



Biological Systems Engineering

UNIVERSITY OF WISCONSIN-MADISON

2017 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

Preface

The Biological Systems Engineering Department at the University of Wisconsin Madison is the oldest agricultural engineering program in the United States. But our 113-year-old department has continually reinvented itself to maintain a leadership role in research, teaching, and extension. Building on its strong agricultural engineering history, the department has continued to grow in many exciting, innovative, and progressive activities as described in this document.

To that end, we are pleased to provide you with our Annual Summary, based on activities underway and completed in calendar year 2017. The Biological Systems Engineering Department is affiliated with the College of Agricultural and Life Sciences, the College of Engineering, the UW-Madison Agricultural Research Stations, and the University of Wisconsin Cooperative Extension Service. The mission of the department includes achieving excellence in teaching, research and extension. Our Biological Systems Engineering undergraduate program is fully accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>. The graduate program offers both Master of Science and Doctoral degrees. We have 218 undergraduate and 45 graduate students. The department offers a wide range of courses with options in Machinery Systems Engineering, Food and Bioprocess Engineering, Natural Resources and Environmental Engineering.

The goal of our research program is to contribute new and valuable knowledge to the fields of machinery systems, food and bio-processing, natural resources and environment, construction, bio-energy and energy systems, and agricultural safety and health. Research projects also serve to train graduate students and to increase the quality of undergraduate education. Our research program is financially supported by state and federal appropriations and by gifts and grants from industry, government agencies, and individuals. The gifts and grants support is gratefully acknowledged, as a critical part of our 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 feel free 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.



Troy Runge, Assc. Professor and Chair
Biological Systems Engineering Department, UW-Madison
Email: trunge@wisc.edu
Phone: (608) 890-3143
460 Henry Mall, Madison WI 53706

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People

Faculty

Anex, Robert: Professor, Ph.D., Teaching/Research
Bohnhoff, David: Professor, Ph.D., Teaching/Research
Choi, Christopher: Professor, Ph.D., Teaching/Research
Gunasekaran, Sundaram: Professor, Ph.D., Teaching/Research
Kammel, David: Professor, Ph.D., Extension/Research
Karthikeyan, K.G.: Professor, Ph.D., Teaching/Research
Larson, Rebecca: Assistant Professor, Ph.D., Teaching/Research
Luck, Brian: Assistant Professor, Ph.D., Extension/Research
Pan, Xuejun: Associate Professor, Ph.D., Teaching/Research
Reinemann, Douglas: BSE Chair, Professor, Ph.D., Extension/Teaching/Research
Runge, Troy: Associate Professor, Ph.D., Teaching/Research
Shinners, Kevin: Professor, Ph.D., Teaching/Research
Shutske, John: Professor, Ph.D., Extension/Teaching/Research
Straub, Richard: Professor, Ph.D., Teaching/Research, Associate Dean of CALS
Thompson, Anita: Professor, Ph.D., Teaching/Research

Affiliated Faculty

Etzel, Mark: Professor, Ph.D., Food Science
Hanna, Awad: Professor, Ph.D., Civil & Environmental Engineering
Hartel, Richard: Professor, Ph.D., Food Science
Long, Sharon: Professor, Ph.D., Soil Science
Ralph, John: Professor, Ph.D., Biochemistry

Senior Scientists

Nelson, Shawn: Ph.D., Biological Systems Engineering
Vadas, Peter: Professor, Ph.D., U.S. Dairy Forage Research Center
Zhu, Jun Yong: Professor, Ph.D., Forestr

Emeritus Faculty and Staff

Bohne, Harold M.
Massie, Leonard R.
Bubenzer, Gary D.

Muck, Richard E.
Buelow, Frederick H.
Peterson, James O.

Chapman, Larry J.
Pharo, Candice
Converse, James C.
Rowell, Roger M.
Cramer, Calvin O.
Schuler, Ronald T.
Denes, Ferencz S.

Schwarz, James
Finner, Marshall F.
Sumwalt, Debby
Holmes, Brian J.
Walsh, Patrick W.
Koegel, Richard G.

Academic Staff

Aguirre-Villegas, Horacio: Assistant Scientist
Jensen, Abigail: Associate Outreach Specialist, AgrAbility of Wisconsin
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: Distinguished Senior Scientist
Yang, Qiang: Assistant Scientist
Zopp, Zachariah: Assistant Researcher

Technical Personnel

Habeck, Kody: Senior Instrument Maker
Friede, Joshua: Associate Instrument Specialist

Office Personnel

Meyer, Terry: Financial Specialist
Reinen, Sue: Academic Department Supervisor
Spahn, Pam: Payroll and Benefits Specialist
Wood, Elizabeth (Betsy): Univ Svc Prg Assoc

Research Associates

Chen, Mingjie (Runge)
Sharara, Mahmoud (Runge)
Drewry, Jessica (Luck)

Mylamparabil Udayan, Anu Prathap (Guna)
Zhou, Bo (Choi)

Master's Students

Buschert, Elizabeth (Thompson)
Eisner, Natalie (Luck)
Evans, Jeffrey (Anex)
Flick, Daniel (Shinners)
Fuller, Sarah (Thompson)
Harmon, Joshua (Luck)

Jordan, Kari (Gunasekaran/Connelly)
Jozik, Natalie (Anex)
McAfee, Joshua (Shinners)
Nigon, Cyrus (Shinners)
Powers, Andrew (Thompson)
Price, Evan (Runge)

Skog, Andrew (Thompson/Wu)
Thiede, Justin (Shinners)
Walters, Chase (Shinners)

Wang, Zening (Pan)
Yang, Shu-ching (Pan)

Ph.D. Students

Atkins, Ian (Choi)
Bashar, Rania (Karthikeyan)
Boswell, Edward (A. Thompson)
Brotz, Michael (Anex)
Francis Clar, Jordi (Anex)
Gaillard, Richard (Vadas)
Gu, Lei (Anex)
Guan, Jiehao (Gunasekaran)
He, Shengzhi (Bohnhoff)
Holstein, Andrew (Bohnhoff)
Kim, Joonrae (Karthikeyan)
Li, Ning (Pan)
Li, Yanding (Ralph)

Liao, Yang (Pan)
Lu, Lin (Gunasekaran)
Mandalika, Anurag (Runge)
O'Dell, Jane (Rowell/Etzel)
Ortiz Reyes, Edgardo (Anex)
Prasad, Laxmi Raja Vara (Thompson)
Sanford, Joseph (Larson)
Urena-Saborio, Hilary (Gunasekaran)
Wang, Hui (Larson/Noguera)
Yin, Yaoqi (Gunasekaran)

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
110	Intro to Engineering Grand Challenges	Inter Engr.	1
170	Intro to Engineering Design	Inter Engr.	2
201	Land Surveying Fundamentals	CALS	2
249	Engineering Principles for Biological Systems.	BSE	3
270	Intro to Computer Aided Design	BSE	3
308	Career Management for Engineers	BSE	1
349	Quantitative Techniques for Biological Systems	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
508	BSE Design Practicum I - Instruction	BSE	2
509	BSE Design Practicum II - Instruction	BSE	3
571	Small Watershed Engineering	BSE	3
671	Topics in Natural Resource Engineering	BSE	3
717	Water Resources Management Practicum	GNIES	1
718	Water Resources Management Practicum	GNIES	2
719	Water Resources Management Practicum	GNIES	4
875	Mobile Fluid Power Systems	BSE	3
875	Milking Machines	BSE	3
875	Introduction to Integral Ecology	IES	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 the environmental impacts of agricultural systems and the sustainability of biorenewable chemicals and other engineered systems that depend on agriculture. Dr. Anex's research group is currently studying the economic and environmental feasibility of biorenewable chemicals, corn production under changing climate, monitoring of soil microbial activity, life-cycle impacts of irrigation systems.

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).

Teaching

Spring 2017:

- BSE 349, Quantitative Techniques for Biological Systems, 3 Credits, 83 enrolled
- BSE 365 Measurement and Instrumentation for Biological Systems, 3 credits, 53 enrolled.
- BSE 508, Biological Systems Engineering Design Practicum I, 2 Credits, 5 enrolled
- BSE 799, Practicum Agricultural Engineering Teaching, Various credits, 1 enrolled
- BSE 990, Various Research Credits, 1 enrolled

Fall 2017:

- BSE 001, Cooperative Education Program, 1 Credit, 2 enrolled
- BSE 509, Biological Systems Engineering Design Practicum II, 2 Credits, 4 enrolled
- BSE 900, New Graduate Seminar, 1 Credit, 14 enrolled
- BSE 990, Various Research Credits, 2 enrolled

Graduate and Post Docs Advisees

- 1) Jordi Francis Clar, Ph.D., BSE, 2020.
- 2) Michael Brotz, Ph.D., BSE, 2020
- 3) Mahmoud Sharara, Post-Doctoral Researcher, Co-advised with Troy Runge.
- 4) Benjamin Duval, Research Associate.

Graduated

University of Wisconsin, USDA Agricultural Research Service – Columbus, Ohio, South Dakota State University,

- 5) Spencer Evans, M.S., BSE & Agroecology, 2017.
- 6) Lei Gu, Ph.D, BSE, 2017.
- 7) Edgardo Ortiz-Reyes, Ph.D, BSE, 2017.

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) Quantifying nitrogen loss trade-offs between early and late fall dairy manure application. Funding: National Institute of Food and Agriculture (NIFA) and Hatch Program funds. Collaboration with Dr. Carrie Laboski, Soil Science Department.
- 3) 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.
- 4) 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, and USDA National Institute of Food and Agriculture (USDA-NIFA).

- 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.

Publications

2017 Citations: 404

Peer-Reviewed Journal Articles

- 1) Ortiz-Reyes, E., Anex, R.P., 2017. A life cycle impact assessment method for freshwater eutrophication due to the transport of phosphorus from agricultural production. *Journal of Cleaner Production*. doi.org/10.1016/j.jclepro.2017.12.255.
- 2) Harmon, J., B. Luck, K.J. Shinnars, R.P. Anex, J. Drewry, 2017. Time-motion analysis of forage harvest: A case study. *Transactions of the ASABE*. DOI: 10.13031/trans.12484.
- 3) Iqbal, J., Necpalova, M., Archontoulis, S.V., Anex, R.P., Bourguignon, M., Herzmann, D., Mitchell, D.C., Sawyer, J.E., Zhu, Q. and Castellano, M.J., 2017. Extreme weather-year sequences have non-additive effects on environmental nitrogen losses. *Global Change Biology*. DOI: 10.1111/gcb.13866.
- 4) Gunukula, S. and R. Anex. 2017. Techno-economic analysis of multiple bio-based routes to adipic acid. *Biofuels, Bioproducts and Biorefining* 11(5): 897-907.
- 5) Gunukula, S., T. Runge, R. Anex. 2017. Assessment of biocatalytic production parameters to determine economic and environmental viability. *ACS Sustainable Chemistry and Engineering* 5(9):8119-8126.
- 6) Anthony, R., M. Sharara, T. Runge, R. Anex. 2017. Life cycle comparison of petroleum- and bio-based paper binder from Distillers Grains (DG). *Industrial Crops and Products* 96: 1-7.
- 7) Gunukula, S. and R. Anex, 2016. Evaluating and guiding the development of sustainable biorenewable chemicals with feasible space

analysis. *Biochemical Engineering Journal* 119: 74-8

Abstracts, Posters, and Oral Presentations

- 1) Iqbal, J., M. J. Castellano, M. Necpalova, S. V. Archontoulis, J.E. Sawyer, D. Herzmann, R. P. Anex. 2016. Extreme precipitation years impact soil N loss in mid-west corn-soybean cropping system. ASA, CSSA, & SSSA Annual Meeting, Baltimore, MD, November 7.
- 2) Ortiz-Reyes, E. and R. P. Anex. 2017. Environmental performance of isoprene produced from fermentable sugars. National Conference of Minorities in Agriculture, Natural Science and Related Science, Pittsburgh, PA.

Service

Professional

- 1) Associate Editor, *Journal of Industrial Ecology*
- 2) Associate Editor & Editorial Board member, *International Journal of Life Cycle Assessment*
- 3) Member, Leadership Team, NSF Engineering Research Center for Biorenewable Chemicals
- 4) Member, Climate and Corn-based Cropping Systems Coordinated Agricultural Project Leadership Team

University

- 5) Member, UW Physical Sciences Divisional Committee
- 6) Member, UW Baldwin Wisconsin Idea Endowment grant review committee

College of Agriculture and Life Sciences

- 7) Member, Agricultural and Applied Economics Program review committee

Biological Systems Engineering

- 8) Chair, BSE Undergraduate Instruction and Program Committee
- 9) Member, BSE Graduate Instruction and Research Committee

Other

- 10) Member, Wisconsin Energy Institute, Executive Committee
- 11) Proposal review: NSF-CBET, Swiss National Science Foundation



David Bohnhoff

Professor, Ph.D.

50% Teaching / 50% Research

Structural and Building Construction Engineering

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

Work associated with post-frame buildings falls into four primary categories: development of new analysis techniques, development and evaluation of new structural components, creation of new construction techniques and equipment, and dissemination of knowledge via development and interpretation of national standards and rewriting of the NFBA Post Frame Building Design Manual. Work during 2017 was primarily dedicated to development of diaphragm trusses, precast concrete posts, rigid connections for attaching wood posts to concrete, and wood post fabrication equipment; the rewriting ASAE 486.3, and the creation of an electronic workbook for application of ASAE EP486.3.

Research on building environment control in 2017 was focused on rotatable guarded hot box (RGHB) testing of four post-frame wall configurations. Approximately 50 tests were conducted involving insulated and uninsulated specimens featuring separate outer and inner inset girts, and insulated and uninsulated specimens with bookshelf girts.

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 2017 involved fabrication and testing of a hazelnut shell and kernel separator that exploits particle rolling characteristic and laboratory investigations on hazelnut cracking characteristics and equilibrium moisture content.

Teaching

Spring 2017

- BSE 508: BSE Design Practicum I
2 credit lecture, 1 team, 5 students
- InterEgr 170: Introduction to Engineering Design
2 credit lab/lecture course, 20 students

Fall 2017

- BSE 001: Cooperative Education Program
1 credit, 1 student
- BSE 509: BSE Design Practicum II
3 credit lab, 1 team, 6 students

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 2017, worked with Fischbach and Scott Sanford on the design, installation and maintenance of an irrigated hazelnut research plot at the West Madison Agricultural Research Station. Continued work on equipment developed and investigation of hazelnut properties.
- 2) *Wisconsin Frame Builders Association*. Work with local building engineers on

problems facing the industry. Made a technical presentation on the NFBA Post Frame Building Design Manual at the 2017 WFBA Annual Meeting.

Research

- *Evaluation and Optimization of Post-Frame Thermal Envelopes*. Conducted 10 tests each on 4 different wall configurations in the UW-Madison Rotatable Guarded Hot Box. Federal Hatch funded project.
- *Moment Resisting Post-to-Concrete Connection*. Published *Frame Building News* article on rigid connections. Developed new connection for nominal 10-inch wide posts. Fabricated and installed new connection in a test building. Funded in part by the National Frame Buildings Association.
- *Precast Concrete Posts*. Expanded research into components prestressed by pretensioning of steel. Worked with senior design team to design and fabricate device for prestressed component fabrication. Self-funded project.
- *Post and Pier Foundation Design Aid*. Developed an electronic workbook for calculating post/pier foundation strength capacities in accordance with ASABE EP 486.3. Wrote instruction manual for workbook and demonstrated workbook use at the NFBA Frame Building Expo and at the ASABE Annual International Meeting. Funded in part by the National Frame Buildings Association.
- *Diaphragm Trusses*. Developed the use of parallel chord trusses within the roof plane of post-frame buildings for (1) truss bracing and end wall alignment during construction, and (2) use as the main diaphragm element in buildings with floating roof systems. Demonstrated different methods for diaphragm truss installation during construction of an actual building. Self-funded project.
- *Post-Frame Building Construction Tools*. Designed, fabricated and demonstrated the use of a system that can be used (along with a steel I-beam door header) on or off a job site to mechanically-laminate wood assemblies. Also demonstrated the use of pre-fabricated mezzanine decking as portable fall-protection platforms for post-frame building construction. Funded in part by the National Frame Buildings Association.

- *Hazelnut Properties*. Completed equilibrium moisture content study on hazelnut husks, shells and kernels and presented results at the 2017 ASABE Annual International Meeting. Continued static hazelnut cracking study and began study on impact cracking of hazelnuts. Research supported by a SARE grant.
- *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 potatoes and apples. Presented paper at the 2017 ASABE Annual International Meeting on an apparatus for rapid material moisture conditioning using saturated salt solutions. Self-funded project.
- *Continuous Process for Distillation of Mint*. Served as a co-PI with Scott Sanford on research into a continuous process for distillation of mint. Assisted in equipment fabrication and operation. Funded by a USDA Specialty Crop Research Initiative grant.

Publications

Refereed Publications

- 1) Bohnhoff, D.R. (2017). Rigid connections between wood posts and concrete. *Frame Building News*. 29(1):54:58. http://www.nfba.org/uploads/Rigid_Connection_s-Jan_2017_FBN.pdf
- 2) Holstein, A. J., Bohnhoff, D. R. & Choi, C.Y. (2017). A computational and experimental study of conjugate heat transfer through composite thermal envelopes in post-frame buildings. *Computers and Electronics in Agriculture*. In press.

Technical Publications

- 1) Bohnhoff, D. R. & Bohnhoff, R. K. (2017). Equilibrium moisture content of hazelnut husks, shells and kernels. Presented at the 2017 ASABE International Meeting in Spokane, WA. ASABE Paper No. 170065. ASABE. St Joseph, MI. doi: 10.13031/aim.201700658
- 2) Bohnhoff, D. R. (2017). Apparatus for rapid material moisture conditioning using saturated salt solutions. Presented at the 2017 ASABE International Meeting in Spokane, WA. ASABE Paper No. 1700663. ASABE. St Joseph, MI. DOI: 10.13031/aim.201700663
- 3) Sanford, S. A. & Bohnhoff, D. R. (2017) New

essential oil distillation system design and construction- year 1. Presented at the 2017 ASABE International Meeting in Spokane, WA. ASABE Paper No. 1700109. ASABE, St. Joseph, MI. DOI: 10.13031/aim.201700109

- 4) Bohnhoff, D. R. (2017). Post and pier foundation design aid. Presented at the 2017 ASABE International Meeting in Spokane, WA. ASABE Paper No. 1700665. ASABE, St. Joseph, MI. DOI: 10.13031/aim.201700665

Software

- 1) Bohnhoff, D. R. (2017). ASAE_EP486_3_Shallow_Post_and_Pier_Foundation_Design_Workbook-2017-12-17 [Excel Workbook]. Available at: <http://www.nfba.org/index.php/resources/>

Awards

- 1) Faculty advisor for 1st Place Team, 2017 ASABE AGCO Student Design Competition

Professional Development Activities

- 1) Wisconsin Frame Builders Association Annual Meeting, January 24-25, 2017 Appleton, WI
- 2) MOSES Organic Farming Conference, February 23- 25, 2017, LaCrosse, WI
- 3) NFBA Frame Building Expo, March 8-10, 2017, Nashville, TN
- 4) ASABE Annual International Meeting, July 16 - 19, 2017, Spokane, WA
- 5) Hazelnut Processing Company Tours, July 20-22, 2017, Willamette Valley, OR
- 6) Wood-Based Construction - Mass Timber and Beyond, Wed, Sept. 20, 2017, Promega Corporation BioPharmaceutical Technology Center, Madison, W
- 7) Midwest Mechanical Weed Control Field Day, Sept. 26, 2017, East Lansing, MI

Professional Service

- 1) Profession (ASABE/other)
 - i. American Society of Agricultural and Biological Engineers

- Chair, Evelyn E. Rosentreter Standards Award Committee, M-160
 - Chair, Standards Development Committee for ANSI/ASAE EP599.1
 - Chair, Standards Development Committee for ANSI/ASAE EP486.3
 - Standards Development Committee for ASAE EP484
 - Standards Development Committee for X653 – HVAC for Indoor Plants
 - Structures Committee, PAFS-20
 - Agri-Industrial Facility Design and Operation Committee, PAFS-07/1
 - Plant, Animal, & Facilities Systems Standards Oversight Committee, PAFS-03
 - Awards Coordinating Committee, M-102
 - Wisconsin Section – Attended 2 section meetings in 2017
- ii. National Frame Builders Association
 - Technical Publications Review Committee.
 - Reviewed 3 FBN manuscripts in 2017.
 - NFBA Technical & Research Committee. Attended four meetings in 2017
 - Answer numerous technical questions via phone and e-mail on behalf of NFBA
- 2) College/Campus/University
 - i. University General Education Committee
 - ii. West Madison Agricultural Research Station (WMARS) Review Committee
 - iii. Designed and constructed floating slab for WMARS corn dryer
 - iv. Engineered OHD remodel for BSE lab
 - v. Advisory Committee for International Engineering Certificate
 - vi. BSE Undergraduate Instruction and Program Committee



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 in animal housing, pathogen transport that occurs during spray irrigation of liquid manure, and advanced systems for cooling dairy cows.

