurga Mohan

### Research:

- 1) Electrochemical Biosensors to Detect Toxins in Complex Food Matrices, Hatch 2012-2015 (\$216,132)
- 2) In Situ Synthesis of Gold Nanoparticles as Novel Time Temperature Indicator for Food Quality Monitoring, Hatch, 2010-2014 (\$188,047)
- 3) Novel Applications for Biopolymers, SoilNet LLC, 2011-2013 (\$86,640)
- 4) Multiplexed Electrochemical Biosensor for Mycotoxins, The Andersons, 2013-2015 (\$150,000)
- 5) Rapid and Visible Detection of Indicator Organisms, WARF, 2013-14 (\$92,354)
- 6) Paper-fluidic Electrochemical Sensor for Heavy Metal Detection, AO Smith, 2013-14 (\$31,294)
- 7) Determining Microbial Quality of Water, Sanigen, 2013-14 (\$20,000)

### Peer-Reviewed Journal Articles

- 1) Sundramoorthy AK, S Gunasekaran. 2013. Graphene applications for food quality assurance and safety. Trends in Analytical Chemistry (submitted).



- 2) Yang J, W-J Chang, S Gunasekaran. 2013. A paper-fluidic electrochemical device for enzymatic biosensing. *Analyst* (in press).
- 3) Kim H., BY Kim, S Gunasekaran, JW Park, and WB Yoon. 2013. Comparison of concentration dependence of mechanical modulus in two biopolymer gel systems using scaling analysis *Food Science Biotechnology* 22(6):1-6 (DOI: 10.1007/s10068-013-0256-9)
- 4) Woo H-D, T-W Moon, S Gunasekaran, S Ko. 2013. Determining gelation temperature of  $\beta$ -lactoglobulin using in situ microscopic imaging. *J Dairy Science* 96(9):5565-5574 (DOI: 10.3168/jds.2013-6786).
- 5) Yoon W-B, S Gunasekaran. 2013. Investigation of elastic modulus of xanthan and locust bean gum at different concentration of mixture using Cascade model. *J Texture Studies* (DOI:10.1111/jtxs.12040).
- 6) Altay F, S Gunasekaran. 2013. Gelling properties of gelatin-xanthan gum systems with high levels of co-solutes. *J Food Engineering* 118:289-295 (DOI: 10.1016/J.jfoodeng.2013.04.018).
- 7) Yang J, J-H. Yu, JR Strickler, W-J Chang, S Gunasekaran. 2013. Nickel nanoparticle-chitosan-reduced graphene oxide-modified screen-printed electrode for enzyme-free glucose sensing in portable microfluidic devices. *Biosensors and Bioelectronics* 47:530-538 (DOI: 10.1016/J.bios.2013.03.051).
- 8) Yang J, S Gunasekaran. 2013. Electrochemically reduced graphene oxide sheets for use in high performance supercapacitors. *Carbon* 51(1):36-44. (DOI: 10.1016/J.carbon.2012.08.003)
- 9) Altay F, S Gunasekaran. 2013. Mechanical spectra and calorimetric evaluation of gelatin-xanthan gum systems with high levels of co-solutes in the glassy state. *Food Hydrocolloids* 30(2):531-540 (DOI: 10.1016/J.foodhyd.2012.06.013).

## Books and Chapters

- 1) S Gunasekaran. 2013. Nanotechnology for Food: Selected Applications. In: *Food Processing - Principles and Applications*, Jung S, Lamsal BP (eds.) Wiley-Blackwell (in press).
- 2) S Gunasekaran, O Solar. 2013. Heat-induced Casein-Whey Protein Interactions. In: *Protein Interactions and Functionality*, Hettiarachchy N, Sato K, Marshall M (eds.) Taylor and Francis (in press).

## Patents

- 1) Gunasekaran S, Yang J. 2013. Solid Working Electrode with Replaceable Tip. US Patent Publication No. US2013/0264202 A1 (licensed to Intel Inc.)
- 2) Gunasekaran S, Lim S. 2013. Nanoreactors as Time-Temperature Indicators (US Patent Provisional Application No. 61/374,127).
- 3) Gunasekaran S, Lim S. 2013. Visible Detection of Microorganisms (US Patent Provisional application filed P100326US01).
- 4) Gunasekaran S, Yang J. 2013. Electrochemical detection of beta-lactoglobulin (US Patent provisional application filed, P120220US01, s.n. 13/833,438).
- 5) Gunasekaran S, Yang J, Chang W-J. 2013. Disposable digital pH sensing (US Patent provisional application to be filed)

## Conference Proceedings, Technical Papers/Reports

- 8) Bohnhoff, David R. 2013. Insulated Wood Pier Foundation for Hoop Houses. ASABE Paper No. 1551475. ASABE. St Joseph, MI.
- 9) Bohnhoff, David R. 2013. Modifications and Extensions to Design Specifications for Mechanically-Laminated Wood Assemblies. ASABE Paper No. 1620162. ASABE. St Joseph, MI.
- 10) Holstein. A.J. and D.R. Bohnhoff. 2013. The Design and Fabrication of a Rotatable Guarded Hot Box (RGHB) Capable of Static Pressure Application. ASABE Paper No. 1578832. ASABE. St Joseph, MI.

## Abstracts, Posters, and Oral Presentations

- 1) Lu L; Y Wang; S Gunasekaran. 2013. Gelatin/gold nanoparticle-based thermal history indicator for food quality monitoring. Abstract No. 077-04, IFT Annual Meeting, Chicago, IL, July 13-16.
- 2) Lim S, Y You, J Han, Y Choi, S Gunasekaran. 2013. Visible and rapid detection of foodborne pathogens in milk based on aggregation of gold nanoparticles. Abstract No. 031-101, IFT Annual Meeting, Chicago, IL, July 13-16.

## **Professional Service**

- 1) University: Kemper-Knapp Bequest Committee (Chair)
- 2) CALS: Station Representative: NC213, Marketing and delivery of Quality Cereals and Oilseeds; NC1023, Engineering for food safety and quality, S-1007, The Science and Engineering for a Biobased Industry and Economy (Secretary; Vice-Chair; and Chair, 2006); NCDC 201 Nanotechnology and Biosensors.
- 3) COE: Engineers Day Committee

- 4) Department: Undergraduate Instruction Committee; Graduate Research and Instruction Committee (Chair)
- 5) Other: Evaluator for promotion/tenure dossiers and international PhD theses and Reviewer for various Peer-review journals

## **Awards**

- 1) Fulbright Program Specialist, 2012-13
- 2) WARF Challenge Grant Award, 2013



## **David Kammel**

Professor, Ph.D.  
78% Extension / 22% Research  
Agricultural Building Design

The majority of my work is in dairy modernization efforts. This includes programming and coordinating programs in dairy facilities and feeding systems including low cost milking centers, free stall barns, special needs and transition cow barns, and TMR feeding equipment. Much of this work has been with family dairy farms in transition from 60 cows in a tie stall barn to parlor freestall system. This work has been accomplished through the Dairy Modernization workgroup of the Dairy Team which I co-chair. I was also co-chair of the Dairy Theme tent in Farm Progress Days 2013 and am co-chair of the Educational Committee for Farm Technology Days 2014.

### **Teaching:**

Fall 2013

BSE 95: FISC Livestock Housing, 3 Credits, 29 Enrolled

### **Extension/Outreach Activities**

Dairy Modernization Programs. The Dairy Modernization Extension Program has an established recognition with Wisconsin county agents and producers. It has also garnered attention from other states such as Minnesota, Iowa, Illinois, Pennsylvania, New York, and Maine. The majority of my work year has been through producer and agent requests to develop and deliver topics in that area. This includes presenting and coordinating programs in dairy housing facilities and feeding systems including low cost milking centers, free stall barns, compost bedded barns, special needs and transition cow barns, and calf heifer housing. I had over 3200 contacts via email or phone for requests for information, and spoke to over 500 participants in extension meetings. I worked in 24 counties with 22 different agents on client requested farm visits developing plans and educational materials to approximately 100 individual farms. Much of this work has been with family owned dairy farms growing through the transition from 60-100 cows in a tie stall barn into newer milking parlor and freestall or bedded pen housing systems and calf and heifer housing systems. New requests include integrating technology such as automatic milking systems and calf feeding systems into existing and new facility design has become more common. I have also worked with dairy goat/sheep farms as they develop their new farmsteads and point of sale operations. Requests for dairy and beef cattle handling systems are also popular. This work has been accomplished through the Dairy Modernization workgroup of the Dairy Team which I am co-chair, and the Livestock team. Green County and Pierce County had dairy facility tours with tour participants selected from farm that the agents and I had worked with earlier on their new facility designs.

### **Meetings and Activities:**

- 1) 2013 WFBA Conference and Tour, Warrens, WI
- 2) FISC Pasture Management class
- 3) FTD 2013 Barron county, Wisconsin Ideal maternity Pen
- 4) Pepin County Farm management Club Tour
- 5) Dairy Modernization Tour, Pierce St. Croix County
- 6) Dairy Modernization Tour, Green Counties
- 7) River Falls Beef Cattle handling Center Design
- 8) Babcock Training Germany, Belarus
- 9) International Visitors tour host for Finland, Germany, Belarus, Russia, Japan, Argentina
- 10) Southern States Advanced Ruminant Cattle Feedmaster Program Knoxville, TN
- 11) Green County area Dairy management Seminar
- 12) Union Bank Green County Dairy Tour

## **Extension Publications**

- 1) Wisconsin Ideal Calf Pen Fact Sheet, UWEX

## **Book Chapters (peer-reviewed)**

- 1) Kammel, David W. 2013. Chapter 3 Dairy Replacement Housing. Dairy Freestall Housing and Equipment. MWPS 7. Eight Edition. Ames IA.
- 2) Kammel, David W. 2013. Chapter 6 Housing for Transition and Special Needs Cows. Dairy Freestall Housing and Equipment. MWPS 7. Eight Edition. Ames IA.
- 3) Kammel, David W. 2013. Goat Housing Chapter. Goat Production Handbook. Langston University, Langston OK 73050

## **Presentations Developed**

- 1) Dairy Modernization
- 2) Designing Large Dairy Farms
- 3) Cow Comfort Design
- 4) Retrofitting AMS into Existing Facilities
- 5) Group Housing and Management of Calves
- 6) Ventilation of Calf Housing
- 7) Dairy Housing Design and Management
- 8) Dairy Farmstead Master Planning
- 9) Transition Cow Housing and Design and Management

## **Professional Development Activities**

- 1) Sabbatical Spring 2013

## **Professional Service**

- 1) 4 State Dairy Extension Planning Committee
- 2) BSE Departmental Extension, and Social Committee
- 3) Animal Husbandry Planning Committee
- 4) Phi Kappa Phi Honor Society
- 5) Gamma Sigma Delta Honor Society
- 6) Alpha Epsilon Honor Society
- 7) ASABE member 28 years



## K.G. Karthikeyan

Professor, Ph.D.

50% Teaching / 50% Research

Natural Resources and Environment

Professor Karthikeyan's Fields of Interest include: fate, removal, and transport of nutrients and contaminants in surface/subsurface environments; water quality chemistry; land application of agricultural/municipal/industrial waste; applications of GIS/water quality models; physical and chemical processes for water, wastewater, and waste treatment; and soil decontamination.

### Teaching:

Spring 2013

BSE 472: 3 Credits, 16 enrolled

BSE 571: 3 Credits, 13 Enrolled

Fall 2013

BSE 372: 2 Credits, 29 Enrolled

BSE 509: 3 Credits, 39 Enrolled

BSE 671: 1-3 Credits, 10 Enrolled

### Graduate Students Advised:

Josh Accola (Master's Degree)

Rania Bashir (Ph.D. Student)

Linchen Han (Ph.D. Student)

Jasmeet Lamba (Ph.D. Student)

Elizabeth Miller (Ph.D. Student)

Sara Nason (Ph. D. Student)

Michael Polich (Master's Degree)

### Research:

- 1) "Multi-Scale Investigation of Winter Runoff and Nutrient Loss Processes in Actively Managed Dairy Agroecosystems." USDA-NIFA (AFRI Foundation Grant). \$499,500 [PIs: K.G. Karthikeyan, P. Vadas, F. Arriaga, L.W. Good, W. Jokela]. 10/1/13 to 9/30/17.
- 2) "Subsurface Fate and Transport of Cryptosporidium in Soils of Wisconsin's Carbonate Aquifer Region." Wisconsin (WI) Groundwater Coordinating Council. \$102,500 [PIs: K.G. Karthikeyan, A.M. Thompson, S.C. Long, B.J. Lepore]. 7/1/12 to 6/30/14.
- 3) "Phosphorus Index and Snowmelt Runoff Risk Assessment: Demonstration and Refinement." USDA-NRCS, Conservation Innovation Grant (CIG). \$134,850 [PIs: A.M. Thompson, L. Good, K.G. Karthikeyan, J. Panuska]. 9/1/12 to 8/31/15.

- 4) "Implications of Climate Change and Biofuel Development for Great Lakes Regional Water Quality and Quantity." USGS-National Institute for Water Resources Program. \$247,563 [PIs: A.M. Thompson, R. Jackson, B. Lepore, K.G. Karthikeyan]. 9/1/10 to 8/31/14.
- 5) "Paper Fluidic Electrochemical Sensor for Heavy Metal Detection." UW-Milwaukee RGI Program. \$120,000 [PIs: W.-J. Chang, S. Gunasekaran, K.G. Karthikeyan]. 7/1/13 to 6/30/15.
- 6) "Implications of Phosphorus Recovery from Wastewater for Biosolids Management." USDA-NIFA Hatch. \$183,228 [PI: K.G. Karthikeyan]. 10/1/12 to 9/30/16.
- 7) "Crop Plant Uptake of Pollutants of Emerging Concern." USDA-NIFA Interdisciplinary Hatch. \$323,454 [PIs: K.G. Karthikeyan, J.A. Pedersen]. 10/1/12 to 9/30/16.

### Peer-Reviewed Journal Articles

- 1) Han, L., K.G. Karthikeyan, M.A. Anderson, K. Gregory, J. Wouters. 2013. Mechanistic Insights into the Use of Oxide Nanoparticles Coated Asymmetric Electrodes for Capacitive Deionization. *Electrochim. Acta.* 90:573-581.
- 2) Huisman, N.L.H., K.G. Karthikeyan, J. Lamba, A.M. Thompson, G. Peaslee. 2013. Quantification of Seasonal Sediment and P Transport Dynamics using in an Agricultural Watershed Using Radiometric Fingerprinting Techniques. *J. Soils & Sediments.* 13:1724-1734.
- 3) Han, L., K.G. Karthikeyan, M.A. Anderson, K. Gregory. Exploring the Impact of Pore Size Distribution on the Performance of Carbonaceous Electrodes for Capacitive Deionization. *Langmuir* (revised manuscript submitted Dec. 2013).

