



Biological Systems Engineering

UNIVERSITY OF WISCONSIN-MADISON

2014 Annual Summary of Teaching, Research & Extension



College of Agricultural & Life Sciences
University of Wisconsin-Madison

Biological Systems Engineering
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Executive Summary

The Biological Systems Engineering Department is the oldest agricultural engineering department in the United States but as you will see in our annual report, we are engaged in many exciting, innovative, forward-looking activities in teaching, research and extension. The Biological Systems Engineering Department is affiliated with the College of Agricultural and Life Sciences (CALS), the College of Engineering (COW), the UW-Madison Agricultural Research Stations, and the Cooperative Extension (UWEX).

Our undergraduate program is fully accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>. Undergraduate enrollment is at an all-time high with over 160 students and continued growth projected into the future. We have become the largest of the applied agriculture departments in the college as indicated by number of degrees granted by program. 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. The department offers a wide range of courses to support our undergraduate specialization areas: Machinery Systems Engineering, Food and Bioprocess Engineering, Natural Resources and Environmental Engineering, and Structural Systems Engineering.

The graduate program offers both Master of Science and Doctoral degrees with over 50 graduate students. Our graduate research program is to advance the science of sustainable food and bio-products production systems, train graduate students, and to increase the quality of undergraduate instruction. Our research programs are financially supported by state and federal appropriations and by gifts and grants from industry, government agencies, and individuals. This support is gratefully acknowledged. The gifts and grants continue to increase as a percent of budget.

Extension and outreach programs are an integral part of the department and are highly regarded in the UWEX system. Many of our Extension personnel are also involved in research and classroom teaching. Extension and outreach activities are directed toward providing continuing education opportunities for the citizens of Wisconsin and the nation. The mission is to extend research knowledge and to assist in assimilating it into the community.

Since this report is only a summary, please visit our website, <bse.wisc.edu> or to contact faculty and staff with any questions about specific activities. Publications listed in this report are available upon request.

I also welcome your comments on our annual report and other departmental matters so do not hesitate to contact me by e-mail: djreinem@wisc.edu, snail mail, or telephone 608-262-0223.

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 A.: Assistant Professor, Ph.D., Teaching/Research
Luck, Brian D.: Assistant Professor, Ph.D., Extension/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

Etzell, 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., Ph.D., Adjunct Professor, Biomedical Engineering
Vadas, Peter: Professor, Ph.D., U.S. Dairy Forage Research Center
Zhu, Jun Yong: Professor, Ph.D., Forestry

EMERITUS FACULTY

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

ACADEMIC STAFF

Contresras-Govea, Francisco: Outreach Specialist
Cronin, Keith: Assistant Researcher
Duvall, Benjamin: Assistant Scientist
Gerbitz, Hannah: Associate 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.: Senior Scientist, Ph.D.
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
Thompson, Paul: Senior Scientist
Zopp, Zachariah: Assistant Researcher

TECHNICAL PERSONNEL

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

OFFICE PERSONNEL

Reinen, Sue: Academic Department Supervisor
Meyer, Terry: Financial Specialist
Spahn, Pam: Payroll and Benefits Specialist
Sumwalt, Debra K.: Student Services Coordinator
Kent, McKenna: Student Worker

RESEARCH ASSOCIATES

Aguirre-Villegas, Horacio (Larson/Reinemann)	Necpalova, Magdalena (Anex)
Anthony, Renil (Runge/Anex)	Onsekizoglu, Pelin (Gunasekaran)
Chen, Shengli (Pan)	Seenivasan, Rajesh (Gunasekaran)
Cokeliler, Dilek (Gunasekaran)	Sundramoorthy, Ashok Kumar (Gunasekaran)
Fan, Yongming (Pan)	Upton, John (Reinemann)
Harde, Shirishkumar (Pan)	Yang, Qiang (Runge)
Leonardi, Stefania (Reinemann)	Yasri, Nael (Gunasekaran)
Mohan, Chitradurga (Gunasekaran)	Yoo, Chang Geun (Pan)

MASTER'S STUDENTS

Accola, Joshua (Karthikeyan/Thompson)
Bradley, Alysa M. (Larson)
Buschert, Elizabeth I. (Thompson)
Deines, Nickolas F. (Larson)
Dietsche, Scott C. (Shinners)
Francis Clar, Jordi T. (Anex)
Gu, Lei (Anex)
Gunawardhana, Thilina L. (Anex)
Harmon, Joshua D. (Luck)
Harper, Matthew K. (Choi)
Jordan, Kari (Gunasekaran)
Jozik, Natalie S. (Anex)
Karlen, Jacob D. (Shinners)
Krantz, Sarah (Runge)

Lacy, Nolan C. (Shinners)
Li, Ao (Anex)
Mei, Chaoqun (Pan)
Nigon, Brandon J. (Shinners)
Orrick, Justin D. (Shinners)
Pham, Kim Houng (Runge)
Polich, Michael J. (Thompson)
Sanford, Joseph R. (Larson)
Skog, Andrew (Karthikeyan/Thompson)
Stubbe, Ashley (Shinners)
Wang, Zening (Pan)
Wiskur, Glen (Shinners)
Zang, Shuting (Pan)
Zang, Zening (Pan)

PH.D. STUDENTS

Aguirre-Villegas, Horacio Andres
(Larson/Reinemann)
Bashar, Rania (Karthikeyan)
Boswell, Ed (Thompson)
Buchanan, Jack (Reinemann)
Choi, Kyeongok (Gunasekaran)
Drewry, Jessica (Choi)
Guan, Jiehao (Gunasekaran)
Gunukula, Sampath R. (Anex)
Holly, Michael A. (Larson)
Holstein, Andrew (Bohnhoff/Choi)
Lamba, Jasmeet (Thompson/Karthikeyan)
Lan, Wu (Ralph)
Li, Ning (Pan)
Liang, Yifan (Choi/Larson)
Liao, Yang (Pan)
Liu, Zong (Gunasekaran/Runge)

Lu, Lin (Gunasekaran)
McCord, Aleia (Larson)
Miller, Elizabeth (Karthikeyan/Pederson)
Mondaca Duarte, Mario (Choi)
Nason, Sara (Karthikeyan/Pederson)
O'Dell, Jane (Etsel)
Ortiz Reyes, Edgardo (Anex)
Ozdogan, Ayse (Choi/Tinjum)
Penry, John (Reinemann)
Perez, Jose (Larson)
Rowbotham, Robert (Reinemann/Ruegg)
Singh, Harsh: (Thompson)
Wang, Hui: (Larson)
Wang, Yi-Cheng: (Gunasekaran)
Xiang, Zhouyang: (Runge)
You, Youngsang: (Gunasekaran)
Zhou, Shengfei: (Runge)

INSTRUCTIONAL PROGRAMS

Our disciplinary scope is the application of engineering principles to the development of sustainable food and bio-products production systems. The department offers a BS degree in Biological Systems Engineering with areas of specialization: Food, Machinery, Natural Resources, Bio-Process, and Structural Systems Engineering. We have developed a curriculum tailored to each of these areas of specialization. BSE faculty also teach courses to support other CALS programs including the Farm and Industry Short Course (FISC). 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 the University of Wisconsin System, awarding about 40 B.S. degrees each year.

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.

The following courses are taught by BSE faculty to support our instructional mission.

No.	Name	Program	Credits
90	Agricultural Safety & Health	FISC	1
91	Agricultural Energy Management	FISC	2
92	Farm Machinery	FISC	3
94	Farm Power	FISC	2
95	Livestock Housing	FISC	3
99	Intro to Precision Agriculture	FISC	2
102	Intro to Engineering Grand Challenges	Inter Engr.	2
160	Intro to Engineering Design	Inter Engr.	1
201	Land Surveying Fundamentals	CALS	2
216	Irrigation Systems - Design & Use	CALS	1
218	Drainage Systems	CALS	1
209	Career Management for Engineers	BSE	1
249	Engineering Principles for Biological Systems.	BSE	3
270	Intro to Computer Aided Design	BSE	3
309	BSE Design Practicum I - Instruction	BSE	2
349	Quantitative Techniques for Biological Systems	BSE	3
351	Structural Design for Agricultural Facilities	BSE	3
356	Sustainable Residential Construction	BSE	3
364	Engineering Properties of Biological Materials	BSE	3
365	Instrumentation for Biological Systems	BSE	3
367	Renewable Energy Systems	BSE	3
372	On-Site Waste Water Treatment and Dispersal	BSE	2

441	Rheology of Foods and Biomaterials	BSE	3
460	Biorefining: Energy & Products from Renewable Resources	BSE	3
461	Bioprocessing Unit Operations	BSE	3
464	Heat and Mass Transfer in Biological Systems	BSE	3
472	Sediment and Bio-Nutrient Engineering & Mgmt.	BSE	3
473	Irrigation and Drainage Systems Design	BSE	3
475	Engineering Principles of Agricultural Machinery	BSE	3
476	Engineering Principles of Off-Road Vehicles	BSE	3
509	BSE Design Practicum II - Instruction	BSE	3
571	Small Watershed Engineering	BSE	3
671	Topics in Natural Resource Engineering	BSE	3
875	Milking Machines	BSE	3
875	Integral Ecology	BSE	1
900	Graduate Seminar	BSE	1
901	Graduate Research Seminar	BSE	1

CORE FACULTY ACTIVITY REPORTS



Robert Anex

Professor, Ph.D.

40% Teaching / 60%Research

Dr. Anex's research focuses on developing systems for producing energy, fuels and products from biorenewable resources. Dr. Anex's research group is studying the economic and environmental feasibility of biorenewable chemicals developed, nutrient recovery and cycling in biofuel systems, and the 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 2014:

BSE 309: 2 Credits, 4 Enrolled

BSE 349: 3 Credits, 48 Enrolled

BSE 990: Various Research Credits, 6 Enrolled

Fall 2014:

BSE 509: 2 Credits, 4 Enrolled

BSE 990: Various Research Credits, 6 Enrolled

Graduate and Post Doc Advisees

- 1) Sampath Gunukula, PhD BSE, 2016.
- 2) Edgardo Ortiz-Reyes, PhD BSE, 2015.
- 3) Lei Gu, PhD BSE, 2016.
- 4) Jordi Francis Clar, MS, BSE, 2015.
- 5) Ao Li, MS, BSE 2014.
- 6) Thilina Gunawardhana, MS, BSE, 2014.
- 7) Renil Anthony, Post-Doctoral Researcher, Co-advised with Troy Runge.
- 8) Magalena Necpalova, Post-Doctoral Researcher.

Funded Research Projects

- 1) Cost-Effective Soil Nitrous Oxide Emission Monitoring. Funding: 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. Funding: USDA National Institute of Food and Agriculture and Critical Agricultural Materials Program.

- 3) Regional Biomass Feedstock Partnership – Biomass Residue Removal Tool Development. Funding: 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) NSF-Engineering Research Center for Biorenewable Chemicals (CBiRC). Funding: 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.
- 5) A regional program for production of multiple agricultural feedstocks and processing to biofuels and biobased chemicals. Funding: 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.
- 6) Biofuel Cropping Systems for Feedstock Production and Greenhouse Gas Mitigation. Funding: USDA-NIFA. Collaboration from Iowa State University (lead institution).
- 8) Climate Change, Mitigation, and Adaptation in Corn Based Cropping Systems. Funding: 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. Funding: 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

Peer-Reviewed Journal Articles

- 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* 69 (6): 517-531.
- 2) Kladviko, E. J., M. J. Helmers, L. J. Abendroth, D. Herzmann, R. P. Anex, *et al.* 2014. Standardized research protocols enable transdisciplinary research of climate variation impacts in corn production systems. *J. Soil Water Conservation* 69 (6): 532-542.
- 3) Mullins, K. A., H. S. Matthews, W. M. Griffin, C. Hendrickson, R. Anex. 2014. Impacts of variability in cellulosic biomass yields on energy security. *Env. Sci. Tech.* 48(13): 7215-7221.
- 4) Khanal, S., R.P. Anex, C.J. Anderson, D.E.

Herzmann. 2014. Streamflow impacts of biofuel policy-driven landscape change. *PLoS one* 9 (10), e109129.

- 5) 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* 7: 57-71.
- 6) 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>).

Editorials/Book Chapters/Reports

- 1) Graedel, T.E., D. Swackhamer, R. Anex, W. F. Carroll Jr., G.T. Daigger, P. Ferrao, H. Frumkin, S. Katzen, A. Palmisano, S. Polasky, L. Scarlett, R. Stephens, L. Zeise. 2014. Sustainability for the nation: Resource connections and governance linkages. *Enviro. Sci. Tech.* 48(13): 7197-7199.
- 2) Anex, R.P. and R. Lifset. 2014. Life Cycle Assessment: different models for different purposes. *Journal of Industrial Ecology* 18 (3): 321-323.

Service

BSE committees

Undergrad Instruction

Information Technology

External Relations

Graduate Research and Instruction

Associate Editor for J. of Industrial Ecology and

Intl. J. of Life Cycle Assessment

Reviewer for Transactions ASABE, J. of Industrial

Ecology, Swiss National Science Foundation,

Sustainable Chemistry and Engineering, USDA.



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 2014 include a high moment connection for attaching wood posts to concrete, and precast concrete posts. Considerable time in 2014 was dedicated to finishing a complete rewrite of the NFBA Post Frame Building Design Manual.

Research on building environment control in 2014 was largely centered around two projects: construction of a rotatable guarded hot box, and numerical analysis of the impact of convective currents on the performance of post-frame thermal envelopes.

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, fellow CALS faculty and staff, and via direct contact with farmers. Much of the actual research and development work has involved undergraduate students. Work in 2014 involved fabrication and testing of a hazelnut sizer/sorter, design of a hazelnut cracker, investigation of a hazelnut shell and kernel separator, fabrication of a batch barrel washer for produce (primarily root crops), investigation of trellis systems for growing organic hops, and design and construction of a portable hoop house for organic fruit and vegetable production.

Teaching

Spring 2014

BSE 309: BSE Design Practicum I

2 credit lecture, 54 students

Advise 4 teams, 13 students

BSE 356: Sustainable Residential Construction

3 credits lecture, 64 students

Fall 2014

BSE 351: Structural Design of Agr. Facilities

3 credit lecture, 12 students

INTEREGR 160: Intro to Engineering Design

1 credit lab, 5 teams, 31 students

BSE 509: BSE Design Practicum II

3 credit lab, 4 teams, 13 students

Graduate Students Advised

Andy Holstein (Ph.D. Student)

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 2014, designed, fabricated and tested a hazelnut sizer/sorter; toured hazelnut processing facilities in the Willamette Valley of Oregon, worked with students on the design of a hazelnut cracker and a pair of kernel and shell separators.
- 2) *Growing and Processing Hops*. Toured hop yards and processing facilities in the Willamette Valley of Oregon as part of work on an extension publication on hop trellis systems.

- 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 2014. Funded by National Frame Building Association. \$14,000 in 2014.
- 2) Structural Design of Hoop Houses. Designed and helped construct a portable hoop house for organic farming. Construction funded by West Madison Agricultural Research Station, Department of Horticulture, and funds secured from teaching InterEgr 160. Total expense ~\$12,000.
- 3) Evaluation and Optimization of Post-Frame Thermal Envelopes. Continued work with graduate student Holstein on a rotatable guarded hot box. Federal Hatch. \$43,000/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 an ASABE journal articles for this recently completed Hatch supported project.
- 6) Use of Saturated Salt Solutions in Conditioning Organic Materials. Continued work in this area via conditioning of husk and unhusked hazelnuts, and the de-watering of aronia berries. Unfunded project.
- 7) Moment Resisting Post-to-Concrete Connection. Obtained and conditioned lumber, and tested mechanical connections in advance of Designed, fabricated and installed (for field testing) a new post-to-concrete pier connection with high bending strength in 2014. Personally funded. Working to secure funds for laboratory testing.
- 8) Precast Concrete Posts. Designed, fabricated and field installed concrete posts that can be used for low-rise organic trellis systems and for post-frame building columns. Personally funded.

Peer-Reviewed Journal Articles

- 1) Bohnhoff, D.R. 2014. Modeling soil behavior with simply springs, part 1: spring placement and properties. *Frame Building News*, 26(2):49-54.

- 2) Bohnhoff, D.R. 2014. Modeling soil behavior with simply springs, part 2: determining the ultimate lateral capacity of a post/pier foundation. *Frame Building News*, 26(3):50-55.
- 3) Bohnhoff, D.R. 2014. Shallow post and pier foundation design. *Wood Design Focus*, 24(1):4-9.
- 4) Bohnhoff, D.R. 2014. Below-grade insulation for post-frame buildings. Part I. Minimizing frost heave. *Wood Design Focus*, 24(1):10-20.
- 5) Bohnhoff, D.R. 2014. Below-grade insulation for post-frame buildings. Part I. Minimizing heat transfer. *Wood Design Focus*, 24(1):21-31.

Books & Chapters

- 1) Bohnhoff, D. R. 2014. Post and Pier Foundation Design. Submitted for publication in the NFBA Post Frame Building Design Manual. National Frame Builders Association. Chicago, IL. 42 pages.
- 2) Bohnhoff, D. R. 2014. Diaphragm Design. Submitted for publication in the NFBA Post Frame Building Design Manual. National Frame Builders Association. Chicago, IL. 30 pages.
- 3) Bohnhoff, D. R. 2014. Metal-Clad Wood-Frame Diaphragm Properties. Submitted for publication in the NFBA Post Frame Building Design Manual. National Frame Builders Association. Chicago, IL. 12 pages.
- 4) Bohnhoff, D. R. 2014. Post Design. Submitted for publication in the NFBA Post Frame Building Design Manual. National Frame Builders Association. Chicago, IL. 36 pages.

Awards

Faculty advisor for 1st Place Team, 2014 ASABE AGCO Student Design Competition

Professional Development Activities

- 1) Wisconsin Frame Builders Annual Tour and Conference, January 28 & 29, 2014, Janesville, WI
- 2) Institute for Urban Agriculture and Nutrition, Madison Campus Symposium, April 11, 2014, Madison, WI
- 3) Upper Midwest Hazelnut Growers Conference, March 7-8, 2014, Gays Mills, WI
- 4) ASABE Section Meetings, Mar 26 and October 1
- 5) Willamette Valley Tour (visit 4 hazelnut growers, 5 hazelnut processors, 3 hop growers, a cherry grower and processor, a vineyard two Oregon

- State University (OSU) research stations and faculty at OSU). May 29 – June 6, 2014.
- 6) Organic Fruit Growers Association Field Day, August 13, 2014, Bayfield, WI
 - 7) Cummins Nursery Grounds and Facilities Tour. Provided by Steve Cummins. July 11, 2014, Ithaca, NY
 - 8) St. Lawrence Nurseries Grounds and Facilities Tour. Provided by Bill MacKentley, July 12, 2014, Potsdam, NY
 - 9) ASABE Annual International Meeting, July 13-16, 2014, Montreal, QC Canada.

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 2014 and printed student awards
 - Manuscript reviewer
- ii. National Frame Builders Association
 - Technical Publications Review Committee.

- Review 4 FBN manuscripts in 2014.
- NFBA T&R Committee. Attended four meetings in Chicago in 2014
- 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. University General Education Committee (4 hours)
- iii. College of Engineering Academic Planning, Curriculum, and Regulations Council (CoE APCRC) (1.5 hr per month)
- iv. Advisory Committee for International Engineering Certificate
- v. BSE Undergraduate Instruction and Program Committee Chair (4 - 5 days per month)
 - Provided overview of BSE program to at least 70 students in 2014. Included many meetings and tours involving parents and potential transfers from outside the university
 - Averaged approximately 45 assigned undergraduate student throughout 2014
 - 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



Christopher Choi

Professor

40% Teaching / 60% Research

Biological Heat and Mass transfer

Dr. Choi's research program is primarily focused on computational and experimental heat and mass transfer in biological, agricultural and environmental systems. Specifically, he has 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 2014

- BSE 309, Biological Systems Engineering Design Practicum I
2 Credits, One design team (4 students) advised
- BSE 464, Heat and Mass Transfer in Biological Systems
3 Credits, 12 Enrolled

Fall 2014

- InterEgr 102, Introduction to Society's Engineering Grand Challenges
2 Credits, 120 Enrolled (Team taught)
- BSE 270, Introduction to Computer Aided Design
3 Credits, 32 Enrolled
- BSE 509, Biological Systems Engineering Design Practicum II
2 Credits, One design team (4 students) advised

Graduate and Post Doc Advisees

1. Jessica Drewry (Ph.D. Student)
2. Matthew Harper (Master's Degree)
3. Andrew Holstein (Ph.D. Student, Co-advised with David Bohnhoff)
4. Yifan Liang (Ph.D. Student)
5. Mario Mondaca (Ph.D. Student)
6. Ayse Ozdogan (Ph.D. Student, Co-Advisee, GLE, UW COE, Co-advised with James Tinjum)
7. Xiaoshuai Wang (Ph.D. Student, Aarhus University, Denmark, Co-advised with G. Zhang)

Funded Research Projects

- 1) Advancement of Computational Model Algal Growth
 - a. Funding: Sandia National Laboratories
 - b. Objectives: The purpose of this study is to advance and apply a computational fluid

dynamics model of algal growth. The model allows for the prediction of algal biomass production in order to assess and optimize commercial scale production in less time and with less expense than experimentation.

- 2) Pathogen Transport during Spray Irrigation of Liquid Manure.
 - a. Collaborator(s): R. Larson and M. Borchardt
 - b. Funding: WI DNR.
 - c. Objectives: Dairy manure disposal by travelling gun or center pivot irrigation has the potential to create aerosolized pathogens that could be transported by air currents to cause illness in people residing or working nearby. The proposed model is to define the setback distance at which the risk of illness from airborne pathogens from manure irrigation.
- 3) Online CAD Course Development for Engineers.
 - a. Funding: UW CALS and UW Continuing Studies
 - b. Objectives: This grant is to develop an online Computer Aided Design (CAD) course which introduces engineering students to basic CAD techniques that include two- and three-dimensional drawing presentation, methods of graphic communication, data analysis, and design synthesis and production methods.
- 4) Assessment of Environmental Impacts of Geothermal Source Heat Exchangers from Wisconsin Groundwater Coordinating Council
 - a. Collaborator(s): D. Hart and J. Tinjum
 - b. Funding: WI Groundwater Council.
 - c. Objectives: This work evaluates the presence, concentration level and spread of the thermal and chemical pollutants

produced by a large-scale ground source heat exchanger. The results of the study should help in any effort to create regulatory guidelines for dealing with any threat these outcomes may pose to humans and the environment.