Teaching

Spring 2017

- BSE 464, Biosystems Heat and Mass Transfer, 3 Credits, 11 Enrolled
- BSE 508, Biological Systems Engineering Design Practicum I
2 Credits, One design team, 3 Enrolled
- BSE 990, Research, Ind. Study, 3 credits, 3 Enrolled

Fall 2017

- BSE 270, Introduction to Computer Aided Design
3 Credits, 58 Enrolled
- BSE 509, Biological Systems Engineering Design Practicum II
3 Credits, One design team, 3 Enrolled
- BSE 990, Research, Ind. Study, 3 credits, 2 Enrolled
- BSE 699, Special Problems (Ind. Study), 3 credits, 1 Enrolled

Graduate and Post Docs Advisees

1. Jessica Drewry, PhD BSE, 2017 (Completed)
2. Matthew Harper, MS BSE 2017 (Completed)
3. Andrew Holstein, PhD BSE, 2017 (Completed),
Co-advised with David Bohnhoff
4. Ian Atkins, MS BSE, 2017 (Completed)
5. Bo Zhou, Post-doctoral Fellow from 2016 to 2018
6. Xiaoshuai Wang, Ph.D. Student at Aarhus, University and exchange student at UW-Madison, Denmark, Co-advised with G. Zhang, 2018 (Expected)
7. Seunghyeon Jung, Ph.D. (In Progress)

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. Developing Sustainable Dairy Cattle Housing for Heat Stress Mitigation

a. Collaborator(s): Cook and Cabrera

b. Funding: Hatch

c. Objectives: We intend to help in the heat stress area of dairy cows by studying the most promising cooling technologies on modern commercial dairy farms by using state-of-the-art fluid dynamics knowledge together with innovative measurements, which will be related to cow behavior and performance, and then incorporated into a dynamic, interactive economic model that can predict the best economic outcomes according to farm specific conditions.

Publications

Peer reviewed Journal Articles

1. *Drewry JL, CY Choi, JM Powell (2017) Design and calibration of chambers for the measurement of housed dairy cow gaseous emissions. Transactions of ASABE, 60:4, 1291-1300.
2. *Ozdogan-Dolcek A, *I Atkins, *MK Harper, JM Tinjum and CY Choi (2017) Performance and sustainability of district-scale ground coupled heat pump systems, Geotechnical and Geological Engineering. 35 (2), 843-856.
3. *Song I, *P Romero-Gomez, *MA Andrade, *M Mondaca, CY Choi (2017) Mixing at junctions in water distribution systems: an experimental study, Urban Water Journal. 1-7.
4. Floria LJ, Hart D, Tinjum J, CY Choi (2017) Potential impacts to groundwater from ground-coupled geothermal heat pumps in district scale, Groundwater. 55:1, 8-9.
5. *Holstein AJ, DR Bohnhoff, CY Choi (2017) A computational and experimental study of conjugate heat transfer through composite thermal envelopes in post-frame buildings, Computers and Electronics in Agriculture.
6. *Drewry JL, *M Mondaca, BD Luck, CY Choi (2017) Computational model of methane and ammonia emissions from dairy barns: development and validation, Computers and Electronics in Agriculture.

Conference Proceedings and Presentations

1. Choi CY (2017), Applications of Computational Fluid Dynamics (CFD) in Agricultural Engineering – A Review, ASABE Annual International Meeting, Spokane, WA.
2. Drewry JL, M Mondaca, BD Luck, CY Choi (2017) A Computational Fluid Dynamics Model of a Dairy Holding Area, ASABE Annual International Meeting, Spokane, WA.
3. Wang X, G Zhang, CY Choi, (2017) Numerical Assessment of a Precision Air Supply System (PASS) Targeting for a Single Cow Partition, ASABE Annual International Meeting, Spokane, WA.

Invited Guest Speaker:

Choi CY, Dairy Cooling: The Benefits and Strategies and Recent Advances, Dairy Strong 2017, Madison, WI (Sponsored by Schaefer Ventilation).

Service

Guest Editor, Computers and Electronics in Agriculture (COMPAG), CFD Applications in Agriculture Special Issue.

Associate Editor, Transactions of the ASABE and Applied Engineering in Agriculture

Organizing member, ASABE's Tenth International Livestock Environment Symposium (ILES IX) in Omaha, Nebraska, USA, Sept. 25-27, 2018.

President, Association of Korean Agricultural, Biological, and Food Engineers (AKABFE), ASABE (term ended in 2017)

Chair, ITSC-217 Computational Methods, Simulations and Applications (term ended in 2017)

Session Organizer, 2017 ASABE International Conference - Computational Fluid Dynamics in Agriculture, Orlando, FL

Member, ITSC-254 Emerging Info Systems, ASABE

Member, PAFS-403 Dairy Facilities and Systems, ASABE

Faculty Senate, University of Wisconsin-Madison

Member, CALS Curriculum Committee

Member, COE Curriculum Committee

Chair, BSE IT Committee, Chair

Member, BSE Executive Committee

Reviewer for numerous refereed journals



Sundaram Gunasekaran

Professor, Ph.D.

50% Research / 50% Administration

Program affiliations: Food Science, Materials Science & Engineering

Nanomaterial synthesis and biosensing; Food engineering and processing

Teaching

BSE 901: Graduate Research Seminar

Graduate student and Post-doc Advisees

Omer Sadak, PhD student
Jiehao Guan, PhD student
Youngsang You, PhD student
Lin Lu, PhD student
Kari Jordan, MS student
Batul Kachwala, MS student
Anu Prathap, post-doc
Rajesh Seenivasan, post-doc
Cao, Xiaodong, Post-doc visitor
Gong, Sheng, Post-doc visitor
Yuan-Jie Teng, Post-doc visitor
Saina Moayedzadeh, PhD Student visitor
Anees Rehman, PhD Student visitor
Lala Rukh, PhD Student visitor
Furhan Bukhari, PhD Student visitor

Research

- Electrochemical Biosensors to Detect Toxins in Complex Food Matrices, USDA Hatch
- Nanobiosensing for Rapid and Visible Detection of Enteric Pathogenic Bacteria, USDA Hatch
- An Electrochemical Immunosensing Method for Detecting and Enumerating Circulating Melanoma Cells, NIH-UW SDRC (Vijay Setaluri, co-PI).
- Regeneration of Multi-Layered Vocal Fold Mucosa, NIH R01 (Welham, PI)
- Biosensing for the detection of antibiotic residues in milk, Demi Co Ltd

Peer-reviewed Journal Articles

Gong S, Chen H, Zhou X, **Gunasekaran S**. 2017. Synthesis and applications of MANs/poly(MMA-co-BA) nanocomposite latex by miniemulsion polymerization. R. Soc. Open Sci. 4: 170844. <http://dx.doi.org/10.1098/rsos.170844>

Hahn J, Kim E, You YS, **Gunasekaran S**, Lim S, Choi YJ. 2017. A Switchable Linker-Based Immunoassay for Ultrasensitive Visible Detection of Salmonella in Tomatoes. J. of Food Sci. (10):2321–2328. DOI: 10.1111/1750-3841.13861

Seenivasan R, CK Singh, JW Warrick, N Ahmad, **S Gunasekaran**. 2017. Microfluidic-integrated patterned ITO immunosensor for rapid detection of prostate-specific membrane antigen biomarker in prostate cancer. Biosens & Bioelect 95: 160-167.

Eakasit S, **Gunasekaran S**. 2017. Enthalpy relaxation in sucrose-maltodextrin-sodium citrate bioglass. J. Food Eng. 211: 85-94.

Eakasit S, **Gunasekaran S**. 2017. Rheological and microstructure evaluations of amorphous sucrose-maltodextrin-sodium citrate mixture. Appl. Rheol. 27(4): 43102 (DOI: 10.3933/AppIRheol-27-43102)

Eakasit S, **Gunasekaran S**. 2017. FTIR spectroscopic evaluation of sucrose-maltodextrin-sodium citrate bioglass. Food Hydrocolloids 70:371-382

Wang YC, Lu L, **Gunasekaran S**. 2017. Biopolymer/gold nanoparticles composite plasmonic thermal history indicator to monitor quality and safety of perishable bioproducts.

Biosensors & Bioelectronics 92:109-116.

Sadak O, Sundramoorthy AK, **S Gunasekaran**. 2017. Highly selective colorimetric and electrochemical sensing of iron (iii) using Nile red functionalized graphene film. Biosensors & Bioelectronics 89:430-4436

Bagci PO, **Gunasekaran S**. 2017. Iron-encapsulated cold-set whey protein isolate gel

Patents

Gunasekaran S, O Sadak. 2017. Fabrication of Flexible and Freestanding Graphene Paper. US Patent Disclosure ref. P180075US01.

Gunasekaran S, A Prathap. 2017. Synthesis of Nanoporous Material for Liquid- And Gas-Phase Detection of Nitroaromatic Explosives and Compounds. US Patent Disclosure ref. P180010US01.

powder. Part 1: Optimization of preparation conditions and in vitro evaluation. Int. J. Dairy Tech 70(1):127–136

Nourbakhsh H, Z Emam-Djomeh, A Madadlou, ME Mousavi, AA Moosavi-Movahedi, **S Gunasekaran**. 2017. Antioxidant peptidic particles for delivery of gallic acid. J Food Processing and Preservation. 41 (1): DOI: doi:10.1111/jfpp.12767

Awards

Distinguished Professor, Zhejiang Academy of Agricultural Sciences, China

Service

Graduate Research and Instruction (Chair, 20 h); Undergraduate Curriculum Committee (20 h); Global Health Institute Advisory Board (10 h); International Division Associate Deans Council (20 h); Center for South Asia Advisory Board (10 h); CALS Dean's Administrative Team (40 h); NSF Peer-review panels (20 h); 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 and the international community. The majority of my work year has been through producer and agent requests to develop and deliver topics

in that area. This includes presenting and coordinating programs in dairy housing facilities and feeding systems including low cost milking centers, free stall barns, compost bedded barns, special needs and transition cow barns, and calf and heifer housing. I had over 6105 direct contacts via email or phone for requests for information, including speaking to over 1805 participants in extension and international meetings. I worked in 36 counties with 34 county agents on client requested farm visits developing plans and educational materials to approximately 200 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 automatic group calf feeding systems into existing and new facility design has become more common. I have also worked with dairy goat/sheep farms and beef farms as they develop their new farmsteads and point of sale operations. Requests for dairy and beef cattle handling systems are also popular. This work has been accomplished through the Dairy Modernization workgroup and the Livestock team. Green County had a dairy facility tour with tour participants selected from farm that the agents and I had worked with earlier on their new facility designs. I have been invited to present dairy educational seminars through the Global Dairy Outreach and the Sheep and Wool Festival. I was invited to Finland, Czech Republic, Slovakia, Japan, and Costa Rica to speak at conferences. I have hosted lectures on campus and tours of farms around Wisconsin for international visitors from Finland, Japan, Germany, and Czech Republic.

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 2 @ 2 week modules for the Senior Design Course DS234.

Meetings and Activities

- Complete Feed Services Transition Cow Meeting
- Minnesota Parlor vs Robot Meetings
- Farm Technology Days Kewaunee
- Dairy Goat Academy SWTC
- Global Dairy Outreach Short Course
- Sheep and Wool Festival
- Grassworks Grazing Pasture Walk
- International Visitors tour host for Germany, Czech Republic, Finland, Japan

Invited Speaker

- Czech Republic Veterinarian Nutrition Company
- Finland Dairy Producers
- Japan Hokkaido Dairy Conference
- Costa Rica Dairy Producers

Dairy Modernization Extension Program Activity

I have made farm visits in the following 34 counties visiting approximately 200 livestock farms and developed preliminary designs for the farmsteads.

- | | | |
|---------------------|--------------------|--------------------------------------|
| 1. Barron (1x) | 13. Jefferson (1x) | 25. Sheboygan (1x) |
| 2. Brown (2x) | 14. Juneau (2x) | 26. St. Croix (1x) |
| 3. Columbia (1x) | 15. Kenosha (1x) | 27. Taylor (1x) |
| 4. Chippewa (1x) | 16. Kewaunee (1x) | 28. Trempealeau (1x) |
| 5. Clark (1x) | 17. Lafayette (1x) | 29. Vernon (1x) |
| 6. Dane (1x) | 18. Manitowoc (1x) | 30. Waupaca (2x) |
| 7. Dodge (1x) | 19. Monroe (2x) | 31. Waushara (1x) |
| 8. Eau Claire (3x) | 20. Outagamie (1x) | 32. Winnebago (1x) |
| 9. Fond du lac (1x) | 21. Racine (1x) | 33. Washburn/Sawyer/
Burnett (1x) |
| 10. Grant (1x) | 22. Rusk (1x) | 34. Wood (1x) |
| 11. Green (4x) | 23. Sauk (1x) | |
| 12. Jackson (3x) | 24. Shawano (1x) | |

Papers, Proceedings, Articles

Jones, Dr. Gordon A., D.V.M., D.W. Kammel. 2017. Large Dairy Herd Design in Temperate and Cold Climate. Third Edition of Large Dairy Herd Management. American Dairy Science Association. 1800 S Oak St. Ste 100. Champaign, IL 61820-6974.

Kammel, David W., 2017. Systems Approach to Dairy Farmstead Design. Third Edition of Large Dairy Herd Management. American Dairy Science Association. 1800 S Oak St. Ste 100. Champaign, IL 61820-6974.

Kammel, D.W., Dr. G.A. Jones. 2017. Transition Cow Housing Design and Management. Third Edition of Large Dairy Herd Management. American Dairy Science Association. 1800 S Oak St. Ste 100. Champaign, IL 61820-6974.

Presentations Developed:

- Sand Laden Manure System Design and Management
- Calf Housing Group Pen Barn Design and Management
- Calf and Heifer Housing Design and Management
- Dairy Facility Design and Management Adapting and Evolving
- Dairy Goat Facility Planning
- Design and Layout for Robotic Milking Systems
- Design and Management of Humane Cattle Handling Facilities
- Beef Cattle Facility Design and Management
- Dairy Housing Design and Management Principles
- Facility Design for Cow Comfort and Increasing Production and Profitability
- Sheep Housing Design and Management for Comfort
- Systems Approach to Dairy Farmstead Design
- Large Dairy Herd Design in Temperate and Cold Climate
- Adapting Dairy Farmstead Design to Climate Change
- Remodeling Retired Dairy Facilities for Raising Steers
- Remodeling Retired Dairy Facilities for Sheep
- Heat Stress Abatement Design and Management
- Farmstead Master Planning

Professional Service

- BSE Departmental Extension, and Social Committee
- Phi Kappa Phi Honor Society
- Gamma Sigma Delta Honor Society
- Alpha Epsilon Honor Society
- ASABE member 30 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 2017

BSE 472, Sediment & Bio-nutrient Engineering and Management

3 Credits, 14 Enrolled

(Evaluation: 4.22/5)

BSE 508, Engr. Design Practicum

2 Credits, 4 students advised

BSE 1, 399, Internships & Co-op Programs

1 Credit, 2 Enrolled

BSE 699, Independent Study

2 Credits, 1 Enrolled

Fall 2017

BSE 372, On-site Wastewater Treatment and Dispersal

2 Credits, 36 Enrolled

(Evaluation: 4.59/5)

BSE 509, Design Practicum II

3 Credits, 55 Enrolled

BSE 799, Practicum – Ag Engr Teaching

3 Credits, 1 Enrolled

6) Caroline Lierl, MS, Environment & Resources (Nelson Institute), 2018

7) Ed Wagner, MS, BSE 2019

8) Chee Thao, MS, BSE, 2019

9) Zachariah Zopp, Associate Researcher, BSE

Funded Research Projects

1) A Multi-Scale Platform for Technology Evaluation and Decision-Making in the Dairy-Water-Energy Nexus.

Collaborators: V. Zavala, CBE; D. Noguera, CEE; R.

Larson, BSE; and A. Hicks, CEE

Funding: USDA-INFEWS (\$2.4 million)

Objectives: Address challenges arising in the dairy-water-energy nexus by combining multi-scale systems analysis and experimental research.

2) 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); \$500,000

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.

3) Elucidating Colloid-Facilitated Phosphorus Migration in Soils: Through X-ray Computed Tomography and Hydrus Modeling.

Collaborators: J. Lamba, P. Srivastava (Auburn), J.

Graduate and Post Docs Advisees

- 1) Rania Bashar, PhD, BSE, 2018
- 2) Elizabeth Miller, PhD, METC, 2018, Co-advising with Joel Pedersen
- 3) Sara Nason, PhD, EC&T, 2017, Co-advised with Joel Pedersen
- 4) Joorae Roger Kim, PhD, BSE, 2020
- 5) Donnie Vineyard, PhD, CEE, 2020, Co-advising with Phillip Barak

Simunek (UC Riverside)

Funding: USDA-NIFA (AFRI); \$500,000

Objectives: To determine the effect of soil characteristics and manure application practices on P losses in various particle-size fractions with a special focus on the colloidal-size range.

(in press).

- 4) 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 (\$295,000).

Objectives: Evaluate the bioaccumulation of chemicals of emerging concern with contrasting chemical characteristics by the model plant *Arabidopsis thaliana* and two crop species (spinach, cucumber)

- 5) Integrated Treatment System for Sustainable Manure Management.

Funding: USDA-NIFA (Hatch)

- 6) Influence of Rhizosphere pH Modulation on Plant Uptake of Pharmaceuticals and Personal Care Product Ingredients.

Collaborator: J. Pedersen, Soils

Funding: USDA-NIFA (Hatch)

- 7) Life Cycle Analysis of Wastewater Derived Fertilizer.

Collaborator: P. Barak, Soils

Funding: USDA-NIFA (Hatch)

- 8) Crop Plant Uptake of Pollutants of Emerging Concern.

Collaborator: J. Pedersen, Soils

Funding: USDA-NIFA (Hatch)

- 9) Fabrication and Functionalization of Whole Biomass Aerogels from Forest Residues as Biosorbents for Heavy Metals.