- 4) Gungor, K., Ozkaynak, A.A., K.G. Karthikeyan, F. Evrendilek, S. Gunasekaran. Modeling Solubilization Dynamics of Manure Organic Matter and Phosphorus as a Function of pH and Enzyme Supplementation. Environmental Protection Engineering. (Under Review)
- 5) Lamba, J., K.G. Karthikeyan, A.M. Thompson. Using Radiometric Fingerprinting and Phosphorus to Elucidate Sediment Transport Dynamics in an Agricultural Watershed. Water Resources Research. (Under Review)
- 6) Lamba, J., A.M. Thompson, K.G. Karthikeyan, F. Fitzpatrick. Apportionment of Stream Bed Sediment Sources in an Agricultural Watershed Using Sediment Fingerprinting Techniques. J. Hydrology. (Under Review)
- 7) Han, L., K.G. Karthikeyan, K. Gregory. Energy Consumption and Recovery in Capacitive Deionization Using Nanoporous Activated Carbon Electrodes. J. Electrochemical Society. (Under Review)

### **Abstracts, Posters, and Oral Presentations**

- 1) ASAE Annual Meeting, Kansas City MO, 2013 - 2 presentations
- 2) AWRA Spring Specialty Conference - Agricultural Hydrology and Water Quality, St. Louis MO, 2013 – 1 presentation
- 3) AWRA Wisconsin Section Conference, Brookfield WI, 2013 – 2 presentations
- 4) Annual ASA-SSSA-CSSA Tri-societies Meeting, Tampa FL, 2013 – 1 presentation

### **Professional Service**

- 1) University of Wisconsin-Madison:
  - a) Member, Physical Sciences Divisional Executive Committee (2012-2015)
  - b) Affiliate faculty, Environmental Chemistry and Technology Program
  - c) Affiliate faculty, Department of Civil & Environmental Engineering (at UW-Madison and Carnegie Mellon University, Pittsburgh PA)
  - d) Affiliate faculty, The Nelson Institute for Environmental Studies (IES)
- 2) UW-Madison Biological Systems Engineering Department:
  - a) Awards Committee (Chair, since fall 2012)
  - b) Graduate Instruction and Research
  - c) Undergraduate Instruction and Program
- 3) Regional Committees:
  - a) SERA-17 (Organization to Minimize Phosphorus Losses from Agriculture)
  - b) W-2082 (Evaluating the Physical and Biological Availability of Pesticides and Pharmaceuticals in Agricultural Ecosystems)
- 4) ASABE Committees:
  - a) Member: SE-412 (Agricultural Waste Management); SW-21 (Hydrology); SW-224 (Pollution by Sediment); BE-24 (Soil and Groundwater Remediation)
- 5) Review Committees:
  - a) Associate Editor: Journal of Environmental Quality
  - b) Panelist: USDA-Agriculture and Food Research Initiative Competitive Grants Program (AFICGP) (2013)



## Rebecca Larson

Assistant Professor, Ph.D.  
50% Extension / 40% Research / 10% Teaching  
Bio-waste Management

The biowaste research team lead by Dr. Larson in the BSE department continues to investigate multiple areas of manure management systems including measuring greenhouse gas emissions, developing a manure based life cycle assessment, examining nutrient runoff from silage storage and feedlots, building and evaluating tile drainage treatment systems, evaluating manure storage systems and agitation practices, evaluating solid/liquid separation technologies, surveying producers to determine manure management practices in Wisconsin, examining the effects of biochar on nutrient management, and evaluating full and laboratory scale anaerobic digestion systems to improve biogas production (among others). All research conducted is integrated into tools and educational programming for use in extension arenas across the country. This information is critical in developing manure management and operational recommendations for producers that promote environmental and economic sustainability. This information is also crucial to those making decisions on manure based regulation and policy.

### Teaching:

ES 360 – Domestic and International Dimensions of Renewable Energy

Faculty advisor duties for this course include presentations during class time and a weekly meeting with the students traveling to Uganda for renewable energy project implementation. Class includes travel to Uganda for 2 weeks (with 5 undergraduates and 3 graduate students) to install a digester and further develop international use of renewable energy systems. Weekly meeting duties include meeting with design teams, working with students to identify critical resources and to develop brainstorming techniques, reviewing and evaluating all weekly oral presentations, advising team on technical aspects of digestion, and overseeing technical components in Uganda.

Manure Management & Lab Instruction for Biological Systems Engineering; Livestock Housing Short Course

### Extension

2013 Midwest Manure Summit: Co-chaired the planning committee to develop a well-attended farmstead manure conference with approximately 200 attendees. The conference attracted numerous stakeholders including producers, industry, and

government. The content of the conference was well received and included a variety of manure experts from around the country providing information on many topics relevant in Wisconsin from energy production to nutrient control. The program will be held again in 2015.

Manure Irrigation Workgroup: Developed a manure irrigation workgroup in response to the issues associated with the use of irrigation systems to land apply manure in Wisconsin. Presented well attended workshops around the state to address concerns with this issue and provide current scientific based information on the topic. The coordinated through UW Extension has also produced a website explaining the issues/practices at <http://fyi.uwex.edu/manureirrigation/>. In connection I have lead a research group to investigate areas with little knowledge to guide the workgroup in making sound decisions with respect to this practice.

### Funded extension/outreach projects:

USDA, North Central Regional Center for Rural Development funded project: Improved information transfer to assist farmers in rural Michigan and Wisconsin in making informed decisions about on-farm small scale anaerobic digesters

External Stakeholder Evaluation: All evaluations were extremely positive in terms of educational programming (including providing leadership, responding to needs, and providing scientific based information). Other feedback to improve on is to reduce workload to improve response time and to increase workshops for anaerobic digesters around the state

## **Advising:**

### Graduate Students:

Horacio Aguirre-Villegas (Ph.D. Biological Systems Engineering; Co-Advisor with D. Reinemann, May 2014)

Nickolas Deines (M.S. Biological Systems Engineering, Summer 2014)

Alysa Bradley (M.S. Biological Systems Engineering, Summer 2014 – to stay on for PhD)

Hui Wang (Ph.D. Biological Systems Engineering, December 2015)

Joseph Sanford (M.S. Biological Systems Engineering, May 2015)

Michael Holly (M.S. in Biological Systems Engineering, July 2013)

Michael Holly (Ph.D. Biological Systems Engineering, May 2016)

Aleia McCord, (PhD Nelson Institute for Environmental Sciences, Co-advisor with J. Patz, May 2015)

### Post-Doctoral:

Dr. Sasikumar Elumalai (Post-Doctoral)

## **Research:**

- 1) Small Scale Anaerobic Digester Research at the Institute for Environmentally Integrated Dairy Management Located at the UW-Madison Marshfield Agricultural Research Station: USDA NIFA
- 2) Silage Leachate: Water Quality Assessment and Treatment: Wisconsin Groundwater Coordinating Council
- 3) AFRI Sustainable Bioenergy CAP: Dairy Systems
- 4) Evaluating and Parameterizing Models to Assess Sediment and Phosphorus Loads from Cattle Exercise Lots in the Six-Mile Creek Adaptive Management Pilot Study Area: WDNR
- 5) Assessment of Manure Storage Processing and Handling on Nutrient and Solids Content: WI Fertilizer Research Council/ DATCP

- 6) Monitoring Sediment and Phosphorus Loads in Runoff from Dairy Feedlot/Exercise Lots to Facilitate Model Parameterization: WDNR
- 7) Pathogen Transport During Manure Irrigation
- 8) QMRA of Manure Irrigation Pathogen Transport
- 9) Impact assessment of anaerobic digestion: economic, environmental, and operational relationships: WDNR
- 10) Biochar/Manure as an Amendment for Improved Soil and Water Quality: Hatch/WISA
- 11) Treatment of Effluent from Agricultural Fields with Subsurface Tile Drains with an In-line Treatment System: Hatch
- 12) Discovery Farms/WDNR: Silage Runoff

## **Peer-Reviewed Journal Articles**

- 1) Sanford, J., C. Burnson, T. Miles, T. Zimonick, J. Panuska, and R.A. Larson. 2013. Low-Cost Manure Total Solids Measurement Device (Submitted).
- 2) Aguirre-Villegas, H. and R.A. Larson. 2013. From Waste to Energy: Life Cycle Assessment of Anaerobic Digestion Systems (submitted, accepted).
- 3) Larson R.A., S.I. Safferman. 2013. Land Application of Waste: Soil Column Leachate Water Quality Analysis (submitted 2013 to be published 2014).

## **Extension Publications**

- 1) Larson, R.A. 2012. Change Nutrient Ratios in Manure with Separation. Wisconsin Agriculturist, September 2012; 52.

## **Conference Proceedings, Technical Papers/Reports**

- 1) Aguirre-Villegas, H. and R.A. Larson. 2013. From Waste to Energy: Life Cycle Assessment of Anaerobic Digestion Systems. From Waste to Worth: Spreading the Science, Denver Colorado April 2013.
- 2) Holly, M. and R.A. Larson. 2013. Characterization and Assessment of First Flush from Silage Leachate and Runoff. From Waste to Worth: Spreading the Science, Denver Colorado April 2013.



- 3) Larson, R.A. and P. Triscari. Impact of Mixing Regime on Biogas production and Methanogen Biomass Stratification. From Waste to Worth: Spreading the Science, Denver Colorado April 2013.
- 4) R.A. Larson, Borchardt, M., S. Spencer, and A. Ozkaynak. 2013. Pathogen Fate in Manure Processing; Anaerobic Digestion and Solid Liquid Separation. From Waste to Worth: Spreading the Science, Denver Colorado April 2013.
- 5) Larson, R.A. 2013. Anaerobic Digestion of Grasses. American Grasslands Conference, Manhattan Kansas, August 2013.

- 12) Larson, R.A. Anaerobic Digestion in Wisconsin. Kiwanis group. October 23, 2013.
- 13) Larson, R.A. Japanese Zinpro. November 4, 2013.
- 14) Larson, R.A. Argonne. November 5, 2013.
- 15) Larson, R.A. WI Pork Association. November 14, 2013.
- 16) Larson, R.A. Weston Roundtable Lecture. November 21, 2013

## Abstracts, Posters, and Oral

### Presentations (Sample of 2013):

- 1) Larson, R.A. Anaerobic Digester Support Facilities. Frame Builders Conference. January 16, 2013.
- 2) Larson, R.A. Crop Management Conference. January 17, 2013.
- 3) Larson, R.A. Anaerobic Digestion. Wisconsin Integrated Resource Management Conference. Green Bay, WI. February 20, 2013.
- 4) Larson, R.A. Dane County Digester Virtual Tour. Midwest Manure Summit. February 26, 2013.
- 5) Larson, R.A. Phosphorus Management. Midwest Manure Summit. February 27, 2013.
- 6) Larson, R.A. Wisconsin Legislative Council. May 21, 2013.
- 7) Larson, R.A. Argentinian Digestion Presentation and Digester Tour. June 10, 2013.
- 8) Larson, R.A. WVPGA Research Summit. June 19, 2013.
- 9) Larson, R.A. Russian Manure Management Presentation. October 1, 2013.
- 10) Larson, R.A. Bulgarian Manure Management Presentation. October 3, 2013.
- 11) Larson, R.A. Latvian Manure Management Presentation and Sand Lane Tour. October 18, 2013.

## Professional Service:

### Department Committee Membership

Extension Committee Member, Fall 2010-Present  
 Pre-Professional Group Advisor, Fall 2011-Present  
 Social Committee, Fall 2010-Present  
 Undergraduate Instruction and Curriculum Committee, Fall 2012 - Present

### College/Campus/University

Consult with CALS Arlington Agricultural Research Station – Struvite and solids removal in swine manure handling system

Member of NRCS Technical Committee reviewing WI NRCS 629 Code of Standards, Waste Treatment

Member of DNR Technical Committee developing standards for Spray Irrigation

UWEX Dairy Team

UWEX Nutrient Management Team

UWEX Bio-energy/Bio-economy Team

### Profession (ASABE/other)

American Society of Biological and Agricultural Engineers

SE-412/SW-263 Committee Member; 2012 Secretary, 2013 Vice-Chair

Air and Waste Management Association

Midwest Renewable Energy Association

Livestock and Poultry Environmental Learning Center

Professional Nutrient Applicators Association of Wisconsin

NIMSS: NCCC-9

NIMSS: S-1032



## Xuejun Pan

Associate Professor, Ph.D.  
50% Teaching / 50% Research  
Bioenergy and Bio-Products Engineering

Dr. Pan's research is focused on developing innovative biorefining processes for producing energy, fuels, chemicals, and materials from renewable resources. Some specific research interests of Dr. Pan are pretreatment and fractionation of lignocellulosic biomass for bioconversion, chemical and enzymatic saccharification of lignocellulose, catalytic conversion of lignocellulose to drop-in hydrocarbon fuel, and value-added utilization of cellulose, lignin, hemicellulose and extractives.

### Teaching:

Spring 2013:

BSE 309: 3 Enrolled

Fall 2013:

BSE 364: 3 Credits, 55 Enrolled

BSE 460: 3 Credits, 12 Enrolled

BSE 509: 3 Students under my Advice

BSE 699: 3 Credit, 1 Enrolled

BSE 799: 3 Credit, 1 Enrolled

BSE 990: Thesis Research

### Advising & Mentoring:

Graduate Students Advised:

Chaoqun Mei (Master's Degree)

Ning Li (Ph.D. Student)

Qiang Yang (Ph.D. Student)

Shuting Zhang (Master's Degree)

Mentoring:

Dr. Chang Guen Yoo (Postdoc)

Dr. Yongming Fan (Visiting Professor, Beijing Forestry University, China)

### Research:

- 1) NSF Career Award (CBET 0847049) Xuejun Pan, "CAREER: Fundamental Understanding of Behaviors and Impacts of Cell Wall Lignin during Bioconversion of Lignocellulose to Fuel Ethanol", \$450,000 (August 2009 – July 2014).
- 2) NSF (National Science Foundation) (CBET 1236562) Xuejun Pan, "Fundamental understanding of HDA process: one-step conversion of lignocellulosic biomass to furan-based precursors for drop-in liquid fuel", \$336,901 (October 2012 - September 2015).
- 3) NSF (National Science Foundation) (CBET 1159561) Xuejun Pan, "Fast saccharification of lignocellulosic biomass under mild conditions in the medium of concentrated lithium bromide", 298,686 (July 2012 - June 2015)

- 4) WARF Accelerator Program Xuejun Pan, "Production of high-concentration sugar directly from lignocellulose under moderate conditions for fuels and chemicals", \$127,825 (May 2013 - April 2014)
- 5) USDA McIntire Stennis (WIS WIS01597) Xuejun Pan, "Direct saccharification and fractionation of forest biomass for fuel and chemical production under mild conditions in concentrated halide salt solution", \$162,312 (October 2011- September 2015)
- 6) National High Magnetic Field Laboratory at University of Florida Jijiao Zeng (UF, ABE), Choong Heon Lee (UF, Neuroscience), Stephen J. Blackband (UF, Neuroscience), Zhaohui Tong (UF, ABE), Xuejun Pan (PI), "Dynamic Visualization of Cell Wall Deconstruction during Pretreatment and Enzymatic Hydrolysis Using MRI", \$5,000 (September 2013-August 2014).