Publications

Peer reviewed Journal Articles

1. Song, I, T Dominguez, CY Choi, MS Kang (2014) Impact of tilling on biosolids drying and indicator microorganisms surviving during solar drying process. *Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances and Environmental Engineering.* 49:14, 1701-1709.
2. Gharagozloo, PE, JL Drewry, AM Collins, TA Dempster, CY Choi, SC James (2014) Analysis and modeling of *Nanochloropsis* growth in lab, greenhouse, and raceway experiments. *Journal of Applied Phycology.* 26:6, 2303-2314.
3. Song, I, SA O'Shaughnessy, CY Choi, CP Gerba (2014) Impacts of tilling and covering treatments on the biosolids solar drying conversion from Class B to Class A, *Environmental Technology.* 35:20, 2610-2618.

Conference Proceedings

1. Rojano, F, PE Bournet, M Hassouna, P Robin, M Kacira, C.Y. Choi (2014) Predicting Sensible and Latent Heat Generation with CFD in Animal Housing for Dairy Cattle. *Int. Conf. of Ag Engineering, Zurich, Switzerland.*
2. Holstein, A, CY Choi, 2014, A Numerical Study of Conjugate Heat Transfer through Composite Thermal Envelops, *ASABE Annual Int. Meeting, Montreal, Canada.*
3. Mondaca, M, MK Harper, CY Choi (2014) Experimental Validation of Computational Fluid Dynamics (CFD) Model of Perforated Polyethylene Tube Ventilation Systems in Dairy Operations, *ASABE Annual Int. Meeting, Montreal, Canada.*
4. Liang, Y, RA Larson, ZP Zopp, MA Borchardt, CY Choi (2014) Pathogen Transport Modeling during Spray Irrigation of Liquid Manure in Wisconsin, *ASABE Annual Int. Meeting, Montreal, Canada.*
5. Harper, MK, M Mondaca, CY Choi (2014) Advances in Cooling Dairy Cattle to Mitigate Heat Stress, *ASABE Annual Int. Meeting, Montreal, Canada.*

Award

1. Superior Paper Award, A conjugate heat and mass transfer model to evaluate the efficiency of conductive cooling for dairy cattle, *ASABE International Meeting.*
2. Superior Paper Award, Analysis of microclimate uniformity in a naturally vented greenhouse with a high-pressure fogging system, *ASABE International Meeting.*

Patent

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

Professional Development

1. Distance Teaching and Learning Conference and Workshop, August 13-14, 2014, Madison, WI.
2. TeachOnline@UW Learning Community for Course Design and Teaching Bi-Weekly Workshops. Fall semester, 2014. (Certificate Received)

Service

BSE IT Committee, Chair
BSE Undergrad Instruction Committee, Member
BSE Executive Committee, Member
CALs Facilities Committee, Chair
CALs Curriculum Committee, Member
COE Curriculum Committee, Member
ASABE Committees
IET-217 Computational Methods, Simulations and Applications, Vice Chair
IET-54 Emerging Info Systems, Member
Session Organizer of ASABE International Conference - Computational Fluid Dynamics in Agriculture, Montreal, Canada
Organizing Committee Member of the Second CIGR International CFD Symposium in Agriculture (2016, Aarhus, Denmark)
Reviewer for Transactions of The ASABE, J. Dairy Science, and several energy and environmental engineering related journals
Associate Editor of Transactions of the ASABE and Applied Engineering in Agriculture



Sundaram Gunasekaran

Professor, Ph.D.

50% Teaching / 50% Research

Program affiliations: Food Science

Program narrative: Food engineering and processing. Nanomaterial synthesis and biosensing for various analytes such as pathogens, toxins etc.

Teaching

BSE 365: Measurements and Instrumentation, 58 students (course evaluation: 3.7)

BSE/FS/ME 441: Rheology of Foods and Biomaterials, 24 students (course evaluation: 4.1)

BSE 900: Graduate Seminar, 8 students

BSE901: Graduate Research Seminar, 8 students

Graduate and Post Docs Advisees

1. Jiehao Guan, (2017)
2. Youngsang You, (2016)
3. Lin Lu, (2015)
4. Zong Liu, (2015)
5. Kyeong-Ok Choi, (2017)
6. Yi-Cheng Wang, (2015)
7. Kari Jordan, MS (2015)
8. Nael Yasri, Post-doc
9. Ashok K. Sundramoorthy, Post-doc
10. Rajesh Seenivasan, Post-doc
11. Chitradurga Mohan, Post-doc visitor
12. Pelin Onsekizoglu, Post-doc visitor
13. Dilek Cokeliler, Post-doc visitor

Research:

Research projects:

- *In situ* Synthesis of Gold Nanoparticles for Food Quality Sensing, USDA Hatch (Jaehyuk Yu, co-PI)
 - Preparing gelatin-capped gold nanoparticles for thermal history of foods for indirectly tracking food quality and safety.
- Electrochemical Biosensors to Detect Toxins in Complex Food Matrices, USDA Hatch
 - Developing nanomaterial functionalized electrochemical biosensors for detecting aflatoxin contamination in corn
- Rapid and Visible Detection of Indicator Organisms. WARF Accelerator Program

- Developing a rapid and yet visual indication of the presence of pathogenic bacteria.
- Multiplex Electrochemical Biosensor for Rapid and Sensitive Detection of Mycotoxins, Andersons Research Grant Program (Senay Simsek of NDSU, co-PI)
 - Developing a biosensor for simultaneous detection of multiple mycotoxin contamination in wheat.
- Determining Microbial Quality of Water. SaniGen Corporation
 - Developing a biosensor for detecting microbial contamination in environmental water.
- Sensing Heavy Metal Contamination and pH. UW-Milwaukee Research Growth Initiative (Woojin Chang of UWM, PI)
 - Developing a biosensor for detecting heavy metal contamination in water such as lead and pH

Grant Proposals:

- 1) SaniGen: Gunasekaran (PI). Determining Microbial Quality of Water. \$100,000 (funded)
- 2) UW Graduate School. Gunasekaran (PI), Ma. High Flexible and Conducting Transparent CNT Film for Displays. \$50,000 (funded)
- 3) NIH-UW SDRC. Gunasekaran (PI), Setaluri. An Electrochemical Immunosensing Method for Detecting and Enumerating Circulating Melanoma Cells. \$15,000 (funded).
- 4) NSF: Gunasekaran (PI), Ruegg, Yu, and Kaspar. Aptasensor Array for the Detection of Mastitis-Causing Bacteria in Milk. \$398,933 (pending)
- 5) NSF: Gunasekaran (PI), Anderson. A Multicomponent Electrochemical System for Remediating Water Contaminated with Heavy Metals Complexed with Inorganic and Organic Ligands. \$385,311 (pending)

- 6) NSF: Chang (PI), Gunasekaran (co-PI). Multiplexed Low-cost Paper-Fluidic Electrochemical Sensor for Detecting Pesticide Residues. \$216,639 (pending)
- 7) USIEF (Obama-Singh Initiative): Gunasekaran (PI), Yu, Long, Kaspar. Food Safety Net. : \$190,000 (pending)
- 8) NSF: Gunasekaran (PI), Ma. Low-Temperature Solution-Processed Flexible Transparent Conducting Carbon Nanotube Film for Display Devices. \$450,518 (pending)
- 9) NIH: Gunasekaran (PI), Setaluri. An Electrochemical Immunosensing Method for Detecting Circulating Tumor cells. \$275,000 (pending)
- 10) NSF-SBIR: Manolache (PI), Gunasekaran. Aptasensor Array for the Detection of Mastitis-Causing Bacteria in Milk. \$398,933 (pending)
- 11) MRA: Setaluri (PI), Gunasekaran. Microfluidics-Based Electrochemical Biosensor for Detecting and Enumerating Melanoma Cells. \$100,000 (pending)
- 12) WI Groundwater Council: Gunasekaran (PI), Long. A Near Real-Time Indicator Organism Monitoring Assay for Irrigation Wells. \$107,000 (pending)
- 13) USDA NIFA: Gunasekaran (PI), Tanumihardjo. Developing Nanostructured Lipid Carriers For Targeted Delivery Of Ginsenosides And Quercetin. \$377,185 (not funded).
- 14) USDA NIFA: Gunasekaran (PI), Ikeda. Developing Casein-Chitosan Conjugate to Incorporate Hydrophobic Nutraceuticals in Foods and Beverages. \$363,648 (not funded).
- 15) USDA NIFA: Integration of a Near Real-Time Microbial Monitoring Assay with Sanitary Assessment to Track Irrigation Water Quality. \$1,000,000 (not funded).
- 16) NSF-I/UCR: Strickler (PI), Gunasekaran. Water Treatment System to Remediate Organic and Inorganic Species and their Heavy Metal Complexes. \$50,000 (not funded)
- 17) USDA Hatch: Gunasekaran (PI), Yu, Ruegg. DNA-Based Nanobiosensor Array for Detection of Mastitis-Causing Bacteria in Milk. \$203,424 (not funded).
- 18) UW Grad School. Setaluri (PI), Gunasekaran. An Electrochemical Immunosensing Method for Detecting Circulating Tumor Cells. \$100,000 (not funded).
- 19) UW ICTR: Setaluri (PI), Gunasekaran. Electrochemical immunosensing method for detecting circulating tumor cells. \$50,000 (not

funded).

Publications

Peer-Reviewed Journal Articles

1. Yasri NG, Sundramoorthy AK, Gunasekaran S. 2014. Highly selective mercury detection on electrochemically exfoliated graphene and poly(3,4-ethylenedioxythiophene): poly(styrenesulfonate)-based nanocomposite film modified electrode. *Frontiers in Materials* 2014, 1, Article 33.
2. Sundramoorthy AK, Gunasekaran S. 2014. Graphene applications in food quality assurance and safety. *Trac-Trend Anal Chem* 2014, 60:36-53 (**5th most downloaded**)
3. Yang J, Nam YG, Lee SK, Kim CS, Koo YM, Chang WJ, Gunasekaran S: Paper-fluidic electrochemical biosensing platform with enzyme paper and enzymeless electrodes, *Sensor Actuat B-Chem* 2014, 203:44-53
4. Ko S, Gunasekaran S. 2014. Evaluation of cheese meltability using convection and conduction melt profilers. *Int J Dairy Technol* 67:194-201
5. Izli N, Gunasekaran S. 2014. Microwave-vacuum drying characteristics of carrot (*Daucus carota* L.). *Philipp Agric Sci* 97:43-51
6. Gunasekaran S, Yoon WB. 2014. Investigation of elastic modulus of xanthan and locust bean gum at different concentrations of mixture using cascade model. *J Texture Stud* 45:80-7

Book Chapters

1. Gunasekaran S, S Ko. 2014. Rationales of Nano- and Microencapsulation for Food Ingredients. In: *Nano- and Microencapsulation for Foods* H-S Kwak (ed.), John Wiley & Sons, Ltd., pp43-64.
2. Ko S, S Gunasekaran. 2014. Controlled Release of Food Ingredients. In: *Nano- and Microencapsulation for Foods* H-S Kwak (ed.), John Wiley & Sons, Ltd., pp327-344.
3. S Gunasekaran. 2014. Nanotechnology for Food: Selected Applications. *In: Food Processing Principles and Applications*, Clark S, Jung S, Lamsal BP (eds.) Wiley-Blackwell, pp 171-206.

Conference Proceedings

1. Gunasekaran S. 2014. Biosensors and flexible electronics. Indian Institute of Science, Center for Nano Science and Engineering, November 24, Bangalore, India. (Invited)
2. Gunasekaran S. 2014. Insight into the Property and Behavior of Saccharides in Amorphous State. The 2nd International Conference on Agriculture and Agro-Industry 2014 Fresh

- Produce, Novel Process and Health Product, November 20-21. Chiang Rai, Thailand. (Invited)
3. Yang J, W-J Chang, S Gunasekaran. 2014. Paper-fluidic enzymatic electrochemical biosensing. IEEE International Conference on Nano/Micro Engineered and Molecular Systems (NEMS), April 13-16, Honolulu, HI.
 4. Lim S, S Gunasekaran. 2014. In situ synthesis of gelatin-capped gold nanoparticles as food thermal history indicator. IEEE Nano/Micro Engineered and Molecular Systems (NEMS), April 13-16, Honolulu, HI.
 5. Yang J, W-J Chang, S Gunasekaran. 2014. Inexpensive Disposable Electrochemical Paper Microfluidic pH Sensor Based on IrO₂-Graphene Nanocomposite Films. Materials Research Society Symposium K: Graphene and Graphene Nanocomposites (K22.06). Nov 30 - Dec 5, Boston, MA.
 6. Wang YC, J Guan, S Gunasekaran. 2014. Amino acid mediated gold nanorods for visible detection of mercury contamination. Abstract No. 253-02, IFT Annual Meeting, June 21 – 24, 2014, New Orleans, LA (**1st place award**)
 7. Lu L, S Gunasekaran. 2014. Nanomaterial-Based Electrochemical Immunosensor for the Detection of Aflatoxins in Grains. Abstract No. 253-03. IFT Annual Meeting, June 21 – 24, 2014, New Orleans, LA

Patents

1. Gunasekaran S, J Yang. 2014. Electrochemical detection of beta-lactoglobulin. Patent No.: US

- 8,834,704 B1.
2. Gunasekaran S, AK Sundramoorthy. 2014. Preparing Flexible Carbon Nanotube Thin-film using a Diazo Dye as a Dispersant and Template (US Patent Provisional Application No. P140224US01).
3. Gunasekaran S, N Yasri. 2014. Remediating Effluents Containing Heavy Metals Complexed with Organic and Inorganic Species (US Patent Provisional Application No. P140335US01).
4. Gunasekaran S, J Yang, W-J Chang. 2014. Disposable Digital pH and Heavy Metal Sensing (US Patent Provisional Application No. 62/087,032).

Awards:

- 100-top Successful Alumni, Asian Institute of Technology, 2014
- WARF Discover Challenge Research Award

Service:

Graduate Research and Instruction (Chair, 40 h)
 Undergraduate Curriculum Committee (20 h)
 CALS Academic Planning Council (40 h)
 College of Engineering Engineer's Day Committee (10 h)
 UW Kemper K. Knapp Bequest Committee (Chair, 30 h)
 NSF Peer-review panels (20 h)
 Refereed journals peer-review (40 h)



David W. Kammel

Professor, Ph.D.
20% Research/80% Extension

David leads the Dairy Modernization Extension Program which is highly regarded by Wisconsin county agents and agricultural producers. It has also garnered attention from other states such as Minnesota, Iowa, Illinois, Pennsylvania, New York, and Maine. The majority of David’s work is through producer and agent requests to farms 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. Recent requests include integrating technology such as automatic milking systems and calf feeding systems into existing and new facility design. David has also helped dairy goat/sheep farms as they develop their new farmsteads and point of sale operations as well as beef cattle housing and handling systems. David has worked with several international groups visiting Wisconsin through the Babcock Institute including Turkey, Finland, Japan, England, and Ukraine as well as Chinese with US Grains Council and invited to speak on farmstead planning by Costa Rican Dairy Producers for their Dairy Congresso.

Teaching

Spring 2014

Dairy Science 234, Dairy Herd Management II
3 Credits, 25 Students

Fall 2014

Farm and Industry Short Course, Livestock Housing
30 Students
Dairy Science 233, Dairy Herd Management
3 Credits, 25 Students

Extension/Outreach Activities

David worked in and visited 39 counties of the state with 36 county extension educators on 275 individual farm projects. He had over 4798 contacts via email or phone for requests for information, and spoke to over 1865 participants in 25 statewide extension meetings. He was invited to speak in Pennsylvania, New York dairy meetings, and Costa Rica Dairy 2014 Annual Congresso. David is a top rated specialist by Extension agents.

	Kammel	BSE	Ag/Ag Bus
Contact	3.94	3.446	3.45
Teaching	4.79	4.120	4.27
Information	4.87	4.299	4.33
Support	4.87	4.229	4.01
Relations	5.00	4.180	4.05
Outcomes	4.93	4.217	4.24

Awards

2014 College of Agricultural and Life Sciences
Pound Extension Award
2014 ASABE Blue Ribbon Award MWPS 7 Dairy
Freestall Housing and Equipment

Publications

Book Chapters:

Kammel, David W. Goat Housing Chapter. Goat
Handbook. Langston University, Langston OK
73050

Popular Press Articles:

Luck, Brian, D.W. Kammel, 2014. Choose your
Mixer Wisely. September 25, 2014. Page 59.
Hoards Dairyman.

Luck, Brian, D.W. Kammel, 2014. Choose your
Mixer Wisely. Page 754. Hoards Dairyman
Spanish Edition. Diciembre 2014.

Invited Proceedings:

Jones, Dr. Gordie, D.W. Kammel. 2014. Facility
Design to Optimize Transition Cow Comfort
with Emphasis on Confinement Systems. Dairy
Cattle Reproduction Council Annual Meeting
Proceedings. Salt Lake City, UT. November 13-
14, 2014.

Speaker Dr. Gordie Jones, Central Sands Dairy

Presentations Developed

- 1) Dairy Modernization
- 2) Modernizing Dairy Facilities
- 3) Budgeting for a Dairy Modernization

- 4) Low Cost Parlor Options and Considerations
- 5) Designing Dairy Farms in the Tropics
- 6) Taking Your Dairy Into the Future
- 7) Calf Barn Ventilation
- 8) Cattle Handling System Design
- 9) Cow Comfort Design
- 10) Remodeling Retired Dairy Barns for Sheep and Goat Production
- 11) Remodeling Retired Dairy barns for Beef Production
- 12) Retrofitting AMS into Existing Facilities
- 13) Dairy Farmstead Master Planning
- 14) Large Dairy Farmstead Design
- 15) Facility Recommendations for the Tropics
- 16) Dairy Modernization in WI
- 17) Growing Wisconsin Family Dairy farms
- 18) Impacts of Dairy Livestock Facility Improvements
- 19) Transition Cow Housing and Design and Management
- 20) History of Dairy Barn Design

Service

- 1) 4 State Dairy Extension Planning Committee
- 2) BSE Departmental Extension, Social, and Building and Space 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

D. Kammel Extension Program Summary	Audience Type	Number Participating	Outcome/Impact	Revenue Generation
Dairy Modernization Farm Visits	County Agents Dairy Producers	275 Producers 36 County Agents	Invested in facility changes Trained county agents	No
Cow College, Waupaca County	Dairy producers Agricultural Professionals	30	Educated producers and Agricultural professionals	No
Automatic Milking Systems, Brown County	Dairy producers Agricultural Professionals	75	Educated producers and Agricultural professionals	No
Focus on Goats, Platteville DATCP	Dairy goat producers and agricultural professionals	50	Educated producers and Agricultural professionals	No
Pennsylvania Dairy Summit, Low Cost Parlors	Dairy producers Agricultural Professionals	500	Educated producers and Agricultural professionals	No
Regional Cattle Feeder Meetings, Remodeled Facilities for Beef Multiple County Sites	Beef producers and agricultural professionals	150	Educated producers and Agricultural professionals	No
CWAS Dairy Meetings, Transition Cow Housing Portage County	Dairy producers Agricultural Professionals	50	Educated producers and Agricultural professionals	No
NY Pro Dairy Winter Dairy Management Meetings, Budgeting for a Dairy Modernization	Dairy producers Agricultural Professionals	300	Dairy producers Agricultural Professionals	No
Grazing Meeting Remodeled Beef Facilities Portage County	Dairy producers Agricultural Professionals	40	Educated Beef producers Agricultural Professionals	No
Farm Management Update Transition Cow Facility Design Outagamie County	Dairy producers Agricultural Professionals	125	Educated Dairy producers Agricultural Professionals Lenders	No
Cuba Kids Monthly meeting History of Dairy barn Design	Retired Extension Faculty	30	Educated Retired Extension Faculty	No
Farm Technology Days Portage County	Dairy Producers Non Ag public	100	Educated producers and non ag public	No

Wisconsin Frame Builders Annual Conference and Tour	Agricultural and Commercial Builders	60	Educated builders	Yes
Sheep and Wool Festival	Sheep Producers and agricultural professionals	50	Educated producers and agricultural professionals	No
Monroe Chees Days Farm Tour	Non ag public	240	Educated non ag public	No
World Dairy Expo Dairy Team Display	Dairy Producers Agricultural professionals	25	Educated producers and agricultural professionals	No
Investing in the Future of the Dairy Business AgriKing Business Sauk County	Dairy Producers Agricultural professionals	50	Educated producers and agricultural professionals	No
Pennsylvania Tech for Tuesday Webinar	Dairy Producers Agricultural professionals	10	Educated producers and agricultural professionals	No
Tri County Beef Producers meeting, Remodeled Retired Barns for Beef	Beef producers and agricultural professionals	40	Educated producers and agricultural professionals	No
Costa Rica Dairy Producers Association Dairy Modernization in Costa Rica Dairy Farms	Dairy Producers Agricultural professionals	600	Educated producers and agricultural professionals	No
International Visitor Tours	Dairy producers Agricultural Professionals	47	Educated producers and agricultural professionals	No
	Total Direct Contacts	2883		



K.G. Karthikeyan

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

Affiliations in CoE: Civil & Environmental Engineering Department

Campus: Gaylord Nelson Institute for Environmental Studies; Environmental Chemistry & Technology Program.

Dr. Karthikeyan performs research related to the development and assessment of management practices to minimize water quality impacts of agricultural/animal production activities and municipal waste water disposal. Specific focus areas include: assessment of environmental fate/transformation of waste and nutrient components; wastewater management, treatment, and reuse; identification and quantification of contributing contamination sources; and watershed modeling.