Collaborator: X. Pan, BSE

Funding: USDA (McIntire-Stennis)

Publications

Peer reviewed Journal Articles

- 1) Vadas, P, L Good, W Jokela, KG Karthikeyan, F Arriaga, M Stock. 2017. Quantifying the Impact of Seasonal and Short-term Manure Application Decisions on Phosphorus Loss in Surface Runoff. *J. Environmental Quality*. 46: 1395-1402.
- 2) Huisman, NLH, A Huisman, KG Karthikeyan. 2017. Seasonal and Animal Farm Size Influences on In-stream Phosphorus Transport in an Agricultural Watershed. *Nutrient Cycling Agroecosystems*. 109:29-42.
- 3) Bashar, R, K Gungor, KG Karthikeyan, P Barak. Cost Effectiveness of Phosphorus Removal Processes in Municipal Wastewater Treatment. *Chemosphere*

Conference Presentations

- 1) Bashar, R, KG Karthikeyan. 2017. Energy positive municipal wastewater treatment: potential for full-scale implementation of a novel aerobic scheme. ASCE-EWRI Congress, Sacramento, CA.
- 2) Bashar, R, KG Karthikeyan. Potential for full-scale implementation of a novel mainstream anaerobic wastewater treatment scheme. 'Water Connection' symposium, Riveredge Nature Center, WI.
- 3) Miller, EL, S Nason, KG Karthikeyan, JA Pedersen. 2017. Rhizosphere effects on lamotrigine accumulation by wheat plants. SETAC North America 38th Annual Meeting, Minneapolis, MN.
- 4) Nason, S, EL Miller, KG Karthikeyan, JA Pedersen. 2017. Influence of transpiration on the accumulation of pharmaceuticals by plants. SETAC North America 38th Annual Meeting, Minneapolis.
- 5) Nason, S, EL Miller, KG Karthikeyan, JA Pedersen. 2017. Model systems to study plant accumulation of ionizable organic contaminants. Abstracts Papers Amer. Chem. Soc., 254, ENVR 257, San Francisco.
- 6) Stock, MN, FJ Arriaga, PA Vadas, LW Good, KG Karthikeyan. 2017. Reducing winter runoff losses from dairy agroecosystems through tillage and manure application timing. Soil Science Society of America: 2017 Annual International Meeting, Soil and Water Management and Conservation Division. Tampa, FL.
- 7) Stock, MN, FJ Arriaga, KG Karthikeyan, PA Vadas, LW Good. 2017. Reducing winter phosphorus losses in dairy agroecosystems: Testing manure management with a water-energy balance approach. NC-1178 Regional Meeting, Soil and Water Conservation Society. Madison, WI.
- 8) Stock, MN, FJ Arriaga, KG Karthikeyan, PA Vadas, LW Good. 2017. Reducing winter phosphorus losses from dairy agroecosystems through tillage and manure application timing. American Water Resources Association: WI Section, 41st Annual Meeting Abstracts, p24-25. Elkhart Lake, WI. American Water Resources Association.
- 9) Vadas, PA, LW Good, WE Jokela, KG Karthikeyan, FJ Arriaga, M Stock. 2017. Impact of Seasonal and Shortterm Manure Application Decisions on Phosphorus Loss in Runoff. Soil Water Conservation Society Annual Meeting. Madison, WI.
- 10) Stock, MN, F Arriaga, PA Vadas, LW Good, KG Karthikeyan. 2017. Fall tillage and manure application timing after corn silage affect winter runoff losses. Fact Sheet for the North American Manure Expo.

Service

BSE committees

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

Regional Committees

SERA-17 (Organization to Minimize Phosphorus Losses from Agriculture)
NC1186 (Water Management and Quality for Ornamental Crop Production and Health)

W-2082 (Evaluating the Physical and Biological Availability of Pesticides and Pharmaceuticals in Agricultural Ecosystems)

Review Committees

NSF Research Traineeship (NRT) Program USDA-NIFA
Environment Technology journal
Environmental Chemistry journal
US-Israel BARD Program



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

Dr. Larson has been in the Biological Systems Engineering Department for over 7 years and has developed 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 impacts 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, feed storage runoff and water quality issues, and selection of manure processing systems to achieve specific economic and environmental goals.

Teaching

BSE 472, Sediment and Bio-Nutrient Engineering and Management, 3 credits
BSE 509, student team advisor

Daniel Coleman, (Biological Systems Engineering)
Jacob Roundy (Biological Systems Engineering)
Jordan Englebert (Biological Systems Engineering)

Graduate, Post Docs, and other Advisees

- 1) Joseph Sanford, Ph.D. Student, Biological Systems Engineering
- 2) Hui Wang, Ph.D. Candidate, Biological Systems Engineering
- 3) Horacio A. Aguirre-Villegas, Ph.D. Assistant Scientist, Biological Systems Engineering
- 4) Mahmoud Sharara, Ph.D., Assistant Scientist, Biological Systems Engineering
- 5) Josephat Musinguzi, M.S., Soil Science, Makerere University, Kampala, Uganda

Undergraduate Researchers in 2017

Jenna Walsh, (Biological Systems Engineering)
Tanner Wears, (Biological Systems Engineering)
Eric Peltola, (Biological Systems Engineering)
Tyler Lecy, (Biological Systems Engineering)
Esmeralda Tovar, (Biological Systems Engineering)
Victoria Shveytser, (Biological Systems Engineering)

Extension / Outreach

30+ days of extension programing
International programming (Uganda, Rwanda, China, and Brazil)
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
Manure Irrigation Workgroup and related programming
Creating an Enduring U.S. Dairy Sector, 30th ADSA Discover Conference, Chicago, IL
Anaerobic Digestion Tour
Dane County Manure Planning
Development of the Dairy Virtual Farm
2017 Midwest Manure Summit
Manure EXPO
LPELC Waste to Worth Conference

Funded Research Projects Ongoing

- 1) Climate Change Mitigation and Adaptation in Dairy Production
Collaborators: M. Ruark, M. Jahn, M. Wattiaux, B. Bland, M. Stephenson, D. Reinemann
Funding: AFRI/CAP \$9,865,566 (\$642,484)
Objectives: Manure Emissions Research (Lead), Dairy Life Cycle Assessment, Extension Material Development and Outreach (Lead)
- 2) 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
- 3) 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
- 4) 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
- 5) 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
- 6) 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
- 7) Multi-stakeholder decision-making for the development of livestock waste-to-biogas systems
Collaborators: V. Zavala
Funding: NSF CBET \$346,051
Objectives: provide scientific based information on the development of anaerobic digestion systems

- 8) A Multi-Scale Platform for Technology Evaluation and Decision-Making in the Dairy-Water-Energy Nexus
Collaborators: V. Zavala, D. Noguera, K. Karthikeyan, and A. Hicks
Funding: NSF and USDA NIFA (INFEWS) \$2,400,000
Objectives: provide scientific based information on waste optimization across sectors to reduce environmental impacts
- 9) Carbon and Nitrogen Use Efficiency in Wisconsin Dairy Production Systems
Collaborators: M. Wattiaux and K. Weigel
Funding: Hatch Multistate Proposal \$250,000
Objectives: provide information on the greenhouse gas and ammonia emission over the dairy system when integrating new diets
- 10) Development of an In-Line Manure Nitrogen Sensor for Real-Time Monitoring during Land Application
Collaborators: B. Luck and F. Arriaga
Funding: Wisconsin Alumni Research Foundation \$39,770
Objectives: develop a sensor for continuous monitoring of manure nutrients during application

Publications in 2017

Peer Reviewed Journal Articles

1. Shutske, J.M., D.M. Schaefer, **R.A. Larson**, C. Skjolaas, L.Y. Binversie, S. Rifleman, K. Erb, and S. Leonard. 2017. Investigation of a Worker Death While Agitating Manure in a Non-Enclosed Storage. *Journal of Agromedicine*, Accepted.
2. Holly, M.A. and **R.A. Larson**. 2017. Thermochemical Conversion of Biomass Storage Covers to Reduce Ammonia Emissions from Dairy Manure. *Water, Air, & Soil Pollution*, 228:434..
3. Yang, Q., H. Wang, R.A. Larson, and T. Runge. 2017. Comparative study of chemical pretreatments of dairy manure for enhanced biomethane production. *Bioresource Technology*, 12(4):7363-7375.
4. Shutske, J.M., **R.A. Larson**, D.M. Schaefer, L.Y. Binversie, S. Rifleman, C. Skjolaas. 2017. *Notes from the Field: Death of a Farm Worker After Exposure to Manure Gas in an Open-Air Environment - Wisconsin*, August 2016. *Morbidity and Mortality Weekly Report (MMWR)*, 66(32):861–862.
5. Aguirre-Villegas, H.A., T.H. Passos-Fonseca, D.J. Reinemann, and **R.A. Larson**. 2017. Grazing intensity affects the environmental impact of dairy systems. *Journal of Dairy Science*, 100(8):6804-6821.

6. Liang, Y., C.Y. Choi, **R.A. Larson**, and J. Schauer. 2017. Modeling Airborne Pathogen Transport during Spray Irrigation of Liquid Manure in Wisconsin. *Agriculture, Ecosystems & Environment*. In review, revisions requested and submitted.
7. Burch, T., S. Spencer, J. Stokdyk, B. Kieke, **R.A. Larson**, A. Firnstahl, A. Rule, and M. Borchardt. 2017. Quantitative Microbial Risk Assessment for Spray Irrigation of Dairy Manure Based on an Empirical Fate and Transport Model. *Environmental Health Perspectives*, 125(8):087009.
8. McCord, A.I., S.A. Stefanos, V. Tumwesige, D. Lsoto, A. Meding, A. Adong, J.J. Schauer, and **R.A. Larson**. 2017. The impact of biogas and fuelwood use on institutional kitchen air quality in Kampala, Uganda. *Indoor Air*, 27(6):1067-1081.
9. Holly, M.A., **R.A. Larson**, M. Powell, M. Ruark, and H. Aguirre-Villegas. 2017. Evaluating greenhouse gas and ammonia emissions from digested and separated manure through storage and land application. *Agriculture, Ecosystems & Environment*, 239:410-419.
10. Aguirre-Villegas, H. and **R.A. Larson**. 2017. Evaluating Greenhouse Gas Emissions from Dairy Manure Management Practices using Survey Data and Lifecycle Tools. *Journal of Cleaner Production*, 143:169-179.
11. Holly, M.A. and **R.A. Larson**. 2017. Effects of Manure Storage Additives on Manure Composition and Greenhouse Gas and Ammonia Emissions. *Transactions of the ASABE*, 60(2): 449-456.
12. Sharara, M., **R.A. Larson**, A. Sampat, V. Zavala, L.W. Good, T. Runge, P. Porter, A. Smith. 2017. Spatially explicit methodology for coordinated manure management in shared watersheds. *Journal of Environmental Management*, 192(1):48-56.
4. H. Aguirre-Villegas, **R.A. Larson**, M.D. Ruark, D. Liang, V. Cabrera, M. Wattiaux, and L. Chase. 2017. Mitigation of Enteric Methane Emissions from Dairy Cows. University of Wisconsin-Extension, Publication No. UWEX A4131-08 GWQ 080.
5. **R.A. Larson**, H. Aguirre-Villegas, C. Skjolaas, J. Shutske, J. Nelson, J. Schauer, and K. Erb. 2017. Reducing Risks from Manure Storage Agitation Gases. University of Wisconsin-Extension, Publication No. UWEX A4131-06 GWQ 078.
6. H. Aguirre-Villegas, **R.A. Larson**, M.D. Ruark. 2017. Greenhouse Gas and Ammonia Emissions from Dairy Manure Management Systems. University of Wisconsin-Extension, Publication No. UWEX A4131-05 GWQ 077.
7. H. Aguirre-Villegas, **R.A. Larson**, M.D. Ruark. 2017. Solid-Liquid Separation of Manure and Effects on Greenhouse Gas and Ammonia Emissions. University of Wisconsin-Extension, Publication No. UWEX A4131-04 GWQ 076.
8. H. Aguirre-Villegas, **R.A. Larson**, M.D. Ruark. 2017. Manure Agitation. University of Wisconsin-Extension, Publication No. UWEX A4131-03 GWQ 075.
9. Hofstetter, D., H. Aguirre-Villegas, **R.A. Larson**, and E. Fabian-Wheeler (main content and design developers). 2017. Sustainable Dairy Virtual Farm, Penn State and University of Wisconsin-Madison, <http://wpsudev2.vhost.psu.edu/virtualfarm/>.

Extension Document and Other Publications

1. Aguirre-Villegas, **R.A. Larson**, and M.D. Ruark. 2017. Managing Manure Nitrogen to Reduce Losses. University of Wisconsin-Extension, Publication No. UWEX A4131-10 GWQ 082.
 2. H. Aguirre-Villegas, M. Wattiaux, **R.A. Larson**, M.D. Ruark. 2017. Dairy Cow Nitrogen Efficiency. University of Wisconsin-Extension, Publication No. UWEX A4131-09 GWQ 081.
 3. H. Aguirre-Villegas, **R.A. Larson**, M.D. Ruark, D. Liang, V. Cabrera, M. Wattiaux, and L. Chase. 2017. Accounting Techniques for Enteric Methane Emissions from Dairy Cows. University of Wisconsin-Extension, Publication No. UWEX A4131-07 GWQ 079.
- #### Conference Presentations:
1. Aguirre-Villegas H.A. and **R.A. Larson**. 2017. Greenhouse gas emissions from dairy manure management. *2017 ASABE Annual International Meeting, July 16-19, 2017, Spokane, WA*.
 2. **Larson, R.A.**, M.A. Holly, and H.A. Aguirre-Villegas. 2017. Assessment of Anaerobic Digesters and Solid Liquid Separators in Wisconsin: tracking nutrients and assessing emissions (POSTER). *2017 ASABE Annual International Meeting, July 16-19, 2017, Spokane, WA*.
 3. **Larson, R.A.**, A. McCord, V. Tumwesige, D. Lsoto, J. Musinguzi, S. Stefanos, and D. Nampamya. 2017. Integrating Anaerobic Digesters in Uganda: Assessment of Performance, Impact of Digestate Application to Crop Yields, and an Evaluation of Air Quality with Conversion to Biogas Stoves.

- 2017 ASABE Annual International Meeting, July 16-19, 2017, Spokane, WA.
4. Aguirre-Villegas H.A. and **R.A. Larson**. 2017. Anaerobic Digestion in Developing Regions for Household Applications. *2017 ASABE Annual International Meeting, July 16-19, 2017, Spokane, WA*.
 5. Sharara, M., T. Runge, **R.A. Larson**, and J.G. Primm. 2017. Techno-economic optimization of community-based manure processing. *2017 ASABE Annual International Meeting, July 16-19, 2017, Spokane, WA*.
 6. **Larson, R.A.**, A. McCord, V. Tumwesige, and H. Aguirre-Villegas. 2017. Integrating Small Scale Digestion Systems in Developing Regions. *LPELC Waste to Worth 2017: International Conference on Livestock and Poultry Environmental Quality, April 18-21, 2017, Cary, NC*.
 7. **Larson, R.A.**, M. Holly, M. Powell, and H. Aguirre-Villegas. 2017. Reducing GHG and ammonia emissions from manure systems. *LPELC Waste to Worth 2017: International Conference on Livestock and Poultry Environmental Quality, April 18-21, 2017, Cary, NC*.
 8. Aguirre-Villegas, H. and **R.A. Larson**. 2017. Estimating GHG Emissions from Manure Management Practices in Dairy Systems. *LPELC Waste to Worth 2017: International Conference on Livestock and Poultry Environmental Quality, April 18-21, 2017, Cary, NC*.
 9. **Larson, R.A.** and B.J. Holmes. DFI Environmental Management Course. *Nestle, June 5-9, 2017, Harbin, China*.
 10. **Larson, R.A.** 2017. Workshop: Whole Farm Nutrient Management. *VSIGERA International Symposium on Agricultural Residues, May 9-11, 2017, Foz du Iguacu, Brazil*.
 11. **Larson, R.A.** 2017. Workshop: Manure Systems and Processing. *VSIGERA International Symposium on Agricultural Residues, May 9-11, 2017, Foz du Iguacu, Brazil*.
 12. **Larson, R.A.** 2017. Workshop: Nutrient Management: Manure Storage and Land Application. *VSIGERA International Symposium on Agricultural Residues, May 9-11, 2017, Foz du Iguacu, Brazil*.

Service

Biological Systems Engineering Committees
 Extension
 Faculty Meeting Secretary
 CALS International Program Committee
 CALS Equity and Diversity Committee
 CALS Equity and Diversity Department Representative
 American Society of Agricultural and Biological Engineers, National Society, NRES-27 Agricultural By-Products and Animal Mortality Management Systems, Past-Chair
 American Society of Agricultural and Biological Engineers, National Society, K.K. Barnes Student Paper Award Competition Committee, Chair
 eXtension, Livestock and Poultry Environmental Learning Center
 North Central Coordinating Committee 9 (NCCC-9), Midwest Plan Service Research and Extension Educational Materials (Midwest Extension Engineers), Past-Chair
 Wisconsin Biogas Council, Advisory Committee
 Reviewer for Journals and USDA panels
 UWEX Dairy Team
 UWEX Nutrient Management Team
 UWEX Bio-energy/Bio-economy Team

Awards in 2017

2017 Blue Ribbon Award for "Considerations for the Use of Manure Irrigation Practices: Report from the Wisconsin Manure Irrigation Workgroup" American Society of Agricultural and Biological Engineers (ASABE)



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, Affiliate Faculty in the Department of Entomology

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. Other research is focused on deployment mechanisms of a pheromone based mating disruption product for controlling pest insects in cranberry. Applied research is also being conducted on current remote sensing technologies and their application to cranberry production. Finally, Dr. Luck is conducting on-farm research investigating aftermarket planter attachments for no-till planting into heavy residue such as cover crops.

Dr. Luck's extension programming is centered around Precision Agriculture Technology. Topics of high interest in 2017 have been variable rate technology, remote sensing and the use of unmanned aerial vehicles (UAV's), and issues dealing with "big data" in agriculture.

Teaching

Spring 2017

Ecoinformatics Seminar Course: Guest Lecture

Fall 2017

SC_FISC 38-016 Precision Agriculture Technologies:
Guest Lecture.

Graduate Student Advisees

- 1) Dervis Gursoy, M.S., Biological Systems Engineering, 2019.
- 2) Natalie Eisner, M.S., Entomology, 2018 (co-advising with Dr. Shawn Steffan).

Graduate Committee Membership

- 1) Steven Vossberg, M.S., Agronomy, 2017 (advisor: Shawn Conley).
- 2) Jessica Drewry, Ph.D., BSE, 2017 (advisor: Chris Choi).

Completed Graduate Students:

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

Post Doctoral Researchers

- 1) Jessica Drewry

Extension/Outreach

Activities within Wisconsin:

- 1) Soils Area Meetings: Madison
- 2) Soils Area Meetings: Eau Claire
- 3) Soils Area Meetings: Sparta
- 4) Soils Area Meetings: Dodgeville
- 5) Soils Area Meetings: Juneau
- 6) Soils Area Meetings: Kiel
- 7) Soils Area Meetings: Shawano
- 8) Soils Area Meetings: Marshfield
- 9) Mayr Family Corn Maze (AgrAbility Benefit)
- 10) Team Forage Training, Marathon Co.
- 11) Discovery Farms Field Day, Rock Co.
- 12) Columbia Co. Winter Grains Meeting
- 13) Monroe Co. Winter Grains Meeting
- 14) WI Corn/Soy Expo (2 Presentations)
- 15) MFA/WCO/Nutrient Applicators Symposium
- 16) Wisconsin Cranberry Growers Cranberry School
- 17) Wisconsin Agribusiness Classic

National Extension Activities:

- 1) National AgrAbility Training Workshop: (60 attendees). Presentation on Succession Planning Work in Wisconsin.
- 2) B. D. Luck. 2017. Precision is the division in silage. Michigan State University/MSU Extension Agriculture Innovation Day. August 24, 2017 at Lake City Research Center, Lake City, MI.

Funded Research Projects

- 1) *Graduate School Fall Research Competition: Development of an in-line manure nitrogen sensor for real-time monitoring during land application.*
R. Larson and **B. D. Luck**
Description: Previous research has shown that light transmittance, reflectance, and trans-reflectance can be used to determine the nutrient content of liquid manure. This research aims to develop an accurate manure nutrient sensor that is capable of providing feedback to a rate controller for the spatially variable application of manure to agricultural fields.
- 2) *Quantifying and characterizing digital information technology needs to support Wisconsin Agriculture.*
J. Shutske, **B. D. Luck**, D. Trechter, M. Alvarez-Stroud, A. Reynolds
Funding: CERANR
Description: Survey and case-studies on agribusiness professionals, producers, and extension professionals to determine rural broadband and technology requirements for future agriculture production.
- 3) *Unmanned Aerial Vehicle based remote sensing technique for detection of cranberry insect pests.*
B. D. Luck and S. A. Steffan
Funding: Wisconsin Specialty Crop Block Grant Program
Description: The University of Wisconsin – Madison will implement precision agriculture practices with the use of remote sensing technology and Unmanned Aerial Vehicles for the identification and mapping of problem areas within cranberry beds, specifically insect infestation, and will provide dissemination of research results through grower meetings and conferences.