### Peer-Reviewed Journal Articles

- 1) Li, Z.Q., Z.H. Jiang, B.H. Fei, Z.Y. Cai, X.J. Pan. Comparison of bamboo green, timber and yellow in sulfite (SPORL), sulfuric acid and sodium hydroxide pretreatments for enzymatic saccharification. *Bioresource Technology*, 2014, 151, 91-99.
- 2) Lundberg, B., X.J. Pan, A. White, H. Chau, and A. Hotchkiss. Rheology and composition of processed citrus fiber *Journal of Food Engineering. Journal of Food Engineering*, 2014, 125, 97-104.
- 3) Pan, X.J. and J.N. Saddler. Effect of replacing polyol by organosolv and kraft lignin on the property and structure of rigid polyurethane foam. *Biotechnology for Biofuels*, 2013, 6, 12.
- 4) Zhang, D.S., Q. Yang, J.Y. Zhu, and X.J. Pan. Sulfite (SPORL) Pretreatment of Switchgrass for Enzymatic Saccharification. *Bioresource Technology*, 2013, 129, 127-134.

- 5) Li, Z.Q., Z.H. Jiang, B.H. Fei, X.J. Pan, Z.Y. Cai, X. Liu, and Y. Yu. Ethanolsolv with NaOH pretreatment of moso bamboo for efficient enzymatic saccharification. *BioResources*, 2013, 8 (3), 4711-4721.

### Invited Book Chapters (peer-reviewed)

- 1) Q. Yang and X.J. Pan. Fabrication and applications of biocompatible graphene oxide and graphene. In: "Handbook of Grapene Science", CRC Press/Taylor & Francis. (Scheduled to publish in 2014)
- 2) C.G. Yoo and X.J. Pan. Pretreatment of lignocellulosic biomass. In: "Bioenergy: Principle and Applications", Edited by Y.B. Li and S.K. Khanal, John Wiley & Sons, Inc. (Scheduled to publish in 2014)

### Invited presentations

- 1) X.J. Pan. Cellulase-mimetic polymeric solid catalysts for saccharification of lignocellulose. June 4, 2013, Technical Institute of Physics and Chemistry, China Academy of Sciences, Beijing, China.
- 2) X.J. Pan. Cellulase-mimetic polymeric solid catalysts for saccharification of lignocellulose. June 3, 2013, Beijing Forestry University, Beijing, China.
- 3) X.J. Pan. Cellulase-mimetic polymeric solid catalysts for saccharification of lignocellulose. May 22, 2013, Tianjin University of Science and Technology, Tianjin, China.

### Oral conference presentations

- 1) X.J. Pan and Qiang Yang. Synthesis and performance of cellulose-mimetic solid catalysts for hydrolysis of cellulose. 2013 AIChE Annual Meeting, November 3-8, 2013, San Francisco, CA
- 2) Chang Geun Yoo, Shuting Zhang, and X.J. Pan. Optimization of one-pot HDA process for converting lignocellulosic biomass to drop-in liquid fuel. 245 th ACS National Meeting & Exposition, April 7-11, 2013, New Orleans, LA.
- 3) Qiang Yang and X.J. Pan. Cellulase mimetic solid acids for hydrolysis of cellulose in water. 245 th ACS National Meeting & Exposition, April 7-11, 2013, New Orleans, LA.

### Poster conference presentations

- 1) Chaoqun Mei and X.J. Pan. Dissolution of cellulose in aqueous lithium bromide solution. 245 th ACS National Meeting & Exposition, April 7-11, 2013, New Orleans, LA.

### Professional Service

- 1) University
  - a) Graduate Instruction and research Committee (2007-Present)
  - b) Undergraduate Instruction and Program Committee (2007-Present)
  - c) CoE Assessment Committee (2009-Present)
  - d) Involved in ABET Assessment Efforts

### Civic Service

- 1) Editorship
  - a) Associate Editor, *BioEnergy Research* (2013-Present)
  - b) Editorial board member *Journal of Biobased Materials and Bioenergy* (since 2007)
  - c) Editorial board member of *International Journal of Agricultural and Biological Engineering* (since 2008)
- 2) Conference Organization
  - a) International Scientific Committee member, 17th International Symposium on Wood, Fiber and Pulping Chemistry, June 12-14, 2013, Vancouver, Canada.
  - b) Fundamentals and Practice of Cell Wall Deconstruction, Cellulose Renewable Materials Division, the 245th ACS National Meeting, New Orleans, LA, April 7-11, 2013.
- 3) Journal Article Reviewer
  - a) ACS Sustainable Chem Eng
  - b) BioEnergy Research (x2)
  - c) Biomass & Bioenergy
  - d) Cellulose
  - e) ChemSusChem
  - f) Energy & Fuels
  - g) Journal of Agricultural and Food Chemistry
  - h) Powder Technology
  - i) Wood Chem Technol
- 4) Proposal Reviewer
  - a) NSF Review Panel
  - b) USDA NIFA SBIR Review Panel



## Douglas J. Reinemann

Professor and Chairman, Ph.D.

24% Teaching / 25% Research / 51% Extension

Faculty Affiliate in Dairy Science, AgroEcology, Center for Integrated Ag Systems, Gaylord Nelson Institute for Environmental Studies, Energy Analysis and Policy Program

Dr. Reinemann has directed the activities of the UW Milking Research and Instruction lab since 1990. His research interests include the biomechanics of machine milking, milk quality assurance, and the development and deployment of robotic milking systems. As a long-time member and frequent chair of the NMC, IDF, ISO and ASABE milking machine committees, his work with international experts has been focused on the development and interpretation methods for machine milking performance indicators.

Doug has also been working at the interface between energy and agricultural systems for more than 24 years. His research and extension interests included energy use and energy production in agricultural systems. He is a member of the sustainability group of the UW Great Lakes Bioenergy Research Center examining environmental impacts of biofuels production systems. He also leads the UW 'green cheese' team who are investigating synergies between dairy and biofuels production systems in Wisconsin. Doug has been actively involved with the Midwest Rural Energy Council - an organization of power suppliers addressing issues related to energy supply to agricultural production and processing operations as well as integrating renewable energy resources into the energy distribution grid.

### Teaching

Spring 2013

BSE 367, Renewable Energy Systems  
3 Credits, 78 Enrolled

Summer 2013

BSE 367, Renewable Energy Systems  
3 Credits, 21 Enrolled – (Special session for sustainable System Engineering MS program)

Fall 2013

BSE 367, Renewable Energy Systems  
3 Credits, 68 Enrolled  
AgroEcology/BSE 875, Integral Ecology  
1-3 Credits, 5 Enrolled

### Graduate Students Advised

- 1) Horacio A. Aguirre-Villegas, PhD 2013 BSE, Co-advised with Rebecca Larson
- 2) Jack Buchanan, MS AgroEcology, 2013.
- 3) Robert Rowbotham, PhD 2015, Dairy Science, Co-advised with Pamela Ruegg

### Extension / Outreach

Support UWEX agent programs in Milking Machines, Milking Parlors, Robotic Milking, Milking Management, Energy, and Bio-Energy Outcomes 4.25 (4.18)

External Stakeholder Programs

MRIL web site and MilkTech professional development courses (International On-Line curriculum used in 4 countries)

MREC web site and annual educational conference on rural energy issues.

Stray Voltage Investigators Courses

### Research

Milking Machine Research: Avon Dairy Solutions  
Future Cow Automated Pre-Milking Preparation:  
With Pamela Ruegg

Great Lakes Bioenergy Research Center:  
Sustainability Group, Life Cycle Assessment:  
DOE, with Paul Meier

Climate Change Mitigation and Adaptation In Dairy Production: AFRI/CAP, With Ruark, Larson, Watteaux, Bland, Benson, Jahn and Stephenson  
Energy Intensity, Carbon Footprint, And Environmental Impact Of Pasture-Based Dairy, DATCP, With Victor Cabrerra

Farm-Based Bioenergy Infrastructure: Wisconsin Focus On Energy, with Carol Barford

USDA Energy Self Assessment Website: With Scott Sanford

### Publications:

Peer reviewed

Kraatz, S, Sinistore, JC, and Reinemann, DJ, 2013. Energy intensity and global warming potential of corn grain ethanol production in Wisconsin (USA). Food and Energy Security, June 2013.

Book Chapters

Reinemann, DJ, 2013. Milking Machines and Milking Parlors. Chapter 7, pp 177-198:

Handbook of Farm, Dairy, and Food Machinery, Second Edition. Myer Kutz, Ed., Academic Press an imprint of Elseviere, 735 pp.

#### Conference Proceedings

- Reinemann, DJ and C Kamphuis, 2013. Managing Milk Quality in Automatic Milking Systems. Proceedings of the 2013 Precision Dairy Conference, Rochester, Minnesota
- Barford, C, Reinemann, DJ, Gollnik, R and Narayana, A, 2013. Farm-Based Bioenergy Infrastructure for Wisconsin: Too Big, Too Little or Just Right? Report to the Public Service Commission of Wisconsin & the Statewide Energy Efficiency and Renewables Administration, Focus on Energy program, August 2013.
- Mein, GA, DJ Reinemann, and PD Thompson, 2013. Understanding the Milking Machine: The Contribution Of Cyclic Liner Compression To Effective Pulsation. Proceedings of the Annual meeting of the National Mastitis Council.
- Reinemann, DJ, AMA Gomez, PE Thompson and I Ohnstad, 2013. Exploring the Role Of Liner Dimension, Shape, And Venting On Milking Performance. Proceedings of the Annual meeting of the National Mastitis Council.

## **Professional Development**

Advanced Milking Physiology Workshop  
WISELI Department Chair's Climate Workshop  
Faculty & Staff Pay Tools Workshop  
Integral Theory Conference

## **Professional Service**

BSE Undergrad Instruction committee  
BSE IT committee member  
Midwest Rural Energy Council, Ex-Officio Executive Board Member and secretary  
Wisconsin Association of Milk, Food, and Environmental Sanitarians member  
National Mastitis Council, Milking Machine Committee  
International Dairy Federation, Chair machine milking committee  
American Society of Agricultural and Biological Engineers

- IET-441 Milk Handling Equipment
- IET-433 Agricultural Wiring and Electrical Energy Applications

Reviewer for Transactions ASABE, J. Dairy Science, J. Dairy Research, and several energy related journals



## Troy Runge

Assistant Professor, Ph.D.

60% Research / 40% Teaching

Biomaterials, Bioenergy, Bioprocessing

Troy Runge is an Assistant Professor in the Biological Systems Engineering in CALS where he performs research and teaches in the bioenergy field. Troy is a lignocellulose chemist by training and has Pulp and Paper Science degrees including a B.S. from UW-Stevens Point and M.S. and Ph.D. degrees from the Institute of Paper Science and Technology at the Georgia Institute of Technology. Troy spent several years at UW as the Director of the Wisconsin Bioenergy

Initiative, and prior to that spent fifteen years working at Kimberly-Clark Corporation in a variety of research and engineering roles for pulp, tissue, nonwoven, and hygiene product production. Troy is currently working in several aspects of bioenergy and bio-based materials with an emphasis on biomass composition and separation technologies.

### Teaching:

BSE 249: 3 Credits, 43 Enrolled

BSE 461: 3 Credits, 12 Enrolled

### Advising:

Graduate Students:

Shengfei Zhou (Ph.D. Student)

Zhouyang Xiang (Ph.D. Student)

Zong Liu (Ph.D. Student)

Sarah Krantz (Master's Degree)

Kim Pham (Master's Degree)

Post Master's and Post-Doctoral:

Dr. Sasikumar Elumalai (Post-Doctoral)

### Research:

- 1) *Development of Affordable Bioenergy and Bioproducts Laboratories for Education*. Troy Runge\*, Eric Singsaas, Tim Zauche, and Chris Baxter. Funding from USDA Higher Education Challenge Grant (2012 – 2014) \$291,236. Collaboration with UW Stevens Point and UW Platteville. This educational project will create twelve laboratory bioenergy classes that are developed to be low-cost enabling any interested University to implement either as supplementation to existing classes or as a stand-alone bioenergy lab class.
- 2) *Accelerated Renewable Energy (ARE)*. John Markley\*, Tom Cox, John Norman, Jim Leverich, & Troy Runge. Funding from USDA Biomass Research and Development Initiative (2012-2016) - \$7,000,000. Collaboration with Maple Leaf Dairy (Cleveland, WI), Soil Net, LLC (Madison, WI), Braun Electric, Inc. (St. Nazianz, WI), and FEECO International, Inc. (Green Bay, WI). The ARE project investigates a process to reduce environmental impacts of dairy manure through on-farm fractionation and processing of manure into economically valuable products that will provide cash flow to the dairy.
- 3) *Dried Distiller Grain Based Polymer Dispersions for Paper Coatings*. Troy Runge\* & Rob Anex. Funding from USDA NIFA (2013-2016) - \$499,426. Collaboration with Didion Ethanol. This project seeks to extract hemicellulose from DDG to create a replacement for petroleum based paper coatings. The project will assess the technical and economic viability along with the environmental impact.
- 4) *Extracting Value from Ensiled Biomass*. Funding: Hatch (2012-2014) - \$77,722. This project is using a combination of a biological and chemical system to determine the economics of ensiled biomass storage for cellulosic biofuels with the added step of extracting and purifying the produced lactic acid to be utilized as value-added monomer.
- 5) *Amendments for Improved Soil and Water Quality*. Troy Runge\* & Becky Larson. Funding from Hatch (2012-2014) - \$89,674. The research investigates the use of biochar, a residual stream from pyrolysis or gasification, as a soil amendment to reduce nutrient and contaminant leaching from field-applied manure.
- 6) *Renewable Chemicals at Corn Ethanol Plants*. Funding from Wisconsin Corn Promotion Board (2012-2014) - \$40,490. This project researches a process that fractionates DDGS into a high protein stream, and a high carbohydrate stream which is dehydrated into furfural to provide an additional revenue source for corn ethanol plants.

