



Biological Systems Engineering

UNIVERSITY OF WISCONSIN-MADISON

2015 Annual Summary of Teaching, Research & Extension



College of Agricultural & Life Sciences
University of Wisconsin-Madison

Biological Systems Engineering
460 Henry Mall
Madison, WI 53706
bse@wisc.edu

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 (CAL S), 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: Emeritus 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

Barthels (Gerbitz), Hannah: Associate Outreach Specialist, AgrAbility of Wisconsin,
Cronin, Keith: Assistant Researcher
Duvall, Benjamin: Assistant Scientist
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.: Asst Faculty Assoc (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
Freide, Joshua: Associate Instrument Specialist

OFFICE PERSONNEL

Reinen, Sue: Academic Department Supervisor
Meyer, Terry: Financial Specialist
Spahn, Pam: Payroll and Benefits Specialist
Sumwalt, Debra: Student Services Coordinator (ended 9/2015)
Wood, Elizabeth (Betsy): Univ Svc Prg Assoc (started 9/2015)
Kent, McKenna: Student Worker
Paetsch, John: Student Worker

RESEARCH ASSOCIATES

Aguirre-Villegas, Horacio (Larson/Reinemann) Zhou, Shengfei (Runge)
Anthony, Renil (Runge/Anex)
Harde, Shirishkumar (Pan)
Seenivasan, Rajesh (Gunasekaran)
Sharara, Mahmoud (Runge)
Sundramoorthy, Ashok Kumar (Gunasekaran)
Upton, John (Reinemann)
Yang, Qiang (Runge)
Yoo, Chang Geun (Pan)

MASTER'S STUDENTS

Accola, Joshua (Karthikeyan/Thompson)
Buschert, Elizabeth (Thompson)
Dietsche, Scott (Shinners)
Evans, Jeffrey (Anex)
Francis Clar, Jordi (Anex)
Fuller, Sarah (Thompson)
Harmon, Joshua (Luck)
Harper, Matt (Choi)
Jordan, Kari (Gunasekaran/Connelly)
Jozik, Natalie (Anex)
Lacy, Nolan (Shinners)

Nigon, Brandon (Shinners)
Polich, Michael (Thompson)
Powers, Andrew (Thompson)
Sanford, Joseph (Larson)
Skog, Andrew (Thompson/Wu)
Stubbe, Ashley (Shinners)
Thiede, Justin (Shinners)
Walters, Chase (Shinners)
Wang, Zening (Pan)
Yang, Shu-ching (Pan)

PH.D. STUDENTS

Atkins, Ian (Choi)
Bashar, Rania (Karthikeyan)
Drewry, Jessica (Choi)
Gu, Lei (Anex)
Guan, Jiehao (Gunasekaran)
Gunukula, Sampath (Anex)
Hinde, Alysia (Larson)
Holly, Michael (Larson)
Holstein, Andrew (Bohnhoff)
Jun, Hong Jin (Choi)
Lan, Wu (Ralph)
Li, Nang (Pan)
Li, Yanding (Ralph)

Liang, Yifan (Choi/Larson)
Liao, Yang (Pan)
Lu, Lin (Gunasekaran)
Mandalika, Anurag (Runge)
Mondaca Duarte, Mario (Choi)
O'Dell, Jane (Rowell/Etzel)
Ortiz Reyes, Edgardo (Anex)
Perez, Jose (Larson)
Wang, Hui (Larson/Noguera)
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 sustainability of biofuels and biorenewable chemicals, as well as the agricultural systems on which they depend. Dr. Anex's research group is studying the economic and environmental feasibility of biorenewable chemicals, corn production under future climate, and monitoring of soil microbial activity.

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 2015:

BSE 309: 2 Credits, 4 Enrolled

BSE 349: 3 Credits, 52 Enrolled

BSE 990: Various Research Credits, 7 Enrolled

Fall 2015:

BSE 509: 2 Credits, 4 Enrolled

BSE 990: Various Research Credits, 7 Enrolled

Graduate and Post Docs Advisees

- 1) Sampath Gunukula, PhD, BSE, 2016.
- 2) Edgardo Ortiz-Reyes, PhD, BSE, 2016.
- 3) Lei Gu, PhD, BSE, 2016.
- 4) Jordi Francis Clar, MS, BSE, 2016
- 5) Natalie Jozik, MS, BSE, 2017
- 6) Mahmoud Sharara, Post-Doctoral Researcher, Co-advised with Troy Runge.
- 7) Benjamin Duval, Research Associate.

Graduated

- 8) Thilina Gunawardhana, MS, BSE, 2015.
- 9) Renil Anthony, Post-Doctoral Researcher, Co-advised with Troy Runge.

Funded Research Projects

- 1) Improving life-cycle nitrogen use efficiency and environmental performance of corn production through improved fertilizer timing and rate. Funding: USDA Agriculture and Food Research Initiative (AFRI).
- 2) 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.

- 3) Dried Distiller Grain Based Polymer Dispersions for Paper Coatings. Funding: USDA National Institute of Food and Agriculture and Critical Agricultural Materials Program.
- 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) 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).

- 7) 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) Li, A., B.D. Duval, R.P. Anex, P. Scharf, J. Ashtekar, P. Owens, C. Ellis. 2015. A case study of environmental benefits of sensor-based nitrogen application in corn. *Journal of Environmental Quality*, doi: 10.2134/jeq2015.07.040.
- 2) Gunukula, S., P. L. Keeling, R. P. Anex. 2015. Risk advantages of platform technologies for biorenewable chemical production. *Chemical Engineering Research and Design* doi:10.1016/j.cherd.2015.10.035.
- 3) Necpalova, M., R. P. Anex, M. N. Fienen, S. J. Del Grosso, M. J. Castellano, J. E. Sawyer, J. Iqbal, J. Pantoja, D. Barker. 2015. Understanding the DayCent model: calibration, sensitivity, and identifiability through inverse modeling. *Environmental Modelling and Software* 66: 110-130.
- 4) Jarchow, M. E., M. Liebman, S. Dhungel, R. Deitzel, D. Sundberg, R. P. Anex, M. L. Thompson, T. Chua. 2015. Tradeoffs among agronomic, energetic, and environmental performance characteristics of corn and prairie bioenergy cropping systems. *GCB Bioenergy* 7: 57-71..

Abstracts, Posters, and Oral Presentations

- 1) Duval, B. D., P. C. Scharf, M. D. Hartman, S. J. DelGrosso, R. P. Anex. 2015. Can varying nitrogen application rates and timing reduce the environmental impact of corn under future climate? ASA, CSSA, & SSSA Annual Meeting, Minneapolis, MN, November 16.
- 2) Gu, L., R. P. Anex, M. N. Fienen, M. J. Helmers. 2015. Understanding prediction robustness of the root zone water quality model (RZWQM). ASA, CSSA, & SSSA Annual Meeting, Minneapolis, MN, November 17.
- 3) Anex, R. P., Francis Clar, J., Parkin, T. 2015. Maximizing cost-effectiveness of soil N₂O Monitoring. ASA, CSSA, & SSSA Annual Meeting, Minneapolis, MN, November 17.
- 4) Francis-Clar, J., Anex, R. P., M. Allie, C. Elwood, I. Rigell, B. Lunzer. 2015. A novel system for high-resolution, near-continuous measurement of soil N₂O isotope fluxes. ASA, CSSA, & SSSA Annual Meeting, Minneapolis, MN, November 17.
- 5) Ortiz Reyes, E., R. P. Anex. 2015. Life cycle environmental benefits of non-cellulosic fermentable sugars for the production of biofuels and chemicals. Poster #1712. ASA, CSSA, & SSSA Annual Meeting, Minneapolis, MN, November 16.
- 6) Anex, R.P. 2015. The Bioenergy Water Nexus. Bioenergy Focus Day (Session 203), ASABE Annual International Meeting, New Orleans, LA, 28 July.
- 7) Anex, R.P. and J. Francis-Clar. 2015. Near-continuous isotopic characterization of soil N₂O fluxes from maize production. American Geophysical Union Fall Meeting, San Francisco, CA.



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 2015 include a high moment connection for attaching wood posts to concrete, and precast concrete posts.

Research on building environment control in 2015 was largely centered around construction of a rotatable guarded hot box.

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 2015 involved fabrication and testing of a hazelnut cracker, design and fabrication of an aspirator for hazelnut shell and kernel separation, laboratory investigations on hazelnut cracking characteristics and equilibrium moisture content, assessment of hazelnut sizing equipment, and design and fabrication of specialty bike trailers for local food delivery.

Teaching

Spring 2015

BSE 309: BSE Design Practicum I

2 credit lecture, 54 students

Instructor Rating: 4.12/5.0

BSE 356: Sustainable Residential Construction

3 credits lecture, 28 students

Instructor Rating: 4.35/5.0

InterEgr 160: Introduction to Engineering Design

Taught lab portion of 3 credit course, 34 students

Fall 2015

BSE 351: Structural Design of Agr. Facilities

3 credit lecture, 11 students

Instructor Rating: 4.78/5.0

InterEgr 160: Introduction to Engineering Design

Taught lab portion of 3 credit course, 33 students

BSE 509: BSE Design Practicum II

3 credit lab, 1 team, 4 students

Graduate Students Advised

- 1) Andy Holstein (Ph.D. Student)
- 2) Henry He (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 2015, designed, fabricated and tested an aspirator for kernel and shell separation; worked with students on the design of a hazelnut cracker and on the design of a second generation aspirator.
- 2) *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) 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.
- 2) Moment Resisting Post-to-Concrete Connection. Tested single members and three layer assemblies in advance of the design, fabrication and testing of a series of new post-to-concrete pier connection. Personally funded. Working to secure funds for laboratory testing.
- 3) Developed additional analysis procedures for lateral loads on post and pier foundations and presented methodology at the 2015 ASABE International Meeting.
- 4) 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. Conducted laboratory tests on three different designs and began data analysis. Personally funded.
- 5) Hazelnut Processing. Conducted fundamental research into whole nut sizing. Preliminary results reported at the 2105 ASABE Annual International Meeting. Also began research on hazelnut cracking characteristics.
- 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.

Publications

Refereed Publications

- 1) Holstein, A.J. and D. R. Bohnhoff. 2015. Bending Properties of Concrete -to-Wood I-Section Connections. *Applied Engineering in Agriculture*, 31(1): 121-131.

Technical Publications

- 1) Bohnhoff, D.R. 2015. Lateral Strength and Stiffness of Post and Pier Foundations. ASABE Paper No. 152190408. ASABE. St. Joseph, MI.

Awards

Faculty advisor for 1st Place Team, 2015 ASABE AGCO Student Design Competition

Professional Development Activities

- 1) Wisconsin Frame Builders Association Annual Meeting, January 20-21, 2015, Eau Claire, WI
- 2) Frame Building Expo, February 17-20, 2015, Louisville, KY
- 3) MOSES Organic Field Day on Cover Crops, July 21, 2015, Sweet Springs Farm, Gays Mills, WI

- 4) ASABE Annual International Meeting, July 26 - 29, 2015, New Orleans, LA.

Professional Service

- 1) Profession (ASABE/other)
 - i. American Society of Agricultural and Biological Engineers
 - Structures and Environment Standards Committee, PAFS-03
 - Structures Committee, PAFS-20
 - Agri-Industrial Facility Design and Operation Committee, PAFS-07/1
 - Evelyn E. Rosentreter Standards Award Committee, M-160
 - Mechanically Laminated Columns working group, X559
 - Wisconsin Section – Attended 2 section meetings in 2015
 - Manuscript reviewer
 - ii. National Frame Builders Association
 - Technical Publications Review Committee. Review 4 FBN manuscripts in 2015.
 - NFBA T&R Committee. Attended four meetings in 2015
 - Answer numerous technical questions via phone and e-mail on behalf of NFBA
- 2) College/Campus/University
 - i. University General Education Committee (6 hours)
 - ii. College of Engineering Academic Planning, Curriculum, and Regulations Council (CoE APCRC) (4 hours)
 - iii. Advisory Committee for International Engineering Certificate
 - iv. BSE Undergraduate Instruction and Program Committee Chair (4 - 5 days per month)
 - Provided overview of BSE program to at least 70 students in 2015. Included many meetings and tours involving parents and potential transfers from outside the university
 - Averaged approximately 55 assigned undergraduate student throughout 2015
 - 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; microclimate control, 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 2015

- BSE 309, Biological Systems Engineering Design Practicum I
2 Credits, Two design teams, 9 Enrolled
- BSE 799, Practicum-Ag Engr Teaching, Ind. Study, 3 Credits, 1 Enrolled
- BSE 990, Research, Ind. Study, 1-5 credits, 4 Enrolled

Fall 2015

- InterEgr 102, Introduction to Society's Engineering Grand Challenges
2 Credits, 138 Enrolled (Team taught by six faculty)
- BSE 270, Introduction to Computer Aided Design
3 Credits, 47 Enrolled
- BSE 509, Biological Systems Engineering Design Practicum II
2 Credits, Two design teams, 9 Enrolled
- BSE 799, Practicum-Ag Engr Teaching, Ind. Study, 3 Credits, 2 Enrolled
- BSE 990, Research, Ind. Study, 2-5 credits, 5 Enrolled

Graduate and Post Docs Advisees

- 1) Jessica Drewry, PhD BSE, 2017
- 2) Matthew Harper, MS BSE 2016
- 3) Andrew Holstein, PhD BSE, 2016, Co-advised with David Bohnhoff
- 4) Yifan Liang, MS BSE 2015 (Completed)
- 5) Mario Mondaca, PhD BSE, 2016
- 6) Hongjin Jun, PhD BSE, TBD
- 7) Ayse Ozdogan, PhD BSE, 2015 GLE, Co-advised with James Tinjum (Completed)
- 8) Xiaoshuai Wang, Ph.D. Student, Aarhus
- 9) University, Denmark, Co-advised with G. Zhang

Mentoring (Visiting Student):

1. Camille Vincensini (National Institute of Applied Science – Lyon, France, MS Engineering)

Funded Research Projects

- 1) 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.
- 2) Assessment of Innovative Cooling Methods of Lactating Dairy Cows using Computational Fluid Dynamics
 - a. Collaborator(s): none
 - b. Funding: USDA
 - c. Objectives: The project will develop and test a series of computational models that are potentially capable of assessing (i) the effectiveness of an array of air jets aimed so as to impinge directly on targeted animals and (ii) a cooling mattress that transfers a cow's body heat away from the animal by means of thermal conduction.
- 3) Heat Stress and Dairy Cooling – A Survey
 - a. Collaborator(s): none
 - b. Funding: Schaefer Fan Co.
 - c. Objectives: The project will develop four survey papers for producers and

researchers related to dairy cooling in America's Midwest, Arid- and Semi-Arid Regions, and Hot and Humid Regions.

4. Assessment of Large-Scale Geothermal Exchange Field using Computational Methods and the DTS measurement system
 - a. Collaborator(s): Jim Tinjum
 - b. Funding: Fall Competition, UW Vice Chancellor's Office
 - c. Objectives: The project will developed a unique research strategy for obtaining high-precision experimental measurements of temperature and heat flux profiles along the complete path of a closed-loop ground heat exchangers, one that includes heat flux occurring in the grout.

Publications

Peer reviewed Journal Articles

- 1) Mondaca M, *MA Andrade, CY Choi, KE Lansey (2015) Development of a cost function of water distribution systems for residential subdivisions, *Urban Water Journal*. 12:2, 145-153.
- 2) Drewry JL, CY Choi, An L, Gharagozloo PE (2015) A computational fluid dynamics model of algal growth: development and validation. *Transactions of the ASABE*. 58:2, 203-213.
- 3) *Rojano F, P Bournet, M Hassouna, P Robin, M Kacira, and CY Choi (2015) Modeling heat and mass transfer of a broiler house using computational fluid dynamics. *Biosystems Engineering*. 136, 25-38.
- 4) Ortiz XA, JF Smith, F Rojano, CY Choi, J Bruer, T Steele, N Schuring, J Allen II, and RJ Collier (2015) Evaluation of conductive cooling of lactating dairy cows under controlled environmental conditions, *Journal of Dairy Science*. 98, 1759-1771.

Conference Proceedings

- 1) Drewry JL, JM Powell, CY Choi (2015) A computational fluid dynamics model of methane and ammonia emissions from tie-stall dairy barns, The ASABE 1st Climate Change Symposium: Adaptation and Mitigation, May 3-5, 2015, Chicago, Illinois.
- 2) Choi CY, IK Atkins (2015) An Annual Review - Computational Fluid Dynamics (CFD) Applications in Agriculture, ASABE Annual International Meeting, New Orleans, Louisiana.

- 3) Mondaca M and CY Choi, (2015) Assessment of Convective Cooling of Dairy Cows using Three Dimensional Geometry for Computational Simulations, ASABE Annual International Meeting, New Orleans, Louisiana.
- 4) Harper MK and CY Choi, (2015) Energy Saving Applications of Ground-Source Heat Pumps for Agricultural Buildings, ASABE Annual International Meeting, New Orleans, Louisiana.

Outreach Activities

Invited Review Panel

- 1) USDA-NIFA Review Panel Member - Agriculture Food and Technology: Engineering Products and Processes, June 15-19, 2015.