Teaching:

Spring 2014

BSE 472, Sediment & Bio-nutrient
Engineering and Management
3 Credits, 17 Enrolled

BSE 309, Engr. Design Practicum
2 credits, 4 students advised

Fall 2014

BSE 372, On-site Wastewater Treatment
and Dispersal
2 Credits, 25 Enrolled

BSE 509, Design Practicum II
3 Credits, 53 students enrolled

Graduate and Post Docs Advisees

- 1) Rania Bashar, PhD BSE, 2016.
- 2) Jasmeet Lamba, PhD BSE, 2014, Co-advised with Anita Thompson
- 3) Elizabeth Miller, PhD METC, 2017, Co-advising with Joel Pedersen
- 4) Sara Nason, PhD EC&T, 2017, Co-advising with Joel Pedersen
- 5) Joshua Accola, MS, BSE, 2015, Co-advising with Anita Thompson
- 6) Andrew Skog, MS, BSE, 2017, Co-advising with Anita Thompson
- 7) Zachariah Zopp, Assistant Researcher, BSE

Funded Research Projects:

- 1) Multi-Scale Investigation of Winter Runoff and Nutrient Loss Processes in Actively Managed Dairy Agroecosystems.
Collaborators: P Vadas, USDA-ARS, F. Arriaga and L.W. Good, Soils.
Funding: USDA-NIFA (AFRI)
Objectives: Improve the understanding and modeling of biochemical and physical processes controlling frozen-soil and snowmelt infiltration, runoff, and nutrient loss from soil and applied manure for actively managed dairy systems.
- 2) Uptake of Wastewater-derived Micropollutants by Plants Irrigated with Reclaimed Wastewater.
Collaborators: J Pedersen, Soils; M. Shenker and B. Chefetz (HUJI-Israel).
Funding: US-Israel BARD Program.
Objectives: Evaluate the bioaccumulation of chemicals of emerging concern with contrasting chemical characteristics by the model plant *Arabidopsis thaliana* and two crop species (tomato, maize).
- 3) Subsurface Fate and Transport of Cryptosporidium in Soils of Wisconsin's Carbonate Aquifer Region.
Collaborators: A.M. Thompson, BSE; S.C. Long, Soils; F. Madison.
Funding: Wisconsin DNR.
Objectives: Understand the subsurface fate and transport characteristics of manure-borne pathogens
- 4) Phosphorus Index and Snowmelt Runoff Risk Assessment: Demonstration and Refinement.

Collaborators: A.M. Thompson, BSE; L.W. Good, Soils.

Funding: USDA / CIG

Objectives: Demonstrate the ability of a process-based P Index formulation to assess management effects on runoff P losses from fields under frozen soil conditions.

- 5) Implications of Phosphorus Recovery from Wastewater for Biosolids Management.
Funding: USDA-NIFA (Hatch).
- 6) Crop Plant Uptake of Pollutants of Emerging Concern.
Collaborator: J. Pedersen, Soils.
Funding: USDA-NIFA (Hatch).
- 7) Implications of Climate Change and Biofuel Development for Great Lakes Regional Water Quality and Quantity.
Collaborators: A.M. Thompson, BSE; D. Hyndman (MSU).
Funding: USGS-NIWR

Publications

Peer reviewed Journal Articles

- Lamba, J, AM Thompson, KG Karthikeyan, and FA Fitzpatrick. 2015. Sources of fine sediment stored in agricultural lowland streams, Midwest, USA (*in press*).
- Lamba, J, KG Karthikeyan, and AM Thompson. 2015. Apportionment of suspended sediment sources in an agricultural watershed using sediment fingerprinting. *Geoderma*. 239-240: 25-33.
- Han, L, KG Karthikeyan, MA Anderson, and K Gregory. 2014. Exploring the Impact of Pore Size Distribution on the Performance of Carbon Electrodes for Capacitive Deionization System. *J. Colloid Interface Science*. 430:93-99.

Lamba, J, KG Karthikeyan, and AM Thompson. 2014. Using radiometric fingerprinting and phosphorus to elucidate sediment transport dynamics in an agricultural watershed. *Hydrol. Processes*. DOI: 10.1002/hyp.10396.

Gungor, K, AA Ozkaynak, KG Karthikeyan, F Evrendilek, and S Gunasekaran. 2015. Modeling solubilization dynamics of manure organic matter and phosphorus as a function of pH control and enzyme supplementation. *Environment Protection Engineering (in press)*.

Service

BSE committees

Awards (Chair)
Undergraduate Instruction & Program
Graduate Instruction & Research

CALS

Departmental Review Committee (Forest & Wildlife Ecology)

UW-Madison

Physical Sciences Divisional Committee

Regional Committees

SERA-17 (Organization to Minimize Phosphorus Losses from Agriculture)
W-2082 (Evaluating the Physical and Biological Availability of Pesticides and Pharmaceuticals in Agricultural Ecosystems)

Review Committees

J. Environmental Quality (Assoc. Editor)
Transactions ASABE
Environment Science & Technology
US-Israel BARD Program
USDA-NIFA



Rebecca A. Larson

Assistant Professor and Extension Specialist, Ph.D.
10% Teaching / 40% Research / 50% Extension

Program Affiliations: Gaylord Nelson Institute for Environmental Studies, WEI affiliate, WISELI, UWEX Dairy Team, UWEX Bioenergy and Bio-economy Team, Professional Nutrient Applicators Association of Wisconsin (PNAAW)

Dr. Larson has been in the Biological Systems Engineering Department for just over 4 years and has developed an extensive research and extension programs for manure management. Her research interests include manure management, evaluating and mitigating environmental impacts of manure and other agricultural based by-products, evaluating risk from manure pathogens, and manure handling and processing systems. Her international work has focused on integrating small scale manure systems particularly involving anaerobic digestion as a means of manure management as well as increasing nutrient value of manure while reducing environmental losses and risk to human health. Her extension efforts include interaction with producers in the state and internationally in increase understanding of manure and agricultural by-product management. This includes significant work in handling and processing designs including anaerobic digestion and composting. She works to continue to transform the way we use manure and agricultural by-products in an effort to increase agricultural productivity and economic growth while decreasing the environmental impacts and adjusting to the many pressing issues facing agriculture today. This year that includes a significant effort in issues related to climate change mitigation and adaption, evaluating risk of manure application technologies, and issues related to anaerobic digestion and manure processing systems.

Teaching

Spring 2014

BSE 472, Sediment and Bio-Nutrient Engineering and Management

3 Credits, 17 Enrolled

Graduate and Post Docs Advisees

- 1) Joseph Sanford, M.S., BSE, 2015
- 2) Aleia McCord, Ph.D., Nelson Institute for Environmental Sciences, 2016
- 3) Hui Wang, Ph.D., BSE, 2016
- 4) Yifan Liang, Ph.D., BSE, 2016, co-advised with Chris Choi
- 5) Michael Holly, Ph.D., BSE, 2016
- 6) Alysa Bradley, Ph.D., BSE, 2018 (completed M.S., BSE in 2014)
- 7) Jose Perez, Ph.D., BSE, 2018
- 8) Horacio A. Aguirre-Villegas, Post Doctoral Researcher, Co-advised with Douglas Reinemann

Extension / Outreach

30+ days of extension programing

Farm Technology Days exhibit

International anaerobic digestion programing

Anaerobic digestion programing (statewide and national)

Support UWEX agent programs in manure management, manure system designs, manure processing systems including composting, solid/liquid separation, sand separation, and anaerobic digestion

External Stakeholder Programs

Climate change programming (statewide and national planning)

National conference planning (Livestock and Poultry Environmental Learning Center and Dairy 2050)

Manure Irrigation Workgroup and related programming

Funded Research Projects

- 1) Climate Change Mitigation and Adaptation In Dairy Production
Collaborators: M. Ruark, M. Jahn, M. Watteaux, B. Bland, M. Stephenson, D. Reinemann
Funding: AFRI/CAP
Objectives: Manure Emissions Research (Lead), Dairy Life Cycle Assessment, Extension Material Development and Outreach (Lead)
- 2) Monitoring Sediment and Phosphorus Loads in Runoff from Dairy Feedlot/Exercise Lots to Facilitate Model Parameterization
Collaborators: L. Good, P. Vadas, D. Busch
Funding: WDNR
Objectives: Evaluating and treating (or minimizing Impact) or runoff from dairy feedlot systems

- 3) Pathogen Transport During Manure Irrigation
Collaborators: M. Borchardt, C. Choi
Funding: WDNR
Objectives: Evaluate the airborne pathogen transport concentrations from manure irrigation systems and if possible determine setback distances and/or management strategies to minimize risk
- 4) Reducing Nitrogen Losses from Agricultural Systems: Incorporating Biochar into Farmstead Management Strategies
Collaborators: T. Runge
Funding: USDA NIFA
Objectives: Evaluate biochar in manure systems to mitigate the impacts to water quality and air quality
- 5) Biochar/Manure as an Amendment for Improved Soil and Water Quality
Collaborators: T. Runge
Funding: UW Hatch
Objectives: Evaluate leachate water quality of soil columns amended with biochar receiving manure applications
- 6) Treatment of Effluent from Agricultural Fields with Subsurface Tile Drains with an In-line Treatment System
Collaborators: n/a
Funding: UW Hatch
Objectives: Design and evaluate an in-line treatment systems for tile drainage
- 7) Silage Storage Runoff
Collaborators: Discovery Farms
Funding: Discovery Farms
Objectives: Develop silage storage runoff collection systems to reduce wastewater collection volumes while increasing the load reduction to treatment systems
- 8) Biogas Treatment to Remove Hydrogen Sulfide
Collaborators: n/a
Funding: UW Graduate School
Objectives: Develop a biological treatment system to reduce the H₂S content from anaerobic digesters
- 9) Developing Science Based Materials to Assess the Environmental Impact of Swine Facilities
Collaborators: n/a
Funding: Wisconsin Pork Producers Association
Objectives: provide scientific based information on the environmental and social impacts of new pork production facilities
- 10) Increasing International Adoption of Small-Scale Anaerobic Digestion
Collaborators: n/a
Funding: UW WEI

Objectives: Increase the feasibility and implementation of small scale digestion systems in Bolivia and Uganda

Publications

Peer reviewed Journal Articles

Aguirre-Villegas, H.A., T. H. Passos-Fonseca, D. J. Reinemann, L. E. Armentano, M. A. Wattiaux, V. E. Cabrera, J. M. Norman, and **R.A. Larson**. 2014. Green cheese: Partial life cycle assessment of greenhouse gas emissions and energy intensity of integrated dairy and bioenergy systems. *Journal of Dairy Science*. Accepted in Print.

Aguirre-Villegas, H., **R.A. Larson**, and D. Reinemann. 2014. From Waste-To-Worth: Energy, Emissions, and Nutrient Implications of Manure Processing Pathways. *Biofuels, Bioproducts & Biorefining*, 8:770-793.

R.A. Larson, J. Panuska, J. Sanford, and C. Burnson. 2013. Low-Cost Manure Total Solids Measurement Device. *ASABE Applied Engineering in Agriculture*. Submitted.

Extension documents

Manure irrigation report

Professional Development

UW Teaching Academy

Service

BSE committees

Undergrad Instruction (5 hrs)

Extension (2 hrs)

Pre-professional club advisor (150 hrs)

Faculty Meeting Secretary (10 hrs)

CALS

Design assistance for manure system at Arlington Agricultural Research Station

ASABE Committees

NRES-27 Chair

Livestock and Poultry Environmental Learning Center

NCCC-9 (Midwest extension) Vice-chair

Reviewer for journals and USDA panels



Brian D. Luck

Assistant Professor, Ph.D.
30% Research / 70% Extension

Affiliations: University of Wisconsin - Madison College of Agriculture and Life Sciences, University of Wisconsin Extension, Biological Systems Engineering Department

Dr. Luck has been the director of the Bio-Instrumentation Lab since January of 2014. His research interests include machine management/logistics, remote sensing, and applied image processing. Current research within the Bio-Instrumentation Lab is focused on time-motion analysis of machinery involved in forage harvest with the goal to optimize the process through logistical modeling and quantification of the corn silage kernel processing score via image analysis techniques.

Dr. Luck's extension programming is centered around Precision Agriculture Technology. Topics of high interest in 2014 have been variable rate technology, remote sensing and the use of unmanned aerial vehicles (UAV's), and issues dealing with "big data" in agriculture. Steps were taken toward the development of a Precision Agriculture software and data management training program. This program will encompass education about the aforementioned high interest topics as well as utilization and interpretation of data produced/acquired. Initially this program will be offered to extension agents and then will be expanded to training workshops for stakeholders.

Teaching

Spring 2014

BSE 309 (2 credits): ¼ Scale Tractor Design Team (5 Students).

SC_FISC 38-016 Precision Agriculture.

Technologies: Guest Lecture on Variable Rate Seeding Technologies

BSE 365 Measurement and Instrumentation for Biological Systems: Guest Lecture on Applications of Instrumentation.

Fall 2014

BSE 509 (2 credits): ¼ Scale Tractor Design Team (5 Students).

SC_BSE 92 Farm Machinery: Guest Lecture on General Precision Agriculture.

Graduate Students and Post Docs

Advised

- 1) Joshua Harmon, M.S., Biological Systems Engineering, 2016.

Graduate Committee Membership

- 1) Glenn Wiskur, M.S., BSE, 2014 (advisor: Kevin Shinnars).

- 2) Justin Orrick, M.S., BSE, 2014 (advisor: Kevin Shinnars).

Extension/Outreach

Activities within Wisconsin:

- 1) Portage Co. Forage Association – Remote Sensing Presentation (70 attendees).
- 2) Trempealeau Co. Field Day – General Precision Agriculture Presentation (20 attendees).
- 3) Waupaca Co. Field Day – Remote Sensing Presentation (30 attendees).
- 4) Grant and Lafayette Co. Field Day – Remote Sensing and General Precision Agriculture Presentations (50 attendees).
- 5) St. Croix and Pierce Co. Field Day – Remote Sensing Presentation (71 attendees).
- 6) World Dairy Expo USDA Dairy Forage Research Center Booth – Kernel Processing Score via Image Analysis Presentation (30 attendees).
- 7) MFPA Crops Processing Conference – "Big Data" in Agriculture Presentation (100 attendees).

- 8) Soils Area Meetings – General Precision Agriculture Presentation
(50 – 70 attendees at 8 locations across Wisconsin).

2014 Agent Performance Rating Averages:

Contacts = 3.11/5.0
Teaching = 4.22/5.0
Information = 4.22/5.0
Support = 4.17/5.0
Relations = 4.29/5.0
Outcomes = 4.29/5.0

Activities outside Wisconsin:

- 1) Kentucky Corn Growers Association Crop Observation & Research Education (CORE) Group – Variable Rate Seeing Presentation (20 attendees).

Funded Research Projects

Assessment of corn silage kernel processing score via digital image processing techniques.

B. D. Luck* and K. J. Shinnners

Funding: Midwest Forage Association Midwest Forage Research Program

Collaborators: None

Description: Assess the feasibility of determining particle size distribution of processed corn silage kernels with image analysis.

Evaluation of wide swath mower-conditioner performance.

K. J. Shinnners* and **B. D. Luck**

Funding: CNH Global

Collaborators: None

Description: Quantify drying rate, leaf loss, power requirements, and cut quality between New Holland model H7450 (102 in. wide rubber crushing rolls) and New Holland model 313 (125 in. wide rubber crushing rolls) (co-PI).

AgrAbility of Wisconsin: Assistive technology program for farmers with disabilities.

R. J. Straub* and **B. D. Luck**

Funding: USDA NIFA – AgrAbility

Collaborators: Easter Seals of Wisconsin

Description: Assisting farmers with disabilities to work with Easter Seals of Wisconsin and Department of Vocational Rehabilitation to acquire assistive technologies to help them to continue farming. Extension component and management of employees (co-PI).

Publications

Peer reviewed Journal Articles:

- J. L. Purswell, **B. D. Luck**, J. D. Davis. 2014. Technical Note: Effect of air deflectors on fan performance in tunnel-ventilated broiler houses with a dropped

ceiling. *Applied Engineering in Agriculture* 30(3):471-475.

- B. D. Luck**, J. D. Davis, J. L. Purswell, A. S. Kiess, S. J. Hoff, J. W. W. Olsen. 2014. The effect of measurement density on air velocity distribution characterization in a commercial broiler production facility. *Transactions of the ASABE* 57(5): 1443-1454.

- B. D. Luck**, J. D. Davis, J. L. Purswell, A. S. Kiess, S. J. Hoff. 2015. Assessing the effect of house size and design on air velocity distribution in commercial broiler houses. *Transactions of the ASABE. In Process.*

Service

BSE Committees:

Extension (2 hrs)

CALS Committees:

2014 ANRE Conference Planning Committee (15 hrs)

2014 ANRE Awards Selection Committee (5 hrs)

UWEX Committees:

ANRE Team Grains Member (5 hrs)

ANRE Team Forage Member (5 hrs)

ASABE Committees:

SE 405 – Poultry Housing (Member and Chair)

PM 23/7/2 – Forage & Biomass Engineering (Member and Vice Chair)

Other:

2014 Farm Technology Days Field Demonstrations – Company Liaison

(co-managed with Scott Sanford)

¼ Scale Tractor Team Advisor

2014 Grant Proposals (full list)

- 1) *Assessment of corn silage kernel processing score via digital image processing techniques.* B. D. Luck* and K. J. Shinnners. Funding: Midwest Forage Association Midwest Forage Research Program (07/2014 – 03/2015) - \$2,202. Collaborators: None. Description: Assess the feasibility of determining particle size distribution of processed corn silage kernels with image analysis. Comparison of three differing camera resolutions and four differing kernel processor settings (none, 2, 3, and 5 mm separation distances). *Funded.*
- 2) *Evaluation of wide swath mower-conditioner performance.* K. J. Shinnners* and B. D. Luck. Funding: CNH Global (05/2014 – 06/2015) - \$18,353. Collaborators: None. Description: Quantify drying rate, leaf loss, power requirements, and cut quality between New Holland model H7450 (102 in. wide rubber crushing rolls) and New Holland model 313 (125 in. wide rubber crushing rolls) (co-PI). *Funded.*

- 3) *AgrAbility of Wisconsin: Assistive technology program for farmers with disabilities.* R. J. Straub* and B. D. Luck. Funding: USDA NIFA - AgrAbility (09/2014 – 08/2018) - \$720,000. Collaborators: Easter Seals of Wisconsin. Description: Assisting farmers with disabilities to work with Easter Seals of Wisconsin and Department of Vocational Rehabilitation to acquire assistive technologies to help them to continue farming. Extension component and management of employees (co-PI). *Funded.*
- 4) *Real-time in-field determination of kernel processing score for corn silage using image processing techniques.* B. D. Luck. Funding: USDA NIFA – Critical Agriculture Research and Extension (CARE) Program (04/2015 – 03/2018) - \$149,321. Collaborators: Midwest Forage Association and Wisconsin Custom Operators. Description: Continuation of Midwest Forage Association grant for further refinement of image processing for kernel particle size distribution for processed corn silage. Final product will be a smart-phone application that stakeholders can utilize for processing score in the field. *Awaiting award decision.*
- 5) *Application of new telematics technology applied to hay, forage, and biomass production.* B. D. Luck* and K. J. Shinnars. Funding: USDA NIFA – AFRI Foundation (10/2014 – 10/2016) - \$191,664. Collaborators: None. Description: Forage harvest logistics modeling for development of telematics system to optimize harvest processes. *Not Funded.*
- 6) *Securing beginning farmers through succession planning.* B. D. Luck. Funding: USDA NIFA – Beginning Farmer and Rancher Development Program (10/2014 – 09/2015) - \$47,112. Collaborators: None. Description: Utilizing AgrAbility’s network of aging and disabled farmers to facilitate succession planning. *Not Funded.*
- 7) *Identification of alfalfa abiotic stress via remote sensing techniques.* B. D. Luck*, M. P. Sama, and J. K Ward. Funding: USDA NIFA – Alfalfa and Forage Research Program (10/2014 – 09/2015) - \$164,790. Collaborators: None. Description: Assessment of existing remote sensing products along with integration into a UAV platform for detecting stress in alfalfa. Induced stress will be limited to water shortage/surplus and compaction. *Not Funded.*

CALS Report Annual Summary: Brian Luck - 2014

Program Type	Audience Type	Number Participating	Outcome/Impact	Revenue Generation
Presentation – Remote Sensing (Portage Co.)	Producers	70	Educated producers on remote sensing technologies available and their uses.	No
Presentation – Precision Ag. (Trempeleau Co.)	Producers and Crop Consultants	20	Educated producers and Agricultural professionals on existing precision ag. tech. and its uses.	No
Presentation – Remote Sensing (Waupaca Co.)	Producers and Crop Consultants	30	Educated producers and Agricultural professionals on remote sensing technologies and their uses	No
Presentation – Precision Ag. (Grant & Lafayette Co.)	Producers and Crop Consultants	50	Educated producers and Agricultural professionals on existing precision ag. tech. and its uses	No
Presentation – Remote Sensing (Grant & Lafayette Co.)	Producers and Crop Consultants	50	Educated producers and Agricultural professionals on remote sensing technologies and their uses	No
Presentation – Remote Sensing (St. Croix and Pierce Co.)	Producers and Crop Consultants	71	Educated producers and Agricultural professionals on remote sensing technologies and their uses	No
Precision Ag. Software Training (St. Croix & Pierce Co.)	Extension Agents	7	First attempt at utilizing precision ag. training laptops with AgLeader SMS software.	No
Presentation – KPS w/ Image Processing (World Dairy Expo)	Producers and Machinery Mfg.	30	Research presentation on image analysis and its potential uses in determining kernel processing score for corn silage	No
Precision Ag. Software Training (ANRE Conference)	Extension Agents and State Specialists	50	Precision ag. training with AgLeader SMS software	No
Presentation – Ag. Big Data (MFPA Conference)	Producers and Crop Consultants	100	Educated producers and Agricultural professionals on Ag. Big Data and how to manage it	No
Presentation – Precision Ag. (Soils Area Meetings - Madison)	Crop Consultants	60	Educated producers and Agricultural professionals on existing precision ag. tech. and its uses	No
Presentation – Precision Ag. (Soils Area Meetings - Sparta)	Crop Consultants	60	Educated producers and Agricultural professionals on existing precision ag. tech. and its uses	No