## Peer-Reviewed Journal Articles

- 1) Runge, T.; Zhang, C.; Hemicellulose extraction and its effect on pulping and bleaching. *Tappi Journal*, 12 (10): 45-53 (2013).
- 2) Runge, T.; Porter, P.; Not quite converted: how fuel prices both started and stopped a biomass heating plant project. *Biofuels* 4(5): 493–500(2013).
- 3) Thompson, D.; Campbell, T.; Bals, B.; Runge, T.; Teymourji, F.; Ovard, L.; Chemical Preconversion: Application of Low-severity Pretreatment Chemistries for Commoditization of Lignocellulosic Feedstock. *Biofuels* 4(3): 323–340(2013).
- 4) Digman, M.; Runge, T.; Shinnars, K.; Hatfield, R.D.; Wet Fractionation for Improved Utilization of Alfalfa Leaves. *Biological Engineering Transactions* 6(1): 29-42 (2013).
- 5) Runge, Troy; Houtman, C. Negri, A.; Heinricher, J.; Timber Bamboo Pulp. *Tappi Journal*, 12 (2): 9-15 (2013).
- 6) Runge, T.; Wipperfurth, P.; Zhang, C.; Improving biomass combustion quality using a liquid hot water treatment, *Biofuels* 4(1): 73-83 (2013).

## Conference Proceedings, Technical Papers/Reports

- 17) Runge, Troy; Heinricher, Jackie; Meier, Dan; Co-cooking Moso Bamboo with Hardwoods. TAPPI PEERS Conference, Green Bay, WI (Sept. 18, 2013).
- 18) Runge, Troy; Zhang, Chunhui; Co-cooking Non-woods with Hardwoods. TAPPI PEERS Conference, Green Bay, WI (Sept. 17, 2013).
- 19) Elumalai, S.; Roa-Espinosa, A.; Runge, T.; Markley, J.; Pretreatment for the removal of manure fiber recalcitrance to enhance enzyme saccharification. ASABE Annual International Meeting, Kansas City, MO (July 23, 2012).
- 20) Zhou, S.; Runge, T.; Validation of lignocellulosic biomass carbohydrates determination via acid catalyzed hydrolysis 245th ACS National Meeting and Exposition. New Orleans, Louisiana (April 10, 2013).

## Patents

- 1) US 8512515 B2 Dyer, T.J.; Lostocco, M.R.; Nickel, D.J.; Runge, T.M.; Zwick, K.J.; Goulet, M. T.; Timm, J.T.; Clough, P.H.; Rekoske, M.J.; Wiping products having enhanced cleaning abilities. Kimberly-Clark Worldwide. (August, 20 2013).

## Conference Presentations

- 1) Runge, Troy; Xiang, Zhouyang; Furfural from DDG. International Bioenergy and Bioproducts Conference, Green Bay, WI (Sept. 19, 2013).
- 2) Runge, Troy; Elumalai, Sasikumar; Roa, Aicardo; Markley, John; Manure Fiber to Ethanol. International Bioenergy and Bioproducts Conference, Green Bay, WI (Sept. 19, 2013).
- 3) Runge, Troy; Du, Xiaodong; Biomass Supply Assessment. International Bioenergy and Bioproducts Conference, Green Bay, WI (Sept. 18, 2013).
- 4) Runge, Troy; Heinricher, Jackie; Meier, Dan; Co-cooking Moso Bamboo with Hardwoods. TAPPI PEERS Conference, Green Bay, WI (Sept. 18, 2013).
- 5) Runge, Troy; Zhang, Chunhui; Co-cooking Non-woods with Hardwoods. TAPPI PEERS Conference, Green Bay, WI (Sept. 17, 2013).
- 6) Elumalai, S.; Roa-Espinosa, A.; Runge, T.; Markley, J.; Pretreatment for the removal of manure fiber recalcitrance to enhance enzyme saccharification. ASABE Annual International Meeting, Kansas City, MO (July 23, 2012).
- 7) Zhou, S.; Runge, T.; Validation of lignocellulosic biomass carbohydrates determination via acid catalyzed hydrolysis 245th ACS National Meeting and Exposition. New Orleans, Louisiana (April 10, 2013).

## Professional Development

- 1) Represented UW at the Multi-State S1041 meeting: The Science and Engineering for a Biobased Industry and Economy conference. Maui, HI. (June 2013)
- 2) Attended TAPPI PEERS Conference, Green Bay, WI (September 2013).
- 3) Attended TAPPI International Bioenergy and Bioproducts Conference, Green Bay, WI (September 2013).
- 4) Reviewed “Advanced Technology for Low Cost Ethanol from Engineered Cellulosic Biomass” Project Completion for USDA – NC State (September 2013)
- 5) Reviewed NSF STTR grants (May 2013)

## Professional Service

### University

- 1) BSE Committees – UIPC & Development
- 2) Wisconsin Energy Institute Board

### Civic Service

- 1) Wisconsin Institute of Sustainable Technology Advisory Board
- 2) Wisconsin ASABE Awards Chair
- 3) TAPPI Non-woods Section Secretary
- 4) Numerous journal article reviews



## Kevin Shinnars

Professor, Ph.D.  
50% Teaching / 50% Research  
Power and Machinery

Dr. Shinnars' interests include engineering aspects of systems to cut, dry, harvest, package, store, fractionate and process biological plant material to be used as ruminant animal feed or as a biomass feedstock for production of bio-energy and bio-products. They also include sensors and sensor systems to measure machine performance and crop material properties for Precision Farming systems as applied to hay, forage and bio-mass crops.

### Teaching:

Spring 2013

BSE 309: 2 Credits, 1 Team of 4 Students  
BSE 476: 3 Credits, 40 Enrolled

Fall 2013

BSE 475: 3 Credits, 18 Enrolled  
BSE 509: 3 Credits, 2 Teams of 4 Students

### Graduate Students Advised:

Scott Dietsche (Master's Degree)  
Brandon Nigon (Master's Degree)  
Justin Orrick (Master's Degree)  
Ashley Stubbe (Master's Degree)  
Glenn Wiskur (Master's Degree)

### Research:

- 1) BioMODS – biomass optimized delivery system. USDA-NIFA. 9/13 through 8/16. \$556,717 (\$389,724 direct funds to BSE).
- 2) Mapping of grain and MOG flow from combine separator. John Deere Harvester Works – Global Crop Harvesting Product Development Center. 5/13 through 12/15. \$144,418 (\$101,328 direct funds to BSE).
- 3) Agro-ecosystem approach to sustainable biofuels production via the pyrolysis-biochar platform. USDA – AFRI CAP (subcontract through Iowa State University). 8/11 through 7/16. \$868,454 (\$677,395 direct funds to BSE).
- 4) Investigation of methods to harvest and store corn stover as a biomass feedstock. John Deere Harvester Works – Global Crop Harvesting Product Development Center. 12/07 through 6/15. \$406,744 (\$279,170 direct funds to BSE).
- 5) Harvester modifications to collect sugar cane residue and harvest energy cane feedstocks.

John Deere Thibodaux. 10/11 through 6/14. \$256,889 (\$178,743 direct funds to BSE).

- 6) Novel technologies for field fractionation, harvesting and storage of perennial bioenergy crops. USDA-ARS. 9/08 through 8/13. \$118,048 (all direct funds to BSE).

### Peer-Reviewed Journal Articles

- 3) Shinnars, K.J., G.C. Boettcher, D.M. Schaefer, and A.M. Troutman. 2013. Cattle preference for hay from round bales with different wrap-types. Professional Animal Scientist. 29:665-670.
- 4) Keene, J.R., K.J. Shinnars, L.J. Hill, A.J. Stallcop, S.J. Wemhoff, H.D. Anstey, A. J. Bruns and J.K. Johnson. 2012. Single-pass baling of corn stover. Trans. ASABE. 56(1): 33-40.
- 5) Digman, M.F., T.M. Runge, K.J. Shinnars and R.D. Hatfield. 2013. Wet fractionation for improved utilization of alfalfa leaves. Biological Engineering. 6(1): 29-42.
- 6) Digman, M.F., K.J. Shinnars and M.E. Boettcher. 2013. Crop mergers: management of soil contamination and leaf-loss in alfalfa. Applied Engineering in Agriculture. 29(2): 179-185.
- 7) Williams, S.D. and K.J. Shinnars. 2013. Farm-scale anaerobic storage and aerobic stability of high dry matter perennial grasses as biomass feedstocks. Biomass and Bioenergy. Revisions submitted.
- 8) Cook, D.E., K.J. Shinnars. P.J. Weimer, and R.E. Muck. 2013. High dry matter whole-plant corn as a biomass feedstock. Biomass and Bioenergy. In Press.



## Technical Papers/Reports

- 1) Shinnars, K.J. and J.C. Friede. 2013. Improving the drying rate of switchgrass. ASABE Technical Paper No. 131591968. Presented at the 2013 Annual International Meeting, Kansas City, MO.
- 2) Shinnars, K.J. and J.C. Friede. 2013. Energy requirements for at-harvest or on-farm size-reduction of biomass. ASABE Technical Paper No. 131591983. Presented at the 2013 Annual International Meeting, Kansas City, MO.
- 3) Shinnars, K.J., J.C. Friede, T.J. Kraus and D. Anstey. 2013. Improving bale handling logistics by strategic bale placement. ASABE Technical Paper No. 131591987. Presented at the 2013 Annual International Meeting, Kansas City, MO.

## Outreach Publications

- 1) Shinnars, K.J. and B.J. Holmes. 2013. Making sure your kernel processor is doing its job. Focus on Forage. Vol, 15, No. 4. <http://www.uwex.edu/ces/crops/uwforage/KernelProcessing-FOF.pdf>
- 2) Shinnars, K.J., G.C. Boettcher, D.M. Schaefer, and A.M. Troutman. 2013. New breathable film wrap for round bales improves beef cattle consumption. MFA Forage Focus Fall Issue.

## Abstracts, Posters, and Oral

### Presentations

- 1) Shinnars, K.J. 2013. Challenges with harvest, storage, and transport of perennial grasses as biomass feedstocks. Presented at Switchgrass II September 11th, 2013. Madison, WI.
- 2) Shinnars, K.J. 2013. Review of corn stover harvest and storage research at UW. Presented at DAM II – Deere-ADM-Monsanto Corn Stover Team; November 14th, 2013. Ames, IA.
- 3) Shinnars, K.J. 2013. Machinery research for perennial grasses as biomass feedstocks. Presented at Team Forage Teaching and Technology Conference, Arlington, WI. September 5th, 2013.
- 4) Shinnars, K.J. and B.J. Holmes. 2013. Field evaluation of kernel processing effectiveness. Presented at Team Forage Teaching and Technology Conference, Arlington, WI. September 6th, 2013.
- 5) Shinnars, K.J., R. Mitchell and P. Porter. 2013. Establishing perennial grasses for biomass feedstock production. Field Day sponsored by CenUSA. September 19th, 2013.

## University and Professional Service

- 1) Mentor Committees
  - a) Troy Runge
- 2) Department
  - a) Graduate Research and Instruction Committee
  - b) Undergraduate Instruction Committee
  - c) Facilities Operation Committee – Chair
  - d) Department Advancement Committee
- 3) College and University
  - a) Search Committee – CALS ARS Hancock Station Superintendent
  - b) Graduate Faculty Executive Committee (GFEC)
  - c) GFEC Sub-committee on MS Program Accreditation
  - d) Ten-Year Review – Chemical and Biological Engineering
- 4) Professional
  - a) ASABE PM-23/7-2 Forage Harvesting and Utilization Committee - Chair
  - b) ASABE PM-44 Machinery Management Committee
  - c) ASABE FPE – 709 Biomass Energy and Industrial Products Committee
  - d) Board Member – Wisconsin Custom Operators
- 5) Grant Review Committee
  - a) Merit Review Committee for Advanced Biomass Feedstock Logistics Systems II FOA-Golden CO; April 22-23<sup>rd</sup>, 2013
- 6) Manuscripts Reviews
  - a) Transaction of the ASABE (2)
  - b) Applied Engineering in Agriculture (1)
  - c) Biomass and Bioenergy (1)
  - d) Biotechnology for Biofuels (1)

## Significant Accomplishments

- 1) Received NIFA funding for BioMODS - biomass optimized delivery system in conjunction with Texas A & M University.
- 2) Mentored design team of Dietsche and Nigon which won 1<sup>st</sup> Place in ASABE AGCO Design Competition
- 3) Single-pass round baler for biomass harvest which was first developed at UW has been commercialized through John Deere and Hillco Technologies <http://www.youtube.com/watch?v=xD-zEHxhOA>



## Anita Thompson

Associate Professor, Ph.D.  
50% Teaching / 50% Research  
Natural Resources and Environment

Some fields of interest of Dr. Thompson are hydrologic implications of land use change, urban hydrology and stormwater management, water quality impacts of biofuel crop production, cold regions hydrology, hydrologic modeling, sediment, nutrient and pathogen transport, and polyacrylamides and biosolids for fertilizer and erosion management.

### Teaching:

Fall 2013:

- BSE 473: 2 Credits, 24 Enrolled
- BSE 509: Advisor to NR&E Group, 4 Enrolled
- BSE 671: 3 Credits, 11 Enrolled

### Advising:

Graduate Students:

- Jasmeet Lamba (Ph.D. Student)
- Michael Polich (Master's Degree)
- Stephanie Prellwitz (Master's Degree)
- Harsh Singh (Ph.D. Student)
- Ryan Stenjem (Master's Degree)

Post Master's and Post-Doctoral:

- Dr. Damodhara Mailapalli (Post-Doctoral)
- Zach Zopp (Assistant Researcher)

### Research:

- 1) "Quantifying wintertime drivers of soil erodibility: Improving soil sustainability in agriculture and scientific literacy within a changing climate". USDA-NIFA Hatch. \$237,243. [P.I.s A.M. Thompson, N.J. Balster]
- 2) "Implications of Climate Change and Biofuel Development for Great Lakes Regional Water Quality and Quantity." U.S. Geological Survey (USGS) – National Institute for Water Resources (NIWR). \$247,563. [P.I.s A.M. Thompson, B.J. Lepore, R. Jackson, K.G. Karthikeyan, D. Hyndman, A. Kendall, B. Basso, M. Feinen]
- 3) "Linking Cropping System Diversity with Nutrient Loss Dynamics in Alternative Biofuel Production Systems." USDA-NIFA Hatch. \$270,983. [P.I.s A.M. Thompson, R. Jackson, K.G. Karthikeyan]
- 4) "Predicting sediment delivery in Wisconsin agricultural watersheds." USDA-NIFA Hatch. \$143,938. [P.I. A.M. Thompson]

- 5) "Pathogen Transport during Spray Irrigation of Liquid Manure." WI Department of Natural Resources. \$75,560. [P.I.s K.G. Karthikeyan, A.M. Thompson, J. Panuska, M. Borchardt]
- 6) "P Index and Snowmelt Runoff Risk Assessment: Demonstration and Refinement." USDA-Conservation Innovation Grant. \$134,850 [P.I.s A.M. Thompson, L. Good, J. Panuska, K.G. Karthikeyan, D. Busch]
- 7) "Surface Fate and Transport of Cryptosporidium in Soils of Wisconsin's Carbonate Aquifer Region." Wisconsin Groundwater Coordinating Council. \$100,000 [P.I.s K.G. Karthikeyan, A.M. Thompson, B.J. Lepore, S. Long]