Invited Presentations:

- 1) Choi, CY, Water Distribution Systems and Tap Water, Invited Speaker and Panel Member, Korean Water Resources Corporation, Nov. 18-19, 2015.
- 2) Choi, CY, Pursuing Academic Career in Biological and Agricultural Engineering, Invited Speaker and Panel Member, AKABFE-ASABE Annual International Meeting, New Orleans, Louisiana, July 28, 2015.

Professional Development

TeachOnline@UW Learning Community for Course Design and Teaching, Bi-Weekly Workshops. Spring semester, 2015.

Service

- 1) Associate Editor, Transactions of the ASABE and Applied Engineering in Agriculture
- 2) President, Association of Korean Agricultural, Biological, and Food Engineers, ASABE Community.
- 3) Chair, ITSC-217 Computational Methods, Simulations and Applications
- 4) Session Organizer, 2016 ASABE International Conference - Computational Fluid Dynamics in Agriculture, Orlando, FL
- 5) Organizing Committee Member, the Second CIGR International CFD Symposium in Agriculture (2016, Aarhus, Denmark)
- 6) Member, ITSC-254 Emerging Info Systems
- 7) Member, PAFS-403 Dairy Facilities and Systems
- 8) Chair, CALS Facilities Committee
- 9) Member, CALS Curriculum Committee
- 10) Member, COE Curriculum Committee
- 11) Chair, BSE IT Committee, Chair

- 12) Member, BSE Undergrad Instruction Committee
- 13) Member, BSE Executive Committee
- 14) Reviewer for Transactions of The ASABE and several energy and environmental engineering related journals



Sundaram Gunasekaran

Professor, Ph.D.

50% Teaching / 50% Research

Program affiliations: Food Science, Materials Science and Engineering

Food engineering and processing. Nanomaterial synthesis and biosensing for various analytes such as pathogens, cells, toxins, heavy metals etc.

Teaching

BSE/FS/ME 441: Rheology of Foods and Biomaterials, 23 students (course evaluation: 4.2)

BSE 509: Senior Design, 4 students (1 team)

BSE 900: Graduate Seminar, 8 students

BSE901: Graduate Research Seminar, 14 students

Graduate and Post Docs Advisees

- 1) Omer Sadak, PhD (2017)
- 2) Jiehao Guan, PhD (2017)
- 3) Youngsang You, PhD (2017)
- 4) Lin Lu, PhD (2016)
- 5) Yi-Cheng Wang, PhD (2016)
- 6) Kari Jordan, MS (2016)
- 7) Zhong Liu, PhD (2015)
- 8) Ashok K. Sundramoorthy, Post-doc
- 9) Rajesh Seenivasan, Post-doc
- 10) Nourbakhsh, Himan, PhD Student visitor
- 11) Shanmugam, Sivakumar, Post-doc visitor

Research:

Research projects:

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

of Enteric Pathogenic Bacteria, USDA Hatch

- a. Developing a rapid and yet visual indication of the presence of pathogenic bacteria.
- 4) An Electrochemical Immunosensing Method for Detecting and Enumerating Circulating Melanoma Cells, NIH-UW SDRC (Vijay Setaluri, co-PI).
 - a. Developing an electrochemical immunosensing method for detecting tumor cells in blood
 - 5) Multiplex Electrochemical Biosensor for Rapid and Sensitive Detection of Mycotoxins, Andersons Research Grant Program (Senay Simsek of NDSU, co-PI)
 - a. Developing a biosensor for simultaneous detection of multiple mycotoxin contamination in wheat.
 - 6) Determining Microbial Quality of Water. SaniGen Corporation
 - a. Developing a biosensor for detecting microbial contamination in environmental water.
 - 7) Low-cost disposable cation exchange membrane electrode for pH and heavy metal detection. NSF-IUCRC (Woo-jin Chnag, UWM, co-PI)
 - a. Developing a biosensor for detecting heavy metal contamination in water such as lead and pH
 - 8) Highly Flexible and Conducting Transparent CNT Film for Displays, UW Graduate School (Jack Ma, co-PI)
 - a. Developing a low-temperature solution process for preparing single-walled carbon nanotubes based transparent conducting films for flexible electronic applications

Peer-Reviewed Journal Articles

- 1) Yasri NG, AK Sundramoorthy, S Gunasekaran. 2015. Azo dye functionalized graphene nanoplatelets for selective detection of bisphenol A and hydrogen peroxide. *RSC Advances* 5:87295-87305.
- 2) Ling C, Li Q, Brown ME, Kishimoto Y, Toya Y, Devine EE, Choi K-O, Nishimoto K, Norman IG, Tsegyl T, Jiang JJ, Burlingham WJ, Gunasekaran S, Smith LM, Frey BL, Welham NV. 2015. Bioengineered vocal fold mucosa for functional voice restoration. *Science Translational Medicine* 7:314 314ra187.
- 3) Wang YC, D Cokeliler, S Gunasekaran. 2015. Reduced Graphene Oxide/Carbon Nanotube/Gold Nanoparticles Nanocomposite Functionalized Screen-Printed Electrode for Sensitive Electrochemical Detection of Endocrine Disruptor Bisphenol A. *Electroanalysis*.
- 4) Sundramoorthy AK, Wang Y-C, Gunasekaran S. 2015. Low-Temperature Solution-Process for Preparing Flexible, Highly Conducting, Transparent Carbon Nanotubes Film and Its Application in Flexible Supercapacitors. *NanoResearch* 8(10): 3430-3445.
- 5) Bagci, P, Wang, Y-C, Gunasekaran S. 2015. A green route for synthesis of gold nanoparticles and selective colorimetric detection of cysteine. *J. Food Sci*, N2071–N2078.
- 6) Sundramoorthy AK, Gunasekaran S. 2015. Nanomolar detection of dopamine on partially oxidized graphene/metallic single-walled carbon nanotubes film-coated electrode. *Electroanalysis* 27:1811-1816.
- 7) Seenivasan, R, W-J Chang, S Gunasekaran. 2015. One-Step Fabrication of Cysteine-Functionalized graphene oxide/polypyrrole nanocomposite for highly sensitive detection of lead ions in water. *ACS Appl. Mater. Interfaces* 7:15935–15943
- 8) Yasri NG, Yaghmour A, Gunasekaran S. 2015. Effective removal of organics from corn wet milling steepwater effluent using electrochemical oxidation coupled with adsorption on 3D-granulate graphite electrode. *Journal of Environmental Chemical Engineering*. 3:930-7
- 9) Wang YC, Lu L, Gunasekaran S. 2015. Gold nanoparticle-based thermal history indicator for monitoring low-temperature storage. *Microchimica Acta* 182:1305-11
- 10) Seenivasan R, Maddodi N, Setaluri V, Gunasekaran S. 2015. An electrochemical

immunosensing method for detecting melanoma cells. *Biosensors & Bioelectronics* 68:508-15

- 11) Liu Z, Gonzalez JS, Wang H, Gunasekaran S, Runge T. 2015. Dairy manure protein analysis using UV-vis based on the Bradford method. *Analytical Methods* 7:2645-52
- 12) Guan JH, Wang YC, Gunasekaran S. 2015. Using L-Arginine-Functionalized Gold Nanorods for Visible Detection of Mercury(II) Ions. *Journal of Food Science* 80:N828-N33

Invited Presentations:

- 1) Gunasekaran S. 2015. Biosensors for Food Quality and Safety, University of Wisconsin-Madison, October 26, Madison, WI.
- 2) Gunasekaran S. 2015. Biosensing and flexible electronics. Materials Science & MRSEC Seminar, University of Wisconsin-Madison, October 8, Madison, WI.
- 3) Gunasekaran S. 2015. Biosensors for Food Quality and Safety. FRI FRESH Seminar Series. September 15, Food Research Institute, University of Wisconsin-Madison, Madison, WI.
- 4) Gunasekaran S. 2015. Nanomaterials and Biosensing. Skin Disease Research Center, University of Wisconsin-Madison, August 10, Madison, WI.
- 5) Gunasekaran S. 2015. Bioengineering Seminar Series. BioInnovation through Engineering. Hong Kong University of Science technology, May 20. Hong Kong, China.

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. 2015. Biosensor for detecting mycotoxins in grains. NC213 Winter meeting, Feb. 22-25, Kansas City, KS.

- 2) Bagci PO, Y-C Wang, S Gunasekaran. 2015. One-step green synthesis of gold nanoparticles using Fuji apple juice EuroFoodChem XVII, October 13-16, Madrid, Spain.
 - 3) Yasri NG, AK Sundramoorthy, S Gunasekaran. Single-step preparation of naphthalene-based azo graphene film for electrochemical detection of bisphenol A. Materials & Biomaterials Research Showcase, April 27, University of Western Ontario, Canada.
 - 4) You Y, S Lim, S Gunasekaran. 2015. Highly sensitive and visible detection of bacteria in water. IFT Annual Meeting, July 11-14, Chicago, IL.
 - 5) Wang Y-C, L Lu, S Gunasekaran. 2015. Green synthesis gold nanoparticle based visible thermal history indicator for food quality monitoring. IFT Annual Meeting, July 11-14, Chicago, IL.
 - 6) Wang Y-C, N Okutan, S Gunasekaran, F Altay. 2015. Encapsulation of Vitamin C and E by uniaxial and coaxial electrospinning. IFT Annual Meeting, Chicago, IL. July 11-14.
 - 7) Arıkan BS, Ö Özkan, Y-C Wang, N Okutan, S Gunasekaran, F Altay. 2015. Electrospun nanofiber encapsulation of thyme oil and the characterization of nanofibers. IFT Annual Meeting, July 11-14, Chicago, IL.
 - 8) Seenivasan R, E Stanton, CW. Kaspar, S Gunasekaran. 2015. Electrochemical aptasensor-based detection of *E. coli*. Nanoscale Science & Engineering for Agriculture & Food Systems Gordon Research Conference. June 7-12, Waltham, MA.
 - 9) Sundramoorthy A, S Gunasekaran. 2015. Nanomolar detection of dopamine at oxidized graphene/metallic single-walled carbon nanotubes film-modified electrode. Nanoscale Science & Engineering for Agriculture & Food Systems Gordon Research Conference. June 7-12, Waltham, MA.
 - 10) Wang Y-C, S Gunasekaran. 2015. Nanomaterial-Based Thermal History Indicator for Monitoring Safety of Foods and Perishable Products. Nanoscale Science & Engineering for Agriculture & Food Systems Gordon Research Conference. June 7-12, Waltham, MA.
 - 11) Çökeliler D, Manolache S, Denes FS, Gunasekaran S. 2015. Dense medium plasma technology for synthesis of carbon nanomaterials, The 42nd IEEE International Conference on Plasma Science, Antalya, Turkey, May 24-28.
 - 12) Seenivasan R, V Setaluri, S Gunasekaran. 2015. Electrochemical Detection of Cancer Cells. Fourth Annual WARF Discovery Challenge, University of Wisconsin-Madison, April 9.
 - 13) Guan J, R Seenivasan, S Gunasekaran. 2015. Aptamer-Based Detection of Pathogens. Fourth Annual WARF Discovery Challenge, University of Wisconsin-Madison, April 9.
 - 14) Sundramoorthy AK, S Gunasekaran. 2015. Nanomolar Detection of Neurotransmitter Dopamine. Fourth Annual WARF Discovery Challenge, University of Wisconsin-Madison, April 9.
 - 15) Lu L, S Gunasekaran. 2015. Electrochemical Immunosensor for the Detection of Aflatoxin B1 in Grains. Fourth Annual WARF Discovery Challenge, University of Wisconsin-Madison, April 9.
 - 16) Guan J, Y-C Wang, S Gunasekaran. 2015. A Surfactant Mediate Gold Nanoparticles for Selective and Sensitive Silver Detection. Fourth Annual WARF Discovery Challenge, University of Wisconsin-Madison, April 9.
- Patents:**
- 1) Gunasekaran S, Y-C Wang. 2015. Nonreactors As Thermal History Indicators. US Patent Provisional Application filed, WARF Ref. No. P150240US01).
 - 2) Gunasekaran S, W-J Chang, R Seenivasan. 2015. One-step fabrication of Cysteine-Functionalized Graphene Oxide/Polypyrrole Nanocomposite for Highly Sensitive Detection of Heavy Metals (US Patent Provisional Application filed, No. 62/145,826).
 - 3) Gunasekaran S, J Yang. 2015. Solid Working Electrode with Replaceable Tip. US Patent No. 9,063,073 (has been licensed to Intel Inc.).
- Awards:**
- 1) Fulbright Program Specialist (Uzbekistan)
- Service:**
- 1) Graduate Research and Instruction (Chair, 40 h)
 - 2) Undergraduate Curriculum Committee (20 h)
 - 3) CALS Academic Planning Council (60 h)
 - 4) UW Kemper K. Knapp Bequest Committee (20 h)
 - 5) NSF Peer-review panels (20 h)
 - 6) Refereed journals peer-review (40 h)



David W. Kammel

Professor, Ph.D.
Extension Programming

The Dairy Modernization Extension Program has an established recognition with Wisconsin county agents and producers. It has also garnered attention from other states such as Minnesota, Iowa, Illinois, Pennsylvania, New York, and Maine. The majority of David's work year has been through producer and agent requests to develop and deliver topics in that area. This includes presenting and coordinating programs in dairy housing facilities and feeding systems including low cost milking centers, free stall barns, compost bedded barns, special needs and transition cow barns, and calf heifer housing. He had over 6600 contacts via email or phone for requests for information, and spoke to over 1727 participants in extension meetings. He worked in 32 counties with 30 different agents on client requested farm visits developing plans and educational materials to approximately 276 individual farms. Much of this work has been with family owned dairy farms growing through the transition from 60-100 cows in a tie stall barn into newer milking parlor and freestall or bedded pen housing systems and calf and heifer housing systems. New requests include integrating technology such as automatic milking systems and calf feeding systems into existing and new facility design has become more common He has also worked with dairy goat/sheep farms as they develop their new farmsteads and point of sale operations. Requests for dairy and beef cattle housing and handling systems are also popular. This work has been accomplished through the Dairy Modernization workgroup and the Livestock team. Green County and Pierce County had dairy facility tours with tour participants selected from farm that the agents and David had worked with earlier on their new facility designs.

David has been invited to present dairy educational seminars through the Babcock Institute for Cochran group from Venezuela and US Grains Council for a Chinese group. He has hosted lectures on campus for international visitors from Ireland, Finland, Germany, Japan, Venezuela, and Argentina. He was invited to speak on calf and heifer housing and calf barn ventilation by a German veterinarian association. He was invited to Maine, New Hampshire and Connecticut to speak on heifer housing and management.

Teaching:

I teach the BSE Farm and Industry Short Course "Livestock Housing" Short Course evaluations were done by Short Course office this year. I also guest lecture for Dairy and Animal Science classes including a 2 @ 2 week modules for the Senior Design Course DS234.

Meetings and Activities:

- 2015 WFBA Conference and Tour, Janesville, WI
- Short Course Livestock Housing Class
- FTD 2015 Dane county
- Dairy Modernization Tour, Green
- Indianhead Sheep Breeders, Rice Lake
- Minnesota Parlor Versus Robot Meetings
- Farming for Profit Webinar
- Bi State Equine Meeting
- Cattle Feedlot Meeting
- Arlington Sheep Day
- Small Ruminant Meeting, Baldwin
- Accelerated Genetics Argentina Visitors
- Dry Cow and Transition Cow Management Trempealeau
- Golden Sands pasture Walk
- World Dairy Expo
- International Visitors tour host for Ireland, Finland, China, Germany, Japan, Argentina, Venezuela

Invited Speaker

- Heifer Management Meetings New Hampshire, Maine, Connecticut
- Bovine Practitioners Training and Meetings Germany
- Minnesota Robot versus Parlor Meetings

Dairy Modernization Extension Program Activity:

I have made farm visits in the following 32 counties visiting approximately 276 livestock farms and developed preliminary designs for the farmsteads.

- | | | |
|--------------------|------------------|------------------------------------|
| • Ashland (1x) | • Jackson (3x) | • Rock (1x) |
| • Calumet (1x) | • Jefferson (1x) | • Sauk (2x) |
| • Chippewa (2x) | • Kewaunee (4x) | • Shawano (2x) |
| • Clark (2x) | • La Crosse (1x) | • Sheboygan (1x) |
| • Columbia (2x) | • Manitowoc (3x) | • St. Croix (1x) |
| • Dane (3x) | • Marathon (1x) | • Trempealeau (1x) |
| • Eau Claire (1x) | • Monroe (3x) | • Walworth (3x) |
| • Fond du lac (2x) | • Outagamie (3x) | • Waupaca (2x) |
| • Grant (4x) | • Ozaukee (2x) | • Washburn/Sawyer/
Burnett (3x) |
| • Green (6x) | • Portage (1x) | • Wood (1x) |
| • Iowa (1x) | • Richland (1x) | |

Papers, Proceedings, Articles

- 1) Kammel, David W. 2014. Create a Master plan for modernizing your dairy. Issue 18. November 7, 2-14. Progressive Dairyman.
- 2) Kammel, David W. 2015. Goat Housing Chapter. Meat Goat Production Handbook. Langston University, Langston OK 73050
- 3) Jones, Gordon A., D.W. Kammel. 2015. Designing Facilities to optimize Cow Comfort. Hoards Dairyman. April 25, 2015.
- 4) Jones, Gordon A., D.W. Kammel. 2015. Nine Considerations for Transition Cow Housing. May 10, 2015.
- 5) Jones, Gordon A., D.W. Kammel. 2015. Handle Transition Cows with Ease. May 25, 2015.
- 6) Kammel, David W. 2015. Design Barns for Today's Animals. Farming Magazine. May 2015.
- 7) Kammel, David W. 2015. Dairy Modernization Building Cows Estimates. UWEX. December 2015.
- 8) Halfman, Bill, Adam Hady, Brenda Boetel, David W. Kammel. 2015. UW Extension Holstein Steer Finishing Yardage Cost Survey.