Presentation – Precision Ag. (Soils Area Meetings – Eau Claire)	Crop Consultants	60	Educated producers and Agricultural professionals on existing precision ag. tech. and its uses	No
Presentation – Precision Ag. (Soils Area Meetings - Marshfield)	Crop Consultants	60	Educated producers and Agricultural professionals on existing precision ag. tech. and its uses	No
Presentation – Precision Ag. (Soils Area Meetings - Juneau)	Crop Consultants	60	Educated producers and Agricultural professionals on existing precision ag. tech. and its uses	No
Presentation – Precision Ag. (Soils Area Meetings - Kiel)	Crop Consultants	60	Educated producers and Agricultural professionals on existing precision ag. tech. and its uses	No
Presentation – Precision Ag. (Soils Area Meetings - Shawano)	Crop Consultants	60	Educated producers and Agricultural professionals on existing precision ag. tech. and its uses	No
Presentation – Precision Ag. (Soils Area Meetings - Dodgeville)	Crop Consultants	60	Educated producers and Agricultural professionals on existing precision ag. tech. and its uses	No
		958		



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 2014:

BSE 309: 4 enrolled

BSE 699: 1 enrolled for 2 credits,

BSE 990: 1 enrolled for 3 credits and 1 for 7 credits

Summer 2014:

BSE 001: 1 enrolled for 1 credit

BSE 990: 1 enrolled for 3 credits

Fall 2014:

BSE 299: 1 enrolled for 2 credits,

BSE 364: 3 Credits, 37 Enrolled

BSE 460: 3 Credits, 12 Enrolled

BSE 509: 4 enrolled

BSE 699: 2 enrolled for 3 credits

BSE 799: 1 enrolled for 3 credits

BSE 990: 3 Credit, 3 Enrolled

Advising & Mentoring

Undergraduate Research Assistants Advised:

- 1) Jane Alexander
- 2) Joseph Kraft
- 3) Tim Oshin
- 4) Melanie Swannell
- 5) Shu-Ching Yang

Graduate Students Advised:

- 1) Ning Li (Ph.D. Student)
- 2) Yang Liao (Ph.D. Student)
- 3) Shuting Zhang (Master Student)
- 4) Zening Zhang (Master Student)
- 5) Hongdan Zhang (Visiting Student)

Mentoring:

- 1) Dr. Chang Guen Yoo (Postdoc)
- 2) Dr. Shirishkumar Harde (Postdoc)

- 3) Dr. Yongming Fan (Visiting Professor, Beijing Forestry University, China)
- 4) Dr. Shengli Chen (Visiting Professor, China University of Petroleum)
- 5) Dr. Jian Zhao (Visiting Professor, Shandong University, China)
- 6) Dr. Zhiqiang Pang (Visiting Professor, Qilu University of Technology, China)
- 7) Dr. Gaojin Lyu (Visiting Professor, Qilu University of Technology, 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).
- 7) SIRE-REU award (\$4,865) for supporting an undergraduate student (Shu-Ching Yang) working on a project "SIRE-REU: Conversion of Monosaccharides and Polysaccharides to Furan-Based Precursors for Hydrocarbon Fuels".
- 8) SIRE-REU award (\$4,865) for supporting an undergraduate student (Melanie Swannell) working on a project "SIRE-REU: Isomerization of glucose to fructose in molten halide salt hydrates".

Grant Proposals

- 1) USDA NIFA Fellowships Grant: Chang Geun Yoo and Xuejun Pan (PIs), Biphasic process using molten salt hydrate for chemical transformation of lignocellulose into furan-based chemicals, budget \$142,242, submitted in Feb. 2014. (Not funded)
- 2) NSF: Xuejun Pan (PI), Design and synthesis of cellulase-mimetic bifunctional solid acids for hydrolyzing cellulose, budget \$333,736, submitted in Feb. 2014. (Not funded)
- 3) DOE Bioenergy Technologies Incubator: Xuejun Pan (PI), Conversion of lignocellulosic biomass to fermentable sugars and aromatics precursors (Concept paper), submitted in March 2014. (Not funded)
- 4) WEI Seed Grant: Xuejun Pan (PI) and Chang Geun Yoo (Co-PI), Conversion of lignocellulosic biomass into furan-based products in a biphasic process involving molten salt hydrate, budget \$37,465, submitted in May 2014. (Not funded)
- 5) NC Sun Grant/US DOT: Xuejun Pan (PI), Rob Anex (Co-PI), and Junyong Zhu (Co-PI), Conversion of forest residue to fermentable sugars and lignin-derived aromatics for

advanced biofuel production, budget \$186,497, submitted in June 2014. (Not funded)

- 6) UW Graduate School: Xuejun Pan (PI), Direct conversion of cellulose into chemicals and fuel precursors in a biphasic organosolv system, budget \$34,424, submitted in September 2014. (Funded)
- 7) Hatch: Xuejun Pan (PI), Conversion of forest residue into high-value furan-based chemicals and high-quality lignin in biphasic system involving molten salt hydrate, budget \$123,605, submitted in September 2014. (Funded)
- 8) NSF: Xuejun Pan (PI), Design and synthesis of cellulase-mimetic bifunctional solid acids for hydrolyzing cellulose, budget \$339,406, submitted in November 2014. (Pending)
- 9) CPBR (Consortium for Plant Biotechnology Research) Grant: Xuejun Pan (PI), Sugar production from biomass in molten salt hydrate, budget \$240,000, submitted in December 2014. (Pending)

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) Cheng, J.L., S.-L. Leu, R. Gleisner, X.J. Pan, and J.Y. Zhu. High solids quasi-simultaneous enzymatic saccharification and fermentation of undetoxified whole slurry of SPORL pretreated Douglas fir forest residue. *Cellulose Chemistry and Technology*, 2014, 48, 849-854.
- Vermerris, and Z.H. Tong. Biomimetic Fenton-catalyzed lignin depolymerization to high value aromatics and dicarboxylic acids. *ChemSusChem*, 2015, in press.

Invited Book Chapters (peer-reviewed)

- 1) Q. Yang and X.J. Pan. Fabrication and applications of biocompatible graphene oxide and graphene. In: "Handbook of Graphene Science", CRC Press/Taylor & Francis. (in press)

- 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. (in press)
- 3) C.G. Yoo and X.J. Pan. Fuel ethanol from lignocellulosic biomass. In: "Handbook of Clean Energy Systems", Edited by J.Y. Yan, John Wiley & Sons, Inc. (in press)

Invited Seminars

- 1) X.J. Pan. New approaches for producing sugars and hydrocarbon fuels from lignocellulose. January 21, 2014, Auburn University.
- 2) X.J. Pan. New approaches for producing sugars and hydrocarbon fuels from lignocellulose. January 22, 2014, University of Florida.
- 3) X.J. Pan. Design, synthesis and performance of cellulase-mimetic polymeric solid catalysts for cellulose hydrolysis. June 3, 2014, East China University of Science and Technology, Shanghai, China.
- 4) X.J. Pan. Design, synthesis and performance of cellulase-mimetic polymeric solid catalysts for cellulose hydrolysis. June 4, 2014, Nanjing Forestry University, Nanjing, China.
- 5) X.J. Pan. Design, synthesis and performance of cellulase-mimetic polymeric solid catalysts for cellulose hydrolysis. June 6, 2014, Qilu University of Technology, Jinan, China.
- 6) X.J. Pan. Progress in biomass conversion to fuels, chemicals, and materials. June 16, 2014, Tianjin University of Science and Technology, Tianjin, China.
- 7) X.J. Pan. Design, synthesis and performance of cellulase-mimetic polymeric solid catalysts for cellulose hydrolysis. June 18, 2014, Beijing University of Chemical Technology, Beijing, China.
- 3) C.G. Yoo, S.T. Zhang, H. Kim, J.J. Zeng, J. Ralph, Z.H. Tong, and X.J. Pan. Fractionation and conversion of corn stover for liquid hydrocarbon fuels and valuable lignin by HDA process. The 247th ACS National Meeting & Exposition, March 16-20, 2014, Dallas, TX.
- 4) J.H. Grabber, Y. Tobimatsu, F. Lu, H. Kim, S. Elumalai, Y. Zhu, D. Ress, X.J. Pan, and J. Ralph. Identifying new lignin bioengineering targets for improving biomass and forage utilization: A review of biomimetic studies with maize cell walls. The 247th ACS National Meeting & Exposition, March 16-20, 2014, Dallas, TX.
- 5) S.T. Zhang, C.G. Yoo, and X.J. Pan. Conversion of cellulose to 5-bromomethylfurfura (BMF) in a biphasic system. The 247th ACS National Meeting & Exposition, March 16-20, 2014, Dallas, TX.
- 6) Y.M. Fan and X.J. Pan. Binary organosolv system for direct conversion of cellulose to chemicals and fuels precursors. The 247th ACS National Meeting & Exposition, March 16-20, 2014, Dallas, TX.
- 7) X.J. Pan. Molten salt hydrate system as a platform for saccharification and conversion of lignocellulosic biomass to sugars, chemicals and fuels. The 36th Symposium on Biotechnology for Fuels and Chemicals, April 28 – May 1, 2014, Clearwater Beach, FL.
- 8) X.J. Pan, N. Li, C.Q. Mei, and L. Shuai. One-pot saccharification and fractionation of lignocellulosic biomass in inorganic molten salt hydrate medium to produce high-concentration sugars and high-quality lignin. The 3rd Frontiers in Biorefining, October 21-24, 2014, St. Simons Island, GA.
- 9) Z.H. Tong, J.J. Zeng, C.G. Yoo, F. Wang, X.J. Pan, and W. Vermerris. Biomimetic Fenton catalyzed lignin depolymerization to aromatics and low molecular chemicals. The 3rd Frontiers in Biorefining, October 21-24, 2014, St. Simons Island, GA.

Oral Conference Presentations

- 1) X.J. Pan and Q. Yang. Design, synthesis and performance of cellulase-mimetic polymeric solid catalysts for cellulose hydrolysis. The 247th ACS National Meeting & Exposition, March 16-20, 2014, Dallas, TX.
- 2) X.J. Pan and Q. Yang. Toward a fundamental understanding how lignin impacts enzymatic saccharification of lignocellulose. The 247th ACS National Meeting & Exposition, March 16-20, 2014, Dallas, TX.
- 10) X.J. Pan, N. Li, C.Q. Mei, and L. Shuai. Saccharification and lignin fractionation of lignocellulosic biomass in molten salt hydrate system. 2014 AIChE Annual Meeting, November 16-21, 2014, Atlanta, GA.
- 11) Z.H. Tong, J.J. Zeng, C.G. Yoo, X.J. Pan, W. Vermerris, and F. Wang. Fragmentation of organosolv lignin by Fenton reaction facilitates production of lignin-derived mucolic acid and aromatic compounds. 2014 AIChE Annual Meeting, November 16-21, 2014, Atlanta, GA.

Poster Conference Presentations

- 1) X.J. Pan and Q. Yang. Fundamental understanding and removing strategies of the inhibitory effects of lignin on enzymatic saccharification of lignocellulose. The 36th Symposium on Biotechnology for Fuels and Chemicals, April 28 – May 1, 2014, Clearwater Beach, FL.
- 2) C.G. Yoo and X.J. Pan. Production of furan-based products from lignocellulosic biomass. 2014 AIChE Annual Meeting, November 16-21, 2014, Atlanta, GA.

Award:

Outstanding Faculty Award, Division of International Studies and International Student Services, UW-Madison (2014)

Student Accomplishments:

- 1) Shuting Zhang (Master student) won the best poster award and \$500 prize at the 2014 Discovery Challenge Research Symposium, May 21, 2014, Madison, WI.
- 2) Shuting Zhang (Master student) won International Student Academic Achievement Award in April 2014.
- 3) Shu-Ching Yang (undergraduate student working in Pan lab) won the SIRE-REU award (\$4,865) in May 2014 for supporting her working on a project “SIRE-REU: Conversion of Monosaccharides and Polysaccharides to Furan-Based Precursors for Hydrocarbon Fuels”.
- 4) Melanie Swannell (undergraduate student working in Pan lab) won the SIRE-REU award (\$4,865) in September 2014 for supporting her working on a project “SIRE-REU: Isomerization of glucose to fructose in molten halide salt hydrates”.

Professional Service

- 1) University
 - a) Graduate Instruction and Research Committee (30 hr/y)
 - b) Undergraduate Instruction and Program Committee (40 hr/y)
 - c) CoE Assessment Committee (60 hr/y)

Civic Service

- 1) Editorship
 - a) Associate Editor, *BioEnergy Research*
 - b) Editorial board member *Journal of Biobased Materials and Bioenergy*
 - c) Editorial board member of *International Journal of Agricultural and Biological Engineering*
- 2) Conference Organization
 - a) The session of Biomass Characterization, Pretreatment and Fractionation, Divisions of Forest and Plant Bioproducts and Sustainable Biorefineries, The 2014 AIChE Annual Meeting, Atlanta, November 16-21, 2014.
- 3) Journal Article Reviewer
 - a) ACS Sustainable Chem Eng
 - b) Biotechnology for Biofuels
 - c) ChemSusChem (×4)
 - d) Energy & Fuels
 - e) Journal of Forest Products
- 4) Book Chapter Reviewer
 - a) “Bioenergy: Principle and Applications” by John Wiley & Sons, Inc.
 - b) “Advances in Biochemical Engineering and Biotechnology” by Springer
- 5) Proposal Reviewer
 - a) USDA NIFA SBIR proposal
 - b) USDA NIFA SBIR Review Panel



Douglas J. Reinemann

Professor and Chairman, Ph.D.

24% Teaching / 25% Research / 51% Extension

Affiliations in CALS: Dairy Science Department, AgroEcology Program, Center for Integrated Ag Systems, Greenhouse Learning Community

Campus: Gaylord Nelson Institute for Environmental Studies: Energy Analysis and Policy Program Affiliate and Sustainability Certificate Committee. EPD Sustainable Systems Engineering On-Line MS Program Affiliate, WEI affiliate.

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 include efficient energy use and energy production in agricultural systems. He leads the UW 'Green Cheese' team who are investigating sustainability in 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 2014

BSE 367, Renewable Energy Systems

3 Credits, 75 Enrolled

BSE 309, Engr. Design Practicum

2 credits, 6 students advised

Summer 2014

BSE 367, Renewable Energy Systems

3 Credits, 11 Enrolled – (Special session for sustainable System Engineering MS program)

Fall 2014

BSE 367, Renewable Energy Systems

3 Credits, 69 Enrolled

BSE 509, Design Practicum II

3 Credits, 6 students advised

- 6) Robert Rowbotham, 2015, Dairy Science, Co-advised with Pamela Ruegg

Extension / Outreach

19 days of Extension programing.

Support UWEX agent programs in Milking Machines, Milking Parlors, Robotic Milking, Milking Management, Energy, and Bio-Energy: Agent Outcome Evaluation: 4.25/5.0

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

Graduate and Post Docs Advisees

- 1) Jack Buchanan, PhD GNIES, 2016.
- 2) John Penry, PhD Dairy Science, 2017
- 3) John Upton, Post Doctoral Researcher
- 4) Stefania Leonardi, U of Milan, 2015
- 5) Horacio A. Aguirre-Villegas, Post Doctoral Researcher, Co-advised with Rebecca Larson

Funded Research Projects

- 1) Milking Machine Research
Collaborators: P Thompson, BSE.
Funding: Avon Dairy Solutions.
Objectives: Advance the science of biomechanics of machine milking and milking management.

- 2) Automated Pre-Milking Preparation
Collaborators: P Ruegg, Dairy Science
Funding: Future Cow Inc.
Objectives: Assess sanitary and stimulation efficacy and of automated pre-milking preparation.
- 3) Climate Change Mitigation and Adaptation In Dairy Production
Collaborators: R Larson, M Ruark, M Jahn, M Watteaux, B Bland, M Stephenson
Funding: AFRI/CAP
Objectives: Life Cycle Assessment of Dairy Production Systems
- 4) Energy Self Assessment Website
Collaborators: Scott Sanford
Funding: USDA / CIG
Objectives: Maintenance and development of energy assessment tool web site.

Grant Proposals

CALS Hatch Competition: Effects of increasing residual milk and milking frequency on lactation physiology, milk yield, milking time and teat tissue stress. Co-Investigators, Laura Hernandez Dept. of Dairy Science, Doug Reinemann BSE. RA Funded for 4 years, beginning 2016.

Publications

Peer reviewed Journal Articles

- Aguirre-Villegas, HA, TH Passos-Fonseca, DJ Reinemann, LE Armentano, MA Wattiaux, VE Cabrera, JM Norman, and R Larson, 2014.
Green cheese: Partial life cycle assessment of greenhouse gas emissions and energy intensity of integrated dairy production and bioenergy systems. J. Dairy Science In Press.
- Aguirre-Villegas, HA, R Larson, DJ Reinemann, 2014.
From waste-to-worth: energy, emissions, and nutrient implications of manure processing pathways. Biofuels, Bioproducts and Bio-refining, 8:770–793.

Romero, G, DJ Reinemann, M Alejandro & JR Diaz, 2014. Goat mastitis detection using daily records of milk conductivity: comparative results of different algorithms. Czech J. Anim. Sci., 59, 2014(9)428–434

Conference Proceedings

Reinemann, DJ, 2014. Sensor Technologies to Improve Productivity in Dairy Farms. Paper presented at ExpoLeche, 25 May 2014, San Marcos, Mexico

Professional Development

UW Chair' Chats
Communications and Leadership Development Workshops (2 weeks)
WARF Stewards Table Program
Development Best Practices Workshops

Service

BSE committees
Undergrad Instruction (80 hrs)
IT (10 hrs)
Extension (2 hrs)
External Relations (20 hrs)
Awards (10 hrs/yr)
Facilities & Operations (200 hrs)

ASABE Committees
ED-210 Dept. Administrators
IET-441 Milk Handling Equipment
IET-433 Agricultural Wiring and Electrical Energy Applications

Midwest Rural Energy Council, Ex-Officio Executive Board Member and secretary
National Mastitis Council, Milking Machine Committee
International Dairy Federation, machine milking committee
Reviewer for Transactions ASABE, J. Dairy Science, J. Dairy Research, and several energy related journals

Reinemann Extension and Outreach Summary	Audience Type	Number Participating	Outcome/Impact	Revenue Generation
Midwest Rural Energy Council Annual Educational Conference (3 days)	Electric Utility Farm Reps and Energy Service Professionals	124	Improved energy efficiency and electrical safety on farms. Promotion of renewable energy deployment	Yes
Stray Voltage Investigators Course (4 days)	Stray Voltage Investigators	44	Resolution of stray voltage issues on farms	Yes
Outagamie Co. Robotic Milking Program	Dairy producers and service providers	33	Awareness of new dairy systems technology	No
Fond Du Lac, Oconto and Kewaunee Co. Milking management programs	Dairy producers and service providers	106	Improved milking management on dairy farms	No
Hoads Dairyman Conference Presentation	Dairy producers and service providers	500	Improved milking management on dairy farms	No
Milking Management Program, Chile	Dairy producers and service providers	200	Improved milking management on dairy farms	No
MilkTech On-Line Milking machine program	Milking machine technicians and advisors	1000 - estimated	Improved milking management on dairy farms	No
Milk Quality Web Site development and Maintenance – With Pamela L. Ruegg	Dairy producers and service providers	10,000 - estimated	Improved knowledge of milk quality and milking management	No
	Total Direct Contacts	1007 face-face + 11,000 estimated on-line		



Troy M. Runge

Assistant Professor, Ph.D.
40% Teaching / 60% Research

Campus Affiliations: Gaylord Nelson Institute for Environmental Studies and Wisconsin Energy Institute affiliate.

Dr. Runge is an Assistant Professor in the Biological Systems Engineering Department in CALS where he performs research and teaches in the bioproducts & bioenergy field. His research emphasis is on the biomass composition impact on bioprocessing systems, including biomass to polymers, fuels, and fiber.

Troy is a member of the Wisconsin Energy Institute where his lab group is located. He is leading a project investigating valorizing DDG, a by-product of the corn ethanol industry, and is part of several large bioprocessing consortia projects including investigating the sustainability of various cellulosic energy systems. He also working with several large farms on manure processing to remove phosphorous from watersheds. In addition to his lab-based research, he works closely with start-up bioenergy and biorenewable companies providing engineering and bioprocessing advice.

Teaching

Spring 2014

- BSE 461, Bioprocessing Unit Operations
3 Credits, 24 Enrolled
- BSE 309, Engr. Design Practicum
Guest lecturer, 1 week of lectures
2 credits,

Fall 2014

- BSE 249, Engineering Principles of Biological Systems
3 Credits, 49 Enrolled
- BSE 399, Internship
3 Credits, 1 student advised
- BSE 699, Independent Study
3 Credits, 1 student advised

Graduate and Post Docs Advisees

- 1) Sarah Krantz, MS, BSE, 2014.
- 2) Kim Houngh Pham, MS, GNIES, 2014.
- 3) Zhouyang Xiang, BSE, 2015.
- 4) Shengfei Zhou, BSE, 2015.
- 5) Zong Liu, BSE, 2015. (Co-advise with Sundaram Gunasekaran)
- 6) Qiang Yang, Post Doctoral Researcher.
- 7) Renil Anthony, Post Doctoral Researcher. (Co-advise with Rob Anex)

Outreach

Supported Wisconsin Energy Institute programs including:

- Wisconsin Alumni Event Speaker (Wausau)
- Meeting with interested industry collaborators
- Provide information to UW Extension specialist.