### Publications:

- 1) Prellwitz, S. and A.M. Thompson. 2013. Biota and hydrology influence soil stability in constructed wetlands. *Ecological Engineering*. [In Press]
- 2) Huisman, N.L.H., K.G. Karthikeyan, J. Lamba, A.M. Thompson and G. Peaslee. 2013. Quantification of seasonal sediment and phosphorus transport dynamics in an agricultural watershed using radiometric fingerprinting techniques. *J. Soils and Sediment*. DOI 10.1007/s11368-013-0769-0
- 3) Mailapalli, D.R., D. Misra, and A.M. Thompson. 2013 New approach for estimating hydraulic properties of soils in cold regions. *ISCORD 2013: Planning for Sustainable Cold Regions*. Proceedings of the
- 4) 10th International Symposium on Cold Regions Development, Anchorage, Alaska, June 2-5, 2013. Ed. J. Zufelt. [<http://dx.doi.org/10.1061/9780784412978>]. [Peer Reviewed]

- 5) Doherty, J., J. Miller, S. Prellwitz, A.M. Thompson, S. Loheide, and J. Zedler. Bundles and tradeoffs among six wetland services were associated with hydrologic regime. *Ecosystems*. [In Review - Revisions Requested]
- 6) Lamba, J., A.M. Thompson, and K.G. Karthikeyan. Apportionment of Stream Bed Sediment Sources in an Agricultural Watershed Using Sediment Fingerprinting Techniques. *J. Hydrology*. [In Review]

### **Abstracts/Papers/Presentations:**

- 1) Doherty, J.M., J.F. Miller, S.G. Prellwitz, A.M. Thompson, S.P. Loheide, J.B. Zedler. 2013. Productivity was a poor indicator of five other ecosystem services measured in experimental wetlands. Oral Presentation. 98<sup>th</sup> Annual Meeting of the Ecological Society of America. Minneapolis, MN, August 4-9, 2013.
- 2) Doherty, J.M., J.F. Miller, S.G. Prellwitz, A.M. Thompson, S.P. Loheide, J.B. Zedler. 2013. Productivity did not predict other wetland ecosystem services. Oral Presentation. 5th World Conference on Ecological Restoration, Society for Ecological Restoration, Madison, Wisconsin, October 6-11, 2013.
- 3) Lamba, J, K.G. Karthikeyan and A.M. Thompson. 2013. Using Fallout Radionuclides to Track Sediment Movement within an Agricultural Watershed. Oral Presentation. American Water Resources Association Wisconsin Section Annual Conference. Brookfield, Wisconsin, March 7-8, 2013.
- 4) Lamba, J, K.G. Karthikeyan and A.M. Thompson. 2013. Apportionment of suspended sediment sources in an agricultural watershed using radiometric fingerprinting techniques. Oral Presentation. 2013 American Water Resources Association Spring Specialty Conference: Agricultural Hydrology and Water Quality II. St. Louis, Missouri, March 25-27, 2013.
- 5) Lamba, J., A.M. Thompson, K.G. Karthikeyan, and J.C. Panuska. 2013. Use of sediment fingerprinting techniques to identify provenance of stream bed sediments. Oral Presentation. American Society of Agricultural and Biological Engineers Annual International Meeting, Kansas City, Missouri, July 2013.
- 6) Lamba, J., A.M. Thompson, K.G. Karthikeyan, J.C. Panuska, and L. Good. 2013. Identifying critical source areas of sediment and phosphorus for management practices using SWAT. Poster

- Presentation. American Society of Agricultural and Biological Engineers Annual International Meeting, Kansas City, Missouri, July 2013.
- 7) Mailapalli, D.R., T.D. Stuntebeck, A.M. Thompson, and R. Bannerman. 2013. Effects of slope length and soil moisture content on stormwater runoff from turfgrass. Poster Presentation. American Water Resources Association Wisconsin Section Annual Conference. Brookfield, Wisconsin, March 7-8, 2013.
- 8) Misra, D., D.R. Mailapalli, and A.M. Thompson, 2013. Cryo-pedotransfer functions for estimating hydraulic properties of soils in cold regions. Poster Presentation. Annual Fall Meeting of the American Geophysical Union. San Francisco, California, December 9-13, 2013.
- 9) Polich, M.J., A.M. Thompson and K.G. Karthikeyan. 2013. Runoff Water and Nutrient Fluxes from Biofuel Cropping Systems. Poster Presentation. American Water Resources Association Wisconsin Section Annual Conference. Brookfield, Wisconsin, March 7-8, 2013.
- 10) Polich, M.J., A.M. Thompson and K.G. Karthikeyan. 2013. Water, Soil, and Nutrient Runoff Fluxes from Miscanthus, Corn, and Switchgrass. Poster Presentation. Riveredge Nature Center's Student Research Symposium. Riveredge Nature Center, Saukville, Wisconsin, November 9, 2013.
- 11) Prellwitz, S.G. and A.M. Thompson. 2013. Soil stability and water quality within constructed wetland treatment swales. Poster Presentation. American Society of Agricultural and Biological Engineers Annual International Meeting, Kansas City, Missouri, July 2013.
- 12) Prellwitz, S.G. and A.M. Thompson. 2013. Soil stability and water quality within constructed wetland treatment swales. Oral Presentation. American Water Resources Association Wisconsin Section Annual Conference. Brookfield, Wisconsin, March 7-8, 2013.
- 13) Singh, H.V., A.M. Thompson and J. Panuska. 2013. Sediment Routing through ephemeral grassed waterways in a nested watershed. Poster Presentation. American Water Resources Association Wisconsin Section Annual Conference. Brookfield, Wisconsin, March 7-8, 2013. [Best Student Poster Award Winner]

- 14) Thompson, A.M., S.G. Prellwitz, J.Doherty, J. Miller, S. Loheide, and J. Zedler. 2013. Response of six ecosystem services to different hydroperiods in stormwater treatment wetlands. Oral Presentation. American Society of Agricultural and Biological Engineers Annual International Meeting, Kansas City, Missouri, July 2013.

## **Professional Development Activities**

- 1) Sabbatical Leave, Spring 2013

## **Professional Service**

- 1) Department and University Activities
  - a) Member, UW Committee for Undergraduate Recruitment and Financial Aid 2013-Present
  - b) Member, BSE Development and External Relations Committee 2013-Present
  - c) Member, BSE Building and Space Committee 2010-2013
  - d) Member, BSE Undergraduate Instruction and Program Committee 2002-Present
  - e) Member, BSE Awards Committee 2007-Present
  - f) Faculty Senator Alternate 2013
  - g) Member, The Nelson Institute for Environmental Studies Transportation Management and Policy Certificate Curriculum Committee 2004-Present
  - h) Member, Biology in Engineering Certificate Program Committee 2009-Present

- i) Member, The Nelson Institute for Environmental Studies, Water Resources Management Program Committee 2010-Present
- j) Chair, R. Larson Mentor Committee 2011-Present
- k) Mentor, Women Faculty Mentor Program 2010-Present
- 2) Professional
  - a) Associate Editor, Transactions of the ASABE 2008-Present
  - b) Representative, Consortium of Universities for the Advancement of Hydrologic Sciences 2011-Present
  - c) Vice-Chair, ASABE SW-223, Soil Erosion Research Committee 2013-Present
  - d) Member, American Society of Agricultural and Biological Engineers 1996-Present
  - e) Member, American Water Resource Association 2008-Present
  - f) Member, American Geophysical Union 2007-Present
  - g) Member, ASABE SW-21 Hydrology Committee 2004-Present
  - h) Member, ASABE SW-22 Erosion Control Committee 2004-Present
  - i) Member, ASABE BE-22 Ecological Engineering Committee 2003-Present
  - j) Member, ASABE SW-07 Nomenclature Committee 2010-2013
  - k) Technical Reviewer:
    - i) Water Quality Health and Exposure (1)
    - ii) NSF Competitive Grants Program (1)

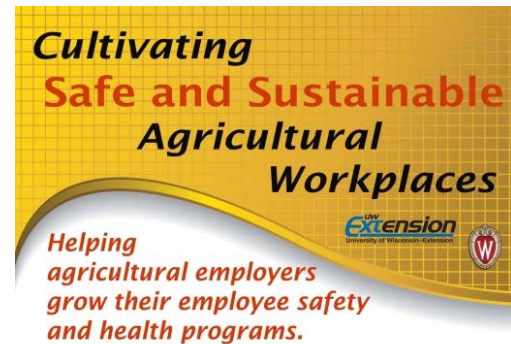
# BSE CENTER ACTIVITY REPORTS



**UW Center for Ag Safety and Health Cheryl Skjolaas**  
Senior Outreach Specialist  
Interim Director

University of Wisconsin  
Center for Agricultural Safety and Health was authorized in May 1994 by Wisconsin Act 455 to respond to the

agricultural safety and health needs of the farming community. It is funded primarily through Cooperative Extension within the University of Wisconsin-Extension (UWEX) and is a joint effort of UWEX and the Department of Biological Systems Engineering, College of Agricultural and Life Sciences, University of Wisconsin-Madison. Cheryl Skjolaas, has been the Interim Director for the Center since 2003. Jeff Nelson supports the work of the Center bringing his expertise in farm rescue and machinery. Jenna Sanford has been a student assistant since May 2012 and is a food engineering major.



## Teaching:

Agricultural Safety and Health Course for Short Course, 1 Credit, 41 Enrolled

## Extension/Outreach Activities

- 1) Responded to programming requests resulting from Wisconsin OSHA outreach and enforcement efforts. OSHA Related Activities included:
  - a. In partnership with WI OSHA coordinated and facilitated Dairy Worker Roundtable 4 to inform a variety of dairy and insurance industry representatives on activities related to dairy worker safety.
  - b. Coordinated and assisted with presentation materials for an OSHA Hazard Communications webinar 11 for participants. Participants represented dairy, potato and vegetable farm owner/operators.
  - c. Continued to update OSHA Dairy LEP resource materials and populate the [fyi.uwex.edu/agsafety](http://fyi.uwex.edu/agsafety) website.
  - d. Developed a program for members of the Wine Growers Association on OSHA general industry standards for wineries and presented at their annual conference to over 50 members.
  - e. Presented a session on OSHA for the Rock County Farm Bureau members.
- 2) Administered \$19,000 for use with 2012-2013 County Farm Safety Grants.
- 3) Continued to provide technical assistance and resources to Agricultural, 4-H and Youth Development, and vocational agricultural instructors on all aspects of agricultural safety.
- 4) Continued to administer the Wisconsin Safe Operation of Tractor and Machinery Certification (TMC) program. Continued to develop website with resources <http://fyi.uwex.edu/tractorcrt> As reported by certifying authorities 339 students received state certificates.
- 5) Taught a session on confined spaces for the Dodge County TMC, February 2013 and a session on road safety for the Walworth, Kenosha, Racine TMC in June 2013.
- 6) DOT/DATCP Road Study
  - a. Continued work as an appointed member of the DOT/DATCP Road Study Committee.
  - b. Co-chair education sub-committee and participated in equipment sub-committee activities.
  - c. Coordinated informational meetings that evolved into 6 Town Hall meetings, held August and September, 2013. Town Hall meetings were attended by over 1200 farmers, custom operators, and town, county and state officials.
  - d. Assisted with development of support materials for Town Hall meetings as well as

- on-line survey used to collect input for the final Road Study recommendations.
- e. Presented to over 100 participants at the Trio Conference as part of a Wisconsin Custom Operators meeting on Phase I Road Study report. Participants included farmer, WCO and PNAAW members, and equipment manufacturers. Also presented to the WI Section of ASABE in March 2013 on this effort.
  - f. Presented on the draft legislation to the Columbia County Corn Growers Association and Fond du Lac County Forage Council, December 2013.
  - g. Developed educational display on road safety for Wisconsin Farm Bureau Federation annual conference and participated in session on Road Issues, December 2013.
- 7) A continued emphasis for 2013 focused on assisting agricultural operations in response to an OSHA Local Emphasis Program (LEP) initiated in November 2011 for the dairy industry. OSHA resources were added to the webpage was created on the <http://fyi.uwex.edu/agsafety> to expand the site for individual's seeking further information and guidance. A two page "Quick Glance at the OSHA Dairy LEP" was update and distributed through the UWEX agricultural agents' newsletters and at the annual PDPW conference in collaboration with the UWEX Dairy Team display. Materials were prepared for the DNR/UWEX CAFO Update Meetings held during February/March and presented by UW Extension educators reaching over 300 farmers, crop consultants and engineers.
  - 8) Dairy Worker Roundtable IV was held via webinar in December 2013. The purpose of this webinar was to discuss the outcome of the 2012-13 LEP and present changes for 2013-14. The webinar format allowed individuals from outside of Wisconsin interested in dairy worker safety to participate in the Roundtable. The 22 participants were from WI OSHA Area Offices, OSHA Region V Office, DOL Wage and Hour including Specialty Populations, PDPW, UWEX, WI Technical Colleges, Rural Insurance, National Farm Medicine Center, Southwest NIOSH Ag Center and NYCAMH.
  - 9) Continued to collect and review farm-related fatalities.
  - 10) Continued work with the Professional Nutrient Applicators Association of Wisconsin (PNAAW) on confined space and road safety issues in

- conjunction with the workgroup for the UW Extension Nutrient Management Team.
- 11) Continued work with the Wisconsin Custom Operator Safety Committee on worker safety and road safety issues.
  - 12) Displayed at the WI FTD Barron County with assistance from Jeff Nelson, Outreach Specialist, BSE, on road safety, tractor overturns and with Mary Bauer, OSHA Eau Claire Regional Office, on grain handling safety. Selected as the recipient of the Donald Peterson Award.
  - 13) Continued to develop and enhance the Center website (<http://fyi.uwex.edu/agsafety>) using Wordpress software with assistance from UW Cooperative Extension.
  - 14) Served on planning committee for the Midwest Manure Summit III held February 26-27, 2013. Taught a breakout session on design considerations for confined spaces in manure storage and handling system.
  - 15) Extension Disaster Education Network
    - a. Continued as EDEN POC for UWEX.
    - b. Hosted the 2013 EDEN Annual Meeting, October 7-11, 2013 at UWEX Pyle Center, for 62 participants from US, Guam, and Philippines.
    - c. Served on Executive Committee as the Annual Meeting host.
    - d. Member of Drought NEIL to develop drought related educational resources.
  - 16) Contributor to eXtension FRESH Community of Practice (COP).
  - 17) Participated in NCERA 197 multi-state committee on agricultural safety and health activities.
  - 18) Responded to media requests for information and radio interviews.

### **Publications:**

- 1) A video CD (also on UWEX You Tube) on Horizontal Silo Management and Safety was developed with Brian Holmes, BSE, and former UWEX educator Katie Behnke. Additional release is awaiting UWEX to complete Spanish translation.