Publications

Peer reviewed Journal Articles:

- 1) J. D. Harmon, **B. D. Luck**, K. J. Shinnars, R. P. Anex, and J. L. Drewry. 2018. Time-motion analysis of forage harvest: A case study. Transactions of the ASABE. Accepted and In Press.
- 2) N. E. Dudenhoeffer, **B. D. Luck**, M. F. Digman, and J. L. Drewry. 2018. Technical Note: Simulation of the forage harvest cycle for asset allocation. Applied Engineering in Agriculture. Accepted and In Press.
- 3) J. L. Drewry, M. R. Mondaca, **B. D. Luck**, C. Y. Choi. 2017. A computational fluid dynamics model of biological heat and gaseous generation in a dairy holding area. Transactions of the ASABE. <https://doi.org/10.13031/trans.12394>. Accepted and In Press.
- 4) L. F. Ferraretto, R. D. Shaver, and **B. D. Luck**. 2017. Silage review: Recent advances and future technologies for whole-plant and fractionated corn silage harvesting. Journal of Dairy Science. <https://doi.org/10.3168/jds.2017-13728>. Accepted and In Press.
- 5) **B. D. Luck**, J. D. Davis, J. L. Purswell, A. S. Kiess, and S. J. Hoff. 2017. Assessing the effect of house size and design on air velocity distribution in commercial broiler houses. Transactions of the ASABE 60(4): 1313-1323
- 6) J. L. Drewry, C. Y. Choi, J. M. Powell, and **B. D. Luck**. 2017. Computational model of methane and ammonia emissions from dairy barns: Development and validation. Computers and Electronics in Agriculture. In Press. <http://dx.doi.org/10.1016/j.compag.2017.07.012>

Meeting Papers:

- 1) J. D. Harmon and **B. D. Luck**. 2017. A case study of a commercial dairy and a custom harvest operation to evaluate forage harvest efficiency. ASABE Annual International Meeting. Spokane, WA.

Extension Publications:

- 1) **B. D. Luck**, J. L. Drewry, J. W. Nelson. 2017. Unmanned Aerial Vehicles (Drones): What you need to know for use in Agriculture. University of Wisconsin Extension Learning Store. In Press.

- 2) **B. D. Luck.** 2017. Calibrate Your Yield Monitor for Greater Accuracy During Harvest. UW Extension Learning Store Publication. University of Wisconsin Extension Learning Store Article #A4146.
- 3) F. J. Arriaga, S. P. Conley, B. M. Jensen, C. A.M. Laboski, J. G. Lauer, **B. D. Luck**, P. D. Mitchell, and D. L. Smith. 2017. Grain Management Considerations in Low-Margin Years. University of Wisconsin Extension Learning Store Article # A4137.

Popular Press Articles

- 1) B. D. Luck. June, 2017. Hay moisture determination methods. Midwest Forage Association Forage Focus.
- 2) B. D. Luck. March, 2017. Spring hay machinery maintenance. Midwest Forage Association Forage Focus.
- 3) B. D. Luck. 2017. Corn silage selfies: Using a smartphone app to check kernel processing. Progressive Forage Issue 3: 43, 45.

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)

CALS Committees:

- 1) Agricultural Research Station Committee (10 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)
- 3) MS-49 – Crop Production Systems, Machinery, and Logistics
(Member and Vice Chair)

Other:

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



Xuejun Pan

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 2017:

BSE 364: 3 credits, 8 enrolled

BSE 799: 1 enrolled for 3 credits,

BSE 990: 2 enrolled for 1 credit, and 2 for 2 credits and 1 for 3 credits

Summer 2017:

BSE 990: 1 enrolled for 2 credits

Fall 2017:

BSE 460: 3 credits, 17 enrolled

BSE 799: 1 enrolled for 3 credits

BSE 990: 1 enrolled for 2 credits and 2 for 3 credits

Advising & Mentoring:

Graduate Students Advised:

- 1) Ning Li (Ph.D. Student)
- 2) Yang Liao (Ph.D. Student)
- 3) Zening Wang (Ph.D. Student)
- 4) Shu-Ching Yang (Master Student)
- 5) Tianjiao Qu (Master Student)
- 6) Xueqin Zhang (Visiting PhD Student)
- 7) Xuliang Lin (Visiting PhD Student)
- 8) Jing Hu (Visiting PhD Student)
- 9) Yulu Wang (Visiting PhD Student)

Postdocs and Visiting Scholars:

- 1) Dr. Zongquan Li (Visiting Professor, Qilu University of Technology, China)
- 2) Dr. Yuliang Li (Visiting Professor, Chang'an University, China)
- 3) Dr. Cuihua Dong (Visiting Professor, Qilu University of Technology, China)
- 4) Dr. Zhiqiang Pang (Visiting Professor, Qilu University of Technology, China)

- 5) Dr. Lirong Tang (Visiting Professor, Fujian Agriculture and Forestry University, China)
- 6) Dr. Dafeng Zheng (Visiting Professor, South China University of Technology, China)
- 7) Dr. Linhuo Gan (Visiting Professor, Huaqiao University, China)

Research Projects:

- 1) NSF (National Science Foundation) (CBET 1703519), Xuejun Pan (PI), "Fabrication and fundamental understanding of cellulase-mimetic bifunctional solid acids for hydrolyzing cellulose", \$325,130 (August 2017- July 2020).
- 2) USDA McIntire Stennis (1013556), Xuejun Pan (PI) and Krishnapuram Karthikeyan (Co-PI). "Fabrication and functionalization of whole biomass aerogels from forest residue as biosorbents for heavy metals". \$163,576 (October 2017 – September 2021).
- 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) Advanced Materials Industrial Consortiums (AMIC) Seed Grant: Liao Yang, Shu-ching Yang, and Xuejun Pan (PI). "Fabrication of a novel functionalized meso-porous material from cellulose and biomass for heavy metal ion and formaldehyde gas adsorption", \$10,196 (December 2016 – August 2017)

Grant Proposals:

- 1) USDA AFRI: Xiao Zhang (PI) and Xuejun Pan (PI). Dicarboxylic acids platform for biorefinery lignin

valorization. Budget \$500,000 (\$160,000 to Pan) submitted June 28, 2017. (Funded)

enzymatic hydrolysis of oil palm trunk. *Energy Procedia*. 2017, 138, 1122-1127.

Patents

- 1) Xuejun Pan and Ning Li. Methods of producing oligosaccharides for use as prebiotics. P180109US01, December 26, 2017.

Publications

Google Scholar: total citations, 7150; H index, 39; i10, 67.

Peer-Reviewed Journal Articles

- 1) Zongquan Li and Xuejun Pan. Strategies to modify physicochemical properties of hemicelluloses from biorefinery and paper industry for packaging material. *Reviews in Environmental Science and Bio/Technology*, accepted.
- 2) Gaojin Lyu, Chang Geun Yoo, and Xuejun Pan. Alkali oxidative cracking for effective lignin depolymerization with molecular oxygen. *Biomass & Bioenergy*, 2018, 108, 7-14.
- 3) Chang Geun Yoo, Ning Li, Melanie Swannell, and Xuejun Pan. Isomerization of Glucose to Fructose catalyzed by Lithium Bromide in Water. *Green Chemistry*, 2017, 19, 4402-4411.
- 4) Liheng Chen, Jinze Dou, Qianli Ma, Ning Li, Ruchun Wu, Huiyang Bian, Daniel J. Yelle, Tapani Vuorinen, Shiyu Fu, Xuejun Pan, J.Y. Zhu. Rapid and near-complete dissolution of wood lignin at $\leq 80^{\circ}\text{C}$ by a recyclable acid hydrotrope. *Science Advances*, 2017, 3, e1701735.
- 5) Hongdan Zhang, Ning Li, Xuejun Pan, Shubin Wu, and Jun Xie. Direct transformation of cellulose to gluconic acid in concentrated iron (III) chloride under mild conditions. *ACS Sustainable Chemistry & Engineering* 5 (5), 4066-4072.
- 6) Chang Geun Yoo, Shuting Zhang, and Xuejun Pan. Effective conversion of biomass into bromomethylfurfural, furfural, and depolymerized lignin in lithium bromide molten salt hydrate of a biphasic system. *RSC Advances*. 2017, 7, 300-308.
- 7) Pongsak Noparat, Poonsuk Prasertsan, Sompong O-Thong, Xuejun Pan. Sulfite pretreatment to overcome recalcitrance of lignocellulose for

Invited Seminars

- 1) X.J. Pan. Acidic lithium bromide trihydrate (ALBTH) method: a new protocol for quantitating lignin in lignocellulosic biomass. July 3, 2017, Qilu University of Technology, Jinan, China.
- 2) X.J. Pan. Design, synthesis and performance of cellulase-mimetic polymeric solid acid catalysts for cellulose hydrolysis. June 29, 2017, Beihua University, Jilin, China.
- 3) X.J. Pan. Acidic lithium bromide trihydrate (ALBTH) method: a new protocol for quantitating lignin in lignocellulosic biomass. June 21, 2017, Tianjin University of Science and Technology, Tianjin, China.
- 4) X.J. Pan. Applications of molten salt hydrates in fractionation, conversion, and valorization of lignocellulosic biomass. June 14, 2017, Kunming University of Science and Technology, Kunming, China.
- 5) X.J. Pan. Applications of molten salt hydrates in fractionation, conversion, and valorization of lignocellulosic biomass. June 12, 2017, Central South University of Forestry and Technology, Changsha, China.
- 6) X.J. Pan. Applications of molten salt hydrates in fractionation, conversion, and valorization of lignocellulosic biomass. June 8, 2017, South China University of Technology, Guangzhou, China.
- 7) X.J. Pan. Applications of molten salt hydrates in fractionation, conversion, and valorization of lignocellulosic biomass. June 8, 2017, Guangdong University of Technology, Guangzhou, China.
- 8) X.J. Pan. Innovative technologies for conversion of lignocellulosic biomass to renewable fuels, chemicals and materials. June 3, 2017, Zhongkai University of Agriculture and Engineering, Guangzhou, China.

Oral Conference Presentations

- 1) Ning Li, Xiaohui Yang, Xuliang Lin, and Xuejun Pan. Cleavage of β -O-4 ether bonds in acidic lithium bromide trihydrate for lignin depolymerization. 2017 AIChE Annual Meeting, October 29-November 3, 2017, Minneapolis, MN.

- 2) Ning Li, Zening Wang, Tianjiao Qu, Joseph Kraft, and Xuejun Pan. Synthesis of water-soluble oligosaccharides as potential prebiotics via non-enzymatic sugar glycosylation. 2017 AIChE Annual Meeting, October 29-November 3, 2017, Minneapolis, MN.
- 3) Yang Liao and Xuejun Pan. Fabrication of functionalized aerogels from cellulose and whole biomass for absorbing formaldehyde from indoor air. 2017 AIChE Annual Meeting, October 29-November 3, 2017, Minneapolis, MN.

Professional Service

- 1) University
 - a) BSE Graduate Instruction and Research Committee (40 hr)
 - b) BSE Undergraduate Instruction and Program Committee (40 hr)
 - c) BSE Social Committee (20 hr)
 - d) CALS International Program Committee (20 hr)
 - e) CoE UPRC/ABET Assessment Committee (80 hr)
 - f) CoE Academic Policy, Curriculum, and Regulation Committee (APCRC) committee (10 hr)
- 2) Graduate thesis committee

Civic Service

- 1) Editorship

- a) Associate Editor, *BioEnergy Research*
 - b) Editorial board member of *Journal of Biobased Materials and Bioenergy*
 - c) Editorial board member of *International Journal of Agricultural and Biological Engineering*
- 2) Conference Organization
 - a) Chair of Session 276: Biomass Characterization, Pretreatment and Fractionation. 2017 AIChE Annual Meeting, October 29-November 3, 2017, Minneapolis, MN.
- 3) Journal Article Reviewer
 - a) ACS Catalysis (X2)
 - b) ACS Sustainable Chemistry and Engineering (x3)
 - c) BioEnergy Research (x1)
 - d) Cellulose (X1)
 - e) Catalysis Letters (x1)
 - f) ChemCatChem (x1)
 - g) ChemSusChem (x1)
 - h) Chemical Engineering Journal (x1)
 - i) Green Chemistry (x6)
 - j) Holzforschung (x1)
 - k) Industrial & Engineering Chemistry Research (x1)
 - l) Journal of Biobased Materials and Bioenergy (x1)
 - m) Separation and Purification Technology (x1)
- 4) Proposal Reviewer
 - a) USDA NIFA Exploratory proposal (x1)
 - b) USDA NIFA SBIR proposal (x1)



Douglas J. Reinemann

Professor and Chair

24% Teaching / 25% Research / 51% Extension

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

Campus Affiliations: American Indian Studies Program, 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 2017

- BSE/IES 367, Renewable Energy Systems assisted Troy Runge
- BSE 509: Advised 4 student group

Fall 2017

- BSE/IES 367, Renewable Energy Systems, assisted Troy Runge
- BSE 509: Advised 4 student group

Graduate and Post Docs Advisees

Pablo Manuel Manuel Silva Bolona, PhD Dairy Science 2020.

Jordan Kuehn, MS Dairy Science 2019, co-advised with Larua Hernandez.

John Penry, PhD Dairy Science, 2017

Alen Dzidic, Visiting Fulbright fellow and professor from Croatia.

Dr. John Upton, Post-Doctoral Milking Machine Researcher, 100% appointment,

Horacio A. Aguirre-Villegas, Post-Doc, Co-advised with Rebecca Larson

Extension / Outreach

Support UWEX agent programs in Milking Machines, Milking Parlors, Robotic Milking, Milking Management, Energy, and Bio-Energy:

DATCP field staff cleaning and sanitation course (attendance 20)

Short course presented at national NMC meeting (attendance 40)

Short course for Alpura field staff, Mexico City (attendance 15)

Milking Quality web site Development

MilkTech professional development courses
International On-Line curriculum used in USA, Argentina, and China

Midwest Rural Energy Council (MREC) Web site development

MREC Annual board meeting and conference planning (2 days),
MREC Annual educational conference on rural energy issues (3 days, attendance 150),
MREC Stray Voltage Investigators Courses (4 days, attendance 40)

Funded Research Projects

Milking Machine Research (\$150k/yr)
Collaborators: P Thompson, Scott Sanford

Publications

Google Scholar: Citations 1665, H index-21, i10-53

Peer reviewed Journal Articles

1. Penry, JF, PM Crump, LL Hernandez, and DJ Reinemann, 2017. Association of milking interval and milk production rate in an automatic milking system. J. Dairy Sci. In Press.
2. Penry, JF, J Upton, S. Leonardi, P.D. Thompson, and DJ Reinemann, 2017. A method for assessing liner performance during the peak milk flow period. J. Dairy Sci. In Press.
3. Penry, JF, PM Crump, PL Ruegg, and DJ Reinemann, 2017. Cow- and quarter-level milking indicators and their associations with clinical mastitis in an automatic milking system. J. Dairy Sci. 100(11)9267–9272
4. Aguirre-Villegas, HA, TH Passos-Fonseca, DJ Reinemann, and R Larson, 2017. Got pasture? How grazing intensity affects the environmental impacts of dairy systems. J. Dairy Sci. 100(18)6804-6821
5. Penry, JF, EL Endres, B de Bruijn, A. Kleinhans, PM Crump, DJ Reinemann, LL Hernandez, 2017. Effect of incomplete milking on milk production rate and composition with 2 daily milkings. J. Dairy Sci. 100(2)1535–1540
6. Penry, JF, J Upton, GA Mein, MD Rasmussen, I Ohnstad, PD Thompson, and DJ Reinemann, 2017. Estimating teat canal cross-sectional area to determine the

BSE. Funding: Avon Dairy Solutions. Objectives: Advance the science of biomechanics of machine milking and milking management.

Milking Physiology Research (\$64k/yr) Co-Pi on multi-year Hatch with Laura Hernandez, UW Dairy Science.

Walsh Fellowship (\$50k/yr) Collaborators, Dr. John Upton, Teagasc, Ireland. Milking management in robotically milked cows on pasture.

effects of teat-end and mouthpiece chamber vacuum on teat congestion, J. Dairy Sci. 100(1)821–827

Book Chapters

Reinemann, DJ, 2017. Milking Machine Management. Chapter 9-62 in Large Dairy Herd Management, DK Beede editor, American Dairy Science Association, Champaign IL, pp 853-866.

Conference Proceedings

Upton J, JF Penry, MD Rasmussen, PD Thompson and DJ Reinemann, 2017. Liner Development Work - Effect of pulsation rest phase duration on teat end congestion. Paper presented at the 2017 meeting of the British Mastitis Council.

Professional Development

UW Chair' Chats
Communications and Leadership
Development Workshop (1 week)

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 Energy
Midwest Rural Energy Council, Ex-Officio
Executive Board Member and secretary
National Mastitis Council, Milking Machine

Committee
International Dairy Federation, machine milking
committee
Reviewer for Transactions ASABE, J. Dairy

Science, J. Dairy Research, and several
energy related journals



Troy M. Runge

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

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

Dr. Runge is an Associate 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 biomass chemical composition and its 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 working on several manure processing project investigating cost effective methods of nutrient management and energy production. 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, with a recent emphasis on gamma-valerolactone solvent systems.

Teaching

Course	Semester	Number of Students
BSE 461	Spring 2017	13
BSE 367*	Spring 2017	124
BSE 508**	Spring 2017	5
BSE 461	Fall 2017	12
BSE 249	Fall 2017	90
BSE 367*	Fall 2017	138
BSE 509**	Fall 2017	5

* Assisted by Prof. Reinemann.

**Served as senior project advisor

Graduate and Post Docs Advisees

- 1) Evan Price, M.S. BSE 2017.
- 2) Wei Zhao, M.S. BSE 2018
- 3) Anurag Mandalika, PhD BSE, 2019.
- 4) Shengzhi He, PhD BSE, 2019.
- 5) Qiang Yang, Post-Doctoral Researcher
- 6) Ming-jie Chen, Post-Doctoral Researcher
- 7) Mahmoud Sharara, Assistant Scientist

Outreach

Supported Wisconsin Energy Institute programs including:

- 1) Meetings with state representatives
- 2) Meetings with investors for potential WARF licenses
- 3) Meetings with interested industry

collaborators

Invited talks:

- 1) Troy Runge and Mahmoud Sharara. WI State Agency Integrated Anaerobic Digester Working Group. Decision Support Tool: Coordinated anaerobic digestion of dairy manure (May 9, 2017)
- 2) Troy Runge, Wisconsin Legislative Panel on Anaerobic Digesters and Nutrient Management, Madison WI, Manure Processing in Wisconsin (January 25, 2017)
- 3) Troy Runge, Forward in Energy Forum, Madison, WI (January 31, 2017)

Funded Research Projects

- 1) 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.

- 2) 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.

3) GVL Biorefinery

Funding: NSF SBIR Phase 2

Collaborators: GlucanBio LLC

Objectives: Investigate a biorefinery system that using gamma-valerolactone separation process to create viscose pulps and cellulose nanomaterials.

4) 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.