Funded Research Projects

1. Dried Distiller Grain Based Polymer Dispersions for Paper Coatings.
Collaborators: R. Anex, BSE.
Funding: USDA NIFA Critical Ag
Objectives: Develop a process to extract hemicelluloses as a gum material from DDG residual at a corn ethanol plant.
2. Accelerated Renewable Energy
Collaborators: J. Markley, Biochem, T. Cox, AAE, and J. Leverich, UW Ext.
Funding: USDA BRDI
Objectives: Assess a process to separate digested manure into value added components and investigate the potential to produce cellulosic ethanol.
3. Improving the Value of Agricultural Residues as Feed through Xylan Extraction and Utilization in Pulp and Paper
Funding: USDA Hatch

Objectives: Develop system to utilize agricultural residual crops to improve the wood pulping process.

4. Development of an Affordable Bioenergy and Bioproducts Laboratory-based Education

Funding: USDA / Higher Education

Objectives: Development and on-line distribution of bioenergy laboratory curricular material

Grant Applications

1. Phosphorous Extraction from Anaerobically Digested Dairy Manure for Improved Nutrient Management and Environmental Performance (With Tom Cox, AAE) - USDA HATCH
2. Metabolic Engineering of Fast-Growing Cyanobacteria for Production of High-value Terpenoids (With Toivo Kallas & Matt Nelson, UW Oshkosh) – NSF STTR
3. Wastewater Using Algae For Animal Feed Production – USDA NIFA
4. Reducing Nitrogen Losses from Agricultural Systems: Incorporating Biochar into Farmstead Management Strategies (With Becky Larson, BSE) – USDA NIFA
5. Carbon dioxide efficient utilization for algal growth and harvesting (With Renil Anthony & Shawn Nelson, Didion Inc.) – DOE TABB

Publications

Peer reviewed Journal Articles

1. Zhou, Shengfei, Paul J. Weimer, Ronald D. Hatfield, Troy M. Runge, and Matthew Digman. "Improving ethanol production from alfalfa stems via ambient-temperature acid pretreatment and washing." *Bioresource technology* (2014): 286–292.
2. Xiang, Zhouyang, Renil Anthony, Yuki Tobimatsu, and Troy Runge. "Emulsifying properties of an arabinoxylan–protein gum from distillers' grains and the co-production of animal feed." *Cellulose* 21, no. 5 (2014): 3623-3635.
3. Zhou, Shengfei, and Troy Runge. "Validation of lignocellulosic biomass carbohydrates determination via acid hydrolysis." *Carbohydrate Polymers* 112, no. 4 (2014): 179-185.
4. Runge, Troy; Heinricher, Jackie and Dan Meier. "Co-cooking moso bamboo with hardwoods." *Tappi Journal*, 13 no. 6 (2014): 9 -15.
5. Runge, Troy and Chunhui Zhang. "Co-cooking nonwoods with hardwoods." *Tappi Journal*, 13 no. 6 (2014): 19-24.
6. Runge, Troy, and Scott Paul. "Phyllostachys

bissetii Bamboo as a Solid Fuel Feedstock." *American Journal of Biomass and Bioenergy* 3, no. 1 (2014): 58-67.

7. Elumalai, Sasikumar, Aicardo Roa-Espinosa, John L. Markley, and Troy M. Runge. "Combined sodium hydroxide and ammonium hydroxide pretreatment of post-biogas digestion dairy manure fiber for cost effective cellulosic bioethanol production." *Sustainable Chemical Processes* 2, no. 1 (2014): 12-25.
8. Xiang, Zhouyang, Jamison Watson, Yuki Tobimatsu, and Troy Runge. "Film-forming polymers from distillers' grains: structural and material properties." *Industrial Crops and Products* 59 (2014): 282-289.
9. Du, Xiaodong, and Troy Runge. "Price dynamics in Wisconsin woody biomass markets." *Biomass and Bioenergy* 63 (2014): 250-256.
10. Anthony, R., and T. Runge. "An Approach to Microalgal Production Systems for Commodities." *Oceanography* 2, no. 116 (2014): 2-3.
11. Xiang, Zhouyang, and Troy Runge. "Co-production of feed and furfural from dried distillers' grains to improve corn ethanol profitability." *Industrial Crops and Products* 55 (2014): 207-216.
12. Mandalika, Anurag, Li Qin, Trey K. Sato, and Troy Runge. "Integrated biorefinery model based on production of furans using open-ended high yield processes." *Green Chemistry* 16, no. 5 (2014): 2480-2489.

Conference Proceedings

1. Runge, Troy; Scott, Paul. Silica Reduction in Bamboo Pulps. PEERS Conference Seattle, WA (September 15, 2014)
2. Zhou, Shengfei, Runge, Troy; Weimer, Paul; Hatfield, Ronald; Producing ethanol from alfalfa stems with an acid ensilage pretreatment. 248th ACS National Meeting and Exposition. San Francisco, California (August 10, 2014).
3. Xiang, Zhouyang; Runge, Troy; Film and coating with enhanced properties by cross-linking oxidized xylan with soy protein. 248th ACS National Meeting and Exposition. San Francisco, California (August 10, 2014).
4. Liu, Zong, Runge, T. Effects of polymer and centrifugation speed on pathogen indicators reduction in dairy manure. Paper No. 141905438, 2014 ASABE Annual International Meeting, Montreal QB (July 15, 2014).

Professional Development

North American Colleges and Teachers of Agriculture (NACTA) 2014 Conference (June 25-28, 2014) in Bozeman MT

Service

- Graduate thesis committees
 - Edgardo Ortiz, BSE
 - Sampath, Gunukala, BSE
 - Lei Gu, BSE
 - Ao Li, BSE
 - Michael Olson, CEE
 - Wu La, BSE
 - Thilina Gunawardhana, BSE
 - Alysa Bradley, BSE
 - Murat Sen, CBE
 - Horacio Aguirre-Villegas, BSE
 - Shuting Zhang, BSE
 - David Cook, Dairy Science
- BSE committees
 - Undergrad Instruction (80 hrs)
 - External Relations (20 hrs)
- Wisconsin Energy Institute Advisory Board
- Wisconsin Institute of Sustainable Technology Advisory Board.
- American Society of Agricultural and Biological Engineers
- Technical Association of Pulp and Paper Paper, Non-wood Committee
- Reviewer for journal articles including Transactions ASABE, TAPPI J., Holzforschung, Bioresources Technology, Bioresources, Green Chemistry, Industrial Crops and Products, and Biomass and Bioenergy.
- Reviewer for USDA and DOE grant submissions.



Kevin J. Shinnars

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

Dr. Shinnars has lead responsibilities for the Machinery Systems Engineering teaching and research program in BSE. He has been a member of the BSE faculty since 1985 and he works to create engineering improvements to the machines, practices and processes used to harvest, handle, store, and transport of hay, forage, and biomass crops. His current research focuses on single-pass biomass residue harvesting; improved logistics efficiency for chopped, bulk biomass; reducing costs of perennial grass biomass logistics; and fractional harvest of forage crops for improved animal utilization. Dr. Shinnars teaches the two core Machinery Systems Engineering BSE courses – Off-Road Vehicle Engineering and Engineering Principles of Agricultural Machines. He also serves as advisor to Machinery Systems Engineering students in the Design Practicum Courses.

Teaching

Spring 2014

- BSE / ME 476, Off-Road Vehicle Engineering
3 Credits, Enrollment – 38
Instructor Rating – 4.44/5.00
- BSE 309, Engr. Design Practicum
2 credits, 4 students advised

Fall 2014

- BSE / ME 475, Engineering Principles of
Agricultural Machines
3 Credits, Enrollment – 36
Instructor Rating – 4.67/5.00
- BSE 509, Design Practicum II
3 Credits, 4 students advised

Research Group

Graduate Students Completed in 2014:

- 1) Glenn Wiskur w/ MS ME – Employed by Custom Metalcraft, Inc Springfield, MO
- 2) Justin Orrick w/ MS BSE – Employed by Kuhn North America, Brodhead, WI

Current Graduate Students:

- 1) Brandon Nigon – MS BSE; May 2015
- 2) Scott Dietsche – MS BSE; May 2015
- 3) Ashley Stubbe – MS BSE; May 2015
- 4) Nolan Lacy – MS BSE; December 2015
- 5) Chase Walters – MS BSE; December 2016
- 6) Justin Thiede - MS BSE; December 2016

Outreach Presentations

Invited Presentations:

Single-Pass Baling of Crop Residues During Grain Harvest. Presented at the Joint Meeting of Iowa Sections of ASABE; SAE; ASME and SWE. Cedar Fall, IA. November 7th, 2014.

Outreach Presentations:

Conserving Value of Dry Bales and Baleage During Storage. Presented at Midwest Forage Association Annual Meeting, Wisconsin Dells, WI. January 22nd, 2014.

Diesel Engine Changes to Meet Tier 4 Final Emission Regulations. Presented at Wisconsin Custom Operators Annual Meeting, Wisconsin Dells, WI. January 22nd, 2014.

Kernel Processing - Principles, Trends and Quantifying Effectiveness. Presented at World Dairy Expo, Madison, WI. October 2nd, 2014.

Invited Panel Member:

Future Trends in Wisconsin Agriculture – Panel Discussion at Meeting of Wisconsin Section of National Agri-Marketing Association. Fitchburg, WI. November 20th, 2014.

Awards

Robert G.F. and Hazel T. Spitze Land Grant Faculty Award for Excellence – UW College of Agriculture and Life Sciences – 2014

Funded Research Projects

- 1) BioMODS – Biomass Optimized Delivery System.
Collaborators: Steve Searcy, Texas A & M.
Funding: USDA-NIFA. 9/13 – 8/16
Objectives: Development of improved systems to store and deliver bulk, chopped biomass.
- 2) Combine grain flow mapping.
Funding: John Deere. 5/13 – 12/15
Objectives: Development of systems to quantify grain flow from combine concave and separator grate.
- 3) Agro-ecosystem approach to sustainable biofuels production via the pyrolysis-biochar platform.
Collaborators: Multi-institution
Funding: USDA – AFRI CAP 8/11 – 7/16
Objectives: Improved logistics system for perennial grasses including harvest, handling, storage and transport.
- 4) Investigation of methods to harvest and store corn stover as a biomass feedstock.
Funding: John Deere. 10/10 – 6/16
Objectives: Improvements to a single-pass round baler integrated with the combine harvester.
- 5) Sugar cane harvester modifications to harvest energy cane feedstocks.
Funding: John Deere. 5/11 – 12/15
Objectives: Modifications to a sugar cane harvester to process energy cane.
- 6) Drying rate and losses from wide-swath mower-conditioner.
Collaborators: Brian Luck, BSE
Funding: Case New Holland. 5/14 – 6/15
Objectives: Quantify the drying rate and leaf loss of a wide-roll mower-conditioner.
- 7) Improving harvest technologies for fractionating alfalfa into leaf and stem fractions.

Collaborators: Ron Hatfield & Rich Muck, USDA

Funding: USDA-ARS. 6/14 – 9/17

Objectives: Improve the performance of a alfalfa leaf-stripper and investigate the storage characteristics of stripped leaf fraction.

Publications

Peer Reviewed Journal Publications

- Williams, S.D. and K.J. Shinnars. 2014. Farm-scale anaerobic storage and aerobic stability of high dry matter perennial grasses as biomass feedstock. *Biomass & Bioenergy*. 64:91-98.
- Cook, D.E. K.J. Shinnars, P.J. Weimer and R.E. Muck. 2014. High dry matter whole-plant corn as a biomass feedstock. *Biomass & Bioenergy*. 64:230-236.
- Shinnars, K.J. and W. M. Schlessler. 2014. Reducing baler losses in arid climates by steam re-hydration. *Applied Engineering in Agriculture*. 30(1):11-16.

Service:

Mentor Committees

Brian Luck – Chair
Troy Runge

Department:

Graduate Research and Instruction
Undergraduate Instruction
Facilities Operation – Chair
Department Advancement

College and University:

Graduate School Academic Planning Council
Graduate Faculty Executive Committee (GFEC)
GFEC Sub-committee on MS Program

Accreditation

Ten-Year Review – Geological Engineering

Professional:

ASABE PM-23/7-2 Forage Harvesting and Utilization Committee
ASABE PM-44 Machinery Management Committee

ASABE FPE – 709 Biomass Energy and
Industrial Products Committee
Board Member – Wisconsin Custom
Operators

Grant Review Committee

Review Committee for Advanced Biomass
Feedstock Logistics Systems II – Pella IA;
July 8th and 9th, 2014

Manuscripts Reviews

Transaction of the ASABE (1)
Applied Engineering in Agriculture (1)
BioEnergy Research (2)



Anita Thompson

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

Affiliations: The Nelson Institute for Environmental Studies; Environmental Chemistry & Technology; Agroecology Program.

Dr. Thompson's research program is focused on water quantity and quality impacts associated with land use change. In urban landscapes, she has addressed thermal pollution and mitigation; changes in runoff generation and water quality; and performance of engineered infiltration practices, treatment wetlands, and erosion control practices. In rural landscapes she has focused on runoff generation; transport and delivery of sediment, nutrient, and pathogens through agricultural watersheds; surface and subsurface water and nutrient dynamics associated with biofuel cropping systems; and wintertime hydrologic/erosion processes.

Teaching

Spring 2014:

BSE 571: 3 Credits, 23 Enrolled, Instructor Rating = 4.7 (5 point scale)

BSE 309: Advisor to NR&E Group, 4 Enrolled

Fall 2014:

BSE 509: Advisor to NR&E Group, 4 Enrolled

Advising:

Graduate Students:

Jasmeet Lamba (Ph.D. in BSE, August 2014)

Harsh Singh (Ph.D. in BSE, December 2014)

Ed Boswell (Ph.D. in Soil Science, Expected December 2017)

Michael Polich (M.S. in BSE, January 2015)

Elizabeth Buschert (M.S. in BSE, Expected December 2016)

Josh Accola (M.S. in BSE, Expected December 2015)

Post Master's and Post-Doctoral:

Zach Zopp (Assistant Researcher)

- Lepore, R. Jackson, K.G. Karthikeyan, D. Hyndman, A. Kendall, B. Basso, M. Feinen]
- 3) "Predicting sediment delivery in Wisconsin agricultural watersheds." USDA-NIFA Hatch. \$143,938. [P.I. A.M. Thompson]
 - 4) "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]
 - 5) "Subsurface Fate and Transport of Cryptosporidium in Soils of Wisconsin's Carbonate Aquifer Region." Wisconsin Groundwater Coordinating Council. \$115,000 [P.I.s K.G. Karthikeyan, A.M. Thompson, B.J. Lepore, S. Long]
 - 6) "Use of Watershed Modeling to Target Management Practices in an Agricultural Watershed." NCR SARE. \$9,864 [P.I.s K.G. Karthikeyan, A.M. Thompson]
 - 7) "Successful female leadership in engineering". UW Women in Science and Engineering Leadership Institute (WISELI). \$858. [P.I. A.M. Thompson]

Funded Research Projects (Natural Resources & Environment)

- 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.

Proposals Submitted or In Review

- 1) "Influence of Soil Matrix Temperature Gradient on Subsurface and Surface Nutrient Transport" USDA-NIFA. \$3,378,638 (\$1,010,440 to Thompson). [P.I.s D. Misra, A.M. Thompson, K.G. Karthikeyan, F. Arriaga, B. Luick, D. Mailapalli] Submitted August 13, 2014. Not funded.
- 2) "Engineering Conservation Developments to Provide Ecosystem Services." NSF CBET Environmental Sustainability. \$300,487. [P.I.s

A.M. Thompson, N. Balster, D. Drake, J. Silberbagel, A. Gocmen] Submitted November 5, 2014. In Review.

- 3) "Influence of Landscape Position on Subsurface Transport of *Cryptosporidium* in Soils of Wisconsin's Carbonate Aquifer Regions." Wisconsin Groundwater Coordinating Council. \$115,000. [P.I.s A.M. Thompson, K.G. Karthikeyan, S. Long] Submitted November 21, 2014. In Review

Peer Reviewed Publications (Natural Resources & Environment)

- 1) Lamba, J., A.M. Thompson, K.G. Karthikeyan, J. Panuska, and L. Good. Effect of best management practice implementation on sediment and phosphorus load reductions at subwatershed and watershed scale. *Agricultural Water Management* (In Review).
- 2) Lamba, J., A.M. Thompson, K.G. Karthikeyan, and F. A. Fitzpatrick. 2014. Sources of fine sediment stored in agricultural lowland streams, Midwest, USA. *Geomorphology* (Accepted).
- 3) Lamba, J., K.G. Karthikeyan, and A.M. Thompson. 2014. Using radiometric fingerprinting and phosphorus to elucidate sediment transport dynamics in an agricultural watershed. *Hydrological Processes* (In press).
- 4) Lamba, J., K.G. Karthikeyan, and A.M. Thompson. 2014. Apportionment of suspended sediment sources in an agricultural watershed using sediment fingerprinting. *Geoderma*. DOI: 10.1016/j.geoderma.2014.09.024
- 5) Prellwitz, S. and A.M. Thompson. 2014. Biota and hydrology influence soil stability in constructed wetlands. *Ecological Engineering*. 64:360-366.
- 6) Doherty, J., J. Miller, S. Prellwitz, A.M. Thompson, S. Loheide, and J. Zedler. 2014. Bundles and tradeoffs among six wetland services were associated with hydrologic regime. *Ecosystems*. DOI: 10.1007/s10021-014-9775-3.

Abstracts/Papers/Presentations (Natural Resources & Environment)

- 1) Zopp, Z., A.M. Thompson, K.G. Karthikeyan, and S.C. Long. 2014. Comparison of breakthrough and downward migration of live and irradiated *Cryptosporidium parvum* and microspheres under simulated rainfall. Poster Presentation. AWRA Wisconsin Section Conference, Wisconsin Dells, Wisconsin, March, 13-14, 2014.
- 2) Singh, H., A.M. Thompson, and J. Panuska. 2014. Improving sediment delivery process in a semi-physical model. Poster Presentation. AWRA Wisconsin Section Conference, Wisconsin Dells, Wisconsin, March, 13-14, 2014.
- 3) Lamba, J., A.M. Thompson, and K.G. Karthikeyan. 2014. Apportionment of stream bed sediment sources in an agricultural watershed using sediment fingerprinting technique. Oral Presentation. AWRA Wisconsin Section Conference, Wisconsin Dells, Wisconsin, March, 13-14, 2014.
- 4) Lamba, J., A.M. Thompson, K.G. Karthikeyan. 2014. Fingerprinting suspended sediment sources in an agricultural watershed. Poster Presentation. ASABE Annual International Conference, Montreal, Quebec, Canada, July 13-16, 2014.
- 5) Lamba, J., K.G. Karthikeyan, and A.M. Thompson. 2014. Using radiometric fingerprinting and phosphorus to elucidate sediment transport dynamics in an agricultural watershed. Oral Presentation. ASABE Annual International Conference, Montreal, Quebec, Canada, July 13-16, 2014.
- 6) Thompson, A.M. 2014. Water resource engineering. Women in Science and Engineering (WISE) Residential Program Seminar Series. Madison, WI, September 23, 2014.

- 7) Thompson, A.M. 2014. Thermal pollution: modeling & mitigation. 2014. North American Stormwater and Erosion Control Association 11th Annual Conference. Madison, WI, February 6, 2014.

Professional Service

- 1) Department and University Activities
 - a) Member, UW Committee for Undergraduate Recruitment and Financial Aid 2013-Present (15 hrs/yr)
 - b) Member, UW CALS Equity and Diversity Committee 2014-Present (15 hrs/yr)
 - c) Member, BSE Development and External Relations Committee 2013-Present
 - d) Member, BSE Undergraduate Instruction and Program Committee 2002-Present (10 hrs/yr)
 - e) Member, BSE Awards Committee 2007-Present
 - f) Faculty Senator Alternate 2014
 - g) Member, Biology in Engineering Certificate Program Committee 2009-Present
 - h) Member, The Nelson Institute for Environmental Studies, Water Resources Management Program Committee 2010-Present (4 hrs/yr)
 - i) Member, The Nelson Institute for Environmental Studies, Water Resources Management Program Graduate Admissions Committee 2014 (8 hrs/yr)
- 2) Professional
 - a) Associate Editor, Transactions of the ASABE 2008-Present
 - b) Representative, Consortium of Universities for the Advancement of Hydrologic Sciences, Inc. 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) Technical Reviewer:
 - i) USDA-SBIR Competitive Grants Program
 - ii) NSF Hydrological Sciences Competitive Grants Program
 - iii) J. of Hydrologic Engineering; Ecological Engineering

AFFILIATE AND EMERITUS FACULTY ACTIVITY REPORTS



John Ralph

Professor

Teaching /research/Extension split: 2% Teaching / 98% Research

Program affiliations: Department of Biochemistry, the DOE Great Lakes Bioenergy Research Center

Program's research largely focused on:

- General plant cell wall (CW) chemistry/biochemistry.
 - Lignin Biosynthesis (including pathway delineation), Lignin Structure, Lignin Chemistry, Lignin Reactions.
- Delineation of effects of perturbing lignin biosynthesis, and extensions aimed at redesigning lignins to be more readily degraded to improve lignocellulosics bioprocessing.
 - Development of synthetic methods for biosynthetic products, precursors, intermediates, molecular markers, cell wall model compounds, etc.
 - Solution-state NMR (particularly of CW components, especially lignins); methods development; NMR methods applied to unfractionated cell walls.
 - Plant cell wall cross-linking mechanisms.
 - Methods for wall structural analysis (chemical/degradative, NMR, GC-MS, etc.).
 - Processes such as biomass to bioenergy, pulping, and valorization of cell wall components.