### **Websites Maintained:**

- 1) <http://fyi.uwex.edu/agsafety>
- 2) <http://fyi.uwex.edu/ioh>
- 3) <http://fyi.uwex.edu/tractorcercert>

### **Professional Development**

- 1) Attended ASABE Annual Conference, July 2013



**AgrAbility of Wisconsin**  
**Vicki Janisch Outreach Specialist (Left)**  
**Richard Straub Project Director (Right)**

Program Assistants:  
 Hannah Gerbitz (School Year)  
 Kayla Wrieth (Summer)  
 Lisa Schram (School Year)

**AgrAbility of Wisconsin** started in 1991 upon receipt of a grant from the United States Department of Agriculture. The purpose of the project is to assist farm workers and families who are dealing with disabilities, allowing them to continue in their way of life. Services provided include education, technical assistance, and identification of funding resources. AgrAbility staff provides on-site consultative services and assessments to determine farm modifications and adaptive technology that can be used to assist disabled or otherwise impaired farm workers. Modifications can range from adding a set of extra tractor steps to completely redesigning a milking parlor, and are adapted to each situation. In the past year,

AgrAbility of Wisconsin has served 442 clients with 125 of those individuals being first time clients in our 2012-13 grant year. In its 22 years of existence, AgrAbility of Wisconsin has served over 2,200 clients with a 97% success rate, which is defined as clients who are able to keep farming after services are provided.

AgrAbility of Wisconsin exists as a cooperative partnership between University of Wisconsin-Extension and the Easter Seals Wisconsin FARM program. UW-Extension handles client intake, outreach, and education, while Easter Seals staff provides onsite assessments and adaptation recommendations specific to each farm and situation. Under this unique partnership, AgrAbility of Wisconsin also works with the Division of Vocational Rehabilitation (DVR) to connect clients with services such as funds to purchase assistive technology and rehabilitative services. AgrAbility of Wisconsin services are provided confidentially and free of charge to farm families and workers dealing with the effects of a disability or limitation. Impairments can range from arthritis, amputations, and respiratory illnesses to cognitive disabilities and hearing or visual impairments.

**Teaching:**

- 1) Life Science Communications 270 Fall Semester-Communication in Life Science Industries
- 2) OTA Western Tech Class Farm Visit, La Crosse, WI
- 3) Kewaunee County UW Extension Rural Safety Day, Kewaunee, WI
- 4) Oregon FFA/Ag. Class presentations, Oregon, WI
- 5) AT Across the Lifespan Conference, WI Dells
- 6) Agriculture Assistive Technology Training on-line training course delivered to 253 Participants from 41 different states across the country.

**Extension/Outreach Activities**

- 1) AgrAbility - Agricultural Assistive Technology Training, MSN141967, Easter Seals Wisconsin
- 2) AgrAbility of Wisconsin Project Number: 143-143A488, Easter Seals Wisconsin.
- 3) Midwest Farm Show, La Crosse, January 16-17th
- 4) Marshfield Farm Show- Shoppes at Wood Ridge, Marshfield, January 20-21st
- 5) Eau Claire Farm Show, Eau Claire, March 5-6th
- 6) WPS Farm Show, Oshkosh, March 26-28th
- 7) MATC Assistive Technology Fair, Madison, May 6th
- 8) AgrAbility of Wisconsin Summit, Marshfield, May 16th

- 9) UWEX New Staff Orientation, Madison, May 23rd
- 10) Kewaunee County UW Extension Rural Safety Day, Kewaunee, Kewanee, May 22nd
- 11) ISFAC Quarterly meeting, Waukesha, June 6th
- 12) State FFA Convention, Madison June 12th
- 13) Farm Technology Days – Barron, July 9-10th
- 14) Indian Summer Festival-VA, Milwaukee, September 8-11th
- 15) EDEN Conference tours, Madison, October 8th
- 16) ANRE Conference, Wisconsin Dells, October 9th
- 17) Neighbor to Neighbor meeting- Jeff Berg, La Crosse, October 23rd
- 18) Neighbor to Neighbor meeting- Dale Peterson, Grantsberg, October 28th
- 19) AgrAbility Advisory Council meeting, Madison, November 1st
- 20) AT Across the Lifespan Conference, WI Dells, November 13-14th
- 21) UWEX New Staff Orientation, Madison, October 14th
- 22) OTA Western Tech Class farm Visit, La Crosse, November 26th
- 23) Farm Bureau Annual Meeting, December 6-7th
- 24) Virtual National AgrAbility Training Workshop, December 10-12th
- 25) Oregon FFA/Ag. Class presentations, Oregon, December 19th

## Research:

- 1) NFBA Post-Frame Building Design Manual. Completed four chapters of the principle design document for the post frame building industry in 2013. Funded by National Frame Building Association. \$14,000 in 2013.
- 2) Structural Design of Hoop Houses. Made WFBA and ASABE presentations on an insulated wood foundation for hoop houses. ASABE paper was accompanied by a paper on the subject. Recently designed unique portable hoop house for use at WMARS. Construction of hoop house with wood foundation funded in part by \$6000 USDA grant.
- 3) Evaluation and Optimization of Post-Frame Thermal Envelopes. Continued work with graduate student Holstein on a rotatable guarded hot box. Federal Hatch for 3 months at \$43,000/yr. BSE Department for 9 months at ~\$36,000/yr.
- 4) Development of Small-Scale Storage Facilities For Winter Storage of Fresh Produce. Supports

- 5) Scott Sanford work. SARE Grant through University Of Minnesota. \$36,000/yr.
- 5) Development of Sustainable Post-Frame Building System. Worked with Holstein on submittal of ASCE and ASABE journal articles for this recently completed Hatch supported project.
- 6) Sustainable Air Conditioning Systems For Plant Growth, Animal Growth And Food Storage Facilities. Worked with graduate student Styx on the development of a low-cost, high volume, heat exchanger for high-moisture environments. Project was completed for Styx's M.S. degree. Project funded with money from EPD professional development courses.
- 7) Moment Resisting Post-to-Concrete Connection. Designed, fabricated and installed (for field testing) a new post-to-concrete pier connection with high bending strength in 2013. Personally funded. Working to secure funds for laboratory testing.

## Publications:

- 1) AgrAbility Keeps Farmers Farming. Hoard's Dairyman, March 25, 2013
- 2) AgrAbility of Wisconsin Helps Farmers Overcome Obstacles. WFBF Rural Route, April/May 2013  
[http://issuu.com/wfbf/docs/ruralroute\\_aprmay2013](http://issuu.com/wfbf/docs/ruralroute_aprmay2013)
- 3) AgrAbility of Wisconsin Summit set for May 16. Agri-View, May 2, 2013  
[http://www.agriview.com/briefs/regional/agrability-of-wisconsin-summit-set-for-may/article\\_41d02726-b368-11e2-bd88-001a4bcf887a.html](http://www.agriview.com/briefs/regional/agrability-of-wisconsin-summit-set-for-may/article_41d02726-b368-11e2-bd88-001a4bcf887a.html)
- 4) AgrAbility Summit to provide resources for farmers with disabilities. Marshfieldnewsheerald.com, May 9, 2013.  
<http://www.marshfieldnewsheerald.com/article/20130509/MNH01/305090398/AgrAbility-Summit-provide-resources-farmers-disabilities>
- 5) AgrAbility of Wisconsin Summit. Hoard's Dairyman, May 16, 2013.  
<http://www.hoards.com/calendar/05-16-2013>
- 6) Sharon Farmer Keeps Going With Help from AgrAbility. Agriculturist, May 17, 2013.  
<http://farmprogress.com/story-sharon-farmer-keeps-going-help-agrability-9-98303>
- 7) Agriculture and Disability in Wisconsin. The Rehabilitation Resource-DVR, June 2013.  
[http://dwd.wisconsin.gov/dvr/rehab\\_resource/](http://dwd.wisconsin.gov/dvr/rehab_resource/)



newsletter/2013/06\_newsletter.htm

- 8) Getting Back in the Fields. UW Madison, Big Ten Network June 7, 2013.  
<https://www.youtube.com/watch?v=SFgQrAt7nQ>
- 9) Pecatonica grads showcase the future at state FFA convention. Wisconsin State Journal, June 9, 2013.  
[http://host.madison.com/business/pecatonica-grads-showcase-the-future-of-agriculture-at-state-ffa/article\\_1767072c-64bd-5208-a0f8-344026faf0f7.html](http://host.madison.com/business/pecatonica-grads-showcase-the-future-of-agriculture-at-state-ffa/article_1767072c-64bd-5208-a0f8-344026faf0f7.html)
- 10) Wisconsin FFA meeting as membership hits 29-Year High. Pioneer Press, June 10, 2013.  
[http://www.twincities.com/ci\\_23427084/wisconsin-ffa-meeting-membership-hits-29-year-high](http://www.twincities.com/ci_23427084/wisconsin-ffa-meeting-membership-hits-29-year-high)
- 11) Beyond the Barn: The Power of One- Vita Plus Expedition Chick Day 2013. Vita Plus, August 2013. <http://www.vitaplus.com/starting-strong-calf-care-e-news-august-2013/beyond-barn-power-one-vita-plus-expedition-chick-day>
- 12) Resources for Disabled Farmers. The Larry Meiller Show- September 5, 2013.  
<http://www.wpr.org/shows/resources-disabled-farmers>

## Professional Service

- 1) Department
  - a. BSE Social Committee Member and photographer for various department uses.
- 2) College/Campus/University
  - a. CALS Communicators Committee Member
- 3) Professional (ASABE/Other)
  - a. National AgrAbility Training Workshop Committee member
  - b. National AgrAbility Networking committee member
  - c. National AgrAbility Marketing committee member
  - d. National AgrAbility Evaluation committee member
  - e. Inter-Service Family Assistance Committee (ISFAC) member
- 4) Civic Service
  - a. State, National and County Holstein Association Member
  - b. Dane County Holstein Association Secretary
  - c. Wisconsin Holstein Young Adult Committee Member
  - d. State certified 4-H Judge
  - e. World Dairy Expo Volunteer

# ACADEMIC STAFF ACTIVITY REPORTS



## John Panuska

Natural Resource and Bio Environmental Engineer, Ph.D.  
100% Extension  
Water Resources and Water Quality

Dr. Panuska is registered as a Professional Engineer and professional Hydrologist in Wisconsin. He has research and Extension interests in drainage, irrigation and phosphorus loss from agricultural management systems, watershed runoff and water quality computer modeling, sediment transport and delivery from sources to receiving waters, development and application of water quality management models and

erosion control.

### Teaching:

BSE 201: 1 Credits, 25 Enrolled  
BSE 309: 1 Group of 5 Advised  
BSE 509: 1 Group of 4 Advised

### Extension/Outreach Activities

- 1) *Technical Support for the Arlington Agricultural Research Farm.* Land surveying and conservation design support services were provided to the Arlington Agricultural Research Station (AARS) included several projects. First, a static GPS control survey was completed for the bench mark located near the AARS weather station. Final horizontal and vertical coordinates were computed and verified using a static GPS baseline vector approach and provided to the AARS staff. Project cooperators include the WI Department of Transportation and the WI representative to the National Geodetic Survey. A second project included completion of field staking and a GPS control survey for waterway and terrace construction on fields south and east of the existing headquarters building. The terrace and waterway design work were previously completed as a BSE 509 senior design project. A third project included the GPS survey of an old waterway through fields adjacent to Co. Rd I and west of the Soils storage building and the development of a new waterway profile to be field staked and constructed during 2014.
- 2) *Irrigation Water Management Training.* Collaboration from UW Cooperative Extension and ANRE Program Area. I completed six irrigation water management training sessions

around the state. The audience included UWEX Ag. agents, crop consultants, government agency staff and growers. This training seeks to build greater understanding across a broad range of topics that include: water behavior in soil, sources and sinks for root zone soil water as well as monitoring and tracking root zone soil water content or understanding the root zone soil-water mass balance. Technical assistance in tracking the soil-water mass balance is provided by introducing growers to our new web-based tracking tool, the Wisconsin Irrigation Scheduling Program (WISP) which is now operational. WISP can be accessed from a desktop computer or via portable device such as a smart phone. The WISP tool allows growers to track and report total annual water use and warns them when leaching will occur. In addition, new research suggests that some irrigation water application timing strategies, such as deferred irrigation on soybeans, can further reduce annual consumptive use.

### Research (Co-Principle Investigator):

- 1) UW Consortium Grant re-funded with UW-Platteville and Stevens Point titled: Laboratory and field evaluation of two passive, low-cost samplers for monitoring edge-of-field surface-water runoff. Sampler performance for flow splitting, sediment concentration and particle size analysis is being conducted in a laboratory flume at the UW-Platteville Pioneer Farm, Total grant amount = \$39,586.00 (\$9,422 UW-Madison).

- 2) Conservation Innovation Grant (CIG) to investigate the impact of tillage induced roughness on spring snow melt runoff volume. Several small watersheds are being monitored for flow and tillage surface roughness. Results will be incorporated into the WI phosphorus Index.

## **Lectures & Technical Advising**

- 1) Agriculture Energy Webinar. Completed a national webinar for the Natural Resources Conservation Service on agricultural soil water management. Information included irrigation scheduling and soil moisture monitoring.
- 2) Nutrient and Pest Management Program Advisory Team. Participate on the program advisory board for the NPM program. Attended one day-long meeting.
- 3) Invited Speaker (WCMC). Invited speaker to the 2013 Wisconsin Crop Production Conference.
- 4) Invited Speaker (Frontier FC Coop). Conducted two training session on irrigation water management and soil moisture monitoring.
- 5) Update the Wisconsin Irrigation Scheduling Program (WISP 2011) – Principal investigator to develop and distribute a new web-based irrigation scheduling tool to replace several existing outdated scheduling programs.
- 6) Invited Speaker - Conservation Professional Development Training. Completed a training session on the use and application of computer models to NRCS staff.
- 7) Invited Speaker. WI Processing Crops Meeting to present on irrigation water management.
- 8) Invited Speaker. WI Land and Water Conservation Association to discuss research related to spray drift and irrigation of manure liquids.
- 9) Manure Runoff Risk Mapper. Technical advisor to a multidisciplinary team developing an automated web-based decision support tool for manure runoff risk. The mapper uses the National Weather Service flood forecasting model and shows runoff risk by watershed area state wide.

- 10) WI Nutrient Reduction Strategy Team. Member of the technical advisory panel lead by the WI Department of Natural Resources to develop a statewide nutrient reduction strategy as required by US EPA. Attended a work shop in Davenport Iowa sponsored by the Soil and Water Conservation Society to discuss Iowa's nutrient reduction strategy.
- 11) Demonstration Storms for Identifying Climate Vulnerability. Invited to participate on the technical advisory panel for a NOAA Grant lead by P.I Dr. Ken Potter and Co-David Liebl to investigate and transpose extreme storm events for use in the evaluation of stormwater infrastructure.
- 12) Invited USDA Grant Reviewer. Participated in a NIFA grant review panel for USDA - AFRI, RENRE Foundational Program: Microbial Communities in Soil of USDA, National Institute of Food and Agriculture (NIFA), Institute of Bioenergy, Climate and Environment (IBCE). in Washington, DC.
- 13) Invited Grant Reviewer. For the Leopold Center for Sustainable Agriculture to review a grant application on a tile drainage research project.