Presentations Developed

- 1) Facility Design for Cow Comfort and Increased Production and Profitability
- 2) Remodeling Retired Dairy Facilities for Raising Steers
- 3) Facility Design for Cow Comfort
- 4) Compost barn Design and Management
- 5) Heat Stress Abatement Design and Management
- 6) Cow Comfort Nestles Project
- 7) Farmstead Planning Design
- 8) Heat Stress Mitigation Design and Management
- 9) Calf Barn Ventilation and Building Design
- 10) Cow Cooling
- 11) Calf Housing Design and Management
- 12) Heifer Housing Design and Management
- 13) Remodeling Retired Dairy Barns for Sheep and Goat Housing
- 14) Remodeling Retired Dairy barns for Dairy Beef

Professional Service

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



K.G. Karthikeyan

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

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 2015

BSE 472, Sediment & Bio-nutrient Engineering and Management

3 Credits, 9 Enrolled

(Evaluation: 4.22/5)

BSE 309, Engr. Design Practicum

2 credits, 4 students advised

InterEgr 102, Introduction to Society's

Engineering Challenges

2 Credits, 24 enrolled

Fall 2015

BSE 372, On-site Wastewater Treatment and Dispersal

2 Credits, 24 Enrolled

(Evaluation: 4.71/5)

BSE 509, Design Practicum II

3 Credits, 46 students enrolled

Graduate and Post Docs Advisees

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

- 1) Miller, EL, SL Nason, KG Karthikeyan, JA Pedersen. 2016. Root Uptake of Pharmaceutical and Personal Care Product Ingredients. *Environmental Science & Technology* (in press).
- 2) Gungor, K, AA Ozkaynak, KG Karthikeyan, F Evrendilek, S Gunasekaran. 2016. Modeling solubilization dynamics of manure organic matter and phosphorus as a function of pH control and enzyme supplementation. *Environment Protection Engineering* (in press).
- 3) Han, L., KG Karthikeyan, K. Gregory. 2015. Energy Consumption and Recovery in Capacitive Deionization Using Nanoporus Activated Carbon Electrodes. *Journal of Electrochemical Society*. 162:E282-E288.

- 4) Lamba, J, AM Thompson, KG Karthikeyan, FA Fitzpatrick. 2015. Sources of fine sediment stored in agricultural lowland streams, Midwest, USA. *Geomorphology*. 236:44-53.
- 5) Lamba, J, KG Karthikeyan, AM Thompson. 2015. Apportionment of suspended sediment sources in an agricultural watershed using sediment fingerprinting. *Geoderma*. 239-240: 25-33.
- 6) Lamba, J, KG Karthikeyan, AM Thompson. 2015. Using radiometric fingerprinting and phosphorus to elucidate sediment transport dynamics in an agricultural watershed. *Hydrol. Processes*. 29:2681-2693.

Service

BSE committees

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

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

Environment Technology
US-Israel BARD Program
US-Pakistan (NAS) Science & Technology Cooperation 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 2015

BSE 472, Sediment and Bio-Nutrient Engineering and Management
3 Credits, 9 Enrolled

Graduate and Post Docs Advisees

- 1) Joseph Sanford, M.S., BSE, March 2016 (continuing on with PhD)
- 2) Aleia McCord, Ph.D., Nelson Institute for Environmental Sciences, 2016
- 3) Hui Wang, Ph.D., BSE, 2016
- 4) Yifan Liang, M.S., BSE, 2015 co-advised with Chris Choi
- 5) Michael Holly, Ph.D., BSE, 2016
- 6) Alysa Bradley, Ph.D., BSE, 2018
- 7) Horacio A. Aguirre-Villegas, Post Doctoral Researcher

Extension / Outreach

- 30+ days of extension programing
- Farm Technology Days exhibit
- International anaerobic digestion programming (Uganda and Bolivia)
- Anaerobic digestion programming, including the 2015 Wisconsin Anaerobic Digestion Operator Training

- 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
- National conference planning (Livestock and Poultry Environmental Learning Center, Waste to Worth 2015 Seattle, WA)
- Manure Irrigation Workgroup and related programming
- 2015 Midwest Manure Summit, Green Bay, WI
- Creating an Enduring U.S. Dairy Sector, 30th ADSA Discover Conference, Chicago, IL

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 \$10,000,000 (\$450,000)
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 \$26,000
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 \$138,964
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 \$467,969
Objectives: Evaluate biochar in manure systems to mitigate the impacts to water quality and air quality
 - 5) Evaluation of Manure Storage Capital Projects in the Yahara River Watershed
Collaborators: L. Good, P. Porter, T. Runge
Funding: UW Hatch \$99,900
Objectives: Evaluate the placement of manure storage and incorporation of manure technologies to reduce P loading to surface water in Dane County, WI
 - 6) Field testing the Integration of Slurry Separation Technology & Refrigeration Units with Anaerobic Digestion Systems in Uganda
Collaborators: V. Tumwesige
Funding: MSU GCFSI, US AID \$249,702
Objectives: Design and evaluate an in-line treatment systems for tile drainage
 - 7) Reducing Water for Anaerobic Digestion
Collaborators: V. Tumwesige, S. Stefanos, A. McCord
Funding: Securing Water for Food (SWFF) \$500,000
Objectives: implementing solid liquid separation systems to reduce the water usage in East Africa
 - 8) Biogas Treatment to Remove Hydrogen Sulfide
Collaborators: n/a
Funding: UW Graduate School \$35,860
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 \$26,000
Objectives: provide scientific based information on the environmental and social impacts of new pork production facilities
 - 10) Treatment of Effluent from Agricultural Fields with Subsurface Tile Drains with an In-line Treatment System
Collaborators: n/a
Funding: UW Hatch \$76,706

Objectives: Design and test in-line tile drainage treatment systems which using sorption to remove nitrate using oxidized biochar and phosphorus using furnace slag

- 11) Silage Storage Runoff
Collaborators: Discovery Farms
Funding: Discovery Farms \$60,000
Objectives: Develop silage storage runoff collection systems to reduce wastewater collection volumes while increasing the load reduction to treatment systems

Publications

Peer reviewed Journal Articles

- 1) R.A. Larson, J. Panuska, J. Sanford, and C. Burnson. 2015. Low-Cost Manure Total Solids Measurement Device. ASABE Applied Engineering in Agriculture. Accepted in Print.
- 2) Aguirre-Villegas, H.A. and R.A. Larson. 2015. Effects of management and co-digestion on life cycle emissions and energy from anaerobic digestion. Greenhouse Gas Sci Technol. 5:1–19.
- 3) Bradley, A., R.A. Larson, T. Runge. 2015. Effect of Wood Biochar in Manure Applied Sand Columns on Leachate Quality. Journal of Environmental Quality, 44(6):1720-1728.
- 4) Vadas, P., L. Good, J. Panuska, D. Busch, R.A. Larson. 2015. A new model for phosphorus loss in runoff from outdoor cattle lots. Transactions of the ASABE, 58(4):1035-1046.

Invited Presentations:

- 1) Larson, R.A., M. Borchardt, T. Burch, S. Spencer, Z. Zopp, C. Choi, Y. Liang. 2015. Manure Irrigation: Airborne Pathogen Transport and Assessment of Technology Use in Wisconsin. LPELC Waste to Worth 2015: Advancing Sustainability in Agriculture, March 30-April 3, 2015, Seattle, WA.
- 2) Bradley, A., R.A. Larson, and T. Runge. 2015. Effect of Wood Biochar in Manure Applied Sand Columns on Leachate Quality. LPELC Waste to Worth 2015: Advancing Sustainability in Agriculture, March 30-April 3, 2015, Seattle, WA.
- 3) Wang, H. and R.A. Larson. 2015. Effect of Mixing of Biogas Production. LPELC Waste to Worth 2015: Advancing Sustainability in Agriculture, March 30-April 3, 2015, Seattle, WA.
- 4) Holly, M. and R.A. Larson. 2015. GHG and ammonia emissions from manure storage and land application following manure processing. LPELC Waste to Worth

- 2015: Advancing Sustainability in Agriculture, March 30-April 3, 2015, Seattle, WA.
- 5) Aguirre-Villegas, H. and R.A. Larson. From Waste-to-Worth: Environmental Impacts and Sustainability of Manure Processing Pathways. Biogas Science 2014, Vienna, Austria, 26th-30th October 2014.
 - 6) Liang, Y., R.A. Larson, and C.Y. Choi. 2015. Modeling Airborne Pathogen Transport during the Use of Manure Irrigation Practice in Wisconsin. ASABE Annual International Meeting, July 26-29, 2015, New Orleans, LA.
 - 7) Sanford, J., and R.A. Larson. 2015. Evaluation of Phosphorus Filter Media for an In-Line Tile Drainage Treatment System. ASABE Annual International Meeting, July 26-29, 2015, New Orleans, LA.
 - 8) Wang, H. and R.A. Larson. 2015. Effect of Dietary Tannin on Biomethane Potential of Dairy Manure. ASABE Annual International Meeting, July 26-29, 2015, New Orleans, LA.
 - 9) Holly, M. and R.A. Larson. 2015. Gas Reduction Benefits from Storage to Application of Anaerobic Digestion and Solid-liquid Separation of Dairy Manure. ASABE Annual International Meeting, July 26-29, 2015, New Orleans, LA.
 - 10) Aguirre-Villegas, H. and R.A. Larson. Comparing different manure management practices in dairy

farms of Wisconsin. ASABE Annual International Meeting, July 26-29, 2015, New Orleans, LA.

- 11) Larson, R.A., A. Bradley, and T. Runge. 2015. Impact of biochar additions to nitrogen leaching in sand columns. ASABE Annual International Meeting, July 26-29, 2015, New Orleans, LA.

Extension documents

Manure irrigation report

Professional Development

UW Teaching Academy

Service

- 1) BSE committees
 - Extension (2 hrs)
 - Pre-professional club advisor (25 hrs)
 - Faculty Meeting Secretary (10 hrs)
- 2) ASABE Committees
 - NRES-27 Past Chair
- 3) Livestock and Poultry Environmental Learning Center
- 4) NCCC-9 (Midwest extension) Chair
- 5) 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

Program Narrative: 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 2015 have been variable rate technology, remote sensing and the use of unmanned aerial vehicles (UAV's), and issues dealing with "big data" in agriculture. The Precision Agriculture software and data management training program was implemented on select agriculture agents and was successful in 2015 and will be expanded in 2016.

Teaching

Spring 2015

BSE 309 (2 credits): ¼ Scale Tractor Design Team (4 Students).

SC_FISC 38-016 Precision Agriculture. Technologies: Guest Lecture

SC_SOILS 52 Soil & Crop Nutrient Management: Guest Lecture

Fall 2015

BSE 509 (2 credits): ¼ Scale Tractor Design Team (4 Students).

SC_BSE 92 Farm Machinery: Guest Lecture on AgriTechnica Trip 2015.

Graduate Students and Post Docs

Advisees

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

Graduate Committee Membership

- 1) Justin Orrick, M.S., BSE, 2015 (advisor: Kevin Shinnars).
- 2) Ashley Stubbe, M.S., BSE, 2015 (advisor: Kevin Shinnars).
- 3) Scott Dietsch, M.S., BSE, 2015 (advisor: Kevin Shinnars)

Extension/Outreach

Activities within Wisconsin (1438 Direct

Extension Contacts)

- 1) Wisconsin Crop Management Conference – UAV Presentation (150 attendees).
- 2) MFA/WCO/Nutrient Applicators Symposium – Kernel Processing Score/Image Analysis (50 attendees).
- 3) Cranberry School – Precision Agriculture Presentation (50 attendees).
- 4) Fond du Lac/Dodge Co. Corn Growers – UAV Presentation (30 attendees).
- 5) Wisconsin Fresh Fruit and Vegetable Grower Conference – Sprayer Calibration Presentation (60 attendees).
- 6) TH AgriChemicals Invited Presentation – General Precision Ag. Presentation (70 attendees).
- 7) Wisconsin Potato and Vegetable Growers Association – Big Data Presentation (80 attendees).
- 8) Seymour/Brillion Field Day – UAV/Remote Sensing Presentation (30 attendees)
- 9) Richland Center/Sparta Field Day – UAV/Remote Sensing Presentation (25 attendees)

- 10) Northern Safari Webinar Series – General Precision Ag. Presentation (~50 attendees).
- 11) WAPAC Crop Consultants Conference – UAV/Remote Sensing Presentation (40 attendees).
- 12) Trempealeau Co. Field Day – General Precision Ag. Presentation (30 attendees)
- 13) Juneau/Adams/Marionette Co Corn Growers – Precision Ag./Remote Sensing/Big Data Presentation (50 attendees).
- 14) AgrAbility Summit – Assistive Technology Presentation (45 attendees).
- 15) Barron County NW Ag. Agent Training – Precision Ag. Software (12 attendees)
- 16) Chippewa Valley Tech. College – Guest lecture Precision Ag. Software (10 attendees)
- 17) Columbia Co. Corn Growers – Precision Agriculture Presentation (60 attendees).
- 18) Fond du Lac/Dodge Corn Growers – Big Data Presentation (30 attendees).
- 19) Cranberry Growers Workshop – UAV/Remote Sensing Presentation (60 attendees)
- 20) Wisconsin Counties Association – UAV/Remote Sensing Presentation (15 attendees).
- 21) Cranberry Growers Summer Meeting – UAV/Remote Sensing Presentation (30 attendees).
- 22) Farm Technology Days Training – Tram Driver/Field Demo (85 attendees).
- 23) Farm Technology Days Training – Tram Driver/Field Demo (100 attendees).
- 24) Agronomy/Soils Field Day – Research Update (75 attendees).
- 25) Sheboygan Co. Field Day – UAV/Remote Sensing Presentation (45 attendees).
- 26) Farm Technology Days Field Demonstrations (3 day event).
- 27) Outagamie Co. Forage Council Field Day – Big Data Presentation (50 attendees).
- 28) Juneau Co. Lunch and Learn – UAV/Remote Sensing Presentation (20 attendees).
- 29) Center for Dairy Profitability Meeting – UAV/Remote Sensing Presentation (36 attendees).
- 30) Trempealeau Co. Field Day – Getting Started with Precision Ag. (10 attendees).
- 31) Fond du Lac/Dodge Forage Council Meeting – UAV/Remote Sensing Presentation (40 attendees).

Funded Research Projects

- 1) *Image processing based kernel processing score determination via smart device: Initial smart device application development.*
B. D. Luck
 Funding: Midwest Forage Association Midwest Forage Research Program
 Collaborators: None
 Description: Continuation of development of image processing based kernel processing score determination and migration from MATLAB code to smart device implementation.
- 2) *Remote sensing via unmanned aerial vehicles of cranberry beds.*
B. D. Luck
 Funding: Wisconsin Cranberry Board
 Collaborators: Jed Colquhoun, Leroy Kummer, Nick Gebhardt, and Dani Faber
 Description: Develop materials for fitting a UAV with multi-spectral camera for measuring vegetative indices in cranberries. Collect weekly data on cranberry beds in central Wisconsin. Develop training material for analyzing vegetative indices data for cranberry beds.
- 3) *Easter Seals of Wisconsin: Securing Beginning Farmers through Succession Planning*
 P. Leverenz and **B. D. Luck**
 Funding: USDA – NIFA: Beginning Farmer
 Description: Utilizing AgrAbility of Wisconsin’s database of farmers with disabilities we offer outreach and information to farmers in need of succession planning and put them in contact with professionals that can help with the process.
- 4) *Optimization of the Forage Harvest Process via Logistics Modeling and Economic Analysis*
B. D. Luck
 Funding: CNH Global

Description: Define the forage harvest process via GPS data and Controller Area Network Data on all machines involved. Model the system for optimization.

- 5) *Unmanned Aerial Vehicle deployed mating disruption systems in Wisconsin cranberries*

B. D. Luck and S. Steffan

Funding: Graduate School Fall Research

Competition

Description: Develop a lightweight and low-power mechanism for deploying a mating disruption system from unmanned aerial vehicles.