Graduate and Post Docs Advisees

- 1) Kate Helmich, Biochemistry, 2017
- 2) Wu Lan, BSE, 2017
- 3) Dan Gall, CEE, 2015, Co-advised with Dan Noguera
- 4) Brian Keppler, UWCMB, 2015, Co-advised with Andrew Bent
- 5) Emily Frankman, Michigan State University, 2017, Co-advised with Curt Wilkerson
- 6) Oana Dima, Wout Boerjan, VIB, Gent, Belgium, 2015, Co-advised with Wout Boerjan
- 7) Zhouyang Xiang, BSE, 2016, Co-advised with Troy Runge
- 8) Shengfei Zhou, BSE, 2016, Co-advised with Troy Runge
- 9) J. Zachary Olshlag, UW CEE, Co-advised with Dan Noguera
- 10) Xiaoni Nie, Beijing U., China, Dec 2014, Co-advised with Runcang Sun
- 11) Yi-Kai Su, UW Microbio, Aug 2014, Co-advised with Tom Jeffrie

- 12) Heather Free, U. Auckland, NZ, Aug 2014, Co-advised with Philip Harris
- 13) Brett Diehl, Penn State U., Apr 2014, Co-advised with Nicole Brown
- 14) Yang Lin, UCSB, Dec 2014, Co-advised with Jennifer King
- 15) Chris Gilbert, UW Chem Engr, Aug 2014, Co-advised with George Huber

Research

- 1) Lignin Management: Optimizing Yield and Composition Lignin-Modified Plants. C. Chapple, W. Boerjan, C. Halpin, X. Li
- 2) Funding: Stanford U. GCEP (Global Climate and Energy Program). 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. We have discovered novel genes that mitigate the growth defects seen in severely lignin-

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- depleted plants. Revealing the mechanism(s) by which this mitigation occurs is crucial to fundamental understanding and useful manipulation of how plants partition carbon and may enable biomass manipulation for carbon sequestration in the future.
- 3) Regulation and Predictive Modeling of Lignin Biosynthesis. V.L. Chiang, F. Isik, J. Ducoste, R.R. Sederoff, H. Kim. Funding: NSF. Our role is to structurally characterize the entire set of transgenic aspens downregulated in 20 lignin-pathway-related genes, and to provide the comparative data used for modeling lignin biosynthesis.
 - 4) Plants Designed for Improved Processing. S.D. Mansfield, C.G. Wilkerson, J.C. Sedbrook, F. Lu. Funding: GLBRC (DOE Office of Science BER). The goal is 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. The major success this year was a *Science* paper describing the culmination of our long-term effort to engineer monolignol ferulate conjugates into poplar lignification to produce lignins with weak bonds in the polymer chain backbone, facilitating pulping and biomass pretreatment.
 - 5) Plant Cell Wall Profiling Facility. H. Kim. GLBRC (DOE Office of Science BER). This project was 'simply' to address the need to support the to NMR instruments and the facility, to enable the processing of samples from within (and ultimately beyond) GLBRC. The major work involves profiling plant cell wall structure, for both polysaccharides and lignin, in biomass lines with altered cell wall traits.
 - 6) Development of Crucial Tools for Lignin Research. M.G. Hahn, F. Chen, S. Decker (F. Lu, Y. Zhu, H. Kim, J. Grabber). Funding: DOE Office of Science BER. The aim is to generate for the research community a series of crucial tools to help address the current pressing issues. The prime objectives are to: develop a set of monoclonal antibodies to specific structures in lignins – for structural and localization studies; develop a system for producing polymer-supported lignin monomers and oligolignols – for additional antibody screens, reactivity determination, elucidation of cross-coupling propensities, and beyond; develop fluorescent-tagged monolignols – to aid in lignin localization studies and to help elucidate monolignol transport mechanisms.
 - 7) Biodegradative Oxidant Production by Fungi in Lignocellulose. K.E. Hammel, C.G. Hunt. Funding: DOE Office of Science BER. An attempt to provide the tools to determine: the spatial range over which ligninolytic oxidants are produced by a fungal cell; whether brown rot and white rot fungi differ from each other in the quantity of oxidants produced; which genes with proposed roles in the generation of reactive oxygen species by each fungus are highly expressed at the time of maximum oxidant production, i.e., which are physiologically important.
 - 8) Solids Separation for a Feedstock-Flexible System. R.R. Raines. Funding: Hyrax Energy. Cell wall structural support work to help the development of ionic-liquid-based methods to produce cheap sugars and lignin from biomass.

Publications

Peer reviewed Journal Articles

- Azarpira A, Ralph J, Lu F (2014) Catalytic alkaline oxidation of lignin and its model compounds: A pathway to aromatic biochemicals. *BioEnergy Research* 7(1): 78-86
- Bao Z, Benson SM, Dionne JA, Maher K, Boerjan W, Halpin C, Nelson R, Nichols D, Ralph J, Ramakrishnan TS (2014) In search of clean, affordable energy. *Oilfield Review* 26(1): 4-15
- Bonawitz ND, Kim JI, Tobimatsu Y, Ciesielski PN, Anderson NA, Ximenes E, Maeda J, Ralph J, Donohoe BS, Ladisch M and others (2014) Disruption of Mediator rescues the stunted growth of a lignin-deficient *Arabidopsis* mutant. *Nature* 509(7500): 376-380
- Diehl BG, Watts HD, Kubicki JD, Regner MR, Ralph J, Brown NR (2014) Towards lignin-protein crosslinking: amino acid adducts of a lignin model quinone methide. *Cellulose* 21(3): 1395-1407
- Gall DL, Kim H, Lu F, Donohue TJ, Noguera DR, Ralph J (2014) Stereochemical features of glutathione-dependent enzymes in the *Sphingobium* sp. Strain SYK-6 β -aryl etherase pathway. *J. Biol. Chem.* 289(12): 8656-8667
- Gall DL, Ralph J, Donohue TJ, Noguera DR (2014) A group of sequence-related sphingomonad enzymes catalyzes cleavage of β -aryl ether linkages in lignin β -guaiacyl and β -syringyl ether dimers. *Environ Sci Technol* 48(20): 12454-12463
- Gaskell J, Marty A, Mozuch M, Kersten PJ, BonDurant

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- SS, Sabat G, Azarpira A, Ralph J, Skyba O, Mansfield SD and others (2014) Influence of *Populus* genotype on gene expression by the wood decay fungus *Phanerochaete chrysosporium*. *Appl. Environ. Microbiol.* 80(18): 5828-5835
- Green AR, Lewis KM, Barr JT, Jones JP, Lu F, Ralph J, Vermerris W, Sattler SE, Kang C (2014) Determination of the structure and catalytic mechanism of *Sorghum bicolor* caffeic acid O-methyltransferase and the structural impact of three brown midrib12 mutations. *Plant Physiol.* 165(4): 1440-1456
- Kim H, Ralph J (2014) A gel-state 2D-NMR method for plant cell wall profiling and analysis: a model study with the amorphous cellulose and xylan from ball-milled cotton linters. *RSC Advances* 4(15): 7549-7560
- Morreel K, Saeys Y, Dima O, Lu F, Van de Peer Y, Vanholme R, Ralph J, Vanholme B, Boerjan W (2014) Systematic structural characterization of metabolites in *Arabidopsis* via candidate substrate-product pair networks. *Plant Cell* 26(3): 929-945
- Niculaes C, Morreel K, Kim H, Lu F, McKee L, Ivens B, Hausteraete J, Vanholme B, Hertzberg M, Fromm J, Bulone V, Polle A, Ralph J, Boerjan W (2014) Phenylcoumaran benzylic ether reductase prevents accumulation of compounds formed under oxidative conditions in Poplar xylem. *Plant Cell* 26(9): 3775-3791
- Petrik D, Karlen SD, Cass C, Padmakshan D, Lu F, Liu S, Le Bris P, Antelme S, Santoro N, Wilkerson CG, Sibout R, Lapierre C, Ralph J, Sedbrook JC (2014) p-Coumaroyl-CoA:Monolignol Transferase (PMT) acts specifically in the lignin biosynthetic pathway in *Brachypodium distachyon*. *Plant J.* 77(5): 713-726
- Scheutz M, Benzke A, Smith R, Watanabe Y, Tobimatsu Y, Ralph J, Demura T, Ellis B, Samuels L (2014) Laccases direct lignification in the discrete secondary cell wall domains of protoxylem. *Plant Physiol.* 166(2): 798-807
- Sundin L, Vanholme R, Geerinck J, Goeminne G, Höfer R, Kim H, Ralph J, Boerjan W (2014) Mutation of the inducible *ARABIDOPSIS THALIANA* CYTOCHROME P450 REDUCTASE2 alters lignin composition and improves saccharification. *Plant Physiol.* 166(4): 1956-1971
- Takasuka TE, Bianchetti CM, Tobimatsu Y, Bergemann LF, Ralph J, Fox BG (2014) Structure-guided analysis of catalytic specificity of the abundantly secreted chitosanase SACTE_5457 from *Streptomyces* sp. SirexAA-E. *Proteins: Structure, Function, and Bioinformatics* 82(7): 1245-1257
- Tobimatsu Y, Wouwer D, Allen E, Kumpf R, Vanholme B, Boerjan W, Ralph J (2014) A click chemistry strategy for visualization of plant cell wall lignification. *Chem Commun* 50: 12262-12265
- Tsuji Y, Vanholme R, Tobimatsu Y, Ishikawa Y, Foster C, Kamimura N, Hishiyama S, Hashimoto S, Shino A, Hara H and others (2014) Introduction of chemically labile substructures into *Arabidopsis* lignin through the use of the C α dehydrogenase from *Sphingobium* sp. strain SYK-6. *Plant Biotechnology Journal*: in press, accepted 11/26/2014
- Van Acker R, Leplé J-C, Aerts D, Storme V, Goeminne G, Ivens B, Légee F, Lapierre C, Piens K, Van Montagu MCE and others (2014) Improved saccharification and ethanol yield from field-grown transgenic poplar deficient in cinnamoyl-CoA reductase. *Proc. Natl. Acad. Sci.* 111(2): 845-850
- Vanholme B, Vanholme R, Turumtay H, Goeminne G, Ceserano I, Goubet F, Morreel K, Rencoret J, Bulone V, Hoojimaïjers C and others (2014) Accumulation of N-acetylglucosamine oligomers in the plant cell wall affects plant architecture in a dose-dependent and conditional manner. *Plant Physiol.* 165(1): 290-308
- Wilkerson CG, Mansfield SD, Lu F, Withers S, Park J, Karlen SD, Gonzales-Vigil E, Padmakshan D, Unda F, Rencoret J and others (2014) Monolignol ferulate transferase introduces chemically labile linkages into the lignin backbone. *Science* 344(6179): 90-93
- Yelle DJ, Japich AN, Houtman CJ, Lu F, Timokhin VI, Fort RA, Ralph J, Hammel KE (2014) A highly diastereoselective oxidant contributes to ligninolysis by the white rot basidiomycete *Ceriporiopsis subvermispora*. *Appl. Environ. Microbiol.*: in press (accepted 9/20/2014)

Books & Chapters

- Carpita N, Ralph J, McCann M (2014) The Cell Wall. In: Buchanan BB ed. *Biochemistry and Molecular Biology of Plants*. 2 ed. in press.
- Lu F (2014) Lignin: Structural Analysis, Applications in Biomaterials, and Ecological Significance. Hauppauge, New York, USA, Nova Science Publishers, Inc. 419 p
- Lu F, Ralph J (2014) The DFRC (Derivatization Followed by Reductive Cleavage) method and its applications for lignin characterization. In: Lu F (ed). *Lignin: Structural Analysis, Applications in Biomaterials, and Ecological Significance*. Hauppauge, New York, USA, Nova Science Publishers, Inc. pp 27-65

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Conference Proceedings

- Cardenas CL, Avci U, Davis RH, Dong R, Tobimatsu Y, Gao R, Lu F, Mansfield SD, Chapple C, Chen F and others (2014) Novel lignins and the case for valorization of lignin in the biorefinery. 2014 Plants and Bioenergy Congress. Guelph, Ontario, Canada. p. B1-04, p. 34
- Cardenas CL, Avci U, Tobimatsu Y, Gao R, Voelker A, Regner M, Lu F, Chen F, Decker S, Ralph J and others (2014) Development of crucial tools for lignin research. 2014 Genomic Science Contractor-Grantee Meeting XII. Washington, DC. p. 146
- Cass C, Peraldi A, Dowd P, Mottiar Y, Santoro N, Foster C, Karlen SD, Bukhman Y, Thrower N, Johnson E and others (2014) Phenylalanine Ammonia Lyase reduction in *Brachypodium distachyon* alters cell wall composition and fungi susceptibilities while minimally affecting caterpillar herbivory and abiotic stress tolerances. 2014 Plants and Bioenergy Congress. Guelph, Ontario, Canada. p. B2-06, p. 41
- Chen F, Gallego-Giraldo L, D'Souza N, Tobimatsu Y, Ralph J, Dixon RA (2014) Novel lignins and the case for valorization of lignin in the biorefinery. 2014 Plants and Bioenergy Congress. Guelph, Ontario, Canada. p. A16, p. 24
- Chen F, Tobimatsu Y, Nakashima J, Escamilla-Treviño LL, Jackson L, Dixon RA, Ralph J, Gilna P (2014) Coexistence but independent biosynthesis of catechyl and guaiacyl/syringyl lignin polymers in plant seeds. 2014 Genomic Science Contractor-Grantee Meeting XII. Washington, DC. p. 202
- Chen F, Tobimatsu Y, Ralph J, Dixon RA (2014) Novel lignins demonstrate the flexibility of lignin biosynthesis in plants. 247th National American Chemical Society Meeting. Dallas, TX. p. Cell-120
- Chen F, Zhao Q, Tobimatsu Y, Ralph J, Dixon RA (2014) Genetics and serendipity – new insights into lignin polymerization and natural variability. Lignin 2014: From Biosynthesis to Utilization. Umeå, Sweden, Umeå Plant Science Center. p. Talk S3, p. 32
- del Rio JC, Rencoret J, Prinsen P, Gutiérrez A, Ralph J, Martínez AT (2014) A detailed structural characterization of the lignin from wheat straw. 13th European Workshop on Lignocellulosics and Pulp. Seville, Spain, Institute of Natural Resources and Agrobiolology of Seville (IRNAS-CSIC). p. 311-314
- Gao R, Lu F, Zhu Y, Hahn MG, Ralph J (2014) Flexible method for conjugation of lignin model compounds to highly cationized carrier Pproteins. 247th National American Chemical Society Meeting. Dallas, TX.
- Grabber J, Tobimatsu Y, Lu F, Kim H, Elumalai S, Zhu Y, Ress DK, Pan X, Ralph J (2014) Identifying new lignin bioengineering targets for improving biomass and forage utilization: A review of biomimetic studies with maize cell walls. 247th National American Chemical Society Meeting. Dallas, TX. p. Cell-118
- Helmich KE, Withers S, Lu F, Wilkerson CG, Ralph J, Phillips GN (2014) Homology models of two BAHD acyl-transferase enzymes important in lignin biosynthesis. 247th National American Chemical Society Meeting. Dallas, TX.
- Hunt CG, Timokhin VI, Zhu Y, Houtman CJ, Kitin P, Hammel KE, Ralph J (2014) Ratiometric fluorescent probes for imaging reactive oxygen species produced by biodegradative fungi in lignocellulose. 247th National American Chemical Society Meeting. Dallas, TX.
- Karlen SD, Padmakshan D, Lu F, Petrik DL, Cass CL, Liu S, Santoro N, Wilkerson CG, Sibout R, Lapiere C and others (2014) Misregulation of *p*-coumaroyl-CoA:monolignol transferase in *Brachypodium distachyon*. 247th National American Chemical Society Meeting. Dallas, TX. p. Cell-186
- Kim H, Li Q, Liu J, Yang C, Shi R, Wang J, Chen H-C, Lin C-Y, Lin Y-C, Sun Y-H and others (2014) 2D NMR (HSQC) profiling of transgenic *Polulus trichocarpa* lignins. 13th European Workshop on Lignocellulosics and Pulp. Seville, Spain, Institute of Natural Resources and Agrobiolology of Seville (IRNAS-CSIC). p. 463-466
- Kim H, Tobimatsu Y, Li Q, Liu J, Zhao Q, Chen F, Anderson NA, Dixon RA, Chapple C, Chiang VL and others (2014) Gel-state 2D NMR method for plant cell wall profiling and analysis: The aldehyde structures in CAD-deficient plants revisited. 247th National American Chemical Society Meeting. Dallas, TX. p. Cell-186
- Lan W, Lu F, Morreel K, Rencoret J, del Rio J-C, Zakai U, Jones AD, Zhu Y, Boerjan W, Ralph J (2014) Tricin, a novel monomer in grass lignins. 247th National American Chemical Society Meeting. Dallas, TX.
- Lu F, Gao R, Zhang A, Ralph J (2014) Incorporation of hydroxycinnamates into lignin in grass cell walls: NMR evidence for pathways. 247th National American Chemical Society Meeting. Dallas, TX. p. Cell-184
- Padmakshan D, Karlen SD, Lu F, Petrik DL, Cass CL, Liu S, Wilkerson CG, Sibout R, Lapiere C, Sedbrook JC and others (2014) Quantitative DFRC method for determining monolignol *p*-coumarates released from grass lignins. 247th National American Chemical Society Meeting. Dallas, TX.
- Ralph J (2014) The metabolic malleability of lignification: increasing complexity and simplicity at the same time! 8th

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- Annual Glycoscience Symposium: "Integrating Models of Plant Cell Wall Structure, Biosynthesis and Assembly". Complex Carbohydrate Research Center University of Georgia, Athens, GA. Session C
- Ralph J (2014) Ruminations (Anselme Payen After-dinner Talk. 247th National American Chemical Society Meeting. Dallas, TX.
- Ralph J, Lu F, Kim H, Tobimatsu Y, Zhu Y, Rencoret J, Karlen SD, Padmakshan D, Liu S, Regner M and others (2014) Redesigning lignin for improved plant cell wall deconstruction – recent developments. 13th European Workshop on Lignocellulosics and Pulp. Seville, Spain, Institute of Natural Resources and Agrobiolgy of Seville (IRNAS-CSIC). p. 53-58
- Ralph J, Lu F, Kim H, Tobimatsu Y, Zhu Y, Rencoret J, Karlen SD, Padmakshan D, Regner M, Grabber J and others (2014) Redesigning lignin for improved plant cell wall deconstruction: a case study. 247th National American Chemical Society Meeting. Dallas, TX. p. Cell-217
- Ralph J, Mansfield SD, Wilkerson CG, Lu F, Karlen SD, Padmakshan D, Withers S, Park J, Gonzales-Vigil E, Unda F and others (2014) Designing plant cell walls for deconstruction: Using monolignol ferulate conjugates to introduce ester bonds into the lignin backbone. 2014 Plants and Bioenergy Congress. Guelph, Ontario, Canada. p. A15, p. 24
- Ralph J, Mansfield SD, Wilkerson CG, Lu F, Karlen SD, Padmakshan D, Withers S, Park J, Gonzales-Vigil E, Unda F and others (2014) Designing plant cell walls for deconstruction: Using monolignol ferulate conjugates to introduce ester bonds into the lignin backbone. Renewable Chemicals from Lignin. London, UK, Royal Society of Chemistry. Paper 3
- Ralph J, Mansfield SD, Wilkerson CG, Lu F, Karlen SD, Padmakshan D, Withers S, Park J, Gonzales-Vigil E, Unda F and others (2014) Designing plant cell walls for deconstruction: Using monolignol ferulate conjugates to introduce ester bonds into the lignin backbone. Cambridge University, Department of Biochemistry seminars. Cambridge, UK
- Ralph J, Mansfield SD, Wilkerson CG, Lu F, Karlen SD, Padmakshan D, Withers S, Park J, Gonzales-Vigil E, Unda F and others (2014) Designing plant cell walls for deconstruction: Using monolignol ferulate conjugates to introduce ester bonds into the lignin backbone. Rothamsted Research Institute, Institute seminars. Rothamsted, UK
- Ralph J, Mansfield SD, Wilkerson CG, Lu F, Karlen SD, Padmakshan D, Withers S, Park J, Gonzales-Vigil E, Unda F and others (2014) Designing plant cell walls for deconstruction: Using monolignol ferulate conjugates to introduce ester bonds into the lignin backbone. University of Edinburgh, Biochemistry Department Seminars. Edinburgh, UK
- Ralph J, Mansfield SD, Wilkerson CG, Lu F, Karlen SD, Padmakshan D, Withers S, Park J, Gonzales-Vigil E, Unda F and others (2014) Designing plant cell walls for deconstruction: Using monolignol ferulate conjugates to introduce ester bonds into the lignin backbone. Lignobiotech. Concepción, Chile, Universidad de Concepción. KeyNote 2, p. 33
- Ralph J, Mansfield SD, Wilkerson CG, Lu F, Karlen SD, Padmakshan D, Withers S, Park J, Gonzales-Vigil E, Unda F and others (2014) Designing plant cell walls for deconstruction: Using monolignol ferulate conjugates to introduce ester bonds into the lignin backbone. Next Generation Liquid Biofuels and Co-products. Rotorua, New Zealand, Advance Biofuels Research Network. KeyNote 2
- Ralph J, Mansfield SD, Wilkerson CG, Lu F, Karlen SD, Padmakshan D, Withers S, Park J, Gonzales-Vigil E, Unda F and others (2014) Designing plant cell walls for deconstruction: Using monolignol ferulate conjugates to introduce ester bonds into the lignin backbone. Lignin 2014: From Biosynthesis to Utilization. Umeå, Sweden, Umeå Plant Science Center. KeyNote Talk S5, p. 43
- Ralph J, Mansfield SD, Wilkerson CG, Lu F, Karlen SD, Padmakshan D, Withers S, Park J, Gonzales-Vigil E, Unda F and others (2014) Designing plant cell walls for deconstruction: Using monolignol ferulate conjugates to introduce ester bonds into the lignin backbone. Renewable Chemicals from Lignin. Palm Cove, Queensland, Australia, Fifth International Conference on Plant Cell Wall Biology. Session 1, Talk 4
- Ralph J, Mansfield SD, Wilkerson CG, Lu F, Karlen SD, Padmakshan D, Withers S, Park J, Gonzales-Vigil E, Unda F and others (2014) Designing plant cell walls for deconstruction: Using monolignol ferulate conjugates to introduce ester bonds into the lignin backbone. CSIRO Seminar Series. Werribee, Victoria, Australia
- Ralph J, Mansfield SD, Wilkerson CG, Lu F, Karlen SD, Padmakshan D, Withers S, Park J, Gonzales-Vigil E, Unda F and others (2014) Designing plant cell walls for deconstruction: Using monolignol ferulate conjugates to introduce ester bonds into the lignin backbone. CSIRO Seminar Series. Australian National University and CSIRO, Canberra, Victoria, Australia
- Smith R, Scheutz M, Ellis B, Ralph J, Mansfield SD, Samuels L (2014) Parenchyma cells and fibres in xylem function as good neighbours during lignification in *Arabidopsis thaliana*. Lignin 2014:

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From Biosynthesis to Utilization. Umeå, Sweden, Umeå Plant Science Center. Talk S1, p. 22

Sundin L, Vanholme R, Geerinck J, Goeminne G, Kim H, Ralph J, Boerjan W (2014) Mutation of the inducible ARABIDOPSIS THALIANA CYTOCHROME P450 REDUCTASE 2 alters lignin composition and improves saccharification. Lignin 2014: From Biosynthesis to Utilization. Umeå, Sweden, Umeå Plant Science Center. Talk S5, p. 45

Timokhin VI, Baumann S, Kitin P, Houtman CJ, Ralph J, Hammel KE, Hunt CG (2014) Fluorescent probe selective for hydrogen atom abstraction based on polyethylene glycol cleavage. 2014 Genomic Science Contractor-Grantee Meeting XII. Washington, DC. p. 177

Tobimatsu Y, Ralph J, Kim H, Lu F, Dixon RA, Chen F, Zhao Q, Nakashima J, Escamilla-Treviño L, Jackson L and others (2014) Lignins exclusively derived from unusual monolignols. JST-ALCA International Workshop for Plant Cell Wall Engineering: Towards Reduction of CO₂ Emissions. Tokyo, Japan

Tobimatsu Y, Wagner A, Donaldson L, Mitra P, Loque D, Dima O, Niculaes C, Boerjan W, Kim J-I, Anderson NA and others (2014) Synthetic monolignol mimics for understanding lignin biosynthesis. 247th National American Chemical Society Meeting. Dallas, TX. p. Cell-185

Ulbrich A, Higbee AJ, Austin S, Noguera DR, Ralph J, Westphall MS, Coon JJ (2014) Characterization and quantification of fermentation inhibitors in biomass hydrolysates for biofuel production. 62nd American Society of Mass Spectrometry Conference. Baltimore, MD, ASMS. p. WOA-9:50

Wagner A, Tobimatsu Y, Phillips L, Flint H, Geddes B, Steward D, Ralph J (2014) Lignin manipulations in conifers. Lignin 2014: From Biosynthesis to Utilization. Umeå, Sweden, Umeå Plant Science Center. Talk S5, p. 42

Zhang K, Cai Y, Kim H, Hou G, Yang H, Miller L, Ralph J, Liu C-J (2014) Alteration of Populus wood ultra-structure and digestibility via expression of a novel monolignol methyltransferase. 247th National American Chemical Society Meeting. Dallas, TX. p. Cell-183

Patents and Invention Disclosures

p-Coumaroyl-CoA:Monolignol Transferase. US Application Number 14/365,744 filed on June 16, 2014

Antimicrobial ferulic acid derivatives and uses thereof. WARF IDR #5781, 09820569-

P140248US01, App. # 61/987788. Filed May 02, 2014

Use of Lig etherases to produce stereo-pure chemicals and biofuel precursors from aromatic oligomers WARF IDR #5734, P140190. Invention Disclosure, March 19, 2014.