## **Poster & Presentations**

- 1) Wisconsin Potato and Vegetable Growers Association Annual Educational Conference, 2013 Wisconsin Farm Technology Days (irrigation posters and equipment demonstration).

## **Professional Services**

- 1) BSE Survey Lab. Manager. Provide land surveying support services and equipment to BSE, and other CALS departments as needed. Provided land surveying support for the spray irrigation research project, BSE 509 senior design project, the climate change in dairy production grant project.



## Jeff Nelson

Senior Research Specialist/Lecturer/Computer Support

50% Teaching / 50% Research

Power and Machinery, Precision Agriculture, Information Technology

### Teaching:

Farm Power Short Course: 2 Credits, 22 Enrolled

Farm Machinery Short Course: 3 Credits, 35 Enrolled

InterEgr 160: 3 Credit, 31 Enrolled

### Extension/Outreach Activities

- 1) Farm Rescue Program in Shawano County. 2 hour presentation to the Shawano County EMS Association. Attended by about 30 personnel.
- 2) Produced and staffed a Farm Safety display at Farm Technology Days. Assisted other dept. personnel with their displays. Interviewed and appeared on Eau Claire TV for a Tractor Rollover display  
<http://www.weau.com/home/headlines/Safety-a-focus-of-2013-Farm-Technology-Days-in-Barron-County-214841951.html>
- 3) Presented at Dane County Tractor and Machine Operation class. 25 11-17 yr olds. Tractor rollover, auger entanglement, PTO entanglement, landed MedFlight. Participated as Middleton Fire and BSE.

### Computer Support:

- 1) Maintenance of the computer lab in 217. Duties include physical maintenance of the lab room, maintenance of the BSE controlled software and computer hardware, local contact for the CAE managed machines.
- 2) Department-wide activities include troubleshooting problems, consulting on purchases, installing new software, updating old computers, maintaining the departmental server, and attending various training seminars on campus.
- 3) Maintain the department's network infrastructure as a DoIT Authorized Agent.
- 4) Represent the department on a CALS Info Tech user group.
- 5) Local support contact for the 101 classroom AV system.
- 6) Maintain an AV system in the B25 and 118 classrooms.
- 7) Mounted and implemented the Main Hall Information monitor. Create and maintain announcements

- 8) Oversaw the move of DHCP service to DoIT.
- 9) Assisted Dr.Xuejun Pan with starting a website on the CALS web hosting service.
- 10) Set up, maintain, and trained students in the use of the new 3D printer. One student group created a model that helped them win a national design competition
- 11) Participated in a campus-wide live evaluation of the new Office365 email and calendaring system

### Other Activities:

- 1) Guest speaker for Panuska's BSE 201 – GPS Technologies and Equipment
- 2) Superintendent of the State FFA Agricultural Mechanics Career Development Event. 88 students from 23 schools participated
- 3) Served on the Building and Space, Information Technology, and Undergraduate Instruction committees
- 4) Attend various seminars related to Instructional Technology and campus computing issues
- 5) Worked with Debby Sumwalt to produce and host a departmental display at the Majors Fair in Union South
- 6) Assisted with maintaining department Continuation Of Operations Plan (COOP) and Emergency Occupant Plan
- 7) Assist with the NIDRR AgrAbility Training grant – developing on-line training materials for Rehab Counselors and technical assistance with the on-line course.

### Civic Service:

- 1) Middleton Fire Department: Maintain and support the department's computers, Aerial and engine operator, Served on a committee putting together a new Heavy Rescue vehicle, Fire Investigation Team member, Hazardous Materials Technician, Spent Fire Prevention Week presenting in all the elementary schools in Middleton, and American Heart Association Certified CPR Instructor



## Scott Sanford

Senior Outreach Specialist  
25% Extension, 10% Teaching, 65% Gift/Grant  
Rural Energy Program

Scott Sanford is a Senior Outreach Specialist in the Biological Systems Engineering department at the University of Wisconsin-Madison where he has been on staff since 2002. He works on and manages the Rural Energy Program. He has developed audit tools and educational materials for the program and makes presentations on energy conservation. Currently he is working on energy conservation on dairy farms, irrigation system, grain drying, cold storage facilities and greenhouses. Scott also teaches the Agricultural Energy Management and the Introduction to Precision Agriculture courses for the Farm and Industry Short course program. Prior to joining the university, Mr. Sanford worked in the dairy equipment business for 17 years holding positions in engineering, marketing and manufacturing.

### Teaching:

Ag Energy Management, 22 Enrolled  
Intro to Precision Agriculture, 15 Enrolled  
BSE 367: Online Teaching Assistant  
BSE 473: Irrigation Equipment  
HORT 334: Greenhouse Energy Efficiency  
DYSC 433: Milking Units/Milking Parlors

### Extension/Outreach Activities

- 1) *Farm Tech Days*. Field Demo sub-Chairperson. Oversaw field demo during show. Coached county Field Demo committee. Developed an LED lighting display for the Applied Technology Center.
- 2) *WFMVGA Meeting*. Environmental Control in High Tunnels
- 3) *Greenhouse Energy Auditor Training*. Franklyn Energy Services LLC
- 4) *Greenhouse Energy Efficiency*. SD Organic Growers Conference
- 5) *On-Farm Energy Conservation*. SD Organic Growers Conference
- 6) *SARE Regional Professional Development Training – Energy*. Webinar Series, Coordinator, Presentations on Animal Housing, Greenhouse Energy Efficiency, Dairy farm Energy Efficiency, and Optimization of Irrigation.
- 7) *SARE Development of Small-Scale Facilities for Winter Storage of Fresh Produce* Presentation at South Dakota Organic Growers Conference.

### Research:

- 1) Energy Self-Assessment Website Maintenance - DJ Reinemann, SA Sanford Funding from USDA-NCRS (\$56,350). Project provides maintenance and web hosting services for the Energy Self-Assessment web site previous developed. Provide troubleshooting, error corrections and programming support. Answer e-mail and phone inquires as needed. Provide assistance in transferring the website to USDA at the end of the maintenance period. Project dates: 8-15-2011 to 7-31-2014
- 2) SARE Regional Agricultural Energy Use Professional Development. Funding from AGRIC, COOP STATE RESEARCH EDUCATIONAL & EXT SERV (\$74,919). Develop a resource list for energy efficiency and webinars on the topics of dairy farms, grain drying, irrigation, greenhouses, animal housing (poultry/swine/equine), and field crops. Project dates: 1/1/2010 to 12-3-2011 Extended to 6-31-2013
- 3) SARE Research & extension grant – Bohnhoff/Sanford. Funding from USDA-National Institute of Food & Agriculture (\$107,742). PI Development of Small-Scale Storage Facilities for Winter Storage of Fresh Produce. Develop designs and plans that are expandable for small scale cold storage facilities targeted at winter stored crops. Develop low-cost environmental controls to aid in controlling temperature and maintaining humidity levels. Author a publication that covers the design and management of winter storage facilities. Hold workshops and webinars throughout the

Midwest to disseminate the information and plans. Project Dates: 9-1-2011 to 8-31-2013  
Extended to 8-31-2014

- 4) WI Energy Extension Partnership. Funding from USDOE (\$39,498) Assist in developing an in-service training for Extension Agents. Develop and present webinar series on energy topics. Energy Display at Farm Technology Days. Partnership with UW-Extension and WI State Energy Office. Project Dates: 2-6-2012 to 9-29-2013
- 5) On-Farm Energy Quality Assurance Training – Sanford PI. Funding from USDA-NRCS (\$100,000). Develop series of webinars for training NRCS personnel about energy use in different agricultural enterprises. Provide written materials and references for webinar presentations. Setup and coordinate an in-person field training session. Provide consultation on reviewing audits. Project Dates: 9-24-2013 to 9-30-2014

### **Publications:**

- 1) On-Farm Energy Conservation & Efficiency Series – S. Sanford  
<http://fyi.uwex.edu/biotrainingcenter/>  
Introduction to Farm energy Use – D. Day, S. Sanford, Farm Practices to Improve Energy

Efficiency: Field Operations – D. Day, Dairy Energy Efficiency – S. Sanford, Grain Drying – K. Hellevang, S. Sanford, Irrigation - S. Sanford, Animal Housing - S. Sanford, Greenhouses - S. Sanford, and Resources for Energy Efficiency and Renewable Energy Programs – S. Sanford, P. Porter

- 2) Lighting Technology: LED lamps for Home, Farm and Small Business - Scott Sanford (currently in layout and production – UWEX A publication)
- 3) Wood Heating Appliances for Homes and Businesses - Choosing the right equipment - Scott Sanford, David S. Liebl (currently in layout and production – UWEX A publication)

### **Professional Service**

- 1) ASABE Committees
  - a. SE-303 – Environment of Plant Structures
  - b. IET-441 – Milk Handling Equipment
  - c. IET-433 – Electrical Utilization & Energy Applications
  - d. FPE-702 – Crop & Feed Processing & Storage
  - e. SE-414 - Renewable Power Generation
  - f. SW-241 - Sprinkler Irrigation
  - g. T-11 – Energy
  - h. Wisconsin Section
- 2) Social Committee BSE – chair



## Astrid Newenhouse

Senior Scientist, Ph.D.

10% FTE Jan.-July and Sept., 42% FTE Oct.-Dec.

Healthy Farmers Healthy Profits

During 2013, Larry Chapman and I expanded the outreach of projects previously completed concerning fall prevention in rural nursing homes and home health agencies. This work received recognition from nursing staff and people who work in aging and disability fields. Although unsuccessful in securing funding to continue agricultural safety work, we made new contacts for our network of people who may be interested in applying for grants together or working on future projects. These contacts were mostly in health related fields.

With the Midwest Rural Energy Council, Newenhouse began a project to develop a presentation handout on wind energy and stray voltage into an Extension publication, filling a need for information in this area and making the information accessible to a wider audience.

### Extension/Outreach Activities:

1. Center for Agricultural Safety and Health:
2. Distributed two publications (developed in 2012) Nursing Facilities Annotated List of Falls Management Resources, and Home Health Agencies Annotated List of Falls Management Resources throughout Wisconsin and nationally via venues such as the Wisconsin Clinical Resource Center, the Wisconsin Office of Rural Health, and Aging and Disability Resource Centers. Here is a sample comment describing the impact of this work: I am a Community Health Educator with the Aging & Disability Resource Center of Central Wisconsin and co-chair of the Wood County Falls Prevention Coalition. Your work with The Falls Management Program was passed along through one of the statewide listserves and I'm finding it very helpful. Our team just completed a survey with 99 facilities in Wood County....
3. Distributed information and research results upon request to farmers, previous funders, government agencies, and non-profits.
4. Maintained connections to farm managers, advisors, researchers, and tool distributors in US and abroad concerning work efficiency and ergonomics.
5. Midwest Rural Energy Council Scholar:
6. Outreach concerning rural energy issues including helping coordinate an annual conference, workshops, and developing Extension publications.
7. ad-hoc Senior Scientist
8. Guest speaker on Larry Meiller's WHA radio call-in show, "Garden Talk", Nov. 29, 2013
9. Participated in CALS Communicators meetings.

### Research:

With Larry Chapman, wrote research grant proposals concerning rural safety and health issues to agencies

such as the USDA Rural Health and Safety Education (RHSE) Competitive Grants Program, State of Wisconsin Department of Health Services Division of Quality Assurance, and The Retirement Research Foundation. Worked with collaborators in the UW Department of Orthopaedics and Rehabilitation, UW School of Medicine and Public Health, UW School of Nursing, regional nursing home staff and associations, private health care agencies, and health care consultants. None of the projects were funded in 2013.

### Peer-Reviewed Journal Articles:

1. Karsh BT, Newenhouse AC, Chapman LJ. *Barriers to the adoption of ergonomic innovations to control musculoskeletal disorders and improve performance*. Applied Ergonomics 2013;44(1):161-167.
2. Chapman LJ, Newenhouse AC. *Wisconsin nursing home staff perceptions of a falls management intervention*. Wisconsin Medical Journal 2013;112(4):162-168. (cover article of the August issue)

### Reports

3. Final report, USDA NIFA Rural Health and Safety Education Program (PI Larry Chapman). *Front line staff fall prevention training for rural Wisconsin nursing homes*. 10/1/2012-9/30/2013, \$189,090.

### Professional Development Activities:

Promoted to Senior Scientist July 1, 2013.

### Professional Service:

College/Campus/University: Participated in UW Cooperative Extension Agriculture and Natural Resources Education Program Area Annual Meeting, also CALS Communicators Meetings.

Profession (ASABE/other): Participated in Joint Council of Extension Professionals Galaxy IV Conference, Sept 16-20, Pittsburgh, PA.

Civic Service: 4-H County Fair Judge, Girl Scout Troop Leader



## **Paul Thompson**

Adjunct Professor, Ph.D.  
10% Research on Gifts/Grants  
Milking and Milk Cooling

Dr. Thompson's interests include milking, milk handling, milk cooling, biological sensors, diagnostic ultrasound, alternative energy sources, and business management.

### **Research:**

- 1) Milking Machine Research. Funded by Avon Dairy Solutions. This project is aimed at developing methods to characterize the performance of the milking liner and to gain a better understanding of the physiological interactions between milking machine liners and the cow. We are especially interested in understanding the influence of liner shape, material and novel new design elements. In addition to assisting as needed, my individual contribution has been to develop sensors for detection of the start and end of milk flow from each teat during machine milking. So far, an optical sensor showed promise, but was abandoned in favor of a vibration monitor mounted on the short milk tube. The characteristic vibratory signatures of air flow only and of mixed air/milk flow have been recorded and this information will be used to develop a Labview V.I. that will detect milk flow start and stop. Correlation of milk flow start or stop with differential pressure across the liner will allow calculation of liner compression under actual milking conditions.

### **Publications:**

- 1) Exploring the Role of Liner Dimension, Shape, and Venting on Milking Performance. Douglas J. Reinemann, Sonia Maria Ares-Gomez, Paul D. Thompson, and Ian Ohnstadt. Invited Presentation, NMC Annual Meeting Proceedings, 2013
- 2) Understanding the Milking Machine: The Contribution of Cyclic Liner Compression to Effective Pulsation. Graeme A. Mein, Douglas J. Reinemann, and Paul D. Thompson. Invited Presentation, NMC Annual Meeting Proceedings, 2013



# EMERITUS AND AFFILIATED FACULTY ACTIVITY REPORTS



## Ferencz Denes

Professor Emeritus, Ph.D.  
Research  
Food Safety

Dr. Denes has an interest in the fields of plasma-enhanced synthesis and surface modification of materials, immobilization of active biomolecules onto plasma-functionalized surfaces, deposition of anti-fouling and anti-microbial surface layers, plasma-enhanced synthesis of nanoparticle systems, and development of novel non-equilibrium plasma tools.