Publications

- 1) **B. D. Luck**, J. D. Davis, J. L. Purswell, A. S. Kiess, S. J. Hoff. 2016. Assessing the effect of house size and design on air velocity distribution in commercial broiler houses. *Transactions of the ASABE. In Process.*
- 2) **B. D. Luck**, J. Harmon, K. J. Shinnars. 2016. In field determination of Kernel Processing Score via Image Analysis Techniques for Harvested Corn

Silage. *Applied Engineering in Agriculture. In Process.*

Service

BSE Committees:

- 1) Extension (2 hrs)
- 2) Facilities (2 hrs)

UWEX Committees:

- 1) ANRE Team Grains Member (5 hrs)
- 2) ANRE Team Forage Member (5 hrs)

ASABE Committees:

- 1) ESH-04/2 Farmers with Disabilities Technology Exchange (Member and Vice Chair)
- 2) PM 23/7/2 – Forage & Biomass Engineering (Member and Chair)
- 3) MS-49 – Crop Production Systems, Machinery, and Logistics (Member)

Other:

- 1) 2015 Farm Technology Days Field Demonstrations – Machinery Company Liaison
- 2) 2015 Farm Technology Days Innovation Square Coordinator.
- 3) ¼ Scale Tractor Team Advisor



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 2015:

- BSE 001: 1 enrolled for 1 credit
- BSE 508: 3 enrolled
- BSE 699: 2 enrolled for 3 credits,
- BSE 990: 1 enrolled for 9 credits and 3 for 3 credits

Summer 2015:

- BSE 001: 1 enrolled for 1 credit
- BSE 990: 1 enrolled for 3 credits and 3 for 2 credits

Fall 2015:

- BSE 460: 3 Credits, 12 Enrolled
- BSE 509: 3 enrolled
- BSE 699: 3 enrolled for 3 credits
- BSE 799: 1 enrolled for 3 credits
- BSE 990: 1 enrolled for 5 credits, 1 enrolled for 6 credits and 2 for 3 credits

Advising & Mentoring

Undergraduate Research Assistants Advised:

- 1) Joseph Kraft
- 2) Melanie Swannell
- 3) Maxwell Horne
- 4) Cassandra Brzycki

Graduate Students Advised:

- 1) Ning Li (Ph.D. Student)
- 2) Yang Liao (Ph.D. Student)
- 3) Shu-Ching Yang (Master Student)
- 4) Zening Zhang (Master Student)
- 5) Hongdan Zhang (Visiting PhD Student)
- 6) Xuliang Lin (Visiting PhD Student)

Postdocs and Visiting Scholars:

- 1) Dr. Chang Guen Yoo (Postdoc)
- 2) Dr. Shirishkumar Harde (Postdoc)
- 3) Dr. Jian Zhao (Visiting Professor, Shandong University, China)

4) Dr. Zhiqiang Pang (Visiting Professor, Qilu University of Technology, China)

5) Dr. Gaojin Lyu (Visiting Professor, Qilu University of Technology, China)

6) Dr. Xiaohui Yang (Visiting Professor, Institute of Chemical Industry of Forestry Products, Chinese Academy of Forestry)

Research Projects

- 1) NSF (National Science Foundation) (CBET 1236562), Xuejun Pan (PI), "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 2016).
- 2) NSF (National Science Foundation) (CBET 1159561), Xuejun Pan (PI), "Fast saccharification of lignocellulosic biomass under mild conditions in the medium of concentrated lithium bromide", 298,686 (July 2012 - June 2016)
- 3) USDA McIntire Stennis (WIS01861), Xuejun Pan (PI), "Conversion of Forest Residue into High-Value Furan-Based Chemicals and High-Quality Lignin in Biphasic System Involving Molten Salt Hydrate", \$160,000 (October, 2015- September, 2019)
- 4) WARF Accelerator Program, Xuejun Pan (PI), "Production of high-concentration sugar directly from lignocellulose under moderate conditions for fuels and chemicals", \$127,825 (May 2013 - December 2015)
- 5) USDA McIntire Stennis (WIS WIS01597), Xuejun Pan (PI), "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) UW Bridge Funding, Xuejun Pan (PI), "Design and synthesis of cellulase-mimetic bifunctional

solid acids for hydrolyzing cellulose”, \$36,600 (June. 2015 – Jun. 2017)

- 7) UW Graduate School, Xuejun Pan (PI), “Direct Conversion of Cellulose into Chemicals and Fuel Precursors in a Biphasic Organosolv System”, \$36,953 (Jul. 2015 – Jun. 2016)
- 8) SIRE-REU, Xuejun Pan (PI), “Isomerization of glucose to fructose”, \$4,865 (July 2014 - July 2015)

SIRE-REU, Xuejun Pan (PI), “Conversion of monosaccharides and polysaccharides to furan-based precursors for hydrocarbon fuels”, \$4,865 (May 2014 - June 2015)

Publications

Patents

- 1) X.J. Pan and L. Shuai. Saccharification of Lignocellulosic Biomass. US 9,187,790, Nov. 17, 2015.
- 2) G.S. Wang, X.J. Pan, J.Y. Zhu and R. Gleisner. Sulfite pretreatment for biorefining biomass. US9,090,915, July 28, 2015.

Peer-Reviewed Journal Articles

- 1) Hongdan Zhang, Ning Li, Xuejun Pan, Shubin Wu, and Jun Xie. Oxidative conversion of glucose to gluconic acid by iron (III) chloride in water under mild conditions. Green Chemistry, 2016, DOI: 10.1039/C5GC02614H.
- 2) Qiang Yang and Xuejun Pan. Correlation between lignin physicochemical properties and inhibition to enzymatic hydrolysis of cellulose. Biotechnology and Bioengineering, 2016, DOI: 10.1002/bit.25903
- 3) Qiang Yang and Xuejun Pan. Synthesis and application of bifunctional porous polymers bearing chloride and sulfonic acid as cellulase-mimetic solid acids for cellulose hydrolysis. BioEnergy Research, 2016, DOI 10.1007/s12155-015-9702-2.
- 4) Chang Geun Yoo, Hoon Kim, Fachuang Lu, Ali Azarpira, Xuejun Pan, Kyeong Keun Oh, Jun Seok Kim, John Ralph, and Tae Hyun Kim. Understanding the physicochemical characteristics and the improved enzymatic saccharification of corn stover pretreated with aqueous and gaseous ammonia. BioEnergy Research, 2016, DOI 10.1007/s12155-015-9662-6.
- 5) Zhiqiang Pang, Cuihua Dong, and Xuejun Pan. Enhanced deconstruction and dissolution of lignocellulosic biomass in ionic liquid at higher

water content by lithium chloride. Cellulose, 2016, 23, 323-338.

- 6) Pongsak Noparat, Poonsuk Prasertsan, Sompong O-Thong, and Xuejun Pan. Dilute acid pretreatment of oil palm trunk biomass at high temperature for enzymatic hydrolysis. Energy Procedia, 2015, 79, 924-929.
- 7) Grabber, J., N. Santoro, C.E. Foster, S. Elumalai, J. Ralph, and X.J. Pan. Incorporation of flavonoid derivatives or pentagalloyl glucose into lignin enhances cell wall saccharification following mild alkaline or acidic pretreatments. BioEnergy Research, 2015, 8, 1391-1400.
- 8) Zeng, J.J., C.G. Yoo, F. Wang, X.J. Pan, W. Vermerris, and Z.H. Tong. Biomimetic Fenton-catalyzed lignin depolymerization to high value aromatics and dicarboxylic acids. ChemSusChem, 2015, 8, 861-871.

Invited Book Chapters (peer-reviewed)

- 1) C. Zhang, R. Gleisner, C.J. Houtman, X. Pan, and J.Y. Zhu. Sulfite pretreatment to overcome the recalcitrance of lignocelluloses for bioconversion of woody biomass. In: “Biomass Fractionation Technologies for a Lignocellulosic Feedstock Based Biorefinery”, Edited by S. I. Mussatto, Elsevier. (in press).
- 2) 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)
- 3) 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)
- 4) C.G. Yoo and X.J. Pan. Fuel ethanol from lignocellulosic biomass. In: “Handbook of Clean Energy Systems”, Edited by J.Y. Yan, Vol. 1: Renewable Energy, p119-138, Wiley, 2015.

Invited Seminars

- 1) X.J. Pan. New approaches for producing sugars from lignocellulosic biomass. April 14, 2015. University of Minnesota-Twin City.
- 2) X.J. Pan. Fuel ethanol production in the United States. June 26, 2015, Qilu University of Technology, Jinan, China.
- 3) X.J. Pan. Research, development and production of fuel ethanol in the United States. June 16, 2015, Guangxi University, Nanning, China.
- 4) X.J. Pan. Fundamental understanding and removing strategies of the inhibitory effects of

lignin on enzymatic saccharification of lignocellulose, May 28, 2015, Jiangnan University, Wuxi, China.

- 5) X.J. Pan. Biomass production and conversion: status quo and future directions, May 26, 2015, South China University of Technology, Guangzhou, China.
- 6) X.J. Pan. Innovative technologies to convert lignocellulosic biomass to fuels, chemicals, and materials, May 25, 2015, South China University of Technology, Guangzhou, China.

Oral Conference Presentations

- 1) Chang Geun Yoo, Shuting Zhang, and Xuejun Pan. High-yield production of furans from lignocellulosic biomass under mild conditions in a biphasic process with molten salt hydrate. 2015 AIChE Annual Meeting, November 8-13, 2014, Salt Lake City, UT.
- 2) Chang Geun Yoo, Shuting Zhang, and Xuejun Pan. Simultaneous production of furfural, bromomethylfurfural and high-quality lignin from lignocellulosic biomass in a biphasic process involving molten salt hydrate. *The 37th Symposium on Biotechnology for Fuels and Chemicals*, April 27-30, 2015, San Diego, CA.
- 3) Chang Geun Yoo, Shuting Zhang, and Xuejun Pan. Biphasic process using molten salt hydrate for chemical transformation of lignocellulosic biomass into furan-based chemicals. *249th ACS National Meeting & Exposition*, March 22 -26, 2015, Denver, CO.
- 4) Ning Li, Joseph Kraft, and Xuejun Pan. Homogeneous saccharification of lignocellulosic biomass in molten salt hydrates. *249th ACS National Meeting & Exposition*, March 22 -26, 2015, Denver, CO.
- 5) Ning Li, Jane Alexander, and Xuejun Pan. Facile quantification of biomass lignin using acidic lithium bromide (ALB) method. *249th ACS National Meeting & Exposition*, March 22 -26, 2015, Denver, CO.

Poster Conference Presentations

- 1) Melanie Swannell, Chang Geun Yoo, and Xuejun Pan. Effects of halide salt hydrates on isomerization of glucose to fructose. *249th ACS National Meeting & Exposition*, March 22 -26, 2015, Denver, CO.
- 2) Chang Geun Yoo, Jijiao Zeng, Shuting Zhang, Hoon Kim, John Ralph, Zhaohui Tong, and Xuejun Pan. Characterization and evaluation of

the lignin from one-pot HDA process for chemical transformation of biomass into hydrocarbons. *249th ACS National Meeting & Exposition*, March 22 -26, 2015, Denver, CO.

- 3) X.J. Pan. Sugar production from biomass in molten salt hydrate. 2015 CPBR Symposium, March 3-4, 2015, Washington D.C.

Awards

- 1) Excellence in International Activities Award, College of Agricultural and Life Science, UW-Madison (2015)
- 2) High-demand Faculty Retention Award (2015)

Student Accomplishments

- 1) Ning Li. PhD student. Bruhn Fellowship. 2015.

Professional Service

- 1) University
 - a) BSE Graduate Instruction and Research Committee (30 hr)
 - b) BSE Undergraduate Instruction and Program Committee (40 hr)
 - c) BSE Social Committee (10 hr)
 - d) CoE Assessment Committee (80 hr)

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) Session 56: Biomass Characterization, Pretreatment and Fractionation. 2015 AIChE Annual Meeting, November 8-13, 2014, Salt Lake City, UT.
- 3) Journal Article Reviewer
 - a) Green Chemistry
 - b) Journal of Wood Chemistry
 - c) Chemical Science
 - d) Carbohydrate Polymers
 - e) Holzforschung (x2)
 - f) Industrial and Engineering Chemistry Research
 - g) Journal of Physical Chemistry
- 4) Proposal Reviewer
 - a) NSF panel
 - b) NSF proposal
 - c) Hatch proposa



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 2015

BSE/IES 367, Renewable Energy Systems

3 Credits, 90 enrolled

BSE 375 Special Topics Sr. Design Advisor

3 credits, 2 enrolled

Fall 2015

BSE/IES 367, Renewable Energy Systems, team

taught with Troy Runge, 3 Credits, 83 enrolled

BSE 875 Integral Ecology, 1 credit 5 enrolled

Graduate and Post Docs Advisees

- 1) John Penry, PhD Dairy Science, 2017
- 2) Jack Buchanan, PhD, GNIES, 2016.
- 3) Robert Rowbotham, PhD 2015, Dairy Science, Co-advised with Pamela Ruegg
- 4) Stefania Leonardi, Visiting Scientist, PhD U of Milan, 2015
- 5) Dr. John Upton, Post Doctoral Milking Machine Researcher, 100% appointment,
- 6) Dr. Muireann Ni Chonfhaola, Post Doctoral Milking Machine Researcher, 50% appointment
- 7) Horacio A. Aguirre-Villegas, Post Doctoral LCA Researcher, Co-advised with Rebecca Larson

Extension / Outreach

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

Milking Lab web site Development

MilkTech professional development courses

International On-Line curriculum used in USA, Argentina, and China (with 7 days of resident instruction)

Midwest Rural Energy Council

Web site development

board meeting and conference planning (2 days)

Annual educational conference on rural energy issues (3 days, attendance 120).

Stray Voltage Investigators Courses (5 days, attendance 40)

Funded Research Projects

- 1) Milking Machine Research (\$150k/yr)
Collaborators: P Thompson, BSE. Funding: Avon Dairy Solutions. Objectives: Advance the science of biomechanics of machine milking and milking management.

- 2) Climate Change Mitigation and Adaptation In Dairy Production (\$60k/yr) Collaborators: R Larson, M Ruark, M Jahn, M Watteaux, B Bland, M Stephenson Funding: AFRI/CAP Objectives: Life Cycle Assessment of Dairy Production Systems.
- 3) Milking Physiology Research (\$64k/yr) Co-Pi with Laura Hernandez, UW Dairy Science
- 4) Automated Pre-Milking Preparation (\$30k/yr) Collaborators: P Ruegg, Dairy Science Funding: Future Cow Inc. Objectives: Assess sanitary and stimulation efficacy and of automated pre-milking preparation.

Publications

Google Scholar Citations 1343, H index 17, i10 Index 35

Peer reviewed Journal Articles

- 1) Meier, PJ, KR Cronin, EA Frost, TM Runge, BE Dale, DJ Reinemann, and J Detlor, 2015. Potential for Electrified Vehicles to Contribute to U.S. Petroleum and Climate Goals and Implications for Advanced Biofuels. *Environ. Sci. Tech.* 49(14)8277-8286.
- 2) Leonardi, S, JF Penry, FM Tangorra, PD Thompson and DJ Reinemann, 2015. Methods of Estimating Liner Compression. *Journal of Dairy Science*, 98(10)6905-6912.
- 3) Aguirre-Villegas, H, R Larson and DJ Reinemann, 2015. Effects of management and co-digestion on life cycle emissions and energy from anaerobic digestion. *Greenhouse Gasses Science and Technology* 5:1-19(2015).
- 4) Sinistore, JC, DJ Reinemann, RC Izaurralde, KR Cronin, PJ Meier, TM Runge & XS Zhang, 2015. Life Cycle Assessment of Switchgrass Cellulosic Ethanol Production in the Wisconsin and Michigan Agricultural Contexts. *Bioenerg. Res.*
- 5) Aguirre-Villegas, HA, TH Passos-Fonseca, DJ Reinemann, LE Armentano, MA Wattiaux, VE Cabrerra, JM Norman, and R Larson, 2015. Green cheese: Partial life cycle assessment of greenhouse gas emissions and energy intensity of integrated dairy production and bioenergy systems. *J. Dairy Science*, 98(3)1571-92.

Books

- 1) Mein, GA, and DJ Reinemann. *Machine Milking: Volume 1.* Amazon Books.

Conference Proceedings

- 1) Reinemann, DJ, 2015. *Milking Machine Basics and Special Considerations for Small Ruminants,*

Proceedings of the Dairy Sheep Association for North America 21st annual symposium, Nov 5-7, Madison, WI,

- 2) Penry, JF, J Upton, and DJ Reinemann, 2015. Revisiting gentle milking: Concepts, new research and field application. *Proceedings of the Countdown Symposium 2015, Dairy Australia.* Melbourne Australia, Pgs 5-12.
- 3) Upton, J, JF Penry, PD Thompson, and DJ Reinemann, 2015. Development of Milking Research Techniques. *Proceedings of Moorpark 15, Irish Dairying – Sustainable Expansion conference, Teagasc, Animal Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork Ireland.* Pp 102-103.
- 4) Leonardi, S, JF Penry, F Tangorra, PD Thompson, and DJ Reinemann, 2015. Comparing Methods of Estimating Liner Compression. *Proceedings of the Annual Meeting of the National Mastitis Council.*
- 5) Penry, JF, S Leonardi, F Tangorra, PD Thompson, J Upton and DJ Reinemann, 2015. Using Average Milk Flow to Map Liner Performance. *Proceedings of the Annual Meeting of the National Mastitis Council.*

Professional Development

UW Chair' Chats

Communications and Leadership Development Workshops (2 weeks)

Service

BSE Department Chair

BSE committees

Undergrad Instruction

IT

Extension

External Relations

Awards

Facilities & Operations

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, Chair of machine milking committee

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



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 and Dane county on manure processing to remove phosphorous from watersheds. In addition to his lab-based research, he works collaboratively with start-up bioenergy and biorenewable companies providing engineering and bioprocessing including pulp and chemicals (furfural and isoprene).