Using Derivatization Followed by Reductive Cleavage (DFRC) to select plant lines for propagation based on the level of monolignol ferulate conjugate incorporated into plant lignin.

Invention Disclosure, WARF-accepted: P150118
Corn lines containing zip lignin transgenes WARF IDR #5876, P140352. Invention Disclosure, April 30, 2014

Awards

American Chemical Society, Anselme Payen Award (Cellulose and Renewable Materials Division). [Awarded at the 2014 National ACS in Dallas, TX, March 2014]

Selected by Thompson Reuters for HighlyCited.com as a Highly Cited Researcher

Service

Great Lakes Bioenergy Research Center (Management Team, and Plants Area Lead) ~200 hrs

Editorial Boards:

BioEnergy Research, J. Wood Chemistry and Technology, Holzforschung, J. Science of Food and Agriculture, Journal of Wood Science (Japan Wood Soc.)

Scientific Advisory Boards: FuncFiber, Umeå, Sweden; Joint BioEnergy Institute (JBEI), Berkeley, CA; Center for Direct Catalytic Conversion of Biomass to Biofuels (C3Bio), Purdue, IN; Genome-Canada's program on 'Harnessing microbial diversity for sustainable use of forest biomass resource,' U. British Columbia, Vancouver, Canada; The CSIRO Food, Nutrition and Bioproducts Flagship's program (Werribee, Victoria, Australia).

Conference Scientific Boards: "Lignin 2014: From Biosynthesis to Utilization" in Umeå, Sweden, 2014; "Eighteenth International Symposium on Wood, Fiber, and Pulping Chemistry" in Vienna, Austria, 2015

Prize Committee: Marcus Wallenberg Prize Selection Committee (Stockholm, Sweden)

Reviewer: some 50 journal article reviews for some 20 journals; Peer review panels, 5; Grant Reviewer, 5.



Ferencz Denes

Professor Emeritus, Ph.D.
Research
Food Safety

Research

- (1) Synthesis and Characterization of Carbon-host, Magnetic Nanoparticle Systems for Biotech Applications (potential sensor, *in vivo* magnetic imaging, and vaccine developments), using Original Submerged-arc Atmospheric-pressure Plasma Tools.
Collaborators: Professor Sundaram Gunasekaran, BSE, UW, Sorin Manolache, Assistant Scientist Scientist
Funding source: None
- (2) Development of benzene- and acetonitrile-origin nanoparticle systems (NPs) under Dense Medium Plasma (DMP) environments, and characterization of NPs using advanced analytical techniques (GC-MS, ATR-FTIR, particle size distribution, SEM, TEM, ESR) Evaluation of the potentials of these complex NPs for potential biotech applications.
- (3) Characterization of Carbon-based and Iron/iron-oxide-based NPs and their activity *in vitro* and *in vivo* environments for the generation of enhanced immunological response.

Collaborators: Professor Matyas Sandor and Professor Zsuzsa Fabry Medical School, University of Wisconsin, Madison 5468 Medical Science Center

- 1) Prototype Cold Plasma Reactor for a Removal of Man-made and Natural (Toledo-type) Xenobiotics for Water Systems, NSF SBIR Phase 1 (proposal pending), PIs: S. Manolache, M. Raabe; UW Subaward 30,000, PI S. Gunasekaran, Consultant F.S. Denes.

Publications

DENSE MEDIUM PLASMA TECHNOLOGY FOR SYNTHESIS CARBON NANOMATERIALS, Dilek Çökeliler, Sorin Manolache, Ferencz S. Denes, Sundaram Gunesakaran, ICOPS 2015, Antalya, Turkey



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 Solid wood and Wood Fiber-Based Composites based on Chemical Modification.* Funding from two private companies. 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 micro organisms is one way to stop or decrease fungal attack.
- 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 places 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 vazo 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 in Improve Decay Resistance and Dimensional Stability.* Funding from EcoBuild, Stockholm, Sweden. 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. 2014. Fire retardant treatment of wood. McGraw-Hill Yearbook of Science and Technology, 118-120.

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- 2) Rowell, R.M. 2014. Acetylated wood: History and performance. *Japanese Lumber Journal*, 55(8) 1-2.
- 3) Rowell, R.M. 2014. Compatibility of acetylated wood with concrete. *Proceedings: The International Research Group on Wood protection*, IRG/WP 14-40673, May 11–15, St. George, Utah.
- 4) Rowell, R.M. and J.P. Dickerson 2014. Deterioration and Protection of Sustainable Biomaterials, Chapter 18, pp 301–327, ACS Symposium Series, Vol. 1158.
- 5) Rowell, R.M. 2014. The use of biomass to produce bio-based composites and building materials, *Advances in Biorefineries, Biomass and Waste Supply Chain Exploitation*, Chapter 25: 803-818.
- 6) Rowell, R.M. 2014. Acetylation of wood – A review. *International Journal of Lignocellulosic Products*, 1 (1): 1- 27.

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. 2014 Modification of wood: Chemical and Thermal, *Proceedings: The 12th Pacific Rim Bio-Based Composites Symposium and 3rd Forest Science Forum*, June 4-7, Beijing, China.
- 2) Rowell, R.M. 2014. Accessibility and reactivity of hydroxyl groups in wood. *Proceedings: The 57th SWST International Convention and The 7th Wood Structure and Properties Conference and The 6th European Hardwood Conference*. June 23-27, Zvolen, Slovakia.
- 3) Rowell, R.M. 2014. Dimensional stability and fungal durability of acetylated and heat treated wood, In *Proceedings: 68th Forest Products Society, World Conference on Timber Engineering*, August, Quebec, Canada
- 4) Rowell, R.M. 2014. Accessibility and reactivity of hydroxyl groups in wood, In: *Proceedings: 10th Northern European Network for Wood Science Engineering*, October, Edinburgh, Scotland.
- 5) Rowell, R.M. 2014. Forest residues as reinforcing fillers in thermoplastic composites, In: *Proceedings: Toward forest products and processes with lower environmental impact*. Fernando Caldeira, Ed. University Fernando Pessoa, Porto, Portugal., 219-226

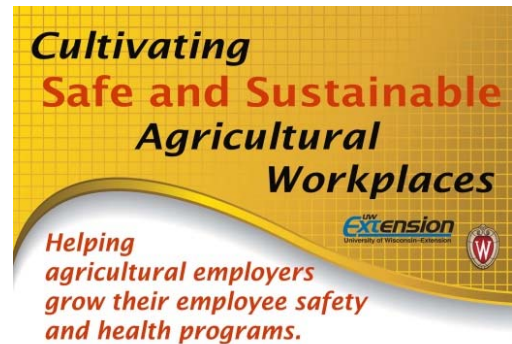
BSE CENTERS ACTIVITY REPORTS



UW Center for Ag Safety and Health Cheryl Skjolaas

Senior Outreach Specialist
100% Extension

Program affiliations: UW Center for Agricultural Safety and Health; Extension Disaster Education Network



Ms Skjolaas has programmed in the area of agricultural safety and health since 1990. She has served as the Interim Director the UW Center for Agricultural Safety and Health since 2003. Her outreach interests include employer and worker safety with a focus on youth agricultural safety, farm rescue, and disaster education. In her outreach programs she collaborates and partners with UW Extension county based faculty and staff as well as numerous agencies and organizations including DATCP, DOT, OSHA, Technical College Agribusiness Instructors, high school vocational education instructors, WCO, and PNAAW.

Addressing the issue of agricultural equipment on public roads was a significant part of Cheryl's programming efforts in 2014. She serves as the co-chair for the education and outreach subgroup of the DOT/DATCP Road Study Committee. In early 2014, her educational efforts focused on assisting the agricultural industry with understanding proposed legislation. After 2013 Wisconsin Act 377 was enacted, she has made significant contribution to the educational efforts. She assisted with the development of educational resources and taught 37 programs reaching over 2000 participants. Resource materials that she collaborated on developing have been widely distributed to farmers, agri-businesses, equipment dealers, law enforcement officers and local government officials. She provided leadership for a train-the-trainer program, offered in July 2014, that provided training to 92 participants representing agricultural organizations, equipment dealers and manufacturers, agri-business, insurance, local government officials, highway commissioners and UW Extension.

Teaching:

- Farm Industry Short Course Agricultural Safety and Health (3 week – 1 credit course) 32 students
- Summer safety intern shared with UW Arlington Research Station
- Assisting a UW Whitewater Master's Student with required project in collaboration with UW Marshfield Research Station.

trained each year in these programs that require 24 hours of instruction. Currently on this program Cheryl is working to update the teaching resources with agricultural instructors and UW Extension agents. Information is available to instructors on <http://fyi.uwex.edu/tractorcet>.

Extension programs

- Provided administrative assistance for the Wisconsin Safe Operation of Tractor and Machinery Certification Program for Youth Operators. Approximately 400 youth are

- Responded to programming requests resulting from Wisconsin OSHA outreach and enforcement efforts. **OSHA Related Activities** included:
 - Coordinated and assisted with presentation materials for an OSHA Shop Safety webinar. 11 for participants and developed resources have been widely distributed. Participants

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- represented dairy, potato and vegetable farm owner/operators.
- Continued to update OSHA Dairy LEP resource materials and populate the fyi.uwex.edu/agsafety website.
- Assisted 4 dairy farms and 1 grain farm with their safety programs.
- Collaborating to develop a safety program for Wisconsin Custom Operator members that will be recognized by insurance providers for reduced premiums. Program to be offered in March 2015.
- Administered \$19,000 for use with 2013-14 County Farm Safety Grants.
- Continued to provide technical assistance and resources to Agricultural, 4-H and Youth Development, and high school and technical college agricultural instructors on all aspects of agricultural safety.
- Continued to collect and review farm-related fatalities.
- 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.
- Displayed at the Wisconsin Farm Technology Days in Portage County with assistance from Jeff Nelson, Outreach Specialist, BSE, on Wisconsin Act 377.
- Continued to develop and enhance the UW Center for Agricultural Safety and Health website (<http://fyi.uwex.edu/agsafety>)

Extension Disaster Education

Network

- Continued as EDEN POC for UWEX.
- Serving as secretary for Executive Committee, 2014-2016.
- Serving on annual conference planning committee for 2014 and 2015;
- Member of Drought NEIL to develop drought related educational resources.

Other

- Participated in NCERA 197 multi-state committee on agricultural safety and health activities.
- Responded to media requests for information and radio interviews.

Publications

Maintain websites:

- <http://fyi.uwex.edu/agsafety>
- <http://fyi.uwex.edu/ioh>
- <http://fyi.uwex.edu/tractorcercert>

Awards

ANRE Outstanding Specialist, October 2014

Service

ASABE member 2012- present

Epsilon Sigma Phi member, 1995 – present

Center Goals

Goal 1: To revise the curriculum and resources used with the Wisconsin Safe Operation of Tractor and Machinery Safety Certification Program

The program curriculum and resources need to be updated including modification to allow for a blended learning option using eXtension on-line resources. New materials need to be developed to reflect the changes to safe operation on public roads resulting from 2013 Wisconsin Act 377. In addition, program risk management needs to be reviewed for instructor and volunteer qualification and requirements for safe operation of tractors and machinery by the youth during training.

Goal 2: Development of Worker Safety Resources for Dairy Farms

Resources to address worker safety on dairy farms continue to be requested by producers. While initial response to the Occupational Safety and Health Administration (OSHA) Dairy Local Emphasis Program (LEP) focused primarily in barns and milking areas, safety materials to address safety with tractors and machinery operation, horizontal silos fall protection, and confined spaces with manure storage and handling continue to be requested. Materials

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are needed in both English and Spanish which requires additional consideration in educational design and development.

Goal 3: 2013 Wisconsin Act 377 had staggered effective dates for laws related operating agricultural equipment on Wisconsin highways. Lighting and marking of Implements of Husbandry (IoH) along with associated Rules of the Road laws have an effective date of November 1, 2015. Resources are being requested to help agricultural producers understand these new lighting and marking requirements for their IoH and what the changes in the Rules of the Road statutes mean when operating agricultural equipment on highways. These materials are being developed in collaboration with the Wisconsin State Patrol.

Goal 4: Operator Safety for Custom Operators. In working with the Wisconsin Custom Operators (WCO) an educational program is being developed to assist members and non-members with certification program for their employees. This program will address operation of agricultural machines as well as commercial motor vehicles. The program will be piloted in March 2015.

Areas of Concerns/Challenges

Addressing Worker Safety in Agriculture

Goal 1: Collaboration with Wisconsin Department of Public Instruction to revise program and meet national curriculum standards. National curriculum standards for these programs are under-development for these programs. Challenge is to align resources with standards without clear guidance at this time.

Goal 2: Developing materials for Hispanic workers requires consideration educational

design and delivery different from traditional outreach education. Resources for translation of materials and culturally appropriate educational design and delivery are limited within the system.

Goal 3 and 4 - There's the potential for additional legislative changes to the laws related to agricultural equipment operating on highways in the 2015-2016 legislative session.



Richard Straub- Project Director (Left)
Vicki Janisch- Outreach Specialist
Hannah Gerbitz- Outreach Specialist
Brian Luck- Co-Director (Right)

Program Assistants:

Lisa Schram (School Year)
 Abigail Jensen (School Year/Summer)

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 501 clients with 160 of those individuals being first time clients in our 2013-14 grant year. In its 23 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.

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 15-16th
- 4) Marshfield Farm Show- Shoppes at Wood Ridge, Marshfield, February 19-20th
- 5) Eau Claire Farm Show, Eau Claire, March 4-5th
- 6) ISFAC Quarterly meeting, La Crosse, March 6th
- 7) JCEP Conference, La Crosse, March 12-13th
- 8) WPS Farm Show, Oshkosh, March 25-27th
- 9) National AgrAbility Training Workshop, March 31- April 3rd
- 10) AgrAbility of Wisconsin Summit, La Crosse, May 8th

- 11) Kewaunee County Dairy Breakfast, Kewaunee, June 15th
- 12) ISFAC Quarterly meeting, Waukesha, June 6th
- 13) State FFA Convention, Madison June 12th
- 14) Farm Technology Days – Stevens Point, August 12-14
- 15) Indian Summer Festival-VA, Milwaukee, September 5-7
- 16) Outreach Meeting with DATCP Staff- Madison, September 9
- 17) CALS Career Fair- Madison, September 23
- 18) Neighbor to Neighbor meeting- Mosinee, Gary Stankowski- September 25
- 19) World Dairy Expo- Madison, September 30- October 5
- 20) Madison Non-profit Day- Madison, October 2

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- 21) Governor's Ag Week Kickoff- Sun Prairie, October 6
- 22) Waunakee Veteran Farm Visit- Waunakee, October
- 23) ANRE Conference, Wisconsin Dells, October 20-22
- 24) AgrAbility Advisory Council meeting, Madison, November 6
- 25) DATCP Special Populations Outreach Meeting, Madison, November 24
- 26) Farm Bureau Annual Meeting, Wisconsin Dells, December 5-7
- 27) Virtual National AgrAbility Training Workshop, December 2-4

Teaching:

- 1) Biological Systems Engineering 309/509 Senior Design Class
- 2) Biological Systems Engineering 270 Computer Aided Design
- 3) Dodgeville Kiwanis Club meeting presentation

Publications:

- 1) Monroe County Farm Bureau Newsletter: 2/2014- "AgrAbility of Wisconsin"
 - a. <http://wfbf.com/wp-content/uploads/2011/03/201402-Monroe.pdf>
- 2) Hoards Dairyman: 4/21/14- "AgrAbility of Wisconsin Summit set for May 8th, 2014"
 - a. http://www.hoards.com/IB_AgrAbility-Wisconsin-Summit-2014
- 3) The Country Today: 5/12/14- "Lending A Helping Hand: AgrAbility of Wisconsin offers assistance for disabled, aging farmers"
 - a. http://www.thecountrytoday.com/farm/article_50edd186-d9e6-11e3-8155-0019bb2963f4.html
- 4) AgriView: 10/8/2014- Gary Stankowski- "AgrAbility of Wisconsin Helps Farmers"
 - a. http://www.agriview.com/news/dairy/agrability-of-wisconsin-helps-farmers/article_fd8790c5-af6e-5046-bac2-98cd8172ded2.html
- 5) Wisconsin Ag Connection: 10/17/2014- Press release- "Luck Hired as Co-Director of AgrAbility of Wisconsin"
 - a. <http://www.wisconsinagconnection.com/story-state.php?id=1230&yr=2014>

- 6) AgriMarketing: 10/20/2014- Press Release- "AgrAbility of Wisconsin names Brian Luck Co-Director"
 - a. <http://www.agrimarketing.com/s/91868>
- 7) Wisconsin Agriculturist: 10/28/2014- Press Release- "AgrAbility of Wisconsin Hires Two New Staff Members"
 - a. <http://farmprogress.com/story-agrability-wisconsin-hires-two-new-staff-members-9-119520>
- 8) Morning Ag Clips: 10/28/2014- Gary Stankowski- "AgrAbility of Wisconsin Helps Farmers"
 - a. <https://www.morningagclips.com/agrability-of-wisconsin-helps-farmers/>
- 9) AgrAbility Plowing Ahead Newsletter- Hard Copy- Keith Posselt, Gary Stankowski
- 10) Easter Seals Wisconsin: 11/10/2014- Press Release- "FARM Program Continues to Thrive with AgrAbility of Wisconsin"
 - a. http://www.eastersealswisconsin.com/nod_e?page=1
- 11) Wisconsin State Farmer: 11/17/2014- Ron Kusiak- "AgrAbility helps farmers stay in business"
 - a. <http://www.wisfarmer.com/features/contributors/agrability-helps-farmers-stay-in-business-b99391841z1-282985241.html>
- 12) AgriView: 11/24/2014- Press release- "USDA grant funds AgrAbility of Wisconsin for four more years"
 - a. http://www.agriview.com/news/regional/usda-grant-funds-agrability-of-wisconsin-for-four-more-years/article_d4f57088-275f-58bd-b779-b09a084eed68.html
- 13) News from Cooperative Extension: 11/24/2014- Press release- "USDA grant funds AgrAbility of Wisconsin for four more years"
 - a. <http://fyi.uwex.edu/news/2014/11/24/usda-grant-funds-agrability-of-wisconsin-for-four-more-years/>
- 14) Wisconsin State Farmer: 11/24/2014- "Wisconsin AgrAbility the most active in US"
 - a. <http://www.wisfarmer.com/features/contributors/wisconsin-agrability-the-most-active-in-us-b99396777z1-283793221.html>
- 15) Morning Ag Clips: 11/25/2014- Press release- "Funding for AgrAbility of Wisconsin"
 - a. <https://www.morningagclips.com/funding-for-agrability-of-wisconsin/>