5) Creating a Pulping Model for Zip-Lignin Modified Trees

Collaborators: John Ralph, Biochem

Funding: WARF

Objectives: Investigate economic potential of using zip-lignin modified trees to improve profitability in pulp and paper operations

6) Scalable, Continuous Processing of Concentrated Lignocellulosic Biomass

Collaborators: Dan Klingenberg, CBE; Thatcher Root, CBE; Tim Scott, FPL; and Carl Houtman, FPL

Funding: WARF

Objectives: develop a scalable, continuous process to separately extract soluble lignin, C5 and C6 sugars (or C6 products) utilizing the GVL acid-hydrolysis chemistry

7) Cellulose Nanofiber Products from a GVL Biorefinery

Funding: USDA Hatch

Objectives: Develop a system to use the GVL biorefinery systems to produce cellulose nanofibers

ice environmental freeway: a deep learning and rough sets approach." *Soft Computing* (2017): 1-10.

- 3) Mandalika, Anurag, and Troy M. Runge. "Addition of corn stover arabinoxylan into hardwood during pulping for improved physical properties." *TAPPI JOURNAL* 16, no. 9 (2017): 495-504.
- 4) Zhao, Wei, Liangjie Xu, Shaoxin Xi, Jizhou Wang, and Troy Runge. "A Sensor-Based Visual Effect Evaluation of Chevron Alignment Signs' Colors on Drivers through the Curves in Snow and Ice Environment." *Journal of Sensors* (2017): Article ID 9168525.
- 5) Zhou, Shengfei, Troy Runge, Steven Karlen, John Ralph, Eliana Gonzales-Vigil, and Shawn Mansfield. "Chemical Pulping Advantages of Zip-lignin Hybrid Poplar." *ChemSusChem* 10, no. 18 (2017): 3565-3573
- 6) Yang, Qiang, Hui Wang, Rebecca Larson, and Troy Michael Runge. "Comparative Study of Chemical Pretreatments of Dairy Manure for Enhanced Biomethane Production." *BioResources* 12, no. 4 (2017): 7363-7375.
- 7) Gunukula, Sampath, Troy Runge, and Robert P. Anex. "Assessment of Biocatalytic Production Parameters to Determine Economic and Environmental Viability." *ACS Sustainable Chemistry & Engineering* (2017).
- 8) Alonso, David Martin, Sikander H. Hakim, Shengfei Zhou, Wangyun Won, Omid Hosseinaei, Jingming Tao, Valerie Garcia-Negron et al. "Increasing the revenue from lignocellulosic biomass: Maximizing feedstock utilization." *Science Advances* 3, no. 5 (2017): e1603301.
- 9) Cronin, Keith R., Troy M. Runge, Xuesong Zhang, R. César Izaurralde, Douglas J. Reinemann, and Julie C. Sinistore. "Spatially Explicit Life Cycle Analysis of Cellulosic Ethanol Production Scenarios in Southwestern Michigan." *BioEnergy Research* 10 (2017):13-25.
- 10) Mahmoud Sharara, Apoorva Sampath, Laura W. Good, Amanda S. Smith, Pamela Porter, Victor M. Zavala, Rebecca Larson, Troy Runge. Spatially explicit methodology for coordinated manure management in shared watersheds. *Journal of Environmental Management*, 192 (2017): 48–56.
- 11) Liu, Zong, Zach Carroll, Sharon Long, and Troy Runge. Centrifuge Separation Effect on Bacterial Indicator Reduction in Dairy Manure. *Journal of Environmental Management*, 191 (2017): 268–

Publications

Peer reviewed Journal Articles

- 1) Kim, Seungdo, Xuesong Zhang, Bruce Dale, Ashwan Daram Reddy, Curtis Dinneen Jones, Keith Cronin, Roberto Cesar Izaurralde, Troy Runge, and Mahmoud Sharara. "Corn stover cannot simultaneously meet both the volume and GHG reduction requirements of the renewable fuel standard." *Biofuels, Bioproducts and Biorefining* (2017).
- 2) Zhao, Wei, Liangjie Xu, Jing Bai, Menglu Ji, and Troy Runge. "Sensor-based risk perception ability network design for drivers in snow and

274.

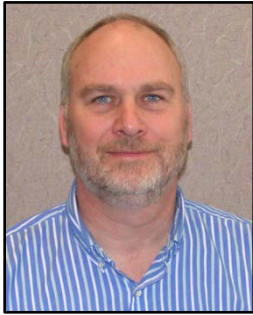
- 12) Anthony, Renil, Mahmoud A. Sharara, Troy M. Runge, and Robert P. Anex. "Life cycle comparison of petroleum-and bio-based paper binder from distillers grains (DG)." *Industrial Crops and Products* 96 (2017): 1-7.

Conference Proceedings

- 1) Mahmoud A. Sharara, Troy M. Runge, and Rebecca Larson. Assessment of Coordinated Anaerobic Digestion of Dairy Manure. Livestock and Poultry Environmental Learning Center (LPELC) Webinar Series (August 14, 2017).
- 2) Mahmoud A. Sharara, Troy M. Runge, Rebecca Larson, and John Primm. Techno-economic optimization of community-based manure processing. Annual International meeting of the American Society of Agricultural and Biological Engineering (ASABE), Spokane, WA (July 19, 2017).
- 3) Mahmoud A. Sharara, Troy M. Runge, Rebecca Larson. Economic Assessment of Coordinated Anaerobic Digestion of Dairy Manure. Assessment of coordinated anaerobic digestion of dairy manure. Waste to Worth 2017. Cary, NC (April 19, 2017).
- 4) Troy Runge. Manure Processing Technologies. Wisconsin Manure Summit Program, Green Bay, WI (February 22, 2017).

Service

- Graduate thesis committees
 - Ning Li, BSE
 - Lei Gu, BSE
 - Shu-ching Zhang, BSE
 - Zach Brentzel, CBE
- BSE committees
 - External Relations & Development
 - Information Technology
- UW Madison committees
 - SciMed Graduate Research Scholars Advisory Board
 - CALS Organizational Redesign Committee
- Professional societies
 - American Society of Agricultural and Biological Engineers
 - Technical Association of Pulp and Paper Paper, Non- wood Committee
 - American Chemical Society
- External committees
 - Reviewer for USDA grant submissions.
 - Vice-chair S1041 multi-state group
 - Vice-chair TAPPI Non-woods committee



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 improving hay and biomass logistics through new machine forms and processed; reducing costs of 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 2017

BSE / ME 476, Off-Road Vehicle Engineering 3 Credits, Enrollment – 38 Instructor Rating – 4.25/5.00

BSE 875 – Mobile Fluid Power Systems 3 Credits, Enrollment – 6

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

Fall 2017

BSE / ME 475, Engineering Principles of Agricultural Machines 3 Credits, Enrollment – 24 Instructor Rating – 4.23/5.00

BSE 509, Design Practicum II 3 Credits, 4 students advised

Research Group

Graduate Students Completed in 2017:

1) Justin Thiede - MS BSE; May 2017

Current Graduate Students:

1) Josh McAfee – MS BSE; January 2018

2) Cyrus Nigon – MS BSE; January 2018

3) Dan Flick – MS BSE; August 2018

4) Nolan Monhollen – MS BSE; August 2019

5) Jacob Hrebik – MS BSE; May 2020

Undergraduate Students Employed in 2017:

Jake Hrebik, Eric Pessig; Brian Gilbertson

Outreach/Technical Presentations

Invited Presentations:

1) Wrapped Bale Silage. Presented at the 2017 Ag Plastic Update for Optimum Feed Storage and Management. Lancaster, WI. March 15th, 2017.

2) Conventional and Novel Approaches to Creating High-Density Biomass Bales. Presented at Inter. Conference on Agricultural Engineering. Hanover, Germany November 11th, 2017.

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) Improving combine residue management.
Funding: John Deere.
Objectives: Develop systems to quantify straw residue particle-size; apply sensor systems to measure residue distribution.

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.

Collaborators: Dan Schaeffer, Animal Science

Funding: John Deere.

Objectives: Improving corn stover yield on single-pass harvest system; conduct beef animal feeding trials.

5) High-density baling of biomass.

Funding: John Deere.

Objectives: Assessment of alternative baling process that does not employ a plungerhead.

6) Corn stover harvest – stover drying rate and high-density baling.

Funding: DuPont Biosciences

Objectives: Improve corn stover harvest through increased drying rates and greater bale density.

7) Improving harvest technologies for fractionating alfalfa into leaf and stem fractions.

Collaborators: Ron Hatfield - USDA; Bei Wu, China Agricultural University

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) Shinnars, K.J., B.K. Sabrowsky, C.L. Studer, and R.L. Nicholson. 2017. Switchgrass harvest progression in the North-Central US. *BioEnergy Research*. 10(3), 613-625

2) Shinnars, K.J. and J.C. Friede. 2017. Enhancing the drying rate of switchgrass. *BioEnergy Research*. 10(3), 603-612.

Peer Reviewed Journal Publications - Accepted

1) McAfee, J.M., K.J. Shinnars and J.C. Friede. 2017. Twine-tension in high-density largesquare bales. Accepted for publication in *Applied Engineering in Agriculture*.

Conference Proceedings

1) Shinnars, K.J. J.C. Friede, J.R. McAfee, D.E. Flick, N.C. Lacy and C.M. Nigon. 2017. Conventional and novel approaches to creating high-density biomass bales. In *Proceedings of 75th Inter. Conference on Agricultural Engineering*. Hanover, Germany. p. 367-374

Service

Graduate Committees

1) Josh Harmon 2) Evan Price

Mentor Committees

1) Brian Luck – Chair

Department

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

College and University

- 1) CALS Ag Research Stations Director Search Committee - Chair

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 (3)
- 2) Bioenergy Research (1)



John Shutske

Professor, Ph.D.

15% Teaching / 25% Research / 60%

Extension Safety Engineering & Agricultural Health

Dr. Shutske's interests and activities include research, outreach, and education to help people to safely apply, design, and evaluate new technologies in ways that reduce injury risk and other negative health outcomes for people and the environment, while simultaneously pursuing enhanced profitability. John also has an affiliate faculty appointment in the UW's Family Medicine Department within the School of Medicine and Public Health. This relationship includes working with health professionals, Extension colleagues, and agricultural services providers to reduce the burden of occupational illness and injury in farming.

Shutske's Extension work in 2017 focused on many aspects of agriculture, occupational health and safety with emphasis on investigative analysis and education around manure gas incidents and issues as well as mitigating the negative impacts of farm financial stress such as impaired decision making, physical health, and injury. Dr. Shutske is the Wisconsin PI on a multi-institutional (Michigan State and UW-Madison) project involving collaborators across numerous disciplines (dairy science, biological systems engineering veterinary medicine, and medicine) investigating the spread of antimicrobial resistance connected to the dairy industry, largely focused on the potential roles and risk factors associated with dairy farm workers. Shutske also leads a project with UW-River Falls on information technology, use, barriers, and professional development needs for dairy, livestock and crop farmers as well as agricultural service providers.

Teaching

Spring 2017

BSE 508: Biological Systems Engineering Design Practicum I (Senior Design, part 1)

Note: BSE 308: Career Management for Engineers (moved from fall to spring semester starting spring, 2018)

Presentations, Workshops, Seminars

1. Agricultural Tools & Technology: Five Big Ag Trends (100 people)
2. Kewaunee County WFTD Planning and Show Updates (50 people)
3. Generations in the Workplace (35 people)
4. Our Brain on Stress: Considerations for Ag Finance Experts (110 people)
5. Manure Gas Safety: Monitoring and Other Considerations (130 people)
6. Updates in Farm Safety, Digital Ag (30 people)
7. Physical Injury in Agriculture (30 people)
8. Our Brain on Stress: Considerations for

Extension Educators (150 people)

9. Your Brain and Stress: Consideration for Financial Mediators and DATCP Farm Center Staff (45 people)
10. Manure Storage Safety Update: Inquiry & Investigation on Recent Human and Animal Death Events (100 people)
11. Agriculture's Big Challenges (and Opportunities) in 2025 and Beyond (110 people)
12. Wisconsin Farm Technology Days Opportunity (22 people)
13. Farm Safety—What can we do Regionally and Nationally? (30 people)
14. Wisconsin Ag Safety and Health Updates (15 people)
15. Developing a Custom Farm Safety & Health Plan (30 people)
16. Investigative Analysis of 2016 Manure Gas Fatality in Portage County, WI (35 people)
17. Helping Farmers During Stressful Times (165 people)
18. Manure Gas Monitoring Safety (35 people)
19. The Future of Agriculture (A 10,000 ft. View) (35 people)
20. Our Brains and Stress: Psychology of a Distressed

Borrower (135 people)

Videos

1. Selection Methods for Design Alternatives
2. Safety Engineering, Part 1: Hazard Assessment
3. Safety Engineering, Part 2: Safety Hierarchy, Warnings, FMEA, Fault Tree Analysis
4. Project Scheduling, Planning, & PERSONAL Time Management/Productivity
5. Market and Customer Research
6. Information Retrieval, Research, Sources & Tools
7. Documenting Your Design Journey
8. Moving Wisconsin Farm Technology Days Forward!

Articles

1. Shutske, J.M., Schaefer, D., Larson, R., Erb, K., Skjolaas, C., Leonard, S., Nelson, J., Binversie, E. and Rifleman, S., 2017. Investigation of a worker death while agitating manure in a non-enclosed storage. *Journal of Agromedicine*.
2. Shutske, J.M., Larson, R.A., Schaefer, D.M., Binversie, E., Rifleman, S., and Skjolaas, C. 2017. Notes from the Field: Death of a Farm Worker After Exposure to Manure Gas in an Open Air Environment—Wisconsin, August 2016. *MMWR. Morbidity and Mortality Weekly Report*, 66. Available at: <https://www.cdc.gov/mmwr/volumes/66/wr/pdfs/mm6632a6.pdf>
3. Shutske, J.M. 2017. Farm Stress & Decision-Making During Challenging Times. UW Extension & UW Madison. Publication A-ASH-101. Available at: <https://uwmadison.box.com/v/A-ASH-101>
4. Shutske, J.M. 2017. McHenry Case Study: Our Brain on Stress. UW Extension & UW Madison. Publication A-ASH-102. Available at: <https://uwmadison.box.com/v/A-ASH-102>
5. Shutske, J.M. 2017. Your Work as an Ag Professional: Helping Tame Farm Stress--Top 10 List. UW Extension & UW Madison. Publication A-ASH-103. Available at: <https://uwmadison.box.com/v/A-ASH-103>

6. R.A. Larson, H. Aguirre-Villegas, C. Skjolaas, J. Shutske, J. Nelson, J. Schauer, and K. Erb. 2017. Reducing Risks from Manure Storage Agitation Gases. University of Wisconsin-Extension, Publication No. UWEX A4131-06 GWQ 078. Available at: <https://learningstore.uwex.edu/Assets/pdfs/A4131-06.pdf>
7. Putting Farm Safety into Practice
8. <https://fyi.uwex.edu/news/2017/09/08/putting-farm-safety-into-practice/>
9. Five top trends driving changes in agriculture
<https://fyi.uwex.edu/news/2017/01/12/five-top-trends-driving-changes-in-agriculture/>
10. Resolutions for a safer 2018 on Wisconsin farms
<http://www.wisfarmer.com/story/news/2017/12/28/resolutions-safer-2018-wisconsin-farms/983569001/>
11. Stress Has an Impact on Dairy Farmers
<https://www.dairyherd.com/article/stress-has-impact-dairy-farmers>
12. Tools & Technology: Five Big Ag Trends
<https://www.slideshare.net/shutske/five-megatrends-in-agriculture-tools-technology-2017>
13. 5 Tech And Social Trends Poised To Transform Agriculture
<https://www.wiscontext.org/5-tech-and-social-trends-poised-transform-agriculture>

Coverage by Media and Popular Press

1. Hydrogen sulfide fatality prompts education efforts
<http://www.wisfarmer.com/story/news/2017/05/16/hydrogen-sulfide-fatality-prompts-education-efforts/324213001/>
2. ROPS Cost Share Now Available
3. <http://www.fabulousfarmbabe.net/2017/03/30/rops-cost-share-now-available/>
4. New Technology Propels Agriculture Forward
<http://www.farmsincanada.ca/news/2017/02/new-technology-propels-agriculture-forward/>
5. Tendências de futuro na agricultura
<http://www.popularempresas.pt/tendencias->

- de-futuro-na-agricultura/
6. New technology propels agriculture forward <http://www.ontariofarmer.com/sitepages/?aid=11979&cn=Quicklinks&an=New%20technology%20propels%20agriculture%20forward>
 7. Putting farm safety into practice <https://www.morningagclips.com/putting-farm-safety-into-practice/>
 8. Man, 13 Cattle Die From Manure Gas <https://www.acsh.org/news/2017/08/17/man-13-cattle-die-manure-gas-11709>
 9. Farmers: Power Down The Stress Cycle <https://www.agriculture.com/family/health-safety/farmers-power-down-the-stress-cycle>

Awards Received

1. Wisconsin Agri-Business Association, 2017 Outstanding Service to Industry Award (January 2017)
2. Purdue University, 2017 Outstanding Agricultural and Biological Engineering Alumni Award (April 2017)

Service Activities

1. Chair, West Madison Agricultural

Research Station Visioning Committee.
Chair, Board of Directors, Wisconsin Farm Technology Days, Inc.

2. UW-Extension, Cooperative Extension, Integrated Working Group (ad-hoc member)
3. Advisory Board of Upper Midwest Agricultural Safety and Health Center (UMASH) <http://umash.umn.edu/advisory-board/>

Funded Projects

- USDA-NIFA. Project: Mitigating transmission of antimicrobial resistance on large dairy farms by reducing behavioral pathways of exposure. Shutske, John (PI, Wisconsin sub-contract); Ruegg, Pamela L. (PI at Michigan State); Sethi, Ajay; Goldberg, Tony; Suen, Garret; Safdar, Nasia. Funding Total: \$1,200,000. Wisconsin subcontract: \$815,000
- UW Consortium for Extension And Research In Agriculture And Natural Resources (CERANR). Project: Quantifying & Characterizing Digital Information Technology Needs to Support Wisconsin Agriculture. Shutske, John (PI); Luck, Brian; Trechter, D. Funding Total: \$54,489.



Anita Thompson

Professor, Ph.D.

50% Teaching / 50% Research

Natural Resources and Environment

Affiliations: The Nelson Institute for Environmental Studies (Nelson Institute Professor of Water Resources and 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.

Honors & Awards:

Recipient, Nelson Institute Professor of Water Resources, Nelson Institute for Environmental Studies, 2016-Present

Teaching:

Spring 2017:

BSE 508: Advisor to NR&E Group, 4 Enrolled

BSE 571: 3 credits, 30 Enrolled

BSE 990: Various Research Credits, 4

Enrolled

ENVIR ST 718: 2 credits, 15 Enrolled

Summer 2017:

BSE 990: Various Research Credits, 3

Enrolled

ENVIR ST 719: 4 credits, 15 Enrolled

Fall 2017:

BSE 473: 2 credits, 42 Enrolled

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

BSE 691: 2 credits, 1 Enrolled

BSE 990: Various Research Credits, 6

Enrolled

ENVIR ST 717: 1 credit, 8 Enrolled

ENVIR ST 999: 1 credit, 5 Enrolled

Advising:

Graduate Students:

Thesis

Ed Boswell (Ph.D. in Soil Science, Expected May 2018)

Laxmi Prasad (Ph.D. in BSE, Expected December 2020)

Elizabeth Buschert (M.S. in BSE, December 2017)

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

Yu Li (M.S. in BSE and Nelson Institute Water Resources Management, Expected August 2018)

Andrew Skog (M.S. in BSE, Expected December 2018)

Andrew Powers (M.S. in BSE, Expected December 2018)

Yi Wang (M.S. in BSE and Nelson Institute Water Resources Management, Expected May 2019)

Rachel Johnson, Wisconsin Distinguished Graduate Fellow (M.S. in BSE and Nelson Institute Water Resources Management, Expected May 2020)

Practicum [M.S. in Nelson Institute Water Resources Management; graduation date or expected date in ()]

Amanda Smith (May 2017) Sean Spencer (May 2017) Abigail Cook (December 2017)

Bridget Faust (Dec 2017) Katherine Hanson (Dec 2017) Eric Mortensen (Dec 2017)

Haley Briel (May 2018) Jack Cotrone (May 2018) Alex Delvoye (May 2018)

Marty Dillenburg (May 2018) Sarah Fanning (May 2018) Yiyi Hu (May 2018)

Alex Jeffers (May 2018) Thor Jeppson (May 2018) Yu Li (May 2018)

Ryan McGuire (May 2018) Tom Pearce (May 2018) Catherine Schumak (May 2018)

Yi Wang (May 2018) Courtney Botelho
 (May 2019) Mitch Buthod (May 2019)
 Marie Dematatis (May 2019) ianna
 Johnson (May 2019) Nemesis
 OrtizDeclet (May 2019)
 Kyle Pepp (May 2019)

Post Master's and Post-Doctoral:

Zach Zopp (Assistant Researcher)
 Dr. Xiang Ji (Visiting Scholar)

Undergraduate Research Advisees:

Anita Liu (B.S. Biological Systems Engineering,
 May 2017)
 Allison LoBue (B.S. Biological Systems
 Engineering, Expected December 2018)

Undergraduate Advisees:

17 (Biological Systems Engineering)

Funded Research Projects (Natural Resources & Environment):

1) "Influence of Soil Matrix Temperature Gradient on Subsurface and Surface Nutrient Transport".