Teaching

Course	Semester	Number of Students
BSE 461	Spring 2015	20
BSE 375-1*	Spring 2015	4
BSE 375-2	Spring 2015	9
BSE 699	Spring 2015	2
BSE 249	Fall 2015	53
BSE 367*	Fall 2015	88

* Co-taught with Prof. Reinemann.

Graduate and Post Docs Advisees

- 1) Zhouyang Xiang, PhD BSE, 2015.
- 2) Shengfei Zhou, PhD BSE, 2015.
- 3) Zong Liu, PhD BSE, 2015. (Co-advised with Sundaram Gunasekaran)
- 4) Anurag Mandalika, PhD BSE, 2018.
- 5) Qiang Yang, Post-Doctoral Researcher.
- 6) Mahmoud Sharara, Post-Doctoral Researcher.
- 7) Shengfei Zhou, Post-Doctoral Researcher

Outreach

- 1) Supported Wisconsin Energy Institute programs including:
Wisconsin Alumni Event Speaker (Wausasu)
Meeting with interested industry collaborators
Provide information to UW Extension specialist.
- 2) Assisted CAFO farms with manure separation/management issues

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 a system to utilize agricultural residual crops to improve the wood pulping process
 - 4) Metabolic Engineering of Fast-Growing Cyanobacteria for Production of High-value Terpenoids
Collaborators: Toivo Kallas & Matt Nelson, UW Oshkosh
Funding: NSF STTR
Objectives: Design and build a photobioreactor system capable of growing cyanobacteria and collecting isoprene.
 - 5) Cellulose materials from GVL
Funding: GlucanBio LLC
Objectives: Investigate a biorefinery system that using gamma-valerolactone separation process to create high value products from wood feedstocks.
 - 6) Reducing Nitrogen Losses from Agricultural Systems: Incorporating Biochar into Farmstead Management Strategies
Collaborators: Becky Larson, BSE
Funding: USDA NIFA
Objectives: Investigate biochar additions to manure and wastewater handling, processing, storage, and application systems will significantly reduce N losses increasing nutrient use efficiency and thereby increasing the environmental and economic sustainability of livestock facilities.
 - 7) Yahara Watershed Manure Management
Collaborators: Becky Larson, BSE; Laura Good, Soil Science; and Pam Porter, P² group
Funding: Dane County
Objectives: Investigate management strategies of manure storage in the Yahara watershed that can reduce winter spreading and thereby reduce phosphorous runoff.
- Environmental Quality* 44, no. 6 (2015): 1720-1728.
- 3) Anthony, Renil, Zhouyang Xiang, and Troy Runge. Paper Coating Performance of Hemicellulose-rich Natural Polymer from Distiller's Grains, *Progress in Organic Coatings* 89 (2015): 240–245
 - 4) Yang, Qiang, Shengfei Zhou, and Troy Runge. Magnetically Separable Base Catalysts for Isomerization of Glucose to Fructose. *Journal of Catalysis* 330 (2015): 474–484.
 - 5) Xiang, Zhouyang and Troy Runge. "Emulsifying Properties of Succinylated Arabinoxylan-Protein Gum Produced from Corn Ethanol Residuals" *Food Hydrocolloids* 52 (2015) 423-430.
 - 6) Meier, Paul J., Keith R. Cronin, Ethan A. Frost, Troy Runge, Bruce E. Dale, Douglas J. Reinemann, and Jennifer Detlor. "Potential for Electrified Vehicles to Contribute to US Petroleum and Climate Goals and Implications for Advanced Biofuels." *Environmental Science & Technology* 49, no. 14 (2015): 8277–8286.
 - 7) Zhou, Shengfei, Qiang Yang and Troy Runge. "Mechanism of Improved Cellulosic Bio-ethanol Production from Alfalfa Stems via Ambient-temperature Acid Pretreatment." *Bioresources Technology* 193 (2015): 288–296.
 - 8) Sinistore, Julie C., Douglas J. Reinemann, R. César Izaurralde, Keith R. Cronin, Paul J. Meier, Troy Runge, and Xuesong Zhang. "Life Cycle Assessment of Switchgrass Cellulosic Ethanol Production in the Wisconsin and Michigan Agricultural Contexts." *BioEnergy Research* (2015): 1-13.
 - 9) Zhou, Shengfei, Qiang Yang, and Troy Runge. "Ambient-temperature sulfuric acid pretreatment to alter structure and improve enzymatic digestibility of alfalfa stems." *Industrial Crops and Products* 70 (2015): 410-416.
 - 10) Liu, Zong, Jorge Santini Gonzalez, Hui Wang, Sundaram Gunasekaran, and Troy Runge. "Dairy manure protein analysis using UV-vis based on the Bradford method." *Analytical Methods* 7, no. 6 (2015): 2645-2652.

Publications

Peer reviewed Journal Articles

- 1) Runge, Troy and Scott Paul. "Silica Reduction in Bamboo Pulp." *TAPPI Journal* 14, no. 11 (2015): 743-749.
- 2) Bradley, A., R. A. Larson, and Troy Runge. "Effect of Wood Biochar in Manure-Applied Sand Columns on Leachate Quality." *Journal of*

Conference Proceedings

- 1) Liu, Zong and Troy Runge. Dairy Manure Protein

Analysis Using UV-Vis Based on the Bradford Method. 2015 ASABE Annual International Meeting, New Orleans, LA (July 28, 2015).

- 2) Liu, Zong, Zach Carroll, Sharon Long, and Troy Runge. Cationic Polymer and High-speed Centrifugation Effects on Pathogen Reduction during Manure Solid / Liquid Separation. 2015. Waste to Worth Conference, Seattle, WA (April 1, 2015).

Service

- Graduate thesis committees
 - Edgardo Ortiz, BSE
 - Sampath, Gunukala, BSE
 - Lei Gu, BSE
 - David Cook, Dairy Science
- BSE committees
 - Ricardo Alamillo, CBE
 - Undergrad Instruction (80 hrs)
 - External Relations (20 hrs)
- UW Madison committees
 - SciMed Graduate Research Scholars Advisory Board
- Professional societies
 - American Society of Agricultural and Biological Engineers
 - Technical Association of Pulp and Paper Paper, Non-wood Committee
 - Reviewer for USDA and NSF 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 2015

- BSE / ME 476, Off-Road Vehicle Engineering
3 Credits, Enrollment – 39
Instructor Rating – 4.69/5.00
- BSE 309, Engr. Design Practicum
2 credits, 5 students advised
- BSE 875, Mobile Fluid Power Systems
3 Credits, Enrollment – 7

Fall 2015

- BSE / ME 475, Engineering Principles of
Agricultural Machines
3 Credits, Enrollment – 33
Instructor Rating – 4.65/5.00
- BSE 509, Design Practicum II
3 Credits, 5 students advised

Research Group

Graduate Students Completed in 2015:

- 1) Brandon Nigon – MS BSE; Caterpillar
- 2) Scott Dietsche – MS BSE; MacDon Industries
- 3) Ashley Stubbe – MS BSE; Greenheck Fans

Current Graduate Students:

- 1) Nolan Lacy – MS BSE; May, 2016
- 2) Chase Walters – MS BSE; December 2016
- 3) Justin Thiede - MS BSE; December 2016

Visiting Scholar

- 1) Bei Wu; College of Engineering, China
Agricultural University, Beijing, China

Undergraduate Students Employed in 2015:

Ian Rigell, Cyrus Nigon, Nate Felix, Jake Hrebik, Reid Christ

Outreach Presentations

Invited Presentations:

- 1) Alternative Biomass Harvest and Logistics Systems. Presented at the ASABE Ag Equipment Technology Conference; Louisville, KY; Febr. 10th, 2015.
- 2) New Harvest and Processing Practices to Enhance Forage Feed Value. Presented at the Vita-Plus Custom Harvesters Conference; Onalaska, WI; Febr. 18th, 2015.
- 3) Next Generation Biomass Harvest and Logistics Systems. Presented at DuPont GEN II Corn Stover Feedstock Supply Chain Systems Ideation Meeting; Nevada, IA; Febr. 22nd, 2015.

Technical Presentations

- 1) Nigon, B. K. Shinnars and D. Cook. 2015. Fractional Harvest of Corn Silage. ASABE Presentation No. 152182882. ASABE AIM New Orleans, LA.
- 2) Lacy, N. and K. Shinnars. 2015. Reconfiguring Round Bale Shape and Density to Improve Biomass Transport. ASABE Presentation No. 152190871. ASABE AIM New Orleans, LA.
- 3) Dietsche, S., J. Friede and K. Shinnars. 2015. Increasing Biomass Yield When Single-Pass Baling. ASABE Presentation No. 152182896. ASABE AIM New Orleans, LA.
- 4) Digman, M. and K. Shinnars. 2015. Evaluation of a Pull-type Harvesting System for Fractionation of Alfalfa. ASABE Presentation No. 15220950. ASABE AIM New Orleans, LA.
- 5) Digman, M. and K. Shinnars. 2015. Uniformity of Manipulated Windrows: The Utility of a Ranging Laser Scanner. ASABE Presentation No. 152215210. ASABE AIM New Orleans, LA.

- 6) Orrick, J., K. Shinnors and S. Searcy. 2015. BioMODS – BioMass Optimized Delivery System. ASABE Presentation No. 152190740. ASABE AIM New Orleans, LA.

Funded Research Projects

- 1) BioMODS – Biomass Optimized Delivery System. Collaborators: Steve Searcy, Texas A & M. Funding: USDA-NIFA. Objectives: Development of improved systems to store and deliver bulk, chopped biomass.
- 2) Combine grain flow mapping. Funding: John Deere. 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. 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. 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. Objectives: Modifications to a sugar cane harvester to process energy cane.
- 6) Improving harvest technologies for fractionating alfalfa into leaf and stem fractions. Collaborators: Ron Hatfield & Rich Muck, USDA. Funding: USDA-ARS. Objectives: Improve the performance of a alfalfa leaf-stripper and investigate the storage characteristics of stripped leaf fraction.

Publications

Peer Reviewed Journal Publications

- 1) Nigon, C.J., K.J. Shinnors and D.E. Cook. 2015. Harvester modifications to alter composition and dry matter of corn-silage. Applied Engr. Agr. In Press.

- 2) Cook, D.E., R. W. Bender, Zhenzhen L., K. J. Shinnors, and D. K. Combs. 2015. Effects of alkali treatment of whole plant corn silage and corn stover fractions on fermentation and fiber digestibility. Anim Feed Sci Technol. In Review.
- 3) Cook, D.E., R. W. Bender, K. J. Shinnors, and D. K. Combs. 2015. The effects of calcium oxide treated whole-plant and fractionated corn-silage on intake, digestion, and lactation performance in dairy cows. J Dairy Sci. Accepted.

Popular Press

- 1) Shinnors, K.J., C.J. Nigon and D.E. Cook. 2015. A new approach to harvesting corn-silage. Hoards Dairyman. May 25, 2015 Page 367.
- 2) Shinnors, K.J. 2015. Breathable film wrap improves hay consumption. Hay and Forage Grower.
- 3) Shinnors, K.J., C.J. Nigon and D.E. Cook. 2015. Toplage – a corn-silage between high-cut and snaplage. Midwest Forage Grower.

Service

Mentor Committees

- 1) Brian Luck – Chair
- 2) Troy Runge

Department

- 1) Graduate Research and Instruction
- 2) Undergraduate Instruction
- 3) Facilities Operation – Chair
- 4) Department Advancement

College and University

- 1) CALS Ag Research Stations Oversight Committee
- 2) Graduate School Academic Planning Council
Graduate Faculty Executive Committee (GFEC)
- 3) GFEC Sub-committee on MS Accreditation

Professional

- 1) ASABE PM-23/7-2 Forage Harvesting and Utilization Committee
- 2) Board Member – Wisconsin Custom Operators
- 3) ASABE PM-44 Machinery Management Committee
- 4) ASABE FPE – 709 Biomass Energy and Industrial Products Committee

Manuscripts Reviews

- 1) Transaction of the ASABE (1)
- 2) Biomass and Bioenergy (2)
- 3) Energies (1)
- 4) Precision Ag (1)



Anita Thompson

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

Affiliations: The Nelson Institute for Environmental Studies (Chair, Water Resources Management Graduate Program); 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 2015:

BSE 309: Advisor to NR&E Group, 3 Enrolled

Summer 2015:

BSE 990: Various Research Credits, 3 Enrolled

Fall 2015:

BSE 473: 2 credits, 16 Enrolled

BSE 509: Advisor to NR&E Group, 3 Enrolled

BSE 990: Various Research Credits, 2 Enrolled

ENVIR ST 717: 1 credit, 11 Enrolled

Advising

Graduate Students:

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

Elizabeth Buschert (M.S. in BSE and Nelson Institute Environment & Resources, Expected May 2017)

Andrew Skog (M.S. in BSE, Expected May 2017)

Sarah Fuller (M.S. in BSE and Nelson Institute Water Resources Management, Expected May 2018)

Andrew Powers (M.S. in BSE, Expected December 2017)

Lucas Treutel (M.S. in Nelson Institute Water Resources Management, Expected May 2016)

Harsh Singh (Ph.D. in BSE, January 2015)

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

Josh Accola (M.S. in BSE, January 2015)

Post Master's and Post-Doctoral:

Zach Zopp (Assistant Researcher)

McNair Postbaccalaureate Achievement Program:

Daniel Linton (B.S. Environmental Studies, Expected May 2016)

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".
Funding: USDA-NIFA Hatch.
P.I.s: A.M. Thompson, N.J. Balster
Objectives: 1) quantify the effect of aspect, topographic position, and snow cover on freeze-thaw cycles and soil climate in a rural agricultural watershed, 2) measure critical shear stress, soil erodibility and aggregate stability in response to freeze-thaw conditions to parameterize models such as WEPP, and 3) design and test an open-inquiry, outdoor curriculum on soil erosion in an agricultural watershed.
- 2) "Implications of Climate Change and Biofuel Development for Great Lakes Regional Water Quality and Quantity."
Funding: U.S. Geological Survey – National Institute for Water Resources .
P.I.s: A.M. Thompson, B.J. Lepore, R. Jackson, K.G. Karthikeyan, D. Hyndman, A. Kendall, B. Basso, M. Feinen
Objectives: 1) collect detailed surface and subsurface water quality and quantity measurements to better understand the nutrient dynamics of biofuel crop systems, 2) enhance a recent SALUS and ILHM coupling, and parameterize the models for plot-scale simulations of biomass production and water/nutrient dynamics, 3) validate SALUS-ILHM at the regional scale and investigate the

implications of climate change and intensive biofuel production in Great Lakes Basin watersheds in a range of hydrogeological settings.

- 3) "P Index and Snowmelt Runoff Risk Assessment: Demonstration and Refinement."
Funding: USDA-Conservation Innovation Grant.
P.I.s: A.M Thompson, L. Good, J. Panuska, K.G. Karthikeyan, D. Busch
Objectives: 1) Demonstrate the ability of a process-based P Index formulation to assess management effects on runoff P losses from fields under frozen soil conditions. 2) Test and refine the method used in a process-based P Index to determine the effect of field management practices on frozen soil runoff volume. 3) Adapt the refined frozen soil runoff risk assessment method (within the process-based P Index) to identify field conditions and management practices capable of minimizing runoff when animal manure is applied to frozen soils.
- 4) "Subsurface Fate and Transport of Cryptosporidium in Soils of Wisconsin's Carbonate Aquifer Region."
Funding: Wisconsin Groundwater Coordinating Council.
P.I.s: K.G. Karthikeyan, A.M. Thompson, B.J. Lepore, S. Long
Objectives: 1) Determine whether irradiated *C. parvum* is an effective surrogate soil surface-to-groundwater tracers for future field studies of *C. parvum* transport, and 2) Determine the *C. parvum* fate and transport potential for several Wisconsin soils which have developed overlying NE Wisconsin's vulnerable carbonate aquifer.

Publications

Peer Reviewed Publications (Natural Resources & Environment)

- 1) Singh, H. and A.M. Thompson. 2015. Effect of antecedent soil moisture content on soil critical shear stress in agricultural watersheds. *Geoderma*. 262:165-173
- 2) Lamba, J., A.M. Thompson, K.G. Karthikeyan, and F. A. Fitzpatrick. 2015. Sources of fine sediment stored in agricultural lowland streams, Midwest, USA. *Geomorphology*. 236:44-53.
- 3) Lamba, J., K.G. Karthikeyan, and A.M. Thompson. 2015. Using radiometric fingerprinting and phosphorus to elucidate sediment transport dynamics in an agricultural

watershed. *Hydrological Processes*. DOI: 10.1002/hyp.10396.