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- 16) The Country Today: 11/26/2014- Ron Kusiak-
“Mosinee farmer tells his story of perseverance”
 - a. <http://www.thecountrytoday.com/farm/article/1116a23e-75ab-11e4-93fc-df5df05e1b69.html>
- 17) The Cattle Network: 11/26/2014- Press release-
“USDA to fund AgrAbility of Wisconsin for four more years”
 - a. <http://www.cattlenetwork.com/news/industry/usda-fund-agrability-wisconsin-four-more-years>
- 18) DATCP Website: 11/25/2014- Video- “Dairy 30x20 Initiative to Grow Wisconsin Dairy”
 - a. http://datcp.wi.gov/Farms/Dairy_Farming/index.aspx
- 19) AgrAbility Plowing Ahead Newsletter- Electronic, featuring Steve Acheson

Professional Service

- 1) Department- Vicki
 - a. BSE Social Committee Member and photographer for various department uses.
- 2) College/Campus/University- Vicki
 - a. CALS Communicators Committee Member
- 3) Professional (ASABE/Other)- Vicki
 - a. National AgrAbility Training Workshop Committee member
 - b. National AgrAbility Networking committee member
 - c. National AgrAbility Marketing committee member
 - d. National AgrAbility and Arthritis Conference Planning Committee member

- e. Arthritis Community of Interest committee member
 - f. National AgrAbility Evaluation committee member
 - g. Inter-Service Family Assistance Committee (ISFAC) member
- 4) Civic Service- Vicki
 - 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
 - 5) Department- Hannah
 - a. Biological Systems Engineering Social Committee Member
 - 6) Professional (ASABE/Other)- Hannah
 - 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
 - 7) Civic Service- Hannah
 - a. Rock County Farm Bureau- membership committee member, Leadership Institute participant, YFA Committee chair
 - b. Church Social Media Committee member
 - c. Dairy Girl Network member

ACADEMIC STAFF ACTIVITY REPORTS



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, 28 Enrolled
Farm Machinery Short Course: 3 Credits, 28 Enrolled
BSE 475: 3 Credits, 36 enrolled (taught lab section)

Extension/Outreach Activities

- 1) Farm Rescue Program for the Fox Valley Regional Trauma Advisory Council. 2 hour presentation attended by about 80 personnel.
- 2) Produced and staffed a Farm Safety display at Farm Technology Days. Assisted other dept. personnel with their displays
- 3) Presented at Dane County Tractor and Machine Operation class to 20 11-17 yr olds. Tractor rollover, auger entanglement, PTO entanglement. Participated as Middleton Fire and BSE.
- 4) Assisted Cheryl Skjolaas as a Safety Advisor for a liquid manure agitation program where multiple machines were demonstrated.
- 5) Arranged a tour and training for the Middleton Fire Department of the new manure digester in the Town of Springfield
- 6) Provided a Farm Safety talk to the International Farmers Aid Association group on campus. Presented to 20 people through an interpreter.
- 7) Assisted Cheryl Skjolaas and Brian Luck with Implement of Husbandry Extension programs
- 8) Worked with Brian Luck to get 20 laptop computers purchased for a portable classroom for FISC teaching and Precision Ag programs. Assisted Brian with training sessions for County Extension Agents

Information Technology 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 (liaison with Classroom Media Services).
- 6) Maintain an AV system in the B25 and 118 classrooms.
- 7) Helped select and install new AV equipment for B25. Equipment was at no cost to the department.
- 8) Maintain the Main Hall Information monitor. Create announcements and maintain hardware.
- 9) Oversaw the move of DHCP service to DoIT.
- 10) Assisted BadgerPulling and AgrAbility with starting websites on the CALS web hosting service.
- 11) Set up, maintain, and trained students in the use of the new 3D printer and 3D scanner.
- 12) Assisted getting the new copier set up and trained people in its use
- 13) Selected, set-up, and maintain the new plotter

Service

BSE Committees

- 1) Served on the Building and Space, Information Technology, and Undergraduate Instruction committees

Farm and Industry Short Course Committees

- 1) Appointed to the Farm and Industry Short Course Advisory Council. The Council works with the FISC

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Director to determine policies and procedures for the FISC program.

- 2) Served on a FISC Review Board reviewing admission applications for the FISC program
- 3)

Departmental Support Activities

- 1) Guest speaker for Panuska's BSE 201 – GPS Technologies and Equipment
- 2) Superintendent of the State FFA Agricultural Mechanics Career Development Event. 91 students from 23 schools participated.
- 3) Attend various seminars related to Instructional Technology and campus computing issues
- 4) Worked with Debby Sumwalt to produce a departmental display at the Majors Fair in Union South
- 5) Assisted with maintaining department Continuation Of Operations Plan (COOP) and Emergency Occupant Plan
- 6) Recorded BSE901 presentations and posted to YouTube for students and faculty to review for improvement
- 7) Served on a final interview board for the Financial Specialist position
- 8) Assisted Brian Luck with advising the Quarter Scale Tractor Pulling Team.

Civic Service

- 1) Middleton Fire Department: Maintain and support the department's computers, WI Certified Aerial and Engine operator, Fire Investigation Team member, Hazardous Materials Technician, and American Heart Association Certified CPR Instructor

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Astrid Newenhouse

Senior Scientist, Ph.D.

42% FTE Jan.-July and Sept., 62% FTE Oct.-Dec.

Program affiliations: Midwest Rural Energy Council, MilkTech, Center for Agricultural Safety and Health, and UW Environmental Resources Center

Astrid Newenhouse is a senior scientist at the University of Wisconsin-Madison working on projects in a wide range of topics. She performs research, writes publications, produces outreach materials, and analyzes data. Currently at the Department of Biological Systems Engineering she works with the Midwest Rural Energy Council. With a background in horticulture, Astrid has field research experience on topics including crop water use, nutrient management, nitrogen loss to tile drains, living mulches to reduce pesticide use, information dissemination for farmers, rural occupational and public health interventions, and ergonomic tools for small scale farmers. In Extension, Astrid has worked in 4-H curriculum development, Master Gardener training, Wisconsin Master Naturalist training, and outreach to fresh market farmers. Astrid is a regular guest on WI Public Radio and has worked extensively on The Wisconsin Gardener TV show.

Extension/Outreach Activities:

- Provide assistance to the Midwest Rural Energy Council (MREC) by coordinating council activities, maintaining website, maintaining records, helping write and produce publications, and helping organize annual conference on rural energy issues.
- Provide assistance to MilkTech professional development courses (an international on-line curriculum).
- Provide assistance with annual Stray Voltage Investigators Courses.
- Distribute information and research results on previous projects such as the Healthy Farmers, Healthy Profits Project (workplace safety and ergonomics). This information goes to farmers, researchers, farm advisors, funders, government agencies, and non-profits nationwide.
- Maintain connections to farm managers, advisors, researchers, and tool distributors in US and abroad concerning work efficiency and ergonomics.
- Work within the department as an ad-hoc Senior Scientist.
- Guest speaker on Larry Meiller's WHA radio call-in show, "Garden Talk", Dec. 5 2014.
- Participated in CALS Communicators meetings.

Research:

USDA-NRCS Conservation Innovation Grant "Water Research in the Central Sands"

Collaborators: WI Potato and Vegetable Growers Association, Midwest Food Processors Association, UW B.S.E. researchers John Panuska and Scott Sanford, and staff and faculty in the Departments of Soil Science, Horticulture, and Entomology
Funding source: USDA-NRCS

Summary: Collect data on crop water use through Leaf Area Index monitoring, evapotranspiration measurements, and soil moisture monitoring to help create a growth curve equation that will update the Wisconsin Irrigation Scheduling Program software. Growers who use this program can schedule irrigation more closely to save water and energy. This helps growers improve irrigation efficiency.

Peer-Reviewed Journal Articles:

Website

Understanding Crop Irrigation, University of Wisconsin Cooperative Extension. January 30, 2015.
<http://fyi.uwex.edu/cropirrigation/>

UW-Extension Publications

- Panuska J, Sanford S, and Newenhouse A. 2014. Methods to Monitor Soil Moisture. University of Wisconsin-Extension Publication A3600-02.
- Reinemann D, Heinzen J, and Newenhouse A. 2014. Wind Turbines & Farm Stray Voltage. Midwest Rural Energy Council & University of Wisconsin Extension Publication GWQ065.
- Reinemann D, Heinzen J, and Newenhouse A. 2014. How do Wind Turbines Generate

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Electricity? Midwest Rural Energy Council
Publication.

Conference Presentations

- Newenhouse A, Panuska J, Schmitt B, Maerz N, Chipman K. 2014. Crop canopy monitoring in vegetable fields to improve irrigation scheduling and water use efficiency (poster). UW Cooperative Extension Agriculture and Natural Resources Education Program Area Annual Meeting, October 20-22, Wisconsin Dells, WI. Also Farm Technology Days, August 12-14, 2014, Stevens Point WI.

Professional Development Activities:

- Participated in UW Cooperative Extension Agriculture and Natural Resources Education Program Area Annual Meeting
- CALS Communicators Meetings.

Professional Service:

- Guest on WI Public Radio
- 4-H County Fair Judge
- Girl Scout Troop Leader
- Healthy Lawn Team (non-profit) board member & speaker on organic lawn care.

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John C. Panuska

Distinguished Faculty Associate, Ph.D., P.E.
100% Extension

Affiliations: UWEX Agriculture and Natural Resources Program

Dr. Panuska has been with the Biological Systems Engineering Department since 2006 as a Natural Resources Extension Specialist where he conducts research, outreach and teaching. His primary focus is in the areas of irrigation, drainage and nutrient management. His work includes outreach programming and the development tools as well as advising local, state and Federal agencies in ways to improve water and nutrient use efficiency in agricultural production. These tools include the Wisconsin Irrigation Scheduling Program (WISP 2012) and research to support the SNAP Plus nutrient management planning software. Dr. Panuska also teaches BSE courses, maintains the Department's land surveying laboratory and provides training and equipment to students, faculty and staff for land surveying projects.

Teaching

Spring 2014

BSE 309, Engr. Design Practicum I
2 credits, 4 students advised

Fall 2014

BSE 201 Land Surveying Fundamentals
2 Credits, 33 Enrolled
BSE 509, Design Practicum II
3 Credits, 4 students advised
Guest lectures in BSE 571 and BSE 372

Graduate and Post Docs Advisees

Assisted in advising and served on the committees of the following students:

- 9) Harsh Singh; (Ph.D.); Biological Systems Engineering (2010 – 2015)
- 10) Jasmeet Lamda; (Ph.D.); Biological Systems Engineering, (2009 – 2014)
- 11) Michael Polich; (MS); Biological Systems Engineering (2010 – 2015).

Extension / Outreach

Irrigation Water Management

1. Farm Tech Days, field display and booth
2. Irrigation workshops – Spooner/Barron/Chippewa/Pierce 86 attendees
 - a. Hancock Station, 31 attendees
 - b. WI Soybean Area Meetings, 85 attendees
 - c. WI Processing Crops Mtg., 40 attendees

- d. WI Potato & Veg. Growers Ed. Mtg., poster

Drainage

1. WI Land Improvement Contractors Mtg., 36 attendees.
2. Brown County Drainage Program, 96 attendees

Nutrient Management

WI Crop Management Conference, 30 attendees

Agent Ratings

Average of all categories: 4.21 / 5.0

Funded Research Projects

- 11) Sustainable Ag. Research and Ed. (SARE) Grant
Collaborators: Precision Water Works, Plainfield, WI.
Funding: USDA - SARE
Objectives: Demonstrate the capabilities of sophisticated soil moisture probes.
- 12) Collaborator, Preserving Water Resources in Central WI
Collaborators: A.J. Bussan, Russ Groves
Funding: USDA / CIG
Objectives: Research and develop ways to better manage water for vegetable production in Central Sands Region of WI. Includes WISP irrigation scheduler development & outreach.
- 13) The Effects of Surface Roughness on Snowmelt Runoff
Collaborators: L.W. Good, A. Thompson
Funding: USDA / CIG

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Objectives: Quantify the impacts of surface roughness on snowmelt runoff to improve the SNAP Plus nutrient management model.

14) Tools Integrating Land-user Management Decisions with Watershed Processes to Achieve Water Quality Goals.

Collaborators: Dane Co., NRCS, Nature Conservancy, USGS, DATCP, WDNR

Funding: USDA / AFRI

Objectives: To evaluate the ability of a targeted BMP installation strategy to reduce sediment and nutrient export from an Ag. watershed.

Publications

Peer reviewed Journal Articles

Panuska, J., S. Sanford and A. Newenhouse. 2014. Methods to monitor soil moisture. UWEX Publ. # A3600-02, 12p.

Sanford, S. and **J. Panuska**. 2014. Irrigation Management in Wisconsin, the Wisconsin Irrigation Scheduling Program (WISP), UWEX Publ. # A3600-01. 16p.

Larson, R. A., **J. Panuska**, J. Sanford and C. Burnson. 2015. Inexpensive in-field manure solids tester. Applied Eng. Agric. (In review).

Professional Development

Director-at-large, American Water Resources Association, Wisconsin Chapter.

Service

Land surveying technical assistance to the Dept of Agronomy and the Dept. of Soil Science. (40 hrs.)

Completed a field plot monument location and elevation survey at the Agronomy Field plots for a graduate student in the Dept. of Genetics. (10 hrs.)

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Extension / Outreach report for John Panuska 2014

Program Type	Audience Type	Number Participating	Outcome/Impact	Revenue Generation
Irrigation Field Display and Booth (Farm Technology Days, Plover, WI)	Producers and General Public	~200	Educated growers and the general public on irrigation water management.	Yes
Irrigation Water Management Training Workshops (Western WI, Spooner/ Barron/Chippewa Falls/Pierce Co.)	Producers and Government Agency Staff	86	Introduced Wisconsin producers to the basics of irrigation water management.	No
Agent Sponsored Training Program (Hancock Station)	Producers, Government Agency Staff, and Research Station Staff	31	Trained Wisconsin producers in the use and application of the Wisconsin Irrigation Scheduling Program.	No
Trade Organization (WI Soybean Association) Sponsored Training Program	Soybean Producers	85	Trained Wisconsin producers in the basics of irrigation soil water management.	No
Agent Sponsored Training Program, WI Processing Vegetables Meeting	Producers and Vegetable Processors	40	Updated growers and industry attendees on irrigation water management issues.	No
Educate Industry Group on the Engineering Aspects of Drainage, WI Land Improvement Contractors Association	Construction Contractors	36	Raised awareness of contractors installing drain tile to the engineering aspects of the process.	No
Specialist Sponsored Training Program (Brown County)	Ag. Producers, Tile Installers, Material Suppliers, and Agency Staff	96	Educated attendees on the engineering design aspects of tile drains.	Yes
WI Crop Management Conference, Trade Association Sponsored Meeting and Training Event, WI Ag Business Association	Farm Coops and Agrichemical Suppliers, Government Agency Staff	30	Educated attendees on the basics of irrigation water management	No

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Scott Sanford

Distinguished Outreach Specialist (M.Eng)
Rural Energy Program
25% Extension, 5% Teaching, 70% Gift/Grant

Scott Sanford is a Distinguished 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 efficiency and renewable energy. 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

Spring 2014

Farm and Industry Short Course
SC-FICS 38 Intro to Precision Agriculture
- 2 credits, 25 Enrolled
HORT 334: Greenhouse Energy Efficiency
- guest lecture

Fall 2014

DYSC 433: Milking Units/Milking Parlors
- guest Lecture & lab

- 86 attendees

- 9) SARE Development of Small-Scale Facilities for Winter Storage of Fresh Produce Presentations
 - a. Wisconsin Fresh Market Growers Conf
 - b. Illinois Specialty Crop Conference
 - c. Great Plains Fruit and Vegetable Growers Conference
 - d. Indiana Hort Congress
 - e. Iowa Fruit and Vegetable Growers Conference
 - f. MOSES Organic conference
- ~ 800 attendees total for all meetings

Extension/Outreach Activities

- 1) Farm Tech Days. Field Demo sub-Chairperson. Oversaw field demo during show. Coached county Field Demo committee. Added a tillage demonstration along with vegetable harvest tour (potatoes, sweet corn).
- 2) Dairy Farm Energy Efficiency - Eau Claire & Bangor
- 3) Midwest Rural Energy Council - Agricultural Lighting
- ~ 60 attendees
- 4) USDA/NRCS Energy training Webinar series (12)
Average 50 attendees / webinar
- 5) Selection of Wood Burning Appliances
 - a. Tri-State Forestry Conference
- ~70 attendees
 - b. Heating the Midwest Conference
- ~ 10 attendees
- 6) Ag Energy Auditor training for Dairy farms – Focus on Energy-CESA10 (37 hrs) – 25 attendees
- 7) WPS Farm Show – LED Lighting Display
- 8) Irrigation workshops –
Spoooner/Barron/Chippewa/Pierce

UWEX Agent Outcome Rating: 3.86/5 (2014)

Research

Energy Power and Energy Systems

- 1) Energy Self-Assessment Website Maintenance - DJ Reinemann, SA Sanford Funding from USDA-NRCS (\$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) 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

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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

- 3) WI Refuels with Wood Energy - Statewide Wood Energy Team –Sanford PI Funding US Forest Service pass thru WI State Energy Office (\$85,582). Collaborators: Amanda Mott- WI State Energy Office, Don Peterson - ,Jason Fischbach-UWEX, Tim Baye – UWEX, TJ Morice – Marth Wood Products, Lew McCreery – US Forest Service, Steven Hubbard – WDNR, Sabina Dhungana – WDNR. Assist in the development of training programs on using wood for thermal and process heat to replace fossil fuels. Provide content for a wood energy site. Provide consultation services for businesses interested in converting to wood energy. Develop publications on conversion to wood energy. Project Dates: 10-8-2014 to 7-31-2017.

Structures/Construction

- 4) Development of Small-Scale Storage Facilities for Winter Storage of Fresh Produce. SARE Research & extension grant – Bohnhoff/Sanford -PI. Funding from USDA-National Institute of Food & Agriculture (\$107,742). Collaborator: John Hendrickson- Center for Integrated Agriculture. 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 5-31-2015

Publications

Peer Reviewed Publications

- 1) Lighting Technology: LED lamps for Home, Farm and Small Business - Scott Sanford
- 2) Wood Heating Appliances for Homes and Businesses - Choosing the Right Equipment - Scott Sanford, David S. Liebl – ASABE 2014 Educational Blue Ribbon Award

Magazine Articles

- 3) Progressive Dairyman – April 1, 2014/Issue 6 – LED lighting for dairy barns

Awards

ASABE 2014 Educational Blue Ribbon Award - Wood Heating Appliances for Homes and Businesses - Choosing the Right Equipment - Scott Sanford, David S. Liebl

Service

Departmental committees
- Social Committee – ~15 hrs
- Extension – 1-2 hrs

College Campus committees - None

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

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Sanford – Extension and Outreach Summary

Program Type	Audience Type	Number Participating	Outcome/Impact	Revenue Generation
Farm Tech Days – Field demo committee	Farmers, general public	~200 on committee 100's viewed demonstrations	Educated producers and Agricultural professionals & general public	No
Dairy Farm Energy Efficiency - Eau Claire & Bangor	Dairy producers Agricultural Professionals	6 agents 28 producers	Educated producers and Agricultural professionals	No
Midwest Rural Energy Council - Agricultural Lighting	Electric Utility reps	120	More informed on new LED lighting	No
USDA/NRCS Energy training Webinar series 12 webinars Presented 4 of 12	NRCS State Engineers	~ 50 per webinar	Educate about how energy is used on farms and technologies and management to reduce use	Grant funded
Selection of Wood Burning Appliances	Forest land owners	80	Educate on high efficiency heating appliances and types of wood fuel	No
Ag Energy Auditor training for Dairy farms	Focus on Energy Ag energy auditors	25	Educated on Ag Lighting and Dairy farm energy efficiency	Yes
Irrigation workshops – Spooner/Barron/Chi ppewa/Pierce	Growers with irrigation	86	Educated on equipment options for irrigation and irrigation water management	No
Development of Small-Scale Facilities for Winter Storage of Fresh Produce	Growers – 6 meetings across Midwest	~800	Educate growers on options for cold storage and management of the facility	Grant funded
Intro to Precision Agriculture	Beginning farmers	25	Education on different types of technologies for precision Ag	No
Greenhouse Energy Efficiency	HORT 334	30	Educated about how to reduce energy costs in a greenhouse	No
Milking units and Milking parlors	DYSC 433	30	Educate about types of milking parlors and components for milking cows	No
	Total Direct Contacts	1474		

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Paul Thompson

Senior Scientist, Ph.D.
100% Research

Dr. Thompson is involved in research which will lead to development of experimental techniques for quantifying the characteristics and performance of milking machines, and particularly the compressive forces exerted on the teat by the teat cup liner. A biomedical engineer by training, his current research focus is the use of non-destructive testing techniques such as vibration analysis for non-invasive monitoring of milk flow within the teat during machine milking.

Prior to coming to UW, he was President of DEC AgriTech, a group of companies that included BouMatic, a major manufacturer in Madison, as well as other dairy technology and equipment companies in the US, UK, Germany, France, Brazil, Australia and New Zealand. Prior to that he managed milking machine research at USDA's Beltsville Agricultural Research Center. He is also affiliated with UW's Biomedical Engineering Department, where as a member of the design faculty, he advises student teams in that department's design courses.

He has chaired ASABE's Milk Handling, Biomedical Engineering, and Divisional Transactions Editorial committees, ADSA's Physiology Committee, and NMC's Milking Machine Committee. He is also past president of NMC, and of the Association of Equipment Manufacturers Agricultural Equipment Division.

Teaching

Spring 2014

BME 301, Biomedical Engineering Design
1 Credit, 13 Enrolled
Instructor Rating 4.17/5

Fall 2014

BME 400, Capstone Design Course
3 Credits, 18 Enrolled

Graduate and Post Doc Advisees

Member of John Penry's Ph.D. Committee

Research

Milking Machine Research
Collaborators: D.J. Reinemann, BSE
Funding: Avon Dairy Solutions
Objectives: Advance the science of biomechanics of machine milking and milking management.

Professional Development

Completed one-week Sound Analysis Workshop at Cornell University

Service

Departmental:

Social Committee, approximately 20 hours annually

ASABE:

PAFS-402/1, Milk Handling Equipment Committee

T-11, Energy Committe