Funding: USDA-NIFA Hatch.

P.I.: A.M. Thompson

Objectives: 1) conduct a field-scale study to understand and quantify the impact of thermal gradients, thermal fluctuations (freeze-thaw) and non-isothermal soil moisture dynamics on nutrient storage and redistribution in soil profiles and their transport via surface and/or subsurface flux. 2) Calibrate and validate a 2D model and use the model to simulate a range of scenarios to understand the effect of nutrient application rate and timing under different soil moisture conditions, soil types and soil temperature along the profile, and climatic conditions to evaluate nutrient availability in soils.

2) "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.

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.

5) "Beaver Dam Lake and Beaver Creek Watershed Assessment"

Funding: Beaver Dam Lake Improvement Association.

P.I.: A.M. Thompson

Objective: 1) Confirm land use with the Beaver Creek sub-watershed, 2) Characterize sediment and phosphorus loading potential in the Beaver Creek sub-watershed, 3) assess streambank habitat, biological habitat and potential for legacy P in Beaver Creek, 4) Monitor water quality in Beaver Creek and Beaver Dam Lake, 5) Identify sources of phosphorus in the lake, 6) Increase community engagement around water quality issues in the lake, and 7) make land and water management recommendations for the watershed.

6) "Stricker's Pond Watershed Assessment."

Funding: City of Middleton.

P.I.: A.M. Thompson

Objective: 1) Assess the ecological condition of Stricker's pond and its watershed and 2) make land and water management recommendations for the watershed.

Peer Reviewed Publications (Natural Resources & Environment):

Published:

1) Singh, H., A.M. Thompson, B. Gharabaghi. 2017. Event runoff and sediment-yield neural networks models for assessment and design of management practices for small agricultural

watersheds. *Journal of Hydrologic Engineering*. 22(2): 1-12. doi:10.1061/(ASCE)HE.1943-5584.0001457

- 2) Sattar, A., B. Gharabaghi, F. Sabouri, A.M. Thompson. 2017. Urban Stormwater Thermal Gene Expression Models for Protection of Sensitive Receiving Streams. *Hydrologic Processes*. 31(13):2330-2348.
- 3) Singh, H., J.C. Panuska, A.M. Thompson. 2017. Estimating sediment delivery ratios for grassed waterways using WEPP. *Land Degradation and Development*. 28: 2051-2061. DOI: 10.1002/ldr.2727.

In Review:

- 4) Gocman, A., A. Wells, K. Nixon, N. Balster, D. Drake, J. Silbernagel, A.M. Thompson. Are All Conservation Subdivision the Same? A Comparative Assessment of Conservation Subdivision Landscape Structures. *Landscape and Urban Planning* (Revisions Requested)
- 5) Stenjem, R., A.M. Thompson, K.G. Karthikeyan, B.J. Lepore, A. Kendall, D. Hyndman. Subsurface water and nutrient dynamics of cellulosic biofuel cropping systems. *Agriculture, Ecosystems and Environment*.
- 6) Parish, A., A. Kendall, A.M. Thompson, R. Stenjem, D. Hyndman. Perennial cellulosic biofuel crops significantly alter ET and recharge fluxes: Direct quantification using Automated Equilibrium Tension Lysimeters. *GCB Bioenergy*.

Abstracts/Papers/Presentations (Natural Resources & Environment):

- 1) Thompson, A.M. 2017. UW-Nelson Institute – Green Lake Partnership: Green Lake Watershed Information System and Water Quality in Big Green Lake Wetland Ecosystems. Green Lake Association Annual Meeting. Green Lake, WI. June 17, 2017. INVITED PRESENTATION.
- 2) Thompson, A.M. 2017. Watershed Land Use and Management Impacts on Water Quality. 2017 Water@UW Spring Symposium. Madison, WI. May 9, 2017. INVITED PRESENTATION.
- 3) Ward Good, L., J. Panuska, Z. Zopp, and A. Thompson. 2017. A method to assess field management effects on snowmelt runoff volume for field-scale runoff risk evaluation tools. Soil and Water Conservation Society Annual Conference, Madison, WI, July 30 – Aug 2, 2017.
- 4) Boswell, E. A.M. Thompson, and Balster, N.

2017. Soil particle size distribution and critical shear stress responses to experimental manipulation of snow cover, Wisconsin, USA.

- Poster Presentation. ASABE Annual International Meeting, Spokane, Washington, July, 16-19, 2017.
- 5) Buschert, E., Z. Zopp, B. Herrick, and A.M. Thompson. 2017. Sources and sinks for phosphorus in a pond-prairie system. Poster Presentation. AWRA Wisconsin Section Conference, Elkhart Lake, Wisconsin, March, 9-10, 2017.
 - 6) Fuller, S. and A.M. Thompson. 2017. Spatial and temporal variation of sediment and phosphorus in Green Lake's Wetland Ecosystems. Poster Presentation. AWRA Wisconsin Section Conference, Elkhart Lake, Wisconsin, March, 9-10, 2017.
 - 7) Boswell, E. A.M. Thompson, and Balster, N. 2017. Influence of freezing and thawing on soil aggregate dynamics and sediment detachment. Poster Presentation. AWRA Wisconsin Section Conference, Elkhart Lake, Wisconsin, March, 9-10, 2017
 - 8) Buschert, E., Z. Zopp, B. Herrick, A.M. Thompson. 2017. Sources and sinks for phosphorus in Curtis Prairie. Science Day, University of Wisconsin Arboretum. February 9, 2017.

Professional Service

Department and University Activities

- a) Chair, UW Nelson Institute Water Resources Management Graduate Program, 2015 – Present
- b) Member, UW Graduate School Research Committee for the Physical Sciences, 2016-2019
- c) Member, UW Committee on Undergraduate Recruitment, Admissions, and Financial Aid, 2013-2017
- d) Member, Water@UW Executive Committee, 2017-Present
- e) Member, Water@UW Steering Committee, 2016-2017
- f) Member, UW CALS Equity and Diversity Committee, 2014-2017
- g) Member, UW CALS Scholarship and Loans Committee, 2017-Present
- h) Alternate Senator, UW Faculty Senate, 2012-Present

- i) Member, BSE Development and External Relations Committee, 2013-Present
- j) Member, BSE Undergraduate Instruction and Program Committee, 2002-2017
- k) Member, BSE Awards Committee 2007-Present
- l) Member, Soil Science Faculty Search and Screen Committee (Soil Physics), 2017
- m) Member, BSE Faculty Search and Screen Committee (Machinery Systems), 2017
- n) Member, Biology in Engineering Certificate Program Committee, 2009-Present
- o) Member, The Nelson Institute for Environmental Studies, Water Resources Management Program Committee, 2010-Present
- p) Member, The Nelson Institute for Environmental Studies, Water Resources Management Program Graduate Admissions Committee, 2014-Present
- q) Chair, R. Larson Mentor Committee, 2011-Present
- r) Proposal Reviewer, USDA-CSREES Hatch

Professional

- s) Member, Organizing Committee for 2021 ASABE International Soil Erosion Symposium, 2016-2021
- t) Associate Editor, Transactions of the ASABE, 2008-Present

- u) Representative, Consortium of Universities for the Advancement of Hydrologic Sciences, Inc., 2011-Present
- v) Representative, Universities Council on Water Resources, 2015-Present
- w) Chair, ASABE NRES-223, Soil Erosion Research Committee, 2015-2017
- x) Vice-Chair, ASABE NRES-22 Erosion Control Committee, 2017-Present
- y) Member, American Society of Agricultural and Biological Engineers, 1996-Present
- z) Member, American Water Resource Association, 2008-Present
- aa) Member, American Geophysical Union, 2007-Present
- bb) Member, ASABE NRES-21 Hydrology Committee, 2004-Present
- cc) Member, ASABE NRES-22 Erosion Control Committee, 2004-Present
- dd) Member, ASABE BE-22 Ecological Engineering Committee, 2003-Present
- ee) Reviewer, Promotion Case Clemson University
- ff) Reviewer, Transactions of ASABE; Journal of Soil and Water Conservation, Journal of Environmental Management

Affiliate and Emeritus Faculty Activity Reports



Ferencz S. Denes

Professor Emeritus, Ph.D.

Research

Food Safety

Research Interests

Low and atmospheric, non-equilibrium plasma (including submerged arc plasmas)-enhanced synthesis and surface modification of materials.

Plasma-mediated synthesis, characterization, and surface functionalization of carbon-host and hybrid nanoparticles and magnetic nanoparticles for biotech applications.

Active Research

Functionalization of magnetic iron oxide nanoparticles, at high pressure (around 20 Tons/cm²) in the presence of melamine.

Evaluation of the efficacy of the surface attachment of primary amine functionalities, and the potential in the next step o the attachment of Avidin functionalize with Fluoresceine-Thio-Isocyanate, required for biotech applications.

Characterization of the functionalized nanoparticles 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

Analytical Assistance

Professor Ioan I. Negulescu: Fluorescence evaluation
Louisiana State University, Baton Rouge Louisiana.
Dr. Brian Edwards: Survey and High Resolution ESCA
University of Texas at Arlington.



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 component.

Publications

Peer reviewed Journal Articles

Zhou S, Runge T, Karlen SD, Ralph J, Gonzales-Vigil E, Mansfield SD (2017) Chemical pulping advantages of Zip-lignin hybrid poplar. *ChemSusChem* **10**: 3565-3573

Yue F, Lu F, Regner M, Sun R, Ralph J (2017) Lignin-derived thioacidolysis dimers: Reevaluation, new products, authentication, and quantification. *ChemSusChem* **10**: 830-835

Yue F, Gao R, Piotrowski JS, Kabbage M, Lu F, Ralph J (2017) Scaled-up production of poacic acid, a plant-derived antifungal agent. *Industrial Crops & Products* **103**: 240-243

Van Acker R, Déjardin A, Desmet S, Hoengenaert L, Vanholme R, Morreel K, Laurans F, Kim H, Santoro N, Foster C, Goeminne G, Légée F, Lapierre C, Pilate G, Ralph J, Boerjan W (2017) Different routes for conifer- and sinapaldehyde and higher saccharification upon deficiency in the DEHYDROGENASE CAD1. *Plant Physiology* **175**: 1018-1039

Unda F, Kim H, Hefer C, Ralph J, Mansfield SD (2017) Altering carbon allocation in hybrid poplar (*Populus alba* × *grandidentata*) impacts cell wall growth and development. *Plant Biotechnology Journal* **15**: 865-878

Smith RA, Scheutz M, Karlen SD, Bird D, Tokunaga N, Sato Y, Mansfield SD, Ralph J, Samuels AL (2017)

Defining the diverse cell populations contributing to lignification in Arabidopsis stems. *Plant Physiology* **174**: 1028-1036

Smith RA, Cass CL, Mazaheri M, Sekhon RS, Heckwolf M, Kaeppler H, de Leon N, Mansfield SD, Kaeppler SM, Sedbrook JC, Karlen SD, Ralph J (2017) Suppression of CINNAMOYL-CoA REDUCTASE increases the level of monolignol-ferulates incorporated into maize lignins. *Biotechnology for Biofuels* **10**: 109: 101-110

Singh R, Hu J, Regner M, Round JW, Ralph J, Saddler JN, Eltis LD (2017) Enhanced delignification of steam-pretreated poplar by a bacterial laccase. *Nature Scientific Reports* **7**: 42121: 42121-42113

Saleme MdLS, Cesarino I, Vargas L, Kim H, Vanholme R, Goeminne G, Van Acker R, Campos de Assis Fonseca F, Pallidis A, Voorend W, Nicomedes J, Jr., Van Doorselaere J, Ralph J, Boerjan W (2017) Silencing *CAFFEYOYL SHIKIMATE ESTERASE* in poplar affects lignification and improves saccharification. *Plant Physiology* **175**: 1040-1057

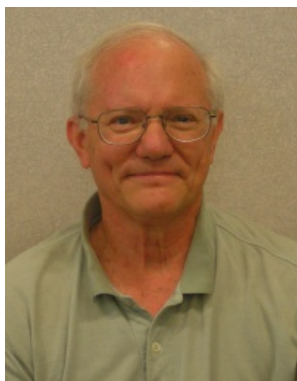
Novo M, Silvar C, Merino F, Martinez T, Ralph J, Lu F, Pomar F (2017) Deciphering the role of the phenylpropanoid metabolism in the tolerance of pepper (*Capsicum annuum* L.) to *Verticillium dahliae* Kleb. *Plant Science* **258**: 12-20

Mnich E, Vanholme R, Oyarce P, Liu S, Lu F, Goeminne G, Jorgensen B, Motawie MS, Boerjan W, Ralph J, Ulvskov P, Moller BL, Bjarnholt N, Harholt J

- (2017) Degradation of lignin β -aryl ether units in *Arabidopsis thaliana* expressing *LigD*, *LigF* and *LigG* from *Sphingomonas paucimobilis* SYK-6. *Plant Biotechnology Journal* **15**: 581-593
- McClelland DJ, Motagamwata AH, Li Y, Rover MR, Wittrig AM, Wu C, Buchanan JS, Brown RC, Ralph J, Dumesic JA, Huber G** (2017) Functionality and molecular weight distribution of red oak lignin before and after pyrolysis and hydrogenation. *Green Chemistry* **19**: 1378-1389
- MacMillan CP, Birke H, Chuah A, Brill E, Tsuji Y, Ralph J, Dennis ES, Llewellyn D, Pettolino FA** (2017) Tissue and cell-specific transcriptomes in cotton reveal the subtleties of gene regulation underlying the diversity of plant secondary cell walls. *BMC Genomics* **18**: 539: 531-518
- Li H, Yelle DJ, Li C, Yang M, Ke J, Zhang R, Liu Y, Zhu N, Liang S, Mo X, Ralph J, Currie CR, Mo J** (2017) Lignocellulose pretreatment in a fungus-cultivating termite. *Proceedings of the National Academies of Sciences* **114**: 4709-4714
- Kim KH, Dutta T, Ralph J, Mansfield SD, Simmons BA, Singh S** (2017) Impact of lignin polymer backbone esters on ionic liquid pretreatment of poplar. *Biotechnology for Biofuels* **10**: 101: 101-110
- Kim H, Padmakshan D, Li Y, Rencoret J, Hatfield RD, Ralph J** (2017) Characterization and elimination of undesirable protein residues in plant cell wall materials for enhancing lignin analysis by solution-state NMR. *Biomacromolecules* **18**: 4184–4195
- Karlen SD, Smith RA, Kim H, Padmakshan D, Bartuce A, Mobley JK, Free HCA, Smith BG, Harris PJ, Ralph J** (2017) Highly decorated lignins occur in leaf base cell walls of the Canary Island date palm *Phoenix canariensis*. *Plant Physiology* **175**: 1058-1067
- Jun S-Y, Walker A, Kim H, Ralph J, Vermerris W, Sattler S, Kang C** (2017) The enzyme activity and substrate specificity of two major cinnamyl alcohol dehydrogenases in sorghum (*Sorghum bicolor*), SbCAD2 and SbCAD4. *Plant Physiology* **174**: 2128-2145
- Johnson A, Kim H, Ralph J, Mansfield SD** (2017) Natural acetylation impacts carbohydrate recovery during deconstruction of *Populus trichocarpa* wood. *Biotechnology for Biofuels* **10**: 2-12
- Jensen A, Cabrera Y, Hsieh C-W, Nielsen J, Ralph J, Felby C** (2017) 2D NMR characterization of wheat straw residual lignin after dilute acid pretreatment with different severities. *Holzforschung* **71**: 461-469
- Gall D, Ralph J, Donohue TJ, Noguera DR** (2017) Biochemical transformation of lignin for deriving valued commodities from lignocellulose. *Current Opinion in Biotechnology* **45**: 120-126
- Eloy NB, Voorend W, Lan W, de Lyra Soriano Saleme M, Cesarino I, Vanholme R, Smith RA, Goeminne G, Pallidis A, Morreel K, Nicomedes J, Jr., Ralph J, Boerjan W** (2017) Silencing CHALCONE SYNTHASE in maize impedes the incorporation of tricin into lignin and increases lignin content. *Plant Physiology* **173**: 998-1016
- del Río JC, Rencoret J, Gutiérrez A, Kim H, Ralph J** (2017) Hydroxystilbenes are monomers in palm fruit endocarp lignins. *Plant Physiology* **174**: 2072-2082

Awards

- 1) Clarivate Analytics Highly Cited Researcher, 1 of 10 at UW-Madison.



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 2017

PhD course in wood chemistry – 20 students, KTH, Stockholm, Sweden

Fall 2017

Chemical modification of wood MATC – 45 students
Madison, WI

Publications

Peer Reviewed Journal Articles

- 1) Rowell, R.M. 2017. Bio-Based Composites. Natural Fibers: Properties, Mechanical Behavior, Functionalization and Applications. R.M. Kozlowski and M. Muzyczek, eds, Nova Science Publishers, New York, NY, Chapter 13, 257-267, 2017.
- 2) Rowell, R.M. 2017. Stable and durable wood building materials based on molecular level chemical modification. Int. J. Comp. Meth. And Exp. Meas, Vol 5, No 6 894-904.
- 3) Rowell, R.M. and Bongers, F. 2017. Role of Moisture in the Failure of Coatings on Wood, Coatings 7(12), 219-228.

Conference Proceedings

- 1) Rowell, R.M. 2017. Stable and durable wood building materials based on molecular level chemical

modification. Proceedings: First International Conference on Timber Structures and Engineering, New Forest, UK, June 2017. 2) Rowell, R.M. 2017. Interface between research and industry: From the lab to the commercial world – a broken link. .Proceedings: 4th International conference on Technology transfer or the development of new products in agriculture and industry. Poznan, Poland, June 2017.

Invited Conferences

- 1) International Timber Conference, June 19, Manchester, UK
- 2) First International Conference on Timber Structures and Engineering. “Stable and durable wood building materials based on molecular level chemical modification”. New Forest, UK, June.
- 3) First International Conference on Technology transfer for the development of new products in agriculture and industry June 27, Melpin, Poland
- 4) 4th International conference Interface between research and industry: From the lab to the commercial world. Poznan, Poland, June 29.
- 5) Accsys Worldwide Conference on Wood Modification, Sept 24-26, Duiven, The Netherlands.

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 served as the Interim Director the UW Center for Agricultural Safety and Health from September, 2003 until July, 2016. 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, Wisconsin Potato and Vegetable Growers, and Professional Nutrient Applicator Association of Wisconsin (PNAAW).