- 4) Lamba, J., K.G. Karthikeyan, and A.M. Thompson. 2015. Apportionment of suspended sediment sources in an agricultural watershed using sediment fingerprinting. *Geoderma*. 239-240: 25-33.
- 5) 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. *International Journal of Sediment Research* (In Review).
- 6) Singh, H., A.M. Thompson, B. Gharabaghi. Neural networks models for assessment and design of management practices for small agricultural watersheds. *Hydrologic Engineering* (In Review).
- 7) Singh, H., A.M. Thompson, J. Panuska. Estimating sediment delivery ratios for grassed waterways using WEPP. *Land Degradation and Development* (In Review).
- 8) Sabouri, F., B. Gharabaghi, A. Sattar, A.M. Thompson. Thermal modeling of stormwater management ponds using evolutionary algorithms. *Journal of Hydrology*. (In Review).
- 9) Zopp, Z., K.G. Karthikeyan, A.M. Thompson, S. Long. Subsurface transport of Cryptosporidium in soils of Wisconsin's carbonate aquifer region. *Journal of Environmental Quality*. (In Review).
- 10) Mailapalli, D.R., A.M. Thompson, and A. Dubey. Effect of Polyacrylamide Coated Biosolid on Phosphorus Movement in Soil-Plant-Water System. *Journal of Environmental Quality*. (In review).
- 11) Zopp, Z., K.G. Karthikeyan, A.M. Thompson, S. Long. A Cryptosporidium Soil Extraction Compatible with USEPA Method 1623.1: Cryptosporidium and Giardia in Water by Filtration/IMS/FA. *Journal of Microbiological Methods*. (In Review)

Abstracts/Papers/Presentations (Natural Resources & Environment)

- 1) Boswell, E., N. Balster, A.M. Thompson. 2015. Quantifying the effects of wintertime processes on soil detachment. Oral Presentation. ASA, CSSA and SSSA International Annual Meeting, Minneapolis, MN, November 15-18, 2015.
- 2) Lamba, J., A.M. Thompson, K.G. Karthikeyan, F. Fitzpatrick. 2015. Using Sediment Fingerprinting

Techniques to Elucidate Sediment and Phosphorus Transport Dynamics in an Agricultural Watershed. Oral Presentation. ASA, CSSA and SSSA International Annual Meeting, Minneapolis, MN, November 15-18, 2015.

- 3) Linton, D., A.M. Thompson, M. Kabbage. 2015. Fungal inoculation techniques specific to agricultural soil. Poster Presentation. 23rd Annual McNair Scholars Symposium. McNair Scholars: Creating the Discourse. University of California, Berkeley. July 30 – Aug 2, 2015.
- 4) Thompson, A.M. 2015. Conservation Subdivision/Development: A Water Perspective. Oral Presentation. International Urban Wildlife Conference 2015. Chicago, IL. May 17-20, 2015.
- 5) Thompson, A.M. 2015. Urban Hydrology and Stormwater Management. Oral Presentation. Sustainable Landscapes in the Built Environment Workshop. Madison, WI. October 16, 2015.
- 6) Thompson, A.M. 2015. Erosion and Sediment Delivery in Agricultural Watersheds. Oral Presentation. Water@UW Symposium, Madison, WI. May 11, 2015.
- 7) Zopp, Z., A.M. Thompson, S.C. Long, K.G. Karthikeyan, and F.W. Madison. 2015. Subsurface transport of cryptosporidium in soils of Wisconsin's carbonate aquifer region. Oral Presentation. AWRA Wisconsin Section Conference, Oconomowoc, Wisconsin, March, 5-6, 2015.

Professional Service

- 1) Department and University Activities
 - a) Chair, UW Nelson Institute Water Resources Management Graduate Program, 2015 - Present
 - b) Member, UW Committee for Undergraduate Recruitment and Financial Aid 2013-Present
 - c) Member, UW CALS Equity and Diversity Committee 2014-Present
 - d) Member, BSE Development and External Relations Committee 2013-Present

- e) Member, BSE Undergraduate Instruction and Program Committee 2002-Present
 - f) Member, BSE Awards Committee 2007-Present
 - g) Faculty Senator Alternate
 - h) Member, Biology in Engineering Certificate Program Committee 2009-Present
 - i) Member, The Nelson Institute for Environmental Studies, Water Resources Management Program Committee 2010-Present
 - j) Member, The Nelson Institute for Environmental Studies, Water Resources Management Program Graduate Admissions Committee 2015
 - k) Chair, R. Larson Mentor Committee 2011-Present
 - l) Mentor, Women Faculty Mentor Program 2010-Present
- 2) Professional
 - a) Associate Editor, Transactions of the ASABE 2008-Present
 - b) Representative, Consortium of Universities for the Advancement of Hydrologic Sciences, Inc. 2011-Present
 - c) Chair, ASABE SW-223, Soil Erosion Research Committee 2015-present
 - d) Vice-Chair, ASABE SW-223, Soil Erosion Research Committee 2013-2015
 - e) Member, American Society of Agricultural and Biological Engineers 1996-Present
 - f) Member, American Water Resource Association 2008-Present
 - g) Member, American Geophysical Union 2007-Present
 - h) Member, ASABE SW-21 Hydrology Committee 2004-Present
 - i) Member, ASABE SW-22 Erosion Control Committee 2004-Present
 - j) Member, ASABE BE-22 Ecological Engineering Committee 2003-Present
 - k) Technical Reviewer:
 - i) Geoderma; Hydrological Processes; Journal of Soil and Water Conservation

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

The group's research is largely focused in the following areas:

- 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.

Teaching

Biochem 621, "Plant Biochemistry" (contributed 4 lectures)

Graduate Students and Post Docs Advised

Degree program and expected completion date:

Ph.D. Students

Wu Lan	John Ralph	UW BSE	in progress	2016
Yanding Li	John Ralph	BSE	in progress	2017
Brian Keppler	Andrew Bent	UW CMB	in progress	2016
John Tran	Curt Wilkerson	MSU	in progress	2017
Emily Frankman	Curt Wilkerson	MSU	in progress	2017
J. Zachary Oshlag	Dan Noguera	UW CEE	in progress	2017
Brian J. Graham	Ron Raines	Biochem	in progress	2017
Oana Dima	Wout Boerjan	VIB, Gent, Belgium	graduated	2015
Zhouyang Xiang	Troy Runge	UW BSE	graduated	Jun 2015
Shengfei Zhou	Troy Runge	UW BSE	graduated	Jun 2015
Dan Gall	Dan Noguera	UW CEE	graduated	Oct 2015
Kate Helmich	John Ralph	UW Biochemistry	graduated	Oct 2015
Johnnie Walker	Brian Fox	UW Biochemistry	graduated	Nov 2015

[Type text]

Postdocs Advised

Ali Azarpira
Dharshana Padmakshan
Fengxia Yue
Alden Voelker
Ruili Gao
Rebecca Smith

Techs Advised

Matt Regner
Sarah Liu

Assistant, Associate, or Senior Scientists Advised

Yuki Tobimatsu (Assistant)
Steven Karlen (Assistant > Associate)
Fachuang Lu (Senior)
Hoon Kim (Senior)
Yukiko Tsuji (Assistant)
Vitaliy Tymokhin (Assistant)
Maggie Phillips (Research Coordinator, GLBRC)
Eva Ziegelhoffer (Research Coordinator, GLBR)

Research

- 1) Lignin management: optimizing yield and composition in lignin-modified plants.
C. Chapple, W. Boerjan, C. Halpin, X. Li
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-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.
- 2) Regulation and predictive modeling of lignin biosynthesis.
V.L. Chiang, F. Isik, J. Ducoste, R.R. Sederoff, H. Kim
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.
- 3) Plants Designed for Improved Processing
S.D. Mansfield, C.G. Wilkerson, J.C. Sedbrook, F. Lu
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.
- 4) Plant Cell Wall Profiling Facility
H. Kim
GLBRC (DOE Office of Science BER)

- This project was 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.
- 5) Development of Crucial Tools for Lignin Research
M.G. Hahn, F. Chen, S. Decker (F. Lu, Y. Zhu, H. Kim, J. Grabber)
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.
 - 6) Biodegradative oxidant production by fungi in lignocellulose
K.E. Hammel, C.G. Hunt
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.

Publications

Peer reviewed Journal Articles

- 1) Anderson NA, Tobimatsu Y, Ciesielski PN, Ximenes E,

- Ralph J, Donohoe BS, Ladisch M, Chapple C (2015) Manipulation of guaiacyl and syringyl monomer synthesis in an Arabidopsis Cinnamyl Alcohol Dehydrogenase Mutant results in atypical lignin biosynthesis and modified cell wall structure. *Plant Cell* 27(8): 2195-2209
- 2) Cass CL, Peraldi A, Dowd PF, Mottiar Y, Santoro N, Karlen SD, Bukhman Y, Foster CE, Thrower N, Bruno LC and others (2015) Effects of *PHENYLALANINE AMMONIA LYASE (PAL)* knockdown on cell wall composition, biomass digestibility, and biotic and abiotic stress responses in *Brachypodium*. *J. Exp. Bot.* 66(14): 4317-4335
 - 3) del Río JC, Lino AG, Colodette JL, Lima CF, Gutiérrez A, Martínez AT, Lu F, Ralph J, Rencoret J (2015) Differences in the chemical structure of the lignins from sugarcane bagasse and straw. *Biomass & Bioenergy* 81: 322-328
 - 4) Dima O, Morreel K, Vanholme B, Kim H, Ralph J, Boerjan W (2015) Small glycosylated lignin polymers are stored in Arabidopsis leaf vacuoles. *Plant Cell* 27(3): 695-710
 - 5) Grabber JH, Santoro N, Foster CE, Elumalai S, Ralph J, Pan X (2015) Incorporation of flavonoid derivatives or pentagalloyl glucose into lignin enhances cell wall saccharification following mild alkaline or acidic pretreatments. *BioEnergy Research* 8(3): 1391-1400
 - 6) Lan W, Lu F, Regner M, Zhu Y, Rencoret J, Ralph SA, Zakai UI, Morreel K, Boerjan W, Ralph J (2015) Tricin, a flavonoid monomer in monocot lignification. *Plant Physiol.* 167(4): 1284-1295
 - 7) Li Z, Bansal N, Azarpira A, Bhalla A, Chen CH, Ralph J, Hegg EL, Hodge DB (2015) Chemical and structural changes associated with Cu-catalyzed alkaline-oxidative delignification of hybrid poplar. *Biotechnology for Biofuels* 8(123): 1
 - 8) Lin Y, King JY, Karlen SD, Ralph J (2015) Using 2D NMR spectroscopy to assess effects of UV radiation on cell wall chemistry during litter decomposition. *Biogeochemistry* 125(3): 427-436
 - 9) Lu F, Karlen SD, Regner M, Kim H, Ralph SA, Sun R-c, Kuroda K-i, Augustin MA, Mawson R, Sabarez H and others (2015) Naturally *p*-hydroxybenzoylated lignins in palms. *BioEnergy Research* 8(3): 934-952
 - 10) Luterbacher JS, Azarpira A, Motagamwala AH, Lu F, Ralph J, Dumesic JA (2015) Aromatic monomer production integrated into the γ -valerolactone sugar platform. *Energy and Environmental Science* 8(9): 2657-2663
 - 11) Peoelking VGdC, Giordano A, Ricci-Silva ME, Rhys Williams TC, Peçanha DA, Ventrella MC, Rencoret J, Ralph J, Pereira Barbosa MH, Loureiro M (2015) Analysis of a modern hybrid and an ancient sugarcane implicates a complex interplay of factors in affecting recalcitrance to cellulosic ethanol production. *PLOS ONE* 10(8): e0134964, 1-25
 - 12) Piotrowski JS, H. O, Lu F, Li SC, Hinchman L, Rangjan A, Smith DL, Higbee AJ, Ulbrich A, Coon JJ and others (2015) Plant-derived antifungal agent poacic acid targets β -1,3-glucan. *Proc. Natl. Acad. Sci.* 112(12): E1490-E1497
 - 13) Smith RA, Gonzales-Vigil E, Karlen SD, Park J-Y, Lu F, Wilkerson CG, Samuels L, Mansfield SD, Ralph J (2015) Engineering monolignol *p*-coumarate conjugates into Poplar and Arabidopsis lignins. *Plant Physiol.* 169(4): 2992-3001
 - 14) Tsuji Y, Vanholme R, Tobimatsu Y, Ishikawa Y, Foster CE, Kamimura N, Hishiyama S, Hashimoto S, Shino A, Hara H and others (2015) Introduction of chemically labile substructures into *Arabidopsis* lignin through the use of LigD, the $\text{C}\alpha$ -dehydrogenase from *Sphingobium* sp. strain SYK-6. *Plant Biotechnol. J.* 13(6): 821-832
 - 15) Wagner A, Tobimatsu Y, Phillips L, Flint H, Geddes B, Lu F, Ralph J (2015) Syringyl lignin production in conifers: Proof of concept in a Pine tracheary element system. *Proc. Natl. Acad. Sci.* 112(19): 6218-6223
 - 16) Yelle DJ, Japich AN, Houtman CJ, Lu F, Timokhin VI, Fort RA, Ralph J, Hammel KE (2015) A highly diastereoselective oxidant contributes to ligninolysis by the white rot basidiomycete *Ceriporiopsis subvermispora*. *Appl. Environ. Microbiol.* 80(24): 7536-7544

Books & Chapters

- 1) Carpita N, Ralph J, McCann M (2015) The Cell Wall. In: Buchanan BB, Gruissem W, Jones RL (ed). *Biochemistry and Molecular Biology of Plants*. 2 ed. Chichester, UK, Wiley Blackwell. pp 45-110

Conference Proceedings

- Bartley LE, Peck ML, Lin F, Karlen SD, Ebert B, Zhang C, Sykes R, Gjersing E, Thibivilliers S, Lee S and others (2015) Genetic analysis reveals acyltransferases that incorporate hydroxycinnamates into grass cell walls. Gordon Research Conference on Plant Metabolic Engineering. Waterville Valley, NH.
- Helmich KE, Pereira JH, Heins RA, Gall D, McAndrew RP, Bingman C, Donohue TJ, Noguera DR, Simmons BA, Sale KL and others (2015) Structural sties of β -aryl ether lignin degradation. 2015 DOE Genomic Sciences Meeting. Washington, DC.
- Karlen SD, Lu F, Padmakshan D, Regner M, Pearson T, Zhu Y, Rencoret J, Smith RA, Withers S, Frankman E and others (2015) Introducing readily cleavable bonds into the lignin backbone: The Zip-Lignin™ strategy. 2015 DOE Genomic Sciences Meeting. Washington, DC.
- Petrik D, Lapierre C, Karlen SD, Cass C, Telander T, Ralph J, Sedbrook JC (2015) Mis-expressing PMT-like BAHD acyltransferases in *Brachypodium* results in altered cell wall composition and stunted growth. Gordon