### Research:

- 1) Design and Development of a Atmospheric Pressure, Hybrid Dense medium (DMP) Plasma Tool (Submerged Arc Plasma) combined with Ultra Sound (US) Environment. Goals: (1) Synthesis of controlled- dimensional-size, sole, hybrid and magnetic nanoparticle systems with potential use in microelectronics, optics and biotech applications. (2) Atmospheric Pressure, DMP/US Plasma-Aided Synthesis of Carbon-based Nanoparticle Systems that are decorated with Primary Amine Functionalities. (3) Coating Magnetic Iron Oxide Nanoparticles with Surface layers Resulting from Plasma-generated Nascent Atomic and Molecular-fragment Particles.
- 2) Development of functionalized nano-particle systems for targeted drug delivery. Collaboration with Richard B. Timmons, University of Texas at Arlington, and Prof. M. Sandor and Prof. Zs. Fabry, Department of Pathology and Laboratory Medicine, UW School of Medicine and Public Health 5468 MSC. Goal: Development of functional nanoparticle systems for targeted drug-delivery applications.
- 3) Design and Development of an Atmospheric Pressure Surface-Plasma Tool Provided with Cooling/Heating Possibilities (Peltier Effect) of the Surface that is Exposed to the Plasma Layer. Goal: Conversion of low-temperature- and low pressure-deposited organic, crystalline or non-crystalline, sole or multiple thin layers into solid phase three-dimensional macromolecular networks with potential use in microelectronics

and optical applications. The functionality of the plasma toll is under evaluation.

### Peer-Reviewed Journal Articles

- 1) B. J. Larson, S. D. Gillmor, J. M. Braun, L. E. Cruz-Barba, D. E. Savage, F. S. Denes, and M. G. Lagally Long-Term Reduction in Poly(dimethylsiloxane) Surface Hydrophobicity via Cold-Plasma Treatments, | Langmuir 2013, 29, 12990–12996 Department of Materials Science and Engineering, University of Wisconsin Madison, 1509 University Avenue, Madison, Wisconsin, Langmuir 2013, 29, 12990–12996.
- 2) F.S. Denes, S. Manolache and H. Jian, Dense Medium Plasma Environments Used for the Synthesis of Nanoparticle Systems and Structural Modification of Liquid Media, Journal of Photopolymer Science and Technology, Volume 26, Number 4 (2013) 513 –527

### Conferences/Lectures

- 1) Key-note Lecture of F.S. Denes at the Photopolymer and Science and Technology, International Meeting, Chiba, Japan, June 2013.



## Roger Rowell

Professor Emeritus, Ph.D.

Research:

Forestry, Composite Agricultural Materials

Dr. Rowell has interests in the fields of biomaterials, wood chemistry, carbohydrate chemistry, chemical modification of wood, dimensional stability of wood, biodurability of wood, water repellency, and wood hardening.

### Research:

- 1) *Development of Advanced Wood Fiber-Based Composites based on Fiber Modification.* Funding from a private company. The performance of wood fiber-based composites can be greatly improved by chemical modification of the fiber the composite is made. Dimensional stability and water repellency can be greatly improved by bulking the cell wall with bonded chemicals and by using hydrophobic reactants. Decay resistance can be greatly improved using the same chemistries since restricting access to water by the microorganisms is one way to stop or decrease fungal attack. One of the technologies that has been studied is the reaction of wood with acetic anhydride. The dimensional stability of acetylated wood and its decay resistance is greatly increased. This is a non-toxic approach to wood preservation that is presently commercially available. New patents are being written to support this research.
- 2) *Removal of Contaminates from Water.* Funding from public and private funds. Small test filters are being placed in streams that are contaminated from (1) animals that live in or around that stream or (2) land fill in the area. One filter has been placed near Rose Hill Kansas near a cattle farm (63rd road supported by Rose Hill High School), one in Georgia (Canton) near a horse farm (Mill Creek supported by Venture Crew 469), one in Oregon (Portland, supported by Siskiyou Dharma) and one in Wisconsin near a cattle farm. The water is first checked for particles and color and then a small test filter is placed in part of the stream. The filters are made of small particles of bark in mesh bags. The filter remains in the stream for 24 hours and then a water sample is taken to check for particles and color.
- 3) *Development of Wood with Increase Hardness.* Funding from a private company. The hardness of wood can be greatly increased by impregnating the wood with acrylic monomers and polymerizing them in situ. A vaso catalyst is used along with heat to cure the polymer. A dye can be added to the monomer mixture to change the color of the final wood product. Hardness is increased several hundred percent and the final product is used for industrial flooring. Several different acrylates are under test along with different mixtures of acrylates and glycols. Distribution of the in situ polymer is investigated by SEM.
- 4) *Heat Treatments of Wood to Improve Decay Resistance and Dimensional Stability.* Funding from a private company. Wood that is heated at high temperatures (120-350 C) becomes more decay resistant and has a higher dimensional stability than unheated wood. The mechanism of effectiveness is due to the decomposition of the hygroscopic hemicellulose polymers in the cell wall. There is a 10 to 20% decrease in weight and a decrease in strength properties upon heating either in the presence or absence of oxygen. The heated wood is brash but has increased resistance to brown-rot fungi but not to white-rot fungi. After heating at 220 C for 3 hours, there is a 50% decrease in the equilibrium moisture content and an increase of 50% in dimensional stability.

### Peer-Reviewed Journal Articles

- 1) Rowell, R.M. 2013. Acoustical properties of nontraditional woods. *McGraw-Hill Yearbook of Science and Technology*, 3-6.
- 2) Rowell, R.M. 2013. Acoustical properties of acetylated wood. *J. Chem. Chem. Eng.* 7:834-841.

## Patents

- 1) Rowell, R.M. 2013. Treatment of Wood Pieces. U.S. Patent 20130303751, November 14, 2013.

## Conference Proceedings, Technical Papers/Reports

- 1) Rowell, R.M., J. Alexander and M. Maes. Hierarchical shift for wood panels from biocomposite to biomaterial. In: Proceedings: International Panel Products Symposium, Oct 9-10, Llandudno, Wales



### Larry Chapman

Senior Scientist Emeritus  
Research  
Healthy Farmers Healthy Profits

Some fields of interest of Mr. Chapman include neurotoxicology, ergonomics, work design, labor efficiency in agricultural production systems, intervention evaluation effectiveness in occupational health, technology transfer and diffusion of innovations, occupational stress, fresh market vegetable production methods, dairy production methods, and childhood and adult injury prevention.

## Research:

- 1) Chapman LJ, Newenhouse AC. Nursing home staff perception of a falls management intervention. Wisconsin Medical Journal 2013;112(4):162-168.
- 2) Chapman LJ, Brunette CM, Tavieria AD. A seven year intervention to diffuse economic innovations with safety benefits to Wisconsin dairy farmers. Journal of Agricultural Safety and Health;2013;19(3): 147-162.



## John Ralph

Affiliate Professor  
WI Bioenergy Initiative

### Graduate Students Advised:

Wu Lan (Research Assistant)

### Research:

- 1) Plants Designed for Improved Processing. Wu lan. Funding from DOE GLBRC Project 1.1.9. Lots of Collaborators. The long-term project goals are to understand lignification and cell wall crosslinking, and the limits to cell-wall-phenolics metabolic plasticity, to alter composition and structure in ways that significantly improve biomass processing energetics.
- 2) Lignin Management: Optimizing Yield and Composition in Lignin-Modified Plants. Matt Regner, Yukiko Tsuji, Hoon Kim, and Fachuang Lu. Funding from Stanford University's Global Climate and Energy Program. Collaboration with Wout Boerjan (U. Gent, Belgium), Clint Chapple (Purdue), Claire Halpin (U. Dundee, Scotland), and Xu Li (NCSU). This project aims to maximize the utility of plant lignocellulosic biomass as an abundant, sustainable, and carbon-neutral energy feedstock by optimizing both its yield and composition to facilitate downstream conversions to fuel and electricity.
- 3) Development of Crucial Tools for Lignin Research. Hoon Kim, Fachuang Lu, Yimin Zhu, Ruili Gao, Alden Voelker, Matt Regner, Yuki Tobimatsu. Fundin from DOE Office of Science and Office of Biological Research. Collaboration with Michael Hahn (U. GA), Fang Chen and Richard Dixon (U. NT), and Steve Decker (NREL). Three primary objectives of this research are therefore to: a) Develop a set of monoclonal antibodies to specific structures in lignins – for structural and localization studies; b) Develop a robust and flexible system for producing polymer-supported lignin monomers and oligolignols – for antibody screening, reactivity determination, elucidation of cross-coupling propensities, and beyond; and c) Develop fluorescent-tagged monolignols – to aid in lignin localization studies and to help elucidate monolignol transport mechanisms.
- 4) Biodegradative Oxidant Production by Fungi in Lignocellulose: *in situ* Mapping and Relationship to Gene Expression. Vitaliy Tymokhin, Yimin Zhu Funding from DOE Office of Science and Office of Biological Research. Collaboration with Ken Hammel, Chris Hunt, and Carl Houtman (USFPL). Our overall aim in the proposed work is to provide new insights into the mechanisms that fungi of interest employ to degrade lignocellulose.
- 5) Regulation and Predictive Modeling of Lignin Biosynthesis. Hoon Kim, Sarah Liu. Funding from NSF. Collaboration from Vincent Chiang and Ron Sederoff (NCSU). Our work in this project includes tasks related to lignin structural elucidation.

### Peer-Reviewed Journal Articles

- 1) R. Vanholme, I. Cesarino, K. Rataj, Y. Xiao, L. Sundin, G. Goeminne, H. Kim, J. Cross, K. Morreel, P. Araujo, L. Welsh, J. Haustraete, C. McClellan, B. Vanholme, J. Ralph, G. Simpson, C. Halpin and W. Boerjan. Caffeoyl shikimate esterase (CSE), a newly discovered gene in the lignin biosynthetic pathway. *Science*, 341(6150), 1103-1106 (2013). [COVER ARTICLE]
- 2) Y. Tobimatsu, A. Wagner, L. Donaldson, P. Mitra, C. Niculaes, O. Dima, J.-I. Kim, N. A. Anderson, D. Loque, W. Boerjan, C. Chapple and J. Ralph. Visualization of plant cell wall lignification using fluorescence-tagged monolignols. *The Plant Journal*, 76(3), 357-366 (2013). [COVER ARTICLE]
- 3) Wagner, Y. Tobimatsu, G. Goeminne, L. Phillips, H. Flint, D. Steward, K. M. Torr, W. Boerjan and J. Ralph. Suppression of CCR changes metabolite profile and cell wall composition in *Pinus radiata* tracheary elements. *Plant Molecular Biology*, 81(1-2), 105-117 (2013). [COVER ARTICLE]
- 4) Y. Zhu, M. Regner, F. Lu, H. Kim, A. Mohammadi, T. J. Pearson and J. Ralph. Preparation of

- monolignol  $\gamma$ -acetate,  $\gamma$ -p-hydroxycinnamate, and  $\gamma$ -p-hydroxybenzoate conjugates: Selective deacylation of phenolic acetates with hydrazine acetate. *RSC Advances*, 3(44), 21964-21971 (2013).
- 5) Q. Zhao, Y. Tobimatsu, R. Zhou, S. Pattathil, L. Gallego-Giraldo, C. Fu, G. L. Shadle, L. A. Jackson, M. G. Hahn, H. Kim, J. Ralph, F. Chen and R. A. Dixon. Loss of function of Cinnamyl Alcohol Dehydrogenase 1 causes accumulation of an unconventional lignin and a temperature-sensitive growth defect in *Medicago truncatula*. *Proceedings of the National Academy of Sciences of the United States of America*, 110(33), 13660-13665 (2013).
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## Books & Chapters

- 1) F. Lu and J. Ralph. The DFRC (Derivatization Followed by Reductive Cleavage) method and its applications for lignin characterization. in *Lignin: Structural Analysis, Applications in Biomaterials, and Ecological Significance*, ed. F. Lu, Nova Science Publishers, Inc, Hauppauge, New York, USA, in press (2014).

## Patents

Method for modifying lignin structure using monolignol ferulate conjugates. Patent Number: US 8,569,465 B2; Date of Patent: October 29, 2013  
 Feruloyl-CoA:Monolignol Transferase, Pub No.: US 2013/0219547 A1 (August 22, 2013). Assignors: Curtis Wilkerson, John Ralph, Saunia Withers

## Conference Proceedings

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- 2) J. Ralph, C. G. Wilkerson, S. D. Mansfield, F. Lu, J. H. Grabber, R. A. Dixon, F. Chen, H. Kim, Y. Zhu, Y. Tobimatsu, J. Rencoret, D. Padmakshan, S. D. Karlen, M. Regner, S. Withers, J. C. Sedbrook and W. Boerjan. Altering plant lignins for improved processing. Abstracts of Papers of the American Chemical Society, New Orleans, LA (2013).
  - 3) J. Ralph, C. G. Wilkerson, F. Lu, H. Kim, Y. Zhu, J. Rencoret, J. H. Grabber, R. D. Hatfield, J. C. Sedbrook, S. D. Mansfield, W. Boerjan, S. D. Karlen, Y. Tobimatsu, D. Padmakshan, M. Regner, S. Withers, Y.-Y. Park, D. Petrik, R. A. Dixon, F. Chen, C. Chapple, J.-K. Weng, A. Wagner, L. Donaldson and C. Lapierre. Approaches toward improving bioenergy crops for efficient biomass conversion. Ohio Plant Biotechnology Consortium, Ohio State U., Wooster, OH (2013).
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  - 9) H. Kim and J. Ralph. High-resolution 2D-NMR (HSQC) profiling of the xylan and amorphous cellulose from ball-milled cotton linter cellulose using the DMSO-d(6)/pyridine-d(5) solvent system. Abstracts of Papers of the American Chemical Society, 245 (2013).
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  - 11) C. L. Cardenas, U. Avci, R. H. Davis, R. Dong, J. Ralph, H. Kim, S. D. Mansfield and M. G. Hahn. Lignin-directed monoclonal antibodies. XIIIth Cell Wall Meeting, Nantes, France (2013).
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## Awards

- 1) 2013 - American Chemical Society, Anselme Payen Award (Cellulose and Renewable Materials Division). [to be awarded at the 2014 National ACS in Dallas, March 2014]
- 2) 2013 - The University of Seville–BRUKER Award 2012 that recognizes the best scientific paper using NMR techniques for the paper “Structural Characterization of Wheat Straw Lignin as Revealed by Analytical Pyrolysis, 2D-NMR and Reductive Cleavage Methods.” <http://investigacion.us.es/noticias/756>
- 3) 2012 - Fulbright fellowship, U. Vienna, Oct. 2012–Jan. 2