Addressing issues related to Manure Storage and Handling Systems was an area of emphasis for Cheryl during 2017. After several deaths in Wisconsin related to this safety topic. As a pre-conference to the 2017 Midwest Manure Summit, she led a one-day pre-conference training working with an OSHA Compliance Assistance Specialist and an industry representative. While participation was small there 2 engineers from a manure equipment company looking to address issues with designs, 1 large dairy safety director representing over 50 employees, 5 UW Extension dairy and livestock educators and a writer from Manure Manager magazine that extended the reach of the program. She also presented on manure gas safety for the Biogas Digester pre-conference, during a general session and staffed a display on safety equipment. At the display, assistance was provided to a custom manure applicator that the next day went and purchased monitors for his crew. The dairy farm safety director further developed the farms written confined space program and monitoring plan. Cheryl's efforts continued with her involvement on the planning committee for the North American Manure Expo held at UW Arlington Research Station, August 22 and 23, 2018. She assisted the committee with the safety plans and procedures for the events involving manure agitation. In addition she presented on air monitoring equipment with a MSA technical representative to over 60 attendees. Continuing her work with agricultural emergency preparedness she worked with UW Extension agricultural agents to conduct a training for emergency responders from Lafayette and Green counties reaching over 100 rescue personnel and farmers.

Teaching

- Farm Industry Short Course Agricultural Safety and Health (3 week – 1 credit course) 41 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.

- Administered \$19,200 for use with 2016-17 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.

- Presented on OSHA Hazard Communications Program as a session for the 2017 Agricultural Safety Connection conference.
- Assisted two Wisconsin dairy farms with safety reviews related to OSHA investigations and citations. Case is closed for one farm and the assistance helped reduce their penalty by
- Participated with UW Extension Dairy Team on El Campeno newsletter articles and team activities.
- Continued work with the Professional Nutrient Applicators Association of Wisconsin (PNAAW) manure related safety in conjunction with the workgroup for the UW Extension Nutrient Management Team. Part of a grant funded multi-state effort with Environmental Resource Center (ERC) to develop an online training for applicators funding by NRCS.
- Continued to develop and enhance the UW Center for Agricultural Safety and Health website (<http://fyi.uwex.edu/agsafety>) and Implement of Husbandry website (<http://fyi.uwex.edu/ioh>)
- Responded to media requests for information and radio interviews. Interviewed by two Madison area tv networks and Wisconsin Public Radio on highway safety for agricultural vehicles after a significant motor vehicle and combine crash during fall 2017.

Extension Disaster Education Network (EDEN) and Emergency Preparedness

- Continued as EDEN Point of Contact for UW Extension.
- Serving as chair-elect for Executive Committee, 2016-2018.
- Chaired annual meeting committee for 2017.
- Providing leadership to develop and conduct EDEN professional development webinar series for 2017-18. Two webinars conducted in 2017 and 3 planned for 2018 using eXtension Zoom webinar platform. This professional development is for EDEN institutions including 1862 and 1890 institutions as well as Sea Grant Extension. Webinar recordings are available on EDEN website (<http://eden.lsu.edu>) .
- Continued to serve as UW Extension representative to the Farm Service Agency State Emergency Board
- Serving on the Wisconsin Emergency Management All Hazards Mitigation Team and Radiological Emergency Program Recovery Team. Assisted with planning of 3 Radiological planning meetings in Green, Dunn and

Manitowoc counties on revising agricultural information and processes.

- Serving as an UW Extension representative to Wisconsin Animal Health Emergency Management System (WAHEMS) and served on a Foot and Mouth Preparedness Exercise planning committee for a Wisconsin Emergency Management (WEM) Northeast Wisconsin region to be held January 2018.

Other

- Completed 30 hour Fundamentals of Online Teaching certificate from UW-Madison Division of Continuing Studies.
- Completed Federal Emergency Management Agency (FEMA) Incident Command System 100 and 200 online courses

Publications

Websites:

- <http://fyi.uwex.edu/agsafety>
- <http://fyi.uwex.edu/ioh>
- <http://fyi.uwex.edu/tractorcet>
- Co-author publication “Reducing Risks from Manure Storage Agitation Gases”, UWEX A4131-06 GWQ 078, 2017.
- Co-author article “Unusual Worker Death Investigation While Agitating Liquid Beef Manure”, Journal of AgroMedicine, posted online October 25, 2017.
- Co-author “Notes from the Field: Death of a Farm Worker after Exposure to Manure Gas in an Open Air Environment – Wisconsin, August 2016” published Center for Disease Control Mortality and Morbidity Weekly Report (MMWR), August 18, 2017. No. 32.
- Co-author “Skid Steer Loader Safety,” A4150, and “La operación segura de minicargadoras de dirección deslizante,” A4150S, UW Extension 2017.

Service

- NCERA 197 multi-state committee on agricultural safety and health activities.
- Epsilon Sigma Phi member, 1995 – present

Center Goals

- Goal 1: Assist with review of UW Center for Safety and Health.
- Goal 2: Assist with revisions to the curriculum and

resources used with the Wisconsin Safe Operation of Tractor and Machinery Safety Certification Program

- Goal 3: Development of Worker Safety Resources for Dairy Farms
 - Continue to develop materials in both English and Spanish.
 - Work with BSE 508 students on fall protection systems related to horizontal silos and silage piles.
 - Cooperate with the Wisconsin Potato and Vegetable Growers Association on safety resources for field workers and agricultural vehicle operators.



AgrAbility of Wisconsin

Richard Straub

Project Director

Abigail Jensen

Outreach Specialist

Brian Luck

Co-Director

Program Assistants

Rachel Gerbitz (Summer/ School Year)

Anna Gries (School Year)

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

AgrAbility of Wisconsin served 460 clients with 70 of those individuals being first time clients in our 2016-17 grant year. In its 26 years of existence, AgrAbility of Wisconsin has served over 2,700 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 11-12
- 2) Wisconsin Fresh Fruit and Vegetable Conference, January 22-24
- 3) MREC Conference, February 9
- 4) Marshfield Mall Farm Show- Marshfield, Feb 15-16
- 5) MOSES Organic Farming Conference, Feb 23-25
- 6) Eau Claire Farm Show- Eau Claire, Mar 7-8
- 7) AgrAbility Annual Summit- Marshfield, Mar 15
- 8) PDPW Business Conference- Madison, Mar 16
- 9) National AgrAbility Training Workshop, Tennessee, Mar 20-23
- 10) WPS Farm Show- Oshkosh, Mar 28-30
- 11) Midwest Horse Sale, Apr 5-7
- 12) JCEP Conference, Apr 19
- 13) Kewaunee County Rural Safety Day- Kewaunee, May 25
- 14) WI FFA Convention, Jun 14
- 15) WI Farm Tech Days, Jul 11-13

- 16) Neighbor to Neighbor Meeting, Jul 26
- 17) Skip Ellenbecker Golf Outing, Jul 29
- 18) UW-Extension Booth at State Fair, West Allis, Aug 3
- 19) Neighbor to Neighbor Meeting, Aug 4

Teaching:

- 1) UW Madison Marketing class presentation
- 2) FFA Classroom presentations
- 3) UW Madison Rural Health class presentation
- 4) Wisconsin Rehabilitation Council presentations

Publications:

1. Wisconsin State Farmer
 - a. "AgrAbility helps farmers stay on the farm"
 - b. "Easter Seals Wisconsin hosting annual Neighbor-to-Neighbor meeting"
 - c. "AgrAbility changes farmers' lives"
 - d. "Collaboration effort helps farmers with disabilities"
 - e. "Modernization tops Calumet Sundae on a Dairy Farm"
2. AgriView
 - a. "DeLaval, AgrAbility assist farmers"
 - b. "AgrAbility Summit held March 15"
3. The Country Today
 - a. "DeLaval, AgrAbility offers farmer assistance program"
 - b. "AgrAbility program moves ahead despite policy change"
 - c. "New policy limits help for farmers with

- 20) Indian Summer Festival, Milwaukee, Sept 8-10
- 21) World Dairy Expo, Madison, Oct 1-4
- 22) AgrAbility Advisory Council Meeting- Madison, Nov 1

disabilities"

4. Dairy Star
 - a. "A survivor's story: Bragger loses leg in auger accident, advocates farm safety"
 - b. "Drawing Strength from family: Williams still farming despite health problems"

Professional Development

- 1) Nonprofit Administration and Development Courses

Professional Service

- 1) Professional (ASABE/Other)
 - a. National AgrAbility National Training Workshop Planning Committee
 - Farmer Stipend, Chair
 - Hospitality, committee member
 - Farm Luncheon, committee member
 - Exhibitors, committee member
- 2) Civic Service
 - a. Walworth County Farm Bureau Member
 - b. World Dairy Expo Volunteer
 - c. Cows on the Concourse Event Planning Committee
 - Logistics Committee Chair
 - d. UW Madison LSC Mentor

Academic Staff Activity Reports



Horacio A. Aguirre-Villegas

Assistant Scientist, Ph.D.

100% Research

Dr. Horacio Aguirre-Villegas is a scientist conducting cutting-edge research integrating life cycle assessment methods at the intersection of energy, waste management, climate change, and food security. His work has contributed to the development of novel science-based data and to provide solutions that promote the sustainability of agricultural systems by integrating bio-energy generation and increasing the value of waste streams. His current research focuses on promoting the environmental sustainability of the dairy industry and increasing the value of manure streams. His research agenda has been published in a wide array of academic peer-reviewed journals and has been successfully translated into extension and outreach documents to inform wider audiences, particularly U.S. farmers and policy makers.

Funded Research Projects

1) Title: Climate Change Mitigation and Adaptation In Dairy Production

Funding: AFRI/CAP

PI's: Ruark M, Jahn M, Wattiaux M, Bland B, Stephenson M, Reinemann DJ, and Larson R

Objectives: Life cycle assessment modeling and extension material development and outreach

2) Title: Developing Science Based Materials to Assess the Environmental Impact of Swine Facilities

Funding: Wisconsin Pork Producers Association

PI's: Larson R

Objectives: provide scientific based information on the environmental and social impacts of new pork production facilities. Survey design

3) Title: A Multi-Scale Platform for Technology Evaluation and Decision-Making in the Dairy-Water-Energy Nexus

Funding: Wisconsin Pork Producers Association

PI's: Zavala V, Noguera D, Karthikeyan K, Larson R, and Hicks A

Objectives: provide scientific based information on waste optimization across sectors to reduce environmental impacts

Peer-reviewed Journal Publications

1. Aguirre-Villegas HA, Reinemann DJ, Larson R, and Passos-Fonseca T, 2017, Got pasture? How grazing intensity affects the environmental impacts of dairy systems, Journal of Dairy Science, 100:6804-6821, <https://doi.org/10.3168/jds.2016-12325>
2. Aguirre-Villegas HA and Benson CH, 2017, Case history of environmental impacts of an Indonesian coal supply chain, Journal of Cleaner Production, 157:47-56 <http://dx.doi.org/10.1016/j.jclepro.2017.03.232>
3. Holly MA, Larson RA, Powell MJ, Ruark MD, and Aguirre-Villegas HA, 2017, Greenhouse gas and ammonia emissions from digested and separated dairy manure during storage and after land application, Agriculture, Ecosystems and Environment, 239:410-419, <http://dx.doi.org/10.1016/j.agee.2017.02.007>
4. Aguirre-Villegas HA and Larson R., 2017, Evaluating greenhouse gas emissions from dairy manure management practices using survey data and lifecycle tools. Journal of Cleaner Production, 143:169-179

Peer-reviewed Extension Publications

1. Aguirre-Villegas HA, Larson RA, Ruark MD, Liang D, Wattiaux M, Chase L, and Cabrera V, 2017, Mitigation of enteric methane emissions from dairy cows, UWEX A4131-08, GWQ 080
2. Aguirre-Villegas HA, Larson RA, Ruark MD, Liang D, Wattiaux M, Chase L, and Cabrera V, 2017, Enteric methane emissions from dairy cows: Accounting techniques, UWEX A4131-07, GWQ 079
3. Larson RA, Aguirre Villegas HA, Skjolaas C, Shutske J, Nelson J, Schauer J, and Erb K, 2017, Reducing risks from manure storage agitation gases, UWEX A4131-06, GWQ 078
4. Aguirre-Villegas HA, Larson RA, and Ruark MD, 2017, Greenhouse gas and ammonia emissions from dairy manure management systems, University of Wisconsin-Extension, Publication Numbers: UWEX A4131-05, GWQ 077
5. Aguirre-Villegas HA, Larson RA, and Ruark MD, 2017, Solid-liquid separation of manure and effects on greenhouse gas and ammonia emissions, University of Wisconsin-Extension, Publication Numbers: UWEX A4131-04, GWQ 076
6. Aguirre-Villegas HA, Larson RA, and Ruark MD, 2017, Manure agitation, University of Wisconsin-Extension, Publication Numbers: UWEX A4131-03, GWQ 075
7. Aguirre-Villegas HA, Larson RA, and Ruark MD, 2016, Dairy anaerobic digestion systems and their impact on greenhouse gas and ammonia emissions, University of Wisconsin-Extension, Publication Numbers: UWEX A4131-02, GWQ 074

Web Pages

1. Hofstetter D, Fabian-Wheeler E, Larson R, Aguirre-Villegas HA, Betz C, and Ruark M, 2017, Virtual Farm Dairy: A modelled dairy farm

informing farmers, educators, dairy operators, and the general public about the components of modern dairy farms and ways to reduce the environmental impacts, making them more resilient to climate events and maintaining productivity. University of Wisconsin-Madison, Penn State University, and United States Department of Agriculture,
<http://wpsudev2.vhost.psu.edu/virtualfarm/>

Invited Presentations

1. Aguirre-Villegas HA and Larson R, 2017, GHG emissions from dairy manure management. ASABE Annual Meeting at Spokane, WA
2. Aguirre-Villegas HA and Larson R, 2017, Anaerobic digestion for household applications in developing regions. ASABE Annual Meeting at Spokane, WA
3. Larson R and Aguirre-Villegas HA, 2017, Assessment of anaerobic digesters and solid-liquid separators in Wisconsin: Tracking nutrients and assessing emissions. Poster presented at the 2017 Annual Meeting of the American Society of Agricultural and Biological Engineers, Spokane, WA
4. Fabian E, Hofstetter D, Ruark M, Larson R, Aguirre-Villegas HA and Betz C, 2017, Development of a multi-layered interactive virtual farm website for dairy sustainability information. Poster presented at the 2017 Annual Meeting of the American Society of Agricultural and Biological Engineers, Spokane, WA
5. Aguirre-Villegas HA and Larson R, 2017, Estimating GHG emissions from manure management practices in dairy systems. LPELC Waste to Worth 2017: International Conference on Livestock and Poultry Environmental Quality, Cary, NC
6. Hofstetter D, Fabian-Wheeler E, Larson R, Aguirre-Villegas HA, Betz C, and Ruark M, 2017, Transferring knowledge of dairy sustainability issues through a multi-layered interactive

“virtual farm” website. LPELC Waste to Worth 2017: International Conference on Livestock and Poultry Environmental Quality, Cary, NC

7. Larson RA, McCord A, Tumwesige V, Aguirre-Villegas HA, 2017, Integrating Small Scale Digestion Systems in Developing Regions. LPELC Waste to Worth 2017: International Conference on Livestock and Poultry Environmental Quality, Cary, NC
8. Larson RA, Holly M, Powell M, and Aguirre-Villegas HA, 2017, Reducing GHG and ammonia emissions from manure systems. LPELC Waste to Worth 2017: International Conference on Livestock and Poultry Environmental Quality, Cary, NC

Service

1. Natural Resources and Environmental Systems (NRES)-27, Agricultural by-products and Animal Mortality Management Systems

2. Member, North Central Coordinating Committee 9
3. Member, Livestock and Poultry Environmental Learning Center (LPELC), National Cooperative Extension Service
4. Member, American Society of Agricultural and Biological Engineers (ASABE)
5. Reviewer for the following Journals: Journal of Cleaner Production, Journal of Dairy Science, Land Degradation and Development, Bioenergy Research, Agriculture, Sustainability, Energies, Journal of CO2 utilization, Agriculture, Ecosystems and Environment, Science of the Total Environment, International Journal of Life Cycle Assessment



Kody Habeck

Senior Instrumentation Specialist

35% Equipment and Instrument design and fabrication / 30% Facility and Personnel Management / 25% Instructional Support / 9% CALS/Campus Services / 1% DPA backup

Kody Habeck is an Instrumentation Innovation Instructor in the Biological Systems Engineering (BSE) department at the University of Wisconsin – Madison where he has been on academic staff since 2016. He runs and maintains the BSE fabrication shop that is used for fabrication of research projects as well as used by students in various BSE courses. In addition to training students and assisting with their fabrication needs, Mr. Habeck also designs and fabricates requested projects for the BSE department as well as for other CALS departments.

Teaching

- InterEgr 170 – Design Practicum: 2 credits, 24 enrolled
- BSE 508/509 – Design Practicum I & II: 5 credits total, advisor for group of 5 students

Department Support Activities

- Assistant advisor for Quarter Scale Tractor Pulling Team
- Implemented a semester long biweekly Women's Shop Night to allow female BSE students and staff the opportunity to get hands on experience with fabrication machines
- Recorded and edited safety training videos for individual machines in the BSE fabrication shop
- Created an online shop safety and training course composed of safety and training videos, training documentations, quizzes and hands-on tutorials for individual machines in the BSE shop
- Conduct hands on training sessions with all shop users detailing proper machine use and safety
- Maintain service updates and records to the BSE fleet of vehicles -Altered the fabrication shop layout to better suit the fabrication needs of the department
- Submitted Instructional Lab Modernization grant that awarded the department to implement surveillance cameras in the fabrication shop as well as to have an

overhead door installed for access to the shops lean-to raw material storage space

- Completed the UW capital equipment training requirements to become a Department Property Administrator backup
- Completed the UW fire extinguisher refresher training - Completed the UW occupation exposure to hazardous chemicals in laboratories training that satisfies 29 CFR Part 1910.1450(f)
- Implemented new fabrication machines into the BSE shop including a CNC mill, downdraft table, cold saw, 3D prototyping printer and table saw with blade stop technology

Service

BSE Committees

- Facility and Space Committee
- Building Manager for the Agricultural Engineering Laboratory building

Civic

- Instructed a Wisconsin Snowmobile Safety Certification course – 6 hours of class time, 10 students



Jeff Nelson

Assistant Faculty Associate / Computer Support

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, 26 Enrolled (3 week course)

Precision Agriculture Short Course: 2 Credits, 28 Enrolled – SPRING semester (6 week course)

Precision Agriculture Short Course: 2 Credits, 16 Enrolled – FALL semester – (new 8-week version of the class that will be taught in the fall semester going forward)

Farm Machinery Short Course: 2 Credits, 15 Enrolled - (new 8-week version of the class)

Lab sections (2) of BSE 365: 52 enrolled

Guest lectures / demonstrations for department courses:

- 1) Created a Canvas module for BSE 201 on the Fundamentals of GPS
- 2) 3D printing and scanning for BSE 365 labs
- 3) Tillage Equipment and Residue Management for BSE 472
- 4) Assisted KG with setting up Canvas course for BSE 509.

- 4) Assisted Cheryl Skjolaas at the Manure Expo at Arlington ARS. Provided air monitoring during a lagoon agitation demo
- 5) Assisted Dr. Brian Luck with a row crop planter closer wheel study.
- 6) Flew UAVs for remote sensing research projects for Dr. Brian Luck
- 7) Provided electronics technical assistance to Natalie Eisner on a Masters project
- 8) Co-author on an Extension article GWQ080 “Reducing Risks from Manure Storage Agitation Gases”
- 9) Co-author on “Reducing Risks from Manure Storage Agitation Gases” Publication Numbers: UWEX A4131-06 GWQ 078
- 10) Assisted with content for an article in Journal of Agromedicine – “Investigation of a worker death while agitating manure in a non-enclosed storage.” <http://dx.doi.org/10.1080/1059924X.2017.1397076>

Extension/Outreach Activities

- 1) Provided a Farm Safety talk to the International Farmers Aid Association group on campus. Presented to 8 people through an interpreter.
- 2) Half day presentation to the Dane County Tractor and Machine Operation class. 26 11 – 17 yr olds. General Ag Hazard presentation, First Aid / CPR, tractor rollover, auger entanglement, PTO entanglement demos.
- 3) Assisted Cheryl Skjolaas with a Farm Safety / Rescue / Manure Safety presentation at Cotton Wood Dairy, LLC. Talked to approx. 73 fire/rescue personnel and producers about manure storage and handling emergencies

Information Technology Support

- 1) BSE purchased a DJI Vision2+ UAV in 2015. Maintain the UAV and fly it when it is requested.
- 2) Became a FAA Certified Remote Pilot this summer. Required to fly a UAV for UW Madison related work
- 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, 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).
- 8) Maintain an AV system in the B25 and 118 classrooms.
- 9) Maintain the Main Hall Information monitor. Create announcements and maintain hardware.
- 10) Create posts for BSE Facebook page
- 11) Set up, maintain, and trained students in the use of the department's 3D printer and 3D scanner.
- 12) Major activity this year was moving the BSE website to a WordPress system hosted by DoIT. Entire site needed to be re-entered by hand. Oversaw a student worker who assisted with the project.