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- Research Conference on Plant Cell Walls. Bentley U., Waltham, MA.
- Ralph J, collaborators a (2015) Lignin Utilization: from what we have now to where we can go with plant design. UK Royal Society, LBNNet Workshop. Manchester, UK.
- Ralph J, collaborators a (2015) Lignin Utilization: What can we do with 'normal' lignins and the recently 'discovered' novel lignins? MARS cocoa co-product Workshop. Morristown, NJ.
- Ralph J, coworkers ac (2015) Designer Lignins. International Symposium of Wood, Fiber and Pulping Chemistry. Vienna, Austria, U. Vienna, BOKU.
- Ralph J, coworkers ac (2015) Designer lignins for improving the utility of plant biomass. Global Innovation Research Organization Symposium. Koganei Campus, Tokyo U. of Agriculture and Technology, The Global Innovation Research Organization.
- Ralph J, coworkers ac (2015) Redesigning lignin for improved plant cell wall deconstruction. U. Tokyo Seminar Series. The University of Tokyo, Japan.
- Ralph J, coworkers ac (2015) 'Designing' lignins for the biorefinery. International Symposium on Frontiers Research in the Sustainable Humanosphere 2015. Kyoto U., Japan.
- Ralph J, coworkers ac (2015) Redesigning lignin for improved plant cell wall deconstruction – a case study. Tokyo University of Agriculture and Technology Seminar Series. Fuchu Campus, Tokyo University of Agriculture and Technology, Tokyo, Japan.
- Ralph J, coworkers ac (2015) Redesigning lignin for improved plant cell wall deconstruction – a case study. Tokyo University of Agriculture and Technology Seminar Series. Koganei Campus, Tokyo University of Agriculture and Technology, Tokyo, Japan.
- Ralph J, coworkers ac (2015) Designer lignins. The 60th Lignin Symposium. Tsukuba, Japan.
- Ralph J, coworkers ac (2015) Genetic engineering of lignins for improved process and utilization potential – Designer lignins. Marcus Wallenberg Invited Talks. Stockholm, Sweden.
- Ralph J, coworkers ac (2015) Plant improvement: How the future is shaping up for more facile plant cell wall conversion and improved valorization. USDOE BioEnergy 2015. Washington, DC.
- Ralph J, coworkers ac (2015) Pursuing plant traits for reducing processing recalcitrance and adding value. Gordon Research Conference on Plant Cell Walls. Bentley U., Waltham, MA.
- Ralph J, coworkers ac (2015) Engineering lignins designed for deconstruction. Gordon Research Conference on Plant Metabolic Engineering. Waterville Valley, NH.
- Ralph J, coworkers ac (2015) Cell wall profiling (Mainly NMR). International Symposium of Wood, Fiber and Pulping Chemistry, Presymposium Workshop on Analytical Methods. Tulln, Austria, U. Vienna, BOKU.
- Ralph J, coworkers ac (2015) Surprising structural detail and biological insight from NMR of complex natural polymer mixtures (plant cell walls). ANZMAG 2015 (Australian and New Zealand Magnetic Resonance Society). Waitangi, New Zealand, ANZMAG.
- Ralph J, Lu F, Karlen SD, Padmakshan D, Tobimatsu Y, Regner M, Smith R, Kim H, Zhu Y, Rencoret J and others (2015) Designing plant cell walls for deconstruction: Using monolignol ferulate conjugates to introduce ester bonds into the lignin backbone. International Symposium on Wood Science and Technology. Tokyo, Japan, IAWPS, Japan. Paper 3.
- Ralph J, Lu F, Karlen SD, Padmakshan D, Tobimatsu Y, Regner M, Smith R, Kim H, Zhu Y, Rencoret J and others (2015) Designing plant cell walls for deconstruction: Using monolignol ferulate conjugates to introduce ester bonds into the lignin backbone. Joseph E. Varner Memorial Lecture. Washington U., St. Louis
- Ralph J, Lu F, Karlen SD, Padmakshan D, Tobimatsu Y, Regner M, Smith R, Kim H, Zhu Y, Rencoret J and others (2015) An update on Zip-Lignins™ –Lignins 'designed for deconstruction'. American Chemical Society National Meeting. Denver, CO.
- Ralph J, Mansfield SD, Wilkerson CG, Lu F, Karlen SD, Padmakshan D, Withers S, Park J, Gonzales-Vigil E, Unda F and others (2015) Designing plant cell walls for deconstruction: Using monolignol ferulate conjugates to introduce ester bonds into the lignin backbone. Kinleith Mills special seminar series. Kinleith, New Zealand.
- Scheutz M, Benske A, Smith RA, Watanabe Y, Tobimatsu Y, Ralph J, Demura T, Ellis B, Samuels AL (2015) Laccases direct lignification in the discrete secondary cell wall domains of protoxylem. 2015 DOE Genomic Sciences Meeting. Washington, DC.
- Singh R, Hu J, Regner M, Ralph J, Saddler J, Eltis LD (2015) Enhanced delignification of steam-pretreated poplar by a bacterial laccase. 38th Symposium on Biotechnology for Fuels and Chemicals. San Diego, CA, SIMB. Paper 31515
- Smith RA, Gonzales-Vigil E, Karlen SD, Park J-Y, Lu F, Wilkerson CG, Samuels L, Ralph J, Mansfield SD (2015) Engineering monolignol *p*-coumarate conjugates into Poplar and Arabidopsis lignins. Gordon Research Conference on Plant Metabolic Engineering. Waterville Valley, NH.
- Yue F, Lu F, Ralph J (2015) Synthesis of lignin-derived dimers from thioacidolysis followed by Raney nickel desulfurization and their uses as GC quantitation standards. American Chemical Society National Meeting. Boston, MA.

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Awards

- 1) Awarded "Super Professor" (= Distinguished Professor) status at U. Tokyo, Japan, for 2015-16
- 2) American Society of Plant Biologists Highly Cited Author (2009-2013 papers)

Service

College Campus committees with approximate hours per year: ~200, Great Lakes Bioenergy Research Center (Management Team, and Plants Area Lead)

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; BioEnergy Sciences Center (BESC), Oakridge, TN;

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); LBNet, Royal Society (UK).

Conference Scientific Boards: "3rd Lignobiotech Symposium on Biotechnology Applied to Lignocelluloses (Lignobiotech III)" in Concepcion, Chile; "Eighteenth International Symposium on Wood, Fiber, and Pulping Chemistry" in Vienna, Austria.

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, 4; Other Faculty evaluations, 5.

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Ferencz S. 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

- 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

Publications

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

Patents

- 1) Dentrin Cell Targeting Compositions and Uses Thereof

Inventors:

Ferencz S. Denes, Madison, WI (US)

Zsuzsanna Fabry, Madison, WI (US)

Matyas Sandor, Madison, WI (US)

Patent # US 9,107,858 B2

Date of Patent: August 18, 2015

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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.

Teaching

Spring 2015

PhD course in wood chemistry – 30 students,
KTH, Stockholm, Sweden

Fall 2015

PhD course in bio-materials, 9 students,
KTH, Stockholm, Sweden

Publications

Peer Reviewed Journal Articles

- 1) Rowell, R.M. and Bongers, F. 2015. Coating acetylated wood. *Coatings* 5, 792-801.

Conference Proceedings

- 1) Rowell, R.M. 2015. Understanding decay resistance, dimensional stability and strength changes in acetylated wood. In: *Proceedings 58th International convention of society of Wood Science and Technology*, Jackson, WY, June 8-12, 641-651.
- 2) Laine, K., Segerholm, K. Wålinder, M., Rautkari, L., Hughes, M. and Rowell, R. 2015. Acetylation and densification of wood. In: *Proceedings, Northern European Network for Wood Science and Engineering, 11th Annual Meeting*, 14-15 September, Poznan, Poland.
- 3) Rowell, R.M. 2015. Performance of exterior windows and doors made from acetylated wood In *Proceedings: North American wood window and door symposium*, September 23-25, Madison, WI.
- 4) Rowell, R.M. 2015. Dimensional Stability and Fungal Durability of Acetylated wood: A new sustainable building material. In *proceedings: 1st International Scientific Conference WOOD – SCIENCE – ECONOMY*, Oct 5-7, Poznan, Poland.
- 5) Rowell, R.M. 2015. Correlation between equilibrium moisture content and resistance to

decay by brown-rot fungi on acetylated wood
In *Proceedings: 8th European conference on wood modification*, Oct 26-27, Helsinki, Finland.

Invited Conferences

1. 1st International Conference 'Innovations in Wood Materials and Processes', InWood 2015, "Understanding decay resistance, dimensional stability and strength changes acetylated wood", May 19-22, 2015, Brno, Czech Republic.
2. 58th International convention of society of Wood Science and Technology, "Understanding decay resistance, dimensional stability and strength changes in acetylated wood", June 8-12. 2015, Jackson, WY,
3. 11th Annual Meeting Northern European Network for Wood Science and Engineering, "Acetylation and densification of wood", 14-15 September, 2015 Poznan, Poland.
4. North American wood window and door symposium, "Performance of exterior windows and doors made from acetylated wood", September 23-25, 2015, Madison, WI.
5. 5th Accoya world conference, "Can wood that is not toxic be resistant to attack by fungi", September 13-16, 2015, Noordwijk, Netherlands.
6. 1st International Scientific Conference WOOD – SCIENCE – ECONOMY, "Dimensional Stability and Fungal Durability of Acetylated wood: A new sustainable building material", Oct 5-7, 2015, Poznan, Poland.
7. 8th European conference on wood modification, "Correlation between equilibrium moisture content and resistance to decay by brown-rot fungi on acetylated wood", Oct 26-27, 2015, Helsinki, Finland.

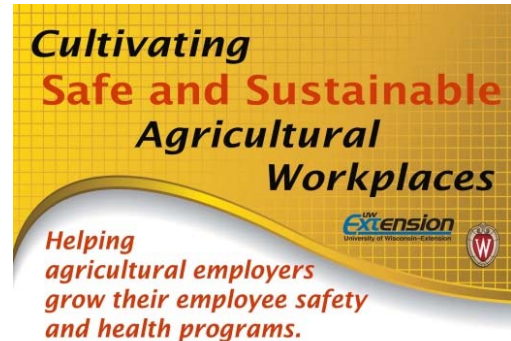
BSE CENTERS ACTIVITY REPORTS



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 2015. She serves as the co-chair for the education and outreach subgroup of the DOT/DATCP Road Study Committee. In early 2015, 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 publication on Lighting and Marking for Implements of Husbandry that is being used to inform farmers, dealers and manufacturers, agri-business, insurance, local government officials, highway commissioners, agricultural educators and UW Extension educators.

Teaching

- Farm Industry Short Course Agricultural Safety and Health (3 week – 1 credit course) 32 students

Extension programs

- Provided administrative assistance for the Wisconsin Safe Operation of Tractor and Machinery Certification Program for Youth Operators. Approximately 400 youth are 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/tractorcert>.
- Professional development presentation to 200 Wisconsin FFA Advisors on requirements of this program and other parts of the Fair Labor Standard Act related to minors working in agriculture.
- In collaboration with Wisconsin Farm Bureau Federation, Wisconsin Department of Instruction worked to clarify requirements of minors operating skid steer loaders with the Wisconsin Department of Workforce Development and Federal Department of Labor Wage and Hour.
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- Responded to programming requests resulting from Wisconsin OSHA outreach and enforcement efforts. **OSHA Related Activities** included:
 - Continued to update OSHA Dairy LEP resource materials and populate the fyi.uwex.edu/agsafety website.
 - Assisted 3 dairy farms with their safety and health programs.
 - Collaborated in the development a safety program for Wisconsin Custom Operator members that was recognized by insurance providers for reduced premiums to members. . Program was offered in March 2015 for 50 members and non-members. Co-taught session on Road Safety with Lt. Klingenberg, Wisconsin State Patrol.
- Administered \$19,200 for use with 2014-15 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 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. A new educational effort in 2015 related to the safe use of draglines and related technologies.
- Continued to develop and enhance the UW Center for Agricultural Safety and Health website (<http://fyi.uwex.edu/agsafety>)

Extension Disaster Education Network and Emergency Preparedness

- Continued as EDEN POC for UWEX.
- Serving as secretary for Executive Committee, 2014-2016.
- Served on annual conference planning committee for 2015.
- Participated in EDEN Strategic Planning Process.
- Serving on the Wisconsin Emergency Management All Hazards Mitigation Team and Radiological Emergency Program Recovery Team.
- Serving as an UWEX representative to Wisconsin Animal Health Emergency Management System (WAHEMS) and participated in a Foot and Mouth Preparedness Exercise, November, 2015.

- Assisted with development of educational materials related to stress for employers and employees in response to the Avian Influenza outbreak in collaboration with Wisconsin Public Health and the Wisconsin Farm Center, DATCP.

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/tractorcert>

Service

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 and 2015 Wisconsin Act 15. 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 are needed in both English and Spanish which

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requires additional consideration in educational design and development.

Goal 3: Significant changes to laws related to operating agricultural equipment on Wisconsin highways in continue in the 2016 legislative session.

- 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 and Wisconsin Farm Bureau Federation.

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.



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

Program Assistants:
Mackenzie Sarbacker (Summer)
Anna Gries (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 served 580 clients with 179 of those individuals being first time clients in our 2014-15 grant year. In its 24 years of existence, AgrAbility of Wisconsin has served over 2,600 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) La Crosse Farm Show- La Crosse, Jan 14-15
- 2) Rock County Ag Showcase- Janesville, Jan 29
- 3) Marshfield Mall Farm Show- Marshfield, Feb 18-19
- 4) MOSES Organic Farming Conference- La Crosse, Feb 26-28
- 5) Eau Claire Farm Show- Eau Claire, Mar 3-5
- 6) WI Ag Women's Summit- Madison, Mar 13-14
- 7) Ginseng Growers Conference- Marathon, Mar 14
- 8) AgrAbility of Wisconsin Summit- Marshfield, Mar 16
- 9) WPS Farm Show- Oshkosh, Mar 24-26
- 10) OTA Western Tech Class Farm Visit- La Crosse, Apr 1

- 11) Neighbor to Neighbor Meeting, Tom Murphy- Soldiers Grove, Apr 8
- 12) AgrAbility National Training Workshop- Rochester, NY, Apr 13-16
- 13) JCEP Conference- Appleton, Apr 28-29
- 14) Kewaunee County Rural Safety Day- Kewaunee, May 20
- 15) FFA Classroom Presentation- Jefferson, Jun 9
- 16) WI FFA Convention- Madison, Jun 9-12
- 17) Neighbor to Neighbor Meeting: Rick Casey- New Richmond, Jul 1
- 18) Skip Ellenbecker Golf outing- Marathon, Aug 7
- 19) Extension Day at State Fair- West Allis, Aug 11
- 20) Farm Tech Days- Sun Prairie, Aug 25-27
- 21) Chippewa Valley Farm City Day- Chippewa, Sept 12
- 22) CALS Career Fair- Madison, Sept 17

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- 23) Assistive Technology Resource Fair- Green Bay, Sept 23
- 24) FFA Farm Tour- Fall Creek, Sept 30
- 25) World Dairy Expo- Madison, Sept 29-Oct 3
- 26) MATC OTA class presentation- Madison, Oct 26
- 27) AgrAbility Advisory Council Meeting- Madison, Nov 4
- 28) UW Cooperative Extension State Conference- Madison, Nov 11-13

Teaching:

- 1) Madison Area Technical College OTA class presentation
- 2) La Crosse OTA class farm tour and informational session
- 3) FFA Classroom presentation

Publications:

- 1) AgrAbility Plowing Ahead Newsletter: 1/2015- Electronic- Steve Acheson, "Local Veteran Finds Peace on Farm"
- 2) Wisconsin Ag Connection: 1/29/2015- "NFMC, AgrAbility of Wisconsin to Hold Summit in March"
 - a. <http://www.wisconsinagconnection.com/story-state.php?id=114&yr=2015>
- 3) Agri-View: 2/11/2015- "AgrAbility conference set in March"
 - a. http://www.agri-view.com/briefs/regional/agrability-conference-set-in-marshfield/article_415c1f73-e3cf-5c12-bfdb-be9eba35e485.html
- 4) Wisconsin Ag Connection: 3/12/2015- "AgrAbility of Wisconsin Summit is next Week"
 - a. <http://www.wisconsinagconnection.com/story-state.php?id=301&yr=2015>
- 5) The Janesville Gazette: 3/21/2015- "AgrAbility helps Sharon farmer stay in business"
 - a. <http://www.gazettextra.com/20150321/agrability-helps-sharon-farmer-stay-in-business>
- 6) The Country Today: 3/23/2015- "New technologies reduce physical strain for farmers"
 - a. http://www.thecountrytoday.com/farm/article_a7344ae6-d172-11e4-a804-9389a97b8e6a.html
- 7) The Country Today: 3/23/2015- "Expert offers tips for avoiding injury"

- a. http://www.thecountrytoday.com/farm/article_c510997a-d172-11e4-90fb-2bb86e3405e3.html
- 8) Agri-View: 3/25/2015- "Programs Help Farmers with Challenges"
 - a. http://www.agri-view.com/news/regional/programs-help-farmers-with-challenges/article_4154c4b1-9919-52de-b97c-2a5020c4ebde.html
- 9) Agri-View: 3/26/2015- "Volunteer digs deep – helping and farming"
 - a. http://www.agri-view.com/news/regional/volunteer-digs-deep---helping-and-farming/article_3d96c62c-6c2e-5325-a120-bd2ac6326c0a.html
- 10) Green Bay Press Gazette: 3/30/2015- "Adaptive Equipment Helps Farmer"
 - a. <http://www.greenbaypressgazette.com/story/money/2015/03/30/adaptive-equipment-helps-farmer/70677214/>
- 11) Dairy Star: 3/30/2015- "Wear and tear of farm work"
 - a. <http://www.dairystar.com/main.asp?Search=1&ArticleID=10926&SectionID=1&SubSectionID=1&S=1>
- 12) Dairy Star: 4/10/2015- "Coming to his aid"
 - a. <http://dairystar.com/main.asp?SectionID=1&SubSectionID=1&ArticleID=10996>
- 13) Agri-View: 4/23/2015- "Farming Pain: Compensating without Compromising"
 - a. http://www.agri-view.com/feature/farmlife/farming-pain-compensate-without-compromising/article_0256e57e-9eae-5435-8b12-df6bcc3113c7.html
- 14) Helping Paws Blog: 7/9/2015- "One hurdle at a time"
 - a. <http://helpingpawsblog.org/2015/07/09/one-hurdle-at-a-time/>

Professional Development

- 1) WI Farm Bureau Federation Institute Class

Professional Service

- 1) Department
 - a. Biological Systems Engineering Social Committee Member (10 hrs/yr)
- 2) Professional (ASABE/Other)

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- a. National AgrAbility Networking committee member
- b. National AgrAbility Marketing committee member
- c. National AgrAbility Evaluation committee member

3) Civic Service

- a. Rock County Farm Bureau- membership committee member, Leadership Institute participant, YFA Committee chair
- b. Church Social Media Committee member
- c. World Dairy Expo Volunteer
- d. Andrew's Voice Marketing Coordinator Volunteer

ACADEMIC STAFF ACTIVITY REPORTS



Jeff Nelson

Assistant Faculty Associate / Computer Support

(Promoted from Senior Research Specialist - effective May 1)

60% Teaching / 20% Computer Support / 20% Other activities supporting the Dept. and Extension

Power and Machinery, Precision Agriculture, Information Technology

Teaching

Farm Power Short Course: 2 Credits, 28 Enrolled
Precision Agriculture Short Course: 2 Credits, 27 Enrolled
Farm Machinery Short Course: 3 Credits, 15 Enrolled
BSE 243: 3 Credits, 15 enrolled

Appeared on the front page of AgriView newspaper (Dec. 10, 2015) as a part of a story on the Farm and Industry Short Course:

http://www.agriview.com/news/education/students-put-short-course-lessons-to-work/article_0e03ba7d-20dd-5b30-bf4c-d028f2763b20.html

Guest lectures / demonstrations for department courses:

- 1) Fundamentals of GPS for BSE 201.
- 2) 3D printing and scanning for BSE 365 labs
- 3) Tillage Equipment and Residue Management for BSE 472
- 4) Unmanned Aerial Vehicles (UAVs) for BSE 475

Extension/Outreach Activities

- 1) 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.
- 2) Provided a Farm Safety talk to the International Farmers Aid Association group on campus. Presented to 20 people through an interpreter.
- 3) Presented "How to Handle Emergencies" to a safety training day for Wisconsin Custom Operators. Approx. 40 attendees
- 4) Worked with Brian Luck on a project to video tractor maneuvering for updated WI Tractor Safety course videos. Project was coordinated by Bill Halfman,

Monroe County Agriculture Agent. We flew a UAV to get video from above for various tractor maneuvers and driving situations.

Information Technology Support

- 1) Major activity this year was switching the department over to Office 365. Served as the department's Migration Coordinator. Many meetings with DoIT to work out a migration schedule. Coordinated on-site student support on migration day for faculty and staff. Met with many on an individual basis to answer questions and train on use of Office365.
- 2) BSE purchased a DJI Vision2+ UAV. Maintain the UAV and train people in its use.
- 3) 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.
- 4) 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.
- 5) Maintain the department's network infrastructure as a DoIT Authorized Agent.
- 6) Represent the department on a CALS Info Tech user group.
- 7) Local support contact for the 101 classroom AV system (liaison with Classroom Media Services). 101 was upgraded with a new AV system this year. Worked with Classroom Media Services to make sure department needs were met and to assist with the install. Coordinated removal of rear cabinet in 101 with the Electric Shop.
- 8) Maintain an AV system in the B25 and 118 classrooms. Updated AV switches for B25 and 118.

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Equipment was at no cost to the department.

Installed speakers in both classrooms

- 9) Maintain the Main Hall Information monitor. Create announcements and maintain hardware.
- 10) Assisted Dr. Brian Luck and Dr. Chris Choi 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.

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 Director to determine policies and procedures for the FISC program.

Departmental Support Activities

- 1) Attend various seminars related to Instructional Technology and campus computing issues
- 2) Produced a departmental display at the Majors Fair in Union South
- 3) Assisted with maintaining department Continuation Of Operations Plan (COOP) and Emergency Occupant Plan
- 4) Assisted Debby Sumwalt with recording BSE901 presentations via Blackboard Collaborate for students and faculty to review for improvement
- 5) Assisted Brian Luck with advising the Quarter Scale Tractor Pulling Team.
- 6) Maintain the department's large format printer. Assist with poster design and production for conferences and meeting.
- 7) Served on a Master's Degree Committee for Brandon Nigon

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



Astrid Newenhouse

Senior Scientist, Ph.D.

462% FTE Jan.-April, 40% FTE May, 32% FTE June-Dec

Program affiliations: Affiliated with 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 mainly 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.

Teaching

Provide help in the classroom with logistics and guest speakers for BSE 367, Renewable Energy Systems, taught by Doug Reinemann.

Extension/Outreach Activities

- 1) 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.
- 2) Provide assistance to MilkTech professional development courses (an international on-line curriculum).
- 3) Provide assistance with annual Stray Voltage Investigators Courses.
- 4) 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. In 2015, for example, a request came from organizers of a new urban food systems resource portal called the Community and Regional Systems (CRFS) Project (<http://www.community-food.org/>). They asked if they could include several of Newenhouse's publications such as the Plain Language Growers Guides Series and a handout

on Postharvest Handling for Best Crop Quality.

Also in 2015, Newenhouse was asked to provide quotes for the book *Soil Sisters; A Toolkit for Women Farmers*, by Lisa Kivist.

- 5) Maintain connections to farm managers, advisors, researchers, and tool distributors in US and abroad concerning work efficiency and ergonomics.
- 6) Work within the department as an ad-hoc Senior Scientist.
- 7) Guest speaker on Larry Meiller's WHA radio call-in show, "Garden Talk", Dec. 11 2015.

Research:

- 1) Title: Understanding Crop Irrigation Website Content Upgrade
 - 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-SARE Wisconsin
 - Summary: The website "Understanding Crop Irrigation" is a UW Cooperative Extension FYI site ("For your information") which was created in January 2015. In July and August a redesign was performed which added much content to the site. There are currently 11 tabs in the toolbar with information and links

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to over 40 resources from 20 state universities and federal agencies. Examples of topics covered are irrigation basics, soil moisture management, irrigation system testing, irrigation scheduling, sprinkler irrigation, drip irrigation, equipment, and educational training. The resources include articles, presentations, book chapters, spreadsheets, software, and videos.

- 2) Title: 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 to 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.

Publications:

Website

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

Book

Machine Milking, Volume I, by Graeme Mein and Doug Reinemann. Published through Create Space 2014 and available on Amazon October, 2015. ISBN: 1517603110, and ISBN-13: 9781517603113. (Newenhouse assisted with images and layout to help publish the book through Create Space.)

Professional Development Activities:

- 1) Participated in UW Cooperative Extension State Conference, and regular meetings of the Agriculture and Natural Resources Education Program Area.
- 2) Participated in CALS Communicators Meetings

Service

Departmental Committees

- 1) Extension Committee (10 hrs)
- 2) Social Committee (20 hrs)

Other

- 1) Guest on WI Public Radio
- 2) 4-H County Fair Judge
- 3) Girl Scout Troop Leader
- 4) Healthy Lawn Team (non-profit) board member & speaker on organic lawn care.

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John 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 2015

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

Fall 2015

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:

- 1) Joe Sanford; (MS); Biological Systems Engineering (2013 – 2016).
- 2) Josh Accola; (MS); Biological Systems Engineering (2012-2015).

Extension / Outreach

Irrigation Water Management

1. Farm Tech Days, field display and booth in innovation square, Dane Co. 30 contacts.
2. Overseeing the WISP 2012 software upgrade and the updating of web-based Ag. Weather Service.
3. Awarded Donald Peterson Outreach Award for 2014 Farm Tech. Days show.
4. Irrigation workshops & programs –
 - a. Hancock Station, conducted 2 irrigation field trainings with Scott Sanford, 25 attendees.
 - b. Webinar with Scott Sanford on soil moisture monitoring, 40 attendees.

- c. Central WI Processing Crops Mtg., speaker, 28 attendees.
- d. North Central Regional Water Network, Speed webinar, Irrigation Activities in WI, 20 attendees.
- e. WI Potato & Veg. Growers Ed. Mtg., speaker, 125 attendees.
- f. WI Crop Mgmt. Conference, Speaker, 100 attendees.

Drainage

Tile Drainage of Agricultural Land, De Pere, WI, 92 attendees.

Nutrient Management/Water Quality

- a. WI Crop Management Conference, speaker, 100 attendees.
- b. Initiated Tech. advisory to develop a new barnyard evaluation model.
- c. WI Land & Water Conservation Assoc., invited speaker, 82 attendees.

Agent Ratings

Average of all categories: N.A / 5.0

External (Not UW) Partner Ratings

Average of all categories: N.A.

Funded Research Projects

- 1) Sustainable Ag. Research and Ed. (SARE) Grant Principal investigator.
Funding: USDA – SARE
Objectives: Funding to upgrade the UWEX Understanding Crop Irrigation web site.
- 2) Collaborator, Preserving Water Resources in Central WI
Lead Investigators: A.J. Bussan, Russell Groves

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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.

- 3) The Effects of Surface Roughness on Snowmelt Runoff

Funding: USDA / CIG

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

Publications

Peer reviewed Journal Articles

- 1) Vadas, P. A., L.W. Good, **J. C. Panuska**, D. L. Busch and R.A. Larson. A New Model for Predicting Phosphorus Export in Runoff from Outdoor Cattle Lots. *Trans. ASABE*, 58, 1035-1045

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

Professional Development

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

Service

- 1) Land surveying technical assistance to the Dept of Agronomy and the Dept. of Soil Science. (20 hrs.)
- 2) Completed design and field stakeout for a grassed waterway at the Arlington Ag. Research Station. (30 hrs.).
- 3) Technical advisor to the Standards Oversight Council for stormwater treatment swales to develop a new statewide engineering design standard.

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Scott Sanford

Distinguished Outreach Specialist (M.Eng)
Rural Energy Program
30% Extension, 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. 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 2015

HORT 334: Greenhouse Energy Efficiency
– guest lecture, March 5

Fall 2015

BSE 473 – Irrigation equipment

Extension/Outreach Activities

- 1) Farm Tech Days. Education Co-Chairperson. Organized and manned the UWEX tents at the Statz Farm
- 2) Midwest Forage Association meeting – Wisconsin Dells, Presentation: Irrigation 101, Jan 20 - ~ 45 attendees
- 3) Wisconsin Frame Builders Association – Eau Claire, Presentation: Energy Efficient Lighting, Jan 21 - ~ 30 attendees
- 4) Brown Co Commercial Greenhouse meeting, Presentation: Greenhouse Energy Efficiency, Jan 22 – 23 attendees
- 5) New Jersey Vegetable Growers Conference, Feb 4, Presentation: Energy Issues for Indoor Crop Production & On-Farm Crop Storage, ~ 35 attendees
- 6) State Line Fruit and Vegetable Growers meeting, Feb 5, Rockford, IL, Presentation: On-Farm Cold Storage, ~ 25 attendees
- 7) USDA/NRCS Energy training Workshops (3 days/each) April 21-23, June 9-11, 23-25; 70 attendees
- 8) Wood Energy Webinar Series, Series of 8 webinars for the general public. Feb. 18, 25, March 4, 11, 18, 25, April 1, 8. 56 people registered for 282 webinars or average of 5 per person.

- 9) Irrigation Management Professional Development training. Webinar series, March 10, 17, 24, 31, April 7; 54 attendees
- 10) Irrigation Management PD workshops – Hancock June, Spooner – August 13; 31 attendees
- 11) Midwest Farm Energy – Morris, MN; Presentation: Energy Efficient Lighting, June 17, 62 attendees
- 12) Milwaukee Co – Beginning Farmer meeting, Irrigation 101, June 30, 18 attendees
- 13) Commercial Flower Growers of WI, Greenbay, WI, Presentation: Energy Efficient wood Burning Appliances, Sept 22, - 10 attendees
- 14) Commercial Flower Growers of WI Annual meeting, Denmark, WI, Booth Display about wood energy. Oct 7, - 40 attendees.

Agent Ratings

UWEX Agent Outcome Rating: 3.86/5 (2014)

Research

Energy

- 1) On-Farm Energy Quality Assurance Training – Sanford PI. Funding from USDA-NRCS (\$100,000). Develop series of webinars for training NRCS personnel about energy use in different agricultural enterprises. Provide written materials and references for webinar presentations. Setup and coordinate an in-person field training workshops. Provide consultation on reviewing audits. Project Dates: 9-24-2013 to 9-30-2015
- 2) 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, Clint Fandrich - WI State Energy Office Don Peterson

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- , 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.

- 3) Essential Oil Extraction process engineering for improved energy efficiency, Sanford PI, Funding: USDA – NIFA – Specialty Crops (Year 1 - \$226,905). Collaborator: D. Bohnhoff, Develop a proto-type continuous flow steam distillation system and a closed-loop condensate water cooling system. Year 1 is development and testing, Year 2 & 3 will be modifications and on-farm testing. Project Dates: 9-1-2015 to 8-31-2018

Structures/Construction

- 1) 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

Natural Resource

- 1) Irrigation Water Management in Wisconsin. Wisconsin SARE Climate and Irrigation Grant, Sanford – PI. Funding: WI SARE State Coordinator - Funding from USDA-National Institute of Food & Agriculture (\$7500). Collaborator: John Panuska. Provided five webinars starting with an introduction to irrigation and progressing to soil water management, tools for measuring soil moisture, irrigation scheduling tools including WISP-2012, irrigation system testing for uniformity, irrigation system operating costs and maintenance. Also held 3 hands on workshops to train how to perform a uniformity test, types and installations of soil moisture sensors and a demonstration of drip irrigation. Also revised Extension Bulletin A3600, Irrigation Management and produced 2 new

publications on soil moisture monitoring and basics of drip irrigation. Project Dates: 1-1-2015 to 12-31-2015.

- 2) Companion cropping in row crop system, Sanford – PI, Collaborator: Funding: WI SARE State Coordinator - Funding from USDA-National Institute of Food & Agriculture (\$1550). Nick Baker, UW Extension. Field plot study to assess if micro-clover or Kentucky bluegrass could be used as a permanent cover crop to reduce erosion from spring and summer high intensity rainfall events. Study was to assess what the yield reduction would be in a non-irrigated system and if the drought resistant corn varieties being marketed would perform any better. Project Dates: 3-1-2015 to 12-31-2015.

Publications

Peer Reviewed Publications

- 1) Irrigation water Management in Wisconsin, Scott Sanford, John Panuska, A3600-01, UW-Extension Publication
- 2) Method to Monitor Soil Moisture, John Panuska, Scott Sanford, A3600-02, UW-Extension Publication
- 3) On-Farm Cold Storage of Fall-Harvested Fruit and Vegetable Crops: Planning, Design and Operation, Scott Sanford, John Hendrickson, A4105, UW-Extension Publication

Radio Spot

- 1) Wood Energy Feasibility Study with Sevie Kenyon (3 minute)

Awards

- 1) ASABE 2015 Educational Blue Ribbon Award – Lighting Technology: LED lamps for Home, Farm and Small Business, Scott Sanford

Service

- 1) Departmental committees
 - a. Social Committee – ~20 hrs
 - b. Extension – 1-2 hrs
- 2) College Campus committees – None

Professional Service

- 1) ASABE Committees
 - a. PAFS-303 – Environment of Plant Structures
 - b. PAFS-403-1 – Milk Handling Equipment
 - c. PRS-702 – Crop & Feed Processing & Storage
 - d. NRES-24 – Irrigation
 - e. NRES-241 – Sprinkler Irrigation

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- f. ES-300 – Electrical Utilization and Energy Application – Chair
- g. ES-310 – Ag Lighting Group – Chair of std EP344.5 revisions

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Paul Thompson

Senior Scientist, Ph.D.
100% Research

Also Adjunct Professor in Biomedical Engineering

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. Secondly, he develops modifications to traditional pulsation systems to improve repeatability of data collection and to improve milking effectiveness.

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 2015

BME 402, 1 Credit, 13 Enrolled

Fall 2015

BME 400, 3 Credits, 18 Enrolled

Instructor Rating: 4.75/5.0

Graduate and Post Doc Advisees

- 1) John Penry, Ph.D. Dairy Science (member of his committee). Expected graduation: 2017.

Research

- 1) Milking Machine Research

Collaborators: D.J. Reinemann, BSE

Funding: Avon Dairy Solutions

Objectives: Advance the science of biomechanics of machine milking and milking management.

Publications

Peer reviewed Journal articles

- 1) A Quarter Milking Analysis Device – Description and Demonstration. J. Upton, D. Reinemann, J. Penry and P. Thompson. Submitted to Biosystems Engineering. 2015.
- 2) Effect of Pulsation Rest Phase Duration on Teat End Congestion. J. Upton, M. D. Rasmussen, P. Thompson, D. Reinemann and J. Penry. Accepted for publication, Journal of Dairy Science, 2016.
- 3) Methods of Estimating Liner Compression. S. Leonardi, J. Penry, F. Tangorra and P. Thompson. Journal of Dairy Science, 98 (10): 6905-6912. 2015.
- 4) A Method for Assessing Liner Average Milk Flow Rate Performance. J. Penry, S. Leonardi, J. Upton, P. Thompson and D. Reinemann. Submitted to Journal of Dairy Science. 2015

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U.S Patents

- 1) 8,949,034 "System and Method for Health Monitoring Using Real-Time Location" P. Rajkondawar, R. Erdman, D. Johnson, W. Nelson and P. Thompson. 2015.
- 2) 8,950,357 "System and Method for Milking Stall Assignment Using Real-Time location" P. Rajkondawar, R. Erdman, D. Johnson, W. Nelson, P. Thompson and G. Steingraber. 2015
- 3) 9,044,297 "System and Method for Health Monitoring Using Real-Time location" P. Rajkondawar, R. Erdman, D. Johnson, W. Nelson and P. Thompson. 2015

Poster Presentations

- 1) Using Average Milk Flow to Map Liner Performance. J. Penry, S. Leonardi, P. Thompson and D. Reinemann. Presented at 54th Annual Meeting, National Mastitis Council. 2015.

- 2) Comparing Methods of Estimating Liner Performance. S. Leonardi, J. Penry, F. Tangorra, P. Thompson and D. Reinemann. Presented at 54th Annual Meeting, National Mastitis Council. 2015.

Professional Development

- 1) Participated in: "Milking Machine All-Stars" seminar and workshop at UW-Madison, April, 2015.

Service

- 1) Departmental:
Social Committee, approximately 20 hours annually
- 2) ASABE:
 - a. PAFS-403/1, Milk Handling Equipment Committee
 - b. T-11, Energy Committee