Service

BSE Committees

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 Program Committee. The Committee works with the

FISC Director to determine policies and procedures for the FISC program.

- 2) Served on a search and screen committee for a new Assistant Director for FISC

Departmental Support Activities

- 1) Attend various seminars related to Instructional Technology and campus computing issues
- 2) Produced and staffed 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 Brian Luck with advising the Quarter Scale Tractor Pulling Team.
- 5) Maintain the department's large format printer. Assist with poster design and production for conferences and meeting.

Civic Service

- 1) Middleton Fire Department: Assist with maintaining and supporting the department's computers, WI Certified Aerial and Engine operator, Fire Investigation Team member, Hazardous Materials Technician, and American Heart Association Certified CPR Instructor, assist training new engine and aerial apparatus operators.
- 2) Took a week of vacation to do fire safety presentations in Middleton elementary schools during Fire Prevention Week. 22 shows in 7 different schools



Astrid Newenhouse

Senior Scientist, Ph.D.
32% FTE

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

No formal teaching role. Helps advise students enrolled in the BSE Design Practicum classes on projects that pertain to small scale fresh market crop production.

Extension/Outreach Activities

1) Provide assistance to the Midwest Rural Energy Council (MREC) by coordinating council activities. Responsible for maintaining website, maintaining records, helping write and produce publications, collecting dues, maintaining financial records, helping run business meetings, and helping organize an annual conference on rural energy issues. In 2017, when the Rural Electricity Resource Council disbanded, they chose MREC as one recipient of their final assets in order to continue their legacy of education and outreach to farmers, rural homeowners, electric power suppliers and electricians.

2) Provide assistance to MilkTech professional development courses (an international on-line curriculum). Register and communicate with students, work with instructors and help with access to curriculum and tests. In 2017, a newly organized course was offered: Milking Machine Cleaning and Sanitation. The course was one week of online study and one day of hands-on work at the Emmons Blaine Arlington Dairy Research Center, mainly geared as professional development for state milking inspectors.

3) Provide assistance with annual Stray Voltage Investigator's Courses. Register and communicate with students, work with instructors and help with access to curriculum and tests.

4) Provide materials and information to national Workforce Development in Extension Work Group

5) Distribute information and research from previous projects on workplace safety and ergonomics to farmers, researchers, farm advisors, funders, government agencies, and non-profits. In 2017, for example, a farmer in Australia wanted help researching living mulches, and farmers in Minnesota and Illinois wanted information on living mulches as weed control for fresh market strawberry and asparagus crops.

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. 15, 2017.

Publications

Website

Midwest Rural Energy Council, a University of Wisconsin Cooperative Extension website.

<http://mrec.org/>

Professional Development Activities:

1) UW Cooperative Extension Agriculture and Natural Resources Education Program Area

- 2) College of Agricultural and Life Sciences (CALS) Communicators Meetings
- 3) CALS All College Meetings 4) Statewide UW Cooperative Extension Programming Gathering, December 2017
- 4) B.S.E. Women's Shop Nights
- 5)

Service

College Committees

- 1) Appointed to the CALS Committee on Academic Staff Issues, and work on two subcommittees:
 - a. Professional Development
 - b. Communications

Departmental Committees

- 1) Extension Committee
- 2) Social Committee

Other

- 1) Guest on WI Public Radio
- 2) Presentation and tour for Camp Badger participants (kids learning about engineering careers)
- 3) 4-H County Fair Judge
- 4) Healthy Lawn Team (non-profit) board member & speaker on organic lawn care



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, nutrient management and water quality. His work includes outreach programming and the development of decision support tools as well as advising local, state and Federal agencies in ways to improve water and nutrient use efficiency in agricultural production. Some of these tools include the Wisconsin Irrigation Scheduling Program (WISP 2012), the SNAP Plus nutrient management planning tool and the Runoff Risk Advisory Forecast (RRAF) tool. 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

Fall 2017

BSE 201 Land Surveying Fundamentals

2 Credits, 42 enrolled

BSE 508 & 509, Design Practicum I & II

3 Credits, 4 students advised

Guest lectures in BSE 571 and BSE 473

Received an Instructional Laboratory Modernization Grant to upgrade the BSE Department's survey quality Global Positioning System (GPS) equipment.

Amount: \$17,200.00

Graduate and Post Docs Advisees

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

- 6) Elizabeth Buschert, MS
Nelson Institute (2014-2018)
- 7) Sarah Fuller, MS, BSE
(2015-present)
- 8) Andrew Powers, MS, BSE
(2015-present)

Extension / Outreach

External (Non UW) Partner Ratings (2015)

Average of all categories: 4.63/5.00

Irrigation Water Management

- 1) Presented a poster on the new updated ET email service available on the UWEX Ag.

Weather Data web site at the Wisconsin Potato & Vegetable Growers Annual grower education conference in Stevens Point, WI.

- 2) Authored an article for the May 2017 issue of the potato grower's publication Badger Common Tater on the upgraded version of the Wisconsin Irrigation Scheduling Program (WISP).
- 3) Provided on-going support for the Wisconsin Irrigation Scheduling Program (WISP) to growers, the Natural Resources Conservation Service and county agriculture agents.
- 4) Invited speaker to the Central Wisconsin Processing Crops Meeting, at the Hancock Agricultural Research Station on March 1st. Topic: Irrigation Water Management and Scheduling.
- 5) Invited to speak on soil-water dynamics at the 14th Annual Meeting of the North American Stormwater and Erosion Control Association on Feb. 2 - 3 in Wisconsin Dells, WI.
- 6) Invited poster for the Water@UW Madison Fall Poster Session at the Wisconsin Institute for Discovery, Oct. 24th.
- 7) Presented on soil-water dynamics to county agriculture agents at the Biological Systems Engineering Boot Camp Training, DeForest, WI, Nov. 3.

Nutrient Management/Water Quality

- 1) Continued work with the Standards Oversight Council (SOC) to develop water quality model example files to assist designers modeling vegetated treatment swales.
- 2) Assisted at the 2017 North American Manure Expo with the set up and delivery of the educational program during the morning and with crowd control and management during the afternoon field demonstrations.
- 3) Technical advisor to the Regional Runoff Risk Advisory (RRAF) system which is an online system providing information on the risk of runoff to assist in making informed decisions on manure spreading
- 4) Provided technical modeling feedback at the Meeting Our Future Water Needs Workshop, organized by the UW-Madison Water Sustainability and Climate Project held on May 2nd at Pyle Center on the UW-Madison Campus.
- 5) Providing assistance with algorithm development and advisory group coordination for a new web-based barnyard pollutant runoff model APLE-LOTS. The model estimates phosphorus and solids losses from barnyards.
- 6) Co-author of the presentation titled “A Method to Assess Field Management Effects on Snowmelt Runoff Volume for Field-Scale Runoff Risk Evaluation Tools”, presented Aug. 1st at the International Meeting of the Soil and Water Conservation Society, Madison, WI.

Agricultural Drainage

- 1) Planned and assisted in conducting a comprehensive drainage design workshop held in Oshkosh, WI, January 10 – 11.
- 2) Provide on-going support to several county agents on tile drainage issues.
- 3) Invited speaker on tile drain systems for Specialists Central at WI Farm Technology Days on July 13th, Kewaunee, WI

- 4) Collaborated with the Wisconsin State Engineer for the Natural Resources Conservation Service to develop and disseminate a design standard for blind tile inlet construction in WI.

Publications

Peer reviewed Journal Articles

1. Singh, H., Panuska, J., and A. M. Thompson. 2017. Estimating sediment delivery ratios for grassed waterways using WEPP. *Land Degradation & Development*. 28:2015-2061. (Imp. Factor = 8.1)
2. Rebecca Carvin, Laura W. Good, Faith Fitzpatrick, Curt Diehl, Katherine Songer, Kimberly J. Meyer, John C. Panuska, Steve Richter, Kyle Whalley 2017. Testing a two-scale focused conservation strategy for reducing phosphorus and sediment loads from agricultural watersheds. *J. Soil and Water Conserv.* (In press).

Extension Publications

- Sanford, S. and J. Panuska. 2017. The Basics of Drip Irrigation, UW-Extension Publication No. A4119, (In press).

Professional Development

Attended the 14th Annual Conference of the North American Stormwater & Erosion Control Association, WI Chapter Meeting, Ho Chunk Convention Center, Wisconsin Dells, WI, February 1 – 2.

Big Data and Ecoinformatics in Agriculture Research Symposium, held at Union South, UW – Madison, Madison, WI, April 27.

Attended the 72nd Annual International Conference of the Soil and Water Conservation Society held in Madison, WI, July 30 – August 2.

Service

Land surveying technical assistance for the Dept. of Agronomy and Gregg Sanford at the Great Lakes Bio-energy Research Center (20 Hrs.)

Provided surveying equipment and technical assistance for an archeological study at Aztalan, WI (2 Hrs.)

Formally appointed by Chancellor Rebecca Blank to the UW Arboretum Board as the academic staff representative (15 Hrs.)

Publication reviewer for the ASABE Blue Ribbon Competition, March 2017. (6 Hrs)



Scott Sanford

Distinguished Outreach Specialist (M.Engr)
Rural Energy Program
25% Extension, 75% 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 2017

HORT 334: Greenhouse structures and Energy Efficiency – guest lecture, March 8

DSci – 234: Milking Systems, February 22
Milking Parlor Design & Parlor Planning Lab,
March 7

Fall 2017

BSE 473 - Irrigation Systems – guest lecture –
October 2

Extension/Outreach Activities

- 1) Mint Industry Research Council annual meeting – Presentation on Mint Distillation Research, Coronado, CA – January 26, 2017 – about 100 attendees
- 2) Midwest Mint Growers Conference - Presentation on Mint Distillation Research, Valparaiso, IN – February 23, 2017 – about 50 attendees
- 3) Wood Energy Webinars:
 - a. Energy Efficient Wood Heating Appliances for Home and Business – March 16 – 4 attendees

b. Economic Analysis of Wood Energy Projects & Case Studies – March 23 – 18 attendees

4) Midwest Renewable Energy Fair, Custer, WI – Booth on the use of wood for heating June 16-18; Presentation – Not your Grandfather's Boiler – June 17 – 50 attendees

5) NECC 1501 meeting – Farm Energy Production and Use – 8 attendees

6) ASABE annual meeting – Presentation: New Essential oil distillation System – Year 1-2 update – Spokane, WA – July 18, 2017

7) BSE Boot Camp – Presentation – Grain Drying and Managing Stored Grain – 13 attendee

8) Energy Efficiency for Dairy Farms, Virginia Cooperative Extension:

- a. November 29 – 20 attendees
- b. November 30 – 8 attendees

9) Wood Energy Presentations:

- a. Ashland, WI – December 4 - 14 attendees

b. Spooner, WI – December 5 - 18 attendees

Research

Energy

- 1) WI Refuels with Wood Energy - Statewide Wood Energy Team – Sanford PI, Funding: US Forest Service pass thru WI State Energy Office (\$85,582). Collaborators: Olivia Shanahan- WI State Energy Office, Don Peterson - , Jason Fischbach-UWEX, Tim Baye – UWEX, TJ Morice –, 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.
- 2) Essential Oil Extraction process engineering for improved energy efficiency, Sanford PI, Funding: USDA – NIFA – Specialty Crops (494,985). 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
- 3) Milking Research

Proposal Submitted

- 1) Mint Leaf harvesting to reduce distillation energy and water usage, S.A. Sanford, Harvesting the leaves from the mint plant and leaving the stems in the field has the potential to reduce the energy for distillation by half without affecting oil yield because the stems contain almost no oil. The leaf stripping might also allow multiple harvests per year. USDA – Specialty Crops Block Grant, Requested \$72,833, Dec 2017 to April 2020. (Not Funded)
- 2) Development of a harvester for picking and husking nut clusters from bush-type hazelnuts grown in hedgerows, S.A. Sanford and D.R. Bohnhoff, Hazel nut growers in the Midwest are growing hazel nuts as a bush instead of a tree as is being done in other parts of the country. They need mechanical harvesting equipment to remove the green husks and nuts and to separate the nut from the husk for the industry to be profitable. This project will look at

adapting a blueberry or aronia harvester to remove the involucre from the bushes. It will also look at the requirements for dehulling the nut so it can be sold as a whole nut or further processed. USDA – Specialty Crops Research Initiative grant, Requesting \$749,062, Oct 2018 to Sept 2021 (Pending).

3) Wisconsin Maple syrup producer and Landowner Outreach. Promote the expansion of maple syrup production to current producers, workshops for potential new producers and educate landowners on the value to them to lease trees for maple syrup production. USDA- Ag Marketing Service, Requested \$267,239, Sept 2017 to Sept 2020. (not funded)

4) Energy Self-Assessment Website Maintenance and expansion. The website has been off-line since Dec 2016 due to an error. This grant will provide funding to get the website fixed and back on-line and provide funding to update the lighting module to include LED lamps, fix any broken links and develop a module for calculating the energy use and conservation measures in swine facilities. USDA-NRCS, Requested \$39,523, Oct 2018 to Sept 2019 (not funded).

5) Eliminating Barriers to Best Manage Irrigation Practices to Achieve Water Use Reduction. Research to demonstrate that deficit or deferred irrigation can be used on field corn, sweet corn, green beans and soybeans to reduce the amount of water used for irrigation yet produce a crop with minimal reduction in yield. USDA-SARE, Requested \$200,000. (preproposal)

Publications

Peer Reviewed Publications

- 1) The Basics of Drip Irrigation, Scott Sanford, A4119, UW-Extension Publication (At UWEX Publication in layout)

Service

- 1) Departmental committees
 - a. Social Committee – ~20+ hrs
 - b. Extension – 1-2 hrs
- 2) College Campus committees
 - a. Distinguished Prefix Review Committee

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
- f. ES-300 – Electrical Utilization and Energy Application
– Chair
- i. Chair of revision to X5368 – Electric Fencers
- g. ES-310 – Ag Lighting Group –
- i. Chair of std EP344.5 revisions



Paul Thompson

Distinguished Scientist, Ph.D.

100% Research

Adjunct Professor in Biomedical Engineering

Dr. Thompson is involved in research which will lead to development and application 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 nondestructive 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. He is a member of the BSE team evaluating liner designs by use of highly instrumented milking clusters.

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 2017

- BME 402, 1 Credit, 18 Enrolled
 - Instructor Rating 4.2/5.0

Selected comment: "my instructor was really great this semester. He was definitely the best advisor that I have had in design."

- BME 399 (no students enrolled)

Fall 2017

- BME 400, 3 Credits, 19 Enrolled
 - Instructor Rating: not received at time of report.
- BME 399 (no students enrolled)

Research

Milking Machine Research (\$150k/yr)

Collaborators: D Reinemann, BSE.

Funding: Avon Dairy Solutions.

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

Publications

Peer reviewed Journal articles

- 1) Penry, JF, J Upton, S. Leonardi, P.D. Thompson, D.J. Reinemann, 2017. A method for assessing liner performance during the peak milk flow period. Accepted for publication, J. Dairy Sci.

Invention Disclosure Reports Submitted to WARF

- 2) P.D. Thompson, D.J. Reinemann, J.F. Penry, G.A. Mein, 2017. Process and device for determining the time relationship between start or stop of fluid flow and condition of controlling valve or actuator. WARF Case No. P170073
- 3) D.J. Reinemann, J.F. Penry, J. Upton, P. Thompson, 2017. Dynamic control of milking vacuum, pulsation

settings and liner compression. WARF Case No.
P160408

Awards

UW-Madison College of Engineering

LEED (Leaders in Engineering Excellence and
Diversity) Faculty Recognition Award, 2017.

Service

- 1) Departmental:
Social Committee, approximately 20 hours annually
- 2) ASABE:
 - a. PAFS-403/1, Milk Handling Equipment Committee
 - b. T-11, Energy Committee
- 3) Community
Volunteer Tutor at Thoreau Elementary School



Zachariah P. Zopp

Assistant Researcher, M.S.
95% Research / 5% Teaching

Affiliations: UW-Madison Nelson Institute's Water Resource Management Program

Zach Zopp is an Associate Researcher at the University of Wisconsin - Madison residing within the Biological Systems Engineering Department since 2011. With a background in Environmental Sciences, Plant Biology, & Water Resource Management his main areas of research revolve around the impacts of agriculture cropping and manure management practices on water, soil, and air quality in

Wisconsin. He also manages the Environment Quality Laboratory as well as the Soil and Water Laboratory with the BSE department.

Teaching

Fall 2016 BSE 201 Land Surveying Fundamentals. Co-instructor of laboratory session, 2 credit course

Spring 2017 INTER ERG 170 Introduction to Engineering Design. Course Instructor, 2 credit course

BSE 365, Measurements and Instrumentation for Biological Systems. Guest lecturer, 3 credit course.

Funded Research Projects

1) Title: 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) Title: A Multi-scale Platform for Technology Evaluation and Decision-Making in the Dairy-Water-Energy Nexus

Collaborators: K.G.Karthikeyan, BSE; V. Zavala, CBE; D. Noguera, CEE; R. Larson, BSE; and A. Hicks, CEE

Funding: USDA-INFWS

Objectives: Address challenges arising in the dairy-water-energy nexus by combining multi-scale systems analysis and experimental research

3) Title: Beaver Dam Lake Summer 2017 Workshop

Collaborators: A. Thompson, BSE

Funding: Beaver Dam Lake Improvement Association

Objectives: 1) Assess the health of Beaver Dam Lake, Beaver Creek and surrounding watershed. 2) Determine the potential impact of nutrient loading from the surrounding watershed on the lake and creek.

Research Proposals Submitted

Title: Assessing Source Separated Organic Material Compost for Use in Department of Transportation Sites. 2 years.

Collaborators: A. Thompson, S. Loheide.

Funding: Minnesota Department of Transportation Research Program and Research Implementation Program, St. Paul, MN. USA. (not funded).

Publications

Peer Reviewed Journal Publications

1) Zopp, Z., K.G. Karthikeyan., P. Vadas., F. Arriaga., M. Stock. 2017. Predictive Properties of Total Volatile Solids and Electrical Conductivity for the Determination of Nitrogen and Phosphorus in Agricultural Runoff. (In progress).

Presentations

1) Buschert, E., A.M. Thompson, Z.P. Zopp. 2017. Sources and Sinks for Phosphorus in Stormwater Through a Pond-Prairie System. Poster Presentation. America Water Resources Association's Wisconsin Section Conference, Elkhart Lake, WI, March 9-10, 2017.

2) Buschert, E., Z.P. Zopp, B. Herrick, A.M. Thompson. 2017. Sources and sinks for phosphorus in Curtis Prairie. Poster Presentation. 17th Annual Science Day Symposium. UW-Madison Arboretum, Madison, WI, March 1, 2017.

Service

1) UW-Madison Academic Staff Assembly Representative for District 308 2) BSE Space and Operations Committee

Awards

Nominated for the 2018 UW Madison Academic Staff Excellence Award, "Chancellor's Awards for Excellence in Research: Individuals providing critical research support". Recipients to be selected in April 2018.